SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Gordon's College, Abdn, County of Aberdeen, in Lat. 57°9′, Long. 2° 6′, Distance from Sea 1 miles.

Height of Cistern of the Barometer above Mean Sea-Level 66 feet, above Ground 2½ feet. During the MONTH of January 1892.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER. 9 h. A.M. Barometer. * No.	9 h. A.M. Attached Thermometer	9 h. P.M. Barometer. No.	9 h. P.M. Attached Thermometer	SELF-REGISTERING THERMOMETERS, Read Daily, at 9 P.M. Protected in Shade, 4 feet above Ground. Max. No.	Protected in Shade, 4 feet above Ground. Min. No.	Exposed Black Bulbs. Max. in Sun's rays No.	Exposed Black Bulbs. Min. on Grass No.	HYGROMETER. Dry No. ___ Wet No. ___ 9 h. A.M. Dry bulb.	9 h. A.M. Wet bulb.	9 h. P.M. Dry bulb.	9 h. P.M. Wet bulb.	Rain. No. of hours in which it fell.	Rain. Amount in inches. No.	WIND. 9 h. A.M. Direction.	9 h. A.M. Force	9 h. P.M. Direction.	9 h. P.M. Force	Readings of the H. Cup Anemometer. No. ___ 9 h. A.M.	CLOUDS. 9 A.M. Velocity (0—6) and Direction.	9 A.M. Amount (0—10), and Species.	9 P.M. Velocity (0—6) and Direction.	9 P.M. Amount (0—10), and Species.	SUNSHINE. Hours.	THERMOMETERS under Ground. 9 h. A.M. No. 3 inches.	No. 12 inches.	No. 22 inches.	Temperature of WELL at depth of ___ feet, No.	SEA. Temperature at 1 fathom, and Density.	OZONE. 0—10. 9 A.M.	9 P.M.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc. *Mention the hour at which Storms, including Thunder and Lightning, began and ended.*	Days of Month.
		inches.	°	inches.	°	°	°	°	°	°	°	°	°														°	°							
	1	29.670	41.5	29.428	42.0	39.2	35.6			38.0	36.7	37.2	34.8		.07	N.W.	2	N	1½		10	Cu-St	1	St	—									1
	2	29.630	44.0	29.604	40.5	~~43.6~~ 38.6	33.5			43.0	39.4	40.7	36.5		.07	W	1	N.W	2½		3	Ci-Cu	—	—	4									2
AB	3	29.660	40.0	29.790	39.0	~~40.6~~ 35.1	31.6			35.6	32.2	32.8	31.8		.07	N.W.	2	N.W.	2		8	Cu-St	—	—	2½								Snow	3
	4	29.932	36.0	29.830	39.0	33.8	29.8			33.3	33.1	33.2	32.0		.02	N.W.	1½	N.W.	1		9	Cu-St	10	Cu-St	3								Snow	4
	5	29.248	43.5	29.132	41.0	~~46.5~~ 36.5	31.8			42.2	39.1	33.6	31.8		.20	N.W.	1	N.W.	1½		10	Cu-St	10	St	—								Snow	5
	6	28.860	41.0	29.152	41.5	35.2	27.1			31.8	31.0	33.8	32.8		.09	N.W.	2	N.W.	2½		9	Cu	10	Cu.	2									6
	7	29.140	39.0	29.094	37.5	35.0	24.0			25.0	24.0	35.0	34.0		.12	W.	1	W.	1½		10	St	10	St	4								Snow	7
	8	29.180	39.0	29.430	36.0	37.7	26.1			28.0	27.1	30.1	29.0		.17	N.W.	½	E.	1		8	Cu-St	4	Cu	3								Snow	8
	9	29.454	37.0	29.462	~~41.0~~	31.9	26.8			30.7	29.8	31.9	31.6		.14	N.W.	1	N.	½		9	Cu	10	St	1								Snow	9
AB	10	29.820	41.6	~~30.050~~ ~~29.696~~	39.0	35.2	29.5			37.3	35.2	30.8	30.6		.05	N.E.	1½	N.	1		5	Cu	4	Cu	1								Snow	10
	11	29.954	40.0	29.728	41.0	37.2	27.0			30.6	29.1	33.1	32.0		.04	N	½	W.	1		9	Cu-St	10	St	1									11
	12	29.822	40.5	29.854	42.0	39.2	27.0			33.0	30.6	28.5	27.0		—	W.	1	N.E	½		10	Cu-St	9	Cu-St	3									12
	13	29.670	39.0	29.336	40.5	34.6	18.8			22.8	22.0	34.6	33.0		—	W.	½	W.	1		8	Cu	10	St	—									13
	14	29.290	41.5	29.296	39.0	35.2	23.0			33.2	32.1	33.0	32.2		.23	S.W.	1	S.W.	1½		9	Cu	8	Cu	3									14
	15	29.420	42.0	29.440	43.5	36.5	32.0			36.2	35.2	36.4	33.4		.11	S.	1	S.E.	1½		10	Cu-St	10	Cu-St	—									15
	16	29.458	41.5	29.606	43.5	39.6	33.1			36.8	35.0	39.6	36.1		.08	S.E.	1½	S.E.	2		10	St	10	Cu-St	—									16
	17	29.766	42.0	29.824	42.5	40.0	35.6			39.1	36.0	39.8	36.2		.19	S.E.	2	S.E.	2		10	Cu-St	10	St	—									17
	18	29.788	44.0	29.810	43.0	41.1	36.8			39.8	38.6	41.0	40.0		1.32	S.E.	1½	S.E.	2		10	Nim	10	Nim	—									18
	19	29.824	46.0	29.904	46.5	42.3	39.1	AB		~~46.8~~ 40.8	~~46.0~~ 40.0	~~41.0~~ 36.0	~~39.8~~ 34.8		.26	S.	1	S.	1		10	St	10	St	—									19
	20	29.832	46.0	29.882	41.0	39.1	35.3			38.2	36.2	36.0	34.5		—	S.	1	S.	½		10	Cu-St	10	St	—									20
	21	29.752	44.0	29.460	41.5	38.5	29.2			32.9	32.0	38.3	37.6		.02	S.	1	S.	2½		10	St	10	St	½									21
	22	29.578	41.0	29.624	42.0	38.4	33.2			35.0	33.2	37.0	35.2		.02	W.	½	W.	½		6	Cu	10	Cu	—									22
	23	29.778	41.5	29.560	45.0	42.6	29.8			32.0	29.9	42.6	41.8		—	S.W.	1½	S.W.	½		2	St	10	St	2									23
	24	29.756	46.0	29.960	46.5	42.2	33.1			35.4	34.1	36.7	35.0		—	S.W.	1	S.W.	½		3	St	1	St	6									24
	25	30.148	44.0	30.260	44.0	42.0	34.7			37.2	34.9	37.8	35.2		~~.10~~ .15	W.	½	W	½		1	St	1	St	5									25
	26	29.994	46.5	29.906	45.0	47.0	34.0			38.1	37.2	37.2	36.0		~~.15~~	S.W.	1	W.	½		9	Cu-St	10	St	2									26
	27	29.470	50.0	29.560	47.0	48.5	39.0			47.2	45.8	40.3	36.4		—	S.W.	1½	W.	2		9	Cu-St	—	—	2									27
	28	29.734	46.5	29.452	48.5	48.6	34.5			39.1	35.6	47.6	45.0		—	W.	1	W.	1		10	Cu-St	10	St	—									28
	29	29.426	53.0	29.492	53.0	57.7	48.6			52.2	49.5	55.0	49.1		—	W.	1½	W	1½		10	St	1	St	4									29
	30	29.610	48.2	29.630	49.0	54.8	39.4			45.2	39.6	40.0	36.2		—	N.W.	2	N.W	1½		3	St	—	—	6									30
	31	29.658	47.6	29.580	48.0	43.9	35.1			40.4	38.7	~~44.0~~	~~39.2~~		.02	NW.	1	N.W.	1½		2	St	10	St	5									31
	Sums.	19.372	9.6	14.630	8.5	27.1	6.3			15.0	7.9	14.1	14.9		.58		6		9		2.2		2.9		60									
	Means.	29.625	43.1	29.633	42.9	34.9	32.1			36.5	34.6	37.1	35.2				1.2		1.3		7.8		7.1											
	† Total Corrections for Instrumental Errors.	+.006	−.7	+.006	−.7												.06		.06				7.4											
	‡ Corrections for Diurnal Range.																																	
	"Corrected Means."																																	
	No. of Column.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30			

NOTATION USED IN GENERAL REMARKS.

a.	*denotes* aurora.	m.	*denotes* meteor.
ci.	,, cirrus.	ms.	,, meteors.
ci.-cu.	,, cirro-cumulus.	n.	,, nimbus.
ci.-s.	,, cirro-stratus.	r.	,, rain.
cu.	,, cumulus.	h. r.	,, heavy rain.
cu.-s.	,, cumulo-stratus.	c. h. r.	,, continued heavy rain.
d.	,, dew.	s.	,, stratus.
f.	,, fog.	sc.	,, scud.
fr.	,, frost.	s.	,, sleet.
h.-fr.	,, hoar-frost.	s.	,, snow.
h.	,, haze.	so. ha.	,, solar halo.
h. d.	,, heavy dew.	sq.	,, squall.
hl.	,, hail.	sqs.	,, squalls.
l.	,, lightning.	t.	,, thunder.
li. cl.	,, light clouds.	t. s.	,, thunder-storm.
li. sh.	,, light showers.	w.	,, wind.
lu. co.	,, lunar corona.	g.	,, gale of wind.
lu. ha.	,, lunar halo.		

TABLE FOR ESTIMATING FORCE OF WIND.

Estimated Force, 0—6.	Common Designation.	Estimated Force, 0—6.	Common Designation.	Estimated Force, 0—6.	Common Designation.
0	Calm	1·5	Light breeze	4	Blowing hard
0·5	Very light air	2·	Fresh breeze	5	Blowing a gale
1·	Light air	3·	Very fresh	6	Violent gale

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction †† for Temp. (Col. 2), = 29.631 − .037 = 29.594

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction †† for Temp. (Col. 4), = 29.639 − .037 = 29.602

Mean at Station, corrected, and at 32°, = 29.598

Correction for height, 66 feet above Mean Sea-level, = .074

Mean, reduced to 32°, and Sea-level, = 29.672

Highest Reading, corrected for Index error, on the th, = 30.266

Lowest Do. Do., on the th, = 28.866

Difference, or **Monthly Range**, = 1.400

* Each instrument tested at the Office in Edinburgh bears the stamp "S.M.S.;" and a number to be entered in the Heading: or the Number and Initials of the Maker may be here given.
† Embracing corrections for both capillarity and Index Errors.
‡ The Diurnal Range for Scotland is as yet unknown.
†† *Practically*, though not *absolutely* a *minus* correction.
‡‡ These "Hygrometrical Deductions" are calculated from Glaisher's Hygrometrical Tables, Second Edition *only*.
** While the Diurnal Range is unknown, the Arithmetical Mean of Cols. 5 and 6 will be entered as the "Calculated Mean Temperature."
Any observations not taken under the Conditions specified in the Directions on the other side, or noted at the Top of each column, must be marked as such by the observer, in each Schedule. *See over.*

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month**, (corrected for Index Errors), on the th, = 57.7

Lowest in Month, corrected for Index errors, on the th, = 18.8

Difference, or **Monthly Range**, = 38.9

"Corrected **Mean**" **of all the Highest**, (Col. 5), = 40.9

"Corrected **Mean**" **of all the Lowest**, (Col. 6), = 32.1

Difference, or **Mean Daily Range**, = 8.8

** Calculated **Mean Temperature** of Month, = 36.5

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the th, =

"Corrected **Mean**," (Col. 7), **of Black Bulb, Max. in Sun**, =

Lowest at Night, Black Bulb (corrected for Index errors), on the th, =

"Corrected **Mean**," (Col. 8), **of Black Bulb, Min.** on grass, =

Difference of above means or range ("exposed"), =

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb**, (Cols. 9 and 11), = 36.8

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb**, (Cols. 10 and 12), = 34.9

‡‡ Computed **Temperature of Dew-Point**, = 32.2

‡‡ Do. **Elastic Force of Vapour**, = .183

‡‡ Do. **Weight of Vapour in a Cubic Foot of Air**, = 2.10

‡‡ **Relative Humidity** (Saturation = 100), = 84.

RAIN fell on 22 **Days; Amount in Inches**, = 3.58

WIND. SUMMARY. Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	1	1	0	3	4	5	8	9		1.2	
P.M.	~~4~~ 4	0	1	4	3	3	9	7		1.3	
Mean.	2	1	0	4	3	4	9	8	0	1.25 = 15	11

Observations made and Return verified by James Dale, Teacher in Robert Gordon's College, Abdn

(*Signed*) J.H.

Greatest Daily Range = 15°8 on the 13th

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

ONE of the chief objects that the SCOTTISH METEOROLOGICAL SOCIETY proposed to itself when the Society was established in 1855, was to secure PERFECT UNIFORMITY in the system of observation pursued at all its Stations. Uniformity in the observations is absolutely necessary to justify the publication of Monthly Results from different observations, it being found that differences between the Returns from two Stations, so very considerable as to render them quite incomparable, may arise from dissimilarity in the position or shelter of instruments, different hours of observation, or even from the use of differently constructed instruments. It is therefore hoped, that those who kindly furnish Reports to the Society will, by a scrupulous attention to the following Directions, secure for their Monthly Returns an accuracy and value commensurate with the labour and pains involved in making them; and, for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

Hour of Observation. The Council recommend that Observations be made precisely at 9 A.M. and 9 P.M. (Greenwich or Railway Time only), as specified in the following remarks, or at the top of the columns of the Schedule. It is hoped that the utmost punctuality in the time of reading the instruments will be observed. Observers, in some few cases, may find this impossible; in such instances, they are specially requested to mark opposite every reading the time at which it was taken, if not at 9 A.M. or 9 P.M.

Barometer. Weather-Glasses and Aneroids, though well suited to indicate roughly variations of atmospheric pressure, are not fitted for scientific purposes. No Barometer should be used for Meteorological Observation that is not supplied with some means of adjustment or compensation which will secure that the height of the mercury in the tube is accurately measured from the fluctuating surface of the mercury in the cistern.

The Barometer in which the error arising from the fluctuating surface of the mercury in the cistern is entirely got rid of is FORTIN'S Barometer, the arrangement consisting in applying pressure by means of a screw to the bottom of the cistern, which is made of flexible leather, thus raising or depressing the surface till it just meets the ivory point which forms the zero point of the fixed scale.

The Barometer originally constructed by Mr. Adie of London, and usually called the Board of Trade Barometer, has the great convenience of requiring no adjustment of the cistern. Its scale-inches are not true inches, but so much shorter as to compensate the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This is an excellent Barometer for ordinary Observers, inasmuch as it entirely eliminates the error of observation likely to arise in not a few cases in setting the instrument to the zero point of the fixed scale when the light is not good. To show the accuracy with which these Barometers are made, it may be stated, that one was compared, during a whole year, with the Society's Standard Barometer, particular care being given to make the comparison when atmospheric pressure was rising or falling very rapidly, with the result that none of the readings differed from those of the Standard more than 0·003 inch.

A modification of Fortin's Barometer is used at a number of the Society's Stations, by which the coincidence of the zero point with the surface of the mercury is indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When on this little piston-rod is brought, by the adjusting one straight line with those on its ivory frame, the mercury is then at the exact height from which the ted. In taking an observation, this preliminary set- nade with scrupulous accuracy; as a slight error here will vitiate the readings from the vernier.

It is absolutely necessary that the Barometer which is to be used shall have been compared with a Standard Barometer.

The Barometer should be suspended in as good a light as can be secured, and to facilitate the reading, a piece of white paper may be put behind the tube. It must be hung truly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire, and must not be hung against a wall heated by a flue. The object being to secure that the whole instrument, including the brass fittings, the contained mercury, and the attached Thermometer, shall be, when read, at one uniform temperature, it is evident that the best position is that which is least liable to sudden changes of temperature.

In taking an Observation, the Attached Thermometer is first noted: the tube must then be gently tapped, and the cistern-adjustment carefully made. The eye, by raising and lowering it, must be brought into the plane of the back and front of the index—usually the lower edge of the vernier, which must be carefully adjusted so as to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly, so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will facilitate an accurate adjustment and reading of the Barometer. A mistake not unfrequently made by those beginning to observe, consisting in setting the edge of the vernier to the level of the clear surface of the mercury which is in direct contact with the glass tube, must be carefully avoided.

The errors most frequently made in reading the Barometer are errors of 1·000 inch, 0·500 inch, and 0·050 inch; that is to say, instead of 29·365 inches, either of the following is sometimes set down—viz. as 30·365 inches, 28·365 inches, 29·865 inches, or 29·815 inches. Experience having shown that even the very best Observers make these mistakes, particular attention is directed to the matter.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must first be screwed so as to form a tight plug to the cistern, thus preventing the escape of the mercury. Then screw up the mercury not quite to the top of the tube, but to within a quarter of an inch of it, and take down the instrument; it should then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case if, on inclining the instrument, a sharp tap is produced when the mercury strikes the top of the tube. If a dull tap is heard, there is air in the tube, which must be got rid of.

As Barometers are liable to be deranged by the introduction of air into their tubes, on removal from place to place, or in being roughly handled, it may be useful to Observers to know how the air may be expelled. First close up the cistern by screwing the ivory peg tight, so as to prevent the escape of mercury; then screw up the mercury to about half an inch from the top of the tube; and having slowly inverted the instrument, place the top of it on a yielding substance, such as the boot, and gently tap on the cistern with the palm of the hand, so as to induce the air to ascend through the column to the cistern, whence it may escape. Since there is the weight of two atmospheres—the pressure of the mercury in the Barometer, and the air outside—pressing on any air that may be inside the tube, it is usually a tedious operation to get it wholly expelled. After repeated trials, however, it is generally accomplished; and the clear metallic sound of the mercury, when gently struck against the top of the glass tube, will show when the whole of the air has been expelled. On h meter, care must be taken to screw down the m before unfastening the float of the cistern, for, i ed to, the mercury will flow out, and the instru amaged.

Protection and Position of Thermometers. The Council of the Society recommend that the Self-Registering Thermometers, and the Dry and Wet Bulb Hygrometer, be kept in Stevenson's Louvre-boarded Box for Thermometers, painted white inside and outside, and screwed to four stout posts, also painted white, firmly fixed in the ground. The posts must be of such a length that when the Thermometers are hung in position the Bulbs of the Minimum Thermometer, and of the Dry and Wet Bulb Thermometers, will be exactly at the same height of FOUR FEET above the ground, the Maximum Thermometer being hung immediately above the Minimum Thermometer. The Thermometer Box is to be placed over a plot of grass, and in a free open space to which the sun's rays have free access during as much of the day as surrounding conditions enable the Observer to secure. The Thermometers are suspended on cross-laths in the centre of the Box, and face the door, which should open to the north.

The Council regard the question of UNIFORMITY OF HEIGHT ABOVE GROUND, AND METHOD IN PROTECTING THE THERMOMETERS, as vital in every system of Meteorological Observation, since without it Observations made at different Stations are incomparable, and thus rendering it impossible to compare the Climates of places with each other as regards their most important features.

Self-Registering Thermometers. Professor Phillips, and Negretti and Zambra's Maximum Thermometers, and Rutherford's Minimum Thermometer, are recommended. It is recommended that these Thermometers be graduated on the glass stem. The Minimum Thermometer is liable to two derangements—viz., the column of spirit breaking, and part of the spirit distilling by high temperature and lodging at the top of the tube. This derangement is of occasional occurrence with protected Thermometers, but of frequent occurrence with exposed Thermometers. Hence a systematic examination of Minimum Thermometers ought to be a regular part of the work carried on by each Observer.

Fortunately, Spirit Thermometers may be easily set right by any one, when the column of spirit chances to separate. Let the Thermometer be taken in the hand by the end farthest from the bulb, raised above the head, and then forcibly swung down towards the feet; the object being, on the principle of centrifugal force, to send down the detached portion of spirit till it unites with the column. A few throws, or swinging strokes, will generally be sufficient for the purpose; after which the Thermometer should be placed in a slanting position, to allow the rest of the spirit still adhering to the sides of the tube to drain down to the column. But another method must be adopted, if the portion of spirit in the top of the tube be small. Heat should be applied slowly and cautiously to the top end of the tube where the detached portion of spirit is, which, being turned into vapour by the heat, will condense on the surface of the unbroken column of spirit. Care must be taken that the heat is not applied too quickly; for, if this be done, the tube will break and the instrument be destroyed. The best way to apply the requisite amount of heat is by bringing the end of the tube slowly down towards a minute flame from a gas-burner; or, if gas be not at hand, a piece of heated metal will serve instead.

Black-Bulb Thermometers. The bulbs of the Thermometers for registering the greatest heat from the sun's rays, and the least from radiation during night, have a black coating, which may easily be made, or mended, by the application of a mixture of lampblack and printer's ink. They are placed in shallow blackened boxes, whose sides protect the bulbs from the wind. The Maximum should be freely exposed to the sun, and the Minimum should rest on wooden supports a few inches from the surface of the grass, in an open situation. Snow must not be allowed to cover either of these Thermometers; nor the sun's heat to affect the Minimum Thermometer by distillation. Black-bulbs enclosed in 'glass jackets' may also be used, being indeed preferable to the above. It must, however, be added, that the whole subject of the observation of Solar and Terrestrial Radiation is not yet in a sufficiently advanced state to warrant the exclusive recommendation of any one of these methods.

Dry and Wet Bulb Hygrometer. The Hygrometer in use at the Society's Stations consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved form of this apparatus seriously vitiate the Hygrometrical Observations, Observers are specially requested to attend to the following conditions:—The bulbs must hang down by at least an inch free from the scales and frame to which they are attached; the frame must be such as will bring the tubes forward by an inch from any board on which it may be suspended; the water-cup must be covered, and altogether placed to the side, and a little below the level of the wet bulb, but in no case under the bulbs; the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the Observer that the muslin is always clean and moist, and the water pure. In frosty weather, observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

Reading of the Thermometer. In reading the Thermometer great care must be taken to bring the eye exactly opposite the tip of the index or column of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°·9, 40°·0, or 40°·1; or again, 40°·4, 40°·5, 40°·6, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40½°, respectively. So also 40¼°, and 40¾°, more or less, must be registered 40°·2, or 40°·3, and 40°·7, or 40°·8 respectively. In reading Rutherford's Minimum Thermometer, the indication of that end of the index which is next the surface of the spirit is alone noted. On opening the Thermometer Box, the Dry and Wet Bulb Thermometers are to be first, and rapidly, read, inasmuch as they are readily affected by heat from the person of the Observer.

Hour of observing Temperature. The Hygrometer is read at 9 A.M. and 9 P.M. The Self-Registering Thermometers are read at 9 P.M. only, as indicating the greatest and least degrees of temperature in the 24 hours preceding. It is not a matter of indifference when the Self-Registering Thermometers are read, since, in winter at least, the extremes may occur at any hour; and it is necessary to refer their occurrence to their proper meteorological day. In the Society's schedules, the indications registered on the 3d are those of a series of phenomena commencing at 9 P.M. on the 2d, and extending till 9 P.M. on the 3d.

Verification of Thermometers. No instrument ought to be used for Meteorological purposes till it has been carefully tested by comparison with a standard Thermometer. When such Thermometers as are not graduated on the stem, but merely on an attached scale, undergo repairs, they are very liable to be moved from their position on the Scale, and ought never afterwards to be used without being re-tested. The Self-Registering, especially the Minimum Thermometers, ought frequently to be compared with the dry bulb of the Hygrometer. The freezing-point of each Thermometer, marked by a scratch on the tube, ought to be tested once a year, in snow or melting ice.

In selecting instrume ints require attention:—The divisions of t ers in reference to their scales, and the perfe meter from air; the correct numbering of the scale of every instrument; the rejection of Thermometers the frameworks of which are not likely to stand exposure to the weather, as shown in the past by repeated and annoying breakages of Thermometers of similar construction; and as regards Maximum Thermometers, either Negretti and Zambra's, or Phillip's, whether they will act at the highest temperatures they may be required to register. By the laws of the Society, Members and Observers have a right to have their instruments compared by the Secretary, and to advise with him regarding the purchase of instruments.

Wind. Very great care should be bestowed on the Observations of the Wind, the accuracy of which, both as regards Direction and Force, is so essential towards the right discussion of many of the more important problems of the science.

1. As regards Direction. A Wind-Vane ought to be elevated at least 12 feet above surrounding objects. When it oscillates incessantly, the mean direction should be taken. In all cases, but especially when the Vane is stationary, and when the wind is feeble, reference may be made to the direction of smoke, etc., in well-exposed situations. Careful observations are recommended to be made on the changes in the direction of the wind; and during storms, extra observations at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, is likely to give highly valuable and important results, particularly in connection with the system of thickly-planted Stations over a limited district round Edinburgh called STORM STATIONS, in the course of being established by the Society for the systematic investigation of the relation of the force of the wind to BAROMETRIC GRADIENTS, and other points connected with storms.

2. As regards Velocity and Pressure. The Council would recommend the Hemispherical Cup Anemometer,—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the mean Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind at any particular hour of observation, the Pressure Anemometers recently brought under the notice of the Society by Mr. T. Stevenson, the Honorary Secretary, and Mr. R. Ballingall, the Society's Observer at Eallabus, are recommended as likely to secure uniformity in making observations on the Force of the Wind.

Rain Gauges. Many causes conspire to produce anomalies in Rain Returns, arising partly from the difficulty of obtaining a perfectly unobjectionable situation for observation, and partly from the defective nature of the instruments used. The Rain Gauge should not be placed on a slope or terrace, but on a level piece of ground, in as open a situation as the Observer can secure for it. As it is often difficult to obtain a position as free and unobstructed by surrounding objects as is desirable, care should be taken to place it at some distance from shrubs, trees, buildings, or other obstructions, at least as many feet from their base as they are in height. The more important directions, towards which it is most desirable to have a free exposure, are, in the order of their importance, S.W., N.E., S.E., S., and W. The rim of the gauge must be perfectly level, and fixed so that it will remain level in all weathers, and be at a height of one foot above ground, over grass. In such gauges as Fleming's, which are furnished with a measuring-rod attached to a float, the rod ought to be fixed down, and the float rise to its height only at the time the instrument is read, it being found that a stem projecting above the rim of the gauge seriously interferes with the proper measurement of the Rain-fall. When a measuring-glass is used, care should be taken to hold it quite perpendicular. The Rain Gauge ought to be read daily at 9 A.M., and the reading entered in the Returns of the previous day. If the Gauge is read once a month, the reading is to be made on the first of the month, and the amount entered for the previous month.

Snow-falls. Snow-falls may, for convenience, be registered in the rain columns, under the following conditions:—When a Snow shower occurs, it should be noted in the 'Remarks,' and the letter S affixed to the depth of water received in Gauge. The depth of the snow must be measured in some open place where no drift is observed, and registered in addition to, and as a check upon, the indications of the Rain Gauge. For wind, rain, and snow, as indeed in every column, the Observer cannot be too careful to register observations only; and nothing that partakes of the nature of deduction or inference.

Clouds. Convenient abbreviations for the nomenclature of Clouds will be found on the other side. The amount of Cloud ought to be estimated from the greater or less obscuration of the sky overhead (*i.e.* within 20° or 30° of the zenith). The strata of Clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the Clouds' column, though their appearance and changes may be noted among the Remarks. The amount of Cloud is entered from a scale of 0 to 10; thus, when the sky overhead is free from Clouds it is entered 0, when half-covered by Clouds, 5, wholly covered, 10, and so on.

Observations of the Clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—Thus, in the column Velocity and Direction, 6, S. W.

——— will indicate that the upper strata of Clouds travel with
2, W.

extreme velocity from S.W., and those in the lower regions from W., with one-third the speed of the former. Again, in the second

4, st.

Cloud column, an entry of ——— will indicate that the higher
2, cu-st.

regions are covered to the amount of 4-tenths with stratus Clouds; and that the sky is further obscured to the extent of 2-tenths by lower Clouds of the cumulo stratus kind.

Remarks on peculiar Clouds, accompanied with drawings, will assist materially in the development of a more exact nomenclature of Clouds, as well as throw light on the electrical, and other of the more obscure phenomena of Meteorology.

Sunshine. The approximate number of Hours in which objects in the sun's rays cast shadows, should be entered in the proper column.

Underground Thermometers. As the germination and growth of crops and plants generally depend greatly on the temperature of the soil,—its amount and constancy,—the Council recommend that Observations in this interesting department be made at 9 A.M., by Thermometers permanently fixed in the soil, their bulbs being sunk to depths of 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain-water being conveyed to the bulbs by the stems or wooden frames.

Temperature of the Sea. A knowledge of the Temperature of the Sea is not only in itself, but in its relations to that of our island, a most important branch of Meteorology. The Council therefore recommend that the Temperature of the Sea be carefully taken by a properly constructed apparatus, from boats, or, if this be impracticable, from the ends of piers and rocks round the coast, where it is not influenced by that of river water, and as little influenced as possible along the coast, and thus acquiring the temper her greatly heated by the sun or cooled by noc or near the time of high water, in cases where the observations cannot be taken daily, the observation may be made on the 5th, 15th, and 25th of each month. When convenient, extra Sea Observations might be taken for other and greater depths, noting always the Temperature of the Air, and the Hour of Observation. It is also very desirable that observations on the daily Maxima and Minima by Thermometers continuously immersed, be instituted at points along the coast, by the method proposed by Mr. T. Stevenson, and already commenced at Peterhead and Leith.

Temperature of Wells. The Temperature of the water at the bottom of wells ought when practicable, to be taken, both the returns of the Well and of the water being noted.

Mention what Test-Papers are used, Schönbein's or Moffat's, etc.

Ozone. The Paper is affixed by a pin to a board in the Thermometer Box, and the indications registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus 3$^{S.W.}_{1}$, as an Ozone entry in the schedule will indicate that the Ozone paper is tinted as 3 on the scale, that the wind is from the N.W., and that its force on the scale 0—5 is 4, or blowing fresh.

Atmospheric Electricity. Too much importance cannot be attached to the electric condition of the atmosphere in connection with terrestrial magnetism, barometrical, thermometrical, and meteorological phenomena generally. A proper Electrometer is, in truth, necessary to every complete meteorological observatory.

Remarks. The Remarks column is unavoidably too narrow. Some of the most valuable Observations that can be taken are those for which no rules can be given nor hours assigned. The use of contractions ought, therefore, to be taken every advantage of, and a list of such as are in general use is given at the foot of the column. Besides special and extraordinary Observations, great prominence ought to be given in this column to Prevalent Diseases, differences in character, colour, velocity, and direction between the Lower and Upper Strata of clouds, the Colour of the Sky, etc. Remarks ought to be made on the occurrence of Meteors, Auroræ Boreales, remarkable depressions, elevations, and fluctuations of the Barometer, Thunder-Storms, and remarkable falls of Snow, Hail, or Rain, the Hour of Storms of Wind commencing, attaining their maximum, and ending, as well as such Notes on Storms as have been hinted at above. When lofty hills are in the vicinity of a Station, the Height of Clouds and of the Snow-line in winter should be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. should be registered, either in two columns, otherwise unoccupied, or ruled off for the purpose, from the column of 'Remarks.'

Observations in connection with the Periodic Return of the Seasons. Observations in connection with the Periodic Return of the Seasons, possess not only great scientific value, but are of considerable importance in connection with Agriculture, Horticulture, and Natural History. The Council would direct the special attention of Observers to the registration of such phenomena, so that the published Summaries may fairly represent the whole of Scotland. Observations ought to be confined to individual trees and shrubs; to particular species of birds, and, in the case of crops, to specified sorts reared from year to year on a selected piece of ground or farm. The Annual Table, published yearly in the Society's Journal, will indicate the species of plants and animals to which special attention is more particularly directed.

The Council recommend Observers, before purchasing new instruments, and in repairing old ones, to communicate with the Meteorological Secretary, in order that every instrument may be examined and improved before being used; and they consider it necessary that he should have full power to reject any instrument which, on being presented for comparison, does not afford him satisfaction.

(By Order) A. B.

EDINBURGH, *December* 1888.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	Leaf Buds first Appear.	In Leaf.	Divested of Leaves.
Alder,				
Ash,				
Beech,				
Birch,				
Elm,				
Larch,				
Lime,				
Oak,				
Sycamore or Plane,				

SHRUBS, ETC.	First in Blossom.
B[illegible]rry,	
ree or Elder,	
h	
horn,	
um,	
Lilac,	
Mezereon,	
Mountain Ash or Rowan,	
Red Flowering Currant,	
Rhododendron Ponticum,	
Whin,	

FRUITS.	First in Blossom.	Fruit Ripe generally.
Apple,		
Black Currant,		
Cherry,		
Gean,		
Gooseberry,		
Peach,		
Pear,		
Plum,		
Strawberry,		

CROPS, mentioning variety.	Sowing or Planting.	Appearing above Ground.	In Ear or Flower.	First Cut or Tassel.
Barley,				
Bere or Bigg,				
Oats,				
Wheat,				
Beans,				
Pease,				
Potatoes,				
Turnips,				
Rye Grass,				

MIGATORY BIRDS.	First Arrival.	Departure.
Cuckoo,		
Curlew,		
House-Swallow,		
Lapwing,		
Plover,		
Sand-Martin,		
Starling,		
Swan,		
Rail or Corn Crake,		

Have the goodness also to state any information you may be able to collect relative to the Crops of Grain, Hay, Potatoes, Turnips, Fruits, etc., whether plentiful, or in perfection; whether any have suffered from blight, diseases, etc. Whether Epizootic disease prevails among cattle; and the Agricultural condition of the district generally.

Aberdeen
Jan 1892

To the SECRETARY,
Scottish Meteorological Society,
122 George Street,
EDINBURGH.

BOOK POST.

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Gordon's College, Abdn, County of Aberdeen, in Lat. 57°9', Long. 2° 6' W, Distance from Sea 1 miles.

Height of Cistern of the Barometer above Mean Sea-Level 66 feet, above Ground 2½ feet. During the MONTH of February 1892.

The Hours of Observation are of Greenwich Time.

Sunshine. Rain By mistake, Rain in Column of Sunshine, and vice-versa

Days of Month.	BAROMETER. 9 h. A.M. * No.	Barometer.	Attached Thermometer	9 h. P.M. Barometer. No.	Attached Thermometer	SELF-REGISTERING THERMOMETERS, Read Daily, at 9 P.M. Protected in Shade, 4 feet above Ground. Max. No.	Min. No.	Exposed Black Bulbs. Max. in Sun's rays No.	Min. on Grass No.	HYGROMETER. Dry No. Wet No. 9 h. A.M. Dry bulb.	Wet bulb.	9 h. P.M. Dry bulb.	Wet bulb.	Rain No. of hours in which it fell.	Rain Amount in inches. No.	WIND. 9 h. A.M. Direction.	Force	9 h. P.M. Direction.	Force	Readings of the H. Cup Anemometer No. 9 h. A.M.	CLOUDS. 9 A.M. Velocity (0—6) and Direction.	Amount (0—10), and Species.	P.M. Velocity (0—6) and Direction.	Amount (0—10), and Species.	Rain Hours.	THERMOMETERS under Ground. 9 h. A.M. No. 3 inches.	No. 12 inches.	No. 22 inches.	Temperature of WELL at depth of feet, No.	SEA. Temperature at 1 fathom, and Density.	OZONE. 0—10. 9 A.M.	9 P.M.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc. Mention the hour at which Storms, including Thunder and Lightning, began and ended.	Days of Month.
	inches.	°	inches.	°	°	°	°	°	°	°	°	°	°																						
1	28·820	51·0	28·620	47·0	46·8	39·8			43·2	40·1	45·1	40·4	2		S.	1	S.W.	1½		7	Cu	2	Cu	—											1
2	28·638	46·0	28·796	46·5	46·6	31·4			32·0	29·1	36·2	35·0	4		W.	1	S.W.	1½		2	Cir	10	St	·05											2
3	29·076	44·2	29·496	49·0	37·8	31·1			35·1	33·3	32·0	30·6	3		N.W.	1	N.W.	1½		8	Cu	—	—	·04										Snow	3
4	29·384	46·5	29·090	44·0	38·2	26·3			~~38·0~~ 28·2	~~34·1~~ 27·1	38·0	34·1	2		N.W.	½	W	1½		8	St	—	—	·03											4
5	29·108	46·0	29·340	46·5	40·0	29·1			37·2	34·1	34·5	33·0	4		W	1½	N.W.	1½		1	St	5	Cu	—											5
6	29·510	45·0	29·644	45·4	41·8	34·4			38·8	34·0	38·6	35·1	5		S.W.	½	S.W.	½		2	St	10	Cu-St	·02											6
7	29·482	44·5	29·396	46·0	45·8	36·6			43·1	40·0	44·2	42·3	2		S	1	S	½		10	Nim	9	Cu-St	·15											7
8	29·568	46·0	29·980	45·6	47·2	37·5			42·0	40·6	43·4	41·8	1		N.W.	1	N.W.	½		10	Cu-St	9	Cu-St	·04											8
9	30·032	49·0	30·052	48·0	52·7	38·6			41·3	40·8	41·9	40·0	3		S	1	S	—		10	St	4	Cu-St	—											9
10	30·130	47·5	30·198	49·0	50·1	35·0			40·8	38·4	46·6	44·0	4		S.W.	½	W.	1		5	Cir-St	6	Cu-St	—											10
11	30·272	50·5	30·284	50·0	55·2	44·0			47·2	44·0	46·5	42·1	5		W	½	W.	1		4	Ci-St	5	Cu-St	·03											11
12	30·300	52·0	30·480	47·0	51·1	35·6			49·0	45·4	36·2	33·1	2		N.W.	½	N.E.	2		8	Cu-St	8	Cu	·03											12
13	30·528	45·0	30·384	46·0	38·1	34·9			38·0	34·2	36·2	33·4	1		N	½	N	½		10	Cu-St	10	St	·11											13
14	29·904	47·1	29·770	45·5	38·2	33·5			37·6	35·5	37·0	35·1	—		S.W.	1	S.E.	1½		10	St	10	St	·12											14
15	29·786	46·0	29·940	42·0	38·2	30·6			36·2	32·2	33·6	30·5	2		E.	1	E.	1		6	Cu-St	8	Cu	·03										Heavy showers of hail and snow	15
16	29·904	42·0	29·564	37·6	33·2	26·1			26·6	26·0	29·1	28·9	3		N.	½	N	1		3	Cu	10	Cu-St	·10										Snow	16
17	29·236	40·0	29·152	43·0	33·3	27·0			28·8	28·5	28·8	27·0	2		N.W.	1	N.W.	1½		4	Ci-St	7	Cu-St	·06										Snow	17
18	29·232	41·0	29·298	34·6	30·4	18·8			26·2	25·8	~~25·0~~ 18·8	~~25·0~~ 18·6	3		N.W.	1	N.	½		6	Cu	1	Cu	—										Snow	18
19	29·346	37·0	29·504	40·5	32·8	17·5			25·0	25·0	23·0	23·0	5		N.W.	½	N.W.	1		5	Cu-St	2	St	·11											19
20	29·570	40·0	29·660	42·0	34·1	19·0			25·2	25·0	34·1	31·6	4		N.	1	E.	1		5	Cir	9	Cu	·43										Snow	20
21	29·560	41·5	29·480	41·0	39·8	32·2			38·3	37·8	37·5	36·5	—		E	2	E	1		10	St	10	St	·25											21
22	29·570	43·0	29·574	43·0	~~39·1~~ 44·1	32·4			43·0	42·1	33·8	33·4	—		S.E.	½	—	—		10	St	10	St	·12											22
23	29·744	44·0	29·780	46·0	44·1	33·5			40·2	39·4	40·2	40·0	2		S.E.	1	—	—		8	Cu-St	10	St	·08											23
24	29·806	46·0	29·840	46·5	42·2	38·5			39·4	38·8	40·2	40·0	—		S.	½	S	½		10	St	10	St	·01											24
25	29·874	47·0	29·832	47·5	46·0	38·0			41·1	40·4	42·9	42·3	—		S½	½	S.	1		10	St	10	Cu-St	—										Dense fog in morning	25
26	30·044	46·0	30·128	46·5	39·2	26·8			38·6	38·1	38·3	38·0	—		S.E.	½	S	1		10	St	10	St	·02											26
27	30·144	44·5	30·036	46·0	40·1	35·8			39·1	38·2	38·0	37·1	—		N	1	N	½		10	Cu-St	10	St	·02											27
28	29·970	46·5	29·940	45·5	40·1	34·5			37·5	36·4	37·8	37·0	1		N	1	N	½		8	Cu-St	10	St	·03											28
29	30·048	45·5	30·120	46	41	34			35·3	34·5	36	34	2		N	½	E	½		10	St	10	St	·01											29
30																																				30
31																																				31
Sums.	13 12 10 19·526	13 4 150·3	14 7 8 20·380	15 5 14 2·0	17 9 48·2	16 10 31·9			16 8 20 4·0	14 8 15 4·8	15 9 19 7·9	10 6 14 7·9				26·		26·		210		215		1·92											
Means.	29·673	45·2	29·703	44·9	41·7	32·5			37·0	35·3	36·8	35·1	62			~~2·6~~ 0·9		0·9		7·2		7·4													
+ Total Corrections for Instrumental Errors.	×006	−7	×006	−7												0·6		0·6		7·3															
‡ Corrections for Diurnal Range.																																				
"Corrected Means."																																				
No. of Column.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30						

NOTATION USED IN GENERAL REMARKS.

a.	denotes aurora.	m.	denotes meteor.
ci.	,, cirrus.	ms.	,, meteors.
ci.-cu.	,, cirro-cumulus.	n.	,, nimbus.
ci.-s.	,, cirro-stratus.	r.	,, rain.
cu.	,, cumulus.	h. r.	,, heavy rain.
cu.-s.	,, cumulo-stratus.	c. h. r.	,, continued heavy rain.
d.	,, dew.	s.	,, stratus.
f.	,, fog.	sc.	,, scud.
fr.	,, frost.	s.	,, sleet.
h.-fr.	,, hoar-frost.	s.	,, snow.
h.	,, haze.	so. ha.	,, solar halo.
h. d.	,, heavy dew.	sq.	,, squall.
hl.	,, hail.	sqs.	,, squalls.
l.	,, lightning.	t.	,, thunder.
li. cl.	,, light clouds.	t. s.	,, thunder-storm.
li. sh.	,, light showers.	w.	,, wind.
lu. co.	,, lunar corona.	g.	,, gale of wind.
lu. ha.	,, lunar halo.		

TABLE FOR ESTIMATING FORCE OF WIND.

Estimated Force, 0—6.	Common Designation.	Estimated Force, 0—6.	Common Designation.	Estimated Force, 0—6.	Common Designation.
0	Calm	1·5	Light breeze	4	Blowing hard
0·5	Very light air	2·	Fresh breeze	5	Blowing a gale
1·	Light air	3·	Very fresh	6	Violent gale

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction †† for Temp. (Col. 2), = 29.679 − ·042 = 29.637

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction †† for Temp. (Col. 4), = 29.709 − ·042 = 29.667

Mean at Station, corrected, and at 32°, = 29.652

Correction for height, 66 feet above Mean Sea-level, = ·074

Mean, reduced to 32°, and Sea-level, = 29.726

Highest Reading, corrected for Index error, on the th, = 30.528

Lowest Do. Do., on the th, = 28.620

Difference, or **Monthly Range**, = 1.908

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month**, (corrected for Index Errors), on the th, = 55·2

Lowest in Month, corrected for Index errors, on the th, = 17·5

Difference, or **Monthly Range**, = 37·7

"Corrected **Mean**" **of all the Highest**, (Col. 5), = 41·7

"Corrected **Mean**" **of all the Lowest**, (Col. 6), = 32·5

Difference, or **Mean Daily Range**, = 9·2

** Calculated **Mean Temperature** of Month, = 37·1

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the th, =

"Corrected **Mean**," (Col. 7), **of Black Bulb, Max. in Sun**, =

Lowest at Night, Black Bulb (corrected for Index errors), on the th, =

"Corrected **Mean**," (Col. 8), **of Black Bulb, Min.** on grass, =

Difference of above means or range ("exposed"), =

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb**, (Cols. 9 and 11), = 36·9

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb**, (Cols. 10 and 12), = 35·2

‡‡ Computed **Temperature of Dew-Point**, = 32·8

‡‡ Do. **Elastic Force of Vapour**, = ·187

‡‡ Do. **Weight of Vapour in a Cubic Foot of Air**, = 2·17

‡‡ **Relative Humidity** (Saturation = 100), = 86

RAIN fell on 23 **Days; Amount in Inches**, = 1.92

WIND. SUMMARY.

Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	6		2	3	5	3	3	7			
P.M.	5	1	4	1	5	3	3	5	2		
Mean.	6	0	3	2	5	3	3	6	1	0·4 = 0·81	

* Each instrument tested at the Office in Edinburgh bears the stamp "S.M.S.;" and a number to be entered in the Heading; or the Number and Initials of the Maker may be here given.
† Embracing corrections for both capillarity and Index Errors.
‡ The Diurnal Range for Scotland is as yet unknown.
†† *Practically*, though not *absolutely* a *minus* correction.
‡‡ These "Hygrometrical Deductions" are calculated from Glaisher's Hygrometrical Tables, Second Edition *only*.
** While the Diurnal Range is unknown, the Arithmetical Mean of Cols. 5 and 6 will be entered as the "Calculated Mean Temperature."
Any observations not taken under the Conditions specified in the Directions on the other side, or noted at the Top of each column, must be marked as such by the observer, in each Schedule. *See over.*

Observations made and Return verified by James Dale, Teacher in Robert Gordon's College, Aberdeen

(Signed)

Greatest Daily Range = 15·5 on the 12th

J.M.

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

ONE of the chief objects that the SCOTTISH METEOROLOGICAL SOCIETY proposed to itself when the Society was established in 1855, was to secure PERFECT UNIFORMITY in the system of observation pursued at all its Stations. Uniformity in the observations is absolutely necessary to justify the publication of Monthly Results from different observations, it being found that differences between the Returns from two Stations, so very considerable as to render them quite incomparable, may arise from dissimilarity in the position or shelter of instruments, different hours of observation, or even from the use of differently constructed instruments. It is therefore hoped, that those who kindly furnish Reports to the Society will, by a scrupulous attention to the following Directions, secure for their Monthly Returns an accuracy and value commensurate with the labour and pains involved in making them; and, for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

Hour of Observation.

The Council recommend that Observations be made precisely at 9 A.M. and 9 P.M. (Greenwich or Railway Time only), as specified in the following remarks, or at the top of the columns of the Schedule. It is hoped that the utmost punctuality in the time of reading the instruments will be observed. Observers, in some few cases, may find this impossible; in such instances, they are specially requested to mark opposite every reading the time at which it was taken, if not at 9 A.M. or 9 P.M.

Barometer.

Weather-Glasses and Aneroids, though well suited to indicate roughly variations of atmospheric pressure, are not fitted for scientific purposes. No Barometer should be used for Meteorological Observation that is not supplied with some means of adjustment or compensation which will secure that the height of the mercury in the tube is accurately measured from the fluctuating surface of the mercury in the cistern.

The Barometer in which the error arising from the fluctuating surface of the mercury in the cistern is entirely got rid of is FORTIN'S Barometer, the arrangement consisting in applying pressure by means of a screw to the bottom of the cistern, which is made of flexible leather, thus raising or depressing the surface till it just meets the ivory point which forms the zero point of the fixed scale.

The Barometer originally constructed by Mr. Adie of London, and usually called the Board of Trade Barometer, has the great convenience of requiring no adjustment of the cistern. Its scale-inches are not true inches, but so much shorter as to compensate the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This is an excellent Barometer for ordinary Observers, inasmuch as it entirely eliminates the error of observation likely to arise in not a few cases in setting the instrument to the zero point of the fixed scale when the light is not good. To show the accuracy with which these Barometers are made, it may be stated, that one was compared, during a whole year, with the Society's Standard Barometer, particular care being given to make the comparison when atmospheric pressure was rising or falling very rapidly, with the result that none of the readings differed from those of the Standard more than 0·003 inch.

A modification of Fortin's Barometer is used at a number of the Society's Stations, by which the coincidence of the zero point with the surface of the mercury is indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When the index-line on this little piston-rod is brought, by the adjusting screw, to form one straight line with those on its ivory frame, the surface of the mercury is then at the exact height from which the scale is graduated. In taking an observation, this preliminary setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the vernier.

It is absolutely necessary that the Barometer which is to be used shall have been compared with a Standard Barometer.

The Barometer should be suspended in as good a light as can be secured, and to facilitate the reading, a piece of white paper may be put behind the tube. It must be hung truly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire, and must not be hung against a wall heated by a flue. The object being to secure that the whole instrument, including the brass fittings, the contained mercury, and the attached Thermometer, shall be, when read, at one uniform temperature, it is evident that the best position is that which is least liable to sudden changes of temperature.

In taking an Observation, the Attached Thermometer is first noted: the tube must then be gently tapped, and the cistern-adjustment carefully made. The eye, by raising and lowering it, must be brought into the plane of the back and front of the index—usually the lower edge of the vernier, which must be carefully adjusted so as to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly, so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will facilitate an accurate adjustment and reading of the Barometer. A mistake not unfrequently made by those beginning to observe, consisting in setting the edge of the vernier to the level of the clear surface of the mercury which is in direct contact with the glass tube, must be carefully avoided.

The errors most frequently made in reading the Barometer are errors of 1·000 inch, 0·500 inch, and 0·050 inch; that is to say, instead of 29·365 inches, either of the following is sometimes set down—viz. as 30·365 inches, 28·365 inches, 29·865 inches, or 29·815 inches. Experience having shown that even the very best Observers make these mistakes, particular attention is directed to the matter.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must first be screwed so as to form a tight plug to the cistern, thus preventing the escape of the mercury. Then screw up the mercury not quite to the top of the tube, but to within a quarter of an inch of it, and take down the instrument; it should then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case if, on inclining the instrument, a sharp tap is produced when the mercury strikes the top of the tube. If a dull tap is heard, there is air in the tube, which must be got rid of.

As Barometers are liable to be deranged by the introduction of air into their tubes, on removal from place to place, or in being roughly handled, it may be useful to Observers to know how the air may be expelled. First close up the cistern by screwing the ivory peg tight, so as to prevent the escape of mercury; then screw up the mercury to about half an inch from the top of the tube; and having slowly inverted the instrument, place the top of it on a yielding substance, such as the boot, and gently tap on the cistern with the palm of the hand, so as to induce the air to ascend through the column to the cistern, whence it may escape. Since there is the weight of two atmospheres—the pressure of the mercury in the Barometer, and the air outside—pressing on any air that may be inside the tube, it is usually a tedious operation to get it wholly expelled. After repeated trials, however, it is generally accomplished; and the clear metallic sound of the mercury, when gently struck against the top of the g… e whole of the air has been expelled. … , care must be taken to screw down t… e unfastening the float of the cistern, … , the mercury will flow out, and the in… d.

Protection and Position of Thermometers.

The Council of the Society recommend that the Self-Registering Thermometers, and the Dry and Wet Bulb Hygrometer, be kept in Stevenson's Louvre-boarded Box for Thermometers, painted white inside and outside, and screwed to four stout posts, also painted white, firmly fixed in the ground. The posts must be of such a length that when the Thermometers are hung in position the Bulbs of the Minimum Thermometer, and of the Dry and Wet Bulb Thermometers, will be Thermometer, and of the Dry and Wet Bulb Thermometers, will be exactly at the same height of FOUR FEET above the ground, the Maximum Thermometer being hung immediately above the Minimum Thermometer. The Thermometer Box is to be placed over a plot of grass, and in a free open space to which the sun's rays have free access during as much of the day as surrounding conditions enable the Observer to secure. The Thermometers are suspended on cross-laths in the centre of the Box, and face the door, which should open to the north.

