

[illegible]

Departure.

INSTRUCTIONS FOR MAKING METEOROLOGICAL OBSERVATIONS

Those persons who kindly furnish Monthly Tables of the Weather to the Scottish Meteorological Society are requested to attend to the following Instructions, seeing that one of the most important ends of Meteorological Observations is their being comparable with one another; and for this purpose it is requisite that all should, if possible, observe at a like hour, and in a like manner, and have their Instruments placed, in so far as circumstances allow, in a like position :

Hour 9 Observations.—All instruments which are observed twice a day, should be read at the same hour morning and evening, in order to furnish mean results. The Society recommends *a quarter before nine o'clock, morning and evening*, as the most convenient hour; but should this be inconvenient for the observer, another hour may be chosen, attending, however, to the above rule, that this evening and morning readings be taken at the same hour, and this hour entered on the schedule.

Barometers of Messrs. Aids and Sor's construction are recommended; but any instruments may be used which have adjustable surfaces, and have been compared. Before this instrument is suspended for use it should be examined, in order to ascertain whether the space above the mercury is free from air. This is done by inclining the instrument somewhat from the vertical position, when, if free from air, the mercury will settle against the upper end of the tube with a sharp tap. The mercury should then completely fill the tube. If any air has got admittance, it should be driven into the stem by reversing the instrument, and tapping it gently with the hand. If it cannot be thus expelled, the instrument is useless till repaired.

The Barometer should be hung in a good light, and perfectly perpendicular, as ascertained by the plumb line; and it ought always to be gently tapped before taking the reading, to prevent adhesion of the mercury to the tube. In reading the eye ought to be placed on the exact level of the top of the column of mercury. The reading of the attached Thermometer ought always to be the first taken, as the heat of the breath, or the proximity of the person, are apt to influence its readings.

The corrections necessary to be applied to the Brometer readings depend on the form of the instrument. The mode of making these corrections, and the tables employed for the purpose, will be found in the "Report of the Committee of the Royal Society on Physics and Meteorology," 1840, page 18. The daily readings of the Brometer ought to be entered on the *Schelléus* as *readings*, and the corrections only applied to the mean for the month. *Self-Registering Thermometers and Hygrometers*.—These should be placed alongside of each other, in a place freely exposed to the air, but protected from sunshine, and from reflected heat, as well as from radiation and from rain, and as near as may be *four feet* from the general surface of the ground. Different contrivances are used for this purpose, either a double ventilated box with louver-boarded sides, faced at a north window, and projecting 12 inches from the wall, so as to allow a free current of air to pass between the box and the wall; or in a double meat-stall ventilated box with louver-boarded sides, faced in an exposed place, and if possible over grass. Whatever means are finally decided on, the position of the instruments should be mentioned, and should not be changed (without due notice being given to the Secretary) in order that the results of one month's observations may be strictly comparable with those of another.

The *Saltzman* Thermometers should be placed exactly horizontal. In the case of the ordinary maximum Thermometers, with dry glass or steel index, the bulb may be very slightly elevated in order that the mercurial column may be somewhat aided by the force of gravity in pushing forward the float or index; and in the case of the *minimum* Thermometers, the bulb must be slightly depressed to prevent a raising of the spirit to the top of the tube, and also that any part raised in vapour may return to the column. These Thermometers, if read once a-day, should *always be read on the evening*, so that the temperatures marked by the floats indicate the minimum and the readings of the day on which the reading is taken. N.B.—The readings of these instruments are taken from that extremity of the float which is *nearest the head of the column of mercury or of spirit*.

The maximum Registering Thermometer, for taking the extreme heat of the sun's rays, should have its bulb blackened and the surface rendered dull, and it should be mounted in a blackened box, whose sides should be so high as to protect the bulb from wind. It should be so placed that the sun's rays have free access to it during the heat of the day.

The *minimum* Registering Thermometer, for ascertaining the lowest temperature during the night from radiation, should have its bulb similarly blackened and rendered dry, and be similarly mounted. It should be laid out, about sunset, over grass, in a place freely exposed to the sky, and raised on wooden supports a few inches above the surface, and removed during the day.

Hyperparasites. The wet bulb requires the moshin covering it to be often changed. In towns once a month, or often, if the weather is dry, and the moshin gets foul; in the country whenever the moshin seems to be foul. The bulb should be covered with thin tissue or blotting paper below the moshin, and the moshin should always be thoroughly wetted, and freed from starch, before being used; and the cotton wick which conducts moisture to it should be previously soaked in a solution of washing soda, and then in pure water, before being attached, in order that

it may be thoroughly wetted, else it will conduct the moisture imperfectly, and yield false results. In frosty weather, water must be poured over the wet bulb, so as to form a thin film of ice on the mesh; the evaporation from the ice going on as from the simply wetted bulb.

Rain Gauge—As a "Planning's Rain Gauge" seem to possess several advantages over others, the Society gives the preference to them; but whatever form is employed, in order that all the stations may yield comparable results, it is recommended that the Gauge be sunk in the ground so that the top of the receiver is nearly on a level with the top blades of close cut grass, in a place as distant as possible from trees, houses, high walls, and irregular or broken ground. When more than one Rain Gauge is kept, they ought to be placed near each other, but at different heights about the ground, and their indications noted in the *general remarks*, mentioning their height above ground—the regular column in the Schedule being reserved for the ground Rain Gauge alone.

Winds—isolated winds or weather-cools are apt to give false indications of the general direction of the wind, in consequence of the currents of air at the surface of the ground being so much influenced by the neighborhood of hills, valleys, buildings, etc. Where low clouds are seen drifting along their direction in reference to known objects, or as noted by means of a mirror on which a compass may be laid, or by means of a circular mirror fixed over the centre of a pocket compass, will, in general, give the true direction of the current of air near the earth's surface. The motion of the higher strata of clouds gives no such indication. Failing the clouds, the general direction of the smoke of a handker or village, or of a tall chimney, gives a better indication of the general direction of the wind than any wind-vane. The observations should state whether the assessment the direction by reflection or otherwise. It is generally agreed to reckon the force of the wind from 0 to 5, the latter being the severest hurricane in this island.

Clouds.—The Society recommends observers to adopt the Howard nomenclature of clouds. The scale of cloud in the visible sky is reckoned from 0 to 10. Thus, a sky quite free from cloud is 0; a sky half covered with cloud is 5; and a sky three-fourths or even more of the visible sky without obscuring the sunshin, so that the indications noted in the column for clouds would not necessarily express, or agree with, the column for sunshin. As the full moon, so long as it above the horizon, is thought by some eminent astronomers to have a powerful effect in dispersing clouds, it will be well to note in the general observations any facts bearing on this point, for a few days (or nights, as the case may be) before and after every full moon; and the same observations ought to be made at the periods of new moon.

Sunshine. The amount of sunshine may be represented by figures in the fractional form, of which the *denominator* indicates the number of hours from sunrise to sunset, and the *numerator* the number of hours the sun shines. Thus, if the sun rose at 6, and set at 6, and during that period shone for 3 hours, it would be represented as $\frac{3}{12}$.

Thermometers under Ground.—Though the temperature and hygrometric conditions of the air are those which chiefly influence the growth of crops, it is important for the health of the crop, and for the germination of the seed, that the soil itself should have a certain temperature. To collect facts which may illustrate this, it is recommended to have *Thermometers* sunk 3 inches and 12 inches below the surface of the ground, to ascertain the temperatures of what may be termed the agricultural soil.

Temperature of the Sea.—As the meteorology of the island is quite incomplete without a knowledge of the mean temperature of the ocean which surrounds it, the Society strongly recommends taking the temperature of the sea at a depth of 6 feet or 1 fathom from the end of all piers or rocks round the coast, where free from the influence of river water, and as near as may be about the time of high water. A thermometer, with its bulb fixed in a small tin pichery, covered with a sloping lid and with a weight attached, is sunk to the required depth, and in ten minutes drawn up and read. Convenient and cheap instruments are furnished to Messrs Aisle and Son, and Mr Bryson, Edinburgh.

The temperature of springs or deep wells is recommended to be taken whenever practicable, mentioning whether spring or well, and its depth from the surface.

Meters, Aurora Borealis, Remarkable Depression or Elevation of Barometer, Remarkable Falls of Rain, Hail or Snow, Thunder and Lightning, etc., should be specially noticed, together with the exact hour at which they were first seen, their continuance, and direction.

Budding, Leafing, and Flowering of Trees.—It is necessary to bear in mind that varieties of the same species of trees differ widely in their times of leafing and flowering. *Individual* trees or shrubs of each kind should therefore be chosen (if possible early kinds), and their indications should be alone noted—always the same year from year to year being noticed.

Onani—a question whether Schomburgk or Morfitt's sons and daughters are used. They may be had at Messrs. Adie and Scott's, 50, Princess Street, and at Mr. Brydson's, 60, P. Princess Street, Edinburgh.

Electricity—Pith balls suspended by a silk thread, in connection with a metallic conductor, and under cover, and the degrees of a circle being used to express the degree of repulsion, form a cheap and convenient electrometer. Excited glass or sealing-glass ascertains the nature of the electricity.

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at March Hall Park, County of Midlothian, in Lat. _____, Long. _____, Height above Sea _____ feet.

Distance from Sea _____ miles.

During the MONTH of February 1880.