The Council regard the question of UNIFORMITY OF HEIGHT ABOVE GROUND, AND METHOD IN PROTECTING THE THERMOMETERS, as vital in every system of Meteorological Observation, since without it Observations made at different Stations are incomparable, thus rendering it impossible to compare the Climates of places with each other as regards their most important features.

Self-Registering Thermometers.

Professor Phillips, and Negretti and Zambra's Maximum Thermometers, and Rutherford's Minimum Thermometer, are recommended. It is recommended that these Thermometers be graduated on the glass stem. The Minimum Thermometer is liable to two derangements—viz., the column of spirit breaking, and part of the spirit distilling by high temperature and lodging at the top of the tube. This derangement is of occasional occurrence with protected Thermometers, but of frequent occurrence with exposed Thermometers. Hence a systematic examination of Minimum Thermometers ought to be a regular part of the work carried on by each Observer.

Fortunately, Spirit Thermometers may be easily set right by any one, when the column of spirit chances to separate. Let the Thermometer be taken in the hand by the end farthest from the bulb, raised above the head, and then forcibly swung down towards the feet; the object being, on the principle of centrifugal force, to send down the detached portion of spirit till it unites with the column. A few throws, or swinging strokes, will generally be sufficient for the purpose; after which the Thermometer should be placed in a slanting position, to allow the rest of the spirit still adhering to the sides of the tube to drain down to the column. But another method must be adopted, if the portion of spirit in the top of the tube be small. Heat should be applied slowly and cautiously to the top end of the tube where the detached portion of spirit is, which, being turned into vapour by the heat, will condense on the surface of the unbroken column of spirit. Care must be taken that the heat is not applied too quickly; for, if this be done, the tube will break and the instrument be destroyed. The best way to apply the requisite amount of heat is by bringing the end of the tube slowly down towards a minute flame from a gas-burner; or, if gas be not at hand, a piece of heated metal will serve instead.

Black-Bulb Thermometers.

The bulbs of the Thermometers for registering the greatest heat from the sun's rays, and the least from radiation during night, have a black coating, which may easily be made, or mended, by the application of a mixture of lampblack and printer's ink. They are placed in shallow blackened boxes, whose sides protect the bulbs from the wind. The Maximum should be freely exposed to the sun, and the Minimum should rest on wooden supports a few inches from the surface of the grass, in an open situation. Snow must not be allowed to cover either of these Thermometers; nor the sun's heat to affect the Minimum Thermometer by distillation. Black-bulbs enclosed in 'glass jackets' may also be used, being indeed preferable to the above. It must, however, be added, that the whole subject of the observation of Solar and Terrestrial Radiation is not yet in a sufficiently advanced state to warrant the exclusive recommendation of any one of these methods.

Dry and Wet Bulb Hygrometer.

The Hygrometer in use at the Society's Stations consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved form of this apparatus seriously vitiate the Hygrometrical Observations, Observers are specially requested to attend to the following conditions:—The bulbs must hang down by at least an inch free from the scales and frame to which they are attached; the frame must be such as will bring the tubes forward by an inch from any board on which it may be suspended; the water-cup must be covered, and altogether placed to the side, and a little below the level of the wet bulb, but in no case under the bulbs; the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the Observer that the muslin is always clean and moist, and the water pure. In frosty weather, observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

Reading of the Thermometer.

In reading the Thermometer great care must be taken to bring the eye exactly opposite the tip of the index or column of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°·9, 40°·0, or 40°·1; or again, 40°·4, 40°·5, 40°·6, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40½°, respectively. So also 40¼°, and 40¾°, more or less, must be registered 40°·2, or 40°·3, and 40°·7, or 40°·8 respectively. In reading Rutherford's Minimum Thermometer, the indication of that end of the index which is next the surface of the spirit is alone noted. On opening the Thermometer Box, the Dry and Wet Bulb Thermometers are to be first, and rapidly, read, inasmuch as they are readily affected by heat from the person of the Observer.

Hour of observing Temperature.

The Hygrometer is read at 9 A.M. and 9 P.M. The Self-Registering Thermometers are read at 9 P.M. only, as indicating the greatest and least degrees of temperature in the 24 hours preceding. It is not a matter of indifference when the Self-Registering Thermometers are read, since, in winter at least, the extremes may occur at any hour; and it is necessary to refer their occurrence to their proper meteorological day. In the Society's schedules, the indications registered on the 3d are those of a series of phenomena commencing at 9 P.M. on the 2d, and extending till 9 P.M. on the 3d.

Verification of Thermometers.

No instrument ought to be used for Meteorological purposes till it has been carefully tested by comparison with a standard Thermometer. When such Thermometers as are not graduated on the stem, but merely on an attached scale, undergo repairs, they are very liable to be moved from their position on the Scale, and ought never afterwards to be used without being re-tested. The Self-Registering, especially the Minimum Thermometers, ought frequently to be compared with the dry bulb of the Hygrometer. The freezing-point of each Thermometer, marked by a scratch on the tube, ought to be tested once a year, in snow or melting ice.

In selecting instruments, the following points require attention:—The divisions of the vernier of Barometers in reference to their scales, and the perfect freedom of the Barometer from air; the correct numbering of the scale of every instrument; the rejection of Thermometers the frameworks of which are not likely to stand exposure to the weather, as shown in the past by repeated and annoying breakages of Thermometers of similar construction; and as regards Maximum Thermometers, either Negretti and Zambra's, or Phillip's, whether they will act at the highest temperatures they may be required to register. By the laws of the Society, Members and Observers have a right to have their instruments compared by the Secretary, and to advise with him regarding the purchase of instruments.

Wind.

Very great care should be bestowed on the Observations of the Wind, the accuracy of which, both as regards Direction and Force, is so essential towards the right discussion of many of the more important problems of the science.

1. As regards Direction.

A Wind-Vane ought to be elevated at least 12 feet above surrounding objects. When it oscillates incessantly, the mean direction should be taken. In all cases, but especially when the Vane is stationary, and when the wind is feeble, reference may be made to the direction of smoke, etc., in well-exposed situations. Careful observations are recommended to be made on the changes in the direction of the wind; and during storms, extra observations at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, is likely to give highly valuable and important results, particularly in connection with the system of thickly-planted Stations over a limited district round Edinburgh called STORM STATIONS, in the course of being established by the Society for the systematic investigation of the relation of the force of the wind to BAROMETRIC GRADIENTS, and other points connected with storms.

2. As regards Velocity and Pressure.

The Council would recommend the Hemispherical Cup Anemometer,—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the mean Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind at any particular hour of observation, the Pressure Anemometers recently brought under the notice of the Society by Mr. T. Stevenson, the Honorary Secretary, and Mr. R. Ballingall, the Society's Observer at Eallabus, are recommended as likely to secure uniformity in making observations on the Force of the Wind.

Rain Gauges.

Many causes conspire to produce anomalies in Rain Returns, arising partly from the difficulty of obtaining a perfectly unobjectionable situation for observation, and partly from the defective nature of the instruments used. The Rain Gauge should not be placed on a slope or terrace, but on a level piece of ground, in as open a situation as the Observer can secure for it. As it is often difficult to obtain a position as free and unobstructed by surrounding objects as is desirable, care should be taken to place it at some distance from shrubs, trees, buildings, or other obstructions, at least as many feet from their base as they are in height. The more important directions, towards which it is most desirable to have a free exposure, are, in the order of their importance, S.W., N.E., S.E., S., and W. The rim of the gauge must be perfectly level, and fixed so that it will remain level in all weathers, and be at a height of one foot above ground, over grass. In such gauges as Fleming's, which are furnished with a measuring-rod attached to a float, the rod ought to be fixed down, and the float rise to its height only at the time the instrument is read, it being found that a stem projecting above the rim of the gauge seriously interferes with the proper measurement of the Rain-fall. When a measuring-glass is used, care should be taken to hold it quite perpendicular. The Rain Gauge ought to be read daily at 9 A.M., and the reading entered in the Returns of the previous day. If the Gauge is read once a month, the reading is to be made on the first of the month, and the amount entered for the previous month.

Snow-falls.

Snow-falls may, for convenience, be registered in the rain columns, under the following conditions:—When a Snow shower occurs, it should be noted in the 'Remarks,' and the letter S affixed to the depth of water received in Gauge. The depth of the snow must be measured in some open place where no drift is observed, and registered in addition to, and as a check upon, the indications of the Rain Gauge. For wind, rain, and snow, as indeed in every column, the Observer cannot be too careful to register observations only; and nothing that partakes of the nature of deduction or inference.

Clouds.

Convenient abbreviations for the nomenclature of Clouds will be found on the other side. The amount of Cloud ought to be estimated from the greater or less obscuration of the sky overhead (*i.e.* within 20° or 30° of the zenith). The strata of Clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the Clouds' column, though their appearance and changes may be noted among the Remarks. The amount of Cloud is entered from a scale of 0 to 10; thus, when the sky overhead is free from Clouds it is entered 0, when half-covered by Clouds, 5, wholly covered, 10, and so on.

Observations of the Clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—Thus, in the column Velocity and Direction, 6, S. W.

——— will indicate that the upper strata of Clouds travel with
2, W.

extreme velocity from S.W., and those in the lower regions from W., with one-third the speed of the former. Again, in the second
4, st.

Cloud column, an entry of ——— will indicate that the higher
2, cu-st.

regions are covered to the amount of 4-tenths with stratus Clouds; and that the sky is further obscured to the extent of 2-tenths by lower Clouds of the cumulo stratus kind.

Remarks on peculiar Clouds, accompanied with drawings, will assist materially in the development of a more exact nomenclature of Clouds, as well as throw light on the electrical, and other of the more obscure phenomena of Meteorology.

Sunshine.

The approximate number of Hours in which objects in the sun's rays cast shadows, should be entered in the proper column.

Underground Thermometers.

As the germination and growth of crops and plants generally depend greatly on the temperature of the soil,—its amount and constancy,—the Council recommend that Observations in this interesting department be made at 9 A.M., by Thermometers permanently fixed in the soil, their bulbs being sunk to depths of 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain-water being conveyed to the bulbs by the stems or wooden frames.

Temperature of the Sea.

A knowledge of the Temperature of the Sea is not only in itself, but in its relations to that of our island, a most important branch of Meteorology. The Council therefore recommend that the Temperature of the Sea be carefully taken by a properly constructed apparatus, from boats, or, if this be impracticab… the ends of piers and rocks round the coast, where it is not … river water, and as little influenced as possible … along the coast, and thus acquiring the temper… er greatly heated by the sun or cooled by noct… or near the time of high water, in cases where the observations cannot be taken daily, the observation may be made on the 5th, 15th, and 25th of each month. When convenient, extra Sea Observations might be taken for other and greater depths, noting always the Temperature of the Air, and the Hour of Observation. It is also very desirable that observations on the daily Maxima and Minima by Thermometers continuously immersed, be instituted at points along the coast, by the method proposed by Mr. T. Stevenson, and already commenced at Portobello and Liverpool.

Temperature of Wells.

The Temperature of the water at the bottom of Wells ought, when practicable, to be taken, with the depth of the Well and of the water being noted.

Mention what Test-Papers are used, Schönbein's or Moffat's, etc.

Ozone.

The Paper is affixed by a pin to a board in the Thermometer Box, and the indications registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus $3^{S.W.}_{4}$, as an Ozone entry in the schedule will indicate that the Ozone paper is tinted as 3 on the scale, that the wind is from the N.W., and that its force on the scale 0—5 is 4, or blowing fresh.

Atmospheric Electricity.

Too much importance cannot be attached to the electric condition of the atmosphere in connection with terrestrial magnetism, barometrical, thermometrical, and meteorological phenomena generally. A proper Electrometer is, in truth, necessary to every complete meteorological observatory.

Remarks.

The Remarks column is unavoidably too narrow. Some of the most valuable Observations that can be taken are those for which no rules can be given nor hours assigned. The use of contractions ought, therefore, to be taken every advantage of, and a list of such as are in general use is given at the foot of the column. Besides special and extraordinary Observations, great prominence ought to be given in this column to Prevalent Diseases, differences in character, colour, velocity, and direction between the Lower and Upper Strata of clouds, the Colour of the Sky, etc. Remarks ought to be made on the occurrence of Meteors, Aurore Boreales, remarkable depressions, elevations, and fluctuations of the Barometer, Thunder-Storms, and remarkable falls of Snow, Hail, or Rain, the Hour of Storms of Wind commencing, attaining their maximum, and ending, as well as such Notes on Storms as have been hinted at above. When lofty hills are in the vicinity of a Station, the Height of Clouds and of the Snow-line in winter should be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. should be registered, either in two columns, otherwise unoccupied, or ruled off for the purpose, from the column of 'Remarks.'

Observations in connection with the Periodic Return of the Seasons.

Observations in connection with the Periodic Return of the Seasons, possess not only great scientific value, but are of considerable importance in connection with Agriculture, Horticulture, and Natural History. The Council would direct the special attention of Observers to the registration of such phenomena, so that the published Summaries may fairly represent the whole of Scotland. Observations ought to be confined to individual trees and shrubs; to particular species of birds, and, in the case of crops, to specified sorts reared from year to year on a selected piece of ground or farm. The Annual Table, published yearly in the Society's Journal, will indicate the species of plants and animals to which special attention is more particularly directed.

The Council recommend Observers, before purchasing new instruments, and in repairing old ones, to communicate with the Meteorological Secretary, in order that every instrument may be examined and improved before being used; and they consider it necessary that he should have full power to reject any instrument which, on being presented for comparison, does not afford him satisfaction.

(By Order) A. B.

EDINBURGH, *December* 1888.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	Leaf Buds first Appear.	In Leaf.	Divested of Leaves.
Alder,				
Ash,				
Beech,				
Birch,				
Elm,				
Larch,				
Lime,				
Oak,				
Sycamore or Plane,				

SHRUBS, ETC.	First in Blossom.
Barberry,	
Bourtree or Elder,	
Broom,	
Hazel,	
Hawthorn,	
Holly,	
Laburnum,	
Lilac,	
Mezereon,	
Mountain Ash or Rowan,	
Red Flowering Currant,	
Rhododendron Ponticum,	
Whin,	

FRUITS.	First in Blossom.	Fruit Ripe, generally.
Apple,		
Black Currant,		
Cherry,		
Gean,		
Gooseberry,		
Peach,		
Pear,		
Plum,		
Strawberry,		

CROPS, mentioning variety.	Sowing or Planting.	Appearing above Ground.	In Ear or Flower.	First Cut or Raised.
Barley,				
Bere or Bigg,				
Oats,				
Wheat,				
Beans,				
Pease,				
Potatoes,				
Turnips,				
Rye Grass,				

MIGATORY BIRDS.	First Arrival.	Departure.
Cuckoo,		
Curlew,		
House-Swallow,		
Lapwing,		
Plover,		
Sand-Martin,		
Starling,		
Swan,		
Rail or Corn Crake,		

Have the goodness also to state any information you may be able to collect relative to the Crops of Grain, Hay, Potatoes, Turnips, Fruits, etc., whether plentiful, or in perfection; whether any have suffered from blight, disease, etc. Whether Epizootic disease prevails among cattle; and the Agricultural condition of the district generally.

Aberdeen
Feb 1892

BOOK POST.

To the SECRETARY
Scottish Meteorological Society,
122 George Street,
EDINBURGH.

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Gordon's College, Aberdeen, County of Aberdeen, in Lat. 57°9'N, Long. 2°6'W, Distance from Sea 1 mile.

Height of Cistern of the Barometer above Mean Sea-Level 66 feet, above Ground 2½ feet. During the MONTH of March 1892

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER. 9 h. A.M. Barometer. * No.	Attached Thermometer	9 h. P.M. Barometer. No.	Attached Thermometer	SELF-REGISTERING THERMOMETERS, Read Daily, at 9 P.M. Protected in Shade, 4 feet above Ground. Max. No.	Min. No.	Exposed Black Bulbs. Max. in Sun's rays No.	Min. on Grass No.	HYGROMETER. Dry No. Wet No. 9 h. A.M. Dry bulb	Wet bulb	9 h. P.M. Dry bulb	Wet bulb	Rain. No. of hours in which it fell.	Amount in inches. No.	WIND. 9 h. A.M. Direction.	Force	9 h. P.M. Direction.	Force	Readings of the H. Cup Anemometer. No. 9 h. A.M.	CLOUDS. 9 A.M. Velocity (0—6) and Direction.	Amount (0—10), and Species.	P.M. Velocity (0—6) and Direction.	Amount (0—10), and Species.	SUNSHINE. Hours.	THERMOMETERS under Ground. 9 h. A.M. No. 3 inches.	No. 12 inches.	No. 22 inches.	Temperature of WELL at depth of feet, No.	SEA. Temperature at 1 fathom and Density.	OZONE. 0—10. 9 A.M.	9 P.M.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc. *Mention the hour at which Storms, including Thunder and Lightning, began and ended.*	Days of Month.
		inches.	°	inches.	°	°	°	°	°	°	°	°	°																								
	1	30.184	46.0	30.294	45.0	39.2	34.3			37.8	36.9	36.1	33.3		.01	E	1	E	1½		10	St	10	St	3											1
	2	30.394	45.5	30.420	45.0	38.7	33.0			35.8	32.2	34.8	30.0		—	S.E.	1	S.E.	1½		10	St	10	St	3											2
	3	30.430	45.6	30.444	45.0	37.7	32.6			~~37.7~~ 34.0	~~27.0~~ 30.2	~~38.8~~ 35.1	~~32.0~~ 32.0		—	S.E.	½	S.E.	1		10	Cu-St	10	Cu-St	3											3
	4	30.452	46.0	30.426	45.0	38.0	32.6			37.7	32.0	38.0	32.6		—	S.E.	1	S.E.	½		10	St	10	St	—											4
	5	30.374	44.5	30.304	45.0	37.3	24.8			36.0	31.8	35.8	34.8		.01	S	½	S	½		9	St	8	Cu	4											5
	6	30.272	44.5	30.152	45.5	40.6	29.5			35.4	32.4	36.0	33.2		—	S	½	S.W.	½		9	Cu	10	Cu-St	3											6
	7	30.004	44.0	29.920	44.5	36.5	32.0			33.2	30.7	33.4	31.0		—	S.W.	½	S.W.	1		10	St	5	Ci-Cu	—											7
	8	29.~~804~~ 804	45.5	29.604	46.0	44.2	31.0			33.2	32.2	33.3	31.3		.01	W	½	W	½		2	St	10	St	6											8
19	9	29.~~828~~ 828	45.0	29.328	46.0	34.2	24.6			32.8	30.2	25.0	23.1		.02	N.W.	1	N.W.	1		5	St	6	Cu-St	7											9
	10	29.448	46.0	29.628	44.5	43.2	23.8			28.1	25.8	31.8	30.1		.12	N	1	N.E.	½		10	St	10	St	3										Snow	10
	11	29.686	45.0	29.734	46.0	37.4	27.0			28.4	27.0	32.6	31.0		.25	N.E	—	E	½		8	Cu	10	St	4										Snow	11
	12	29.648	46.0	29.508	45.0	36.4	26.2			33.5	31.2	34.8	33.0		.27	N	½	N	½		6	Cu	9	Cu	3										Snow	12
	13	29.423	46.2	29.322	45.0	39.2	34.8			34.0	32.8	34.8	33.2		.22	N.E	½	N	—		10	Cu-St	10	Cu-St	1										Snow	13
	14	29.358	46.0	29.444	45.5	38.2	29.0			32.4	31.0	35.8	34.0		.13	N	1	N	½		10	Cu	10	Cu	3										Snow	14
	15	29.410	46.0	29.480	44.6	41.1	24.8			26.8	26.0	29.1	27.8		—	N.E.	½	N	1		1	St	1	St	8											15
	16	29.706	46.5	29.748	45.0	41.2	24.1			25.8	24.0	37.0	35.2		.01	N.E.	½	N.W.	1½		2	St	10	St	4											16
	17	29.706	47.0	29.942	47.5	52.8	37.0			45.1	43.6	41.0	39.2		—	W	1	W	1		9	Cu-St	10	St	3											17
	18	30.136	49.0	30.228	47.5	51.1	37.5			48.1	45.8	43.4	42.4		—	S.	1	S.W.	1½		8	Cu-St	1	St	5											18
	19	30.358	48.0	30.408	51.0	44.1	37.9			42.8	41.3	40.6	38.2		—	S	1	S.E.	1		10	St	10	St	—											19
	20	30.428	48.5	30.304	48.0	43.4	37.4			40.4	37.2	38.1	35.0		—	S.E	1	S.E	½		4	Cu-St	10	St	8											20
	21	30.248	46.5	30.350	46.5	47.2	32.1			36.3	34.0	41.3	40.0		.01	S.W.	½	N.W.	1		~~10~~ 9	~~St~~ Cu-St	10	St	~~4~~ 2											21
	22	30.510	45.5	30.496	44.5	49.0	34.4			40.1	37.2	44.8	41.2		—	N.W.	1	N.W.	1		5	Cu-St	~~8~~ 5	~~St~~ Cu-St	~~6~~ 7											22
	23	30.432	49.0	30.308	50.0	49.1	43.6			46.2	43.1	45.1	42.2		—	N.W.	1	N.W.	½		10	St	10	St	4											23
	24	30.158	49.5	30.006	44.0	56.2	40.0			45.3	41.0	45.2	41.0		—	W	1	S.W.	½		3	Cu-St	5	Cu-St	6											24
	25	29.852	47.0	29.532	44.0	60.8	33.5			42.3	39.2	41.2	38.0		.01	W	½	W	1		4	Ci-St	1	St	6											25
	26	29.588	45.0	29.736	43.5	41.2	28.3			36.0	35.2	39.0	37.1		.05	N	1	N	1½		10	St	10	St	—											26
	27	29.420	43.0	29.476	42.0	38.1	24.0			32.3	31.0	29.3	29.0		.01	N	1	N.E.	—		4 ~~5~~	Cu-St	10	St	4											27
	28	29.836	42.0	30.210	41.0	37.1	23.0			33.1	32.0	30.0	29.0		.02	W	1	N	1		10	Cu-St	10	St	4											28
	29	30.346	39.0	30.420	45.0	47.1	25.1			~~32.4~~ 47.1	~~31.8~~ 25	37.1	33.0		—	N.W.	1	S.W.	1		—	—	10	St	11											29
	30	30.454	45.5	30.408	46.8	54.1	30.0			38.3	35.0	42.2	37.1		—	S.W.	1½	S.W.	1		1	St	4	Ci-St	10											30
	31	30.330	44.5	30.304	51.0	66.2	34.2			47.2	38.1	47.5	45.2		.02	S.W.	½	S.W.	1		5	Ci-Cu	10	St	8											31
	Sums.	14 10 14	196	14 10 12	15 5	17 8	14 9			15 10	11 8	14 9	12 5		1.17		24.5		7/6		24		25 5		133											
		0.348	182.3	0.406	189.6	120.0	31.5			200.8	121.9	218.6	143.2																						
	Means.	30.013	45.9	30.013	46.1	43.9	31.0			36.5	33.9	37.6	34.6				0.8		0.8		6.9		8.2												
	† Total Corrections for Instrumental Errors.	+006	-7	+006	-7												06		08			7.6													
	‡ Corrections for Diurnal Range.																																		
	"Corrected Means."		45.2		45.7																														
	No. of Column.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30				

NOTATION USED IN GENERAL REMARKS.

a.	*denotes* aurora.	m.	*denotes* meteor.
ci.	,, cirrus.	ms.	,, meteors.
ci.-cu.	,, cirro-cumulus.	n.	,, nimbus.
ci.-s.	,, cirro-stratus.	r.	,, rain.
cu.	,, cumulus.	h. r.	,, heavy rain.
cu.-s.	,, cumulo-stratus.	c. h. r.	,, continued heavy rain.
d.	,, dew.	s.	,, stratus.
f.	,, fog.	sc.	,, scud.
fr.	,, frost.	s.	,, sleet.
h.-fr.	,, hoar-frost.	s.	,, snow.
h.	,, haze.	so. ha.	,, solar halo.
h. d.	,, heavy dew.	sq.	,, squall.
hl.	,, hail.	sqs.	,, squalls.
l.	,, lightning.	t.	,, thunder.
li. cl.	,, light clouds.	t. s.	,, thunder-storm.
li. sh.	,, light showers.	w.	,, wind.
lu. co.	,, lunar corona.	g.	,, gale of wind.
lu. ha.	,, lunar halo.		

TABLE FOR ESTIMATING FORCE OF WIND.

Estimated Force, 0—6.	Common Designation.	Estimated Force, 0—6.	Common Designation.	Estimated Force, 0—6.	Common Designation.
0	Calm	1·5	Light breeze	4	Blowing hard
0·5	Very light air	2·	Fresh breeze	5	Blowing a gale
1·	Light air	3·	Very fresh	6	Violent gale

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction †† for Temp. (Col. 2), = 30.019 − .045 = 29.974

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction †† for Temp. (Col. 4), = 30.019 − .045 = 29.974

Mean at Station, corrected, and at 32°, = 29.974

Correction for height, feet above Mean Sea-level, = .074

Mean, reduced to 32°, and Sea-level, = 30.048

Highest Reading, corrected for Index error, on the th, = 30.510

Lowest Do. Do., on the th, = 29.320

Difference, or **Monthly Range,** = 1.190

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month,** (corrected for Index Errors), on the 31 th, = 66.2

Lowest in Month, corrected for Index errors, on the 28th, = 23.0

Difference, or **Monthly Range,** = 43.2

"Corrected **Mean**" **of all the Highest,** (Col. 5), = 43.9

"Corrected **Mean**" **of all the Lowest,** (Col. 6), = 31.0

Difference, or **Mean Daily Range,** = 12.9

** Calculated **Mean Temperature** of Month, = 37.4

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the th, =

"Corrected **Mean,**" (Col. 7), **of Black Bulb, Max. in Sun,** =

Lowest at Night, Black Bulb (corrected for Index errors), on the th, =

"Corrected **Mean,**" (Col. 8), **of Black Bulb, Min.** on grass, =

Difference of above means or range ("exposed"), =

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb,** (Cols. 9 and 11), = 36.8

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** (Cols. 10 and 12), = 34.2

‡‡ Computed **Temperature of Dew-Point,** = 30.5

‡‡ Do. **Elastic Force of Vapour,** = .171

‡‡ Do. **Weight of Vapour in a Cubic Foot of Air,** = 1.96

‡‡ **Relative Humidity** (Saturation = 100), = 78

RAIN fell on 16 **Days; Amount in Inches,** = 1.17

WIND. SUMMARY.

Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	5	4	1	4	4	4	5	3			
P.M.	8	3	2	5	1	2	5	3			
Mean.	5	3	2	4	3	5	4	5	0	0·8 = 0·64	11

* Each instrument tested at the Office in Edinburgh bears the stamp "S.M.S." and a number to be entered in the Heading; or the Number and Initials of the Maker may be here given.
† Embracing corrections for both capillarity and Index Errors.
‡ The Diurnal Range for Scotland is as yet unknown.
†† *Practically*, though not *absolutely* a *minus* correction.
‡‡ These "Hygrometrical Deductions" are calculated from Glaisher's Hygrometrical Tables, Second Edition *only*.
** While the Diurnal Range is unknown, the Arithmetical Mean of Cols. 5 and 6 will be entered as the "Calculated Mean Temperature."
Any observations not taken under the Conditions specified in the Directions on the other side, or noted at the Top of each column, must be marked as such by the observer, in each Schedule. *See over.*

Observations made and Return verified by James Dale — Teacher, Robert Gordon's College

(Signed)

Greatest Daily Range = 32·0 on the 31st

W.

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

ONE of the chief objects that the SCOTTISH METEOROLOGICAL SOCIETY proposed to itself when the Society was established in 1855, was to secure PERFECT UNIFORMITY in the system of observation pursued at all its Stations. Uniformity in the observations is absolutely necessary to justify the publication of Monthly Results from different observations, it being found that differences between the Returns from two Stations, so very considerable as to render them quite incomparable, may arise from dissimilarity in the position or shelter of instruments, different hours of observation, or even from the use of differently constructed instruments. It is therefore hoped, that those who kindly furnish Reports to the Society will, by a scrupulous attention to the following Directions, secure for their Monthly Returns an accuracy and value commensurate with the labour and pains involved in making them; and, for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

The Council recommend that Observations be made precisely at 9 A.M. and 9 P.M. (Greenwich or Railway Time only), as specified in the following remarks, or at the top of the columns of the Schedule. It is hoped that the utmost punctuality in the time of reading the instruments will be observed. Observers, in some few cases, may find this impossible; in such instances, they are specially requested to mark opposite every reading the time at which it was taken, if not at 9 A.M. or 9 P.M.

Hour of Observation.

Weather-Glasses and Aneroids, though well suited to indicate roughly variations of atmospheric pressure, are not fitted for scientific purposes. No Barometer should be used for Meteorological Observation that is not supplied with some means of adjustment or compensation which will secure that the height of the mercury in the tube is accurately measured from the fluctuating surface of the mercury in the cistern.

Barometer.

The Barometer in which the error arising from the fluctuating surface of the mercury in the cistern is entirely got rid of is FORTIN'S Barometer, the arrangement consisting in applying pressure by means of a screw to the bottom of the cistern, which is made of flexible leather, thus raising or depressing the surface till it just meets the ivory point which forms the zero point of the fixed scale.

The Barometer originally constructed by Mr. Adie of London, and usually called the Board of Trade Barometer, has the great convenience of requiring no adjustment of the cistern. Its scale-inches are not true inches, but so much shorter as to compensate the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This is an excellent Barometer for ordinary Observers, inasmuch as it entirely eliminates the error of observation likely to arise in not a few cases in setting the instrument to the zero point of the fixed scale when the light is not good. To show the accuracy with which these Barometers are made, it may be stated, that one was compared, during a whole year, with the Society's Standard Barometer, particular care being given to make the comparison when atmospheric pressure was rising or falling very rapidly, with the result that none of the readings differed from those of the Standard more than 0·003 inch.

A modification of Fortin's Barometer is used at a number of the [illegible]idence of the zero point with by a little ivory float, whose case of the cistern. When is brought, by the adjusting hose on its ivory frame, the exact height from which the vation, this preliminary setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the vernier.

It is absolutely necessary that the Barometer which is to be used shall have been compared with a Standard Barometer.

The Barometer should be suspended in as good a light as can be secured, and to facilitate the reading, a piece of white paper may be put behind the tube. It must be hung truly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire, and must not be hung against a wall heated by a flue. The object being to secure that the whole instrument, including the brass fittings, the contained mercury, and the attached Thermometer, shall be, when read, at one uniform temperature, it is evident that the best position is that which is least liable to sudden changes of temperature.

In taking an Observation, the Attached Thermometer is first noted: the tube must then be gently tapped, and the cistern-adjustment carefully made. The eye, by raising and lowering it, must be brought into the plane of the back and front of the index—usually the lower edge of the vernier, which must be carefully adjusted so as to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly, so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will facilitate an accurate adjustment and reading of the Barometer. A mistake not unfrequently made by those beginning to observe, consisting in setting the edge of the vernier to the level of the clear surface of the mercury which is in direct contact with the glass tube, must be carefully avoided.

The errors most frequently made in reading the Barometer are errors of 1·000 inch, 0·500 inch, and 0·050 inch; that is to say, instead of 29·365 inches, either of the following is sometimes set down—viz. as 30·365 inches, 28·365 inches, 29·865 inches, or 29·815 inches. Experience having shown that even the very best Observers make these mistakes, particular attention is directed to the matter.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must first be screwed so as to form a tight plug to the cistern, thus preventing the escape of the mercury. Then screw up the mercury not quite to the top of the tube, but to within a quarter of an inch of it, and take down the instrument; it should then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case if, on inclining the instrument, a sharp tap is produced when the mercury strikes the top of the tube. If a dull tap is heard, there is air in the tube, which must be got rid of.

As Barometers are liable to be deranged by the introduction of air into their tubes, on removal from place to place, or in being roughly handled, it may be useful to Observers to know how the air may be expelled. First close up the cistern by screwing the ivory peg tight, so as to prevent the escape of mercury; then screw up the mercury to about half an inch from the top of the tube; and having slowly inverted the instrument, place the top of it on a yielding substance, such as the boot, and gently tap on the cistern with the palm of the hand, so as to induce the air to ascend through the column to the cistern, whence it may escape. Since there is the weight of two atmospheres—the pressure of the mercury in the Barometer, and the air outside—pressing on any air that may be inside the tube, it is usually a tedious operation to get it wholly expelled. After repeated trials, however, it is generally accomplished; and the clear metallic sound of the mercury, when gently struck against the top of the glass [illegible]r when the whole of the air has been expelled. On [illegible] Barometer, care must be taken to screw down the [illegible] tube before unfastening the float of the cistern, for [illegible]ttended to, the mercury will flow out, and the instr[illegible]sly damaged.

The Council of the Society recommend that the Self-Registering Thermometers, and the Dry and Wet Bulb Hygrometer, be kept in Stevenson's Louvre-boarded Box for Thermometers, painted white inside and outside, and screwed to four stout posts, also painted white, firmly fixed in the ground. The posts must be of such a length that when the Thermometers are hung in position the Bulbs of the Minimum Thermometer, and of the Dry and Wet Bulb Thermometers, will be exactly at the same height of FOUR FEET above the ground, the Maximum Thermometer being hung immediately above the Minimum Thermometer. The Thermometer Box is to be placed over a plot of grass, and in a free open space to which the sun's rays have free access during as much of the day as surrounding conditions enable the Observer to secure. The Thermometers are suspended on cross-laths in the centre of the Box, and face the door, which should open to the north.

Protection and Position of Thermometers.

The Council regard the question of UNIFORMITY OF HEIGHT ABOVE GROUND, AND METHOD IN PROTECTING THE THERMOMETERS, as vital in every system of Meteorological Observation, since without it Observations made at different Stations are incomparable, thus rendering it impossible to compare the Climates of places with each other as regards their most important features.

Professor Phillips, and Negretti and Zambra's Maximum Thermometers, and Rutherford's Minimum Thermometer, are recommended. It is recommended that these Thermometers be graduated on the glass stem. The Minimum Thermometer is liable to two derangements—viz., the column of spirit breaking, and part of the spirit distilling by high temperature and lodging at the top of the tube. This derangement is of occasional occurrence with protected Thermometers, but of frequent occurrence with exposed Thermometers. Hence a systematic examination of Minimum Thermometers ought to be a regular part of the work carried on by each Observer.

Self-Registering Thermometers.

Fortunately, Spirit Thermometers may be easily set right by any one, when the column of spirit chances to separate. Let the Thermometer be taken in the hand by the end farthest from the bulb, raised above the head, and then forcibly swung down towards the feet; the object being, on the principle of centrifugal force, to send down the detached portion of spirit till it unites with the column. A few throws, or swinging strokes, will generally be sufficient for the purpose; after which the Thermometer should be placed in a slanting position, to allow the rest of the spirit still adhering to the sides of the tube to drain down to the column. But another method must be adopted, if the portion of spirit in the top of the tube be small. Heat should be applied slowly and cautiously to the top end of the tube where the detached portion of spirit is, which, being turned into vapour by the heat, will condense on the surface of the unbroken column of spirit. Care must be taken that the heat is not applied too quickly; for, if this be done, the tube will break and the instrument be destroyed. The best way to apply the requisite amount of heat is by bringing the end of the tube slowly down towards a minute flame from a gas-burner; or, if [illegible] not at hand, a piece of heated metal will serve instead.

The bulbs of the Thermometers for registering the greatest from the sun's rays, and the least from rad during night, have a black coating, which may be made, or mended, by the application of a m of lampblack and printer's ink. They are placed in sl blackened boxes, whose sides protect the bulbs from the The Maximum should be freely exposed to the sun, and the mum should rest on wooden supports a few inches from the s of the grass, in an open situation. Snow must not be allov cover either of these Thermometers: nor the sun's heat to the Minimum Thermometer by distillation. Black-bulbs ei in 'glass jackets' may also be used, being indeed preferable above. It must, however, be added, that the whole subject observation of Solar and Terrestrial Radiation is not yet in ciently advanced state to warrant the exclusive recommenda any one of these methods.

Black-Bulb Thermometers.

The Hygrometer in use at the Society's Stations consists Thermometers usually, but not necessarily, n on one frame. As apparently slight deviatio[illegible] the approved form of this apparatus seriously vitiate the Hygrometrical Observations, Observers are specially requested to attend to the following conditions:—The bulbs must hang down by at least an inch free from the scales and frame to which they are attached; the frame must be such as will bring the tubes forward by an inch from any board on which it may be suspended; the water-cup must be covered, and altogether placed to the side, and a little below the level of the wet bulb, but in no case under the bulbs; the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the Observer that the muslin is always clean and moist, and the water pure. In frosty weather, observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

Dry and Wet Bulb Hygrometer.

In reading the Thermometer great care must be taken to bring the eye exactly opposite the tip of the index or column of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°·9, 40°·0, or 40°·1; or again, 40°·4, 40°·5, 40°·6, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40½°, respectively. So also 40¼°, and 40¾°, more or less, must be registered 40°·2, or 40°·3, and 40°·7, or 40°·8 respectively. In reading Rutherford's Minimum Thermometer, the indication of that end of the index which is next the surface of the spirit is alone noted. On opening the Thermometer Box, the Dry and Wet Bulb Thermometers are to be first, and rapidly, read, inasmuch as they are readily affected by heat from the person of the Observer.

Reading of the Thermometer.

The Hygrometer is read at 9 A.M. and 9 P.M. The Self-Registering Thermometers are read at 9 P.M. only, as indicating the greatest and least degrees of temperature in the 24 hours preceding. It is not a matter of indifference when the Self-Registering Thermometers are read, since, in winter at least, the extremes may occur at any hour; and it is necessary to refer their occurrence to their proper meteorological day. In the Society's schedules, the indications registered on the 3d are those of a series of phenomena commencing at 9 P.M. on the 2d, and extending till 9 P.M. on the 3d.

Hour of observing Temperature.

No instrument ought to be used for Meteorological purposes till it has been carefully tested by comparison with a standard Thermometer. When such Thermometers as are not graduated on the stem, but merely on an attached scale, undergo repairs, they are very liable to be moved from their position on the Scale, and ought never afterwards to be used without being re-tested. The Self-Registering, especially the Minimum Thermometers, ought frequently to be compared with the dry bulb of the Hygrometer. The freezing-point of each Thermometer, marked by a scratch on the tube, ought to be tested once a year, in snow or melting ice.

Verification of Thermometers.

In selecting Instruments, the following points require attention:—The divisions of the vernier of Barometers in reference to their scales, and the perfect freedom of the Barometer from air; the correct numbering of the scale of every instrument; the rejection of Thermometers the frameworks of which are not likely to stand exposure to the weather, as shown in the past by repeated and annoying breakages of Thermometers of similar construction; and as regards Maximum Thermometers, either Negretti and Zambra's, or Phillip's, whether they will act at the highest temperatures they may be required to register. By the laws of the Society, Members and Observers have a right to have their instruments compared by the Secretary, and to advise with him regarding the purchase of instruments.

Very great care should be bestowed on the Observations of the Wind, the accuracy of which, both as regards Direction and Force, is so essential towards the right discussion of many of the more important problems of the science.

Wind.

A Wind-Vane ought to be elevated at least 12 feet above surrounding objects. When it oscillates incessantly, the mean direction should be taken. In all cases, but especially when the Vane is stationary, and when the wind is feeble, reference may be made to the direction of smoke, etc., in well-exposed situations. Careful observations are recommended to be made on the changes in the direction of the wind; and during storms, extra observations at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, is likely to give highly valuable and important results, particularly in connection with the system of thickly-planted Stations over a limited district round Edinburgh called STORM STATIONS, in the course of being established by the Society for the systematic investigation of the relation of the force of the wind to BAROMETRIC GRADIENTS, and other points connected with storms.

1. As regards Direction.

The Council would recommend the Hemispherical Cup Anemometer,—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the mean Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind at any particular hour of observation, the Pressure Anemometers recently brought under the notice of the Society by Mr. T. Stevenson, the Honorary Secretary, and Mr. R. Ballingall, the Society's Observer at Eallabus, are recommended as likely to secure uniformity in making observations on the Force of the Wind.

2. As regards Velocity and Pressure.

Many causes conspire to produce anomalies in Rain Returns, arising partly from the difficulty of obtaining a perfectly unobjectionable situation for observation, and partly from the defective nature of the instruments used. The Rain Gauge should not be placed on a slope or terrace, but on a level piece of ground, in as open a situation as the Observer can secure for it. As it is often difficult to obtain a position as free and unobstructed by surrounding objects as is desirable, care should be taken to place it at some distance from shrubs, trees, buildings, or other obstructions, at least as many feet from their base as they are in height. The more important directions, towards which it is most desirable to have a free exposure, are, in the order of their importance, S.W., N.E., S.E., S., and W. The [illegible] the gauge must be perfectly level, and fixed so that it will [illegible]evel in all weathers, and be at a height of one foot above [illegible]over grass. In such gauges as Fleming's, which are furnished [illegible]measuring-rod attached to a float, the rod ought to be fixed [illegible]nd the float rise to its height only at the time the instrument [illegible]it being found that a stem projecting above the rim of the [illegible]eriously interferes with the proper measurement of the Rain-[illegible]hen a measuring-glass is used, care should be taken to hold [illegible] perpendicular. The Rain Gauge ought to be read daily at [illegible]and the reading entered in the Returns of the previous day. [illegible]Gauge is read once a month, the reading is to be made on the [illegible]the month, and the amount entered for the previous month. [illegible]w-falls may, for convenience, be registered in the rain columns, [illegible]under the following conditions:—When a Snow [illegible]r-falls. shower occurs, it should be noted in the 'Remarks,' [illegible]e letter S affixed to the depth of water received in Gauge. [illegible]pth of the snow must be measured in some open place where [illegible]t is observed, and registered in addition to, and as a check [illegible]the indications of the Rain Gauge. For wind, rain, and snow, [illegible]ed in every column, the Observer cannot be too careful to register observations only; and nothing that partakes of the nature of deduction or inference.

Rain Gauges.

Convenient abbreviations for the nomenclature of Clouds will be found on the other side. The amount of Cloud ought to be estimated from the greater or less obscuration of the sky overhead (*i.e.* within 20° or 30° of the zenith). The strata of Clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the Clouds' column, though their appearance and changes may be noted among the Remarks. The amount of Cloud is entered from a scale of 0 to 10; thus, when the sky overhead is free from Clouds it is entered 0, when half-covered by Clouds, 5, wholly covered, 10, and so on.

Clouds.

Observations of the Clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—Thus, in the column Velocity and Direction, 6, S. W.

———— will indicate that the upper strata of Clouds travel with 2, W.

extreme velocity from S.W., and those in the lower regions from W., with one-third the speed of the former. Again, in the second 4, st.

Cloud column, an entry of ———— will indicate that the higher 2, cu-st.

regions are covered to the amount of 4-tenths with stratus Clouds; and that the sky is further obscured to the extent of 2-tenths by lower Clouds of the cumulo stratus kind.

Remarks on peculiar Clouds, accompanied with drawings, will assist materially in the development of a more exact nomenclature of Clouds, as well as throw light on the electrical, and other of the more obscure phenomena of Meteorology.

The approximate number of Hours in which objects in the sun's rays cast shadows, should be entered in the proper column.

Sunshine.

As the germination and growth of crops and plants generally depend greatly on the temperature of the soil,—its amount and constancy,—the Council recommend that Observations in this interesting department be made at 9 A.M., by Thermometers permanently fixed in the soil, their bulbs being sunk to depths of 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain-water being conveyed to the bulbs by the stems or wooden frames.

Underground Thermometers.

A knowledge of the Temperature of the Sea is not only in itself, but in its relations to that of our island, a most important branch of Meteorology. The Council therefore recommend that the Temperature of the Sea be carefully taken by a properly constructed apparatus, from boats, or, if this be impracticable, from the ends of piers and rocks round the coast, where it is not influenced by that of river water, and as little influenced as possible by currents sweeping along the coast, and thus acquiring the temperature of the land, either greatly heated by the sun or cooled by nocturnal radiation. At or near the time of high water, in cases where the observations cannot be taken daily, the observation may be made on the 5th, 15th, and 25th of each month. When convenient, extra Sea Observations might be taken for other and greater depths, noting always the Temperature of the Air and the Hour of Observation. It is also very desirable that observations on the daily Maxima and Minima by Thermometers continually exposed, be instituted at points along the coast, by the method proposed by Mr. T. Stevenson, and already commenced at Peterhead and Liverpool.

Temperature of the Sea.

The Temperature of the water at the bottom of Wells ought, when practicable, to be taken, both the depth of the Well and of the water being noted.

Temperature of Wells.

Mention what Test-Papers are used, Schönbein's or Moffat's, etc.

The Paper is affixed by a pin to a board in the Thermometer Box, and the indications registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus $3^{S.W.}_{4}$, as an Ozone entry in the schedule will indicate that the Ozone paper is tinted as 3 on the scale, that the wind is from the N.W., and that its force on the scale 0—5 is 4, or blowing fresh.

Ozone.

Too much importance cannot be attached to the electric condition of the atmosphere in connection with terrestrial magnetism, barometrical, thermometrical, and meteorological phenomena generally. A proper Electrometer is, in truth, necessary to every complete meteorological observatory.

Atmospheric Electricity.

The Remarks column is unavoidably too narrow. Some of the most valuable Observations that can be taken are those for which no rules can be given nor hours assigned. The use of contractions ought, therefore, to be taken every advantage of, and a list of such as are in general use is given at the foot of the column. Besides special and extraordinary Observations, great prominence ought to be given in this column to Prevalent Diseases, differences in character, colour, velocity, and direction between the Lower and Upper Strata of clouds, the Colour of the Sky, etc. Remarks ought to be made on the occurrence of Meteors, Aurorae Boreales, remarkable depressions, elevations, and fluctuations of the Barometer, Thunder-Storms, and remarkable falls of Snow, Hail, or Rain, the Hour of Storms of Wind commencing, attaining their maximum, and ending, as well as such Notes on Storms as have been hinted at above. When lofty hills are in the vicinity of a Station, the Height of Clouds and of the Snow-line in winter should be recorded.

Remarks.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. should be registered, either in two columns, otherwise unoccupied, or ruled off for the purpose, from the column of 'Remarks.'

Observations in connection with the Periodic Return of the Seasons, possess not only great scientific value, but are of considerable importance in connection with Agriculture, Horticulture, and Natural History. The Council would direct the special attention of Observers to the registration of such phenomena, so that the published Summaries may fairly represent the whole of Scotland. Observations ought to be confined to individual trees and shrubs; to particular species of birds, and, in the case of crops, to specified sorts reared from year to year on a selected piece of ground or farm. The Annual Table, published yearly in the Society's Journal, will indicate the species of plants and animals to which special attention is more particularly directed.

Observations in connection with the Periodic Return of the Seasons.

The Council recommend Observers, before purchasing new instruments, and in [illegible]ng old ones, to communicate with the Meteorological Secretary, in order that every instrument may be examined and improved before being used; and they consider it necessary that he should have full power to reject any instrument which, on being presented for comparison, does not afford him satisfaction.

(By Order) A. B.

EDINBURGH, *December* 1888.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	Leaf Buds first Appear.	In Leaf.	Direstel of Leaves.
Alder,				
Ash,				
Beech,				
Birch,				
Elm,				
Larch,				
Lime,				
Oak,				
Sycamore or Plane,				

SHRUBS, ETC.	First in Blossom.
Barberry,	
Bourtree or Elder,	
Broom,	
Hazel,	
Hawthorn,	
Holly,	
Laburnum,	
Lilac,	
Mezereon,	
Mountain Ash or Rowan,	
Red Flowering Currant,	
Rhododendron Ponticum,	
Whin,	

FRUITS.	First in Blossom.	Fruit Ripe generally.
Apple,		
Black Currant,		
Cherry,		
Gean,		
Gooseberry,		
Peach,		
Pear,		
Plum,		
Strawberry,		

CROPS, mentioning variety.	Sowing or Planting.	Appearing above Ground.	In Ear or Flower.	First Cut or Tassel.
Barley,				
Bere or Bigg,				
Oats,				
Wheat,				
Beans,				
Pease,				
Potatoes,				
Turnips,				
Rye Grass,				

MIGATORY BIRDS.	First Arrival.	Departure.
Cuckoo,		
Curlew,		
House-Swallow,		
Lapwing,		
Plover,		
Sand-Martin,		
Starling,		
Swan,		
Rail or Corn Crake,		

Have the goodness also to state any information you may be able to collect relative to the Crops of Grain, Hay, Potatoes, Turnips, Fruits, etc., whether plentiful, or in perfection; whether any have suffered from blight, disease, etc. Whether Epizootic disease prevails among cattle; and the Agricultural condition of the district generally.

Aberdeen
March 1892

THE SECRETARY
Scottish Meteorological Society,
122 *George Street.*
EDINBURGH.

BOOK POST.

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Robert Gordons College, Aberdeen, County of Aberdeen, in Lat. 57°9'N, Long. 2°6'W, Distance from Sea 1 mile.

Height of Cistern of the Barometer above Mean Sea-Level 66 feet, above Ground 2½ feet. During the MONTH of April 1892.

The Hours of Observation are of Greenwich Time.