Days of Week.	Days of Month.	BAROMETER.		SELF-REGISTERING THERMOMETERS.				HYGROMETER.				WIND.				RAIN.		CLOUD.	SUNSHINE.	THERMOMETERS under Ground.		Temperature of SPRING or WELL.	Temperature of SEA.	OZONE.	ELECTRICITY.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, etc. <i>Mention the hour at which these began and ended.</i>	
		h. A.M.		h. P.M.		Max. in Air.	Min. in Air.	Max. Black bulb in Sun.	Min. Black bulb over Grass.	h. A.M.		h. P.M.		h. A.M.		Days on which it fell.	Amount.										
		Barometer.	Attach- ed Ther- mometer	Barometer.	Attach- ed Ther- mometer					Direction.	Mean Force 1-6.	Direction.	Mean Force 1-6.	h. A.M.													
														3 inches.	12 inches.												
		inches.	"	inches.	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"			
	1					35 ⁷ / ₈	25			31	29	33	31														
	2					35 ⁷ / ₈	29			29 ¹ / ₂	23	35	32														
	3					46	27			32 ³ / ₈	31	42	40 ³ / ₈														
	4					45	39 ¹ / ₂			45	43	45	43				4/10										
	5					44	32			40	39	35 ¹ / ₂	33 ³ / ₄														
	6					37	28 ¹ / ₂			29 ³ / ₈	29 ¹ / ₂	31 ³ / ₈	29 ¹ / ₂														
	7					34 ¹ / ₂	28 ³ / ₈			34 ³ / ₈	32 ³ / ₈	34	33														
	8					33 ¹ / ₂	29 ¹ / ₂			33	32 ¹ / ₂	32	30 ⁷ / ₈														
	9					32	23			—	—	—	—														
	10					30	20 ¹ / ₂			—	—	—	—														
	11					33 ¹ / ₂	27			29	28 ¹ / ₂	32 ³ / ₈	32 ³ / ₈				5/10										
	12					33	29 ¹ / ₂			31	29 ¹ / ₂	31 ³ / ₄	30 ³ / ₄														
	13					31 ³ / ₈	21 ¹ / ₂			—	—	—	—														
	14					34 ³ / ₈	15 ¹ / ₂			—	—	34	32 ³ / ₄														
	15					41	38			34 ³ / ₈	32 ³ / ₈	41	37														
	16					41	33 ¹ / ₂			39 ³ / ₈	37 ³ / ₈	39	38 ³ / ₈														
	17					41	29 ³ / ₈			33	32 ³ / ₈	36 ³ / ₄	34 ³ / ₈														
	18					48 ¹ / ₂	32 ¹ / ₂			38 ³ / ₈	37	44	43 ³ / ₈				4 ¹ / ₂ /10										
	19					41	26 ¹ / ₂			35	34	30	29														
	20					37	28 ¹ / ₂			33	31	36 ³ / ₈	35														
	21					37	27 ³ / ₈			32 ¹ / ₂	30	31 ¹ / ₂	29 ³ / ₈														
	22					37	24 ¹ / ₂			31 ³ / ₄	30	37 ³ / ₈	36 ³ / ₄														
	23					44	35			41	40	40 ³ / ₈	38														
	24					41	36			41	40	39 ³ / ₈	38														
	25					42 ¹ / ₂	37			40 ³ / ₈	38 ³ / ₈	40 ¹ / ₂	37				5/10										
	26					46 ³ / ₈	37 ¹ / ₂			44	42 ³ / ₈	41	37 ¹ / ₂														
	27					40 ¹ / ₂	32			39	35	37 ¹ / ₂	36														
	28					38	32 ¹ / ₂			36	33	34 ¹ / ₂	32														
	29					40	31 ¹ / ₂			36	34 ¹ / ₂	34	33														
	30																										
	31																										
	Sums.					116	16 ¹ / ₂																				
	Means.					37.0	29.5																				
	Index Errors.																										
	Correc- tion 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

Barometer, mean corrected reading of Column No. 1 (A.M.),.....=..... Column No. 3 (P.M.),.....=..... Barometer, Highest observed reading of Month,.....=.....
 Diameter of tube _____ inch; correction for capillarity to be added,.....+..... Capillarity,.....=+..... Lowest do. do.,.....=.....
 Sum,..... Sum,..... Difference, or Monthly Range,.....=.....
 Correction for Temperature from Column No. 2 to be deducted,.....= -..... Temp. from Col. 4,.....= -.....
 Sum,..... Sum,.....
 Correction for Height above Sea-level, _____ feet, to add,.....= +..... Height,.....= +.....
 Barometer corrected and reduced to 32° and Sea-level,.....=..... At 32° and Sea-level,.....=.....

SUMMARY OF THE WINDS.										
Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.
A.M.										
P.M.										

Dry bulb Thermometer (mean of Cols. 9 and 11),*..... Highest Reading Self-Registering Thermometer,..... on the
 Wet bulb Thermometer (mean of Cols. 10 and 12),*..... Lowest do. do.,..... on the
 † Dew-point Temperature,..... Difference, being Monthly Range,.....
 † Elastic Force of Vapour,..... Mean of Self-Registering Thermometers,.....
 † Weight of Vapour in a Cubic Foot of Air,..... Mean Daily Range,.....
 † Additional Weight required to Saturate a Cubic Foot,..... Greatest Daily Range,.....
 † Degree of Humidity (Saturation 100),.....

* If the readings are taken at 9^h and 3^h, the 9^h readings to be alone taken to account, as the correction for Diurnal Range in Scotland is unknown.

† All these calculated from Glaisher's Hygrometric Tables, Second Edition only.

‡ The Diurnal Range for Scotland is as yet unknown.

(Signed) _____

(Designation) _____

N.B.—This Schedule should be returned (post-paid) as early as possible after the completion of the Month, with the Sums correctly added, and the Means deduced. No Wax or Wafers ever to be employed in closing the Schedule—the Gummed Corner to be alone used.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	Flower.	Last Date first appear.	In Leaf.	Dispersed of Leaves.	CROPS mentioning variety.	Sowing or planting.	Appearing above ground.	In Ear or Flower.	First Cut or Rashed.
Alder,					Barley,				
Ash,					Beet or Big,				
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.
Barberry,		Apple,			Cuckoo,		
Bourne 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,		
Myrtle,		Strawberry,			Rail,		
Mountain Ash or Rowan,					Other Birds, naming them—		
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.

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Hour of Observation.—All instruments which are observed twice a-day, should be read at the same hour morning and evening, in order to furnish mean results. The Society recommends a quarter before nine o'clock morning and evening, as the most convenient hour; but should this be inconvenient for the observer, another hour may be chosen, attending, however, to the above rule, that the evening and morning readings be taken at the same hour, and this hour entered on the schedule.

Barometer.—Barometers of Messrs. Adie and Son's construction are recommended; but any instruments may be used which have adjustable surfaces, and have been compared. Before this instrument is suspended for use it should be examined, in order to ascertain whether the space above the mercury is free from air. This is done by inclining the instrument somewhat from the vertical position, when, if free from air, the mercury will settle against the upper end of the tube with a sharp tap. The mercury should then completely fill the tube. If any air has got admittance, it should be driven into the cistern by reversing the instrument, and tapping it gently with the hand. If it cannot be thus expelled, the instrument is useless till repaired.

The Barometer should be hung in a good light, and perfectly perpendicular, as ascertained by the plumb line; and it ought always to be gently tapped before taking the reading, to prevent adhesion of the mercury to the tube. In reading the eye ought to be placed on the exact level of the top of the column of mercury. The reading of the attached Thermometer ought always to be the first taken, as the heat of the breath, or the proximity of the person, are apt to influence its readings.

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Hygrometer.—The wet bulb requires the muslin covering it to be often changed. In towns once a month, or oftener, if the weather is dusty, and the muslin gets foul; in the country whenever the muslin seems to be foul. The bulb should be covered with thin tissue or blotting paper below the muslin, and the muslin should always be thoroughly wetted, and freed from starch before being used; and the cotton wick which conducts moisture to it should be previously soaked in a solution of washing soda, and then in pure water, before being attached, in order that

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Ozone.—Mention whether Schombert's or Moffat's scale and papers are used. They may be had at Messrs. Adie and Son's, 30, Princes Street, and at Mr. Bryson's, 60, Princes Street, Edinburgh. *Electricity.*—Fift balls suspended by a silk thread, in connection with a metallic conductor, and under cover, and the degrees of a circle being used to express the degree of repulsion, form a cheap and convenient electrometer. Excited glass or sealing-wax ascertains the nature of the electricity.

Morning	21	March 1867
Evening	22	March 1867
23	March 1867	
24	March 1867	
25	March 1867	
26	March 1867	
27	March 1867	
28	March 1867	
29	March 1867	
30	March 1867	
31	March 1867	

6 D. bulb. ¹⁰ large
in 20

Right

March Hall pass / March 1860

[illegible]

MARCH
1860

19

Height of Cistern of the Barometer above Mean Sea-level _____ feet, above Ground _____ feet. During the MONTH of April 1860
The Hours of Observation are of Greenwich Time.

[illegible]

Observations made and
Return verified by

(Signed)

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS, WITH REMARKS ON THE USE OF INSTRUMENTS.

One of the objects of immediate importance, that the Scottish Meteorological Society has proposed to itself, is to secure a perfect uniformity in the system of observation, pursued at all its Stations. A certain degree of uniformity is absolutely necessary to justify the publication of Monthly Results from different observations; and it is found that differences between the Returns from any 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 persons 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 unremitting uniformity 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 o'clock, (Greenwich or Railway Time only), twice a-day for some, and once, (morning or evening), for other instruments, as specified in the following remarks, or at the top 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 at what time it was taken, if not at 9 o'clock.

Barometer.—Weather-glasses and Aneroids, though admirably adapted, as the latter certainly are, to indicate variations of atmospheric pressure, are not well fitted for scientific purposes. Nor can any Barometer be used for Meteorological Observations that is not supplied with such means of adjustment or compensation as will secure the height of the mercury in the tube being accurately measured from the fluctuating surface of the mercury in the cistern. It is also necessary that every Barometer shall have been compared with a Standard.

Two moderate-sized Barometers have been approved of by the Council; if properly tested and attended to, they are both well adapted to Meteorological purposes.

An excellent Barometer is constructed by Mr. Adie of London, the use of which is attended with 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 form of instrument has been adopted by the Board of Trade, and has received the approval of the Meteorological Committee of the British Association. In another form of the Barometer, the scales of the cistern, are of leather, and thus, by aid of a screw acting on the bottom, the surface of the contained mercury can be adjusted to the zero-point of the fixed scale; their co-incidence being 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.

When a Barometer having adjustable scales has to be removed from its fastenings, the ivory peg must be secured so as to form a tight plug to the cistern. Then screw up the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may 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 when, on inclining the instrument so that the mercury strikes the top of the tube, a sharp tap is produced. If this is prevented by air it may be removed to the cistern, and got rid of, by inverting the Barometer, (care being taken to prevent the loss of mercury by tightening the ivory peg), and gently tapping it; and if this plan fails, the instrument must be repaired. The Barometer should be suspended in a good light, which may be improved by putting a piece of white paper behind the tube. It must be perfectly perpendicular, and exposed to neither the Sun's direct rays nor the heat of a fire.

In taking an observation, the attached thermometer is first noted; the tube must then be gently tapped and the cistern adjusted carefully made. By raising and lowering the eye, 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 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 greatly facilitate an accurate adjustment and reading of the Barometer.

Protection of Thermometers.—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box, painted white outside, and black within, and fixed 4 feet above grass in an exposed position, free from merely local influences. The laths forming the sides and doors of the Boxes are arranged so as to once to "protect" the Thermometers, and to allow a complete ventilation of the interior. The instruments are suspended on cross-laths, in the centre of the Box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had at the Society's Office.

Self-registering Thermometers.—Professor Phillips's, and Negretti and Zambra's Patent "Maximum" Thermometers are recommended; printed directions for their use may be obtained with each instrument. The "Minimum" Thermometer of Kiehlford is recommended when graduated on the glass stem and affixed to a frame separate from the "Maximum." This Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by an observer. When the column of spirit breaks, it may be reunited by striking the instrument repeatedly against the palm of the hand; when part of the spirit distils by high temperature, it will be found in the upper lobe, and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. This instrument must be hung perfectly horizontal; the bulb end should incline slightly downwards, rather than the other.

The above remarks apply equally to the Thermometers for registering the greatest heat from the Sun's rays and the least from radiation during night. Their bulbs have a black coating, which may easily be made, or mended, by the application of a mixture of lamp black and painter'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 alcohol by distillation.

Verification of Thermometers.—No instrument ought to be used for Meteorological purposes that has not been carefully tested by comparison with a Standard Thermometer. When such Thermometers 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 scales, and ought never afterwards to be used without being re-tested. The self-registering, and 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. For comparison of Thermometers, a properly-tested thermometer may be had, on loan, by any observer, from the Meteorological Secretary.

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and well-tested form of this apparatus seriously vitiate the "Hygrometrical Deductions," 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 placed to the side, and a little below the level of the wet bulb;—in no case under the bulb;—the main 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 that 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. One form of "Mason's" Hygrometer is highly objectionable. The frame of the Thermometers is enclosed in a tin case, which also supports the water cup underneath. This arrangement must be immediately altered by pulling the boxwood frame out of the tin case, and hanging them side by side, so that the forementioned requirements shall be complied with, as far as possible.

Reading of the Hygrometer.—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index, or column of mercury. The reading should be taken to tenths of a degree, and noted in decimals. Thus the thermometer will be read—39.5, 40.6, or 40.1; or again, 40.4, 40.3, or 40.6; according as it indicates a little more or less, or a little over 40°, or 40.5, or 40.4, or 40.3, or 40.2, or 40.1, or 40.0, or 39.9, or 39.8, or 39.7, or 39.6, or 39.5, or 39.4, or 39.3, or 39.2, or 39.1, or 39.0, or 38.9, or 38.8, or 38.7, or 38.6, or 38.5, or 38.4, or 38.3, or 38.2, or 38.1, or 38.0, or 37.9, or 37.8, or 37.7, or 37.6, or 37.5, or 37.4, or 37.3, or 37.2, or 37.1, or 37.0, or 36.9, or 36.8, or 36.7, or 36.6, or 36.5, or 36.4, or 36.3, or 36.2, or 36.1, or 36.0, or 35.9, or 35.8, or 35.7, or 35.6, or 35.5, or 35.4, or 35.3, or 35.2, or 35.1, or 35.0, or 34.9, or 34.8, or 34.7, or 34.6, or 34.5, or 34.4, or 34.3, or 34.2, or 34.1, or 34.0, or 33.9, or 33.8, or 33.7, or 33.6, or 33.5, or 33.4, or 33.3, or 33.2, or 33.1, or 33.0, or 32.9, or 32.8, or 32.7, or 32.6, or 32.5, or 32.4, or 32.3, or 32.2, or 32.1, or 32.0, or 31.9, or 31.8, or 31.7, or 31.6, or 31.5, or 31.4, or 31.3, or 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SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at *March Hill Park*, County of *Midlothian*, in Lat. _____, Long. _____, Distance from Sea _____ miles.Height of Cistern of the Barometer above Mean Sea-level _____ feet, above Ground *4* feet.During the MONTH of *May* 186*0*
The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read daily, at 9 P.M.				HYGROMETER. No.				WIND.		RAIN.		CLOUDS.				THERMOMETERS. under Ground.			SEA.	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 began and ended.	Days of Month.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
		9 h. A.M.		9 h. P.M.		Protected, in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		9 h. P.M.		Direction.	Force.	Readings of the H. Cup Anemo- meter, at 9 P.M.	No. of hours in which it fell.	Amount in inches.	Velocity, (0-6), and Direction.	Amount, (0-10), and Species.	Velocity, (0-6), and Direction.	Amount, (0-10), and Species.	No. 3 inches.	No. 12 inches.					No. 22 inches.	Temperature of WELL at Depth of feet. No.	Temperature at 1 fathom, and Density.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
		Barometer. † No.	Attach- ed Ther- mometer	Barometer. No.	Attach- ed Ther- mometer	Max. No.	Min. No.	Max. in Sun's rays	Min. on Grass.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.																			9 h. A.M.	9 h. P.M.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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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.	" squall.
fr.	" frost.	sl.	" sleet.
h.-fr.	" hoar-frost.	sn.	" snow.
h.	" haze.	so. ha.	" solar halo.
h. d.	" heavy dew.	sq.	" squall.
hl.	" hail.	sq.	" 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), = _____"Corrected Mean" of Barometer at 9 P.M., minus the Correction +
for Temp. (Col. 4), = _____

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

Correction for Height, _____ feet, above Mean Sea-level, = _____

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

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

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

Difference, or Monthly Range, = _____

* Each instrument tested at the Office in Edinburgh bears the stamp "S.M.S." and a number to be entered in the Reading; or the Number and Initials of the Maker may be here given.
* Barometric corrections for both capillary 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 Glashier'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 User.

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

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

Difference, or Monthly Range, = _____

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

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

Difference, or Mean Daily Range, = _____

** Calculated Mean Temperature of Month, = _____

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 the _____ th, = _____

Difference of above Means or Range ("exposed"), = _____

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry
Bulb, = _____

Mean (corrected) A.M. and P.M. Reading of Wet Bulb, = _____

†† Computed Temperature of Dew-point, = _____

†† Do. Elastic Force of Vapour, = _____

†† Do. Weight of Vapour in a Cubic Foot of Air, = _____

†† Relative Humidity, (Saturation = 100), = _____

RAIN fell on _____ Days; Amount in Inches, = _____

WIND.		SUMMARY.									
Direction.	N°	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.											
P.M.											
Mean.											

N.B.—The Sums to be correctly added, and the Means deduced. Returns from the "Principal Towns" should be in Edinburgh not later than the 2nd; those from Other Places, not later if possible than the 6th. This Schedule not to be Gummed or Fastened, and Forwarded by Book Post, prepaid.

Observations made and
Return verified by

(Signed)

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

ONE of the objects of immediate importance, that the Scottish Meteorological Society has proposed to itself, is to secure a perfect uniformity in the system of observation pursued at all its Stations. A certain degree of uniformity is absolutely necessary to justify the publication of Monthly Results from different observations; and it is found that differences between the Returns from any 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 persons 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 o'clock, (Greenwich or Railway Time only), twice a-day for some, and once, (morning or evening), for other instruments, as specified, in the following remarks, or at the top 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 oppositely every reading at what time it was taken, if not at 9 o'clock.

Barometer.—Weather-glasses and Aneroids, though admirably adapted, as the latter certainly are, to indicate variations of atmospheric pressure, are not well fitted for scientific purposes. Nor can any Barometer be used for Meteorological Observations that is not supplied with such means of adjustment, or compensation, as will secure the height of the mercury in the tube being accurately measured from the fluctuating surface of the mercury in the cistern. It is also necessary that every Barometer shall have been compared with a Standard.

Two moderate-sized Barometers have been approved of by the Council; if properly tested and attended to, they are both well adapted to Meteorological purposes.

An excellent Barometer is constructed by Mr. Alio of London, the use of which is attended with the great convenience of requiring no adjustment of the cistern. Its scale-marks 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 form of instrument has been adopted by the Board of Trade, and has received the approval of the Meteorological Committee of the British Association. In another form of the Barometer, the sides of the cistern are of leather, and thus, by aid of a screw acting on the bottom, the surface of the contained mercury can be adjusted to the zero-point of the fixed scale; their co-incidence being 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 cistern.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then screw up the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may 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 when, on inclining the instrument so that the mercury strikes the top of the tube, a sharp tap is produced. If this is prevented by air it may be removed by the cistern, and got rid of by inverting the Barometer, (care being taken to prevent the loss of mercury by tightening the ivory peg), and gently tapping it; and if this plan fails, the instrument must be repaired. The Barometer must be suspended in a good light, which may be improved by putting a piece of white paper behind the tube. It must be perfectly perpendicular, and exposed to neither the Sun's direct rays nor the heat of a fire.