Days of Month	BAROMETER. 9 h. A.M. Barometer. * No.	Attached Thermometer	9 h. P.M. Barometer. No.	Attached Thermometer	SELF-REGISTERING THERMOMETERS, Read Daily, at 9 P.M. Protected in Shade, 4 feet above Ground. Max.	Min.	Exposed Black Bulbs. Max. in Sun's rays No.	Min. on Grass No.	HYGROMETER. Dry No.___ Wet No.___ 9 h. A.M. Dry bulb.	Wet bulb.	9 h. P.M. Dry bulb.	Wet bulb.	Rain. No. of hours in which it fell.	Amount in inches. No.	WIND. 9 h. A.M. Direction.	Force	9 h. P.M. Direction.	Force	Readings of the H. Cup Anemometer. No. 9 h. A.M.	CLOUDS. 9 A.M. Velocity (0—6) and Direction.	Amount (0—10), and Species.	P.M. Velocity (0—6) and Direction.	Amount (0—10), and Species.	SUNSHINE. Hours.	THERMOMETERS under Ground. 9 h. A.M. No. 3 inches.	No. 12 inches.	No. 22 inches.	Temperature of WELL at depth of ___ feet, No.	SEA. Temperature at 9 A.M. Salinity and Density.	OZONE. 0—10. 9 A.M.	9 P.M.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc. *Mention the hour at which Storms, including Thunder and Lightning, began and ended.*	Days of Month
	inches.	°	inches.	°	°	°	°	°	°	°	°	°																							
1	30.330	49.5	30.374	51.0	72.7	33.8			58.5	47.2	54.1	46.7		—	W	½	W	—		5	Cu-St	2	St	11										1
2	30.344	60.0	30.290	52.0	64.0	37.0			60.2	48.5	47.8	44.2		—	S.E.	1	S.E.	—		3	Ci-Cu	0	0	11										2
3	30.152	53.5	30.096	52.0	54.1	38.2			50.4	47.1	41.8	40.0		—	S.E.	1	S.W.	½		6	Ci-Cu	4	Ci-Cu	5										3
4	29.824	51.0	29.772	55.0	56.1	38.1			51.2	46.5	50.2	48.0		—	S.E.	½	S	½		3	Cu-St	2	St	6										4
5	29.844	54.0	29.924	52.0	66.2	40.0			54.7	53.0	46.2	45.3		.02	S	1	S	½		4	Ci-Cu	5	Ci-Cu	8										5
6	30.040	53.0	30.080	56.2	55.2	40.1			52.1	48.8	46.1	43.3		—	N.E.	1	N.E.	½		10	St	10	Cu-St	2										6
7	30.086	48.5	30.116	44.0	45.4	38.1			44.2	43.0	41.3	39.2		—	N	1	N	1		10	St	5	Ci-St	2										7
8	30.156	50.0	30.146	47.5	51.2	38.3			47.6	44.5	~~38.3~~ 43.0	41.8		—	N.E.	1	E.	1		3	Cir	10	Cu-St	8										8
9	30.200	49.0	30.166	47.5	49.3	37.5			46.2	42.3	41.3	40.1		—	S.	1	S.E.	1		4	Cu	2	St	8										9
10	30.134	48.5	30.020	50.5	53.1	37.0			46.3	43.1	41.2	40.2		—	S.E.	1	S.	1		3	Ci-Cu	1	St	11										10
11	30.004	44.0	30.066	47.5	54.7	31.4			45.8	42.0	43.1	40.2		—	S.E.	½	N.E.	1		1	St	10	St	12										11
12	30.010	47.5	29.940	47.1	42.5	30.4			40.0	35.4	31.0	30.0		.10	N	1	N	1		10	Cu-St	8	Cu	3									Snow	12
13	29.742	44.5	29.670	45.0	40.3	28.6			36.0	32.1	30.1	29.0		.09	N	1	N.W.	1½		2	Cu	—	—	9									Snow	13
14	29.660	46.5	29.680	43.0	43.2	28.0			36.5	32.0	32.1	29.0		.02	N.W.	1	N	1		5	Cu	2	Cu	8									Snow	14
15	29.690	42.5	29.682	44.2	45.6	25.8			37.1	32.2	29.1	28.0		.11	N	1	S	½		1	Cu	1	St	4									Snow	15
16	29.658	46.0	29.690	44.5	44.7	21.5			40.7	36.5	34.2	32.1		.01	S	½	S	½		3	Cu	1	St	10									Snow	16
17	29.728	45.5	29.840	46.0	46.0	26.1			37.5	34.9	34.1	31.7		.01	N	1	N	1		5	Cu-St	1	St	7										17
18	29.902	44.5	30.198	45.0	48.0	29.5			39.8	35.0	36.5	34.0		—	N.E.	1	E	1		5	Cu	1	St	11										18
19	30.310	45.5	30.080	46.5	48.1	31.0			40.3	37.1	42.8	37.0		.14	N.W.	1	N	1½		5	Cu	10	St	5										19
20	30.058	50.0	29.806	49.0	61.1	38.2			50.2	44.8	45.6	43.0		.02	W	1	W	1		4	Cu	—	—	12										20
21	29.844	49.0	29.744	51.0	56.8	37.0			47.3	45.1	49.1	47.2		.01	S.W.	½	S.W.	2		6	Cu-Cu	10	St	5										21
22	29.880	54.0	30.008	51.0	59.9	45.1			53.4	45.0	~~54.2~~ 46.2	~~50.1~~ 46.3		—	W	1½	W	1½		1	Ci-Cu	5	St	9										22
23	30.060	52.0	30.036	51.0	57.9	42.0			~~54.2~~ 53.2	~~50.1~~ 48.5	43.2	38.5		—	W	1½	W	1		5	Cu	1	St	12										23
24	30.058	51.0	29.886	54.0	56.1	47.0			52.0	46.1	48.2	42.1		.01	N.W.	2	W	½		5	Ci-Cu	9	Ci-St	11										24
25	29.720	44.5	29.742	51.0	48.2	38.1			47.1	41.2	43.2	39.0		.01	N.W.	2	N	1½		7	Cu	10	St	9										25
26	29.760	48.0	29.730	50.0	44.2	40.3			42.1	34.0	41.2	38.0		.01	N.W.	1½	E	½		9	Cu-St	10	Cu-St	9										26
27	29.508	44.0	29.642	46.0	42.8	36.1			41.3	39.2	40.0	38.0		.35	S.E.	1	S.E.	1		10	St	10	St	—										27
28	29.840	47.0	29.864	46.5	45.6	33.2			42.3	37.8	34.1	31.0		.04	N	1	N	1		6	Cu	5	Cu	8										28
29	29.940	46.0	29.890	46.5	45.6	32.4			39.1	36.0	42.2	34.2		.02	N.E.	1	N	1½		9	Cu	2	St	2										29
30	29.940	51.0	29.960	50.0	54.5	38.4			50.2	44.0	45.2	39.2		—	W	1	W	1		10	Cu-St	10	St	3										30
31																																			31
Sums.	1412 8	166	1518 8	124	1511	1057			1397	1147	1124.6	~~1054.8~~ 1005.8	3	0.97		31		27½		160		147		219										
Means.	28.412	14.7	28.148	14.64	15.51	10.58			13.97	11.47	12.46	~~10.48~~ 10.05				1.0		0.9		5.3		~~4.9~~ 4.7												
† Total Corrections for Instrumental Errors.	+006	-7	+006	-7												06		06		5.1														
‡ Corrections for Diurnal Range.																																			
"Corrected Means."	29.953	48.7	29.944	48.2																															
No. of Column.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30					

NOTATION USED IN GENERAL REMARKS.

a.	*denotes* aurora.		m.	*denotes* meteor.	
ci.	,,	cirrus.	ms.	,,	meteors.
ci.-cu.	,,	cirro-cumulus.	n.	,,	nimbus.
ci.-s.	,,	cirro-stratus.	r.	,,	rain.
cu.	,,	cumulus.	h. r.	,,	heavy rain.
cu.-s.	,,	cumulo-stratus.	c. h. r.	,,	continued heavy rain.
d.	,,	dew.	s.	,,	stratus.
f.	,,	fog.	sc.	,,	scud.
fr.	,,	frost.	s.	,,	sleet.
h.-fr.	,,	hoar-frost.	s.	,,	snow.
h.	,,	haze.	so. ha.	,,	solar halo.
h. d.	,,	heavy dew.	sq.	,,	squall.
hl.	,,	hail.	sqs.	,,	squalls.
l.	,,	lightning.	t.	,,	thunder.
li. cl.	,,	light clouds.	t. s.	,,	thunder-storm.
li. sh.	,,	light showers.	w.	,,	wind.
lu. co.	,,	lunar corona.	g.	,,	gale of wind.
lu. ha.	,,	lunar halo.			

TABLE FOR ESTIMATING FORCE OF WIND.

Estimated Force, 0—6.	Common Designation.	Estimated Force, 0—6.	Common Designation.	Estimated Force, 0—6.	Common Designation.
0	Calm	1·5	Light breeze	4	Blowing hard
0·5	Very light air	2·	Fresh breeze	5	Blowing a gale
1·	Light air	3·	Very fresh	6	Violent gale

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction †† for Temp. (Col. 2), = 29.953 − .054 = 29.899

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction †† for Temp. (Col. 4), = 29.944 − .053 = 29.891

Mean at Station, corrected, and at 32°, = 29.895

Correction for height, feet above Mean Sea-level, = .074

Mean, reduced to 32°, and Sea-level, = 29.969

Highest Reading, corrected for Index error, on the 1st th, = 30.390

Lowest Do. Do., on the 27 th, = 29.514

Difference, or **Monthly Range**, = 0.876

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month**, (corrected for Index Errors), on the 1st th, = 72.7

Lowest in Month, corrected for Index errors, on the 16 th, = 21.8

Difference, or **Monthly Range**, = 50.9

"Corrected **Mean**" **of all the Highest**, (Col. 5), = 57.9

"Corrected **Mean**" **of all the Lowest**, (Col. 6), = 35.3

Difference, or **Mean Daily Range**, = 16.6

** Calculated **Mean Temperature** of Month, 43.6 = 43.6

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the th, =

"Corrected **Mean**," (Col. 7), **of Black Bulb, Max. in Sun**, =

Lowest at Night, Black Bulb (corrected for Index errors), on the th, =

"Corrected **Mean**," (Col. 8), **of Black Bulb, Min.** on grass, =

Difference of above means or range ("exposed"), =

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb**, (Cols. 9 and 11), = 43.9

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb**, (Cols. 10 and 12), = 40.0

‡‡ Computed **Temperature of Dew-Point**, = 35.4

‡‡ Do. **Elastic Force of Vapour**, = .206

‡‡ Do. **Weight of Vapour in a Cubic Foot of Air**, = 2.41

‡‡ **Relative Humidity** (Saturation = 100), = 72

RAIN fell on 16 **Days; Amount in Inches**, = 0.97

WIND. SUMMARY.

Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	6	4	0	6	3	1	5	5	0	1.0	
P.M.	8	2	2	3	5	2	6	1	0	0.9	
Mean.	4	3	1	5	4	1	6	3	0	0.95 = 0.9	

* Each instrument tested at the Office in Edinburgh bears the stamp "S.M.S." and a number to be entered in the Heading; or the Number and Initials of the Maker may be here given.
‡ Embracing corrections for both capillarity and Index Errors.
: The Diurnal Range for Scotland is as yet unknown.
†† *Practically*, though not *absolutely* a *minus* correction.
‡‡ These "Hygrometrical Deductions" are calculated from Glaisher's Hygrometrical Tables, Second Edition *only*.
** While the Diurnal Range is unknown, the Arithmetical Mean of Cols. 5 and 6 will be entered as the "Calculated Mean Temperature." Any observations not taken under the Conditions specified in the Directions on the other side, or noted at the Top of each column, must be marked as such by the observer, in each Schedule. *See over.*

Observations made and Return verified by James Dale Teacher in Robert Gordons College

(Signed)

Greatest Daily Range = 38.9 on the 1st

W.S.

M.A.

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

ONE of the chief objects that the SCOTTISH METEOROLOGICAL SOCIETY proposed to itself when the Society was established in 1855, was to secure PERFECT UNIFORMITY in the system of observation pursued at all its Stations. Uniformity in the observations is absolutely necessary to justify the publication of Monthly Results from different observations, it being found that differences between the Returns from two Stations, so very considerable as to render them quite incomparable, may arise from dissimilarity in the position or shelter of instruments, different hours of observation, or even from the use of differently constructed instruments. It is therefore hoped, that those who kindly furnish Reports to the Society will, by a scrupulous attention to the following Directions, secure for their Monthly Returns an accuracy and value commensurate with the labour and pains involved in making them; and, for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

Hour of Observation.

The Council recommend that Observations be made precisely at 9 A.M. and 9 P.M. (Greenwich or Railway Time only), as specified in the following remarks, or at the top of the columns of the Schedule. It is hoped that the utmost punctuality in the time of reading the instruments will be observed. Observers, in some few cases, may find this impossible; in such instances, they are specially requested to mark opposite every reading the time at which it was taken, if not at 9 A.M. or 9 P.M.

Barometer.

Weather-Glasses and Aneroids, though well suited to indicate roughly variations of atmospheric pressure, are not fitted for scientific purposes. No Barometer should be used for Meteorological Observation that is not supplied with some means of adjustment or compensation which will secure that the height of the mercury in the tube is accurately measured from the fluctuating surface of the mercury in the cistern.

The Barometer in which the error arising from the fluctuating surface of the mercury in the cistern is entirely got rid of is FORTIN'S Barometer, the arrangement consisting in applying pressure by means of a screw to the bottom of the cistern, which is made of flexible leather, thus raising or depressing the surface till it just meets the ivory point which forms the zero point of the fixed scale.

The Barometer originally constructed by Mr. Adie of London, and usually called the Board of Trade Barometer, has the great convenience of requiring no adjustment of the cistern. Its scale-inches are not true inches, but so much shorter as to compensate the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This is an excellent Barometer for ordinary Observers, inasmuch as it entirely eliminates the error of observation likely to arise in not a few cases in setting the instrument to the zero point of the fixed scale when the light is not good. To show the accuracy with which these Barometers are made, it may be stated, that one was compared, during a whole year, with the Society's Standard Barometer, particular care being given to make the comparison when atmospheric pressure was rising or falling very rapidly, with the result that none of the readings differed from those of the Standard more than 0·003 inch.

A modification of Fortin's Barometer is used at a number of the Society's Stations, by which the coincidence of the zero point with the surface of the mercury is indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When the index-line on this little piston-rod is brought, by the adjusting screw, to form one straight line with those on its ivory frame, the surface of the mercury is then at the exact height from which the scale is graduated. In taking an observation, this preliminary setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the vernier.

It is absolutely necessary that the Barometer which is to be used shall have been compared with a Standard Barometer.

The Barometer should be suspended in as good a light as can be secured, and to facilitate the reading, a piece of white paper may be put behind the tube. It must be hung truly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire, and must not be hung against a wall heated by a flue. The object being to secure that the whole instrument, including the brass fittings, the contained mercury, and the attached Thermometer, shall be, when read, at one uniform temperature, it is evident that the best position is that which is least liable to sudden changes of temperature.

In taking an Observation, the Attached Thermometer is first noted: the tube must then be gently tapped, and the cistern-adjustment carefully made. The eye, by raising and lowering it, must be brought into the plane of the back and front of the index—usually the lower edge of the vernier, which must be carefully adjusted so as to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly, so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will facilitate an accurate adjustment and reading of the Barometer. A mistake not unfrequently made by those beginning to observe, consisting in setting the edge of the vernier to the level of the clear surface of the mercury which is in direct contact with the glass tube, must be carefully avoided.

The errors most frequently made in reading the Barometer are errors of 1·000 inch, 0·500 inch, and 0·050 inch; that is to say, instead of 29·365 inches, either of the following is sometimes set down—viz. as 30·365 inches, 28·365 inches, 29·865 inches, or 29·815 inches. Experience having shown that even the very best Observers make these mistakes, particular attention is directed to the matter.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must first be screwed so as to form a tight plug to the cistern, thus preventing the escape of the mercury. Then screw up the mercury not quite to the top of the tube, but to within a quarter of an inch of it, and take down the instrument; it should then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case if, on inclining the instrument, a sharp tap is produced when the mercury strikes the top of the tube. If a dull tap is heard, there is air in the tube, which must be got rid of.

As Barometers are liable to be deranged by the introduction of air into their tubes, on removal from place to place, or in being roughly handled, it may be useful to Observers to know how the air may be expelled. First close up the cistern by screwing the ivory peg tight, so as to prevent the escape of mercury; then screw up the mercury to about half an inch from the top of the tube; and having slowly inverted the instrument, place the top of it on a yielding substance, such as the boot, and gently tap on the cistern with the palm of the hand, so as to induce the air to ascend through the column to the cistern, whence it may escape. Since there is the weight of two atmospheres—the pressure of the mercury in the Barometer, and the air outside—pressing on any air that may be inside the tube, it is usually a tedious operation to get it wholly expelled. After repeated trials, however, it is generally accomplished; and the clear metallic sound of the mercury, when gently struck against the top of the glass [illegible] when the whole of the air has been expelled. On [illegible] Barometer, care must be taken to screw down the [illegible] tube before unfastening the float of the cistern, for, [illegible] ttended to, the mercury will flow out, and the instru[illegible]ly damaged.

Protection and Position of Thermometers.

The Council of the Society recommend that the Self-Registering Thermometers, and the Dry and Wet Bulb Hygrometer, be kept in Stevenson's Louvre-boarded Box for Thermometers, painted white inside and outside, and screwed to four stout posts, also painted white, firmly fixed in the ground. The posts must be of such a length that when the Thermometers are hung in position the Bulbs of the Minimum Thermometer, and of the Dry and Wet Bulb Thermometers, will be exactly at the same height of FOUR FEET above the ground, the Maximum Thermometer being hung immediately above the Minimum Thermometer. The Thermometer Box is to be placed over a plot of grass, and in a free open space to which the sun's rays have free access during as much of the day as surrounding conditions enable the Observer to secure. The Thermometers are suspended on cross-laths in the centre of the Box, and face the door, which should open to the north.

The Council regard the question of UNIFORMITY OF HEIGHT ABOVE GROUND, AND METHOD IN PROTECTING THE THERMOMETERS, as vital in every system of Meteorological Observation, since without it Observations made at different Stations are incomparable, thus rendering it impossible to compare the Climates of places with each other as regards their most important features.

Self-Registering Thermometers.

Professor Phillips, and Negretti and Zambra's Maximum Thermometers, and Rutherford's Minimum Thermometer, are recommended. It is recommended that these Thermometers be graduated on the glass stem. The Minimum Thermometer is liable to two derangements—viz., the column of spirit breaking, and part of the spirit distilling by high temperature and lodging at the top of the tube. This derangement is of occasional occurrence with protected Thermometers, but of frequent occurrence with exposed Thermometers. Hence a systematic examination of Minimum Thermometers ought to be a regular part of the work carried on by each Observer.

Fortunately, Spirit Thermometers may be easily set right by any one, when the column of spirit chances to separate. Let the Thermometer be taken in the hand by the end farthest from the bulb, raised above the head, and then forcibly swung down towards the feet; the object being, on the principle of centrifugal force, to send down the detached portion of spirit till it unites with the column. A few throws, or swinging strokes, will generally be sufficient for the purpose; after which the Thermometer should be placed in a slanting position, to allow the rest of the spirit still adhering to the sides of the tube to drain down to the column. But another method must be adopted, if the portion of spirit in the top of the tube be small. Heat should be applied slowly and cautiously to the top end of the tube where the detached portion of spirit is, which, being turned into vapour by the heat, will condense on the surface of the unbroken column of spirit. Care must be taken that the heat is not applied too quickly; for, if this be done, the tube will break and the instrument be destroyed. The best way to apply the requisite amount of heat is by bringing the end of the tube slowly down towards a minute flame from a gas-burner; or, if gas be not at hand, a piece of heated metal will serve instead.

Black-Bulb Thermometers.

The bulbs of the Thermometers for registering the greatest heat from the sun's rays, and the least from radiation during night, have a black coating, which may easily be made, or mended, by the application of a mixture of lampblack and printer's ink. They are placed in shallow blackened boxes, whose sides protect the bulbs from the wind. The Maximum should be freely exposed to the sun, and the Minimum should rest on wooden supports a few inches from the surface of the grass, in an open situation. Snow must not be allowed to cover either of these Thermometers; nor the sun's heat to affect the Minimum Thermometer by distillation. Black-bulbs enclosed in 'glass jackets' may also be used, being indeed preferable to the above. It must, however, be added, that the whole subject of the observation of Solar and Terrestrial Radiation is not yet in a sufficiently advanced state to warrant the exclusive recommendation of any one of these methods.

Dry and Wet Bulb Hygrometer.

The Hygrometer in use at the Society's Stations consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved form of this apparatus seriously vitiate the Hygrometrical Observations, Observers are specially requested to attend to the following conditions:—The bulbs must hang down by at least an inch free from the scales and frame to which they are attached; the frame must be such as will bring the tubes forward by an inch from any board on which it may be suspended; the water-cup must be covered, and altogether placed to the side, and a little below the level of the wet bulb, but in no case under the bulbs; the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the Observer that the muslin is always clean and moist, and the water pure. In frosty weather, observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

Reading of the Thermometer.

In reading the Thermometer great care must be taken to bring the eye exactly opposite the tip of the index or column of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°·9, 40°·0, or 40°·1; or again, 40°·4, 40°·5, 40°·6, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40½°, respectively. So also 40⅛°, and 40⅜°, more or less, must be registered 40°·2, or 40°·3, and 40°·7, or 40°·8 respectively. In reading Rutherford's Minimum Thermometer, the indication of that end of the index which is next the surface of the spirit is alone noted. On opening the Thermometer Box, the Dry and Wet Bulb Thermometers are to be first, and rapidly, read, inasmuch as they are readily affected by heat from the person of the Observer.

Hour of observing Temperature.

The Hygrometer is read at 9 A.M. and 9 P.M. The Self-Registering Thermometers are read at 9 P.M. only, as indicating the greatest and least degrees of temperature in the 24 hours preceding. It is not a matter of indifference when the Self-Registering Thermometers are read, since, in winter at least, the extremes may occur at any hour; and it is necessary to refer their occurrence to their proper meteorological day. In the Society's schedules, the indications registered on the 3d are those of a series of phenomena commencing at 9 P.M. on the 2d, and extending till 9 P.M. on the 3d.

Verification of Thermometers.

No instrument ought to be used for Meteorological purposes till it has been carefully tested by comparison with a standard Thermometer. When such Thermometers as are not graduated on the stem, but merely on an attached scale, undergo repairs, they are very liable to be moved from their position on the Scale, and ought never afterwards to be used without being re-tested. The Self-Registering, especially the Minimum Thermometers, ought frequently to be compared with the dry bulb of the Hygrometer. The freezing-point of each Thermometer, marked by a scratch on the tube, ought to be tested once a year, in snow or melting ice.

In selecting instruments, the following points require attention:—The divisions of the vernier of Barometers in reference to their scales, and the perfect freedom of the Barometer from air; the correct numbering of the scale of every instrument; the rejection of Thermometers the frameworks of which are not likely to stand exposure to the weather, as shown in the past by repeated and annoying breakages of Thermometers of similar construction; and as regards Maximum Thermometers, either Negretti and Zambra's, or Phillip's, whether they will act at the highest temperatures they may be required to register. By the laws of the Society, Members and Observers have a right to have their instruments compared by the Secretary, and to advise with him regarding the purchase of instruments.

Wind.

Very great care should be bestowed on the Observations of the Wind, the accuracy of which, both as regards Direction and Force, is so essential towards the right discussion of many of the more important problems of the science.

1. As regards Direction.

A Wind-Vane ought to be elevated at least 12 feet above surrounding objects. When it oscillates incessantly, the mean direction should be taken. In all cases, but especially when the Vane is stationary, and when the wind is feeble, reference may be made to the direction of smoke, etc., in well-exposed situations. Careful observations are recommended to be made on the changes in the direction of the wind; and during storms, extra observations at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, is likely to give highly valuable and important results, particularly in connection with the system of thickly-planted Stations over a limited district round Edinburgh called STORM STATIONS, in the course of being established by the Society for the systematic investigation of the relation of the force of the wind to BAROMETRIC GRADIENTS, and other points connected with storms.

2. As regards Velocity and Pressure.

The Council would recommend the Hemispherical Cup Anemometer,—a self-registering instrument which shows the amount of Wind that passes it per day: from which also the mean Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind at any particular hour of observation, the Pressure Anemometers recently brought under the notice of the Society by Mr. T. Stevenson, the Honorary Secretary, and Mr. R. Ballingall, the Society's Observer at Eallabus, are recommended as likely to secure uniformity in making observations on the Force of the Wind.

Rain Gauges.

Many causes conspire to produce anomalies in Rain Returns, arising partly from the difficulty of obtaining a perfectly unobjectionable situation for observation, and partly from the defective nature of the instruments used. The Rain Gauge should not be placed on a slope or terrace, but on a level piece of ground, in as open a situation as the Observer can secure for it. As it is often difficult to obtain a position as free and unobstructed by surrounding objects as is desirable, care should be taken to place it at some distance from shrubs, trees, buildings, or other obstructions, at least as many feet from their base as they are in height. The more important directions, towards which it is most desirable to have a free exposure, are, in the order of their importance, S.W., N.E., S.E., S., and W. The rim of the gauge must be perfectly level, and fixed so that it will remain level in all weathers, and be at a height of one foot above ground, over grass. In such gauges as Fleming's, which are furnished with a measuring-rod attached to a float, the rod ought to be fixed down, and the float rise to its height only at the time the instrument is read, it being found that a stem projecting above the rim of the gauge seriously interferes with the proper measurement of the Rainfall. When a measuring-glass is used, care should be taken to hold it quite perpendicular. The Rain Gauge ought to be read daily at 9 A.M., and the reading entered in the Returns of the previous day. If the Gauge is read once a month, the reading is to be made on the first of the month, and the amount entered for the previous month.

Snow-falls.

Snow-falls may, for convenience, be registered in the rain columns, under the following conditions:—When a Snow shower occurs, it should be noted in the 'Remarks,' and the letter S affixed to the depth of water received in Gauge. The depth of the snow must be measured in some open place where no drift is observed, and registered in addition to, and as a check upon, the indications of the Rain Gauge. For wind, rain, and snow, as indeed in every column, the Observer cannot be too careful to register observations only; and nothing that partakes of the nature of deduction or inference.

Clouds.

Convenient abbreviations for the nomenclature of Clouds will be found on the other side. The amount of Cloud ought to be estimated from the greater or less obscuration of the sky overhead (*i.e.* within 20° or 30° of the zenith). The strata of Clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the Clouds' column, though their appearance and changes may be noted among the Remarks. The amount of Cloud is entered from a scale of 0 to 10; thus, when the sky overhead is free from Clouds it is entered 0, when half-covered by Clouds, 5, wholly covered, 10, and so on.

Observations of the Clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—Thus, in the column Velocity and Direction, $\frac{6}{2}$, S. W. ——— will indicate that the upper strata of Clouds travel with extreme velocity from S.W., and those in the lower regions from W., with one-third the speed of the former. Again, in the second column, an entry of $\frac{4}{2,\ cu\text{-}st.}$ ——— will indicate that the higher regions are covered to the amount of 4-tenths with stratus Clouds; and that the sky is further obscured to the extent of 2-tenths by lower Clouds of the cumulo stratus kind.

Remarks on peculiar Clouds, accompanied with drawings, will assist materially in the development of a more exact nomenclature of Clouds, as well as throw light on the electrical, and other of the more obscure phenomena of Meteorology.

Sunshine.

The approximate number of Hours in which objects in the sun's rays cast shadows, should be entered in the proper column.

Underground Thermometers.

As the germination and growth of crops and plants generally depend greatly on the temperature of the soil,—its amount and constancy,—the Council recommend that Observations in this interesting department be made at 9 A.M., by Thermometers permanently fixed in the soil, their bulbs being sunk to depths of 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain-water being conveyed to the bulbs by the stems or wooden frames.

Temperature of the Sea.

A knowledge of the Temperature of the Sea is not only in itself, but in its relations to that of our island, a most important branch of Meteorology. The Council therefore recommend that the Temperature of the Sea be carefully taken by a properly constructed apparatus, from boats, or, if this be impracticable, from the ends of piers and rocks round the coast, where it is not influenced by that of river water, and as little influenced as possible by currents sweeping along the coast, and thus acquiring the temperature of the land, either greatly heated by the sun or cooled by nocturnal radiation. At or near the time of high water, in cases where the observations cannot be taken daily, the observation may be made on the 5th, 15th, and 25th of each month. When convenient, extra Sea Observations might be taken for other and greater depths, noting always the Temperature of the Air, and the Hour of Observation. It is also very desirable that observations on the daily Maxima and Minima by Thermometers continuously immersed, be instituted at points along the coast, by the method proposed by Mr. T. Stevenson, and already commenced at Peterhead and Liverpool.

Temperature of Wells.

The Temperature of the water at the bottom of Wells ought, when practicable, to be taken, both the depth of the Well and of the water being noted.

Ozone.

Mention what Test-Papers are used, Schönbein's or Moffat's, etc. The Paper is affixed by a pin to a board in the Thermometer Box, and the indications registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus $3^{S.W.}_{4}$, as an Ozone entry in the schedule will indicate that the Ozone paper is tinted as 3 on the scale, that the wind is from the N.W., and that its force on the scale 0—5 is 4, or blowing fresh.

Atmospheric Electricity.

Too much importance cannot be attached to the electric condition of the atmosphere in connection with terrestrial magnetism, barometrical, thermometrical, and meteorological phenomena generally. A proper Electrometer is, in truth, necessary to every complete meteorological observatory.

Remarks.

The Remarks column is unavoidably too narrow. Some of the most valuable Observations that can be taken are those for which no rules can be given nor hours assigned. The use of contractions ought, therefore, to be taken every advantage of, and a list of such as are in general use is given at the foot of the column. Besides special and extraordinary Observations, great prominence ought to be given in this column to Prevalent Diseases, differences in character, colour, velocity, and direction between the Lower and Upper Strata of clouds, the Colour of the Sky, etc. Remarks ought to be made on the occurrence of Meteors, Auroræ Boreales, remarkable depressions, elevations, and fluctuations of the Barometer, Thunder-Storms, and remarkable falls of Snow, Hail, or Rain, the Hour of Storms of Wind commencing, attaining their maximum, and ending, as well as such Notes on Storms as have been hinted at above. When lofty hills are in the vicinity of a Station, the Height of Clouds and of the Snow-line in winter should be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. should be registered, either in two columns, otherwise unoccupied, or ruled off for the purpose, from the column of 'Remarks.'

Observations in connection with the Periodic Return of the Seasons.

Observations in connection with the Periodic Return of the Seasons, possess not only great scientific value, but are of considerable importance in connection with Agriculture, Horticulture, and Natural History. The Council would direct the special attention of Observers to the registration of such phenomena, so that the published Summaries may fairly represent the whole of Scotland. Observations ought to be confined to individual trees and shrubs; to particular species of birds, and, in the case of crops, to specified sorts reared from year to year on a selected piece of ground or farm. The Annual Table, published yearly in the Society's Journal, will indicate the species of plants and animals to which special attention is more particularly directed.

The Council recommend Observers, before purchasing new instruments, and in re[illegible]ering old ones, to communicate with the Meteorological Secretary, in order that every instrument may be examined and improved before being used; and they consider it necessary that he should have full power to reject any instrument which, on being presented for comparison, does not afford him satisfaction.

(By Order) A. B.

EDINBURGH, *December* 1888.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	Leaf Buds first Appear.	In Leaf.	Divested of Leaves.	CROPS, mentioning variety.	Sowing or Planting.	Appearing above Ground.	In Ear or Flower.	First Cut or Raked.
Alder,					Barley,				
Ash,					Bere or Bigg,				
Beech,					Oats,				
Birch,					Wheat,				
Elm,					Beans,				
Larch,					Peas,				
Lime,					Potatoes,				
Oak,					Turnips,				
Sycamore or Plane,					Rye Grass,				

SHRUBS, ETC.	First in Blossom.	FRUITS.	First in Blossom.	Fruit Ripe, generally.	MIGRATORY BIRDS.	First Arrival.	Departure.
[illegible]ountree or Elder,		Apple,			Cuckoo,		
Broom,		Black Currant,			Curlew,		
Hazel,		Cherry,			House-Swallow,		
Hawthorn,		Gean,			Lapwing,		
Holly,		Gooseberry,			Plover,		
Laburnum,		Peach,			Sand-Martin,		
Lilac,		Pear,			Starling,		
Mazereon,		Plum,			Swan,		
Mountain Ash or Rowan,		Strawberry,			Rail or Corn Crake,		
Red Flowering Currant,							
Rhododendron Pontticum,							
Whin,							

Have the goodness also to state any information you may be able to collect relative to the Crops of Grain, Hay, Potatoes, Turnips, Fruits, etc., whether plentiful, or in perfection; whether any have suffered from blight, disease, etc. Whether Epizootic disease prevails among cattle; and the Agricultural condition of the district generally.

Aberdeen
April 1892

BOOK POST.

To the SECRETARY
Scottish Meteorological Society,
122 George Street.
EDINBURGH.

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Aberdeen. Gordon's College County of Aberdeen, in Lat. 57°9'N, Long. 2°6'W, Distance from Sea 1 miles.

Height of Cistern of the Barometer above Mean Sea-Level 66 feet, above Ground 2½ feet. During the MONTH of May 1892

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER. 9 h. A.M. Barometer. No. ___	Attached Thermometer	9 h. P.M. Barometer. No. ___	Attached Thermometer	SELF-REGISTERING THERMOMETERS, Read Daily, at 9 P.M. Protected in Shade, 4 feet above Ground. Max. No. ___	Min. No. ___	Exposed Black Bulbs. Max. in Sun's rays No. ___	Min. on Grass No. ___	HYGROMETER. Dry No. ___ Wet No. ___ 9 h. A.M. Dry bulb.	Wet bulb.	9 h. P.M. Dry bulb.	Wet bulb.	Rain. No. of hours in which it fell.	Amount in inches. No. ___	WIND. 9 h. A.M. Direction.	Force	9 h. P.M. Direction.	Force	Readings of the H. Cup Anemometer. No. ___ 9 h. A.M.	CLOUDS. 9 A.M. Velocity (0—6) and Direction.	Amount (0—10), and Species.	P.M. Velocity (0—6) and Direction.	Amount (0—10), and Species.	SUNSHINE. Hours.	THERMOMETERS under Ground. 9 h. A.M. No. 3 inches.	No. 12 inches.	No. 22 inches.	Temperature of WELL at depth of ___ feet, No. ___	SEA. Temperature at 1 fathom, not Density.	OZONE. 0—10. 9 A.M.	9 P.M.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc. *Mention the hour at which Storms, including Thunder and Lightning, began and ended.*	Days of Month.
		inches.	°	inches.	°	°	°	°	°	°	°	°	°																							
	1	29.896	50.0	29.830	51.0	60.0	38.1			57.5	46.7	46.8	42.0		—	S	1	S	½		5	Cu-st	—	—	12										1
	2	30.008	50.5	30.090	51.0	54.0	36.2			52.5	46.8	42.5	41.2		.01	S	½	N.E.	1		5	Ci-Cu	10	St	5										2
	3	30.006	50.0	30.036	50.0	52.2	38.0			47.0	42.3	42.1	39.0		—	N.E.	1½	N.E.	1		5	Cu	9	Cu	10										3
	4	30.040	48.0	30.030	46.8	46.2	40.0			42.3	39.2	42.1	39.0		—	N	1½	N.	1½		10	Cu-St	10	Cu	1										4
	5	30.022	49.0	30.136	47.8	50.1	38.8			43.3	41.2	39.1	35.0		—	N.E.	1	N	1		10	Cu-St	10	Cu-St	6										5
	6	30.195	49.0	30.048	47.0	52.8	35.6			45.1	39.0	41.4	38.0		—	N	½	N.E.	1		6	Cu	—	—	13										6
	7	29.880	52.0	30.004	48.0	55.2	33.8			50.3	46.3	42.7	38.5		—	N.W.	1	N	1		10	St	10	St	5										7
	8	30.016	49.0	30.020	50.5	49.8	39.0			48.7	46.2	43.6	41.3		—	S.W.	1	S.W.	1		6	Cu-St	5	Ci-St	6										8
	9	30.090	52.0	30.212	49.0	58.2	37.8			52.2	46.1	44.8	43.2		—	S.	1	S.	1		8	Cu	2	St	9										9
	10	30.308	50.0	30.372	49.5	54.2	37.3			43.8	41.0	42.2	40.3		—	S	½	S	½		10	St	—	—	5										10
	11	30.452	48.0	30.470	47.5	56.2	37.5			44.3	41.4	41.8	40.4		—	S	1	S.E.	1		3	Ci-St	5	St	11										11
	12	30.440	48.0	30.252	48.0	55.0	36.0			42.1	39.8	41.3	39.4		.03	S.E.	1	S.	1		6	Ci-Cu	10	Cu-St	7										12
	13	30.0	52.0	29.880	56.5	58.2	38.2			50.2	47.5	42.2	39.2		.19	S.W.	½	S.W.	1		10	St	10	Cu-St	2										13
	14	29.772	52.0	29.780	53.0	64.2	48.0			52.2	48.3	48.2	44.0		.05	S.W.	1	S.W.	½		10	Nim	2	St	5										14
	15	29.530	50.5	29.444	54.0	64.1	43.6			49.8	45.7	52.1	46.8		.05	S.W.	1½	S.W.	½		8	Cu	5	Cu-St	6										15
	16	29.384	52.4	29.470	53.0	54.8	44.0			47.1	45.2	46.5	44.2		.14	W.	1	N.	1		10	St	8	Cu-St	2										16
	17	29.810	52.0	30.004	51.0	58.1	40.1			46.2	43.1	41.6	37.2		.01	N.	1	N	1		7	Cu-St	10	Cu-St	8										17
	18	29.902	50.0	29.636	50.0	49.4	38.6			45.0	41.6	44.8	42.3		.30	~~NW~~ N	~~1~~	~~N.W.~~ N	~~1~~ 1		10	Cu-St	2	St	—										18
	19	29.702	52.0	29.686	54.0	61.9	41.3			52.2	45.7	52.3	46.2		.11	N.W.	1	N.W.	1		5	Cu	4	Cu-St	12										19
AB	20	29.494	51.0	29.~~730~~ 830	50.0	52.1	40.0			49.2	47.8	40.1	38.0		.04	S.W.	½	N.E.	1		10	Cu-St	5	St	1										20
	21	29.760	52.0	29.740	51.0	53.1	36.0			49.8	45.7	39.0	37.2		.24	S.	1½	N	1		10	Cu-St	9	St	9										21
	22	29.912	50.5	29.920	50.0	52.2	37.0			48.8	42.2	43.1	40.6		.35	N.W.	1	N.W.	½		10	Cu-St	10	St	5										22
	23	29.724	50.0	29.684	50.0	58.2	39.0			43.0	42.4	47.1	46.0		.06	S.E.	1	S.E.	½		10	St	10	St	4										23
	24	29.592	52.0	29.748	53.0	63.2	39.0			51.8	50.4	55.2	50.3		.01	S.	1	S.W.	1		10	Cu-St	9	St	8										24
	25	29.730	52.5	29.626	53.0	56.2	46.1			50.2	48.5	53.2	51.1		.14	S.W.	½	S.	½		10	St	—	—	1										25
	26	29.794	53.0	29.820	54.0	63.4	43.2			56.2	51.8	50.3	49.0		.23	S.	1	S.	1		3	Cu-St	8	Ci-St	11										26
	27	29.680	52.5	29.860	56.0	69.0	47.2			53.1	52.0	53.2	51.3		—	S.W.	½	S.	½		10	Cu-St	10	St	10										27
	28	29.940	54.0	29.740	52.0	54.2	41.3			50.6	48.9	42.4	42.0		.23	N.E.	1	N.E.	1		10	St	10	St	1										28
	29	29.630	57.0	29.644	55.0	61.4	46.3			~~56.2~~ 50.3	50.3	51.1	49.0		—	S	1½	S	1		10	Cu-St	8	Ci-St	7										29
	30	29.758	58.0	29.920	57.5	64.8	49.0			60.0	53.6	55.0	52.1		.02	S.W.	1½	S.W.	1		2	Cu	9	Ci-St	10										30
AB	31	29.~~804~~ 806	56.0	29.~~720~~ 804	59.0	65.7	50.2			51.4	50.2	58.3	54.2		.18	S	1	S.W.	1		2	Ci-St	10	Cu-St	8										31
	Sums.	27.445	49.9	27.736	51.1	21.1	13.6			285.1	176.9	185.1	98.0		239		30.5		27.5		241		210		200										
	Means.	29.885	51.6	29.895	51.6	57.0	40.4			49.2	45.7	46.0	43.2				1.0		0.9		7.8		6.8												
	† Total Corrections for Instrumental Errors.	+006	−7	+006	−7												06		06		7.3														
	‡ Corrections for Diurnal Range.																																			
	"Corrected Means."																																			
	No. of Column.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30					

NOTATION USED IN GENERAL REMARKS.

a.	*denotes* aurora.		m.	*denotes* meteor.	
ci.	,,	cirrus.	ms.	,,	meteors.
ci.-cu.	,,	cirro-cumulus.	n.	,,	nimbus.
ci.-s.	,,	cirro-stratus.	r.	,,	rain.
cu.	,,	cumulus.	h. r.	,,	heavy rain.
cu.-s.	,,	cumulo-stratus.	c. h. r.	,,	continued heavy rain.
d.	,,	dew.	s.	,,	stratus.
f.	,,	fog.	sc.	,,	scud.
fr.	,,	frost.	s.	,,	sleet.
h.-fr.	,,	hoar-frost.	s.	,,	snow.
h.	,,	haze.	so. ha.	,,	solar halo.
h. d.	,,	heavy dew.	sq.	,,	squall.
hl.	,,	hail.	sqs.	,,	squalls.
l.	,,	lightning.	t.	,,	thunder.
li. cl.	,,	light clouds.	t. s.	,,	thunder-storm.
li. sh.	,,	light showers.	w.	,,	wind.
lu. co.	,,	lunar corona.	g.	,,	gale of wind.
lu. ha.	,,	lunar halo.			

TABLE FOR ESTIMATING FORCE OF WIND.

Estimated Force, 0—6.	Common Designation.	Estimated Force, 0—6.	Common Designation.	Estimated Force, 0—6.	Common Designation.
0	Calm	1·5	Light breeze	4	Blowing hard
0·5	Very light air	2·	Fresh breeze	5	Blowing a gale
1·	Light air	3·	Very fresh	6	Violent gale

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction †† for Temp. (Col. 2). = 29.891 ..... −.062 = 29.829

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction †† for Temp. (Col. 4), = 29.901 ..... −.062 = 29.839

Mean at Station, corrected, and at 32°, ... = 29.834

Correction for height, 66 feet above Mean Sea-level, ... = .074

Mean, reduced to 32°, and Sea-level, ... = 29.908

Highest Reading, corrected for Index error, on the th, ... = 30.470

Lowest Do. Do., on the th, ... = 29.384

Difference, or **Monthly Range**, ... = 1.086

* Each instrument tested at the Office in Edinburgh bears the stamp "S.M.S.;" and a number to be entered in the Heading; or the Number and Initials of the Maker may be here given.
† Embracing corrections for both capillarity and Index Errors.
‡ The Diurnal Range for Scotland is as yet unknown.
†† *Practically*, though not *absolutely* a *minus* correction.
‡‡ These "Hygrometrical Deductions" are calculated from Glaisher's Hygrometrical Tables, Second Edition *only*.
** While the Diurnal Range is unknown, the Arithmetical Mean of Cols. 5 and 6 will be entered as the "Calculated Mean Temperature."
Any observations not taken under the Conditions specified in the Directions on the other side, or noted at the Top of each column, must be marked as such by the observer, in each Schedule. *See over.*

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month**, (corrected for Index Errors), on the th, ... = 69.0

Lowest in Month, corrected for Index errors, on the th, ... = 33.8

Difference, or **Monthly Range**, ... = 35.2

"Corrected **Mean**" **of all the Highest**, (Col. 5), ... = 57.0

"Corrected **Mean**" **of all the Lowest**, (Col. 6), ... = 40.4

Difference, or **Mean Daily Range**, ... = 16.6

** Calculated **Mean Temperature** of Month, ... = 48.7

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the th, ... =

"Corrected **Mean**," (Col. 7), **of Black Bulb, Max. in Sun**, ...

Lowest at Night, Black Bulb (corrected for Index errors), on the th, =

"Corrected **Mean**," (Col. 8), **of Black Bulb, Min.** on grass, ...

Difference of above means or range ("exposed"), ... =

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb**, (Cols. 9 and 11), ... = 47.6

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb**, (Cols. 10 and 12), ... = 44.4

‡‡ Computed **Temperature of Dew-Point**, ... = 40.9

‡‡ Do. **Elastic Force of Vapour**, ... = .256

‡‡ Do. **Weight of Vapour in a Cubic Foot of Air**, = 2.96

‡‡ **Relative Humidity** (Saturation = 100), ... = 78

RAIN fell on 19 **Days; Amount in Inches**, ... = 2.39

WIND. SUMMARY.

Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	4	3	1	2	9	8	1	3		1.0	
P.M.	7	5		2	8	7		2		0.9	
Mean.	6	4	0	2	9	7	1	2	0	0.95 = 0.90	

Observations made and Return verified by James Dale Teacher in Robert Gordon's College, Aberdn

(Signed) M.

Greatest Daily Range = 24°2 on the 24th

M.

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

ONE of the chief objects that the SCOTTISH METEOROLOGICAL SOCIETY proposed to itself when the Society was established in 1855, was to secure PERFECT UNIFORMITY in the system of observation pursued at all its Stations. Uniformity in the observations is absolutely necessary to justify the publication of Monthly Results from different observations, it being found that differences between the Returns from two Stations, so very considerable as to render them quite incomparable, may arise from dissimilarity in the position or shelter of instruments, different hours of observation, or even from the use of differently constructed instruments. It is therefore hoped, that those who kindly furnish Reports to the Society will, by a scrupulous attention to the following Directions, secure for their Monthly Returns an accuracy and value commensurate with the labour and pains involved in making them; and, for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

The Council recommend that Observations be made precisely at 9 A.M. and 9 P.M. (Greenwich or Railway Time only), as specified in the following remarks, or at the top of the columns of the Schedule. It is hoped that the utmost punctuality in the time of reading the instruments will be observed. Observers, in some few cases, may find this impossible; in such instances, they are specially requested to mark opposite every reading the time at which it was taken, if not at 9 A.M. or 9 P.M.

Hour of Observation.

Weather-Glasses and Aneroids, though well suited to indicate roughly variations of atmospheric pressure, are not fitted for scientific purposes. No Barometer should be used for Meteorological Observation that is not supplied with some means of adjustment or compensation which will secure that the height of the mercury in the tube is accurately measured from the fluctuating surface of the mercury in the cistern.

Barometer.

The Barometer in which the error arising from the fluctuating surface of the mercury in the cistern is entirely got rid of is FORTIN'S Barometer, the arrangement consisting in applying pressure by means of a screw to the bottom of the cistern, which is made of flexible leather, thus raising or depressing the surface till it just meets the ivory point which forms the zero point of the fixed scale.

The Barometer originally constructed by Mr. Adie of London, and usually called the Board of Trade Barometer, has the great convenience of requiring no adjustment of the cistern. Its scale-inches are not true inches, but so much shorter as to compensate the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This is an excellent Barometer for ordinary Observers, inasmuch as it entirely eliminates the error of observation likely to arise in not a few cases in setting the instrument to the zero point of the fixed scale when the light is not good. To show the accuracy with which these Barometers are made, it may be stated, that one was compared, during a whole year, with the Society's Standard Barometer, particular care being given to make the comparison when atmospheric pressure was rising or falling very rapidly, with the result that none of the readings differed from those of the Standard more than 0·003 inch.

A modification of Fortin's Barometer is used at a number of the Society's Stations, by which the coincidence of the zero point with the surface of the mercury is indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When the index-line on this little piston-rod is brought, by the adjusting screw, to form one straight line with those on its ivory frame, the surface of the mercury is then at the exact height from which the scale is graduated. In taking an observation, this preliminary setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the vernier.

It is absolutely necessary that the Barometer which is to be used shall have been compared with a Standard Barometer.

The Barometer should be suspended in as good a light as can be secured, and to facilitate the reading, a piece of white paper may be put behind the tube. It must be hung truly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire, and must not be hung against a wall heated by a flue. The object being to secure that the whole instrument, including the brass fittings, the contained mercury, and the attached Thermometer, shall be, when read, at one uniform temperature, it is evident that the best position is that which is least liable to sudden changes of temperature.

In taking an Observation, the Attached Thermometer is first noted: the tube must then be gently tapped, and the cistern-adjustment carefully made. The eye, by raising and lowering it, must be brought into the plane of the back and front of the index—usually the lower edge of the vernier, which must be carefully adjusted so as to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly, so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will facilitate an accurate adjustment and reading of the Barometer. A mistake not unfrequently made by those beginning to observe, consisting in setting the edge of the vernier to the level of the clear surface of the mercury which is in direct contact with the glass tube, must be carefully avoided.

The errors most frequently made in reading the Barometer are errors of 1·000 inch, 0·500 inch, and 0·050 inch; that is to say, instead of 29·365 inches, either of the following is sometimes set down—viz. as 30·365 inches, 28·365 inches, 29·865 inches, or 29·815 inches. Experience having shown that even the very best Observers make these mistakes, particular attention is directed to the matter.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must first be screwed so as to form a tight plug to the cistern, thus preventing the escape of the mercury. Then screw up the mercury not quite to the top of the tube, but to within a quarter of an inch of it, and take down the instrument; it should then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case if, on inclining the instrument, a sharp tap is produced when the mercury strikes the top of the tube. If a dull tap is heard, there is air in the tube, which must be got rid of.

As Barometers are liable to be deranged by the introduction of air into their tubes, on removal from place to place, or in being roughly handled, it may be useful to Observers to know how the air may be expelled. First close up the cistern by screwing the ivory peg tight, so as to prevent the escape of mercury; then screw up the mercury to about half an inch from the top of the tube; and having slowly inverted the instrument, place the top of it on a yielding substance, such as the boot, and gently tap on the cistern with the palm of the hand, so as to induce the air to ascend through the column to the cistern, whence it may escape. Since there is the weight of two atmospheres—the pressure of the mercury in the Barometer, and the air outside—pressing on any air that may be inside the tube, it is usually a tedious operation to get it wholly expelled. After repeated trials, however, it is generally accomplished; and the clear metallic sound of the mercury, when gently struck against the top of the glass tube, will show when the whole of the air has been expelled. On hanging up the Barometer, care must be taken to screw down the mercury in the tube before unfastening the float of the cistern, for, if this be not attended to, the mercury will flow out, and the instrument be seriously damaged.

The Council of the Society recommend that the Self-Registering Thermometers, and the Dry and Wet Bulb Hygrometer, be kept in Stevenson's Louvre-boarded Box for Thermometers, painted white inside and outside, and screwed to four stout posts, also painted white, firmly fixed in the ground. The posts must be of such a length that when the Thermometers are hung in position the Bulbs of the Minimum Thermometer, and of the Dry and Wet Bulb Thermometers, will be exactly at the same height of FOUR FEET above the ground, the Maximum Thermometer being hung immediately above the Minimum Thermometer. The Thermometer Box is to be placed over a plot of grass, and in a free open space to which the sun's rays have free access during as much of the day as surrounding conditions enable the Observer to secure. The Thermometers are suspended on cross-laths in the centre of the Box, and face the door, which should open to the north.

Protection and Position of Thermometers.

The Council regard the question of UNIFORMITY OF HEIGHT ABOVE GROUND, AND METHOD IN PROTECTING THE THERMOMETERS, as vital in every system of Meteorological Observation, since without it Observations made at different Stations are incomparable, thus rendering it impossible to compare the Climates of places with each other as regards their most important features.

Professor Phillips, and Negretti and Zambra's Maximum Thermometers, and Rutherford's Minimum Thermometer, are recommended. It is recommended that these Thermometers be graduated on the glass stem. The Minimum Thermometer is liable to two derangements—viz., the column of spirit breaking, and part of the spirit distilling by high temperature and lodging at the top of the tube. This derangement is of occasional occurrence with protected Thermometers, but of frequent occurrence with exposed Thermometers. Hence a systematic examination of Minimum Thermometers ought to be a regular part of the work carried on by each Observer.

Self-Registering Thermometers.

Fortunately, Spirit Thermometers may be easily set right by any one, when the column of spirit chances to separate. Let the Thermometer be taken in the hand by the end farthest from the bulb, raised above the head, and then forcibly swung down towards the feet; the object being, on the principle of centrifugal force, to send down the detached portion of spirit till it unites with the column. A few throws, or swinging strokes, will generally be sufficient for the purpose; after which the Thermometer should be placed in a slanting position, to allow the rest of the spirit still adhering to the sides of the tube to drain down to the column. But another method must be adopted, if the portion of spirit in the top of the tube be small. Heat should be applied slowly and cautiously to the top end of the tube where the detached portion of spirit is, which, being turned into vapour by the heat, will condense on the surface of the unbroken column of spirit. Care must be taken that the heat is not applied too quickly; for, if this be done, the tube will break and the instrument be destroyed. The best way to apply the requisite amount of heat is by bringing the end of the tube slowly down towards a minute flame from a gas-burner; or, if gas be not at hand, a piece of heated metal will serve instead.