In taking an Observation, the attached Thermometer is first noted: the tube must then be gently tapped and the cistern-adjustment carefully made. By raising and lowering the eye, 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 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 greatly facilitate an accurate adjustment and reading of the Barometer.

Protection of Thermometers.—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box, painted white outside, and black within, and fixed 4 feet above ground in an exposed position, free from merely local influences. The laths forming the sides and doors of the Boxes are arranged so as to open to protect the Thermometers, and to allow a complete ventilation of the interior. The instruments are suspended on cross-laths, in the centre of the Box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had at the Society's Office.

Self-registering Thermometers.—Professor Phillips's, and Negretti and Zambra's Patent "Maximum" Thermometers, are recommended; printed directions for their use may be obtained with each instrument. The "Minimum" Thermometer of Rutherford is recommended when graduated on the glass stem and affixed to a frame separate from the "Maximum." This Thermometer is liable to two derangements, both of which must be guarded against; and may be easily remedied by an observer. When the column of spirit breaks, it may be reunited by striking the instrument repeatedly against the palm of the hand; when part of the spirit distils by high temperature, it will be found in the upper lobe, and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. This instrument must be hung perfectly horizontal; the bulb end should incline slightly downwards, rather than the other.

The above remarks apply equally to the Thermometers for registering the greatest heat from the Sun's rays and the least from radiation during night. Their bulbs have a black coating, which may easily be made, or mended, by the application of a mixture of lamp black 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 alcohol by distillation.

Verification of Thermometers.—No instrument ought to be used for Meteorological purposes that has not been carefully tested by comparison with a Standard Thermometer. When such Thermometers 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 retested. The self-registering, and 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. For comparison of Thermometers, a properly-tested thermometer may be had, on loan, by any observer, from the Meteorological Secretary.

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and rectified form of this apparatus seriously vitiate the "Hygrometrical Deductions," 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 so stiff 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 placed to the side, and a little below the level of the wick-bulb;—in no case under the bulb;—the meniscus must be of medium thickness, 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 meniscus is always plain 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 noticed 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. One form of "Atan's" Hygrometer is highly objectionable. The frame of the Thermometers is enclosed in a tin case, which also supports the water cup underneath. This arrangement must be immediately altered by pulling the boxwood frame out of the tin case, and hanging them side by side, so that the forementioned requirements shall be complied with, as far as possible.

Reading of the Thermometer.—Great care must be taken to avoid the effects of refraction, by bringing 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—33°·9, 40°·0, or 40°·1; or again, 40°·4, 40°·5, or 40°·6, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40°·5, respectively. So also 40°·3, and 40°·7 or 40°·8 respectively. In reading Rutherford's "Max." and "Min." Thermometers, the indication of that end of the index which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry bulb, must be taken, being so 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 3rd are those of a series of phenomena commencing at 9 P.M. on the 2nd, and extending till 9 P.M. on the 3rd.

Wind.—A wind-vane ought to be elevated 12 feet at least, above surrounding objects. When it oscillates incessantly, the mean direction must be taken; and when it is stationary, and always when the wind is feeble, reference must be made to the direction of the lower strata of clouds overhead, and to the direction of smoke, etc.

Careful observations ought to be made on the changes in the direction of the wind; and during storms, extra observations ought to be made at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, would be likely to give highly interesting and important results.

The Council would strongly recommend that every Observatory be furnished with a Hemispherical-Cup Anemometer;—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the 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, Lind's Anemometer is also recommended; the method of *Estimating* Wind Force by such tables as that given in the schedule is, to say the least, unsatisfactory.

Rain-gauges.—Many causes conspire to produce anomalies in rain returns. They arise, partly, from unfavourable situation for observation, and partly from the defective nature of the instruments used. It is, indeed, difficult to obtain an unexceptionable position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its edges are on a level with the close cut grass around its mouth. The rain-gauge ought to be read daily, and the readings entered in the returns on the day on which the rain fell.

Snow-falls may, for convenience, be registered in the rain columns, under the following conditions:—When a snow shower occurs it must 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 indicated in every column, the observer cannot be too careful to register observations only; and nothing that particles of the nature of detection or inference.

Clouds.—Convenient abbreviations for Luke Howard's nomen-

clature of clouds will be found on the other side. The amount of cloud in the atmosphere 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 among the "Remarks." The amount of cloud is entered from a scale of 0 to 10; thus, when the sky overhead is half-covered by clouds, 5 is entered as the observation, 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:—In the column "Velocity and Direction," 2 W., (for example), will indicate that the upper strata of clouds travel with *eastern* velocity from S.W., and those in the lower regions from W., with one-third the (*eastern*) speed of the former. Again, in the second "Cloud" column, an entry of $\frac{2}{4}$ cu-st. (cu.) 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.

Sunshine.—The 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 health of crops and plants greatly depend on the temperature and soil, its current and consistency; the Council recommend that observations in this interesting department be made at 9 A.M., by thermometers placed in the earth, their bulbs being sunk to 3, 12, and 22 inches, and the stems above ground protected from water being conveyed to the bulbs by the stems or wooden frames. Mention must be made of the geological formation, and agricultural condition of the soil in which these thermometers are placed. **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 very important branch of Meteorology. The Council, therefore, recommend that the temperature of the sea be carefully taken by a properly constructed apparatus, from the ends of piers and rocks round the coast, where it is not influenced by that of river water. At or near the time of high water, on the 5th, 15th, and 25th of each month, the thermometer ought to be sunk exactly six feet (one fathom), and after ten minutes have elapsed, drawn up and read. 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; and continuing to observe for particular depths.

Temperature of Wells.—The temperature of the water at the bottom of wells ought, when practicable, to be taken, and the depth of the well and of the water noted.

Ozone.—Mention whether Schönbein's or Moffat's papers are used—Moffat's are preferred. The paper is affixed by a pin to a board in the thermometer box, and the indication 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 35%, as it is entered in the schedule, will indicate that the ozone paper is tinted as 4; on the scale, that the wind is from the N.W., and that its force on the scale 0–6 is 4, i.e., that it is blowing fresh. Boxes of Papers may be had at the Society's Office. **Electricity.**—Too much importance cannot be attached to electric condition of the atmosphere in connection with terrestrial magnetism, and as a meteorological phenomenon. A proper Electrometer is necessary to every complete meteorological observatory.

Remarks.—The "Remarks" column is too narrow, but unavoidably so. 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 recognised and in use at Greenwich and Southampton, are given at the foot of the column. Besides special and extraordinary observations, great prominence ought to be given in this column to prevalent diseases, difference 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 mists, aurora borealis, remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain; the hour of storms as have been limited at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the snow-line in winter ought to be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. ought to be registered, either in two columns otherwise unoccupied, or in two ruled off for the purpose, from that headed "Remarks." It is intended that observations by the Electrometer should be entered in this manner, or on the side-margin. Additional remarks may be made on the margin.

"Observations in connection with the periodic return of the seasons" possess not only great scientific value, but are of considerable interest to the Agriculturist. The Council would direct the special attention of Observers to the registration of such phenomena; 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 Council recommend that *term-day* observations be taken;—viz., on the 21st days of March, June, September, and December. For these hourly observations separate schedules will be furnished to observers.

Full directions for the use of the instruments mentioned above have been printed, and may be had along with them from the makers.

The Council have agreed to recommend that observers, before purchasing new instruments, should communicate with the Meteorological Secretary; and they consider it desirable that he should have full power to reject any instrument that, on being presented for comparison, does not afford him satisfaction.

(By Order) A. H. B.

Edinburgh, 24th Feb. 1860.

Table with 4 main sections: FOREST TREES, CROPS, MIGRATORY BIRDS, and FRUITS. Each section has columns for First Appearance, In Bar, and First Appearance. The table lists various species and their corresponding observation dates.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS

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 any have suffered from blight, diseases, etc. Whether the goodness prevails among Cattle; and the Agricultural condition of the district generally.

BOOK-POST.

Mr. A. H. BURGESS,

Secretary of the Meteorological Society of Scotland,

10, St Andrew Square,

EDINBURGH.

MAY 1860

76

23

Height of Cistern of the Barometer above Mean Sea-level _____ feet, above Ground _____ feet. During the MONTH of June 1860.
The Hours of Observation are of Greenwich Time.

[illegible]

Observations made and
Return verified by

(Signed)

28

Height of Cistern of the Barometer above Mean Sea-level _____ feet, above Ground _____ feet. During the MONTH of July 1860
The Hours of Observation are of Greenwich Time.

* The Elph 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.

*+ Reducing corrections for both capillarity and Index Errors.

* The Diurnal Range for Scotland is as yet unknown.

* Practically, though not absolutely, a *uniform* 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

N.B.—The Sums to be correctly added, and the Means deduced. Returns from the “Principal Towns” should be in Edinburgh not later than the 2nd; those from Other Places, not later if possible than the 6th. This Schedule not to be Gummed or Fastened, and Forwarded by Book Post, prepaid.

Observations made and
Return verified by

(Signed)

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS, WITH REMARKS ON THE USE OF INSTRUMENTS.

ONE of the objects of immediate importance, that the Scottish Meteorological Society has proposed to itself, is to secure a perfect uniformity in the system of observation pursued at all its Stations. A certain degree of uniformity is absolutely necessary to justify the publication of Monthly Results from different observations; and it is found that differences between the Returns from any two Stations, so very considerable as to render them quite incomparable, may arise from dissimilarity in the position or elevation of instruments, different hours of observation, or even from the use of differently constructed instruments. It is therefore hoped, that those persons 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 Public's enjoyment, 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 o'clock, (Greenwich or Railway Time only), twice a-day for some, and once, (morning or evening), for other instruments, as specified, in the following remarks, on the top of the schedule. It is hoped that the utmost punctuality in the time of reading the instruments will be pursued. Observers, in some few cases, may find this impossible; in such instances they are specially requested to mark opposite every reading at what time it was taken, if not at 9 o'clock.

Barometer.—Weather-glasses and *Anemometers*, though admirably adapted, as the latter certainly are, to indicate variations of atmospheric pressure, are not well fitted for scientific purposes. Nor can any Barometer be used for Meteorological Observations that is not supplied with such means of adjustment or compensation, as will secure the height of the mercury in the tube being accurately measured from the fluctuating surface of the mercury in the cistern. It is also necessary that every Barometer shall have been compared with a *Standard*.

Two moderate-sized Barometers have been approved of by the Council; if properly tested and attended to, they are both well adapted to Meteorological purposes.

An excellent Barometer is constructed by Mr. Adie of London, the use of which is attended with 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 form of instrument has been adopted by the Board of Trade, and has received the approval of the Meteorological Committee of the British Association. In another form of the Barometer, the sides of the cistern are of leather, and thus, by aid of a screw acting on the bottom, the surface of the contained mercury can be adjusted to the zero-point of the fixed scale; their co-incidence being 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*.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then screw up the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may 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 when, on inclining the instrument so that the mercury strikes the top of the tube, a sharp tap is produced. If this is prevented by air it may be removed to the cistern, and got rid of, by inverting the Barometer, (care being taken to prevent the loss of mercury by tightening the ivory peg), and gently tapping it; and if this plan fails, the instrument must be repaired.

The Barometer should be suspended in a good light, which may be improved by putting a piece of white paper behind the tube. It must be perfectly perpendicular, and exposed to neither the Sun's direct rays nor the heat of a fire.

In taking an Observation, the attached Thermometer is first noted: the tube must then be gently tapped, and the cistern adjustment carefully made. By raising and lowering the eye, 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 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 greatly facilitate an accurate adjustment and reading of the Barometer.

Protection of Thermometers.—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box, painted white outside, and black within, and fixed 4 feet above grass in an exposed position, free from mossy local influences. The laths forming the sides and doors of the Boxes are arranged so as to once to "protect" the Thermometers, and to allow a complete ventilation of the interior. The instruments are suspended on cross-laths, in the centre of the Box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had at the Society's Office.

Self-registering Thermometers.—Professor Phillips's, and Negretti and Zambra's Patent *Maximum* Thermometers are recommended; printed directions for their use may be obtained with each instrument. The *Minimum* Thermometer of Rutherford is recommended when graduated on the glass stem and affixed to a frame separate from the *Maximum*. This Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by an observer. When the column of spirit breaks, it may be re-united by striking the instrument repeatedly against the palm of the hand; when part of the spirit distils by high temperature, it will be found in the upper lobe, and must be dislodged from thence by heating the part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. This instrument must be hung perfectly horizontal; the bulb end should incline slightly downwards, rather than the other.

The above remarks apply equally to the Thermometers for registering the greatest heat from the Sun's rays and the least from radiation during night. Their bulbs have a black coating, which may easily be made, or mended, by the application of a mixture of lamp black 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 alcohol by distillation.

Verification of Thermometers.—No instrument ought to be used for Meteorological purposes that has not been carefully tested by comparison with a *Standard Thermometer*. When such Thermometers 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, and 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. For comparison of Thermometers, a properly-tested Thermometer may be had, on loan, by any observer, from the Meteorological Secretary.

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and well-tested form of this apparatus seriously vitiate the "Hygrometrical Deductions," 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 allow the bulb to be suspended by 40 in., from any point on which it may be suspended;—the water-cup must be covered, and placed to the side, and a little below the level of the wet bulb;—the wick under the bulb must be moistened with 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.

One form of "Mason's" Hygrometer is highly objectionable. The frame of the Thermometer is enclosed in a tin case, which also supports the water-cup underneath. This arrangement must be immediately altered by pulling the boxwood frame out of the tin case, and hanging them side by side, so that the aforementioned requirements shall be complied with, as far as possible.

Reading of the Thermometer.—Great care must be taken to avoid the effects of refraction, by bringing 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°·4, 40°·0, or 40°·1; or again, 40°·4, 40°·3, or 40°·6, according as it indicates a little more, an exact coincidence with, or a little over 40°, or 40°·3, respectively. So also 40°·3, and 40°·7 or 40°·8 respectively. In reading Rutherford's "Max." and "Min." Thermometers, the indication of that end of the index which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, being so 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 3rd are those of a series of phenomena commencing at 9 P.M. on the 2nd, and extending till 9 P.M. on the 3rd.

Wind.—A wind-vane ought to be elevated 12 feet at least, above surrounding objects. When it oscillates incessantly, the mean direction must be taken; and when it is stationary, and always when the wind is feeble, reference must be made to the direction of the lower strata of clouds overhead, and to the direction of smoke, &c.

Careful observations ought to be made on the changes in the direction of the wind; and during storms, extra observations ought to be made at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, would be likely to give highly interesting and important results. The Council would strongly recommend that every Observatory be furnished with a Hemispherical-Cup Anemometer;—a self-registering instrument which shows the amount of Wind that passes in per day; from which also the 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, Lind's Anemometer is also recommended: the method of *Estimating* Wind Force by such tables as that given in the schedule is, to say the least, unsatisfactory.

Rain-gauges.—Many causes conspire to produce anomalies in rain returns. They arise, partly, from unfavourable situation for observation, and partly from the defective nature of the instruments used. It is, indeed, difficult to obtain an unexceptionable position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its edges are on a level with the close cut grass around its mouth. The rain-gauge ought to be read daily, and the readings entered in the Returns on the day on which the rain fell.

Snow-falls may, for convenience, be registered in the rain columns, under the following conditions:—When a snow shower occurs it must be noted in the "Remarks." The depth of 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 Luke Howard's nomenclature.

clature of clouds will be found on the other side. The amount of cloud in the atmosphere 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 appearances and changes ought to be noted among the "Remarks." The amount of cloud is entered from a scale of 0 to 10; thus, when the sky *overhead* is half-covered by clouds, 5 is entered as the observation, 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:—In the column "Velocity and Direction," 2 W., (for example) 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 (extreme) speed of the former. Again, in the second "Cloud" column, an entry of 2, over 4, 4, 4, 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 *cirro-stratus* kind.

Sunshine.—The 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 health of crops and plants greatly depend 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 placed in the earth, their bulbs being sunk to 3, 12, and 22 inches, and the stems above ground protected from water being conveyed to the bulbs by the stems or wooden frames. Mention must be made of the geological formation, and agricultural condition of the soil in which these thermometers are placed.

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 very important branch of Meteorology. The Council, therefore, recommend that the temperature of the sea be carefully taken by a properly constructed apparatus, from the ends of piers and rocks round the coast, where it is not influenced by that of river water. At or near the time of high water, on the 5th, 15th, and 25th of each month, the thermometer ought to be sunk exactly six feet (one fathom), and after ten minutes have elapsed, drawn up and read. 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; and continuing to observe for particular depths.

Temperature of Wells.—The temperature of the water at the bottoms of wells ought, when practicable, to be taken, and the depth of the well and of the water noted.

Other Meteorological Remarks.—Schönbain's or Moffat's papers are used—Moffat's are preferred. The paper is affixed by a pin to a board in the thermometer box, and the indication 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 W., as an *ozone* entry in the schedule, will indicate that the ozone paper is timed as 3° on the scale, that the wind is from the N.W., and that its force on the scale 0–6 is 4; i.e., that it is blowing fresh. Boxes of Papers may be had at the Society's Office.

Electricity.—Too much importance cannot be attached to electric condition of the atmosphere in connection with terrestrial magnetism, and as a meteorological phenomenon. A proper magnetometer is necessary to every complete meteorological observatory.

Remarks.—The "Remarks" column is too narrow, but unavoidably so. 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 recognised and in use at Greenwich and Southampton, are 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, &c. Remarks ought to be made on the occurrence of meteors, aurora borealis, remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain, the hour of storms of wind attaining their maximum, as well as such notes on storms as have been hinted at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the snow-line in winter ought to be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. ought to be registered, either in two columns otherwise unoccupied, or in two added off for the purpose, from that headed "Remarks." It is intended that observations by the Electrometer should be entered in this manner, or on the side-marginal. Additional remarks may be made on the margin.

"Observations in connection with the periodic return of the seasons" possess not only great scientific value, but are of considerable interest to the Agriculturist. The Council would direct the special attention of Observers to the registration of such phenomena; that the published Summaries may fairly represent the whole of Scotland. Observation 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.

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The Council have agreed to recommend that observers, before purchasing new instruments, should communicate with the Meteorological Secretary; and they consider it desirable that he should have full power to reject any instrument that, on being presented for comparison, does not afford him satisfaction.

(By Order,) A. H. B.

Edinburgh, 24th Feb. 1869.

FOREST TREES.		FRUITS.		MIGRATORY BIRDS.		Other Birds, naming them.	
In Flower.	In Leaf.	First in Blossom.	First in Fruiting.	First in Spring.	First in Summer.	First in Autumn.	First in Winter.
Alder.	Barberry.	Apple.	Black Currant.	Cherry.	Gum.	Hawthorn.	Holly.
Aspen.	Birch.	Bramble.	Broom.	Cherry.	Gum.	Hawthorn.	Holly.
Beech.	Birch.	Bramble.	Broom.	Cherry.	Gum.	Hawthorn.	Holly.
Birch.	Birch.	Bramble.	Broom.	Cherry.	Gum.	Hawthorn.	Holly.
Blow.	Birch.	Bramble.	Broom.	Cherry.	Gum.	Hawthorn.	Holly.
Oak.	Birch.	Bramble.	Broom.	Cherry.	Gum.	Hawthorn.	Holly.
Sycamore or Plane.	Birch.	Bramble.	Broom.	Cherry.	Gum.	Hawthorn.	Holly.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

BOOK-POST.