The bulbs of the Thermometers for registering the greatest heat from the sun's rays, and the least from radiation during night, have a black coating, which may easily be made, or mended, by the application of a mixture of lampblack and printer's ink. They are placed in shallow blackened boxes, whose sides protect the bulbs from the wind. The Maximum should be freely exposed to the sun, and the Minimum should rest on wooden supports a few inches from the surface of the grass, in an open situation. Snow must not be allowed to cover either of these Thermometers; nor the sun's heat to affect the Minimum Thermometer by distillation. Black-bulbs enclosed in 'glass jackets' may also be used, being indeed preferable to the above. It must, however, be added, that the whole subject of the observation of Solar and Terrestrial Radiation is not yet in a sufficiently advanced state to warrant the exclusive recommendation of any one of these methods.

Black-Bulb Thermometers.

The Hygrometer in use at the Society's Stations consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved form of this apparatus seriously vitiate the Hygrometrical Observations, Observers are specially requested to attend to the following conditions:—The bulbs must hang down by at least an inch free from the scales and frame to which they are attached; the frame must be such as will bring the tubes forward by an inch from any board on which it may be suspended; the water-cup must be covered, and altogether placed to the side, and a little below the level of the wet bulb, but in no case under the bulbs; the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the Observer that the muslin is always clean and moist, and the water pure. In frosty weather, observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

Dry and Wet Bulb Hygrometer.

In reading the Thermometer great care must be taken to bring the eye exactly opposite the tip of the index or column of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°·9, 40°·0, or 40°·1; or again, 40°·4, 40°·5, 40°·6, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40$\frac{1}{2}$°, respectively. So also 40$\frac{1}{4}$°, and 40$\frac{3}{4}$°, more or less, must be registered 40°·2, or 40°·3, and 40°·7, or 40°·8 respectively. In reading Rutherford's Minimum Thermometer, the indication of that end of the index which is next the surface of the spirit is alone noted. On opening the Thermometer Box, the Dry and Wet Bulb Thermometers are to be first, and rapidly, read, inasmuch as they are readily affected by heat from the person of the Observer.

Reading of the Thermometer.

The Hygrometer is read at 9 A.M. and 9 P.M. The Self-Registering Thermometers are read at 9 P.M. only, as indicating the greatest and least degrees of temperature in the 24 hours preceding. It is not a matter of indifference when the Self-Registering Thermometers are read, since, in winter at least, the extremes may occur at any hour; and it is necessary to refer their occurrence to their proper meteorological day. In the Society's schedules, the indications registered on the 3d are those of a series of phenomena commencing at 9 P.M. on the 2d, and extending till 9 P.M. on the 3d.

Hour of observing Temperature.

No instrument ought to be used for Meteorological purposes till it has been carefully tested by comparison with a standard Thermometer. When such Thermometers as are not graduated on the stem, but merely on an attached scale, undergo repairs, they are very liable to be moved from their position on the Scale, and ought never afterwards to be used without being re-tested. The Self-Registering, especially the Minimum Thermometers, ought frequently to be compared with the dry bulb of the Hygrometer. The freezing-point of each Thermometer, marked by a scratch on the tube, ought to be tested once a year, in snow or melting ice.

Verification of Thermometers.

In selecting instruments, the following points require attention:—The divisions of the vernier of Barometers in reference to their scales, and the perfect freedom of the Barometer from air; the correct numbering of the scale of every instrument; the rejection of Thermometers the frameworks of which are not likely to stand exposure to the weather, as shown in the past by repeated and annoying breakages of Thermometers of similar construction; and as regards Maximum Thermometers, either Negretti and Zambra's, or Phillip's, whether they will act at the highest temperatures they may be required to register. By the laws of the Society, Members and Observers have a right to have their instruments compared by the Secretary, and to advise with him regarding the purchase of instruments.

Very great care should be bestowed on the Observations of the Wind, the accuracy of which, both as regards Direction and Force, is so essential towards the right discussion of many of the more important problems of the science.

Wind.

A Wind-Vane ought to be elevated at least 12 feet above surrounding objects. When it oscillates incessantly, the mean direction should be taken. In all cases, but especially when the Vane is stationary, and when the wind is feeble, reference may be made to the direction of smoke, etc., in well-exposed situations. Careful observations are recommended to be made on the changes in the direction of the wind; and during storms, extra observations at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, is likely to give highly valuable and important results, particularly in connection with the system of thickly-planted Stations over a limited district round Edinburgh called STORM STATIONS, in the course of being established by the Society for the systematic investigation of the relation of the force of the wind to BAROMETRIC GRADIENTS, and other points connected with storms.

1. As regards Direction.

The Council would recommend the Hemispherical Cup Anemometer,—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the mean Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind at any particular hour of observation, the Pressure Anemometers recently brought under the notice of the Society by Mr. T. Stevenson, the Honorary Secretary, and Mr. R. Ballingall, the Society's Observer at Eallabus, are recommended as likely to secure uniformity in making observations on the Force of the Wind.

2. As regards Velocity and Pressure.

Many causes conspire to produce anomalies in Rain Returns, arising partly from the difficulty of obtaining a perfectly unobjectionable situation for observation, and partly from the defective nature of the instruments used. The Rain Gauge should not be placed on a slope or terrace, but on a level piece of ground, in as open a situation as the Observer can secure for it. As it is often difficult to obtain a position as free and unobstructed by surrounding objects as is desirable, care should be taken to place it at some distance from shrubs, trees, buildings, or other obstructions, at least as many feet from their base as they are in height. The more important directions, towards which it is most desirable to have a free exposure, are, in the order of their importance, S.W., N.E., S.E., S., and W. The rim of the gauge must be perfectly level, and fixed so that it will remain level in all weathers, and be at a height of one foot above ground, over grass. In such gauges as Fleming's, which are furnished with a measuring-rod attached to a float, the rod ought to be fixed down, and the float rise to its height only at the time the instrument is read, it being found that a stem projecting above the rim of the gauge seriously interferes with the proper measurement of the Rainfall. When a measuring-glass is used, care should be taken to hold it quite perpendicular. The Rain Gauge ought to be read daily at 9 A.M., and the reading entered in the Returns of the previous day. If the Gauge is read once a month, the reading is to be made on the first of the month, and the amount entered for the previous month.

Rain Gauges.

Snow-falls may, for convenience, be registered in the rain columns, under the following conditions:—When a Snow shower occurs, it should be noted in the 'Remarks,' and the letter S affixed to the depth of water received in Gauge. The depth of the snow must be measured in some open place where no drift is observed, and registered in addition to, and as a check upon, the indications of the Rain Gauge. For wind, rain, and snow, as indeed in every column, the Observer cannot be too careful to register observations only; and nothing that partakes of the nature of deduction or inference.

Snow-falls.

Convenient abbreviations for the nomenclature of Clouds will be found on the other side. The amount of Cloud ought to be estimated from the greater or less obscuration of the sky overhead (*i.e.* within 20° or 30° of the zenith). The strata of Clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the Clouds' column, though their appearance and changes may be noted among the Remarks. The amount of Cloud is entered from a scale of 0 to 10; thus, when the sky overhead is free from Clouds it is entered 0, when half-covered by Clouds, 5, wholly covered, 10, and so on.

Clouds.

Observations of the Clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—Thus, in the column Velocity and Direction, 6, S. W.

———— will indicate that the upper strata of Clouds travel with 2, W.

extreme velocity from S.W., and those in the lower regions from W., with one-third the speed of the former. Again, in the second Cloud column, an entry of $\frac{4,\ st.}{2,\ cu\text{-}st.}$ will indicate that the higher regions are covered to the amount of 4-tenths with stratus Clouds; and that the sky is further obscured to the extent of 2-tenths by lower Clouds of the cumulo stratus kind.

Remarks on peculiar Clouds, accompanied with drawings, will assist materially in the development of a more exact nomenclature of Clouds, as well as throw light on the electrical, and other of the more obscure phenomena of Meteorology.

The approximate number of Hours in which objects in the sun's rays cast shadows, should be entered in the proper column.

Sunshine.

As the germination and growth of crops and plants generally depend greatly on the temperature of the soil,—its amount and constancy,—the Council recommend that Observations in this interesting department be made at 9 A.M., by Thermometers permanently fixed in the soil, their bulbs being sunk to depths of 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain-water being conveyed to the bulbs by the stems or wooden frames.

Underground Thermometers.

A knowledge of the Temperature of the Sea is not only in itself, but in its relations to that of our island, a most important branch of Meteorology. The Council therefore recommend that the Temperature of the Sea be carefully taken by a properly constructed apparatus, from boats, or, if this be impracticable, from the ends of piers and rocks round the coast, where it is not in[fluenced] of river water, and as little influenced as possible by [ing] along the coast, and thus acquiring the temperat[ure] either greatly heated by the sun or cooled by noctu[rnal] At or near the time of high water, in cases where the observations cannot be taken daily, the observation may be made on the 5th, 15th, and 25th of each month. When convenient, extra Sea Observations might be taken for other and greater depths, noting always the Temperature of the Air, and the Hour of Observation. It is also very desirable that observations on the daily Maxima and Minima by Thermometers continuously immersed, be instituted at points along the coast, by the method proposed by Mr. T. Stevenson, and already commenced at Peterhead and Liverpool.

Temperature of the Sea.

The Temperature of the water at the bottom of Wells ought, when practicable, to be taken, both the depth of the Well and of the water being noted.

Temperature of Wells.

Mention what Test-Papers are used, Schönbein's or Moffat's, etc.

The Paper is affixed by a pin to a board in the Thermometer Box, and the indications registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus $3^{N.W.}_{4}$, as an Ozone entry in the schedule will indicate that the Ozone paper is tinted as 3 on the scale, that the wind is from the N.W., and that its force on the scale 0—5 is 4, or blowing fresh.

Ozone.

Too much importance cannot be attached to the electric condition of the atmosphere in connection with terrestrial magnetism, barometrical, thermometrical, and meteorological phenomena generally. A proper Electrometer is, in truth, necessary to every complete meteorological observatory.

Atmospheric Electricity.

The Remarks column is unavoidably too narrow. Some of the most valuable Observations that can be taken are those for which no rules can be given nor hours assigned. The use of contractions ought, therefore, to be taken every advantage of, and a list of such as are in general use is given at the foot of the column. Besides special and extraordinary Observations, great prominence ought to be given in this column to Prevalent Diseases, differences in character, colour, velocity, and direction between the Lower and Upper Strata of clouds, the Colour of the Sky, etc. Remarks ought to be made on the occurrence of Meteors, Aurore Boreales, remarkable depressions, elevations, and fluctuations of the Barometer, Thunder-Storms, and remarkable falls of Snow, Hail, or Rain, the Hour of Storms of Wind commencing, attaining their maximum, and ending, as well as such Notes on Storms as have been hinted at above. When lofty hills are in the vicinity of a Station, the Height of Clouds and of the Snow-line in winter should be recorded.

Remarks.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. should be registered, either in two columns, otherwise unoccupied, or ruled off for the purpose, from the column of 'Remarks.'

Observations in connection with the Periodic Return of the Seasons, possess not only great scientific value, but are of considerable importance in connection with Agriculture, Horticulture, and Natural History. The Council would direct the special attention of Observers to the registration of such phenomena, so that the published Summaries may fairly represent the whole of Scotland. Observations ought to be confined to individual trees and shrubs; to particular species of birds, and, in the case of crops, to specified sorts reared from year to year on a selected piece of ground or farm. The Annual Table, published yearly in the Society's Journal, will indicate the species of plants and animals to which special attention is more particularly directed.

Observations in connection with the Periodic Return of the Seasons.

The Council recommend Observers, before purchasing new instruments, and in repairing old ones, to communicate with the Meteorological Secretary, in order that every instrument may be examined and improved before being used; and they consider it necessary that he should have full power to reject any instrument which, on being presented for comparison, does not afford him satisfaction.

(By Order) A. B.

EDINBURGH, *December* 1888.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	Leaf Buds first Appear.	In Leaf.	Divested of Leaves.
Alder,				
Ash,				
Beech,				
Birch,				
Elm,				
Larch,				
Lime,				
Oak,				
Sycamore or Plane,				

SHRUBS, ETC.	First in Blossom.
Barberry,	
Bourtree or Elder,	
Broom,	
Hazel,	
Hawthorn,	
Holly,	
Laburnum,	
Lilac,	
Mezereon,	
Mountain Ash or Rowan,	
Red Flowering Currant,	
Rhododendron Ponticum,	
Whin,	

FRUITS.	First in Blossom.	Fruit Ripe generally.
Apple,		
Black Currant,		
Cherry,		
Gean,		
Gooseberry,		
Peach,		
Pear,		
Plum,		
Strawberry,		

CROPS, mentioning variety.	Sowing or Planting.	Appearing above Ground.	In Ear or Flower.	First Cut or Raised.
Barley,				
Bere or Bigg,				
Oats,				
Wheat,				
Beans,				
Pease,				
Potatoes,				
Turnips,				
Rye Grass,				

MIGATORY BIRDS.	First Arrival.	Departure.
Cuckoo,		
Curlew,		
House-Swallow,		
Lapwing,		
Plover,		
Sand-Martin,		
Starling,		
Swan,		
Rail or Corn Crake,		

Have the goodness also to state any information you may be able to collect relative to the Crops of Grain, Hay, Potatoes, Turnips, Fruits, etc., whether plentiful, or in perfection; whether any have suffered from blight, disease, etc. Whether Epizootic disease prevails among cattle; and the Agricultural condition of the district generally.

Aberdeen
May 1892

To the SECRETARY
Scottish Meteorological Society,
122 George Street.
EDINBURGH.

BOOK POST.

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Aberdeen, County of _____, in Lat. _____, Long. _____, Distance from Sea _____ miles.

Height of Cistern of the Barometer above Mean Sea-Level _____ feet, above Ground _____ feet. During the MONTH of June, 1892.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER. 9 h. A.M. Barometer. * No. ___	Attached Thermometer	9 h. P.M. Barometer. No. ___	Attached Thermometer	SELF-REGISTERING THERMOMETERS, Read Daily, at 9 P.M. Protected in Shade, 4 feet above Ground. Max. No. ___	Min. No. ___	Exposed Black Bulbs. Max. in Sun's rays No. ___	Min. on Grass No. ___	HYGROMETER. Dry No. ___ Wet No. ___ 9 h. A.M. Dry bulb.	Wet bulb.	9 h. P.M. Dry bulb.	Wet bulb.	Rain. No. of hours in which it fell.	Amount in inches. No. ___	WIND. 9 h. A.M. Direction.	Force	9 h. P.M. Direction.	Force	Readings of the H. Cup Anemometer No. ___ 9 h. A.M.	CLOUDS. 9 A.M. Velocity (0—6) and Direction.	Amount (0—10), and Species.	P.M. Velocity (0—6) and Direction.	Amount (0—10), and Species.	SUNSHINE. Hours.	THERMOMETERS under Ground. 9 h. A.M. No. 3 inches.	No. 12 inches.	No. 22 inches.	Temperature of WELL at depth of ___ feet, No. ___	SEA. Temperature at Station, and Density.	OZONE. 0—10. 9 A.M.	9 P.M.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc. *Mention the hour at which Storms, including Thunder and Lightning, began and ended.*	Days of Month.
		inches.	°	inches.	°	°	°	°	°	°	°	°	°																						
	1	29.480	59.0	29.602	58.0	69.1	49.1			59.0	53.8	52.0	49.6		.04	S.W.	1	S	1½		2	Ci-St	1	St	10										1
	2	29.584	56.0	29.306	54.0	52.4	44.2			49.8	48.3	49.8	46.0		.37	S.E.	1	S.E.	1½		10	St	2	St	5										2
	3	29.440	54.0	29.660	55.5	58.4	44.0			51.8	45.7	50.2	45.3		—	S.W.	1½	S.W.	1		8	Cu-St	2	Cir	9										3
	4	29.770	60.0	29.728	56.0	63.0	46.2			58.7	50.0	50.1	48.0		.08	S.	1	S	1½		9	Ci-Cu	10	St	8										4
	5	29.670	54.0	29.930	54.0	51.9	45.3			52.3	50.0	49.1	48.7		—	S.E.	1	E	½		10	St	10	St	—										5
	6	30.102	54.0	30.236	54.0	58.1	47.1			51.9	50.8	50.2	48.8		—	S	½	S.E.	—		10	St	9	Ci-St	10										6
	7	30.308	62.0	30.360	62.0	72.0	47.4			68.0	62.1	62.1	58.2		—	W	½	S.	½		2	Cir	1	St	14										7
	8	30.362	62.0	30.292	62.0	71.0	54.0			66.0	60.1	58.2	55.1		—	S	1	E	½		2	Cir	1	St	14										8
	9	30.280	63.0	30.170	62.0	68.0	55.0			65.3	63.4	55.4	53.0		—	S.E	—	N	½		1	St	10	Cu-St	12										9
	10	30.108	57.5	30.020	56.0	57.2	48.2			50.3	48.1	48.0	45.3		—	N	1	N.E.	½		10	Cu-St	10	Cu-St	—										10
	11	29.932	50.0	29.880	54.0	50.9	42.8			49.2	45.1	44.7	42.3		.02	N.E	1	N	1		10	Cu-St	10	Cu-St	1										11
	12	29.812	50.0	29.912	51.0	52.1	41.2			~~49.2~~ 47.8	~~45.1~~ 43.0	44.0	42.0		.14	N.W.	1	N.W.	1		10	Nim	9	Ci-St	7										12
	13	30.070	51.5	30.196	53.0	50.8	40.0			48.8	45.0	44.5	42.1		.03	N	1½	N.W.	1		8	Cu-St	9	Cu-St	9										13
	14	30.180	51.0	30.080	55.0	58.5	38.6			51.1	50.1	51.2	47.0		—	N.W	1½	N.W.	1½		1	St	10	Cu-St	8										14
	15	29.988	54.0	29.784	54.2	55.1	45.1			52.3	47.6	52.0	51.0		.29	N.W	1	S.E. ~~N.W.~~	1½		10	Cu-St	10	Nim	1										15
	16	29.846	50.0	29.840	52.0	54.8	42.0			46.1	42.0	43.0	40.4		.12	S.E.	1	S.E.	1		5	Cu	10	St	8										16
	17	29.796	51.0	29.920	50.0	54.0	39.8			45.3	44.0	45.0	44.0		.33	S.	½	S	½		10	St	10	Nim	2										17
	18	29.872	52.0	29.878	54.0	54.0	44.0			49.6	47.8	45.6	43.8		.09	N.E.	½	N.E.	—		10	Nim	7	Ci-St	7										18
	19	29.738	53.0	29.746	52.5	52.1	43.0			52.0	49.1	48.8	48.0		.52	N.E.	1	N.E.	½		10	Cu-St	10	Nim	~~0.5~~										19
	20	29.776	54.0	29.830	54.0	~~58.0~~ 54.0	42.9			53.0	48.3	47.1	45.1		—	E.	1	N.E	½		4	Cu	1	St	12.3										20
	21	29.868	54.0	29.912	59.0	56.0	40.2			55.2	49.5	52.0	48.0		—	N	½	S.S.W.	1		6	Cu	1	Cu.	15.3										21
	22	29.873	59.0	29.811	57.0	55.7	44.3			51.4	49.0	49.4	48.1		—	S.S.W.	1½	S.S.W.	1		7	St.	10	St.	0.9										22
	23	29.707	58.0	29.734	57.0	52.6	48.8			49.4	49.1	51.7	49.6		.03	N.E.	1	N.E.	1		10	St.	5	St.	0.4										23
	24	29.874	58.0	29.971	58.0	58.0	44.8			51.4	45.4	49.2	45.7		.01	N.W.	1	S.	1		5	Cu.	7	Cu-S	4.0										24
	25	29.937	58.0	29.741	58.0	57.6	43.0			48.0	44.6	48.3	47.8		—	S.S.E.	1½	S.S.E.	2		10	Nim	10	Nim	0.0										25
	26	29.666	60.0	29.654	61.0	63.1	47.9			61.6	56.1	62.9	59.6		.25	S.W.	1	S.S.W.	1½		10	Nim	5	~~Cu.~~	3.9										26
	27	29.654	63.0	29.782	64.0	67.6	53.0			62.4	52.4	64.4	53.9		.08	S.W.	2	W.S.W.	2½		3	Cu.	3	~~Ci.~~ Cu.	13.9										27
	28	30.102	64.0	30.185	64.0	64.6	50.0			60.0	51.0	53.2	50.4		—	W.S.W.	1	E.	1		5	Cu	4	~~St.~~	11.4										28
	29	30.136	65.0	30.176	64.0	59.0	48.2			57.0	52.0	56.4	50.0		—	S.S.W.	½	S.	1		2	Ci Cu	5	Cu.	11.5										29
	30	30.126	65.0	30.050	67.0	68.0	45.8			56.0	49.2	62.1	53.2		—	S	½	S.W.	1½		5	Cu	7	~~Cu~~	8.6										30
	31																																			31
	Sums.	27.067	202.0	27.346	212.2	253.6	170.5			120.7	24.26	40.6	244.5		2.40		24.0		30.0		205		149		207.7										
	Means.	29.903	56.7	29.912	57.1	58.5	45.7			54.0	49.8	51.4	48.3				1.0		1.0		6.8		6.6		208										
	† Total Corrections for Instrumental Errors.	+006	-.7	+006	-.7												.06		.06																
	‡ Corrections for Diurnal Range.																																			
	"Corrected Means."																																			
	No. of Column.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30					

NOTATION USED IN GENERAL REMARKS.

a.	*denotes* aurora.		m.	*denotes* meteor.	
ci.	,,	cirrus.	ms.	,,	meteors.
ci.-cu.	,,	cirro-cumulus.	n.	,,	nimbus.
ci.-s.	,,	cirro-stratus.	r.	,,	rain.
cu.	,,	cumulus.	h. r.	,,	heavy rain.
cu.-s.	,,	cumulo-stratus.	c. h. r.	,,	continued heavy rain.
d.	,,	dew.	s.	,,	stratus.
f.	,,	fog.	sc.	,,	scud.
fr.	,,	frost.	s.	,,	sleet.
h.-fr.	,,	hoar-frost.	s.	,,	snow.
h.	,,	haze.	so. ha.	,,	solar halo.
h. d.	,,	heavy dew.	sq.	,,	squall.
hl.	,,	hail.	sqs.	,,	squalls.
l.	,,	lightning.	t.	,,	thunder.
li. cl.	,,	light clouds.	t. s.	,,	thunder-storm.
li. sh.	,,	light showers.	w.	,,	wind.
lu. co.	,,	lunar corona.	g.	,,	gale of wind.
lu. ha.	,,	lunar halo.			

TABLE FOR ESTIMATING FORCE OF WIND.

Estimated Force, 0—6.	Common Designation.	Estimated Force, 0—6.	Common Designation.	Estimated Force, 0—6.	Common Designation.
0	Calm	1·5	Light breeze	4	Blowing hard
0·5	Very light air	2·	Fresh breeze	5	Blowing a gale
1·	Light air	3·	Very fresh	6	Violent gale

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction ‡ for Temp. (Col. 2). = 29.909 − .074 = 29.835

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction ‡ for Temp. (Col. 4). = 29.918 − .075 = 29.843

Mean at Station, corrected, and at 32°, ... = 29.839

Correction for height, 66 feet above Mean Sea-level, ... = .074

Mean, reduced to 32°, and Sea-level, ... = 29.913

Highest Reading, corrected for Index error, on the th, ... = 30.362

Lowest Do. Do., on the th, ... = 29.306

Difference, or **Monthly Range**, ... = 1.056

* Each instrument tested at the Office in Edinburgh bears the stamp "S.M.S.;" and a number to be entered in the Heading; or the Number and Initials of the Maker may be here given.
† Embracing corrections for both capillarity and Index Errors.
‡ The Diurnal Range for Scotland is as yet unknown.
†† *Practically*, though not *absolutely* a *minus* correction.
‡‡ These "Hygrometrical Deductions" are calculated from Glaisher's Hygrometrical Tables, Second Edition *only*.
** While the Diurnal Range is unknown, the Arithmetical Mean of Cols. 5 and 6 will be entered as the "Calculated Mean Temperature."
Any observations not taken under the Conditions specified in the Directions on the other side, or noted at the Top of each column, must be marked as such by the observer, in each Schedule. *See over.*

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month**, (corrected for Index Errors), on the th, ... = 72.0

Lowest in Month, corrected for Index errors, on the th, ... = 38.6

Difference, or **Monthly Range**, ... = 33.4

"Corrected **Mean**" **of all the Highest**, (Col. 5), ... = 58.5

"Corrected **Mean**" **of all the Lowest**, (Col. 6), ... = 45.7

Difference, or **Mean Daily Range**, ... = 12.8

** Calculated **Mean Temperature** of Month, ... = 52.1

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the th, ... =

"Corrected **Mean**," (Col. 7), **of Black Bulb, Max. in Sun**, ... =

Lowest at Night, Black Bulb (corrected for Index errors), on the th, =

"Corrected **Mean**," (Col. 8), **of Black Bulb, Min.** on grass, ... =

Difference of above means or range ("exposed"), ... =

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb**, (Cols. 9 and 11), ... = 52.7

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb**, (Cols. 10 and 12), ... = 49.0

‡‡ Computed **Temperature of Dew-Point**, ... = 45.3

‡‡ Do. **Elastic Force of Vapour**, ... = .302

‡‡ Do. **Weight of Vapour in a Cubic Foot of Air**, = 3.43

‡‡ **Relative Humidity** (Saturation = 100), ... = 76

RAIN fell on 15 **Days; Amount in Inches**, ... = 2.40

WIND. SUMMARY.

Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	3	4	2	5	6	4	2	4			
P.M.	2	5	3	5	9	2	1	3			
Mean.	2	5	2	5	8	3	1	4	0	1.0 = 1.00	16

Greatest Daily Range = 24°6 on the 25th

Observations made and Return verified by _____

(Signed) L. Brodie
Observatory, Aberdeen

W.

W.

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

ONE of the chief objects that the SCOTTISH METEOROLOGICAL SOCIETY proposed to itself when the Society was established in 1855, was to secure PERFECT UNIFORMITY in the system of observation pursued at all its Stations. Uniformity in the observations is absolutely necessary to justify the publication of Monthly Results from different observations, it being found that differences between the Returns from two Stations, so very considerable as to render them quite incomparable, may arise from dissimilarity in the position or shelter of instruments, different hours of observation, or even from the use of differently constructed instruments. It is therefore hoped, that those who kindly furnish Reports to the Society will, by a scrupulous attention to the following Directions, secure for their Monthly Returns an accuracy and value commensurate with the labour and pains involved in making them; and, for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

The Council recommend that Observations be made precisely at

Hour of Observation.

9 A.M. and 9 P.M. (Greenwich or Railway Time only), as specified in the following remarks, or at the top of the columns of the Schedule. It is hoped that the utmost punctuality in the time of reading the instruments will be observed. Observers, in some few cases, may find this impossible; in such instances, they are specially requested to mark opposite every reading the time at which it was taken, if not at 9 A.M. or 9 P.M.

Barometer.

Weather-Glasses and Aneroids, though well suited to indicate roughly variations of atmospheric pressure, are not fitted for scientific purposes. No Barometer should be used for Meteorological Observation that is not supplied with some means of adjustment or compensation which will secure that the height of the mercury in the tube is accurately measured from the fluctuating surface of the mercury in the cistern.

The Barometer in which the error arising from the fluctuating surface of the mercury in the cistern is entirely got rid of is FORTIN'S Barometer, the arrangement consisting in applying pressure by means of a screw to the bottom of the cistern, which is made of flexible leather, thus raising or depressing the surface till it just meets the ivory point which forms the zero point of the fixed scale.

The Barometer originally constructed by Mr. Adie of London, and usually called the Board of Trade Barometer, has the great convenience of requiring no adjustment of the cistern. Its scale-inches are not true inches, but so much shorter as to compensate the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This is an excellent Barometer for ordinary Observers, inasmuch as it entirely eliminates the error of observation likely to arise in not a few cases in setting the instrument to the zero point of the fixed scale when the light is not good. To show the accuracy with which these Barometers are made, it may be stated, that one was compared, during a whole year, with the Society's Standard Barometer, particular care being given to make the comparison when atmospheric pressure was rising or falling very rapidly, with the result that none of the readings differed from those of the Standard more than 0·003 inch.

A modification of Fortin's Barometer is used at a number of the Society's Stations, by which the coincidence of the zero point with the surface of the mercury is indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When the index-line on this little piston-rod is brought, by the adjusting screw, to form one straight line with those on its ivory frame, the surface of the mercury is then at the exact height from which the scale is graduated. In taking an observation, this preliminary setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the vernier.

It is absolutely necessary that the Barometer which is to be used shall have been compared with a Standard Barometer.

The Barometer should be suspended in as good a light as can be secured, and to facilitate the reading, a piece of white paper may be put behind the tube. It must be hung truly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire, and must not be hung against a wall heated by a flue. The object being to secure that the whole instrument, including the brass fittings, the contained mercury, and the attached Thermometer, shall be, when read, at one uniform temperature, it is evident that the best position is that which is least liable to sudden changes of temperature.

In taking an Observation, the Attached Thermometer is first noted: the tube must then be gently tapped, and the cistern-adjustment carefully made. The eye, by raising and lowering it, must be brought into the plane of the back and front of the index—usually the lower edge of the vernier, which must be carefully adjusted so as to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly, so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will facilitate an accurate adjustment and reading of the Barometer. A mistake not unfrequently made by those beginning to observe, consisting in setting the edge of the vernier to the level of the clear surface of the mercury which is in direct contact with the glass tube, must be carefully avoided.

The errors most frequently made in reading the Barometer are errors of 1·000 inch, 0·500 inch, and 0·050 inch; that is to say, instead of 29·365 inches, either of the following is sometimes set down—viz. as 30·365 inches, 28·365 inches, 29·865 inches, or 29·815 inches. Experience having shown that even the very best Observers make these mistakes, particular attention is directed to the matter.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must first be screwed so as to form a tight plug to the cistern, thus preventing the escape of the mercury. Then screw up the mercury not quite to the top of the tube, but to within a quarter of an inch of it, and take down the instrument; it should then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case if, on inclining the instrument, a sharp tap is produced when the mercury strikes the top of the tube. If a dull tap is heard, there is air in the tube, which must be got rid of.

As Barometers are liable to be deranged by the introduction of air into their tubes, on removal from place to place, or in being roughly handled, it may be useful to Observers to know how the air may be expelled. First close up the cistern by screwing the ivory peg tight, so as to prevent the escape of mercury; then screw up the mercury to about half an inch from the top of the tube; and having slowly inverted the instrument, place the top of it on a yielding substance, such as the boot, and gently tap on the cistern with the palm of the hand, so as to induce the air to ascend through the column to the cistern, whence it may escape. Since there is the weight of two atmospheres—the pressure of the mercury in the Barometer, and the air outside—pressing on any air that may be inside the tube, it is usually a tedious operation to get it wholly expelled. After repeated trials, however, it is generally accomplished; and the clear metallic sound of the mercury, when gently struck against the top of the glass tube, will show when the whole of the air has been expelled. On hanging up the Barometer, care must be taken to screw down the mercury in the tube before unfastening the float of the cistern, for, if this be not attended to, the mercury will flow out, and the instrument be seriously damaged.

Protection and Position of Thermometers.

The Council of the Society recommend that the Self-Registering Thermometers, and the Dry and Wet Bulb Hygrometer, be kept in Stevenson's Louvre-boarded Box for Thermometers, painted white inside and outside, and screwed to four stout posts, also painted white, firmly fixed in the ground. The posts must be of such a length that when the Thermometers are hung in position the Bulbs of the Minimum Thermometer, and of the Dry and Wet Bulb Thermometers, will be exactly at the same height of FOUR FEET above the ground, the Maximum Thermometer being hung immediately above the Minimum Thermometer. The Thermometer Box is to be placed over a plot of grass, and in a free open space to which the sun's rays have free access during as much of the day as surrounding conditions enable the Observer to secure. The Thermometers are suspended on cross-laths in the centre of the Box, and face the door, which should open to the north.

The Council regard the question of UNIFORMITY OF HEIGHT ABOVE GROUND, AND METHOD IN PROTECTING THE THERMOMETERS, as vital in every system of Meteorological Observation, since without Observations made at different Stations are incomparable, thus rendering it impossible to compare the Climates of places with each other as regards their most important features.

Self-Registering Thermometers.

Professor Phillips, and Negretti and Zambra's Maximum Thermometers, and Rutherford's Minimum Thermometer, are recommended. It is recommended that these Thermometers be graduated on the glass stem. The Minimum Thermometer is liable to two derangements—viz., the column of spirit breaking, and part of the spirit distilling by high temperature and lodging at the top of the tube. This derangement is of occasional occurrence with protected Thermometers, but of frequent occurrence with exposed Thermometers. Hence a systematic examination of Minimum Thermometers ought to be a regular part of the work carried on by each Observer.

Fortunately, Spirit Thermometers may be easily set right by any one, when the column of spirit chances to separate. Let the Thermometer be taken in the hand by the end farthest from the bulb, raised above the head, and then forcibly swung down towards the feet; the object being, on the principle of centrifugal force, to send down the detached portion of spirit till it unites with the column. A few throws, or swinging strokes, will generally be sufficient for the purpose; after which the Thermometer should be placed in a slanting position, to allow the rest of the spirit still adhering to the sides of the tube to drain down to the column. But another method must be adopted, if the portion of spirit in the top of the tube be small. Heat should be applied slowly and cautiously to the top end of the tube where the detached portion of spirit is, which, being turned into vapour by the heat, will condense on the surface of the unbroken column of spirit. Care must be taken that the heat is not applied too quickly; for, if this be done, the tube will break and the instrument be destroyed. The best way to apply the requisite amount of heat is by bringing the end of the tube slowly down towards a minute flame from a gas-burner; or, if gas be not at hand, a piece of heated metal will serve instead.

Black-Bulb Thermometers.

The bulbs of the Thermometers for registering the greatest heat from the sun's rays, and the least from radiation during night, have a black coating, which may easily be made, or mended, by the application of a mixture of lampblack and printer's ink. They are placed in shallow blackened boxes, whose sides protect the bulbs from the wind. The Maximum should be freely exposed to the sun, and the Minimum should rest on wooden supports a few inches from the surface of the grass, in an open situation. Snow must not be allowed to cover either of these Thermometers; nor the sun's heat to affect the Minimum Thermometer by distillation. Black-bulbs enclosed in 'glass jackets' may also be used, being indeed preferable to the above. It must, however, be added, that the whole subject of the observation of Solar and Terrestrial Radiation is not yet in a sufficiently advanced state to warrant the exclusive recommendation of any one of these methods.

Dry and Wet Bulb Hygrometer.

The Hygrometer in use at the Society's Stations consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved form of this apparatus seriously vitiate the Hygrometrical Observations, Observers are specially requested to attend to the following conditions:—The bulbs must hang down by at least an inch free from the scales and frame to which they are attached; the frame must be such as will bring the tubes forward by an inch from any board on which it may be suspended; the water-cup must be covered, and altogether placed to the side, and a little below the level of the wet bulb, but in no case under the bulbs; the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the Observer that the muslin is always clean and moist, and the water pure. In frosty weather, observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

Reading of the Thermometer.

In reading the Thermometer great care must be taken to bring the eye exactly opposite the tip of the index or column of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°·9, 40°·0, or 40°·1; or again, 40°·4, 40°·5, 40°·6, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40½°, respectively. So also 40½°, and 40¾°, more or less, must be registered 40°·2, or 40°·3, and 40°·7, or 40°·8 respectively. In reading Rutherford's Minimum Thermometer, the indication of that end of the index which is next the surface of the spirit is alone noted. On opening the Thermometer Box, the Dry and Wet Bulb Thermometers are to be first, and rapidly, read, inasmuch as they are readily affected by heat from the person of the Observer.

Hour of observing Temperature.

The Hygrometer is read at 9 A.M. and 9 P.M. The Self-Registering Thermometers are read at 9 P.M. only, as indicating the greatest and least degrees of temperature in the 24 hours preceding. It is not a matter of indifference when the Self-Registering Thermometers are read, since, in winter at least, the extremes may occur at any hour; and it is necessary to refer their occurrence to their proper meteorological day. In the Society's schedules, the indications registered on the 3d are those of a series of phenomena commencing at 9 P.M. on the 2d, and extending till 9 P.M. on the 3d.

Verification of Thermometers.

No instrument ought to be used for Meteorological purposes till it has been carefully tested by comparison with a standard Thermometer. When such Thermometers as are not graduated on the stem, but merely on an attached scale, undergo repairs, they are very liable to be moved from their position on the Scale, and ought never afterwards to be used without being re-tested. The Self-Registering, especially the Minimum Thermometers, ought frequently to be compared with the dry bulb of the Hygrometer. The freezing-point of each Thermometer, marked by a scratch on the tube, ought to be tested once a year, in snow or melting ice.

In selecting instruments, the following points require attention:—The divisions of the vernier of Barometers in reference to their scales, and the perfect freedom of the Barometer from air; the correct numbering of the scale of every instrument; the rejection of Thermometers the frameworks of which are not likely to stand exposure to the weather, as shown in the past by repeated and annoying breakages of Thermometers of similar construction; and as regards Maximum Thermometers, either Negretti and Zambra's, or Phillip's, whether they will act at the highest temperatures they may be required to register. By the laws of the Society, Members and Observers have a right to have their instruments compared by the Secretary, and to advise with him regarding the purchase of instruments.

Wind.

Very great care should be bestowed on the Observations of the Wind, the accuracy of which, both as regards Direction and Force, is so essential towards the right discussion of many of the more important problems of the science.

1. As regards Direction.

A Wind-Vane ought to be elevated at least 12 feet above surrounding objects. When it oscillates incessantly, the mean direction should be taken. In all cases, but especially when the Vane is stationary, and when the wind is feeble, reference may be made to the direction of smoke, etc., in well-exposed situations. Careful observations are recommended to be made on the changes in the direction of the wind; and during storms, extra observations at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, is likely to give highly valuable and important results, particularly in connection with the system of thickly-planted Stations over a limited district round Edinburgh called STORM STATIONS, in the course of being established by the Society for the systematic investigation of the relation of the force of the wind to BAROMETRIC GRADIENTS, and other points connected with storms.

2. As regards Velocity and Pressure.

The Council would recommend the Hemispherical Cup Anemometer,—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the mean Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind at any particular hour of observation, the Pressure Anemometers recently brought under the notice of the Society by Mr. T. Stevenson, the Honorary Secretary, and Mr. R. Ballingall, the Society's Observer at Eallabus, are recommended as likely to secure uniformity in making observations on the Force of the Wind.

Rain Gauges.

Many causes conspire to produce anomalies in Rain Returns, arising partly from the difficulty of obtaining a perfectly unobjectionable situation for observation, and partly from the defective nature of the instruments used. The Rain Gauge should not be placed on a slope or terrace, but on a level piece of ground, in as open a situation as the Observer can secure for it. As it is often difficult to obtain a position as free and unobstructed by surrounding objects as is desirable, care should be taken to place it at some distance from shrubs, trees, buildings, or other obstructions, at least as many feet from their base as they are in height. The more important directions, towards which it is most desirable to have a free exposure, are, in the order of their importance, S.W., N.E., S.E., S., and W. The rim of the gauge must be perfectly level, and fixed so that it will remain level in all weathers, and be at a height of one foot above ground, over grass. In such gauges as Fleming's, which are furnished with a measuring-rod attached to a float, the rod ought to be fixed down, and the float rise to its height only at the time the instrument is read, it being found that a stem projecting above the rim of the gauge seriously interferes with the proper measurement of the Rainfall. When a measuring-glass is used, care should be taken to hold it quite perpendicular. The Rain Gauge ought to be read daily at 9 A.M., and the reading entered in the Returns of the previous day. If the Gauge is read once a month, the reading is to be made on the first of the month, and the amount entered for the previous month.

Snow-falls.

Snow-falls may, for convenience, be registered in the rain columns, under the following conditions:—When a Snow shower occurs, it should be noted in the 'Remarks,' and the letter S affixed to the depth of water received in Gauge. The depth of the snow must be measured in some open place where no drift is observed, and registered in addition to, and as a check upon, the indications of the Rain Gauge. For wind, rain, and snow, as indeed in every column, the Observer cannot be too careful to register observations only; and nothing that partakes of the nature of deduction or inference.

Clouds.

Convenient abbreviations for the nomenclature of Clouds will be found on the other side. The amount of Cloud ought to be estimated from the greater or less obscuration of the sky overhead (*i.e.* within 20° or 30° of the zenith). The strata of Clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the Clouds' column, though their appearance and changes may be noted among the Remarks. The amount of Cloud is entered from a scale of 0 to 10; thus, when the sky overhead is free from Clouds it is entered 0, when half-covered by Clouds, 5, wholly covered, 10, and so on.

Observations of the Clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—Thus, in the column Velocity and Direction, 6, S. W.

——— will indicate that the upper strata of Clouds travel with
2, W.

extreme velocity from S.W., and those in the lower regions from W., with one-third the speed of the former. Again, in the second

4, st.
Cloud column, an entry of ——— will indicate that the higher
2, cu-st.

regions are covered to the amount of 4-tenths with stratus Clouds; and that the sky is further obscured to the extent of 2-tenths by lower Clouds of the cumulo stratus kind.

Remarks on peculiar Clouds, accompanied with drawings, will assist materially in the development of a more exact nomenclature of Clouds, as well as throw light on the electrical, and other of the more obscure phenomena of Meteorology.

Sunshine.

The approximate number of Hours in which objects in the sun's rays cast shadows, should be entered in the proper column.

Underground Thermometers.

As the germination and growth of crops and plants generally depend greatly on the temperature of the soil,—its amount and constancy,—the Council recommend that Observations in this interesting department be made at 9 A.M., by Thermometers permanently fixed in the soil, their bulbs being sunk to depths of 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain-water being conveyed to the bulbs by the stems or wooden frames.

Temperature of the Sea.

A knowledge of the Temperature of the Sea is not only in itself, but in its relations to that of our island, a most important branch of Meteorology. The Council therefore recommend that the Temperature of the Sea be carefully taken by a properly constructed apparatus, from boats, or, if this be impracticable, from the ends of piers and rocks round the coast, where it is not influenced by that of river water, and as little influenced as possible by currents sweeping along the coast, and thus acquiring the temperature of the land, either greatly heated by the sun or cooled by nocturnal radiation. At or near the time of high water, in cases where the observations cannot be taken daily, the observation may be made on the 5th, 15th, and 25th of each month. When convenient, extra Sea Observations might be taken for other and greater depths, noting always the Temperature of the Air, and the Hour of Observation. It is also very desirable that observations on the daily Maxima and Minima by Thermometers continuously immersed, be instituted at points along the coast, by the method proposed by Mr. T. Stevenson, and already commenced at Peterhead and Liverpool.

Temperature of Wells.

The Temperature of the water at the bottom of Wells ought, when practicable, to be taken, both the depth of the Well and of the water being noted.

Mention what Test-Papers are used, Schuncke's or Moffat's, etc.

Ozone.

The Paper is affixed by a pin to a board in the Thermometer Box, and the indications registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus $3^{N.W.}_{4}$, as an Ozone entry in the schedule will indicate that the Ozone paper is tinted as 3 on the scale, that the wind is from the N.W., and that its force on the scale 0—5 is 4, or blowing fresh.

Atmospheric Electricity.

Too much importance cannot be attached to the electric condition of the atmosphere in connection with terrestrial magnetism, barometrical, thermometrical, and meteorological phenomena generally. A proper Electrometer is, in truth, necessary to every complete meteorological observatory.

Remarks.

The Remarks column is unavoidably too narrow. Some of the most valuable Observations that can be taken are those for which no rules can be given nor hours assigned. The use of contractions ought, therefore, to be taken every advantage of, and a list of such as are in general use is given at the foot of the column. Besides special and extraordinary Observations, great prominence ought to be given in this column to Prevalent Diseases, differences in character, colour, velocity, and direction between the Lower and Upper Strata of clouds, the Colour of the Sky, etc. Remarks ought to be made on the occurrence of Meteors, Aurore Borealeş, remarkable depressions, elevations, and fluctuations of the Barometer, Thunder-Storms, and remarkable falls of Snow, Hail, or Rain, the Hour of Storms of Wind commencing, attaining their maximum, and ending, as well as such Notes on Storms as have been hinted at above. When lofty hills are in the vicinity of a Station, the Height of Clouds and of the Snow-line in winter should be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. should be registered, either in two columns, otherwise unoccupied, or ruled off for the purpose, from the column of 'Remarks.'

Observations in connection with the Periodic Return of the Seasons.

Observations in connection with the Periodic Return of the Seasons, possess not only great scientific value, but are of considerable importance in connection with Agriculture, Horticulture, and Natural History. The Council would direct the special attention of Observers to the registration of such phenomena, so that the published Summaries may fairly represent the whole of Scotland. Observations ought to be confined to individual trees and shrubs; to particular species of birds, and, in the case of crops, to specified sorts reared from year to year on a selected piece of ground or farm. The Annual Table, published yearly in the Society's Journal, will indicate the species of plants and animals to which special attention is more particularly directed.

The Council recommend Observers, before purchasing new instruments, and in repairing old ones, to communicate with the Meteorological Secretary, in order that every instrument may be examined and improved before being used; and they consider it necessary that he should have full power to reject any instrument which, on being presented for comparison, does not afford him satisfaction.

(By Order) A. B.

EDINBURGH, *December* 1888.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	Leaf Buds first Appear.	In Leaf.	Divested of Leaves.
Alder,				
Ash,				
Beech,				
Birch,				
Elm,				
Larch,				
Lime,				
Oak,				
Sycamore or Plane,				

SHRUBS, ETC.	First in Blossom.
Barberry,	
Bourtree or Elder,	
Broom,	
Hazel,	
Hawthorn,	
Holly,	
Laburnum,	
Lilac,	
Mezereon,	
Mountain Ash or Rowan,	
Red Flowering Currant,	
Rhododendron Ponticum,	
Whin,	

FRUITS.	First in Blossom.	Fruit Ripe, generally.
Apple,		
Black Currant,		
Cherry,		
Gean,		
Gooseberry,		
Peach,		
Pear,		
Plum,		
Strawberry,		

CROPS, mentioning variety.	Sowing or Planting.	Appearing above Ground.	In Ear or Flower.	First Cut or Raised.
Barley,				
Bere or Bigg,				
Oats,				
Wheat,				
Beans,				
Pease,				
Potatoes,				
Turnips,				
Rye Grass,				

MIGATORY BIRDS.	First Arrival.	Departure.
Cuckoo,		
Curlew,		
House-Swallow,		
Lapwing,		
Plover,		
Sand-Martin,		
Starling,		
Swan,		
Rail or Corn Crake,		

Have the goodness also to state any information you may be able to collect relative to the Crops of Grain, Hay, Potatoes, Turnips, Fruits, etc., whether plentiful, or in perfection; whether any have suffered from blight, disease, etc. Whether Epizootic disease prevails among cattle; and the Agricultural condition of the district generally.

Aberdeen
June 1892

To the SECRETARY
Scottish Meteorological Society,
122 George Street,
EDINBURGH.

BOOK POST.

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Aberdeen, County of _____, in Lat. _____, Long. _____, Distance from Sea _____ miles.

Height of Cistern of the Barometer above Mean Sea-Level _____ feet, above Ground _____ feet. During the MONTH of July 1892.

The Hours of Observation are of Greenwich Time.