EDINBURGH.

10, St Andrew Square,

Secretary of the Meteorological Society of Scotland,

Mr A. H. BURGESS,

To

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at *March Hall park*, County of *Midlothian*, in Lat. , Long. , Distance from Sea miles. *27*

Height of Cistern of the Barometer above Mean Sea-level

feet, above Ground feet.

During the MONTH of *August*186*0*

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read daily, at 9 P.M.				HYGROMETER. No.				WIND.				RAIN.		CLOUDS.				SUNSHINE. Hours.	THERMOMETERS. under Ground.			Temperature of WELL at Depth of feet. No.	SEA. Temperature at 1 fathom, and Density.	OZONE. 0-10.	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 began and ended.	Days of Month.	
		9 h. A.M.		9 h. P.M.		Protected, in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		9 A.M.		P.M.		9 h. A.M.											
		Barometer. † No.	Attach- ed Ther- mometer.	Barometer. No.	Attach- ed Ther- mometer.	Max. No.	Min. No.	Max. in Sun's rays No.	Min. on Grass. No.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.	Readings of the H-Cup Anemo- meter, at 9 P.M. No.	No. of hours in which it fell.	Amount in inches. No.	Velocity, (0-10), and Direction.	Amount, (0-10), and Species.	Velocity, (0-10), and Direction.		Amount, (0-10), and Species.	No. 3 inches.	No. 12 inches.						No. 22 inches.
		inches.		inches.																													
	1					63	47																							1			
	2					65.8	48																							2			
	3					60.6	51.3																							3			
	4					62	53													8.8 10										4			
	5					64	44.7																							5			
	6					55	49																							6			
	7					62	47																							7			
	8					54.2	47.2																							8			
	9					60.3	47.2																							9			
	10					57.5	48.4																							10			
	11					57	51.2													13 10										11			
	12					59	50.2																							12			
	13					59.6	47.7																							13			
	14					60.6	50.6																							14			
	15					62	49.1																							15			
	16					61	54																							16			
	17					60.3	53.2																							17			
	18					56.2	50.2													3 10										18			
	19					61	54.6																							19			
	20					61.3	49.3																							20			
	21					68.4	52																							21			
	22					57.1	50																							22			
	23					60.7	55																							23			
	24					61	43.2																							24			
	25					60.8	46.6													3.6 10										25			
	26					58.2	47																							26			
	27					57.1	43.2																							27			
	28					60	46.6																							28			
	29					62	55																							29			
	30					60	53.2																							30			
	31					64	51																							31			
	Sums.					186	146																										
	Means.					60.5	49.5																										
	* Total Corrections for Instrumental Errors.																																
	† Corrections for Diurnal Range.																																
	"Cor-rected 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.	sl.	" sleet.
h-fr.	" hoar-frost.	sn.	" snow.
h.	" haze.	so. ha.	" solar halo.
h. d.	" heavy dew.	sq.	" squall.
hl.	" hail.	sq.	" 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

NOTATION USED IN GENERAL REMARKS.

a.	denotes aurora.	m.	denotes meteor.
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ci-cu.	" cirro-cumulus.	n.	" nimbus.
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d.	" dew.	s.	" sleet.
f.	" fog.	sc.	" squall.
fr.	" frost.	sh.	" shower.
h.-fr.	" hoar-frost.	so. h.	" solar halo.
h.	" haze.	sq.	" squall.
h. d.	" heavy dew.	sq.	" squall.
h. l.	" hail.	sq.	" squall.
l.	" lightning.	t.	" thunder.
li. cl.	" light clouds.	t.-s.	" thunder-storm.
li. sh.	" light showers.	w.	" wind.
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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), =

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

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

Correction for Height, feet, above Mean Sea-level, =

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

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

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

Difference, or Monthly Range, =

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

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

Difference, or Monthly Range, =

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

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

Difference, or Mean Daily Range, =

** Calculated Mean Temperature of Month, =

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 the th, =

Difference of above Means or Range ("exposed"), =

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, =

Mean (corrected) A.M. and P.M. Reading of Wet Bulb, =

†† Computed Temperature of Dew-point, =

†† Do. Elastic Force of Vapour, =

†† Do. Weight of Vapour in a Cubic Foot of Air, =

†† Relative Humidity, (Saturation = 100), =

RAIN fell on Days; Amount in Inches, =

WIND.		SUMMARY.					
Direction.		N	NE	E	SE	S	SW
A.M.							
P.M.							
Mean.							

N.B.—The Sums to be correctly added, and the Means deduced. Returns from the "Principal Towns" should be in Edinburgh not later than the 2nd; those from Other Places, not later if possible than the 6th. This Schedule not to be Gummed or Fastened, and Forwarded by Book Post, prepaid.

Observations made and
Return verified by

(Signed)

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

ONE of the objects of immediate importance, that the Scottish Meteorological Society has proposed to itself, is to secure a *perfect uniformity* in the system of observation pursued at all its Stations. A certain degree of uniformity is absolutely necessary to justify the publication of Monthly Results from different observations; and it is found that differences between the Returns from any 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 persons 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 o'clock, (Greenwich or Railway Time only), twice a-day for some, and once, (morning or evening), for other instruments, as specified, in the following remarks, or at the top 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 at what time it was taken, if not at 9 o'clock.

Barometer.—*Weather-glasses* and *Anemometers*, though admirably adapted, as the latter certainly are, to indicate variations of atmospheric pressure, are not well fitted for scientific purposes. Nor can any Barometer be used for Meteorological Observations that is not supplied with such means of *adjustment* or *compensation* as will secure the *level* of the mercury in the tube being accurately measured from the fluctuating surface of the mercury in the cistern. It is also necessary that every Barometer shall have been compared with a *Standard*.

Two moderate-priced Barometers have been approved of by the Council; if properly tested and attended to, they are both well adapted to Meteorological purposes.

An excellent Barometer is constructed by Mr. Altie of London, the use of which is attended with 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 form of instrument has been adopted by the Board of Trade and has received the approval of the Meteorological Committee of the British Association. In another form of the Barometer, the sides of the cistern are of leather, and thus, by aid of a screw acting on the bottom, the surface of the contained mercury can be adjusted to the zero-point of the fixed scale; their co-incidence being 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 adjusting the screw, to form one straight line with those on its own 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*.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then *serve up* the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may 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 when, on inclining the instrument so that the mercury strikes the top of the tube, a *slight tap* is produced. If this is prevented by air it may be removed to the cistern, and got rid of, by inverting the Barometer, (care being taken to prevent the loss of mercury by tightening the ivory peg), and gently tapping it; and if this plan fails, the instrument must be repaired. The Barometer should be suspended in a good *light*, which may be improved by putting a piece of white paper behind the tube. It must be perfectly perpendicular and exposed to neither the Sun's direct rays nor the heat of a fire.

In taking an *Observation*, the attached Thermometer is first noted: the tube must then be gently tapped and the cistern-adjustment carefully made. By raising and lowering the eye, 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 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 greatly facilitate an accurate adjustment and reading of the Barometer.

Protection of Thermometers.—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box, painted white outside and black within, and fixed 4 feet above grass in an exposed position, free from merely local influences. The laths forming the sides and doors of the Boxes are arranged so as to "protect" the Thermometers, and to allow a complete ventilation of the interior. The instruments are suspended on cross-laths, in the centre of the Box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had at the Society's Office.

Self-registering Thermometers.—Professor Phillips's, and Negretti and Zambra's Patent "*Maximum*" Thermometers are recommended; printed directions for their use may be obtained with each instrument. The "*Minimum*" Thermometer of Rutherford is also recommended when graduated on the glass stem and affixed to a frame separate from the "*Maximum*." This Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by an observer. When the column of spirit breaks, it may be reunited by striking the instrument repeatedly against the palm of the hand; when part of the spirit distils by high temperature, it will be found in the upper lobe, and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. This instrument must be being perfectly horizontal; the bulb end should incline slightly downwards, rather than the other.

The above remarks apply equally to the Thermometers for registering the greatest heat from the Sun's rays and the least from radiation during night. Their bulbs have a black coating, which may easily be made, or mended, by the application of a mixture of lamp black and primer'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 alcohol by distillation.

Registration of Thermometers.—No instrument ought to be used for Meteorological purposes that has not been carefully tested by comparison with a *Standard Thermometer*. When such Thermometers are not graduated on the stem, but inflexibly are attached scale-and-needle 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, and 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. For comparison of Thermometers, a properly-tested Thermometer may be had, on loan, by any observer from the Meteorological Secretary.

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and well-tested form of this apparatus seriously vitiate the "*Hygrometrical Directions*," 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 placed to the side, and a little below the level of the wet bulb;—in no case under the bulb;—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.

One form of "*Mason's*" Hygrometer is highly objectionable. The frame of the Thermometers is enclosed in a tin case, which also supports the water cup underneath. This arrangement must be immediately altered by pulling the boxwood frame out of the tin case, and hanging them side by side, so that the forementioned requirements shall be complied with, as far as possible.

Reading of the Thermometer.—Great care must be taken to avoid the effects of refraction, by bringing 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 40°·4, 40°·5, or 40°·6, according as it indicates a little under an exact coincidence with, or a little over 40°, or 40°·5, respectively. So also, 40½° and 40¾° or 40·6° and 40·7° respectively. 40°·3 and 40°·7 or 40·6° and 40·7° respectively. In reading Rutherford's "*Max*," and "*Min*," Thermometers, the indication of that end of the index which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry bulbs, must be rapidly taken, being so 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 A.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 3rd are those of a series of phenomena commencing at 9 P.M. on the 2nd, and extending till 9 P.M. on the 3rd.