Days of Month.	BAROMETER. 9 h. A.M. * No. ___ Barometer.	Attached Thermometer	9 h. P.M. No. ___ Barometer.	Attached Thermometer	SELF-REGISTERING THERMOMETERS, Read Daily, at 9 P.M. Protected in Shade, 4 feet above Ground. No. ___ Max.	Min.	Exposed Black Bulbs. No. ___ Max. in Sun's rays	No. ___ Min. on Grass.	HYGROMETER. Dry No. ___ Wet No. ___ 9 h. A.M. Dry bulb.	Wet bulb.	9 h. P.M. Dry bulb.	Wet bulb.	Rain. No. of hours in which it fell.	Amount in inches. No. ___	WIND. 9 h. A.M. Direction.	Force	9 h. P.M. Direction.	Force	Readings of the H. Cup Anemometer. No. ___ 9 h. A.M.	CLOUDS. 9 A.M. Velocity (0—6) and Direction.	Amount (0—10), and Species.	P.M. Velocity (0—6) and Direction.	Amount (0—10), and Species.	SUNSHINE. Hours.	THERMOMETERS under Ground. 9 h. A.M. No. 3 inches.	No. 12 inches.	No. 22 inches.	Temperature of WELL at depth of ___ feet, No.	SEA. Temperature at 1 fathom, and Density.	OZONE. 0—10. 9 A.M.	9 P.M.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc. *Mention the hour at which Storms, including Thunder and Lightning, began and ended.*	Days of Month.
	inches.	°	inches.	°	°	°	°	°	°	°	°	°																								
1	30·042	67.	30·052	64.	62·1	45·0	—	—	59·4	50·0	54·1	50·4	—	—	W.	1	ENE.	1	—	Cu	6	Cu.	6	7·9												1
2	30·033	65.	29·855	65.	57·2	45·6			56·0	51·0	53·0	52·1		0·03	SSE.	1	SSE.	1½		Cir.	7	Nim.	10	1·5												2
3	29·690	65.	29·626	65.	62·7	53·0			58·0	54·4	59·4	56·4		0·36	S.	1½	S	1		Nim.	10	Cu-S	10	0·1												3
4	29·684	63.	29·796	63.	60·4	48·7			48·7	47·7	54·0	51·2		0·30	NW.	2	SSE.	1½		Nim.	10	Cu	7	2·1												4
5	29·520	63.	29·522	64.	65·6	48·2			56·4	53·4	59·0	57·0		0·07	SSE.	2½	SW.	1		Cir. Cu.	6	Cir. Cu.	4	7·5												5
6	29·589	64.	29·787	63.	61·0	45·0			54·0	49·2	57·7	50·6		0·01	SW.	1½	SSE.	2½		Cir. Cu.	5	Nim.	10	3·6												6
7	29·070	64.	29·297	64.	63·4	49·1			58·2	54·2	61·6	51·2		0·16	S.	1½	WSW.	2½		Cu-S.	7	Cir. Cu.	4	8·1												7
8	29·414	63.	29·631	64.	63·7	48·8			55·4	49·0	54·4	50·4		—	WSW.	2½	SSE.	1		Cir. Cu.	5	St.	4	5·2												8
9	29·838	64.	29·867	64.	62·7	46·9			54·4	53·0	57·6	53·4		0·03	SW.	1	SSW.	1		Cu-S	7	St.	10	4·2												9
10	30·004	65.	30·083	65.	61·4	52·0			58·2	54·0	54·4	52·1		0·02	NNW.	1	E.	½		Cu.	5	Cu-S	6	4·1												10
11	30·075	64.	30·024	63.	58·7	51·4			56·4	54·1	54·2	52·0		—	E.	½	ESE.	1		St.	4	St.	2	10·9												11
12	29·978	62.	29·833	62.	54·2	49·8			50·4	47·1	51·4	48·4		—	ENE.	1½	NE.	2		St.	10	Nim.	10	—												12
13	29·791	61.	29·852	61.	53·6	48·2			51·0	49·4	51·7	49·7		0·01	N.	2	N	1½		Nim.	10	St.	10	0·1												13
14	29·940	61.	29·972	60.	54·2	46·7			50·0	46·6	51·2	47·4		0·01	NNW.	1	NNW.	1		Cu-S	7	Cu-S	7	1·2												14
15	30·034	60.	30·022	60.	53·0	46·8			49·1	46·7	51·4	47·4		—	NW.	1	NW.	1		Cu-S	7	Cu-S	7	1·0												15
16	29·962	59.	29·962	59.	53·4	45·0			50·0	47·7	50·0	46·6		—	NNW.	1	NNW.	1½		Cu-S	10	Cu-S	9	0·2												16
17	29·920	59.	29·926	60.	54·6	47·0			50·7	48·0	51·4	46·2		0·02	NNW.	1½	NNW.	1½		Cu-S	7	Cu-S	7	3·0												17
18	29·917	58.	29·927	60.	57·4	43·8			49·4	45·4	51·0	47·4		0·01	NW.	1	SSE.	1		Cu-S	7	Nim.	10	1·6												18
19	29·532	59.	29·765	58.	57·7	49·1			50·4	49·8	51·2	50·0		0·43	SSE.	1½	NE.	2½		Nim.	10	Nim.	10	—												19
20	30·125	58.	30·199	59.	56·2	48·2			49·7	48·0	54·2	48·4		0·74	N.	1½	NNW.	1½		Cu-S	7	Cir. St.	2	7·6												20
21	30·184	59.	30·143	61.	61·2	44·1			57·0	51·0	55·6	51·2		—	NW.	½	S.	1		Cir. S St.	6	St.	10	6·5												21
22	30·185	62.	30·189	63.	64·7	52·4			60·2	53·2	60·4	54·4		0·01	WSW.	1	SSW.	1		Cu-S	7	St.	2	0·5												22
23	30·271	63	30·326	65	66·4	50·9			57·6	52·0	53·4	51·4		—	NW.	1½	SSE.	1		Cir Cu	3	St.	1	10·0												23
24	30·381	64.	30·346	64.	57·4	42·7			55·6	53·0	54·2	52·4		—	ENE.	1	SE.	1		St.	6	St.	6	10·4												24
25	30·339	64.	30·316	63	58·0	52·9			57·4	54·2	56·2	53·1		—	SSE.	1	S.	1		St.	9	St.	6	3·6												25
26	30·343	64	30·361	62	59·4	49·9			56·6	54·2	54·4	52·2		—	ESE.	½	E.	½		St.	7	St.	5	2·6												26
27	30·385	63	30·374	62.	58·3	49·8			55·0	52·4	53·4	52·4		—	E.	½	E.	½		St.	9	St.	7	—												27
28	30·377	62.	30·357	60.	57·6	40·9			54·0	51·2	51·4	50·0		—	ENE.	½	E.	½		St.	5	St.	10	5·5												28
29	30·335	62.	30·295	61.	56·4	49·7			51·4	50·0	52·4	50·7		—	E.	½	SSE.	1		St.	10	St.	10	1·0												29
30	30·215	62.	30·055	65.	66·2	47·1			56·6	54·2	57·6	55·1		—	S.	½	S.	½		St.	5	Nim.	10	5·6												30
31	29·948	65.	29·909	66.	65·6	56·3			60·7	56·7	61·4	58·4		0·09	NW.	1	NNW.	½		Cu-S	10	Nim.	10	—												31
Sums.		14 15·12	13		15·16 14	10	15·12	8·14		16·9	15·8	11·10	11·9																							
	30·071	19·34		30·169	19·35		1842·2	1491·0		1692·9	1583·0	1691·3	1583·6	2·30	36½		37½		224		222		41·56												
Means.	29·970	62·4		29·973	62·4		59·4	48·1		54·6	51·0	54·6	51·1		1·2		1·2		7·2		7·2		116.												
† Total Corrections for Instrumental Errors.	+006	−7		+006	−7										06		06																		
‡ Corrections for Diurnal Range.																																			
"Corrected Means."	29·970	61·7		29·979	61·7																														
No. of Column.	1	2		3	4		5	6		7	8	9	10		11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		

NOTATION USED IN GENERAL REMARKS.

a.	*denotes* aurora.		m.	*denotes* meteor.	
ci.	,,	cirrus.	ms.	,,	meteors.
ci.-cu.	,,	cirro-cumulus.	n.	,,	nimbus.
ci.-s.	,,	cirro-stratus.	r.	,,	rain.
cu.	,,	cumulus.	h. r.	,,	heavy rain.
cu.-s.	,,	cumulo-stratus.	c. h. r.	,,	continued heavy rain.
d.	,,	dew.	s.	,,	stratus.
f.	,,	fog.	sc.	,,	scud.
fr.	,,	frost.	s.	,,	sleet.
h.-fr.	,,	hoar-frost.	s.	,,	snow.
h.	,,	haze.	so. ha.	,,	solar halo.
h. d.	,,	heavy dew.	sq.	,,	squall.
hl.	,,	hail.	sqs.	,,	squalls.
l.	,,	lightning.	t.	,,	thunder.
li. cl.	,,	light clouds.	t. s.	,,	thunder-storm.
li. sh.	,,	light showers.	w.	,,	wind.
lu. co.	,,	lunar corona.	g.	,,	gale of wind.
lu. ha.	,,	lunar halo.			

TABLE FOR ESTIMATING FORCE OF WIND.

Estimated Force, 0—6.	Common Designation.	Estimated Force, 0—6.	Common Designation.	Estimated Force, 0—6.	Common Designation.
0	Calm	1·5	Light breeze	4	Blowing hard
0·5	Very light air	2·	Fresh breeze	5	Blowing a gale
1·	Light air	3·	Very fresh	6	Violent gale

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction †† for Temp. (Col. 2), = 29·976 − ·089 = 29·887

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction †† for Temp. (Col. 4), = 29·979 − ·089 = 29·890

Mean at Station, corrected, and at 32°, = 29·888

Correction for height, 66 feet above Mean Sea-level, = ·074

Mean, reduced to 32°, and Sea-level, = 29·962

Highest Reading, corrected for Index error, on the 24 th, = 30·391

Lowest Do. Do., on the 7 th, = 29·076

Difference, or **Monthly Range**, = 1·315

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month**, (corrected for Index Errors), on the 23rd, = 66·4

Lowest in Month, corrected for Index errors, on the 21st, = 40·1

Difference, or **Monthly Range**, = 26·3

"Corrected **Mean**" **of all the Highest**, (Col. 5), = 59·4

"Corrected **Mean**" **of all the Lowest**, (Col. 6), = 48·1

Difference, or **Mean Daily Range**, = 11·3

** Calculated **Mean Temperature** of Month, = 53·8

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the th, =

"Corrected **Mean**," (Col. 7), **of Black Bulb, Max. in Sun**, =

Lowest at Night, Black Bulb (corrected for Index errors), on the th, =

"Corrected **Mean**," (Col. 8), **of Black Bulb, Min.** on grass, =

Difference of above means or range ("exposed"), =

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb**, (Cols. 9 and 11), = 54·6

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb**, (Cols. 10 and 12), = 51·0

‡‡ Computed **Temperature of Dew-Point**, = 47·6

‡‡ Do. **Elastic Force of Vapour**, = ·327

‡‡ Do. **Weight of Vapour in a Cubic Foot of Air**, = 3·74

‡‡ **Relative Humidity** (Saturation = 100). = 76

RAIN fell on 16 **Days; Amount in Inches**, = 2·30

WIND. SUMMARY.											
Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	6	0	7	0	7	2	3	6	0		
P.M.	6	2	6	3	11	1	1	1	0		
Mean.	6	1	7	1	9	2	2	3	0	1·2 =	1·44 ll

* Each instrument tested at the Office in Edinburgh bears the stamp "S.M.S.;" and a number to be entered in the Heading; or the Number and Initials of the Maker may be here given.

† Embracing corrections for both capillarity and Index Errors.

‡ The Diurnal Range for Scotland is as yet unknown.

†† *Practically*, though not *absolutely* a *minus* correction.

‡‡ These "Hygrometrical Deductions" are calculated from Glaisher's Hygrometrical Tables, Second Edition *only*.

** While the Diurnal Range is unknown, the Arithmetical Mean of Cols. 5 and 6 will be entered as the "Calculated Mean Temperature."

Any observations not taken under the Conditions specified in the Directions on the other side, or noted at the Top of each column, must be marked as such by the observer, in each Schedule. *See over.*

Observations made and Return verified by _____

(Signed) W. Brown

Observatory. King's College.

Greatest Daily Range = 21°·1 on the 21st

W.B.

INSTRUCTIONS FOR TAK

WITH RE

REMARKS ON THE USE OF INSTRUMENTS.

ONE of the chief objects that the SCOTTISH METEOROLOGICAL SOCIETY proposed to itself when the Society was established in 1855, was to secure PERFECT UNIFORMITY in the system of observation pursued at all its Stations. Uniformity in the observations is absolutely necessary to justify the publication of Monthly Results from different observations, it being found that differences between the Returns from two Stations, so very considerable as to render them quite incomparable, may arise from dissimilarity in the position or shelter of instruments, d
the use of differently cons
that those who kindly
scrupulous attention to
Monthly Returns an acc
labour and pains involv
published by the Societ
several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

The Council recommend that Observations be made precisely at 9 A.M. and 9 P.M. (Greenwich or Railway Time only), as specified in the following remarks, or at the top of the columns in the Schedule. It is hoped that the utmost punctuality in the time of reading the Instruments will be observed. Observers, in some few cases, may find this impossible; in such instances, they are specially requested to mark opposite every reading the time at which it was taken, if not at 9 A.M. or 9 P.M.

Hour of Observation.

Weather-Glasses and Aneroids, though well suited to indicate roughly variations of atmospheric pressure, are not fitted for scientific purposes. No Barometer should be used for Meteorological Observation that is not supplied with some means of adjustment or compensation which will secure that the height of the mercury in the tube is accurately measured from the fluctuating surface of the mercury in the cistern.

Barometer.

The Barometer in which the error arising from the fluctuating surface of the mercury in the cistern is entirely got rid of is FORTIN'S Barometer, the arrangement consisting in applying pressure by means of a screw to the bottom of the cistern, which is made of flexible leather, thus raising or depressing the surface till it just meets the ivory point which forms the zero point of the fixed scale.

The Barometer originally constructed by Mr. Adie of London, and usually called the Board of Trade Barometer, has the great convenience of requiring no adjustment of the cistern. Its scale-inches are not true inches, but so much shorter as to compensate the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This is an excellent Barometer for ordinary Observers, inasmuch as it entirely eliminates the error of observation likely to arise in not a few cases in setting the instrument to the zero point of the fixed scale when the light is not good. To show the accuracy with which these Barometers are made, it may be stated, that one was compared, during a whole year, with the Society's Standard Barometer, particular care being given to make the comparison when atmospheric pressure was rising or falling very rapidly, with the result that none of the readings differed from those of the Standard more than 0·003 inch.

A modification of FORTIN'S Barometer is used at a number of the Society's Stations, by which the coincidence of the zero point with the surface of the mercury is indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When the index-line on this little piston-rod is brought, by the adjusting screw, to form one straight line with those on its ivory frame, the surface of the mercury is then at the exact height from which the scale is graduated. In taking an observation, this preliminary setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the vernier.

It is absolutely necessary that the Barometer which is to be used shall have been compared with a Standard Barometer.

The Barometer should be suspended in as good a light as can be secured, and to facilitate the reading, a piece of white paper may be put behind the tube. It must be hung truly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire, and must not be hung against a wall heated by a flue. The object being to secure that the whole instrument, including the brass fittings, the contained mercury, and the attached Thermometer, shall be, when read, at one uniform temperature, it is evident that the best position is that which is least liable to sudden changes of temperature.

In taking an Observation, the Attached Thermometer is first noted: the tube must then be gently tapped, and the cistern-adjustment carefully made. The eye, by raising and lowering it, must be brought into the plane of the back and front of the index—usually the lower edge of the vernier, which must be carefully adjusted so as to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly, so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will facilitate an accurate adjustment and reading of the Barometer. A mistake not unfrequently made by those beginning to observe, consisting in setting the edge of the vernier to the level of the clear surface of the mercury which is in direct contact with the glass tube, must be carefully avoided.

The errors most frequently made in reading the Barometer are errors of 1·000 inch, 0·500 inch, and 0·050 inch; that is to say; instead of 29·365 inches, either of the following is sometimes set down—viz. as 30·365 inches, 28·365 inches, 29·865 inches, or 29·815 inches. Experience having shown that even the very best Observers make these mistakes, particular attention is directed to the matter.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must first be screwed so as to form a tight plug to the cistern, thus preventing the escape of the mercury. Then screw up the mercury not quite to the top of the tube, but to within a quarter of an inch of it, and take down the instrument; it should then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case if, on inclining the instrument, a sharp tap is produced when the mercury strikes the top of the tube. If a dull tap is heard, there is air in the tube, which must be got rid of.

As Barometers are liable to be deranged by the introduction of air into their tubes, on removal from place to place, or in being roughly handled, it may be useful to Observers to know how the air may be expelled. First close up the cistern by screwing the ivory peg tight, so as to prevent the escape of mercury; then screw up the mercury to about half an inch from the top of the tube; and having slowly inverted the instrument, place the top of it on a yielding substance, such as the boot, and gently tap on the cistern with the palm of the hand, so as to induce the air to ascend through the column of the mercury. Since there is the attached scale, undergo repairs, the
Barometer, and the air outside—pressing on any air that may be inside the tube, it is usually a tedious operation to get it wholly expelled. After repeated trials, however, it is generally accomplished; and the clear metallic sound, when gently struck against the top of the glass when the whole of the air has been expelled. On
weight of two atmospheres—the pressure of the mercury in the Barometer, before unfastening
taken to screw down the
the float of the cistern, for,
will flow out, and the instr
ty damage!

The Council of the Society recomm
Thermometers, and that
meter, be kept in Stevens
Thermometers, painted w
screwed to four stout pos
fixed in the ground. The posts must b
the Thermometers are hung in position
the Thermometer, and of the Dry and Wet
exactly at the same height of FOUR FEET
mum Thermometer being hung immed
Thermometer. The Thermometer Box
grass, and in a free open space to which t
during as much of the day as surroundi
ver to secure. The Thermometers are s
centre of the Box, and face the door, wh
The Council regard the question
ABOVE GROUND, AND METHOD IN FRO
as vital in every system of Meteorolog
out it Observations made at different
thus rendering it impossible to compar
each other as regards their most impor
Professor Phillips, and Negretti ar
monieters, and Rutherfo
are recommended.
Thermometers be gradu
Minimum Thermometer is liable to
column of spirit breaking, and part of
temperature and lodging at the top of
is of occasional occurrence with prot
frequent occurrence with exposed Th
make examination of Minimum Th
Fortunately, Spirit Thermometers
any one, when the column of spirit eb
Thermometer be taken in the hand b
bulb, raised above the head, and then
the feet; the object being, on the princ
send down the detached portion of
column. A few throws, or swingin
sufficient for the purpose; after which
placed in a slanting position, to allow
hering to the sides of the tube to dra
another method must be adopted, if th
of the tube be small. Heat should be
which, being turned into vapour by th
surface of the unbroken column of spi
the heat is not applied too quickly;
will break and the instrument be destr
the requisite amount of heat is by b
slowly down towards a minute flame f
not at hand, a piece of heated metal
The bulbs of the Thermometers fo
from the sun's rays, a
during night, have a bl
be made, or mended, by
of lampblack and printer's ink.
blackened boxes, whose sides protec
The Maximum should be freely expos
mum should rest on wooden supports
cover either of these Thermometers;
the Minimum Thermometer by distill
in 'glass jackets' may also be used, b
above. It must, however, be added,
ciently advanced state to warrant the
any one of these methods.
The Hygrometer in use at the Soc
one frame. As appl
the approved form of t
the Hygrometrical Observations. Obs
to attend to the following conditions:
by at least an inch free from the scale
attached; the frame must be such as
by an inch from any board on which it
cup must be covered, and altogether
below the level of the wet bulb, but n
muslin must be of medium fineness, a
bulb by the cotton, which also suppli
seen to by the Observer that the mus
and the water pure. In frosty weath
much delicacy, and must be made wi
be moistened by immersion from 15 t
of observation. From the film of ice
proceed as from the moist cloth in or
In reading the Thermometer grea
the eye exactly oppo
column of mercury.
to tenths of a degree.
the Thermometer will be read—39°
40°·4, 40°·5, 40°·6, according as it inc
coincidence with, or a little over 40°;
40°·7, or 40°·8 respectively. In re
Thermometer, the indication of that
the surface of the spirit is alone note
meter Box, the Dry and Wet Bulb
from the person of the Observer.
The Hygrometer of the Sea
ing Thermometers a
in the 24 hours prece
when the Self-Registering
in winter at least, the extremes may
necessary to refer their occurrence t
day. In the Society's schedules, the
3d are those of a series of phenom
2d, and extending till 9 P.M. on the
No instrument ought to be use
till it has been carefu
a standard Thermome
are not graduated
Thermometers, ought fre
dry bulb of the Hygrometer,
Thermometer, marked by a scratch
once a year, in snow or melting ice.
In selecting instruments, the f
tion:—The divisions of the vernier
their scales, and the perfect freedom
water, in cases where the observations
observation may be made on the 5th, 15
and the Dry and Wet Bulb Hygro- posure to the weather, as shown in the past by repeated and annoying
to secure PERFECT UNIFORMITY in the system of observation pursued breakages of Thermometers of similar construction; and as regards
at all its Stations. Uniformity in the observations is absolutely Maximum Thermometers, either Negretti and Zambra's, or Phillips',
necessary to justify the publication of Monthly Results from dif- whether they will act as the highest temperatures they may be re-
ferent observations, it being found that differences between the quired to register. By the laws of the Society, Members and Ob-
Returns from two Stations, so very considerable as to render them servers have a right to have their instruments compared by the Secre-
quite incomparable, may arise from dissimilarity in the position or tary, and to advise with him regarding the purchase of instruments.
shelter of instruments, d bservation, or even from Very great care should be bestowed on the Observations of the
the use of differently cons s. It is therefore hoped, **Wind.** Wind, the accuracy of which, both as regards Direc-
that those who kindly the Society will by a tion and Force, is so essential towards the right
scrupulous attention to cions, secure for their discussion of many of the more important problems of the science.
Monthly Returns an acc onmensurate with the A Wind-Vane ought to be elevated at least 12 feet above sur-
labour and pains involv ; and, for the Tables rounding objects. When it oscillates incessantly, the
published by the Societ , comparableness among the wind is feeble, reference may be made to the direction of smoke, etc.,
several Returns, without which the Society's Reports must inevit- in well-exposed situations. Careful observations are recommended
ably fail in achieving one of the main objects of Meteorological to be made on the changes in the direction of the wind; and during
Observation. storms, extra observations at every hour of Greenwich time. Such
The Council recommend that Observations be made precisely at are specially requested. Observations of simultaneous observation, pursued at different Stations,
9 A.M. and 9 P.M. (Greenwich or Railway Time only), is likely to give highly valuable and important results, particularly
as specified in the following remarks, or at the top in connection with the system of thickly-planted Stations over a
of the columns in the Schedule. It is hoped that the limited district round Edinburgh called STORM STATIONS, in the
utmost punctuality in the time of reading the Instruments will be course of being established by the Society for the systematic investi-
observed. Observers, in some few cases, may find this impossible; gation of the relation of the force of the wind to BAROMETRIC
in such instances, they are specially requested to mark opposite every GRADIENTS, and other points connected with storms.
reading the time at which it was taken, if not at 9 A.M. or 9 P.M. The Council would recommend the Hemispherical Cup Anemo-
Weather-Glasses and Aneroids, though well suited to indicate meter,—a self-registering instrument which shows the
roughly variations of atmospheric pressure, are not **2. As regards amount of Wind that passes it per day; from which**
fitted for scientific purposes. No Barometer should **Velocity and** also the mean Velocity of the Wind at the time of
be used for Meteorological Observation that is not supplied with **Pressure.** observation may be ascertained. For indicating the
some means of adjustment or compensation which will secure that Force of the Wind at any particular hour of observation, the Pressure
the height of the mercury in the tube is accurately measured from Anemometers recently brought under the notice of the Society by
the fluctuating surface of the mercury in the cistern. Mr. T. Stevenson, the Honorary Secretary, and Mr. R. Ballingall, the
The Barometer in which the error arising from the fluctuating Society's Observer at Eallabus, are recommended as likely to secure
surface of the mercury in the cistern is entirely got rid of is FORTIN'S uniformity in making observations on the Force of the Wind.
Barometer, the arrangement consisting in applying pressure by means Many causes conspire to produce anomalies in Rain Returns,
of a screw to the bottom of the cistern, which is made of flexible **Rain Gauges.** arising partly from the difficulty of obtaining a
leather, thus raising or depressing the surface till it just meets the perfectly unobjectionable situation for observation,
ivory point which forms the zero point of the fixed scale. and partly from the defective nature of the instruments used.
The Barometer originally constructed by Mr. Adie of London, The Rain Gauge should not be placed on a slope or terrace, but
and usually called the Board of Trade Barometer, has the great on a level piece of ground in as open a situation as the Observer
convenience of requiring no adjustment of the cistern. Its scale- can secure for it. As it is often difficult to obtain a position
inches are not true inches, but so much shorter as to compensate the as free and unobstructed by surrounding objects as is desirable,
error that would otherwise arise from the fluctuations of the surface care should be taken to place it at some distance from shrubs,
of mercury in the cistern. This is an excellent Barometer for trees, buildings, or other obstructions, at least as many feet from
ordinary Observers, inasmuch as it entirely eliminates the error of their base as they are in height. The more important directions,
observation likely to arise in not a few cases in setting the instru- towards which it is most desirable to have a free exposure, are, in
ment to the zero point of the fixed scale when the light is not good. the order of their importance, S.W., N.E., S.E., S., and W. The
To show the accuracy with which these Barometers are made, it rim of the gauge must be perfectly level, and fixed so that it will
may be stated, that one was compared, during a whole year, with remain level in all weathers, and be at a height of one foot above
the Society's Standard Barometer, particular care being given to ground, over grass. In such gauges as Fleming's, which are furnished
make the comparison when atmospheric pressure was rising or with a measuring-rod attached to a float, the rod ought to be fixed
falling very rapidly, with the result that none of the readings dif- down, and the float rise to its height only at the time the instrument
fered from those of the Standard more than 0·003 inch. is read, it being found that a stem projecting above the rim of the
A modification of FORTIN'S Barometer is used at a number of the gauge seriously interferes with the proper measurement of the Rain-
Society's Stations, by which the coincidence of the zero point with fall. When a measuring-glass is used, care should be taken to hold
the surface of the mercury is indicated by a little ivory float, whose it quite perpendicular. The Rain Gauge ought to be read daily at
stem passes freely through the lid and case of the cistern. When 9 A.M., and the reading entered in the Returns of the previous day.
the index-line on this little piston-rod is brought, by the adjusting If the Gauge is read once a month, the reading is to be made on the
screw, to form one straight line with those on its ivory frame, the first of the month, and the amount entered for the previous month.
surface of the mercury is then at the exact height from which the No drift is observed, and registered in addition to, and as a check
scale is graduated. In taking an observation, this preliminary set- upon, the indications of the Rain Gauge. For wind, rain, and snow,
ting must be made with scrupulous accuracy; as a slight error here as indeed in every column, the Observer cannot be too careful to
will vitiate the readings from the vernier. register observations only; and nothing that partakes of the nature
It is absolutely necessary that the Barometer which is to be used of deduction or inference.
shall have been compared with a Standard Barometer. Convenient abbreviations for the nomenclature of Clouds will be
The Barometer should be suspended in as good a light as can be found on the other side. The amount of Cloud ought
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read, at one uniform temperature, it is evident that the best position Cloud is entered from a scale of 0 to 10; thus, when the sky over-
is that which is least liable to sudden changes of temperature. head is free from Clouds it is entered 0, when half-covered by
In taking an Observation, the Attached Thermometer is first Clouds, 5, wholly covered, 10, and so on.
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inside the tube, it is usually a tedious operation to get it wholly ex-
pelled. After repeated trials, however, it is generally accomplished;
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against the top of the glass when the whole of the
air has been expelled. On
weight of two atmospheres—the pressure of the mercury in the
Barometer, before unfastening
taken to screw down the
the float of the cistern, for,
will flow out, and the instr
ty damage!

The Council of the Society recomm
Thermometers, and that
meter, be kept in Stevens
Thermometers, painted w
screwed to four stout pos
fixed in the ground. The posts must b
the Thermometers are hung in position
the Thermometer, and of the Dry and Wet
exactly at the same height of FOUR FEET
mum Thermometer being hung immed
Thermometer. The Thermometer Box
grass, and in a free open space to which t
during as much of the day as surroundi
ver to secure. The Thermometers are s
centre of the Box, and face the door, wh
The Council regard the question
ABOVE GROUND, AND METHOD IN FRO
as vital in every system of Meteorolog
out it Observations made at different
thus rendering it impossible to compar
each other as regards their most impor
Professor Phillips, and Negretti ar
monieters, and Rutherfo
are recommended.
Thermometers be gradu
Minimum Thermometer is liable to
column of spirit breaking, and part of
temperature and lodging at the top of
is of occasional occurrence with prot
frequent occurrence with exposed Th
make examination of Minimum Th
Fortunately, Spirit Thermometers
any one, when the column of spirit eb
Thermometer be taken in the hand b
bulb, raised above the head, and then
the feet; the object being, on the princ
send down the detached portion of
column. A few throws, or swingin
sufficient for the purpose; after which
placed in a slanting position, to allow
hering to the sides of the tube to dra
another method must be adopted, if th
of the tube be small. Heat should be
which, being turned into vapour by th
surface of the unbroken column of spi
the heat is not applied too quickly;
will break and the instrument be destr
the requisite amount of heat is by b
slowly down towards a minute flame f
not at hand, a piece of heated metal
The bulbs of the Thermometers fo
from the sun's rays, a
during night, have a bl
be made, or mended, by
of lampblack and printer's ink.
blackened boxes, whose sides protec
The Maximum should be freely expos
mum should rest on wooden supports
cover either of these Thermometers;
the Minimum Thermometer by distill
in 'glass jackets' may also be used, b
above. It must, however, be added,
ciently advanced state to warrant the
any one of these methods.
The Hygrometer in use at the Soc
one frame. As appl
the approved form of t
the Hygrometrical Observations. Obs
to attend to the following conditions:
by at least an inch free from the scale
attached; the frame must be such as
by an inch from any board on which it
cup must be covered, and altogether
below the level of the wet bulb, but n
muslin must be of medium fineness, a
bulb by the cotton, which also suppli
seen to by the Observer that the mus
and the water pure. In frosty weath
much delicacy, and must be made wi
be moistened by immersion from 15 t
of observation. From the film of ice
proceed as from the moist cloth in or
In reading the Thermometer grea
the eye exactly oppo
column of mercury.
to tenths of a degree.
the Thermometer will be read—39°
40°·4, 40°·5, 40°·6, according as it inc
coincidence with, or a little over 40°;
40°·7, or 40°·8 respectively. In re
Thermometer, the indication of that
the surface of the spirit is alone note
meter Box, the Dry and Wet Bulb
from the person of the Observer.
The Hygrometer of the Sea
ing Thermometers a
in the 24 hours prece
when the Self-Registering
in winter at least, the extremes may
necessary to refer their occurrence t
day. In the Society's schedules, the
3d are those of a series of phenom
2d, and extending till 9 P.M. on the
No instrument ought to be use
till it has been carefu
a standard Thermome
are not graduated
Thermometers, ought fre
dry bulb of the Hygrometer,
Thermometer, marked by a scratch
once a year, in snow or melting ice.
In selecting instruments, the f
tion:—The divisions of the vernier
their scales, and the perfect freedom
water, in cases where the observations
observation may be made on the 5th, 15
and the Dry and Wet Bulb Hygro- posure to the weather, as shown in the past by repeated and annoying
to secure PERFECT UNIFORMITY in the system of observation pursued breakages of Thermometers of similar construction; and as regards
at all its Stations. Uniformity in the observations is absolutely Maximum Thermometers, either Negretti and Zambra's, or Phillips',
necessary to justify the publication of Monthly Results from dif- whether they will act as the highest temperatures they may be re-
ferent observations, it being found that differences between the quired to register. By the laws of the Society, Members and Ob-
Returns from two Stations, so very considerable as to render them servers have a right to have their instruments compared by the Secre-
quite incomparable, may arise from dissimilarity in the position or tary, and to advise with him regarding the purchase of instruments.
shelter of instruments, d bservation, or even from Very great care should be bestowed on the Observations of the
the use of differently cons s. It is therefore hoped, **Wind.** Wind, the accuracy of which, both as regards Direc-
that those who kindly the Society will by a tion and Force, is so essential towards the right
scrupulous attention to cions, secure for their discussion of many of the more important problems of the science.
Monthly Returns an acc onmensurate with the A Wind-Vane ought to be elevated at least 12 feet above sur-
labour and pains involv ; and, for the Tables rounding objects. When it oscillates incessantly, the
published by the Societ , comparableness among the wind is feeble, reference may be made to the direction of smoke, etc.,
several Returns, without which the Society's Reports must inevit- in well-exposed situations. Careful observations are recommended
ably fail in achieving one of the main objects of Meteorological to be made on the changes in the direction of the wind; and during
Observation. storms, extra observations at every hour of Greenwich time. Such
The Council recommend that Observations be made precisely at are specially requested. Observations of simultaneous observation, pursued at different Stations,
9 A.M. and 9 P.M. (Greenwich or Railway Time only), is likely to give highly valuable and important results, particularly
as specified in the following remarks, or at the top in connection with the system of thickly-planted Stations over a
of the columns in the Schedule. It is hoped that the limited district round Edinburgh called STORM STATIONS, in the
utmost punctuality in the time of reading the Instruments will be course of being established by the Society for the systematic investi-
observed. Observers, in some few cases, may find this impossible; gation of the relation of the force of the wind to BAROMETRIC
in such instances, they are specially requested to mark opposite every GRADIENTS, and other points connected with storms.
reading the time at which it was taken, if not at 9 A.M. or 9 P.M. The Council would recommend the Hemispherical Cup Anemo-
Weather-Glasses and Aneroids, though well suited to indicate meter,—a self-registering instrument which shows the
roughly variations of atmospheric pressure, are not **2. As regards amount of Wind that passes it per day; from which**
fitted for scientific purposes. No Barometer should **Velocity and** also the mean Velocity of the Wind at the time of
be used for Meteorological Observation that is not supplied with **Pressure.** observation may be ascertained. For indicating the
some means of adjustment or compensation which will secure that Force of the Wind at any particular hour of observation, the Pressure
the height of the mercury in the tube is accurately measured from Anemometers recently brought under the notice of the Society by
the fluctuating surface of the mercury in the cistern. Mr. T. Stevenson, the Honorary Secretary, and Mr. R. Ballingall, the
The Barometer in which the error arising from the fluctuating Society's Observer at Eallabus, are recommended as likely to secure
surface of the mercury in the cistern is entirely got rid of is FORTIN'S uniformity in making observations on the Force of the Wind.
Barometer, the arrangement consisting in applying pressure by means Many causes conspire to produce anomalies in Rain Returns,
of a screw to the bottom of the cistern, which is made of flexible **Rain Gauges.** arising partly from the difficulty of obtaining a
leather, thus raising or depressing the surface till it just meets the perfectly unobjectionable situation for observation,
ivory point which forms the zero point of the fixed scale. and partly from the defective nature of the instruments used.
The Barometer originally constructed by Mr. Adie of London, The Rain Gauge should not be placed on a slope or terrace, but
and usually called the Board of Trade Barometer, has the great on a level piece of ground in as open a situation as the Observer
convenience of requiring no adjustment of the cistern. Its scale- can secure for it. As it is often difficult to obtain a position
inches are not true inches, but so much shorter as to compensate the as free and unobstructed by surrounding objects as is desirable,
error that would otherwise arise from the fluctuations of the surface care should be taken to place it at some distance from shrubs,
of mercury in the cistern. This is an excellent Barometer for trees, buildings, or other obstructions, at least as many feet from
ordinary Observers, inasmuch as it entirely eliminates the error of their base as they are in height. The more important directions,
observation likely to arise in not a few cases in setting the instru- towards which it is most desirable to have a free exposure, are, in
ment to the zero point of the fixed scale when the light is not good. the order of their importance, S.W., N.E., S.E., S., and W. The
To show the accuracy with which these Barometers are made, it rim of the gauge must be perfectly level, and fixed so that it will
may be stated, that one was compared, during a whole year, with remain level in all weathers, and be at a height of one foot above
the Society's Standard Barometer, particular care being given to ground, over grass. In such gauges as Fleming's, which are furnished
make the comparison when atmospheric pressure was rising or with a measuring-rod attached to a float, the rod ought to be fixed
falling very rapidly, with the result that none of the readings dif- down, and the float rise to its height only at the time the instrument
fered from those of the Standard more than 0·003 inch. is read, it being found that a stem projecting above the rim of the
A modification of FORTIN'S Barometer is used at a number of the gauge seriously interferes with the proper measurement of the Rain-
Society's Stations, by which the coincidence of the zero point with fall. When a measuring-glass is used, care should be taken to hold
the surface of the mercury is indicated by a little ivory float, whose it quite perpendicular. The Rain Gauge ought to be read daily at
stem passes freely through the lid and case of the cistern. When 9 A.M., and the reading entered in the Returns of the previous day.
the index-line on this little piston-rod is brought, by the adjusting If the Gauge is read once a month, the reading is to be made on the
screw, to form one straight line with those on its ivory frame, the first of the month, and the amount entered for the previous month.
surface of the mercury is then at the exact height from which the No drift is observed, and registered in addition to, and as a check
scale is graduated. In taking an observation, this preliminary set- upon, the indications of the Rain Gauge. For wind, rain, and snow,
ting must be made with scrupulous accuracy; as a slight error here as indeed in every column, the Observer cannot be too careful to
will vitiate the readings from the vernier. register observations only; and nothing that partakes of the nature
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will flow out, and the instr
ty damage!

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

TREES.	In Flower.	Leaf Buds first Appear.	In Leaf.	Divested of Leaves.	CROPS, mentioning variety.	Sowing or Planting.	Appearing above Ground.	In Ear or Flower.	First Cut or Raised.
					Barley,				
Ash,					Bere or Bigg,				
Beech,					Oats,				
Birch,					Wheat,				
Elm,					Beans,				
Larch,					Pease,				
Lime,					Potatoes,				
Oak,					Turnips,				
Sycamore or Plane,					Rye Grass,				

SHRUBS, ETC.	First in Blossom.	FRUITS.	First in Blossom.	Fruit Ripe, generally.	MIGATORY BIRDS.	First Arrival.	Departure.
Barberry,		Apple,			Cuckoo,		
Bourtree or Elder,		Black Currant,			Curlew,		
Broom,		Cherry,			House-Swallow,		
Hazel,		Gean,			Lapwing,		
Hawthorn,		Gooseberry,			Plover,		
Holly,		Peach,			Sand-Martin,		
Laburnum,		Pear,			Starling,		
Lilac,		Plum,			Swan,		
Mezereon,		Strawberry,			Rail or Corn Crake,		
Mountain Ash or Rowan,							
Red Flowering Currant,							
Rhododendron Ponticum,							
Whin,							

Have the goodness also to state any information you may be able to collect relative to the Crops of Grain, Hay, Potatoes, Turnips, Fruits, etc., whether plentiful, or in perfection; whether any have suffered from blight, disease, etc. Whether Epizootic disease prevails among cattle; and the Agricultural condition of the district generally.

Protection and Position of Thermometers.

The Thermometers cannot be taken daily, the observations might be taken for other days the Temperature of the Air, and the Hour of Observation. It is also very desir daily Maxima and Minima by Thermome be instituted at points along the coast, by T. Stevenson, and already commenced a

Temperature of Wells.

The Temperature of the water at t when practicable, to be ta Well and of the water be Mention what Test-Papers are used,

Ozone.

The Paper is affixed by a meter Box, and the ind and 9 P.M. It is desired that these connection with the force and direction observation, in the following manner:—t in the schedule will indicate that the O the scale, that the wind is from the N.W., scale 0—5 is 4, or blowing fresh. Too much importance cannot be att tion of the atmosphere trial magnetism, barome

Atmospheric Electricity.

meteorological phenome Electrometer is in truth, necessary to e cal observatory.

Remarks.

The Remarks column is unavoidably most valuable Observatio those for which no rule assigned. The use of contractions orig every advantage of, and a list of such as at the foot of the column. Besides speci vations, great prominence ought to be g tion between the Lower and Upper Strat valent Diseases, differences in character, Sky, etc. Remarks ought to be made or Auroræ Boreales, remarkable depressions of the Barometer, Thunder-Storms, and re or Rain, the Hour of Storms of Wind

Observations in connection with the Periodic Return of the Seasons.

maximum, and ending, as well as such N limited at above. When lofty hills are in Height of Clouds and of the Snow-line in

By the use of abbreviations, the state 9 P.M. should be registered, either in tw cupied, or ruled off for the purpose, fro

Observations in connection with t are of considerable impo vers to the registration of Council would direct the

The Council recommend Observers published Summaries may fairly repre Observations ought to be confined to to particular species of birds, and, in t sorts reared from year to year on a selec The Annual Table, published yearly in indicate the species of plants and anima is more particularly directed.

The Council recommend Observers sary that he should have full power to r examined and improved before being use Meteorological Secretary, in order that on being presented for comparison, does

EDINBURGH, *December* 1883.

To the SECRETARY
Scottish Meteorological Society,
122 George Street,
EDINBURGH.
BOOK POST.
Aberdeen Aug 1882

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Gordon's College, Abdn, County of Aberdeen, in Lat. 57°9'N, Long. 2°6'W. Distance from Sea 1 miles.

Height of Cistern of the Barometer above Mean Sea-Level 66 feet, above Ground 2½ feet. During the MONTH of August 1892.

The Hours of Observation are of Greenwich Time.

Days of Month.	BAROMETER. 9 h. A.M. Barometer. * No.	Attached Thermometer	9 h. P.M. Barometer. No.	Attached Thermometer	SELF-REGISTERING THERMOMETERS, Read Daily, at 9 P.M. Protected in Shade, 4 feet above Ground. Max.	Min. No.	Exposed Black Bulbs. Max. in Sun's rays No.	Min. on Grass No.	HYGROMETER. Dry No. ___ Wet No. ___ 9 h. A.M. Dry bulb.	Wet bulb.	9 h. P.M. Dry bulb.	Wet bulb.	Rain. No. of hours in which it fell.	Amount in inches. No.	WIND. 9 h. A.M. Direction.	Force	9 h. P.M. Direction.	Force	Readings of the H. Cup Anemometer. No. ___ 9 h. A.M.	CLOUDS. 9 A.M. Velocity (0—6) and Direction.	Amount (0—10), and Species.	P.M. Velocity (0—6) and Direction.	Amount (0—10), and Species.	SUNSHINE. Hours.	THERMOMETERS under Ground. 9 h. A.M. No. 3 inches.	No. 12 inches.	No. 22 inches.	Temperature of WELL at depth of feet. No.	SEA. Temperature at 1 fathom, and Density.	OZONE. 0—10. 9 A.M.	9 P.M.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc. *Mention the hour at which Storms, including Thunder and Lightning, began and ended.*	Days of Month.
	inches.	°	inches.	°	°	°	°	°	°	°	°	°																							
1	29.923	62.0	30.119	64.0	61.5	52.6			52.4	53.1	57.8	48.0			N.E.	1½	N.W.	1½		10	Nim	6	Cu-lt	2½										1
2	30.145	62.0	30.048	62.0	57.4	48.1			51.4	48.0	53.6	50.4	(1)	—	N.W.	½	S	1½		6	Cu-S	6	Cu-lt	6½										2
3	29.935	63.0	29.946	61.0	60.1	51.4			57.0	51.6	53.0	47.7	(2)	—	N.W.	2	N.W.	3		6	Ci-cu	4	Cu-lt	5										3
4	29.987	61.0	29.996	61.0	57.9	45.2			49.4	45.4	56.0	48.0	(3)	0.01	N.W.	2½	N	1		4	Ci-cu	7	Cu-lt	11										4
5	29.798	62.0	29.640	64.0	64.9	47.9			58.6	53.4	61.3	53.4	(4)	—	S.W.	1½	S.W.	2		5	Ci-cu	7	Ci-cu	4½										5
6	29.539	63.0	29.656	64.0	64.2	49.6			57.2	52.2	57.7	51.7	(5)	0.02	S.W.	1½	N.W.	2		6	Cu-lt	5	Cu	10½										6
7	29.862	62.0	29.953	63.0	57.4	48.3			55.2	49.4	55.7	49.4	(6)	0.17	N.W.	1½	N	1		5	Cu	4	Ci-cu	8										7
8	29.897	61.0	29.928	59.0	56.0	48.0			52.4	49.2	51.2	46.2	(7)	—	E.	2	N.E.	2		9	Cu-lt	9	Cu-lt	—										8
9	30.049	60.0	30.149	60.0	56.7	46.0			51.0	44.4	54.2	47.7	(8)	—	N	1½	N.W.	1		7	Cu	2	Cu	4½										9
10	30.171	60.0	30.061	64.0	65.2	37.4			60.6	53.6	62.4	52.6	(9)	—	S.W.	½	S.W.	1		2	Ci-cu	7	Ci-cu	11½										10
11	29.161	62.0	29.940	64.0	66.4	51.9			53.4	51.7	58.2	56.1	(10)	0.78	S.W.	1	S.E.	½		9	St	10	Nim	—										11
12	29.707	64.0	29.717	64.0	66.0	52.1			62.0	57.1	57.2	55.2	(11)	0.13	S	½	S	2		6	Ci-cu	10	Cu-St	3½										12
13	29.447	64.0	29.357	65.0	67.2	54.7			55.0	54.0	60.7	55.2	(12)	0.15	S.E.	1½	S.W.	½		10	Nim	7	Cu-lt	2½										13
14	29.394	65.0	29.448	66.0	66.9	53.0			62.0	56.0	57.0	56.2	(13)	0.06	S.W.	2	S	1		5	Ci-cu	7	Ci-cu	6½										14
15	29.486	64.0	29.621	66.0	67.4	53.8			56.7	53.2	~~E.4~~	~~53.1~~	(14)	0.53	W.	1½	S.W.	1½		5	Ci-cu	3	Cu	9										15
16	29.884	65.0	29.892	65.0	66.0	50.9			58.0	52.4	59.0	54.4	(15) (16)	73	S.W.	1½	S.W.	1		5	Ci-cu	10	Nim	—										16
17	29.868	60.0	30.018	60.0	65.5	50.0			56.6	53.2	50.6	49.1		.04	N.W.	1	N.W.	1		10	Cu-lt	10	St	4½										17
18	29.988	59.0	29.654	58.0	53.2	50.1			54.1	53.0	52.2	52.0		.68	S.	1	S.	1		10	Nim	10	Cu-lt	—										18
19	29.680	58.5	29.838	59.0	57.8	50.2			53.3	53.0	53.1	52.0		.04	E.	½	E.	½		10	Cu-lt	10	St	3½										19
20	29.920	58.5	29.890	59.0	57.8	44.5			56.2	53.2	53.2	50.4		.10	S	1	S	1		~~10~~ 5	Ci-lt	5	Ci-cu	5										20
21	29.920	57.5	29.934	63.0	65.7	50.1			58.5	55.0	63.0	62.0		—	S.W.	1½	S.W.	1½		10	Cu-lt	2	Ci-cu	—										21
22	29.956	62.0	29.880	63.0	66.5	51.4			62.0	60.0	57.2	55.5		—	S.W.	1½	S.W.	½		10	Ci-cu	10	St	1										22
23	29.828	61.0	29.808	61.0	64.5	54.2			58.2	57.0	58.0	58.0		—	S	½	S	½		10	Lt	2	St	7½										23
24	29.770	60.0	29.668	61.0	57.5	50.1			57.2	56.5	55.3	50.0		.01	S	—	S	—		10	St	10	St	—									Dense mist during the day	24
25	29.632	57.0	29.640	58.0	62.0	53.0			55.2	54.0	53.8	52.2		—	N.W.	1	N.W.	½		10	St	5	Ci-cu	2½									Do Do " " "	25
26	29.702	58.0	29.614	57.5	62.1	45.1			57.2	49.1	53.8	50.1		—	W.	1	S.W.	1½		5	Cu	5	Cu	7										26
27	29.380	57.0	29.410	58.0	62.9	45.1			56.8	52.0	53.7	51.0		.09	S.W.	2	S.W.	1		10	Cu-St	2	Cir	6½										27
28	29.444	57.5	29.604	57.0	60.6	45.2			55.4	51.0	50.7	47.0		—	W.	1	N.W.	1		4	Cu	1	St	10										28
29	29.712	56.0	29.632	57.0	60.0	40.2			52.0	47.6	51.3	47.2		.47	N.	1	N.	1		—	—	—	—	10										29
30	29.420	56.0	29.360	57.0	54.2	50.0			51.9	50.0	52.2	52.0		.80	N.E.	1	N.E.	½		10	St	10	St	—										30
31	29.245	58.0	29.440	57.0	54.6	50.5			54.6	54.6	51.0	47.8		.02	N.E.	½	N.E.	1		10	St	2	St	½									Dense fog.	31
Sums.	23.933	18.0	23.883	37.5	4.60	28.18			18.697	3.9	17.55	54.1		3.51		37.5		35.0		228		188		143.5										
Means.	29.772	60.6	29.770	61.2	61.5	49.1			56.0	52.4	55.7	51.7				1.2		1.1		7.4		6.1												
± Total Corrections for Instrumental Errors.	+006	-7	+006	-7																6.8														
‡ Corrections for Diurnal Range.																																		
"Corrected Means."																																		
No. of Column.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30					

NOTATION USED IN GENERAL REMARKS.

a.	*denotes* aurora.		m.	*denotes* meteor.	
ci.	,,	cirrus.	ms.	,,	meteors.
ci.-cu.	,,	cirro-cumulus.	n.	,,	nimbus.
ci.-s.	,,	cirro-stratus.	r.	,,	rain.
cu.	,,	cumulus.	h. r.	,,	heavy rain.
cu.-s.	,,	cumulo-stratus.	c. h. r.	,,	continued heavy rain.
d.	,,	dew.	s.	,,	stratus.
f.	,,	fog.	sc.	,,	scud.
fr.	,,	frost.	s.	,,	sleet.
h.-fr.	,,	hoar-frost.	s.	,,	snow.
h.	,,	haze.	so. ha.	,,	solar halo.
h. d.	,,	heavy dew.	sq.	,,	squall.
hl.	,,	hail.	sqs.	,,	squalls.
l.	,,	lightning.	t.	,,	thunder.
li. cl.	,,	light clouds.	t. s.	,,	thunder-storm.
li. sh.	,,	light showers.	w.	,,	wind.
lu. co.	,,	lunar corona.	g.	,,	gale of wind.
lu. ha.	,,	lunar halo.			

TABLE FOR ESTIMATING FORCE OF WIND.

Estimated Force, 0—6.	Common Designation.	Estimated Force, 0—6.	Common Designation.	Estimated Force, 0—6.	Common Designation.
0	Calm	1·5	Light breeze	4	Blowing hard
0·5	Very light air	2·	Fresh breeze	5	Blowing a gale
1·	Light air	3·	Very fresh	6	Violent gale

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction †† for Temp. (Col. 2), = 29.778 − .084 = 29.694

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction †† for Temp. (Col. 4), = 29.776 − .086 = 29.690

Mean at Station, corrected, and at 32°, = 29.692

Correction for height, 66 feet above Mean Sea-level, = .074

Mean, reduced to 32°, and Sea-level, = 29.766

Highest Reading, corrected for Index error, on the 10 th, = 30.177

Lowest Do. Do., on the 31 th, = 29.354

Difference, or **Monthly Range**, = 0.823

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month**, (corrected for Index Errors), on the 15th, = 67.4

Lowest in Month, corrected for Index errors, on the 10th, = 37.4

Difference, or **Monthly Range**, = 30.0

"Corrected **Mean**" **of all the Highest**, (Col. 5), = 61.5

"Corrected **Mean**" **of all the Lowest**, (Col. 6), = 49.1

Difference, or **Mean Daily Range**, = 12.4

** Calculated **Mean Temperature** of Month, = 55.3

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the th, =

"Corrected **Mean**," (Col. 7), **of Black Bulb, Max. in Sun**, =

Lowest at Night, Black Bulb (corrected for Index errors), on the th, =

"Corrected **Mean**," (Col. 8), **of Black Bulb, Min.** on grass, =

Difference of above means or range ("exposed"), =

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb**, (Cols. 9 and 11), = 53.8

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb**, (Cols. 10 and 12), = 52.0

‡‡ Computed **Temperature of Dew-Point**, = 48.4

‡‡ Do. **Elastic Force of Vapour**, = .342

‡‡ Do. **Weight of Vapour in a Cubic Foot of Air**, = 3.82

‡‡ **Relative Humidity** (Saturation = 100), = 77.

RAIN fell on 18 **Days; Amount in Inches**, = 3.51

WIND. SUMMARY.

Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	2	3	2	1	5	9	3	6		1.2	
P.M.	3	3	1	1	7	9		7		1.1	
Mean.	2	3	2	1	6	9	1	7	0	1.15 = 1.2	

† Each instrument tested at the Office in Edinburgh bears the stamp "S.M.S.;" and a number to be entered in the Heading; or the Number and Initials of the Maker may be here given.

‡ Embracing corrections for both capillarity and Index Errors.

; The Diurnal Range for Scotland is as yet unknown.

†† *Practically*, though not *absolutely* a *minus* correction.

‡‡ These "Hygrometrical Deductions" are calculated from Glaisher's Hygrometrical Tables, Second Edition *only*.

** While the Diurnal Range is unknown, the Arithmetical Mean of Cols. 5 and 6 will be entered as the "Calculated Mean Temperature."

Any observations not taken under the Conditions specified in the Directions on the other side, or noted at the Top of each column, must be marked as such by the observer, in each Schedule. *See over.*

Observations made and Return verified by James Dale, Teacher in Robert Gordon's College

(*Signed*)

Greatest Daily Range = 27°.8 on the 10th.

M.

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

ONE of the chief objects that the SCOTTISH METEOROLOGICAL SOCIETY proposed to itself when the Society was established in 1855, was to secure PERFECT UNIFORMITY in the system of observation pursued at all its Stations. Uniformity in the observations is absolutely necessary to justify the publication of Monthly Results from different observations, it being found that differences between the Returns from two Stations, so very considerable as to render them quite incomparable, may arise from dissimilarity in the position or shelter of instruments, different hours of observation, or even from the use of differently constructed instruments. It is therefore hoped, that those who kindly furnish Reports to the Society will, by a scrupulous attention to the following Directions, secure for their Monthly Returns an accuracy and value commensurate with the labour and pains involved in making them; and, for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

The Council recommend that Observations be made precisely at

Hour of Observation.

9 A.M. and 9 P.M. (Greenwich or Railway Time only), as specified in the following remarks, or at the top of the columns of the Schedule. It is hoped that the utmost punctuality in the time of reading the instruments will be observed. Observers, in some few cases, may find this impossible; in such instances, they are specially requested to mark opposite every reading the time at which it was taken, if not at 9 A.M. or 9 P.M.

Barometer.

Weather-Glasses and Aneroids, though well suited to indicate roughly variations of atmospheric pressure, are not fitted for scientific purposes. No Barometer should be used for Meteorological Observation that is not supplied with some means of adjustment or compensation which will secure that the height of the mercury in the tube is accurately measured from the fluctuating surface of the mercury in the cistern.

The Barometer in which the error arising from the fluctuating surface of the mercury in the cistern is entirely got rid of is FORTIN'S Barometer, the arrangement consisting in applying pressure by means of a screw to the bottom of the cistern, which is made of flexible leather, thus raising or depressing the surface till it just meets the ivory point which forms the zero point of the fixed scale.

The Barometer originally constructed by Mr. Adie of London, and usually called the Board of Trade Barometer, has the great convenience of requiring no adjustment of the cistern. Its scale-inches are not true inches, but so much shorter as to compensate the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This is an excellent Barometer for ordinary Observers, inasmuch as it entirely eliminates the error of observation likely to arise in not a few cases in setting the instrument to the zero point of the fixed scale when the light is not good. To show the accuracy with which these Barometers are made, it may be stated, that one was compared, during a whole year, with the Society's Standard Barometer, particular care being given to make the comparison when atmospheric pressure was rising or falling very rapidly, with the result that none of the readings differed from those of the Standard more than 0·003 inch.

A modification of Fortin's Barometer is used at a number of the Society's Stations, by which the coincidence of the zero point with the surface of the mercury is indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When the index-line on this little piston-rod is brought, by the adjusting screw, to form one straight line with those on its ivory frame, the surface of the mercury is then at the exact height from which the scale is graduated. In taking an observation, this preliminary setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the vernier.

It is absolutely necessary that the Barometer which is to be used shall have been compared with a Standard Barometer.

The Barometer should be suspended in as good a light as can be secured, and to facilitate the reading, a piece of white paper may be put behind the tube. It must be hung truly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire, and must not be hung against a wall heated by a flue. The object being to secure that the whole instrument, including the brass fittings, the contained mercury, and the attached Thermometer, shall be, when read, at one uniform temperature, it is evident that the best position is that which is least liable to sudden changes of temperature.

In taking an Observation, the Attached Thermometer is first noted: the tube must then be gently tapped, and the cistern-adjustment carefully made. The eye, by raising and lowering it, must be brought into the plane of the back and front of the index—usually the lower edge of the vernier, which must be carefully adjusted so as to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly, so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will facilitate an accurate adjustment and reading of the Barometer. A mistake not unfrequently made by those beginning to observe, consisting in setting the edge of the vernier to the level of the clear surface of the mercury which is in direct contact with the glass tube, must be carefully avoided.

The errors most frequently made in reading the Barometer are errors of 1·000 inch, 0·500 inch, and 0·050 inch; that is to say, instead of 29·365 inches, either of the following is sometimes set down—viz. as 30·365 inches, 28·365 inches, 29·865 inches, or 29·815 inches. Experience having shown that even the very best Observers make these mistakes, particular attention is directed to the matter.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must first be screwed so as to form a tight plug to the cistern, thus preventing the escape of the mercury. Then screw up the mercury not quite to the top of the tube, but to within a quarter of an inch of it, and take down the instrument; it should then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case if, on inclining the instrument, a sharp tap is produced when the mercury strikes the top of the tube. If a dull tap is heard, there is air in the tube, which must be got rid of.

As Barometers are liable to be deranged by the introduction of air into their tubes, on removal from place to place, or in being roughly handled, it may be useful to Observers to know how the air may be expelled. First close up the cistern by screwing the ivory peg tight, so as to prevent the escape of mercury; then screw up the mercury to about half an inch from the top of the tube; and having slowly inverted the instrument, place the top of it on a yielding substance, such as the boot, and gently tap on the cistern with the palm of the hand, so as to induce the air to ascend through the column to the cistern, whence it may escape. Since there is the weight of two atmospheres—the pressure of the mercury in the Barometer, and the air outside—pressing on any air that may be inside the tube, it is usually a tedious operation to get it wholly expelled. After repeated trials, however, it is generally accomplished; and the clear metallic sound of the mercury, when gently struck against the top of the glass tube, will show when the whole of the air has been expelled. On hanging up the Barometer, care must be taken to screw down the mercury in the tul tening the float of the cistern, for, if this be not atte ercury will flow out, and the instrument be seriously

The Council of the Society recommend that the Self-Registering Thermometers, and the Dry and Wet Bulb Hygrometer, be kept in Stevenson's Louvre-boarded Box for Thermometers, painted white inside and outside, and screwed to four stout posts, also painted white, firmly fixed in the ground. The posts must be of such a length that when the Thermometers are hung in position the Bulbs of the Minimum Thermometer, and of the Dry and Wet Bulb Thermometers, will be exactly at the same height of FOUR FEET above the ground, the Maximum Thermometer being hung immediately above the Minimum Thermometer. The Thermometer Box is to be placed over a plot of grass, and in a free open space to which the sun's rays have free access during as much of the day as surrounding conditions enable the Observer to secure. The Thermometers are suspended on cross-laths in the centre of the Box, and face the door, which should open to the north.

Protection and Position of Thermometers.

The Council regard the question of UNIFORMITY OF HEIGHT ABOVE GROUND, AND METHOD IN PROTECTING THE THERMOMETERS, as vital in every system of Meteorological Observation, since without it Observations made at different Stations are incomparable, thus rendering it impossible to compare the Climates of places with each other as regards their most important features.

Self-Registering Thermometers.

Professor Phillips, and Negretti and Zambra's Maximum Thermometers, and Rutherford's Minimum Thermometer, are recommended. It is recommended that these Thermometers be graduated on the glass stem. The Minimum Thermometer is liable to two derangements—viz., the column of spirit breaking, and part of the spirit distilling by high temperature and lodging at the top of the tube. This derangement is of occasional occurrence with protected Thermometers, but of frequent occurrence with exposed Thermometers. Hence a systematic examination of Minimum Thermometers ought to be a regular part of the work carried on by each Observer.

Fortunately, Spirit Thermometers may be easily set right by any one, when the column of spirit chances to separate. Let the Thermometer be taken in the hand by the end farthest from the bulb, raised above the head, and then forcibly swung down towards the feet; the object being, on the principle of centrifugal force, to send down the detached portion of spirit till it unites with the column. A few throws, or swinging strokes, will generally be sufficient for the purpose; after which the Thermometer should be placed in a slanting position, to allow the rest of the spirit still adhering to the sides of the tube to drain down to the column. But another method must be adopted, if the portion of spirit in the top of the tube be small. Heat should be applied slowly and cautiously to the top end of the tube where the detached portion of spirit is, which, being turned into vapour by the heat, will condense on the surface of the unbroken column of spirit. Care must be taken that the heat is not applied too quickly; for, if this be done, the tube will break and the instrument be destroyed. The best way to apply the requisite amount of heat is by bringing the end of the tube slowly down towards a minute flame from a gas-burner; or, if gas be not at hand, a piece of heated metal will serve instead.

Black-Bulb Thermometers.

The bulbs of the Thermometers for registering the greatest heat from the sun's rays, and the least from radiation during night, have a black coating, which may easily be made, or mended, by the application of a mixture of lampblack and printer's ink. They are placed in shallow blackened boxes, whose sides protect the bulbs from the wind The Maximum should be freely exposed to the sun, and the Mini mum should rest on wooden supports a few inches from the surface of the grass, in an open situation. Snow must not be allowed to cover either of these Thermometers; nor the sun's heat to affect the Minimum Thermometer by distillation. Black-bulbs enclosed in 'glass jackets' may also be used, being indeed preferable to the above. It must, however, be added, that the whole subject of the observation of Solar and Terrestrial Radiation is not yet in a sufficiently advanced state to warrant the exclusive recommendation of any one of these methods.

Dry and Wet Bulb Hygrometer.

The Hygrometer in use at the Society's Stations consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved form of this apparatus seriously vitiate the Hygrometrical Observations, Observers are specially requested to attend to the following conditions:—The bulbs must hang down by at least an inch free from the scales and frame to which they are attached; the frame must be such as will bring the tubes forward by an inch from any board on which it may be suspended; the water-cup must be covered, and altogether placed to the side, and a little below the level of the wet bulb, but in no case under the bulbs; the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the Observer that the muslin is always clean and moist, and the water pure. In frosty weather, observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

Reading of the Thermometer.

In reading the Thermometer great care must be taken to bring the eye exactly opposite the tip of the index or column of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°·9, 40°·0, or 40°·1; or again, 40°·4, 40°·5, 40°·6, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40¼°, respectively. So also 40½°, and 40¾°, more or less, must be registered 40°·2, or 40°·3, and 40°·7, or 40°·8 respectively. In reading Rutherford's Minimum Thermometer, the indication of that end of the index which is next the surface of the spirit is alone noted. On opening the Thermometer Box, the Dry and Wet Bulb Thermometers are to be first, and rapidly, read, inasmuch as they are readily affected by heat from the person of the Observer.

Hour of observing Temperature.

The Hygrometer is read at 9 A.M. and 9 P.M. The Self-Registering Thermometers are read at 9 P.M. only, as indicating the greatest and least degrees of temperature in the 24 hours preceding. It is not a matter of indifference when the Self-Registering Thermometers are read, since, in winter at least, the extremes may occur at any hour; and it is necessary to refer their occurrence to their proper meteorological day. In the Society's schedules, the indications registered on the 3d are those of a series of phenomena commencing at 9 P.M. on the 2d, and extending till 9 P.M. on the 3d.

Verification of Thermometers.

No instrument ought to be used for Meteorological purposes till it has been carefully tested by comparison with a standard Thermometer. When such Thermometers as are not graduated on the stem, but merely on an attached scale, undergo repairs, they are very liable to be moved from their position on the Scale, and ought never afterwards to be used without being re-tested. The Self-Registering, especially the Minimum Thermometers, ought frequently to be compared with the dry bulb of the Hygrometer. The freezing-point of each Thermometer, marked by a scratch on the tube, ought to be tested once a year, in snow or melting ice.

In selecting instruments, the following points require attention:—The divisions of the vernier of Barometers in reference to their scales, and the perfect freedom of the Barometer from air; the correct numbering of the scale of every instrument; the rejection of Thermometers the frameworks of which are not likely to stand exposure to the weather, as shown in the past by repeated and annoying breakages of Thermometers of similar construction; and as regards Maximum Thermometers, either Negretti and Zambra's, or Phillip's, whether they will act at the highest temperatures they may be required to register. By the laws of the Society, Members and Observers have a right to have their instruments compared by the Secretary, and to advise with him regarding the purchase of instruments.

Wind.

Very great care should be bestowed on the Observations of the Wind, the accuracy of which, both as regards Direction and Force, is so essential towards the right discussion of many of the more important problems of the science.

1. As regards Direction.

A Wind-Vane ought to be elevated at least 12 feet above surrounding objects. When it oscillates incessantly, the mean direction should be taken. In all cases, but especially when the Vane is stationary, and when the wind is feeble, reference may be made to the direction of smoke, etc., in well-exposed situations. Careful observations are recommended to be made on the changes in the direction of the wind; and during storms, extra observations at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, is likely to give highly valuable and important results, particularly in connection with the system of thickly-planted Stations over a limited district round Edinburgh called STORM STATIONS, in the course of being established by the Society for the systematic investigation of the relation of the force of the wind to BAROMETRIC GRADIENTS, and other points connected with storms.

2. As regards Velocity and Pressure.

The Council would recommend the Hemispherical Cup Anemometer,—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the mean Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind at any particular hour of observation, the Pressure Anemometers recently brought under the notice of the Society by Mr. T. Stevenson, the Honorary Secretary, and Mr. R. Ballingall, the Society's Observer at Eallabus, are recommended as likely to secure uniformity in making observations on the Force of the Wind.

Rain Gauges.

Many causes conspire to produce anomalies in Rain Returns, arising partly from the difficulty of obtaining a perfectly unobjectionable situation for observation, and partly from the defective nature of the instruments used. The Rain Gauge should not be placed on a slope or terrace, but on a level piece of ground, in as open a situation as the Observer can secure for it. As it is often difficult to obtain a position as free and unobstructed by surrounding objects as is desirable, care should be taken to place it at some distance from shrubs, trees, buildings, or other obstructions, at least as many feet from their base as they are in height. The more important directions, towards which it is most desirable to have a free exposure, are, in the order of their importance, S.W., N.E., S.E., S., and W. The rim of the gauge must be perfectly level, and fixed so that it will remain level in all weathers, and be at a height of one foot above ground, over grass. In such gauges as Fleming's, which are furnished with a measuring-rod attached to a float, the rod ought to be fixed down, and the float rise to its height only at the time the instrument is read, it being found that a stem projecting above the rim of the gauge seriously interferes with the proper measurement of the Rainfall. When a measuring-glass is used, care should be taken to hold it quite perpendicular. The Rain Gauge ought to be read daily at 9 A.M., and the reading entered in the Returns of the previous day. If the Gauge is read once a month, the reading is to be made on the first of the month, and the amount entered for the previous month.

Snow-falls.

Snow-falls may, for convenience, be registered in the rain columns, under the following conditions:—When a Snow shower occurs, it should be noted in the 'Remarks,' and the letter S affixed to the depth of water received in Gauge. The depth of the snow must be measured in some open place where no drift is observed, and registered in addition to, and as a check upon, the indications of the Rain Gauge. For wind, rain, and snow, as indeed in every column, the Observer cannot be too careful to register observations only; and nothing that partakes of the nature of deduction or inference.

Clouds.

Convenient abbreviations for the nomenclature of Clouds will be found on the other side. The amount of Cloud ought to be estimated from the greater or less obscuration of the sky overhead (*i.e.* within 20° or 30° of the zenith). The strata of Clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the Clouds' column, though their appearance and changes may be noted among the Remarks. The amount of Cloud is entered from a scale of 0 to 10; thus, when the sky overhead is free from Clouds it is entered 0, when half-covered by Clouds, 5, wholly covered, 10, and so on.

Observations of the Clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—Thus, in the column Velocity and Direction, 6, S. W.

——— will indicate that the upper strata of Clouds travel with 2, W.

extreme velocity from S.W., and those in the lower regions from W., with one-third the speed of the former. Again, in the second 4, st.

Cloud column, an entry of ——— will indicate that the higher 2, cu-st.

regions are covered to the amount of 4-tenths with stratus Clouds; and that the sky is further obscured to the extent of 2-tenths by lower Clouds of the cumulo stratus kind.

Remarks on peculiar Clouds, accompanied with drawings, will assist materially in the development of a more exact nomenclature of Clouds, as well as throw light on the electrical, and other of the more obscure phenomena of Meteorology.

Sunshine.

The approximate number of Hours in which objects in the sun's rays cast shadows, should be entered in the proper column.

Underground Thermometers.

As the germination and growth of crops and plants generally depend greatly on the temperature of the soil,—its amount and constancy,—the Council recommend that Observations in this interesting department be made at 9 A.M., by Thermometers permanently fixed in the soil, their bulbs being sunk to depths of 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain-water being conveyed to the bulbs by the stems or wooden frames.

Temperature of the Sea.

A knowledge of the Temperature of the Sea is not only in itself, but in its relations to that of our island, a most important branch of Meteorology. The Council therefore recommend that the Temperature of the Sea be carefully taken by a properly constructed apparatus, from boats, or, if this be impracticable, from the ends of piers and rocks round the coast, where it is not i at of river water, and as little influenced as possible l ping along the coast, and thus acquiring the tempera l, either greatly heated by the sun or cooled by noct At or near the time of high water, in cases where the observations cannot be taken daily, the observation may be made on the 5th, 15th, and 25th of each month. When convenient, extra Sea Observations might be taken for other and greater depths, noting always the Temperature of the Air, and the Hour of Observation. It is also very desirable that observations on the daily Maxima and Minima by Thermometers continuously immersed, be instituted at points along the coast, by the method proposed by Mr. T. Stevenson, and already commenced at Peterhead and Liverpool.

Temperature of Wells.

The Temperature of the water at the bottom of Wells ought, when practicable, to be taken, both the depth of the Well and of the water being noted.

Ozone.

Mention what Test-Papers are used, Schönbein's or Moffat's, etc. The Paper is affixed by a pin to a board in the Thermometer Box, and the indications registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus $3^{S.W.}_{2}$, as an Ozone entry in the schedule will indicate that the Ozone paper is tinted as 3 on the scale, that the wind is from the N.W., and that its force on the scale 0—5 is 4, or blowing fresh.

Atmospheric Electricity.

Too much importance cannot be attached to the electric condition of the atmosphere in connection with terrestrial magnetism, barometrical, thermometrical, and meteorological phenomena generally. A proper Electrometer is, in truth, necessary to every complete meteorological observatory.

Remarks.

The Remarks column is unavoidably too narrow. Some of the most valuable Observations that can be taken are those for which no rules can be given nor hours assigned. The use of contractions ought, therefore, to be taken every advantage of, and a list of such as are in general use is given at the foot of the column. Besides special and extraordinary Observations, great prominence ought to be given in this column to Prevalent Diseases, differences in character, colour, velocity, and direction between the Lower and Upper Strata of clouds, the Colour of the Sky, etc. Remarks ought to be made on the occurrence of Meteors, Aurora Boreales, remarkable depressions, elevations, and fluctuations of the Barometer, Thunder-Storms, and remarkable falls of Snow, Hail, or Rain, the Hour of Storms of Wind commencing, attaining their maximum, and ending, as well as such Notes on Storms as have been hinted at above. When lofty hills are in the vicinity of a Station, the Height of Clouds and of the Snow-line in winter should be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. should be registered, either in two columns, otherwise unoccupied, or ruled off for the purpose, from the column of 'Remarks.'

Observations in connection with the Periodic Return of the Seasons.

Observations in connection with the Periodic Return of the Seasons possess not only great scientific value, but are of considerable importance in connection with Agriculture, Horticulture, and Natural History. The Council would direct the special attention of Observers to the registration of such phenomena, so that the published Summaries may fairly represent the whole of Scotland. Observations ought to be confined to individual trees and shrubs; to particular species of birds, and, in the case of crops, to specified sorts reared from year to year on a selected piece of ground or farm. The Annual Table, published yearly in the Society's Journal, will indicate the species of plants and animals to which special attention is more particularly directed.

The Council recommend Observers, before purchasing new instruments, and in repairing old ones, to communicate with the Meteorological Secretary, in order that every instrument may be examined and improved before being used; and they consider it necessary that he should have full power to reject any instrument which, on being presented for comparison, does not afford him satisfaction.

(By Order) A. B.

EDINBURGH, *December* 1888.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	Leaf Buds first Appear.	In Leaf.	Divested of Leaves.
Alder,				
Ash,				
Beech,				
Birch,				
Elm,				
Larch,				
Lime,				
Oak,				
Sycamore or Plane,				

SHRUBS, ETC.	First in Blossom.
Barberry,	
Bourtree or Elder,	
Broom,	
Hazel,	
Hawthorn,	
Holly,	
Laburnum,	
Lilac,	
Mezereon,	
Mountain Ash or Rowan,	
Red Flowering Currant,	
Rhododendron Ponticum,	
Whin,	

FRUITS.	First in Blossom.	Fruit Ripe generally.
Apple,		
Black Currant,		
Cherry,		
Gean,		
Gooseberry,		
Peach,		
Pear,		
Plum,		
Strawberry,		

CROPS, mentioning variety.	Sowing or Planting.	Appearing above Ground.	In Ear or Flower.	First Cut or Raised.
Barley,				
Bere or Bigg,				
Oats,				
Wheat,				
Beans,				
Pease,				
Potatoes,				
Turnips,				
Rye Grass,				

MIGATORY BIRDS.	First Arrival.	Departure.
Cuckoo,		
Curlew,		
House-Swallow,		
Lapwing,		
Plover,		
Sand-Martin,		
Starling,		
Swan,		
Rail or Corn Crake,		

Have the goodness also to state any information you may be able to collect relative to the Crops of Grain, Hay, Potatoes, Turnips, Fruits, etc., whether plentiful, or in perfection; whether any have suffered from blight, disease, etc. Whether Epizootic disease prevails among cattle; and the Agricultural condition of the district generally.

Aberdeen Aug 1892

To the SECRETARY
Scottish Meteorological Society,
122 George Street,
EDINBURGH.

BOOK POST.

17 P EDINBURGH SP 2 93

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Gordon's College, Abdn, County of Aberdeen, in Lat. 57°9'N, Long. 2°6'W, Distance from Sea 1 miles.

Height of Cistern of the Barometer above Mean Sea-Level 66 feet, above Ground 2½ feet. During the MONTH of September 188 .

The Hours of Observation are of Greenwich Time.

Days of Month	BAROMETER. 9 h. A.M. Barometer. * No.	Attached Thermometer	9 h. P.M. Barometer. No.	Attached Thermometer	SELF-REGISTERING THERMOMETERS, Read Daily, at 9 P.M. Protected in Shade, 4 feet above Ground. Max. No.	Min. No.	Exposed Black Bulbs. Max. in Sun's rays No.	Min. on Grass No.	HYGROMETER. Dry No. Wet No. 9 h. A.M. Dry bulb.	Wet bulb.	9 h. P.M. Dry bulb.	Wet bulb.	Rain. No. of hours in which it fell.	Amount in inches. No.	WIND. 9 h. A.M. Direction.	Force	9 h. P.M. Direction.	Force	Readings of the H. Cup Anemometer. No. 9 h. A.M.	CLOUDS. 9 A.M. Velocity (0—6) and Direction.	Amount (0—10), and Species.	P.M. Velocity (0—6) and Direction.	Amount (0—10), and Species.	SUNSHINE. Hours.	THERMOMETERS under Ground. 9 h. A.M. No. 3 inches.	No. 12 inches.	No. 22 inches.	Temperature of WELL at depth of feet. No.	SEA. Temperature at 1 fathom, and Density.	OZONE. 0—10. 9 A.M.	9 P.M.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc. *Mention the hour at which Storms, including Thunder and Lightning, began and ended.*	Days of Month
	inches.	°	inches.	°	°	°	°	°	°	°	°	°														°	°	°	°	°				
1	29·472	56·5	29·404	58·0	61·0	47·1			50·8	51·5	52·8	50·1		·10	N.W.	1	W	1		10	St	4	St	2										1
2	29·302	55·0	29·282	55·0	60·1	41·4			52·6	46·1	47·2	45·1		·12	W	½	W	1		6	Ci-Cu	1	St	4										2
3	29·344	54·0	29·732	52·0	53·4	42·1			49·8	45·2	49·9	47·0		·24	W	½	N.W.	2		10	Nim	5	Ci-Cu	3										3
4	30·082	53·0	30·184	53·0	53·1	42·1			48·1	44·1	44·0	41·3		—	N.W.	1	N.W.	½		10	Cu-St	10	St	—										4
5	30·148	54·0	30·050	57·0	53·8	41·0			49·1	45·2	47·2	45·6		·35	N.W.	½	W	1		7	Ci-Cu	10	St	4										5
6	30·082	54·0	30·040	57·0	65·0	51·9			58·1	53·3	52·8	50·8		·02	W	½	S.W.	½		9	Cu	4	Ci-St	9										6
7	29·844	56·5	29·932	55·0	58·0	46·1			53·3	52·7	46·8	45·3		·19	S.W.	½	N.W.	—		9	Ci-Cu	10	St	3										7
8	30·008	55·0	29·966	55·0	60·1	47·0			51·8	47·0	48·0	47·0		—	N.W.	½	N.W.	½		—	—	—	—	11										8
9	29·840	56·0	29·772	57·0	60·1	38·6			51·0	48·0	51·5	50·4		—	W	½	W	½		—	—	6	Ci-Cu	6										9
10	29·880	59·0	29·890	58·0	59·9	40·0			58·5	50·2	49·5	47·0		—	W	½	W	1		8	Cu	1	St	7										10
11	29·804	57·0	29·770	58·5	60·9	44·0			51·3	48·5	50·8	48·0		—	S.W.	1	S.W.	—		5	Cu	8	St	7										11
12	29·810	57·0	29·630	57·0	56·0	46·2			52·4	51·6	53·6	53·0		·19	S.W.	1	S	—		10	St	10	Nim	—										12
13	29·420	59·0	29·812	55·0	60·0	45·6			59·1	57·2	45·6	44·0		·20	S	1	N.W.	½		6	Ci-Cu	—	—	4										13
14	29·844	54·0	29·720	57·0	57·6	39·2			51·5	48·0	53·8	51·0		·01	N.W.	1	N.W.	2		2	Cir	3	Cir	5										14
15	29·752	56·5	29·620	58·0	55·2	52·1			54·0	51·1	54·2	52·0		·01	N.W.	½	W.	1½		10	Cu-St	—	—	—										15
16	29·332	56·0	29·422	57·8	57·2	50·2			53·1	51·1	52·4	49·6		·02	S	1½	S.	½		10	Cu-St	10	St	3										16
17	29·760	56·0	29·880	56·5	55·8	41·8			52·1	45·0	51·4	47·8		·04	S.	1	S.W.	2		6	Ci-Cu	10	Cu-St	6										17
18	29·670	56·0	29·590	57·0	59·8	50·3			51·6	49·8	52·4	51·0		—	W	2½	W	1		10	Cu-St	10	St	—										18
19	29·570	58·0	29·946	56·5	61·0	45·1			55·0	51·2	45·4	42·0		·02	S.W.	½	W.	1		3	Cu	2	Cu	5										19
20	30·136	52·0	30·232	54·0	54·1	42·3			46·7	43·5	46·7	42·8		—	N.W.	½	N.W.	½		1	St	1	St	8										20
21	30·286	50·0	30·338	51·0	52·6	34·8			40·2	38·4	39·2	38·3		—	W.	½	N.W.	—		1	St	1	St	10										21
22	30·344	50·0	30·272	52·0	53·1	33·6			41·3	40·0	45·6	43·1		—	N.W.	½	N.W.	½		6	Ci-Cu	4	Cu	9										22
23	30·060	55·0	29·858	55·9	54·7	36·1			50·8	49·1	52·5	53·1		·05	S.W.	½	S.W.	1		~~10th~~ 10	St	10	St	2										23
24	29·572	58·0	29·470	58·0	57·2	47·0			53·1	44·5	50·2	47·0		·01	W.	1½	W.	2		5	Ci-Cu	1	St	9										24
25	29·370	56·0	29·670	55·0	61·0	47·3			54·1	50·1	48·1	43·2		—	S.W.	1½	S.W.	1		5	Ci-Cu	1	St	7										25
26	29·672	55·0	29·396	56·0	55·2	47·0			53·0	49·8	51·1	52·4		·06	S.	1	S.	2		10	St	5	Ci-Cu	—										26
27	29·144	57·0	29·164	55·0	55·3	46·8			55·9	55·0	47·1	44·0		·01	S.	1½	S.W.	2		10	Cu-St	1	St	4										27
28	29·404	51·0	29·380	50·0	53·4	42·0			47·0	41·8	42·8	40·2		—	N.W.	1½	N.W.	2		4	Ci-St	—	—	9										28
29	29·230	51·0	29·248	50·0	54·3	40·1			47·7	45·0	41·8	40·8		—	S.W.	1	S.W.	1		10	Cu-St	10	St	—										29
30	29·284	50·0	29·340	52·0	54·0	34·5			41·1	39·8	45·0	43·5		·31	S.W.	½	S	½		1	St	10	Nim	5									Thunder, lightning, heavy rain 8 to 11 P.M.	30
31																																				31
Sums.	13 67	15 1	15 15 7	15 3	18 8	12 4			12 9	14 8	14 13	11 7																								
	21·666	16·525	21·850	16·592	17·129	13·024			15·335	14·338	14·614	13·967		1·95		26½		29		194		148		145										
Means.	29·472	55·1	29·728	55·3	57·1	43·4			51·1	47·8	48·7	46·5				0·9		1·0		6·5		4·9												
† Total Corrections for Instrumental Errors.	+006	−7	+006	−7												66		66				5·7												
‡ Corrections for Diurnal Range.																																				
"Corrected Means."	29·728	54·4	29·734	54·6																																
No. of Column.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30						

NOTATION USED IN GENERAL REMARKS.

a.	*denotes* aurora.		m.	*denotes* meteor.	
ci.	,,	cirrus.	ms.	,,	meteors.
ci.-cu.	,,	cirro-cumulus.	n.	,,	nimbus.
ci.-s.	,,	cirro-stratus.	r.	,,	rain.
cu.	,,	cumulus.	h. r.	,,	heavy rain.
cu.-s.	,,	cumulo-stratus.	c. h. r.	,,	continued heavy rain.
d.	,,	dew.	s.	,,	stratus.
f.	,,	fog.	sc.	,,	scud.
fr.	,,	frost.	s.	,,	sleet.
h.-fr.	,,	hoar-frost.	s.	,,	snow.
h.	,,	haze.	so. ha.	,,	solar halo.
h. d.	,,	heavy dew.	sq.	,,	squall.
hl.	,,	hail.	sqs.	,,	squalls.
l.	,,	lightning.	t.	,,	thunder.
li. cl.	,,	light clouds.	t. s.	,,	thunder-storm.
li. sh.	,,	light showers.	w.	,,	wind.
lu. co.	,,	lunar corona.	g.	,,	gale of wind.
lu. ha.	,,	lunar halo.			

TABLE FOR ESTIMATING FORCE OF WIND.

Estimated Force, 0—6.	Common Designation.	Estimated Force, 0—6.	Common Designation.	Estimated Force, 0—6.	Common Designation.
0	Calm	1·5	Light breeze	4	Blowing hard
0·5	Very light air	2·	Fresh breeze	5	Blowing a gale
1·	Light air	3·	Very fresh	6	Violent gale

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction †† for Temp. (Col. 2), = 29·728 − ·069 = 29·659

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction †† for Temp. (Col. 4), = 29·734 − ·070 = 29·664

Mean at Station, corrected, and at 32°, = 29·662

Correction for height, 66 feet above Mean Sea-level, = ·074

Mean, reduced to 32°, and Sea-level, = 29·736

Highest Reading, corrected for Index error, on the 22 th, = 30·350

Lowest Do. Do., on the 27 th, = 29·150

Difference, or **Monthly Range**, = 1·200

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month**, (corrected for Index Errors), on the 6 th, = 65·0

Lowest in Month, corrected for Index errors, on the 22 ~~nd~~ th, = 33·0

Difference, or **Monthly Range**, = 32·0

"Corrected **Mean**" of all the Highest, (Col. 5), = 57·1

"Corrected **Mean**" of all the Lowest, (Col. 6), = 43·4

Difference, or **Mean Daily Range**, = 13·7

** Calculated **Mean Temperature** of Month, = 50·2

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the th, =

"Corrected **Mean**," (Col. 7), **of Black Bulb, Max. in Sun**, =

Lowest at Night, Black Bulb (corrected for Index errors), on the th, =

"Corrected **Mean**," (Col. 8), **of Black Bulb, Min.** on grass, =

Difference of above means or range ("exposed"), =

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb**, (Cols. 9 and 11), = 49·9

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb**, (Cols. 10 and 12), = 47·1

‡‡ Computed **Temperature of Dew-Point**, = 44·1

‡‡ Do. **Elastic Force of Vapour**, = ·290

‡‡ Do. **Weight of Vapour in a Cubic Foot of Air**, = 3·34

‡‡ **Relative Humidity** (Saturation = 100), = 81

RAIN fell on 18 **Days; Amount in Inches**, = 1·95

WIND. Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
SUMMARY.											
A.M.	0	0	0	0	5	8	8	9	0	0·4	
P.M.	0	0	0	0	4	7	9	10	0	1·0	
Mean.	0	0	0	0	5	7	9	9	0	0·45 = 0·90	

* Each instrument tested at the Office in Edinburgh bears the stamp "S.M.S.;" and a number to be entered in the Heading: or the Number and Initials of the Maker may be here given.
† Embracing corrections for both capillarity and Index Errors.
‡ The Diurnal Range for Scotland is as yet unknown.
†† *Practically*, though not *absolutely* a minus correction.
‡‡ These "Hygrometrical Deductions" are calculated from Glaisher's Hygrometrical Tables, Second Edition *only*.
** While the Diurnal Range is unknown, the Arithmetical Mean of Cols. 5 and 6 will be entered as the "Calculated Mean Temperature."
Any observations not taken under the Conditions specified in the Directions on the other side, or noted at the Top of each column, must be marked as such by the observer, in each Schedule. *See over.*

Observations made and Return verified by James Dale, Teacher in Robert Gordon's College, Aberdeen

(*Signed*)

Greatest Daily Range = 21·5 on the 9th

W.D.

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

ONE of the chief objects that the SCOTTISH METEOROLOGICAL SOCIETY proposed to itself when the Society was established in 1855, was to secure PERFECT UNIFORMITY in the system of observation pursued at all its Stations. Uniformity in the observations is absolutely necessary to justify the publication of Monthly Results from different observations, it being found that differences between the Returns from two Stations, so very considerable as to render them quite incomparable, may arise from dissimilarity in the position or shelter of instruments, different hours of observation, or even from the use of differently constructed instruments. It is therefore hoped, that those who kindly furnish Reports to the Society will, by a scrupulous attention to the following Directions, secure for their Monthly Returns an accuracy and value commensurate with the labour and pains involved in making them; and, for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

The Council recommend that Observations be made precisely at 9 A.M. and 9 P.M. (Greenwich or Railway Time only), as specified in the following remarks, or at the top of the columns of the Schedule. It is hoped that the utmost punctuality in the time of reading the instruments will be observed. Observers, in some few cases, may find this impossible; in such instances, they are specially requested to mark opposite every reading the time at which it was taken, if not at 9 A.M. or 9 P.M.

Hour of Observation.

Weather-Glasses and Aneroids, though well suited to indicate roughly variations of atmospheric pressure, are not fitted for scientific purposes. No Barometer should be used for Meteorological Observation that is not supplied with some means of adjustment or compensation which will secure that the height of the mercury in the tube is accurately measured from the fluctuating surface of the mercury in the cistern.

Barometer.

The Barometer in which the error arising from the fluctuating surface of the mercury in the cistern is entirely got rid of is FORTIN'S Barometer, the arrangement consisting in applying pressure by means of a screw to the bottom of the cistern, which is made of flexible leather, thus raising or depressing the surface till it just meets the ivory point which forms the zero point of the fixed scale.

The Barometer originally constructed by Mr. Adie of London, and usually called the Board of Trade Barometer, has the great convenience of requiring no adjustment of the cistern. Its scale-inches are not true inches, but so much shorter as to compensate the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This is an excellent Barometer for ordinary Observers, inasmuch as it entirely eliminates the error of observation likely to arise in not a few cases in setting the instrument to the zero point of the fixed scale when the light is not good. To show the accuracy with which these Barometers are made, it may be stated, that one was compared, during a whole year, with the Society's Standard Barometer, particular care being given to make the comparison when atmospheric pressure was rising or falling very rapidly, with the result that none of the readings differed from those of the Standard more than 0·003 inch.

A modification of Fortin's Barometer is used at a number of the Society's Stations, by which the coincidence of the zero point with the surface of the mercury is indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When the index-line on this little piston-rod is brought, by the adjusting screw, to form one straight line with those on its ivory frame, the surface of the mercury is then at the exact height from which the scale is graduated. In taking an observation, this preliminary setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the vernier.

It is absolutely necessary that the Barometer which is to be used shall have been compared with a Standard Barometer.

The Barometer should be suspended in as good a light as can be secured, and to facilitate the reading, a piece of white paper may be put behind the tube. It must be hung truly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire, and must not be hung against a wall heated by a flue. The object being to secure that the whole instrument, including the brass fittings, the contained mercury, and the attached Thermometer, shall be, when read, at one uniform temperature, it is evident that the best position is that which is least liable to sudden changes of temperature.

In taking an Observation, the Attached Thermometer is first noted: the tube must then be gently tapped, and the cistern-adjustment carefully made. The eye, by raising and lowering it, must be brought into the plane of the back and front of the index—usually the lower edge of the vernier, which must be carefully adjusted so as to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly, so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will facilitate an accurate adjustment and reading of the Barometer. A mistake not unfrequently made by those beginning to observe, consisting in setting the edge of the vernier to the level of the clear surface of the mercury which is in direct contact with the glass tube, must be carefully avoided.

The errors most frequently made in reading the Barometer are errors of 1·000 inch, 0·500 inch, and 0·050 inch; that is to say, instead of 29·365 inches, either of the following is sometimes set down—viz. as 30·365 inches, 28·365 inches, 29·865 inches, or 29·815 inches. Experience having shown that even the very best Observers make these mistakes, particular attention is directed to the matter.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must first be screwed so as to form a tight plug to the cistern, thus preventing the escape of the mercury. Then screw up the mercury not quite to the top of the tube, but to within a quarter of an inch of it, and take down the instrument; it should then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case if, on inclining the instrument, a sharp tap is produced when the mercury strikes the top of the tube. If a dull tap is heard, there is air in the tube, which must be got rid of.

As Barometers are liable to be deranged by the introduction of air into their tubes, on removal from place to place, or in being roughly handled, it may be useful to Observers to know how the air may be expelled. First close up the cistern by screwing the ivory peg tight, so as to prevent the escape of mercury; then screw up the mercury to about half an inch from the top of the tube; and having slowly inverted the instrument, place the top of it on a yielding substance, such as the boot, and gently tap on the cistern with the palm of the hand, so as to induce the air to ascend through the column to the cistern, whence it may escape. Since there is the weight of two atmospheres—the pressure of the mercury in the Barometer, and the air outside—pressing on any air that may be inside the tube, it is usually a tedious operation to get it wholly expelled. After repeated trials, however, it is generally accomplished; and the clear metallic sound of the mercury, when gently struck against the top of the glass tu[illegible] when the whole of the air has been expelled. On ha[illegible]rometer, care must be taken to screw down the me[illegible] be before unfastening the float of the cistern, for, if [illegible]ended to, the mercury will flow out, and the instrun[illegible]y damaged.

The Council of the Society recommend that the Self-Registering Thermometers, and the Dry and Wet Bulb Hygrometer, be kept in Stevenson's Louvre-boarded Box for Thermometers, painted white inside and outside, and screwed to four stout posts, also painted white, firmly fixed in the ground. The posts must be of such a length that when the Thermometers are hung in position the Bulbs of the Minimum Thermometer, and of the Dry and Wet Bulb Thermometers, will be exactly at the same height of FOUR FEET above the ground, the Maximum Thermometer being hung immediately above the Minimum Thermometer. The Thermometer Box is to be placed over a plot of grass, and in a free open space to which the sun's rays have free access during as much of the day as surrounding conditions enable the Observer to secure. The Thermometers are suspended on cross-laths in the centre of the Box, and face the door, which should open to the north.

Protection and Position of Thermometers.

The Council regard the question of UNIFORMITY OF HEIGHT ABOVE GROUND, AND METHOD IN PROTECTING THE THERMOMETERS, as vital in every system of Meteorological Observation, since without it Observations made at different Stations are incomparable, thus rendering it impossible to compare the Climates of places with each other as regards their most important features.

Professor Phillips, and Negretti and Zambra's Maximum Thermometers, and Rutherford's Minimum Thermometer, are recommended. It is recommended that these Thermometers be graduated on the glass stem. The Minimum Thermometer is liable to two derangements—viz., the column of spirit breaking, and part of the spirit distilling by high temperature and lodging at the top of the tube. This derangement is of occasional occurrence with protected Thermometers, but of frequent occurrence with exposed Thermometers. Hence a systematic examination of Minimum Thermometers ought to be a regular part of the work carried on by each Observer.

Self-Registering Thermometers.

Fortunately, Spirit Thermometers may be easily set right by any one, when the column of spirit chances to separate. Let the Thermometer be taken in the hand by the end farthest from the bulb, raised above the head, and then forcibly swung down towards the feet; the object being, on the principle of centrifugal force, to send down the detached portion of spirit till it unites with the column. A few throws, or swinging strokes, will generally be sufficient for the purpose; after which the Thermometer should be placed in a slanting position, to allow the rest of the spirit still adhering to the sides of the tube to drain down to the column. But another method must be adopted, if the portion of spirit in the top of the tube be small. Heat should be applied slowly and cautiously to the top end of the tube where the detached portion of spirit is, which, being turned into vapour by the heat, will condense on the surface of the unbroken column of spirit. Care must be taken that the heat is not applied too quickly; for, if this be done, the tube will break and the instrument be destroyed. The best way to apply the requisite amount of heat is by bringing the end of the tube slowly down towards a minute flame from a gas-burner; or, if gas be not at hand, a piece of heated metal will serve instead.

The bulbs of the Thermometers for registering the greatest heat from the sun's rays, and the least from radiation during night, have a black coating, which may easily be made, or mended, by the application of a mixture of lampblack and printer's ink. They are placed in shallow blackened boxes, whose sides protect the bulbs from the wind The Maximum should be freely exposed to the sun, and the Mini mum should rest on wooden supports a few inches from the surface of the grass, in an open situation. Snow must not be allowed to cover either of these Thermometers; nor the sun's heat to affect the Minimum Thermometer by distillation. Black-bulbs enclosed in 'glass jackets' may also be used, being indeed preferable to the above. It must, however, be added, that the whole subject of the observation of Solar and Terrestrial Radiation is not yet in a sufficiently advanced state to warrant the exclusive recommendation of any one of these methods.

Black-Bulb Thermometers.

The Hygrometer in use at the Society's Stations consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved form of this apparatus seriously vitiate the Hygrometrical Observations, Observers are specially requested to attend to the following conditions:—The bulbs must hang down by at least an inch free from the scales and frame to which they are attached; the frame must be such as will bring the tubes forward by an inch from any board on which it may be suspended; the water-cup must be covered, and altogether placed to the side, and a little below the level of the wet bulb, but in no case under the bulbs; the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the Observer that the muslin is always clean and moist, and the water pure. In frosty weather, observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

Dry and Wet Bulb Hygrometer.

In reading the Thermometer great care must be taken to bring the eye exactly opposite the tip of the index or column of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°·9, 40°·0, or 40°·1; or again, 40°·4, 40°·5, 40°·6, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40½°, respectively. So also 40½°, and 40¾°, more or less, must be registered 40°·2, or 40°·3, and 40°·7, or 40°·8 respectively. In reading Rutherford's Minimum Thermometer, the indication of that end of the index which is next the surface of the spirit is alone noted. On opening the Thermometer Box, the Dry and Wet Bulb Thermometers are to be first, and rapidly, read, inasmuch as they are readily affected by heat from the person of the Observer.

Reading of the Thermometer.

The Hygrometer is read at 9 A.M. and 9 P.M. The Self-Registering Thermometers are read at 9 P.M. only, as indicating the greatest and least degrees of temperature in the 24 hours preceding. It is not a matter of indifference when the Self-Registering Thermometers are read, since, in winter at least, the extremes may occur at any hour; and it is necessary to refer their occurrence to their proper meteorological day. In the Society's schedules, the indications registered on the 3d are those of a series of phenomena commencing at 9 P.M. on the 2d, and extending till 9 P.M. on the 3d.

Hour of observing Temperature.

No instrument ought to be used for Meteorological purposes till it has been carefully tested by comparison with a standard Thermometer. When such Thermometers as are not graduated on the stem, but merely on an attached scale, undergo repairs, they are very liable to be moved from their position on the Scale, and ought never afterwards to be used without being re-tested. The Self-Registering, especially the Minimum Thermometers, ought frequently to be compared with the dry bulb of the Hygrometer. The freezing-point of each Thermometer, marked by a scratch on the tube, ought to be tested once a year, in snow or melting ice.

Verification of Thermometers.

In selecting instruments, the following points require attention:—The divisions of the vernier of Barometers in reference to their scales, and the perfect freedom of the Barometer from air; the correct numbering of the scale of every instrument; the rejection of Thermometers the frameworks of which are not likely to stand exposure to the weather, as shown in the past by repeated and annoying breakages of Thermometers of similar construction; and as regards Maximum Thermometers, either Negretti and Zambra's, or Phillip's, whether they will act at the highest temperatures they may be required to register. By the laws of the Society, Members and Observers have a right to have their instruments compared by the Secretary, and to advise with him regarding the purchase of instruments.

Very great care should be bestowed on the Observations of the Wind, the accuracy of which, both as regards Direction and Force, is so essential towards the right discussion of many of the more important problems of the science.

Wind.

A Wind-Vane ought to be elevated at least 12 feet above surrounding objects. When it oscillates incessantly, the mean direction should be taken. In all cases, but especially when the Vane is stationary, and when the wind is feeble, reference may be made to the direction of smoke, etc., in well-exposed situations. Careful observations are recommended to be made on the changes in the direction of the wind; and during storms, extra observations at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, is likely to give highly valuable and important results, particularly in connection with the system of thickly-planted Stations over a limited district round Edinburgh called STORM STATIONS, in the course of being established by the Society for the systematic investigation of the relation of the force of the wind to BAROMETRIC GRADIENTS, and other points connected with storms.

1. As regards Direction.

The Council would recommend the Hemispherical Cup Anemometer,—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the mean Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind at any particular hour of observation, the Pressure Anemometers recently brought under the notice of the Society by Mr. T. Stevenson, the Honorary Secretary, and Mr. R. Ballingall, the Society's Observer at Eallabus, are recommended as likely to secure uniformity in making observations on the Force of the Wind.

2. As regards Velocity and Pressure.

Many causes conspire to produce anomalies in Rain Returns, arising partly from the difficulty of obtaining a perfectly unobjectionable situation for observation, and partly from the defective nature of the instruments used. The Rain Gauge should not be placed on a slope or terrace, but on a level piece of ground, in as open a situation as the Observer can secure for it. As it is often difficult to obtain a position as free and unobstructed by surrounding objects as is desirable, care should be taken to place it at some distance from shrubs, trees, buildings, or other obstructions, at least as many feet from their base as they are in height. The more important directions, towards which it is most desirable to have a free exposure, are, in the order of their importance, S.W., N.E., S.E., S., and W. The rim of the gauge must be perfectly level, and fixed so that it will remain level in all weathers, and be at a height of one foot above ground, over grass. In such gauges as Fleming's, which are furnished with a measuring-rod attached to a float, the rod ought to be fixed down, and the float rise to its height only at the time the instrument is read, it being found that a stem projecting above the rim of the gauge seriously interferes with the proper measurement of the Rainfall. When a measuring-glass is used, care should be taken to hold it quite perpendicular. The Rain Gauge ought to be read daily at 9 A.M., and the reading entered in the Returns of the previous day. If the Gauge is read once a month, the reading is to be made on the first of the month, and the amount entered for the previous month.

Rain Gauges.

Snow-falls may, for convenience, be registered in the rain columns, under the following conditions:—When a Snow shower occurs, it should be noted in the 'Remarks,' and the letter S affixed to the depth of water received in Gauge. The depth of the snow must be measured in some open place where no drift is observed, and registered in addition to, and as a check upon, the indications of the Rain Gauge. For wind, rain, and snow, as indeed in every column, the Observer cannot be too careful to register observations only; and nothing that partakes of the nature of deduction or inference.

Snow-falls.

Convenient abbreviations for the nomenclature of Clouds will be found on the other side. The amount of Cloud ought to be estimated from the greater or less obscuration of the sky overhead (*i.e.* within 20° or 30° of the zenith). The strata of Clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the Clouds' column, though their appearance and changes may be noted among the Remarks. The amount of Cloud is entered from a scale of 0 to 10; thus, when the sky overhead is free from Clouds it is entered 0, when half-covered by Clouds, 5, wholly covered, 10, and so on.

Clouds.

Observations of the Clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—Thus, in the column Velocity and Direction, 6, S. W.

———— will indicate that the upper strata of Clouds travel with
2, W.

extreme velocity from S.W., and those in the lower regions from W., with one-third the speed of the former. Again, in the second

Cloud column, an entry of $\frac{4,\ st.}{2,\ cu\text{-}st.}$ will indicate that the higher regions are covered to the amount of 4-tenths with stratus Clouds; and that the sky is further obscured to the extent of 2-tenths by lower Clouds of the cumulo stratus kind.

Remarks on peculiar Clouds, accompanied with drawings, will assist materially in the development of a more exact nomenclature of Clouds, as well as throw light on the electrical, and other of the more obscure phenomena of Meteorology.

The approximate number of Hours in which objects in the sun's rays cast shadows, should be entered in the proper column.

Sunshine.

As the germination and growth of crops and plants generally depend greatly on the temperature of the soil,—its amount and constancy,—the Council recommend that Observations in this interesting department be made at 9 A.M., by Thermometers permanently fixed in the soil, their bulbs being sunk to depths of 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain-water being conveyed to the bulbs by the stems or wooden frames.

Underground Thermometers.

A knowledge of the Temperature of the Sea is not only in itself, but in its relations to that of our island, a most important branch of Meteorology. The Council therefore recommend that the Temperature of the Sea be carefully taken by a properly constructed apparatus, from boats, or, if this be impracticable, from the ends of piers and rocks round the coast, where it is not influenced by that of river water, and as little influenced as possible by currents sweeping along the coast, and thus acquiring the temperature of the land, either greatly heated by the sun or cooled by nocturnal radiation. At or near the time of high water, in cases where the observations cannot be taken daily, the observation may be made on the 5th, 15th, and 25th of each month. When convenient, extra Sea Observations might be taken for other and greater depths, noting always the Temperature of the Air, and the Hour of Observation. It is also very desirable that observations on the daily Maxima and Minima by Thermometers continuously immersed, be instituted at points along the coast, by the method proposed by Mr. T. Stevenson, and already commenced at Peterhead and Liverpool.

Temperature of the Sea.

The Temperature of the water at the bottom of Wells ought, when practicable, to be taken, both the depth of the Well and of the water being noted.

Temperature of Wells.

Mention what Test-Papers are used, Schönbein's, Lewis's, etc.

The Paper is affixed by a pin to a board in the Thermometer Box, and the indications registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus $3^{N.W.}_{4}$, as an Ozone entry in the schedule will indicate that the Ozone paper is tinted as 3 on the scale, that the wind is from the N.W., and that its force on the scale 0—5 is 4, or blowing fresh.

Ozone.

Too much importance cannot be attached to the electric condition of the atmosphere in connection with terrestrial magnetism, barometrical, thermometrical, and meteorological phenomena generally. A proper Electrometer is, in truth, necessary to every complete meteorological observatory.

Atmospheric Electricity.

The Remarks column is unavoidably too narrow. Some of the most valuable Observations that can be taken are those for which no rules can be given nor hours assigned. The use of contractions ought, therefore, to be taken every advantage of, and a list of such as are in general use is given at the foot of the column. Besides special and extraordinary Observations, great prominence ought to be given in this column to Prevalent Diseases, differences in character, colour, velocity, and direction between the Lower and Upper Strata of clouds, the Colour of the Sky, etc. Remarks ought to be made on the occurrence of Meteors, Auroræ Boreales, remarkable depressions, elevations, and fluctuations of the Barometer, Thunder-Storms, and remarkable falls of Snow, Hail, or Rain, the Hour of Storms of Wind commencing, attaining their maximum, and ending, as well as such Notes on Storms as have been hinted at above. When lofty hills are in the vicinity of a Station, the Height of Clouds and of the Snow-line in winter should be recorded.

Remarks.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. should be registered, either in two columns, otherwise unoccupied, or ruled off for the purpose, from the column of 'Remarks.'

Observations in connection with the Periodic Return of the Seasons, possess not only great scientific value, but are of considerable importance in connection with Agriculture, Horticulture, and Natural History. The Council would direct the special attention of Observers to the registration of such phenomena, so that the published Summaries may fairly represent the whole of Scotland. Observations ought to be confined to individual trees and shrubs; to particular species of birds, and, in the case of crops, to specified sorts reared from year to year on a selected piece of ground or farm. The Annual Table, published yearly in the Society's Journal, will indicate the species of plants and animals to which special attention is more particularly directed.