Wind.—A wind-vane ought to be elevated 12 feet at least above surrounding objects. When it oscillates incessantly, the mean direction must be taken; and when it is stationary, and always when the wind is feeble, reference must be made to the direction of the lower strata of clouds overhead, and to the direction of smoke, etc.

Careful observations ought to be made on the changes in the direction of the wind; and during storms, extra observations ought to be made at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, would be likely to give highly interesting and important results.

The Council would strongly recommend that every Observatory be furnished with a Hemispherical-Cup Anemometer, a self-registering instrument which shows the amount of Wind that passes in per day; from which also the 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 "*Windmill*" Anemometer is also recommended; the method of *Estimating* Wind Force by such tables as that given in the schedule is, to say the least, unsatisfactory.

Rain-gauges.—Many causes conspire to produce anomalies in rain returns. They arise, partly, from unfavourable situation for observation, and partly from the defective nature of the instruments used. It is, indeed, difficult to obtain an unexceptionable position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its edges are on a level with the close cut grass around its mouth. The rain-gauge ought to be read daily, and the readings entered in the returns on the day on which the rain fell.

Snow-falls may, for convenience, be registered in the rain columns under the following conditions:—When a snow-fall occurs it must 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 Luke Howard's nomenclature of deduction or inference.

clature of clouds will be found on the other side. The amount of cloud in the atmosphere ought to be estimated from the greater or less observation 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 appearances and changes ought to be noted among the "*Remarks*." The amount of cloud is entered from a scale of 0 to 10; thus, when the sky overhead is half-covered by clouds, 5 is entered as the observation, 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:—In the column "*Velocity*" only Direction, 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, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 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1000.

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:—In the column "*Velocity*" only Direction, 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, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657

29

Height of Cistern of the Barometer above Mean Sea-level feet, above Ground feet. During the MONTH of *September* 1860 .

The Hours of Observation are of Greenwich Time.

[illegible]

Observations made and
Return verified by

(Signed)

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

ONE of the objects of immediate importance, that the Scottish Meteorological Society has proposed to itself, is to secure a perfect uniformity in the system of observation pursued at all its Stations. A certain degree of uniformity is absolutely necessary to justify the publication of Monthly Results from different observations; and it is found that differences between the Returns from any two Stations, 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 persons 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 o'clock, (Greenwich or Railway Time only), twice a-day for some, and once, (morning or evening), for other instruments, as specified, in the following remarks, on the top 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 at what time it was taken, if not at 9 o'clock.

Barometer.—Weather-glasses and Aneroids, though admirably adapted, as the latter certainly are, to indicate variations of atmospheric pressure, are not well fitted for scientific purposes. No Barometer can be used for Meteorological Observations that will not be supplied with such means of adjustment or compensation as will secure the height of the mercury in the tube being accurately measured from the fluctuating surface of the mercury in the cistern. It is also necessary that every Barometer shall have been compared with a Standard.

Two moderate-priced Barometers have been approved of by the Council; if properly tested and attended to, they are both well adapted to Meteorological purposes.

An excellent Barometer is constructed by Mr. Aitke of London, the use of which is attended with 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 form of instrument has been adopted by the Board of Trade, and has received the approval of the Meteorological Committee of the British Association. In another form of the Barometer, the sides of the cistern are of leather, and thus, by aid of a screw acting on the bottom, the surface of the contained mercury can be adjusted to the zero-point of the fixed scale; their co-incidence being 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.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then screw up the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may 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 when, on inclining the instrument so that the mercury strikes the top of the tube, a sharp tap is produced. If this is prevented by air it may be removed to the cistern, and got rid of, by inverting the Barometer, (care being taken to prevent the loss of mercury by tightening the ivory peg), and gently tapping it; and if this plan fails, the instrument must be repaired.

The Barometer should be suspended in a good light, which may be improved by putting a piece of white paper behind the tube. It must be perfectly perpendicular, and exposed to neither the Sun's direct rays nor the heat of a fire.

In taking an observation, the attached Thermometer is first noted: the tube must then be gently tapped and the cistern adjusted carefully made. By raising and lowering the eye, 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 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 face of the mercury in the tube. The use of a lens will greatly facilitate an accurate adjustment and reading of the Barometer.

Protection of Thermometers.—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box, painted white outside, and black within, and fixed 4 feet above grass in an exposed position, free from merely local influences. The laths forming the sides and doors of the Boxes are arranged so as to act as "protect" the Thermometers, and to allow a complete ventilation of the interior. The instruments are suspended on cross-laths, in the centre of the Box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had at the Society's Office.

Self-registering Thermometers.—Professor Phillips's, and Negretti and Zambra's Patent "Maximum" Thermometers are recommended; printed directions for their use may be obtained with each instrument. The "Minimum" Thermometer of Rutherford is recommended when graduated on the glass stem and affixed to a frame separate from the "Maximum." This Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by an observer. When the column of spirit breaks, it may be reunited by striking the instrument repeatedly against the palm of the hand; when part of the spirit detaches by high temperature, it will be found in the upper lobe, and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. This instrument must be hung perfectly horizontal; the bulb end should incline slightly downwards, rather than the other.

clature of clouds will be found on the other side. The amount of cloud in the atmosphere 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 column, we ought not to take them into account in the clouds among the "Remarks." The amount of cloud is entered from a scale of 0 to 10; thus, when the sky overhead is half-covered by clouds, 5 is entered as the observation, 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:—In the column "Velocity and Direction," 6 S.W. (for example), 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 (extreme) speed of the former. Again, in the second "Cloud" column, an entry of $\frac{2}{4}$ or $\frac{3}{4}$ 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.

Sunshine.—The 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 health of crops and plants greatly depend 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 placed in the earth, their bulbs being sunk to 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. Mention must be made of the geological formation, and agricultural condition of the soil in which these thermometers are placed.

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 very important branch of Meteorology. The Council, therefore, recommend that the temperature of the sea be carefully taken by a properly constructed apparatus, from the ends of piers and rocks round the coast, where it is not influenced by that of river water. At or near the time of high water, on the 5th, 15th, and 25th of each month, the thermometer ought to be sunk exactly six feet (one fathom), and after ten minutes have elapsed, drawn up and read. 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; and continuing to observe for particular depths.

Temperature of Wells.—The temperature of the water at the bottoms of the wells ought, when practicable, to be taken, and the depth of the well and of the water noted.

Ozone.—Mention whether Schönbien's or Moffat's papers are used.—Moffat's are preferred. The paper is affixed by a pin to a board in the thermometer box and the indication 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., 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—6 is "4," i.e., that it is blowing fresh. Boxes of Papers may be had at the Society's Office.

Electricity.—Too much importance cannot be attached to electric condition of the atmosphere in connection with terrestrial magnetism, and as a meteorological phenomenon. A proper Electrometer is necessary to every complete meteorological observatory.

Remarks.—The "Remarks" column is too narrow, but unavoidably so. 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 recognised and in use at Greenwich and Southampton, are given at the foot of the column. Besides special and extraordinary observations, great differences 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, &c. Remarks ought to be made on the occurrence of meteors, aurora borealis, remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain, the hour of storms of wind attaining their maximum, as well as such notes on storms as have been hinted at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the snow-line in winter ought to be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. ought to be registered, either in two columns otherwise unoccupied, or in two ruled off for the purpose, from that headed "Remarks." It is intended that observations by the Electrometer should be entered in this manner, or on the side-margin. Additional remarks may be made on the margin.

Observations in connection with the periodic return of the seasons possess not only great scientific value, but are of considerable interest to the Agriculturist. The Council would direct the special attention of Observers to the registration of such phenomena; that the published Summaries may fairly represent the whole of Scotland. Observation 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 Council recommend that *term-day* observations be taken;—viz., on the 21st days of March, June, September, and December. For these hourly observations separate schedules will be furnished to observers.

Full directions for the use of the instruments mentioned above have been printed, and may be had along with them from the makers.

The Council have agreed to recommend that observers, before purchasing new instruments, should communicate with the Meteorological Secretary; and they consider it desirable that he should have full power to reject any instrument that, on being presented for comparison, does not afford him satisfaction.

(By Order.) A. H. B.

Edinburgh, 24th Feb. 1860.

Clouds.—Convenient abbreviations for Luke Howard's nomen-

FOREST TREES.		FRUITS.		MIGRATORY BIRDS.	
In Flower.	First Appear.	In Leaf.	First in Blossom.	First in Blossom.	First Arrival.
Alder,				Cuckoo,	
Asb.,				House-Swallow,	
Beech,				Curlew,	
Birch,				Swallow,	
Elm,				Starling,	
Larch,				Sand-Martin,	
Oak,				Plover,	
Sycamore or Plane,				Lawling,	
				Black Currant,	
				Apple,	
				Barberry,	
				Broom,	
				Hazel,	
				Hawthorn,	
				Holly,	
				Laburnum,	
				Lilac,	
				Mezereum,	
				Mountain Ash or Rowan,	
				Red Flowering Currant,	
				Rhododendron Ponticum,	
				Whin,	

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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 Exotic disease prevails among Cattle; and the Agricultural condition of the district generally.

Mr A. H. BURGESS,

Secretary of the Meteorological Society of Scotland,

10, St Andrew Square,

EDINBURGH.

BOOK-POST.

SCOTTISH METEOROLOGICAL SOCIETY.