Observations in connection with the Periodic Return of the Seasons.

The Council recommend Observers, before purchasing new instruments, and in replacing old ones, to communicate with the Meteorological Secretary, in order that every instrument may be examined and improved before being used; and they consider it necessary that he should have full power to reject any instrument which, on being presented for comparison, does not afford him satisfaction.

(By Order) A. B.

EDINBURGH, *December* 1888.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	Leaf Buds first Appear.	In Leaf.	Divested of Leaves.
Alder,				
Ash,				
Beech,				
Birch,				
Elm,				
Larch,				
Lime,				
Oak,				
Sycamore or Plane,				

SHRUBS, ETC.	First in Blossom.
Barberry,	
Bourtree or Elder,	
Broom,	
Hazel,	
Hawthorn,	
Holly,	
Laburnum,	
Lilac,	
Mezereon,	
Mountain Ash or Rowan,	
Red Flowering Currant,	
Rhododendron Ponticum,	
Whin,	

FRUITS.	First in Blossom.	Fruit Ripe generally.
Apple,		
Black Currant,		
Cherry,		
Gean,		
Gooseberry,		
Peach,		
Pear,		
Plum,		
Strawberry,		

CROPS, mentioning variety.	Sowing or Planting.	Appearing above Ground.	In Ear or Flower.	First Cut or Raised.
Barley,				
Bere or Bigg,				
Oats,				
Wheat,				
Beans,				
Pease,				
Potatoes,				
Turnips,				
Rye Grass,				

MIGRATORY BIRDS.	First Arrival.	Departure.
Cuckoo,		
Curlew,		
House-Swallow,		
Lapwing,		
Plover,		
Sand-Martin,		
Starling,		
Swan,		
Rail or Corn Crake,		

Have the goodness also to state any information you may be able to collect relative to the Crops of Grain, Hay, Potatoes, Turnips, Fruits, etc., whether plentiful, or in perfection; whether any have suffered from blight, disease, etc. Whether Epizootic disease prevails among cattle; and the Agricultural condition of the district generally.

Aberdeen Sept 1892

To the SECRETARY
Scottish Meteorological Society,
122 George Street.
EDINBURGH.

BOOK POST.

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Gordon's College, Abdn County of Aberdeen, in Lat. 57°9' N, Long. 2°6' W, Distance from Sea 1 miles.

Height of Cistern of the Barometer above Mean Sea-Level 66 feet, above Ground 2½ feet. During the MONTH of October 1892.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER. 9 h. A.M. * No.	Attached Thermometer	9 h. P.M. Barometer. No.	Attached Thermometer	SELF-REGISTERING THERMOMETERS, Read Daily, at 9 P.M. Protected in Shade, 4 feet above Ground. Max. No.	Min. No.	Exposed Black Bulbs. Max. in Sun's rays No.	Min. on Grass No.	HYGROMETER. Dry No.___ Wet No.___ 9 h. A.M. Dry bulb.	Wet bulb.	9 h. P.M. Dry bulb.	Wet bulb.	Rain. No. of hours in which it fell.	Amount in inches. No.	WIND. 9 h. A.M. Direction.	Force	9 h. P.M. Direction.	Force	Readings of the H. Cup Anemometer. No.___ 9 h. A.M.	CLOUDS. 9 A.M. Velocity (0—6) and Direction.	Amount (0—10), and Species.	P.M. Velocity (0—6) and Direction.	Amount (0—10), and Species.	SUNSHINE. Hours.	THERMOMETERS under Ground. 9 h. A.M. No. 3 inches.	No. 12 inches.	No. 22 inches.	Temperature of WELL at depth of feet, No.	SEA. Temperature at 1 Fathom, and Density.	OZONE. 0—10. 9 A.M.	9 P.M.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc. *Mention the hour at which Storms, including Thunder and Lightning, began and ended.*	Days of Month.
		inches.	°	inches.	°	°	°	°	°	°	°	°	°		inches.																					
	1	29.336	54.0	29.360	52.0	53.0	42.4			50.1	47.0	48.0	46.3		.07	S.E.	½	S.E.	½	F	7	Cu	2	St	4								1
	2	29.458	52.0	29.632	52.4	52.6	40.3			49.2	48.3	44.5	43.4		.25	E.	½	E.	1		10	St	2	Ci-Cu	4								2
	3	29.730	53.0	29.674	54.5	53.1	43.0			52.6	50.8	50.8	49.2		.11	S.	1	S.E.	½		10	Cu-St	10	St	—								3
	4	29.638	54.0	29.616	54.0	53.8	43.2			50.2	49.1	50.1	48.0		.23	S.E.	½	S.E.	1		10	St	6	Cu	4								4
	5	29.266	54.0	29.076	53.0	49.9	43.4			48.6	47.8	47.4	45.0		.55	S.S.	1	S.W.	2		10	Nim	10	Nim	2								5
	6	29.124	52.0	29.266	52.5	53.2	46.0			49.0	46.2	49.8	47.0		.01	S	1½	S	½		10	St	10	St	3								6
	7	29.068	51.0	29.124	50.0	48.4	44.2			47.9	45.9	45.4	44.0		.67	N.W.	1½	W.	2		10	Cu-St	9	Nim	—								7
	8	29.272	48.0	29.186	50.0	46.5	42.3			44.5	43.0	46.0	42.6		.25	N.W.	2	N.W.	½		10	St	10	St	—								8
	9	28.836	51.0	29.152	51.2	50.1	38.3			46.1	44.0	47.6	46.2		.54	W.	1	N.W.	2		7	Cu	10	Cu-St	1								9
	10	29.470	50.0	29.770	50.0	49.6	44.0			46.6	44.2	45.0	43.1		.09	N	1½	N.W.	1½		8	Cu	2	St	4								10
	11	29.968	51.0	30.094	50.5	47.0	42.0			47.0	45.9	43.1	42.1		.04	N	1	N	1		9	Cu	10	St	3								11
	12	30.130	50.0	30.184	52.0	48.8	43.4			45.0	44.1	47.1	45.0		.03	N.W.	1½	N	1		8	Cu	10	St	2								12
	13	30.156	51.0	30.174	52.0	48.4	40.2			47.0	45.4	47.5	46.7		.02	N.W.	1	N.W.	½		9	Ci-Cu	2	St	—								13
	14	30.208	52.0	30.172	52.5	52.4	47.0			49.8	48.0	49.0	46.3		.01	N	1	N	1½		6	Cu	7	Cu	8 4								14
	15	30.110	51.0	30.046	50.0	48.3	42.2			45.2	42.8	45.0	43.1		.05	N.E.	1	N.E.	1		6	Cu	10	Cu	4								15
	16	29.940	50.0	30.010	48.0	48.4	42.0			42.8	40.2	42.5	39.8		.09	N.E.	1½	N.E.	2		9	Cu-St	10	Cu-St	3								16
	17	30.068	46.0	30.108	46.0	43.6	35.6			42.1	41.0	41.2	40.3		.05	N.	1½	N	1½		3	Cu	5	Ci-St	2								17
	18	30.294	46.0	30.204	45.0	43.0	35.2			39.6	37.2	37.2	35.4		—	N.	1	N.W.	1		2	Ci-Cu	1	Cir	5								18
	19	30.080	47.0	30.070	47.0	49.4	35.0			43.2	41.0	39.5	38.0		.01	N.	1	N.	1		3	St	1	St	5								19
	20	29.960	48.0	29.760	47.5	44.3	36.2			40.1	38.3	39.9	39.2		.12	N.	1	N.	1		1	St	2	St	6								20
	21	29.608	47.0	29.636	46.0	40.2	36.0			37.2	37.0	40.0	38.3		.21	N.	1	N	2		10	St	10	Nim	3								21
	22	29.492	47.0	29.302	45.0	40.1	33.4			38.1	37.0	41.0	40.2		.68	N.W.	2	N.W.	2		5	Cu	10	Cu	4								22
	23	29.410	46.0	29.520	43.0	41.2	35.2			32.9	31.6	31.4	30.6		.40	N	1½	N.W.	1		10	Nim	5	Cu	—								23
	24	29.670	44.0	29.804	41.2	39.4	33.0			34.8	32.2	42.3	38.1		.12	N.W.	1	N.W.	1		4	Cu	10	Cu	2								24
	25	29.812	44.0	29.886	40.0	37.4	30.2			32.9 44.2	31.6 42.7	36.4 47.8	30.0 47.0		—	N	1	N	1		1	Cu	2	St	8								25
	26	29.910	44.0	29.782	43.0	45.1	30.2			34.8	32.2	42.3	38.1		.20	N.W.	1	S.W.	2		1	St	10	St	8								26
	27	29.368	48.0	29.200	49.0	47.8	42.0			44.2	42.7	47.8	47.0		.48	S.W.	2½	S.W.	2		10	Nim	10	St	—								27
	28	28.906	54.0	29.066	52.0	55.8	46.3			51.7	50.0	50.6	49.1		.13	S	1	S	1		1	St	2	St	6								28
	29	28.996	52.0	29.194	52.5	52.1	46.0			51.0	50.1	50.0	47.0		.02	S	1	S	½		10	Cu-St	2	Cu	3								29
	30	29.472	50.0	29.588	48.0	47.8	37.9			45.1	42.6	42.6	41.0		—	S	1½	S	½		2	Ci-Cu	1	St	6								30
	31	29.604	45	29.736	45.0	45.9	35.0			37.1	35.6	38.7	36.0		—	S	½	S	1		1	St	5	Ci-Cu	5								31
	Sums.		15 4 12	10		11 14 10	10 3		16 12	11 6		15 9	13 8	13 10	13 5 16	10	5·33				37		203		196		101								
	Means.	29·625	49·3		29·658	48·8		47·6	39·6		44·0	42·3	44·0	42·1		1·2		1·2		6·5		6·3												
	† Total Corrections for Instrumental Errors.	+006	−7		+006	−7																													
	‡ Corrections for Diurnal Range.																																		
	"Corrected Means."	29·631	48·6		29·664	48·1																													
	No. of Column.	1	2		3	4		5	6		7	8	9	10		11	12	13	14		15	16	17	18		19	20	21	22	23	24	25	26	27	28	29	30

Snow and Sleet

Severe snow-storm

Hard frost

Hard frost

NOTATION USED IN GENERAL REMARKS.

a.	*denotes* aurora.		m.	*denotes* meteor.	
ci.	,,	cirrus.	ms.	,,	meteors.
ci.-cu.	,,	cirro-cumulus.	n.	,,	nimbus.
ci.-s.	,,	cirro-stratus.	r.	,,	rain.
cu.	,,	cumulus.	h. r.	,,	heavy rain.
cu.-s.	,,	cumulo-stratus.	c. h. r.	,,	continued heavy rain.
d.	,,	dew.	s.	,,	stratus.
f.	,,	fog.	sc.	,,	scud.
fr.	,,	frost.	s.	,,	sleet.
h.-fr.	,,	hoar-frost.	s.	,,	snow.
h.	,,	haze.	so. ha.	,,	solar halo.
h. d.	,,	heavy dew.	sq.	,,	squall.
hl.	,,	hail.	sqs.	,,	squalls.
l.	,,	lightning.	t.	,,	thunder.
li. cl.	,,	light clouds.	t. s.	,,	thunder-storm.
li. sh.	,,	light showers.	w.	,,	wind.
lu. co.	,,	lunar corona.	g.	,,	gale of wind.
lu. ha.	,,	lunar halo.			

TABLE FOR ESTIMATING FORCE OF WIND.

Estimated Force, 0—6.	Common Designation.	Estimated Force, 0—6.	Common Designation.	Estimated Force, 0—6.	Common Designation.
0	Calm	1·5	Light breeze	4	Blowing hard
0·5	Very light air	2·	Fresh breeze	5	Blowing a gale
1·	Light air	3·	Very fresh	6	Violent gale

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction ‡‡ for Temp. (Col. 2), = 29·631 − ·053 = 29·578

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction ‡‡ for Temp. (Col. 4), = 29·664 − ·052 = 29·612

Mean at Station, corrected, and at 32°, = 29·595

Correction for height, 66 feet above Mean Sea-level, = ·074

Mean, reduced to 32°, and Sea-level, = 29·669

Highest Reading, corrected for Index error, on the 18 th, = 30·300

Lowest Do. Do., on the 9 th, = 28·842

Difference, or **Monthly Range**, = 1·458

* Each instrument tested at the Office in Edinburgh bears the stamp "S.M.S.;" and a number to be entered in the Heading; or the Number and Initials of the Maker may be here given.
† Embracing corrections for both capillarity and Index Errors.
‡ The Diurnal Range for Scotland is as yet unknown.
‡‡ *Practically*, though not *absolutely* a *minus* correction.
‡‡ These "Hygrometrical Deductions" are calculated from Glaisher's Hygrometrical Tables, Second Edition *only*.
** While the Diurnal Range is unknown, the Arithmetical Mean of Cols. 5 and 6 will be entered as the "Calculated Mean Temperature." Any observations not taken under the Conditions specified in the Directions on the other side, or noted at the Top of each column, must be marked as such by the observer, in each Schedule. *See over.*

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month**, (corrected for Index Errors), on the 28 th, = 55·8

Lowest in Month, corrected for Index errors, on the 25 th, = 30·2

Difference, or **Monthly Range**, = 25·6

"Corrected **Mean**" **of all the Highest**, (Col. 5), = 47·6

"Corrected **Mean**" **of all the Lowest**, (Col. 6), = 39·6

Difference, or **Mean Daily Range**, = 8·0

** Calculated **Mean Temperature** of Month, = 43·6

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the th, =

"Corrected **Mean**," (Col. 7), **of Black Bulb, Max. in Sun**, =

Lowest at Night, Black Bulb (corrected for Index errors), on the th, =

"Corrected **Mean**," (Col. 8), **of Black Bulb, Min.** on grass, =

Difference of above means or range ("exposed"), =

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb**, (Cols. 9 and 11), = 44·0

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb**, (Cols. 10 and 12), = 42·2

‡‡ Computed **Temperature of Dew-Point**, = 40·0

‡‡ Do. **Elastic Force of Vapour**, = ·248

‡‡ Do. **Weight of Vapour in a Cubic Foot of Air**, = 2·84

‡‡ **Relative Humidity** (Saturation = 100), = 86

RAIN fell on 27 **Days; Amount in Inches**, = 5·33

WIND. SUMMARY.

Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	10	2	1	3	6	1	1	7			
P.M.	8	2	1	3	5	3	1	8			
Mean.	9	2	1	3	6	2	1	4	0	1·2 = 1·44	

Observations made and Return verified by James Dale, Teacher in Robert Gordon's College, Abdn

(Signed)

Greatest Daily Range = 14·9 on the 26th

M.

WDS

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

ONE of the chief objects that the SCOTTISH METEOROLOGICAL SOCIETY proposed to itself when the Society was established in 1855, was to secure PERFECT UNIFORMITY in the system of observation pursued at all its Stations. Uniformity in the observations is absolutely necessary to justify the publication of Monthly Results from different observations, it being found that differences between the Returns from two Stations, so very considerable as to render them quite incomparable, may arise from dissimilarity in the position or shelter of instruments, different hours of observation, or even from the use of differently constructed instruments. It is therefore hoped, that those who kindly furnish Reports to the Society will, by a scrupulous attention to the following Directions, secure for their Monthly Returns an accuracy and value commensurate with the labour and pains involved in making them; and, for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

Hour of Observation.

The Council recommend that Observations be made precisely at 9 A.M. and 9 P.M. (Greenwich or Railway Time only), as specified in the following remarks, or at the top of the columns of the Schedule. It is hoped that the utmost punctuality in the time of reading the instruments will be observed. Observers, in some few cases, may find this impossible; in such instances, they are specially requested to mark opposite every reading the time at which it was taken, if not at 9 A.M. or 9 P.M.

Barometer.

Weather-Glasses and Aneroids, though well suited to indicate roughly variations of atmospheric pressure, are not fitted for scientific purposes. No Barometer should be used for Meteorological Observation that is not supplied with some means of adjustment or compensation which will secure that the height of the mercury in the tube is accurately measured from the fluctuating surface of the mercury in the cistern.

The Barometer in which the error arising from the fluctuating surface of the mercury in the cistern is entirely got rid of is FORTIN'S Barometer, the arrangement consisting in applying pressure by means of a screw to the bottom of the cistern, which is made of flexible leather, thus raising or depressing the surface till it just meets the ivory point which forms the zero point of the fixed scale.

The Barometer originally constructed by Mr. Adie of London, and usually called the Board of Trade Barometer, has the great convenience of requiring no adjustment of the cistern. Its scale-inches are not true inches, but so much shorter as to compensate the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This is an excellent Barometer for ordinary Observers, inasmuch as it entirely eliminates the error of observation likely to arise in not a few cases in setting the instrument to the zero point of the fixed scale when the light is not good. To show the accuracy with which these Barometers are made, it may be stated, that one was compared, during a whole year, with the Society's Standard Barometer, particular care being given to make the comparison when atmospheric pressure was rising or falling very rapidly, with the result that none of the readings differed from those of the Standard more than 0·003 inch.

A modification of Fortin's Barometer is used at a number of the Society's Stations, by which the coincidence of the zero point with the surface of the mercury is indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When the index-line on this little piston-rod is brought, by the adjusting screw, to form one straight line with those on its ivory frame, the surface of the mercury is then at the exact height from which the scale is graduated. In taking an observation, this preliminary setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the vernier.

It is absolutely necessary that the Barometer which is to be used shall have been compared with a Standard Barometer.

The Barometer should be suspended in as good a light as can be secured, and to facilitate the reading, a piece of white paper may be put behind the tube. It must be hung truly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire, and must not be hung against a wall heated by a flue. The object being to secure that the whole instrument, including the brass fittings, the contained mercury, and the attached Thermometer, shall be, when read, at one uniform temperature, it is evident that the best position is that which is least liable to sudden changes of temperature.

In taking an Observation, the Attached Thermometer is first noted: the tube must then be gently tapped, and the cistern-adjustment carefully made. The eye, by raising and lowering it, must be brought into the plane of the back and front of the index—usually the lower edge of the vernier, which must be carefully adjusted so as to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly, so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will facilitate an accurate adjustment and reading of the Barometer. A mistake not unfrequently made by those beginning to observe, consisting in setting the edge of the vernier to the level of the clear surface of the mercury which is in direct contact with the glass tube, must be carefully avoided.

The errors most frequently made in reading the Barometer are errors of 1·000 inch, 0·500 inch, and 0·050 inch; that is to say, instead of 29·365 inches, either of the following is sometimes set down—viz. as 30·365 inches, 28·365 inches, 29·865 inches, or 29·815 inches. Experience having shown that even the very best Observers make these mistakes, particular attention is directed to the matter.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must first be screwed so as to form a tight plug to the cistern, thus preventing the escape of the mercury. Then screw up the mercury not quite to the top of the tube, but to within a quarter of an inch of it, and take down the instrument; it should then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case if, on inclining the instrument, a sharp tap is produced when the mercury strikes the top of the tube. If a dull tap is heard, there is air in the tube, which must be got rid of.

As Barometers are liable to be deranged by the introduction of air into their tubes, on removal from place to place, or in being roughly handled, it may be useful to Observers to know how the air may be expelled. First close up the cistern by screwing the ivory peg tight, so as to prevent the escape of mercury; then screw up the mercury to about half an inch from the top of the tube; and having slowly inverted the instrument, place the top of it on a yielding substance, such as the boot, and gently tap on the cistern with the palm of the hand, so as to induce the air to ascend through the column to the cistern, whence it may escape. Since there is the weight of two atmospheres—the pressure of the mercury in the Barometer, and the air outside—pressing on any air that may be inside the tube, it is usually a tedious operation to get it wholly expelled. After repeated trials, however, it is generally accomplished; and the clear metallic sound of the mercury, when gently struck against the top of the glass [illegible] hen the whole of the air has been expelled. On [illegible] ometer, care must be taken to screw down the n[illegible] before unfastening the float of the cistern, for, i[illegible] ded to, the mercury will flow out, and the instru[illegible] lamaged.

Protection and Position of Thermometers.

The Council of the Society recommend that the Self-Registering Thermometers, and the Dry and Wet Bulb Hygrometer, be kept in Stevenson's Louvre-boarded Box for Thermometers, painted white inside and outside, and screwed to four stout posts, also painted white, firmly fixed in the ground. The posts must be of such a length that when the Thermometers are hung in position the Bulbs of the Minimum Thermometer, and of the Dry and Wet Bulb Thermometers, will be exactly at the same height of FOUR FEET above the ground, the Maximum Thermometer being hung immediately above the Minimum Thermometer. The Thermometer Box is to be placed over a plot of grass, and in a free open space to which the sun's rays have free access during as much of the day as surrounding conditions enable the Observer to secure. The Thermometers are suspended on cross-laths in the centre of the Box, and face the door, which should open to the north.

The Council regard the question of UNIFORMITY OF HEIGHT ABOVE GROUND, AND METHOD IN PROTECTING THE THERMOMETERS, as vital in every system of Meteorological Observation, since without it Observations made at different Stations are incomparable, thus rendering it impossible to compare the Climates of places with each other as regards their most important features.

Self-Registering Thermometers.

Professor Phillips, and Negretti and Zambra's Maximum Thermometers, and Rutherford's Minimum Thermometer, are recommended. It is recommended that these Thermometers be graduated on the glass stem. The Minimum Thermometer is liable to two derangements—viz., the column of spirit breaking, and part of the spirit distilling by high temperature and lodging at the top of the tube. This derangement is of occasional occurrence with protected Thermometers, but of frequent occurrence with exposed Thermometers. Hence a systematic examination of Minimum Thermometers ought to be a regular part of the work carried on by each Observer.

Fortunately, Spirit Thermometers may be easily set right by any one, when the column of spirit chances to separate. Let the Thermometer be taken in the hand by the end farthest from the bulb, raised above the head, and then forcibly swung down towards the feet; the object being, on the principle of centrifugal force, to send down the detached portion of spirit till it unites with the column. A few throws, or swinging strokes, will generally be sufficient for the purpose; after which the Thermometer should be placed in a slanting position, to allow the rest of the spirit still adhering to the sides of the tube to drain down to the column. But another method must be adopted, if the portion of spirit in the top of the tube be small. Heat should be applied slowly and cautiously to the top end of the tube where the detached portion of spirit is, which, being turned into vapour by the heat, will condense on the surface of the unbroken column of spirit. Care must be taken that the heat is not applied too quickly; for, if this be done, the tube will break and the instrument be destroyed. The best way to apply the requisite amount of heat is by bringing the end of the tube slowly down towards a minute flame from a gas-burner; or, if gas be not at hand, a piece of heated metal will serve instead.

Black-Bulb Thermometers.

The bulbs of the Thermometers for registering the greatest heat from the sun's rays, and the least from radiation during night, have a black coating, which may easily be made, or mended, by the application of a mixture of lampblack and printer's ink. They are placed in shallow blackened boxes, whose sides protect the bulbs from the wind The Maximum should be freely exposed to the sun, and the Mini mum should rest on wooden supports a few inches from the surface of the grass, in an open situation. Snow must not be allowed to cover either of these Thermometers; nor the sun's heat to affect the Minimum Thermometer by distillation. Black-bulbs enclosed in 'glass jackets' may also be used, being indeed preferable to the above. It must, however, be added, that the whole subject of the observation of Solar and Terrestrial Radiation is not yet in a sufficiently advanced state to warrant the exclusive recommendation of any one of these methods.

Dry and Wet Bulb Hygrometer.

The Hygrometer in use at the Society's Stations consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved form of this apparatus seriously vitiate the Hygrometrical Observations, Observers are specially requested to attend to the following conditions:—The bulbs must hang down by at least an inch free from the scales and frame to which they are attached; the frame must be such as will bring the tubes forward by an inch from any board on which it may be suspended; the water-cup must be covered, and altogether placed to the side, and a little below the level of the wet bulb, but in no case under the bulbs; the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the Observer that the muslin is always clean and moist, and the water pure. In frosty weather, observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

Reading of the Thermometer.

In reading the Thermometer great care must be taken to bring the eye exactly opposite the tip of the index or column of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°·9, 40°·0, or 40°·1; or again, 40°·4, 40°·5, 40°·6, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40½°, respectively. So also 40¼°, and 40¾°, more or less, must be registered 40°·2, or 40°·3, and 40°·7, or 40°·8 respectively. In reading Rutherford's Minimum Thermometer, the indication of that end of the index which is next the surface of the spirit is alone noted. On opening the Thermometer Box, the Dry and Wet Bulb Thermometers are to be first, and rapidly, read, inasmuch as they are readily affected by heat from the person of the Observer.

Hour of observing Temperature.

The Hygrometer is read at 9 A.M. and 9 P.M. The Self-Registering Thermometers are read at 9 P.M. only, as indicating the greatest and least degrees of temperature in the 24 hours preceding. It is not a matter of indifference when the Self-Registering Thermometers are read, since, in winter at least, the extremes may occur at any hour; and it is necessary to refer their occurrence to their proper meteorological day. In the Society's schedules, the indications registered on the 3d are those of a series of phenomena commencing at 9 P.M. on the 2d, and extending till 9 P.M. on the 3d.

Verification of Thermometers.

No instrument ought to be used for Meteorological purposes till it has been carefully tested by comparison with a standard Thermometer. When such Thermometers as are not graduated on the stem, but merely on an attached scale, undergo repairs, they are very liable to be moved from their position on the Scale, and ought never afterwards to be used without being re-tested. The Self-Registering, especially the Minimum Thermometers, ought frequently to be compared with the dry bulb of the Hygrometer. The freezing-point of each Thermometer, marked by a scratch on the tube, ought to be tested once a year, in snow or melting ice.

In selecting instruments, the following points require attention:—The divisions of the vernier of Barometers in reference to their scales, and the perfect freedom of the Barometer from air; the correct numbering of the scale of every instrument; the rejection of Thermometers the frameworks of which are not likely to stand exposure to the weather, as shown in the past by repeated and annoying breakages of Thermometers of similar construction; and as regards Maximum Thermometers, either Negretti and Zambra's, or Phillip's, whether they will act at the highest temperatures they may be required to register. By the laws of the Society, Members and Observers have a right to have their instruments compared by the Secretary, and to advise with him regarding the purchase of instruments.

Wind.

Very great care should be bestowed on the Observations of the Wind, the accuracy of which, both as regards Direction and Force, is so essential towards the right discussion of many of the more important problems of the science.

1. As regards Direction.

A Wind-Vane ought to be elevated at least 12 feet above surrounding objects. When it oscillates incessantly, the mean direction should be taken. In all cases, but especially when the Vane is stationary, and when the wind is feeble, reference may be made to the direction of smoke, etc., in well-exposed situations. Careful observations are recommended to be made on the changes in the direction of the wind; and during storms, extra observations at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, is likely to give highly valuable and important results, particularly in connection with the system of thickly-planted Stations over a limited district round Edinburgh called STORM STATIONS, in the course of being established by the Society for the systematic investigation of the relation of the force of the wind to BAROMETRIC GRADIENTS, and other points connected with storms.

2. As regards Velocity and Pressure.

The Council would recommend the Hemispherical Cup Anemometer,—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the mean Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind at any particular hour of observation, the Pressure Anemometers recently brought under the notice of the Society by Mr. T. Stevenson, the Honorary Secretary, and Mr. R. Ballingall, the Society's Observer at Fallabus, are recommended as likely to secure uniformity in making observations on the Force of the Wind.

Rain Gauges.

Many causes conspire to produce anomalies in Rain Returns, arising partly from the difficulty of obtaining a perfectly unobjectionable situation for observation, and partly from the defective nature of the instruments used. The Rain Gauge should not be placed on a slope or terrace, but on a level piece of ground, in as open a situation as the Observer can secure for it. As it is often difficult to obtain a position as free and unobstructed by surrounding objects as is desirable, care should be taken to place it at some distance from shrubs, trees, buildings, or other obstructions, at least as many feet from their base as they are in height. The more important directions, towards which it is most desirable to have a free exposure, are, in the order of their importance, S.W., N.E., S.E., S., and W. The rim of the gauge must be perfectly level, and fixed so that it will remain level in all weathers, and be at a height of one foot above ground, over grass. In such gauges as Fleming's, which are furnished with a measuring-rod attached to a float, the rod ought to be fixed down, and the float rise to its height only at the time the instrument is read, it being found that a stem projecting above the rim of the gauge seriously interferes with the proper measurement of the Rainfall. When a measuring-glass is used, care should be taken to hold it quite perpendicular. The Rain Gauge ought to be read daily at 9 A.M., and the reading entered in the Returns of the previous day. If the Gauge is read once a month, the reading is to be made on the first of the month, and the amount entered for the previous month.

Snow-falls.

Snow-falls may, for convenience, be registered in the rain columns, under the following conditions:—When a Snow shower occurs, it should be noted in the 'Remarks,' and the letter S affixed to the depth of water received in Gauge. The depth of the snow must be measured in some open place where no drift is observed, and registered in addition to, and as a check upon, the indications of the Rain Gauge. For wind, rain, and snow, as indeed in every column, the Observer cannot be too careful to register observations only; and nothing that partakes of the nature of deduction or inference.

Clouds.

Convenient abbreviations for the nomenclature of Clouds will be found on the other side. The amount of Cloud ought to be estimated from the greater or less obscuration of the sky overhead (*i.e.* within 20° or 30° of the zenith). The strata of Clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the Clouds' column, though their appearance and changes may be noted among the Remarks. The amount of Cloud is entered from a scale of 0 to 10; thus, when the sky overhead is free from Clouds it is entered 0, when half-covered by Clouds, 5, wholly covered, 10, and so on.

Observations of the Clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—Thus, in the column Velocity and Direction, 6, S. W.

——— will indicate that the upper strata of Clouds travel with 2, W.

extreme velocity from S.W., and those in the lower regions from W., with one-third the speed of the former. Again, in the second Cloud column, an entry of ——— will indicate that the higher 4, st.

2, cu-st.

regions are covered to the amount of 4-tenths with stratus Clouds; and that the sky is further obscured to the extent of 2-tenths by lower Clouds of the cumulo stratus kind.

Remarks on peculiar Clouds, accompanied with drawings, will assist materially in the development of a more exact nomenclature of Clouds, as well as throw light on the electrical, and other of the more obscure phenomena of Meteorology.

Sunshine.

The approximate number of Hours in which objects in the sun's rays cast shadows, should be entered in the proper column.

Underground Thermometers.

As the germination and growth of crops and plants generally depend greatly on the temperature of the soil,—its amount and constancy,—the Council recommend that Observations in this interesting department be made at 9 A.M., by Thermometers permanently fixed in the soil, their bulbs being sunk to depths of 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain-water being conveyed to the bulbs by the stems or wooden frames.

Temperature of the Sea.

A knowledge of the Temperature of the Sea is not only in itself, but in its relations to that of our island, a most important branch of Meteorology. The Council therefore recommend that the Temperature of the Sea be carefully taken by a properly constructed apparatus, from boats, or, if this be impracticable [illegible] of piers and rocks round the coast, where it is not it[illegible]t of river water, and as little influenced as possible b[illegible]ping along the coast, and thus acquiring the tempera[illegible], either greatly heated by the sun or cooled by noct[illegible] At or near the time of high water, in cases where the observations cannot be taken daily, the observation may be made on the 5th, 15th, and 25th of each month. When convenient, extra Sea Observations might be taken for other and greater depths, noting always the Temperature of the Air, and the Hour of Observation. It is also very desirable that observations on the daily Maxima and Minima by Thermometers continuously immersed, be instituted at points along the coast, by the method proposed by Mr. T. Stevenson, and already commenced at Peterhead and Liverpool.

Temperature of Wells.

The Temperature of the water at the bottom of Wells ought, when practicable, to be taken, both the depth of the Well and of the water being noted.

Ozone.

Mention what Test-Papers are used, Schönbein's or Moffat's, etc. The Paper is affixed by a pin to a board in the Thermometer Box, and the indications registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus $3^{\frac{N.W.}{1}}$, as an Ozone entry in the schedule will indicate that the Ozone paper is tinted as 3 on the scale, that the wind is from the N.W., and that its force on the scale 0—5 is 4, or blowing fresh.

Atmospheric Electricity.

Too much importance cannot be attached to the electric condition of the atmosphere in connection with terrestrial magnetism, barometrical, thermometrical, and meteorological phenomena generally. A proper Electrometer is, in truth, necessary to every complete meteorological observatory.

Remarks.

The Remarks column is unavoidably too narrow. Some of the most valuable Observations that can be taken are those for which no rules can be given nor hours assigned. The use of contractions ought, therefore, to be taken every advantage of, and a list of such as are in general use is given at the foot of the column. Besides special and extraordinary Observations, great prominence ought to be given in this column to Prevalent Diseases, differences in character, colour, velocity, and direction between the Lower and Upper Strata of clouds, the Colour of the Sky, etc. Remarks ought to be made on the occurrence of Meteors, Auroræ Boreales, remarkable depressions, elevations, and fluctuations of the Barometer, Thunder-Storms, and remarkable falls of Snow, Hail, or Rain, the Hour of Storms of Wind commencing, attaining their maximum, and ending, as well as such Notes on Storms as have been hinted at above. When lofty hills are in the vicinity of a Station, the Height of Clouds and of the Snow-line in winter should be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. should be registered, either in two columns, otherwise unoccupied, or ruled off for the purpose, from the column of 'Remarks.'

Observations in connection with the Periodic Return of the Seasons.

Observations in connection with the Periodic Return of the Seasons, possess not only great scientific value, but are of considerable importance in connection with Agriculture, Horticulture, and Natural History. The Council would direct the special attention of Observers to the registration of such phenomena, so that the published Summaries may fairly represent the whole of Scotland. Observations ought to be confined to individual trees and shrubs; to particular species of birds, and, in the case of crops, to specified sorts reared from year to year on a selected piece of ground or farm. The Annual Table, published yearly in the Society's Journal, will indicate the species of plants and animals to which special attention is more particularly directed.

The Council recommend Observers, before purchasing new instruments, and in repairing old ones, to communicate with the Meteorological Secretary, in order that every instrument may be examined and improved before being used; and they consider it necessary that he should have full power to reject any instrument which, on being presented for comparison, does not afford him satisfaction.

(By Order) A. B.

EDINBURGH, *December* 1888.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	Leaf Buds first Appear.	In Leaf.	Divested of Leaves.
Alder,				
Ash,				
Beech,				
Birch,				
Elm,				
Larch,				
Lime,				
Oak,				
Sycamore or Plane,				

SHRUBS, ETC.	First in Blossom.
Barberry,	
Bourtree or Elder,	
Broom,	
Hazel,	
Hawthorn,	
Holly,	
Laburnum,	
Lilac,	
Mezereon,	
Mountain Ash or Rowan,	
Red Flowering Currant,	
Rhododendron Pontieum,	
Whin,	

FRUITS.	First in Blossom.	Fruit Ripe generally.
Apple,		
Black Currant,		
Cherry,		
Gean,		
Gooseberry,		
Peach,		
Pear,		
Plum,		
Strawberry,		

CROPS, mentioning variety.	Sowing or Planting.
Barley,	
Bere or Bigg,	
Oats,	
Wheat,	
Beans,	
Pease,	
Potatoes,	
Turnips,	
Rye Grass,	

MIGATORY BIRDS.	First Arrival.	Departure.
Cuckoo,		
Curlew,		
House-Swallow,		
Lapwing,		
Plover,		
Sand-Martin,		
Starling,		
Swan,		
Rail or Corn Crake,		

	Appearing above Ground.	In Ear or Flower.	First Cut or Thinned.

Have the goodness also to state any information you may be able to collect relative to the Crops of Grain, Hay, Potatoes, Turnips, Fruits, etc., whether plentiful, or in perfection; whether any have suffered from blight, diseases, etc. Whether Epizootic disease prevails among cattle; and the Agricultural condition of the district generally.

Aberdeen Oct 1892

2

To the SECRETARY
Scottish Meteorological Society,
122 George Street,
EDINBURGH.

BOOK POST.

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Gordon's College, Aberdn, County of Aberdeen, in Lat. 57°9'N, Long. 2°6'W, Distance from Sea 1 miles.

Height of Cistern of the Barometer above Mean Sea-Level 66 feet, above Ground 2½ feet. During the MONTH of November 1892.

The Hours of Observation are of Greenwich Time.

Days of Month.	BAROMETER. 9 h. A.M. Barometer. * No.	Attached Thermometer	9 h. P.M. Barometer. No.	Attached Thermometer	SELF-REGISTERING THERMOMETERS, Read Daily, at 9 P.M. Protected in Shade, 4 feet above Ground. Max. No.	Min. No.	Exposed Black Bulbs. Max. in Sun's rays No.	Min. on Grass No.	HYGROMETER. Dry No. ___ Wet No. ___ 9 h. A.M. Dry bulb.	Wet bulb.	9 h. P.M. Dry bulb.	Wet bulb.	Rain. No. of hours in which it fell.	Amount in inches. No.	WIND. 9 h. A.M. Direction.	Force	9 h. P.M. Direction.	Force	Readings of the H. Cup Anemometer. No. 9 h. A.M.	CLOUDS. 9 A.M. Velocity (0—6) and Direction.	Amount (0—10), and Species.	P.M. Velocity (0—6) and Direction.	Amount (0—10), and Species.	SUNSHINE. Hours.	THERMOMETERS under Ground. 9 h. A.M. No. 3 inches.	No. 12 inches.	No. 22 inches.	Temperature of WELL at depth of ___ feet, No.	SEA. Temperature at 1 fathom, and Density.	OZONE. 0—10. 9 A.M.	9 P.M.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc. *Mention the hour at which Storms, including Thunder and Lightning, began and ended.*	Days of Month.
	inches.	°	inches.	°	°	°	°	°	°	°	°	°																							
1	29.792	45.0	29.818	42.0	45.9	31.0			33.8	32.1	31.8	30.0		—	S	½	S	—		1	St	1	St	6										1
2	29.802	45.0	29.454	45.0	45.0	28.1			41.9	39.3	40.1	39.0		.23	S	1	S	1.5		4	Cu-St	10	St	2										2
3	29.328	49.0	29.510	47.0	48.2	42.0			45.9	45.0	43.8	42.0		.03	S	1	S	1.5		10	St	5	Cir	1										3
4	29.532	50.0	29.514	51.0	49.8	41.6			47.8	46.4	47.8	46.4		.23	S	1	S	1		10	Nim	1	St	—										4
5	29.532	52.0	29.674	51.0	51.0	43.8			50.1	48.1	47.0	45.0		.02	S	2	S	—		5	Cir	2	Cir	3										5
6	29.760	45.0	29.910	47.0	47.1	36.2			39.2	38.1	37.8	36.0		—	W	.5	S.W.	.5		6	Ci-Cu	2	St	4										6
7	30.070	45.0	30.028	45.5	45.2	32.5			34.0	33.2	42.1	40.8		—	S.W	—	S.W.	1.5		2	St	6	St	4										7
8	29.906	48.0	29.848	50.0	50.1	40.2			46.8	45.0	49.8	47.0		.06	S.W	1.5	S.W	1		10	Cu-St	10	Cu-St	—										8
9	29.866	52.0	29.574	49.0	51.1	41.2			49.3	48.0	42.8	41.2		.13	S.W.	1	S.W.	.5		10	St	2	St	—										9
10	29.952	48.0	29.960	49.0	45.0	33.6			39.1	38.0	42.2	41.4		—	S	.5	S.	.5		5	Ci-Cu	2	Cir	6										10
11	29.964	51.0	29.980	49.0	49.1	40.1			45.2	44.1	47.2	45.8		—	S	1	S	.5		6	Ci-Cu	6	Cu	4										11
12	29.870	50.0	29.630	50.0	47.2	40.8			46.2	45.1	46.8	45.2		.47	S.	1.5	S	1		10	Cu-St	10	St	1										12
13	29.630	51.0	29.606	49.0	47.9	43.5			47.8	47.2	44.1	43.2		.40	S	.5	S.W.	1		10	Nim	10	St	—										13
14	29.638	49.0	29.370	51.0	50.8	41.3			42.8	42.0	50.8	50.0		.77	S.W.	.5	S.E.	2		10	St	10	Nim	—										14
15	29.260	52.0	29.670	51.0	50.9	42.3			49.5	47.2	42.6	40.5		—	S	1	S	.2		8	Nim	4	St	—										15
16	29.734	51.0	29.836	44.0	41.3	32.3			35.1	34.2	33.8	32.8		—	W	.5	S.W.	.5		2	Cir	1	Cir	6										16
17	29.944	46.0	29.928	48.0	42.1	30.2			33.0	32.1	39.2	38.3		—	S.W.	.5	S.W.	—		1	St	2	St	5										17
18	29.840	46.5	29.746	45.0	42.8	31.8			36.9	36.2	40.0	40.0		.23	S	—	S	—		2	St	5	St	4									Very dense haze in morning	18
19	29.692	50.6	29.808	48.0	45.4	34.8			43.1	42.0	45.4	43.4		.01	S	1	S.E.	1		7	Ci-Cu	10	Cu-St	1										19
20	29.930	48.0	30.220	48.0	46.2	43.4			44.2	43.4	45.0	43.2		.04	S.E.	1	S.E.	1		10	St	10	St	—										20
21	30.366	49.0	30.426	48.0	45.1	40.2			44.1	41.0	44.5	41.2		—	S.E.	1	S.E.	1		10	St	10	St	—										21
22	30.436	49.0	30.444	48.0	45.2	43.0			45.0	42.1	45.0	41.4		—	S	.5	S.	.5		10	St	10	St	—										22
23	30.300	49.0	30.184	45.0	44.8	31.4			43.0	40.3	31.6	30.6		—	S.	1	S.W.	.5		10	St	10	St	—										23
24	30.116	47.0	30.198	41.8	41.8	31.0			40.0	38.1	41.8	40.0		.04	S.W.	—	S.W.	1		10	Cu-St	10	St	—										24
25	30.224	48.0	30.070	47.0	42.9	40.3			40.2	36.8	42.9	39.8		.14	S	.5	S.W	1.5		6	Ci-Cu	10	Cu-St	3										25
26	29.828	47.0	30.020	47.0	43.2	40.0			43.5	42.6	42.8	39.6		.01	S.	1	S.	1		10	St	2	St	—										26
27	30.010	47.5	29.996	48.0	49.6	40.1			46.8	43.3	49.0	46.1		—	S.W.	1	S.W.	1		9	Cu	10	Cu	—										27
28	29.894	52.0	29.528	54.0	57.2	46.5			50.0	47.1	53.1	49.8		—	S.W.	2	S.W.	2		7	Cu	5	Ci-Cu	1										28
29	29.616	51.0	29.490	48.0	53.2	33.5			39.2	36.0	33.5	31.8		.02	S.W.	1	W.	1		—	—	1	St	5										29
30	29.766	47.0	29.832	40.0	36.0	31.2			34.0	33.2	32.8	32.0		.01	N.W.	1.5	N.W.	1		2	Cu	1	St	4									Snow	30
31																																			31
Sums.	18 12 9 25·598	15 1 26·0	17 14 11 25·722	15 1 26·63	14 10 6 4 200·5	127·9			14 10 6 7·5	14 5 7·2	12 11 7·7	11 9 23·5	5	2·84	6 26·0		5 25·7			203		178		60										
Means.	29.853	48.7	29.857	47.5	46.7	37.6			42.6	40.9	42.6	40.8			0.9		0.9			6.8		5.9										
† Total Corrections for Instrumental Errors.	·006	-·7	·006	-·7											·06		·06			6·4												
‡ Corrections for Diurnal Range.																																			
"Corrected Means."																																			
No. of Column.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30					

NOTATION USED IN GENERAL REMARKS.

a.	*denotes* aurora.		m.	*denotes* meteor.	
ci.	,, cirrus.		ms.	,, meteors.	
ci.-cu.	,, cirro-cumulus.		n.	,, nimbus.	
ci.-s.	,, cirro-stratus.		r.	,, rain.	
cu.	,, cumulus.		h. r.	,, heavy rain.	
cu.-s.	,, cumulo-stratus.		c. h. r.	,, continued heavy rain.	
d.	,, dew.		s.	,, stratus.	
f.	,, fog.		sc.	,, scud.	
fr.	,, frost.		s.	,, sleet.	
h.-fr.	,, hoar-frost.		s.	,, snow.	
h.	,, haze.		so. ha.	,, solar halo.	
h. d.	,, heavy dew.		sq.	,, squall.	
hl.	,, hail.		sqs.	,, squalls.	
l.	,, lightning.		t.	,, thunder.	
li. cl.	,, light clouds.		t. s.	,, thunder-storm.	
li. sh.	,, light showers.		w.	,, wind.	
lu. co.	,, lunar corona.		g.	,, gale of wind.	
lu. ha.	,, lunar halo.				

TABLE FOR ESTIMATING FORCE OF WIND.

Estimated Force, 0—6.	Common Designation.	Estimated Force, 0—6.	Common Designation.	Estimated Force, 0—6.	Common Designation.
0	Calm	1·5	Light breeze	4	Blowing hard
0·5	Very light air	2·	Fresh breeze	5	Blowing a gale
1·	Light air	3·	Very fresh	6	Violent gale

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction †† for Temp. (Col. 2), = 29.847 − ·052 = 29.795

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction †† for Temp. (Col. 4), = 29.851 − ·048 = 29.803

Mean at Station, corrected, and at 32°, = 29.799

Correction for height, 66 feet above Mean Sea-level, = ·074

Mean, reduced to 32°, and Sea-level, = 29.873

Highest Reading, corrected for Index error, on the th, = 30.450

Lowest Do. Do., on the th, = 29.266

Difference, or **Monthly Range**, = 1.184

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month**, (corrected for Index Errors), on the th, = 57.2

Lowest in Month, corrected for Index errors, on the th, = 28.1

Difference, or **Monthly Range**, = 29.1

"Corrected **Mean**" **of all the Highest**, (Col. 5), = 46.7

"Corrected **Mean**" **of all the Lowest**, (Col. 6), = 37.6

Difference, or **Mean Daily Range**, = 9.1

** Calculated **Mean Temperature** of Month, = 42.2

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the th, =

"Corrected **Mean**," (Col. 7), **of Black Bulb, Max. in Sun**, =

Lowest at Night, Black Bulb (corrected for Index errors), on the th, =

"Corrected **Mean**," (Col. 8), **of Black Bulb, Min.** on grass, =

Difference of above means or range ("exposed"), =

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb**, (Cols. 9 and 11), = 42.6

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb**, (Cols. 10 and 12), = 40.8

‡‡ Computed **Temperature of Dew-Point**, = 38.7

‡‡ Do. **Elastic Force of Vapour**, = ·235

‡‡ Do. **Weight of Vapour in a Cubic Foot of Air**, = 2.70

‡‡ **Relative Humidity** (Saturation = 100), = 86

RAIN fell on 17 **Days; Amount in Inches**, = 2·84

WIND. SUMMARY.

Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.				2	16	9	2	1			
P.M.				4	12	12	1	1			
Mean.	0	0	0	3	14	10	2	1	0	0.9 = 0.81 lb	

* Each instrument tested at the Office in Edinburgh bears the stamp "S.M.S.;" and a number to be entered in the Heading: or the Number and Initials of the Maker may be here given.
† Embracing corrections for both capillarity and Index Errors.
‡ The Diurnal Range for Scotland is as yet unknown.
†† *Practically*, though not *absolutely* a *minus* correction.
‡‡ These "Hygrometrical Deductions" are calculated from Glaisher's Hygrometrical Tables, Second Edition *only*.
** While the Diurnal Range is unknown, the Arithmetical Mean of Cols. 5 and 6 will be entered as the "Calculated Mean Temperature."
Any observations not taken under the Conditions specified in the Directions on the other side, or noted at the Top of each column, must be marked as such by the observer, in each Schedule. *See over.*

Observations made and Return verified by { James Dale, Teacher in Robert Gordon's College, Aberdeen

(Signed)

W.D.S.

Greatest Daily Range = 19·7 on the 29th

M.

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

ONE of the chief objects that the SCOTTISH METEOROLOGICAL SOCIETY proposed to itself when the Society was established in 1855, was to secure PERFECT UNIFORMITY in the system of observation pursued at all its Stations. Uniformity in the observations is absolutely necessary to justify the publication of Monthly Results from different observations, it being found that differences between the Returns from two Stations, so very considerable as to render them quite incomparable, may arise from dissimilarity in the position or shelter of instruments, different hours of observation, or even from the use of differently constructed instruments. It is therefore hoped, that those who kindly furnish Reports to the Society will, by a scrupulous attention to the following Directions, secure for their Monthly Returns an accuracy and value commensurate with the labour and pains involved in making them; and, for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

The Council recommend that Observations be made precisely at

Hour of Observation.

9 A.M. and 9 P.M. (Greenwich or Railway Time only), as specified in the following remarks, or at the top of the columns of the Schedule. It is hoped that the utmost punctuality in the time of reading the instruments will be observed. Observers, in some few cases, may find this impossible; in such instances, they are specially requested to mark opposite every reading the time at which it was taken, if not at 9 A.M. or 9 P.M.

Barometer.

Weather-Glasses and Aneroids, though well suited to indicate roughly variations of atmospheric pressure, are not fitted for scientific purposes. No Barometer should be used for Meteorological Observation that is not supplied with some means of adjustment or compensation which will secure that the height of the mercury in the tube is accurately measured from the fluctuating surface of the mercury in the cistern.

The Barometer in which the error arising from the fluctuating surface of the mercury in the cistern is entirely got rid of is FORTIN'S Barometer, the arrangement consisting in applying pressure by means of a screw to the bottom of the cistern, which is made of flexible leather, thus raising or depressing the surface till it just meets the ivory point which forms the zero point of the fixed scale.

The Barometer originally constructed by Mr. Adie of London, and usually called the Board of Trade Barometer, has the great convenience of requiring no adjustment of the cistern. Its scale-inches are not true inches, but so much shorter as to compensate the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This is an excellent Barometer for ordinary Observers, inasmuch as it entirely eliminates the error of observation likely to arise in not a few cases in setting the instrument to the zero point of the fixed scale when the light is not good. To show the accuracy with which these Barometers are made, it may be stated, that one was compared, during a whole year, with the Society's Standard Barometer, particular care being given to make the comparison when atmospheric pressure was rising or falling very rapidly, with the result that none of the readings differed from those of the Standard more than 0·003 inch.

A modification of Fortin's Barometer is used at a number of the Society's Stations, by which the coincidence of the zero point with the surface of the mercury is indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When the index-line on this little piston-rod is brought, by the adjusting screw, to form one straight line with those on its ivory frame, the surface of the mercury is then at the exact height from which the scale is graduated. In taking an observation, this preliminary setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the vernier.

It is absolutely necessary that the Barometer which is to be used shall have been compared with a Standard Barometer.

The Barometer should be suspended in as good a light as can be secured, and to facilitate the reading, a piece of white paper may be put behind the tube. It must be hung truly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire, and must not be hung against a wall heated by a flue. The object being to secure that the whole instrument, including the brass fittings, the contained mercury, and the attached Thermometer, shall be, when read, at one uniform temperature, it is evident that the best position is that which is least liable to sudden changes of temperature.

In taking an Observation, the Attached Thermometer is first noted: the tube must then be gently tapped, and the cistern-adjustment carefully made. The eye, by raising and lowering it, must be brought into the plane of the back and front of the index—usually the lower edge of the vernier, which must be carefully adjusted so as to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly, so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will facilitate an accurate adjustment and reading of the Barometer. A mistake not unfrequently made by those beginning to observe, consisting in setting the edge of the vernier to the level of the clear surface of the mercury which is in direct contact with the glass tube, must be carefully avoided.

The errors most frequently made in reading the Barometer are errors of 1·000 inch, 0·500 inch, and 0·050 inch; that is to say, instead of 29·365 inches, either of the following is sometimes set down—viz. as 30·365 inches, 28·365 inches, 29·865 inches, or 29·815 inches. Experience having shown that even the very best Observers make these mistakes, particular attention is directed to the matter.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must first be screwed so as to form a tight plug to the cistern, thus preventing the escape of the mercury. Then screw up the mercury not quite to the top of the tube, but to within a quarter of an inch of it, and take down the instrument; it should then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case if, on inclining the instrument, a sharp tap is produced when the mercury strikes the top of the tube. If a dull tap is heard, there is air in the tube, which must be got rid of.

As Barometers are liable to be deranged by the introduction of air into their tubes, on removal from place to place, or in being roughly handled, it may be useful to Observers to know how the air may be expelled. First close up the cistern by screwing the ivory peg tight, so as to prevent the escape of mercury; then screw up the mercury to about half an inch from the top of the tube; and having slowly inverted the instrument, place the top of it on a yielding substance, such as the boot, and gently tap on the cistern with the palm of the hand, so as to induce the air to ascend through the column to the cistern, whence it may escape. Since there is the weight of two atmospheres—the pressure of the mercury in the Barometer, and the air outside—pressing on any air that may be inside the tube, it is usually a tedious operation to get it wholly expelled. After repeated trials, however, it is generally accomplished; and the clear metallic sound of the mercury when gently struck against the top of the glass tub[illegible]en the whole of the air has been expelled. On hang[illegible]ometer, care must be taken to screw down the merc[illegible] before unfastening the float of the cistern, for, if t[illegible]ded to, the mercury will flow out, and the instrume[illegible]damaged.

Protection and Position of Thermometers.

The Council of the Society recommend that the Self-Registering Thermometers, and the Dry and Wet Bulb Hygrometer, be kept in Stevenson's Louvre-boarded Box for Thermometers, painted white inside and outside, and screwed to four stout posts, also painted white, firmly fixed in the ground. The posts must be of such a length that when the Thermometers are hung in position the Bulbs of the Minimum Thermometer, and of the Dry and Wet Bulb Thermometers, will be exactly at the same height of FOUR FEET above the ground, the Maximum Thermometer being hung immediately above the Minimum Thermometer. The Thermometer Box is to be placed over a plot of grass, and in a free open space to which the sun's rays have free access during as much of the day as surrounding conditions enable the Observer to secure. The Thermometers are suspended on cross-laths in the centre of the Box, and face the door, which should open to the north.

The Council regard the question of UNIFORMITY OF HEIGHT ABOVE GROUND, AND METHOD IN PROTECTING THE THERMOMETERS, as vital in every system of Meteorological Observation, since without it Observations made at different Stations are incomparable, thus rendering it impossible to compare the Climates of places with each other as regards their most important features.

Self-Registering Thermometers.

Professor Phillips, and Negretti and Zambra's Maximum Thermometers, and Rutherford's Minimum Thermometer, are recommended. It is recommended that these Thermometers be graduated on the glass stem. The Minimum Thermometer is liable to two derangements—viz., the column of spirit breaking, and part of the spirit distilling by high temperature and lodging at the top of the tube. This derangement is of occasional occurrence with protected Thermometers, but of frequent occurrence with exposed Thermometers. Hence a systematic examination of Minimum Thermometers ought to be a regular part of the work carried on by each Observer.

Fortunately, Spirit Thermometers may be easily set right by any one, when the column of spirit chances to separate. Let the Thermometer be taken in the hand by the end farthest from the bulb, raised above the head, and then forcibly swung down towards the feet; the object being, on the principle of centrifugal force, to send down the detached portion of spirit till it unites with the column. A few throws, or swinging strokes, will generally be sufficient for the purpose; after which the Thermometer should be placed in a slanting position, to allow the rest of the spirit still adhering to the sides of the tube to drain down to the column. But another method must be adopted, if the portion of spirit in the top of the tube be small. Heat should be applied slowly and cautiously to the top end of the tube where the detached portion of spirit is, which, being turned into vapour by the heat, will condense on the surface of the unbroken column of spirit. Care must be taken that the heat is not applied too quickly; for, if this be done, the tube will break and the instrument be destroyed. The best way to apply the requisite amount of heat is by bringing the end of the tube slowly down towards a minute flame from a gas-burner; or, if gas be not at hand, a piece of heated metal will serve instead.

Black-Bulb Thermometers.

The bulbs of the Thermometers for registering the greatest heat from the sun's rays, and the least from radiation during night, have a black coating, which may easily be made, or mended, by the application of a mixture of lampblack and printer's ink. They are placed in shallow blackened boxes, whose sides protect the bulbs from the wind The Maximum should be freely exposed to the sun, and the Minimum should rest on wooden supports a few inches from the surface of the grass, in an open situation. Snow must not be allowed to cover either of these Thermometers; nor the sun's heat to affect the Minimum Thermometer by distillation. Black-bulbs enclosed in 'glass jackets' may also be used, being indeed preferable to the above. It must, however, be added, that the whole subject of the observation of Solar and Terrestrial Radiation is not yet in a sufficiently advanced state to warrant the exclusive recommendation of any one of these methods.

Dry and Wet Bulb Hygrometer.

The Hygrometer in use at the Society's Stations consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved form of this apparatus seriously vitiate the Hygrometrical Observations, Observers are specially requested to attend to the following conditions:—The bulbs must hang down by at least an inch free from the scales and frame to which they are attached; the frame must be such as will bring the tubes forward by an inch from any board on which it may be suspended; the water-cup must be covered, and altogether placed to the side, and a little below the level of the wet bulb, but in no case under the bulbs; the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the Observer that the muslin is always clean and moist, and the water pure. In frosty weather, observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

Reading of the Thermometer.

In reading the Thermometer great care must be taken to bring the eye exactly opposite the tip of the index or column of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°·9, 40°·0, or 40°·1; or again, 40°·4, 40°·5, 40°·6, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40½°, respectively. So also 40¼°, and 40¾°, more or less, must be registered 40°·2, or 40°·3, and 40°·7, or 40°·8 respectively. In reading Rutherford's Minimum Thermometer, the indication of that end of the index which is next the surface of the spirit is alone noted. On opening the Thermometer Box, the Dry and Wet Bulb Thermometers are to be first, and rapidly, read, inasmuch as they are readily affected by heat from the person of the Observer.

Hour of observing Temperature.

The Hygrometer is read at 9 A.M. and 9 P.M. The Self-Registering Thermometers are read at 9 P.M. only, as indicating the greatest and least degrees of temperature in the 24 hours preceding. It is not a matter of indifference when the Self-Registering Thermometers are read, since, in winter at least, the extremes may occur at any hour; and it is necessary to refer their occurrence to their proper meteorological day. In the Society's schedules, the indications registered on the 3d are those of a series of phenomena commencing at 9 P.M. on the 2d, and extending till 9 P.M. on the 3d.

Verification of Thermometers.

No instrument ought to be used for Meteorological purposes till it has been carefully tested by comparison with a standard Thermometer. When such Thermometers as are not graduated on the stem, but merely on an attached scale, undergo repairs, they are very liable to be moved from their position on the Scale, and ought never afterwards to be used without being re-tested. The Self-Registering, especially the Minimum Thermometers, ought frequently to be compared with the dry bulb of the Hygrometer. The freezing-point of each Thermometer, marked by a scratch on the tube, ought to be tested once a year, in snow or melting ice.

In selecting instruments, the following points require attention:—The divisions of the vernier of Barometers in reference to their scales, and the perfect freedom of the Barometer from air; the correct numbering of the scale of every instrument; the rejection of Thermometers the frameworks of which are not likely to stand exposure to the weather, as shown in the past by repeated and annoying breakages of Thermometers of similar construction; and as regards Maximum Thermometers, either Negretti and Zambra's, or Phillip's, whether they will act at the highest temperatures they may be required to register. By the laws of the Society, Members and Observers have a right to have their instruments compared by the Secretary, and to advise with him regarding the purchase of instruments.

Wind.

Very great care should be bestowed on the Observations of the Wind, the accuracy of which, both as regards Direction and Force, is so essential towards the right discussion of many of the more important problems of the science.

1. As regards Direction.

A Wind-Vane ought to be elevated at least 12 feet above surrounding objects. When it oscillates incessantly, the mean direction should be taken. In all cases, but especially when the Vane is stationary, and when the wind is feeble, reference may be made to the direction of smoke, etc., in well-exposed situations. Careful observations are recommended to be made on the changes in the direction of the wind; and during storms, extra observations at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, is likely to give highly valuable and important results, particularly in connection with the system of thickly-planted Stations over a limited district round Edinburgh called STORM STATIONS, in the course of being established by the Society for the systematic investigation of the relation of the force of the wind to BAROMETRIC GRADIENTS, and other points connected with storms.

2. As regards Velocity and Pressure.

The Council would recommend the Hemispherical Cup Anemometer,—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the mean Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind at any particular hour of observation, the Pressure Anemometers recently brought under the notice of the Society by Mr. T. Stevenson, the Honorary Secretary, and Mr. R. Ballingall, the Society's Observer at Eallabus, are recommended as likely to secure uniformity in making observations on the Force of the Wind.

Rain Gauges.

Many causes conspire to produce anomalies in Rain Returns, arising partly from the difficulty of obtaining a perfectly unobjectionable situation for observation, and partly from the defective nature of the instruments used. The Rain Gauge should not be placed on a slope or terrace, but on a level piece of ground, in as open a situation as the Observer can secure for it. As it is often difficult to obtain a position as free and unobstructed by surrounding objects as is desirable, care should be taken to place it at some distance from shrubs, trees, buildings, or other obstructions, at least as many feet from their base as they are in height. The more important directions, towards which it is most desirable to have a free exposure, are, in the order of their importance, S.W., N.E., S.E., S., and W. The rim of the gauge must be perfectly level, and fixed so that it will remain level in all weathers, and be at a height of one foot above ground, over grass. In such gauges as Fleming's, which are furnished with a measuring-rod attached to a float, the rod ought to be fixed down, and the float rise to its height only at the time the instrument is read, it being found that a stem projecting above the rim of the gauge seriously interferes with the proper measurement of the Rainfall. When a measuring-glass is used, care should be taken to hold it quite perpendicular. The Rain Gauge ought to be read daily at 9 A.M., and the reading entered in the Returns of the previous day. If the Gauge is read once a month, the reading is to be made on the first of the month, and the amount entered for the previous month.

Snow-falls.

Snow-falls may, for convenience, be registered in the rain columns, under the following conditions:—When a Snow shower occurs, it should be noted in the 'Remarks,' and the letter S affixed to the depth of water received in Gauge. The depth of the snow must be measured in some open place where no drift is observed, and registered in addition to, and as a check upon, the indications of the Rain Gauge. For wind, rain, and snow, as indeed in every column, the Observer cannot be too careful to register observations only; and nothing that partakes of the nature of deduction or inference.

Clouds.

Convenient abbreviations for the nomenclature of Clouds will be found on the other side. The amount of Cloud ought to be estimated from the greater or less obscuration of the sky overhead (*i.e.* within 20° or 30° of the zenith). The strata of Clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the Clouds' column, though their appearance and changes may be noted among the Remarks. The amount of Cloud is entered from a scale of 0 to 10; thus, when the sky overhead is free from Clouds it is entered 0, when half-covered by Clouds, 5, wholly covered, 10, and so on.

Observations of the Clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—Thus, in the column Velocity and Direction, 6, S. W.

——— will indicate that the upper strata of Clouds travel with
2, W.

extreme velocity from S.W., and those in the lower regions from W., with one-third the speed of the former. Again, in the second

4, st.
Cloud column, an entry of ——— will indicate that the higher
2, cu-st.

regions are covered to the amount of 4-tenths with stratus Clouds; and that the sky is further obscured to the extent of 2-tenths by lower Clouds of the cumulo stratus kind.

Remarks on peculiar Clouds, accompanied with drawings, will assist materially in the development of a more exact nomenclature of Clouds, as well as throw light on the electrical, and other of the more obscure phenomena of Meteorology.

Sunshine.

The approximate number of Hours in which objects in the sun's rays cast shadows, should be entered in the proper column.

Underground Thermometers.

As the germination and growth of crops and plants generally depend greatly on the temperature of the soil,—its amount and constancy,—the Council recommend that Observations in this interesting department be made at 9 A.M., by Thermometers permanently fixed in the soil, their bulbs being sunk to depths of 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain-water being conveyed to the bulbs by the stems or wooden frames.

Temperature of the Sea.

A knowledge of the Temperature of the Sea is not only in itself, but in its relations to that of our island, a most important branch of Meteorology. The Council therefore recommend that the Temperature of the Sea be carefully taken by a properly constructed apparatus, from boats, or, if this be impracticable, from the ends of piers and rocks round the coast, where it is not influenced by that of river water, and as little influenced as possible by currents sweeping along the coast, and thus acquiring the temperature of the land, either greatly heated by the sun or cooled by nocturnal radiation. At or near the time of high water, in cases where the observations cannot be taken daily, the observation may be made on the 5th, 15th, and 25th of each month. When convenient, extra Sea Observations might be taken for other and greater depths, noting always the Temperature of the Air, and the Hour of Observation. It is also very desirable that observations on the daily Maxima and Minima by Thermometers continuously immersed, be instituted at points along the coast, by the method proposed by Mr. T. Stevenson, and already commenced at Peterhead and Liverpool.

Temperature of Wells.

The Temperature of the water at the bottom of Wells ought, when practicable, to be taken, both the depth of the Well and of the water being noted.

Ozone.

Mention what Test-Papers are used, Schönbein's or Moffat's, etc. The Paper is affixed by a pin to a board in the Thermometer Box, and the indications registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus $3^{S.W.}_{4}$, as an Ozone entry in the schedule will indicate that the Ozone paper is tinted as 3 on the scale, that the wind is from the N.W., and that its force on the scale 0—5 is 4, or blowing fresh.

Atmospheric Electricity.

Too much importance cannot be attached to the electric condition of the atmosphere in connection with terrestrial magnetism, barometrical, thermometrical, and meteorological phenomena generally. A proper Electrometer is, in truth, necessary to every complete meteorological observatory.

Remarks.

The Remarks column is unavoidably too narrow. Some of the most valuable Observations that can be taken are those for which no rules can be given nor hours assigned. The use of contractions ought, therefore, to be taken every advantage of, and a list of such as are in general use is given at the foot of the column. Besides special and extraordinary Observations, great prominence ought to be given in this column to Prevalent Diseases, differences in character, colour, velocity, and direction between the Lower and Upper Strata of clouds, the Colour of the Sky, etc. Remarks ought to be made on the occurrence of Meteors, Aurore Boreales, remarkable depressions, elevations, and fluctuations of the Barometer, Thunder-Storms, and remarkable falls of Snow, Hail, or Rain, the Hour of Storms of Wind commencing, attaining their maximum, and ending, as well as such Notes on Storms as have been hinted at above. When lofty hills are in the vicinity of a Station, the Height of Clouds and of the Snow-line in winter should be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. should be registered, either in two columns, otherwise unoccupied, or ruled off for the purpose, from the column of 'Remarks.'

Observations in connection with the Periodic Return of the Seasons.

Observations in connection with the Periodic Return of the Seasons, possess not only great scientific value, but are of considerable importance in connection with Agriculture, Horticulture, and Natural History. The Council would direct the special attention of Observers to the registration of such phenomena, so that the published Summaries may fairly represent the whole of Scotland. Observations ought to be confined to individual trees and shrubs; to particular species of birds, and, in the case of crops, to specified sorts reared from year to year on a selected piece of ground or farm. The Annual Table, published yearly in the Society's Journal, will indicate the species of plants and animals to which special attention is more particularly directed.

The Council recommend Observers, before purchasing new instruments, and in repairing old ones, to communicate with the Meteorological Secretary, in order that every instrument may be examined and improved before being used; and they consider it necessary that he should have full power to reject any instrument which, on being presented for comparison, does not afford him satisfaction.

(By Order) A. B.

EDINBURGH, *December* 1888.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	Leaf Buds first Appear.	In Leaf.	Divested of Leaves.
Alder,				
Ash,				
Beech,				
Birch,				
Elm,				
Larch,				
Lime,				
Oak,				
Sycamore or Plane,				

SHRUBS, ETC.	First in Blossom.
Barberry,	
Bourtree or Elder,	
Broom,	
Hazel,	
Hawthorn,	
Holly,	
Laburnum,	
Lilac,	
Mazereon,	
Mountain Ash or Rowan,	
Red Flowering Currant,	
Rhododendron Pontieum,	
Whin,	

FRUITS.	First in Blossom.	Fruit Ripe, generally.
Apple,		
Black Currant,		
Cherry,		
Gean,		
Gooseberry,		
Peach,		
Pear,		
Plum,		
Strawberry,		

CROPS, mentioning variety.	Sowing or Planting.	Appearing above Ground.	In Ear or Flower.	First Cut or Raised.
Barley,				
Bere or Bigg,				
Oats,				
Wheat,				
Beans,				
Pease,				
Potatoes,				
Turnips,				
Rye Grass,				

MIGATORY BIRDS.	First Arrival.	Departure.
Cuckoo,		
Curlew,		
House-Swallow,		
Lapwing,		
Plover,		
Sand-Martin,		
Starling,		
Swan,		
Rail or Corn Crake,		

Have the goodness also to state any information you may be able to collect relative to the Crops of Grain, Hay, Potatoes, Turnips, Fruits, etc., whether plentiful, or in perfection; whether any have suffered from blight, disease, etc. Whether Epizootic disease prevails among cattle; and the Agricultural condition of the district generally.

To the SECRETARY
Scottish Meteorological Society,
122 George Street,
EDINBURGH.

BOOK POST.

Aberdeen
Nov 1892

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Gordon's College, Aberd, County of Aberdeen, in Lat. 57°9'N, Long. 2°6'W, Distance from Sea 1 miles.

Height of Cistern of the Barometer above Mean Sea-Level 66 feet, above Ground 2½ feet. During the MONTH of December 1892.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER. 9 h. A.M. * No.	Attached Thermometer	9 h. P.M. Barometer. No.	Attached Thermometer	SELF-REGISTERING THERMOMETERS, Read Daily, at 9 P.M. Protected in Shade, 4 feet above Ground. Max. No.	Min. No.	Exposed Black Bulbs. Max. in Sun's rays No.	Min. on Grass No.	HYGROMETER. Dry No.___ Wet No.___ 9 h. A.M. Dry bulb.	Wet bulb.	9 h. P.M. Dry bulb.	Wet bulb.	Rain. No. of hours in which it fell.	Amount in inches. No.	WIND. 9 h. A.M. Direction.	Force	9 h. P.M. Direction.	Force	Readings of the H. Cup Anemometer. No.___ 9 h. A.M.	CLOUDS. 9 A.M. Velocity (0—6) and Direction.	Amount (0—10), and Species.	P.M. Velocity (0—6) and Direction.	Amount (0—10), and Species.	SUNSHINE. Hours.	THERMOMETERS under Ground. 9 h. A.M. No. 3 inches.	No. 12 inches.	No. 22 inches.	Temperature of WELL at depth of feet, No.	SEA. Temperature at 1 fathom, and Density.	OZONE. 0—10. 9 A.M.	9 P.M.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc. *Mention the hour at which Storms, including Thunder and Lightning, began and ended.*	Days of Month.
		inches.	°	inches.	°	°	°	°	°	°	°	°	°																							
	1	29.780	44.5	29.820	42.0	36.0	26.3			31.2	30.8	29.4	28.8		.01	N.W.	½	N.W.	1		10	St	2	St	3										1
	2	30.032	46.0	29.846	42.0	32.2	27.0			29.1	28.3	30.1	29.3		—	N.W.	1	N.W.	2		1	Cu	5	St	3									Snow		2
AB	3	29.~~310~~ ~~310~~	41.0	29.094	40.0	35.8	28.2			36.0	35.2	31.8	29.6		.07	S.W.	2	W	1½		10	St	2	St	—											3
	4	29.126	42.0	29.330	41.0	32.2	27.5			32.5	31.7	32.0	31.2		.04	N.W	1½	N.W.	2		8	Cu	5	Cu-St	1											4
	5	29.390	40.0	29.474	38.0	32.4	25.5			29.0	28.5	29.2	28.2		.08	N.W.	1½	N.W.	1		3	Cu	2	St	3											5
	6	29.592	42.0	29.956	43.0	37.8	28.1			34.1	33.6	37.8	37.0		.34	N.W.	1	N.W.	1		10	St	6	Cu-St	3											6
	7	~~30.120~~ ~~30.120~~	41.0	~~29~~ 30.156	42.0	37.8	29.1			30.1	29.7	34.0	33.2		—	N	—	N	1		6	Ci-Cu	6	Cu	2											7
	8	30.088	42.0	29.710	43.0	34.2	29.3			30.8	30.2	31.8	31.6		.07	N	1	W	½		2	Cir	5	St	2											8
	9	29.790	40.5	29.932	44.0	34.2	29.0			31.6	30.2	32.2	31.8		—	N.W.	1	N	1		8	Cu	2	Cir	2									Snow		9
	10	29.592	39.0	29.190	42.0	38.2	22.0			33.0	32.4	38.0	37.1		.06	S.W.	1½	W	1		10	St	10	St	1											10
	11	29.130	41.0	29.070	42.0	38.1	31.0			35.2	34.0	38.6	37.0		.04	S.W.	1	S.W.	1		2	St	5	St	2											11
	12	29.172	44.0	29.390	42.0	38.2	34.0			38.2	36.8	37.0	36.2		.02	W.x	1½	N.W.	2		10	St	5	St	—											12
	13	29.692	43.0	29.840	41.0	37.2	30.4			36.1	35.0	33.8	33.0		.13	N.W.	1½	N.W.	1		2	Cu	1	St	3											13
TB	14	29.592	41.0	29.710	43.0	~~43.1~~ ~~38.1~~	31.2			39.2	38.1	38.0	36.1		—	W	½	W	—		10	St	4	St	—									Fog in morning		14
	15	29.674	45.0	29.840	43.0	42.8	34.0			39.3	37.2	40.1	37.4		—	W	½	W	1½		10	St	2	St	½									Fog " "		15
	16	30.020	46.0	29.820	47.0	44.2	36.8			39.2	36.4	44.2	42.8		—	W	½	W	1		10	St	10	St	1											16
	17	29.924	48.0	29.770	49.0	51.2	42.3			45.2	43.0	46.0	44.3		.01	S.W	½	S.W.	1		8	St	2	St	1											17
	18	29.670	49.5	29.820	48.0	51.0	40.8			50.1	48.2	42.5	40.0		.04	W.	2	W	½		1	St	1	St	4											18
	19	29.930	47.0	29.974	42.0	47.2	36.5			41.5	39.2	40.4	38.3		—	W.	1	W.	1		10	St	5	St	—											19
	20	30.040	45.0	30.070	45.0	45.0	34.1			36.0	34.1	40.0	38.0		.03	W.	½	W.	½		10	Ci-Cu	10	St	—											20
	21	30.020	48.0	30.004	46.0	41.8	38.2			42.0	41.2	41.0	40.0		.05	W.	½	W.	½		10	Cu-St	10	St	—											21
	22	30.010	48.0	30.040	47.5	43.2	40.1			41.3	41.0	43.0	42.8		.10	W.	1	N.W.	1		10	Nim	10	St	—											22
	23	30.104	49.0	30.070	47.0	44.2	36.7			40.2	39.0	43.4	42.8		—	S.W.	1½	W	1		10	Cu-St	2	St	3											23
	24	29.950	45.0	29.880	42.0	43.8	29.0			34.0	30.2	30.0	29.0		—	N.W.	1	N.W.	½		4	Ci-Cu	2	St	3											24
	25	29.920	40.0	29.954	38.0	32.4	22.0			31.8	31.0	22.0	21.8		—	W.	1	W	½		1	St	1	St	3½											25
	26	30.040	40.0	30.094	40.0	34.2	~~29.1~~ 19.1			29.5	29.3	29.0	29.0		—	S.W.	—	S.W.	½		10	St	1	St	—									Fog during the day		26
	27	30.106	36.0	30.116	38.6	29.1	22.0			25.3	25.0	24.2	24.0		—	S.W	½	S.W.	—		1	St	2	St	3											27
	28	30.004	38.0	29.890	37.0	37.0	21.2			28.2	28.0	36.1	35.8		—	S.W.	½	S.W.	—		1	St	10	Cu-Cu	2											28
	29	29.748	40.0	29.710	41.0	37.2	32.1			36.1	35.4	36.2	35.4		—	S.W.	1½	S.W.	½		2	Ci-St	1	St	3											29
	30	29.782	41.0	29.824	41.0	38.0	32.0			37.5	36.8	35.4	35.2			S	1	S.	½		10	Cu-St	10	St	—											30
	31	29.930	40.0	29.984	40.0	39.2	34.3			36.4	33.7	37.0	35.2			S.W.	1	S.W	½		10	St	4	Cu-St	1											31
	Sums.	13 345	12 1	14 155	11	158	46			147	139	136	129																							
		24·228	133·25	24·378	131·65	70·69	94·98			1099·7	1063·2	1103·6	1071·9		1·03		30		27		210		143		50										
	Means.	29·782	43·0	29·786	42·5	38·9	30·6			35·5	34·3	35·6	34·6				1·0		0·9		6·8		4·6												
	† Total Corrections for Instrumental Errors.	+006	−·7	+006	−·7												06		06		5·7														
	‡ Corrections for Diurnal Range.																																			
	"Corrected Means."	29·788	42·3	29·792	41·8																															
	No. of Column.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30					

NOTATION USED IN GENERAL REMARKS.

a.	*denotes* aurora.		m.	*denotes* meteor.	
ci.	,,	cirrus.	ms.	,,	meteors.
ci-cu.	,,	cirro-cumulus.	n.	,,	nimbus.
ci.-s.	,,	cirro-stratus.	r.	,,	rain.
cu.	,,	cumulus.	h. r.	,,	heavy rain.
cu.-s.	,,	cumulo-stratus.	c. h. r.	,,	continued heavy rain.
d.	,,	dew.	s.	,,	stratus.
f.	,,	fog.	sc.	,,	scud.
fr.	,,	frost.	s.	,,	sleet.
h.-fr.	,,	hoar-frost.	s.	,,	snow.
h.	,,	haze.	so. ha.	,,	solar halo.
h. d.	,,	heavy dew.	sq.	,,	squall.
hl.	,,	hail.	sqs.	,,	squalls.
l.	,,	lightning.	t.	,,	thunder.
li. cl.	,,	light clouds.	t. s.	,,	thunder-storm.
li. sh.	,,	light showers.	w.	,,	wind.
lu. co.	,,	lunar corona.	g.	,,	gale of wind.
lu. ha.	,,	lunar halo.			

TABLE FOR ESTIMATING FORCE OF WIND.

Estimated Force, 0—6.	Common Designation.	Estimated Force, 0—6.	Common Designation.	Estimated Force, 0—6.	Common Designation.
0	Calm	1·5	Light breeze	4	Blowing hard
0·5	Very light air	2·	Fresh breeze	5	Blowing a gale
1·	Light air	3·	Very fresh	6	Violent gale

BARometer, "corrected Mean" at 9 A.M., *minus* the Correction †† for Temp. (Col. 2), = 29.788 − .037 = 29.751

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction †† for Temp. (Col. 4), = 29.792 − .036 = 29.756

Mean at Station, corrected, and at 32°, = 29.754

Correction for height, 66 feet above Mean Sea-level, = .074

Mean, reduced to 32°, and Sea-level, = 29.828

Highest Reading, corrected for Index error, on the 7 th, = 30.162

Lowest Do. Do., on the 11 th, = 29.076

Difference, or **Monthly Range**, = 1.086

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month**, (corrected for Index Errors), on the 17 th, = 57.2

Lowest in Month, corrected for Index errors, on the 26 th, = 19.1

Difference, or **Monthly Range**, = 32.1

"Corrected **Mean**" **of all the Highest**, (Col. 5), = 38.9

"Corrected **Mean**" **of all the Lowest**, (Col. 6), = 30.6

Difference, or **Mean Daily Range**, = 8.3

** Calculated **Mean Temperature** of Month, = 34.7

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the th, =

"Corrected **Mean**," (Col. 7), **of Black Bulb, Max. in Sun**, =

Lowest at Night, Black Bulb (corrected for Index errors), on the th, =

"Corrected **Mean**," (Col. 8), **of Black Bulb, Min.** on grass, =

Difference of above means or range ("exposed"), =

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb**, (Cols. 9 and 11), = 35.5

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb**, (Cols. 10 and 12), = 34.4

‡‡ Computed **Temperature of Dew-Point**, = 32.6

‡‡ Do. **Elastic Force of Vapour**, = .187

‡‡ Do. **Weight of Vapour in a Cubic Foot of Air**, = 2.10

‡‡ **Relative Humidity** (Saturation = 100), = 90

RAIN fell on 15 Days; **Amount in Inches**, = 1.03

WIND. SUMMARY.

Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	2	0	0	0	1	10	10	8		1·0	
P.M.	2	1	0	0	1	7	12	8		0·9	
Mean.	2	1	0	0	1	8	11	8	0	0·95 = 0 gale	

* Each instrument tested at the Office in Edinburgh bears the stamp "S.M.S.;" and a number to be entered in the Heading: or the Number and Initials of the Maker may be here given.
† Embracing corrections for both capillarity and Index Errors.
‡ The Diurnal Range for Scotland is as yet unknown.
†† *Practically*, though not *absolutely* a *minus* correction.
‡‡ These "Hygrometrical Deductions" are calculated from Glaisher's Hygrometrical Tables, Second Edition *only*.
** While the Diurnal Range is unknown, the Arithmetical Mean of Cols. 5 and 6 will be entered as the "Calculated Mean Temperature."
Any observations not taken under the Conditions specified in the Directions on the other side, or noted at the Top of each column, must be marked as such by the observer, in each Schedule. *See over.*

Observations made and Return verified by { James Dale Teacher in Robert Gordon's College, Aberd.

(*Signed*)

Greatest Daily Range = 16°2 with 10th.

W.S.

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

ONE of the chief objects that the SCOTTISH METEOROLOGICAL SOCIETY proposed to itself when the Society was established in 1855, was to secure PERFECT UNIFORMITY in the system of observation pursued at all its Stations. Uniformity in the observations is absolutely necessary to justify the publication of Monthly Results from different observations, it being found that differences between the Returns from two Stations, so very considerable as to render them quite incomparable, may arise from dissimilarity in the position or shelter of instruments, different hours of observation, or even from the use of differently constructed instruments. It is therefore hoped, that those who kindly furnish Reports to the Society will, by a scrupulous attention to the following Directions, secure for their Monthly Returns an accuracy and value commensurate with the labour and pains involved in making them; and, for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

The Council recommend that Observations be made precisely at 9 A.M. and 9 P.M. (Greenwich or Railway Time only),

Hour of Observation. as specified in the following remarks, or at the top of the columns of the Schedule. It is hoped that the utmost punctuality in the time of reading the instruments will be observed. Observers, in some few cases, may find this impossible; in such instances, they are specially requested to mark opposite every reading the time at which it was taken, if not at 9 A.M. or 9 P.M.

Barometer. Weather-Glasses and Aneroids, though well suited to indicate roughly variations of atmospheric pressure, are not fitted for scientific purposes. No Barometer should be used for Meteorological Observation that is not supplied with some means of adjustment or compensation which will secure that the height of the mercury in the tube is accurately measured from the fluctuating surface of the mercury in the cistern.

The Barometer in which the error arising from the fluctuating surface of the mercury in the cistern is entirely got rid of is FORTIN'S Barometer, the arrangement consisting in applying pressure by means of a screw to the bottom of the cistern, which is made of flexible leather, thus raising or depressing the surface till it just meets the ivory point which forms the zero point of the fixed scale.

The Barometer originally constructed by Mr. Adie of London, and usually called the Board of Trade Barometer, has the great convenience of requiring no adjustment of the cistern. Its scale-inches are not true inches, but so much shorter as to compensate the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This is an excellent Barometer for ordinary Observers, inasmuch as it entirely eliminates the error of observation likely to arise in not a few cases in setting the instrument to the zero point of the fixed scale when the light is not good. To show the accuracy with which these Barometers are made, it may be stated, that one was compared, during a whole year, with the Society's Standard Barometer, particular care being given to make the comparison when atmospheric pressure was rising or falling very rapidly, with the result that none of the readings differed from those of the Standard more than 0·003 inch.

A modification of Fortin's Barometer is used at a number of the Society's Stations, by which the coincidence of the zero point with the surface of the mercury is indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When the index-line on this little piston-rod is brought, by the adjusting screw, to form one straight line with those on its ivory frame, the surface of the mercury is then at the exact height from which the scale is graduated. In taking an observation, this preliminary setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the vernier.

It is absolutely necessary that the Barometer which is to be used shall have been compared with a Standard Barometer.

The Barometer should be suspended in as good a light as can be secured, and to facilitate the reading, a piece of white paper may be put behind the tube. It must be hung truly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire, and must not be hung against a wall heated by a flue. The object being to secure that the whole instrument, including the brass fittings, the contained mercury, and the attached Thermometer, shall be, when read, at one uniform temperature, it is evident that the best position is that which is least liable to sudden changes of temperature.

In taking an Observation, the Attached Thermometer is first noted: the tube must then be gently tapped, and the cistern-adjustment carefully made. The eye, by raising and lowering it, must be brought into the plane of the back and front of the index—usually the lower edge of the vernier, which must be carefully adjusted so as to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly, so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will facilitate an accurate adjustment and reading of the Barometer. A mistake not unfrequently made by those beginning to observe, consisting in setting the edge of the vernier to the level of the clear surface of the mercury which is in direct contact with the glass tube, must be carefully avoided.

The errors most frequently made in reading the Barometer are errors of 1·000 inch, 0·500 inch, and 0·050 inch; that is to say, instead of 29·365 inches, either of the following is sometimes set down—viz. as 30·365 inches, 28·365 inches, 29·865 inches, or 29·815 inches. Experience having shown that even the very best Observers make these mistakes, particular attention is directed to the matter.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must first be screwed so as to form a tight plug to the cistern, thus preventing the escape of the mercury. Then screw up the mercury not quite to the top of the tube, but to within a quarter of an inch of it, and take down the instrument; it should then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case if, on inclining the instrument, a sharp tap is produced when the mercury strikes the top of the tube. If a dull tap is heard, there is air in the tube, which must be got rid of.

As Barometers are liable to be deranged by the introduction of air into their tubes, on removal from place to place, or in being roughly handled, it may be useful to Observers to know how the air may be expelled. First close up the cistern by screwing the ivory peg tight, so as to prevent the escape of mercury; then screw up the mercury to about half an inch from the top of the tube; and having slowly inverted the instrument, place the top of it on a yielding substance, such as the boot, and gently tap on the cistern with the palm of the hand, so as to induce the air to ascend through the column to the cistern, whence it may escape. Since there is the weight of two atmospheres—the pressure of the mercury in the Barometer, and the air outside—pressing on any air that may be inside the tube, it is usually a tedious operation to get it wholly expelled. After repeated trials, however, it is generally accomplished; and the clear metallic sound of the mercury, when gently struck against the top of the glass tube, will show when the whole of the air has been expelled. On hanging up the Barometer, care must be taken to screw down the mercury in the tube before unfastening the float of the cistern, for, if this be not attended to, the mercury will flow out, and the instrument be seriously damaged.

The Council of the Society recommend that the Self-Registering Thermometers, and the Dry and Wet Bulb Hygrometer, be kept in Stevenson's Louvre-boarded Box for

Protection and Position of Thermometers. Thermometers, painted white inside and outside, and screwed to four stout posts, also painted white, firmly fixed in the ground. The posts must be of such a length that when the Thermometers are hung in position the Bulbs of the Minimum Thermometer, and of the Dry and Wet Bulb Thermometers, will be exactly at the same height of FOUR FEET above the ground, the Maximum Thermometer being hung immediately above the Minimum Thermometer. The Thermometer Box is to be placed over a plot of grass, and in a free open space to which the sun's rays have free access during as much of the day as surrounding conditions enable the Observer to secure. The Thermometers are suspended on cross-laths in the centre of the Box, and face the door, which should open to the north.

The Council regard the question of UNIFORMITY OF HEIGHT ABOVE GROUND, AND METHOD IN PROTECTING THE THERMOMETERS, as vital in every system of Meteorological Observation, since without it Observations made at different Stations are incomparable, thus rendering it impossible to compare the Climates of places with each other as regards their most important features.

Professor Phillips, and Negretti and Zambra's Maximum Thermometers, and Rutherford's Minimum Thermometer,

Self-Registering Thermometers. are recommended. It is recommended that these Thermometers be graduated on the glass stem. The Minimum Thermometer is liable to two derangements—viz., the column of spirit breaking, and part of the spirit distilling by high temperature and lodging at the top of the tube. This derangement is of occasional occurrence with protected Thermometers, but of frequent occurrence with exposed Thermometers. Hence a systematic examination of Minimum Thermometers ought to be a regular part of the work carried on by each Observer.

Fortunately, Spirit Thermometers may be easily set right by any one, when the column of spirit chances to separate. Let the Thermometer be taken in the hand by the end farthest from the bulb, raised above the head, and then forcibly swung down towards the feet; the object being, on the principle of centrifugal force, to send down the detached portion of spirit till it unites with the column. A few throws, or swinging strokes, will generally be sufficient for the purpose; after which the Thermometer should be placed in a slanting position, to allow the rest of the spirit still adhering to the sides of the tube to drain down to the column. But another method must be adopted, if the portion of spirit in the top of the tube be small. Heat should be applied slowly and cautiously to the top end of the tube where the detached portion of spirit is, which, being turned into vapour by the heat, will condense on the surface of the unbroken column of spirit. Care must be taken that the heat is not applied too quickly; for, if this be done, the tube will break and the instrument be destroyed. The best way to apply the requisite amount of heat is by bringing the end of the tube slowly down towards a minute flame from a gas-burner; or, if gas be not at hand, a piece of heated metal will serve instead.

The bulbs of the Thermometers for registering the greatest heat

Black-Bulb Thermometers. from the sun's rays, and the least from radiation during night, have a black coating, which may easily be made, or mended, by the application of a mixture of lampblack and printer's ink. They are placed in shallow blackened boxes, whose sides protect the bulbs from the wind The Maximum should be freely exposed to the sun, and the Minimum should rest on wooden supports a few inches from the surface of the grass, in an open situation. Snow must not be allowed to cover either of these Thermometers; nor the sun's heat to affect the Minimum Thermometer by distillation. Black-bulbs enclosed in 'glass jackets' may also be used, being indeed preferable to the above. It must, however, be added, that the whole subject of the observation of Solar and Terrestrial Radiation is not yet in a sufficiently advanced state to warrant the exclusive recommendation of any one of these methods.

The Hygrometer in use at the Society's Stations consists of two

Dry and Wet Bulb Hygrometer. Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved form of this apparatus seriously vitiate the Hygrometrical Observations, Observers are specially requested to attend to the following conditions:—The bulbs must hang down by at least an inch free from the scales and frame to which they are attached; the frame must be such as will bring the tubes forward by an inch from any board on which it may be suspended; the water-cup must be covered, and altogether placed to the side, and a little below the level of the wet bulb, but in no case under the bulbs; the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the Observer that the muslin is always clean and moist, and the water pure. In frosty weather, observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

In reading the Thermometer great care must be taken to bring

Reading of the Thermometer. the eye exactly opposite the tip of the index or column of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°·9, 40°·0, or 40°·1; or again, 40°·4, 40°·5, 40°·6, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40½°, respectively. So also 40¼°, and 40¾°, more or less, must be registered 40°·2, or 40°·3, and 40°·7, or 40°·8 respectively. In reading Rutherford's Minimum Thermometer, the indication of that end of the index which is next the surface of the spirit is alone noted. On opening the Thermometer Box, the Dry and Wet Bulb Thermometers are to be first, and rapidly, read, inasmuch as they are readily affected by heat from the person of the Observer.

The Hygrometer is read at 9 A.M. and 9 P.M. The Self-Registering Thermometers are read at 9 P.M. only, as in-

Hour of observing Temperature. dicating the greatest and least degrees of temperature in the 24 hours preceding. It is not a matter of indifference when the Self-Registering Thermometers are read, since, in winter at least, the extremes may occur at any hour; and it is necessary to refer their occurrence to their proper meteorological day. In the Society's schedules, the indications registered on the 3d are those of a series of phenomena commencing at 9 P.M. on the 2d, and extending till 9 P.M. on the 3d.

No instrument ought to be used for Meteorological purposes

Verification of Thermometers. till it has been carefully tested by comparison with a standard Thermometer. When such Thermometers as are not graduated on the stem, but merely on an attached scale, undergo repairs, they are very liable to be moved from their position on the Scale, and ought never afterwards to be used without being re-tested. The Self-Registering, especially the Minimum Thermometers, ought frequently to be compared with the dry bulb of the Hygrometer. The freezing-point of each Thermometer, marked by a scratch on the tube, ought to be tested once a year, in snow or melting ice.

In selecting instruments, the following points require attention:—The divisions of the vernier of Barometers in reference to their scales, and the perfect freedom of the Barometer from air; the correct numbering of the scale of every instrument; the rejection of Thermometers the frameworks of which are not likely to stand exposure to the weather, as shown in the past by repeated and annoying breakages of Thermometers of similar construction; and as regards Maximum Thermometers, either Negretti and Zambra's, or Phillip's, whether they will act at the highest temperatures they may be required to register. By the laws of the Society, Members and Observers have a right to have their instruments compared by the Secretary, and to advise with him regarding the purchase of instruments.

Very great care should be bestowed on the Observations of the

Wind. Wind, the accuracy of which, both as regards Direction and Force, is so essential towards the right discussion of many of the more important problems of the science.

A Wind-Vane ought to be elevated at least 12 feet above surrounding objects. When it oscillates incessantly, the

1. As regards Direction. mean direction should be taken. In all cases, but especially when the Vane is stationary, and when the wind is feeble, reference may be made to the direction of smoke, etc., in well-exposed situations. Careful observations are recommended to be made on the changes in the direction of the wind; and during storms, extra observations at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, is likely to give highly valuable and important results, particularly in connection with the system of thickly-planted Stations over a limited district round Edinburgh called STORM STATIONS, in the course of being established by the Society for the systematic investigation of the relation of the force of the wind to BAROMETRIC GRADIENTS, and other points connected with storms.

The Council would recommend the Hemispherical Cup Anemo-

2. As regards Velocity and Pressure. meter,—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the mean Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind at any particular hour of observation, the Pressure Anemometers recently brought under the notice of the Society by Mr. T. Stevenson, the Honorary Secretary, and Mr. R. Ballingall, the Society's Observer at Eallabus, are recommended as likely to secure uniformity in making observations on the Force of the Wind.

Many causes conspire to produce anomalies in Rain Returns,

Rain Gauges. arising partly from the difficulty of obtaining a perfectly unobjectionable situation for observation, and partly from the defective nature of the instruments used. The Rain Gauge should not be placed on a slope or terrace, but on a level piece of ground, in as open a situation as the Observer can secure for it. As it is often difficult to obtain a position as free and unobstructed by surrounding objects as is desirable, care should be taken to place it at some distance from shrubs, trees, buildings, or other obstructions, at least as many feet from their base as they are in height. The more important directions, towards which it is most desirable to have a free exposure, are, in the order of their importance, S.W., N.E., S.E., S., and W. The rim of the gauge must be perfectly level, and fixed so that it will remain level in all weathers, and be at a height of one foot above ground, over grass. In such gauges as Fleming's, which are furnished with a measuring-rod attached to a float, the rod ought to be fixed down, and the float rise to its height only at the time the instrument is read, it being found that a stem projecting above the rim of the gauge seriously interferes with the proper measurement of the Rainfall. When a measuring-glass is used, care should be taken to hold it quite perpendicular. The Rain Gauge ought to be read daily at 9 A.M., and the reading entered in the Returns of the previous day. If the Gauge is read once a month, the reading is to be made on the first of the month, and the amount entered for the previous month.

Snow-falls may, for convenience, be registered in the rain columns,

Snow-falls. under the following conditions:—When a Snow shower occurs, it should be noted in the 'Remarks,' and the letter S affixed to the depth of water received in Gauge. The depth of the snow must be measured in some open place where no drift is observed, and registered in addition to, and as a check upon, the indications of the Rain Gauge. For wind, rain, and snow, as indeed in every column, the Observer cannot be too careful to register observations only; and nothing that partakes of the nature of deduction or inference.

Convenient abbreviations for the nomenclature of Clouds will be

Clouds. found on the other side. The amount of Cloud ought to be estimated from the greater or less obscuration of the sky overhead (*i.e.* within 20° or 30° of the zenith). The strata of Clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the Clouds' column, though their appearance and changes may be noted among the Remarks. The amount of Cloud is entered from a scale of 0 to 10; thus, when the sky overhead is free from Clouds it is entered 0, when half-covered by Clouds, 5, wholly covered, 10, and so on.

Observations of the Clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—Thus, in the column Velocity and Direction, 6, S. W.

———
2, W.

will indicate that the upper strata of Clouds travel with extreme velocity from S.W., and those in the lower regions from W., with one-third the speed of the former. Again, in the second

4, st.
Cloud column, an entry of ——— will indicate that the higher
2, cu-st.

regions are covered to the amount of 4-tenths with stratus Clouds; and that the sky is further obscured to the extent of 2-tenths by lower Clouds of the cumulo stratus kind.

Remarks on peculiar Clouds, accompanied with drawings, will assist materially in the development of a more exact nomenclature of Clouds, as well as throw light on the electrical, and other of the more obscure phenomena of Meteorology.

The approximate number of Hours in which objects in the sun's

Sunshine. rays cast shadows, should be entered in the proper column.

As the germination and growth of crops and plants generally

Underground Thermometers. depend greatly on the temperature of the soil,—its amount and constancy,—the Council recommend that Observations in this interesting department be made at 9 A.M., by Thermometers permanently fixed in the soil, their bulbs being sunk to depths of 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain-water being conveyed to the bulbs by the stems or wooden frames.

A knowledge of the Temperature of the Sea is not only in itself,

Temperature of the Sea. but in its relations to that of our island, a most important branch of Meteorology. The Council therefore recommend that the Temperature of the Sea be carefully taken by a properly constructed apparatus, from boats, or, if this be impracticable, from the ends of piers and rocks round the coast, where it is not influenced by that of river water, and as little influenced as possible by creeping along the coast, and thus acquiring the temperature, either greatly heated by the sun or cooled by nocturnal radiation. At or near the time of high water, in cases where the observations cannot be taken daily, the observation may be made on the 5th, 15th, and 25th of each month. When convenient, extra Sea Observations might be taken for other and greater depths, noting always the Temperature of the Air, and the Hour of Observation. It is also very desirable that observations on the daily Maxima and Minima by Thermometers continuously immersed, be instituted at points along the coast, by the method proposed by Mr. T. Stevenson, and already commenced at Peterhead and Liverpool.

Temperature of Wells. The Temperature of the water at the bottom of Wells ought, when practicable, to be taken, both the depth of the Well and of the water being noted.

Ozone. Mention what Test-Papers are used, Schönbein's or Moffat's, etc. The Paper is affixed by a pin to a board in the Thermometer Box, and the indications registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus $3^{N.W.}_{\frac{1}{4}}$, as an Ozone entry in the schedule will indicate that the Ozone paper is tinted as 3 on the scale, that the wind is from the N.W., and that its force on the scale 0—5 is 4, or blowing fresh.

Atmospheric Electricity. Too much importance cannot be attached to the electric condition of the atmosphere in connection with terrestrial magnetism, barometrical, thermometrical, and meteorological phenomena generally. A proper Electrometer is, in truth, necessary to every complete meteorological observatory.

Remarks. The Remarks column is unavoidably too narrow. Some of the most valuable Observations that can be taken are those for which no rules can be given nor hours assigned. The use of contractions ought, therefore, to be taken every advantage of, and a list of such as are in general use is given at the foot of the column. Besides special and extraordinary Observations, great prominence ought to be given in this column to Prevalent Diseases, differences in character, colour, velocity, and direction between the Lower and Upper Strata of clouds, the Colour of the Sky, etc. Remarks ought to be made on the occurrence of Meteors, Auroræ Boreales, remarkable depressions, elevations, and fluctuations of the Barometer, Thunder-Storms, and remarkable falls of Snow, Hail, or Rain, the Hour of Storms of Wind commencing, attaining their maximum, and ending, as well as such Notes on Storms as have been hinted at above. When lofty hills are in the vicinity of a Station, the Height of Clouds and of the Snow-line in winter should be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. should be registered, either in two columns, otherwise unoccupied, or ruled off for the purpose, from the column of 'Remarks.'

Observations in connection with the Periodic Return of the Seasons. Observations in connection with the Periodic Return of the Seasons, possess not only great scientific value, but are of considerable importance in connection with Agriculture, Horticulture, and Natural History. The Council would direct the special attention of Observers to the registration of such phenomena, so that the published Summaries may fairly represent the whole of Scotland. Observations ought to be confined to individual trees and shrubs; to particular species of birds, and, in the case of crops, to specified sorts reared from year to year on a selected piece of ground or farm. The Annual Table, published yearly in the Society's Journal, will indicate the species of plants and animals to which special attention is more particularly directed.

The Council recommend Observers, before purchasing new instruments, and in repairing old ones, to communicate with the Meteorological Secretary, in order that every instrument may be examined and improved before being used; and they consider it necessary that he should have full power to reject any instrument which, on being presented for comparison, does not afford him satisfaction.

(By Order) A. B.

EDINBURGH, *December* 1888.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	Leaf Buds first Appear.	In Leaf.	Divested of Leaves.
Alder,				
Ash,				
Beech,				
Birch,				
Elm,				
Larch,				
Lime,				
Oak,				
Sycamore or Plane,				

SHRUBS, ETC.	First in Blossom.
Barberry,	
Bourtree or Elder,	
Broom,	
Hazel,	
Hawthorn,	
Holly,	
Laburnum,	
Lilac,	
Mezereon,	
Mountain Ash or Rowan,	
Red Flowering Currant,	
Rhododendron Ponticum,	
Whin,	

FRUITS.	First in Blossom.
Apple,	
Black Currant,	
Cherry,	
Gean,	
Gooseberry,	
Peach,	
Pear,	
Plum,	
Strawberry,	

CROPS, mentioning variety.	Sowing or Planting.	Appearing above Ground.	In Ear or Flower.	First Cut or Raised.
Barley,				
Bere or Bigg,				
Oats,				
Wheat,				
Beans,				
Pease,				
Potatoes,				
Turnips,				
Rye Grass,				

Fruit Ripe generally.

MIGRATORY BIRDS.	First Arrival.	Departure.
Cuckoo,		
Curlew,		
House-Swallow,		
Lapwing,		
Plover,		
Sand-Martin,		
Starling,		
Swift,		
Rail or Corn Crake,		

Have the goodness also to state any information you may be able to collect relative to the Crops of Grain, Hay, Potatoes, Turnips, Fruits, etc., whether plentiful, or in perfection; whether any have suffered from blight, disease, etc. Whether Epizootic disease prevails among cattle; and the Agricultural condition of the district generally.

Aberdeen Dec. 1892

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To the SECRETARY
Scottish Meteorological Society,
122 George Street,
EDINBURGH.

BOOK POST.