31

Observations taken at *March Hallpark*, County of *Midlothian*, 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 *October* 1860.
The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read daily, at 9 P.M.				HYGROMETER. No.				WIND.				RAIN.		CLOUDS.				THERMOMETERS. under Ground.			SEA.	OZONE.		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 began and ended.	Days of Month.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
		9 h. A.M.		9 h. P.M.		Protected, in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		9 A.M.		P.M.		9 h. A.M.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
		Barometer. † No.	Attnch- ed Ther- mometer	Barometer. No.	Attnch- ed Ther- mometer	Max. No.	Min. No.	Max. in Sun's rays No.	Min. on Grass, No.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.	Readings of the H-Cup Anemo- meter, at 9 P.M.	No. of hours in which it fell.	Amount in inches.	Velocity, (0—10), and Direction.	Amount, (0—10), and Species.	Velocity, (0—10), and Direction.	Amount, (0—10), and Species.	No.	No.		No.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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NOTATION USED IN GENERAL REMARKS.

a.	denotes aurora.	m.	denotes meteor.
cl.	" cirrus.	ms.	" meteors.
cl-cu.	" cirro-cumulus.	n.	" nimbus.
cl-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.	" squall.
fr.	" frost.	sl.	" sleet.
h-fr.	" hoar-frost.	sn.	" snow.
h.	" haze.	so. ha.	" solar halo.
h. d.	" heavy dew.	sq.	" squall.
hl.	" hail.	sgs.	" squalls.
l.	" lightning.	t.	" thunder.
l. cl.	" light clouds.	t-s.	" thunder-storm.
l. 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), = _____

"Corrected Mean" of Barometer at 9 P.M., minus the Correction + for Temp. (Col. 4), = _____

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

Correction for Height, _____ feet, above Mean Sea-level, = _____

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

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

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

Difference, or Monthly Range, = _____

* 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 Glashier'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.-B. THERMOMETER, (in shade, etc.), Highest in Month (corrected for Index errors), on the _____ th, = _____

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

Difference, or Monthly Range, = _____

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

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

Difference, or Mean Daily Range, = _____

* Calculated Mean Temperature of Month, = _____

S.-B. 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 the _____ th, = _____

Difference of above Means or Range ("exposed"), = _____

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, = _____

Mean (corrected) A.M. and P.M. Reading of Wet Bulb, = _____

†† Computed Temperature of Dew-point, = _____

†† Do. Elastic Force of Vapour, = _____

†† Do. Weight of Vapour in a Cubic Foot of Air, = _____

†† Relative Humidity, (Saturation = 100), = _____

RAIN fell on _____ Days; Amount in Inches, _____

WIND.	SUMMARY.									
	Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.
A.M.										
P.M.										
Mean.										

N.B.—The Sums to be correctly added, and the Means deduced. Returns from the "Principal Towns" should be in Edinburgh not later than the 2nd; those from Other Places, not later if possible than the 6th. This Schedule not to be Gummed or Fastened, and Forwarded by Book Post, prepaid.

Observations made and
Return verified by

(Signed)

SCOTTISH METEOROLOGICAL SOCIETY.

33

Observations taken at *March Hall park*, County of *Midlothian*, 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 *November* 1860.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.		SELF-REGISTERING THERMOMETERS. Read daily, at 9 P.M.				HYGROMETER. No.				WIND.				RAIN.		CLOUDS.				THERMOMETERS. under Ground.			SEA.	OZONE.	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 began and ended.	Days of Month.									
		9 h. A.M.		9 h. P.M.		Protected, in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		9 h. A.M.															
		Barometer. † No.	Attach- ed Ther- mometer	Barometer. No.	Attach- ed Ther- mometer	Max. No.	Min. No.	Max. in Sun's rays No.	Min. on Grass. No.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direc- tion.	Force	Direc- tion.	Force	Readings of the H-Cup Anemo- meter, at 9 P.M. No.	No. of hours in which it fell.	Amount in inches. No.	Velocity, (0-10), and Direction.	Amount, (0-10), and Species.	Velocity, (0-10), and Direction.	Amount, (0-10), and Species.	No. 3 inches.	No. 12 inches.			No. 22 inches.	Temperature of WELL at Depth of feet. No.	Temperature at 1 fathom, and Density.	9 A.M. 9 P.M.					
		inches.	"	inches.	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"			"	"	"	"	"	"			
	1					49	40.2			47	46.8	42.8	40.1																		1						
	2					43.9	32.8			40.8	40	37	36																		2						
	3					42.5	29			38.7	38.1	37.5	37.2																		3						
	4					45.4	35			41.6	41	41.8	41.1						5 10												4						
	5					45.7	37			43	42.4	41.2	41																		5						
	6					46	38.8			48.9	42	42	41.5																		6						
	7					42.6	26.5			38.2	38	41.3	41																		7						
	8					42	37			40	39.2	39.9	39.6																		8						
	9					42.7	36			39.3	39	41	40.2																		9						
	10					42.8	37			40.2	40	42	41																		10						
	11					43.7	38.2			43	42.8	40.5	40.2						6 10												11						
	12					40.5	36.1			38.8	38.6	39	39.7																		12						
	13					41	26.4			40	39.7	41	41																		13						
	14					45	38.8			35.7	38	41.9	41																		14						
	15					42	38.8			39.4	39	40.2	39.8																		15						
	16					42.2	35			38.6	38	38	37.2																		16						
	17					36.5	30.2			32.5	32.1	37.6	37																		17						
	18					37	28			30.5	30.7	31	30.5						18 10													18					
	19					41	22.5			33	33	40.6	40.2																		19						
	20					43.4	39.5			38.9	38.2	44	43.4																		20						
	21					45	39			44	43.6	43	42.8																			21					
	22					45.4	38.7			48.8	40.5	48.8	41.8																			22					
	23					41.5	37			40	39.6	39.4	39																			23					
	24					40.6	36			39	39	38	37.8																			24					
	25					40.7	34.8			36.7	36.2	38.2	38						8 10													25					
	26					41	34.1			39	38.2	39	38.3																			26					
	27					49	29.5			28	27.5	31.8	31.8																			27					
	28					35.3	29.1			33	33	34	34																			28					
	29					40	31			37	36.8	40	39.8																			29					
	30					43	37.1			42.1	42	43	43																			30					
	31																																31				
	Sums.					109	167																														
						77.4	129																														
	Means.					42.6	34.3																														
	* Total Corrections for Instrumental Errors.																																				
	† 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. sl. " sleet.					
																																h.-fr. " hoar-frost. sn. " snow.					
																																h. " haze. so. ha. " solar halo.					
																																h. d. " heavy dew. sq. " squall.					
																																hl. " hail. squ. " squalls.					
																																l. " lightning. t. " thunder.					
																																li. cl. " light clouds. t.-s. " thunder-storm.					
																																li. sh. " light showers. w. " wind.					
																																lu. co. " lunar coron. 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					
																																1-5 Very light air 2-3 Fresh breeze 5 Blowing a gale					
																																1-5 Light air 3- Very fresh 6 Violent gale					

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction† = _____
for Temp. (Col. 2), = _____
"Corrected Mean" of Barometer at 9 P.M., minus the Correction† = _____
for Temp. (Col. 4), = _____
Mean at Station, corrected, and at 32°, = _____
Correction for Height, feet, above Mean Sea-level, = _____
Mean, reduced to 32°, and Sea-level, = _____
Highest Reading, corrected for Index error, on the th, = _____
Lowest Do., Do., on the th, = _____
Difference, or Monthly Range, = _____

S.-R. THERMOMETER, (in shade, etc.), Highest in Month (corrected for Index errors), on the th, = _____
Lowest in Month, corrected for Index errors, on the th, = _____
Difference, or Monthly Range, = _____
"Corrected Mean" of all the Highest, (Col. 5), = _____
"Corrected Mean" of all the Lowest, (Col. 6), = _____
Difference, or Mean Daily Range, = _____
** Calculated Mean Temperature of Month, = _____

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 the th, = _____
Difference of above Means or Range ("exposed"), = _____

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, = _____

Mean (corrected) A.M. and P.M. Reading of Wet Bulb, = _____
†† Computed Temperature of Dew-point, = _____
†† Do. Elastic Force of Vapour, = _____
†† Do. Weight of Vapour in a Cubic Foot of Air, = _____
†† Relative Humidity, (Saturation = 100), = _____

RAIN fell on Days; Amount in Inches, = _____

WIND.		SUMMARY.									
Direction.		N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.
A.M.											
P.M.											
Mean.											

N.B.—The Sums to be correctly added, and the Means deduced. Returns from the "Principal Towns" should be in Edinburgh not later than the 2nd; those from Other Places, not later if possible than the 6th. This Schedule not to be Gummed or Fastened, and Forwarded by Book Post, prepaid.

Observations made and
Return verified by

(Signed)

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

One of the objects of immediate importance, that the Scottish Meteorological Society has proposed to itself, is to secure a perfect uniformity in the system of observation pursued at all its Stations. A certain degree of uniformity is absolutely necessary to justify the publication of Monthly Results from different observations; and it is found that differences between the Returns from any 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 persons 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.

Hours of Observation.—The Council recommend that Observations be made precisely at 9 o'clock, (Greenwich or Railway Time only), twice a day for some, and once, (morning or evening), for other instruments, as specified, in the following remarks, or at the top 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 at what time it was taken, if not at 9 o'clock.

Barometer.—Weather-glasses and Anemometers, though admirably adapted, as the latter certainly are, to indicate variations of spheric pressure, are not well fitted for scientific purposes. Nor can any Barometer be used for Meteorological Observations that is not supplied with such means of adjustment or compensation as will secure the height of the mercury in the tube being accurately measured from the fluctuating surface of the mercury in the cistern. It is also necessary that every Barometer shall have been compared with a *Standard*.

Two moderate-sized Barometers have been approved of by the Council; if properly tested and attended to, they are both well adapted to Meteorological purposes.

An excellent Barometer is constructed by Mr. Adie of London, the use of which is attended with the great convenience of requiring no adjustment of the cistern. Its *scale-tubes* 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 form of instrument has been adopted by the Board of Trade, and has received the approval of the Meteorological Committee of the British Association. In another form of the Barometer, the sides of the *cistern* are of leather, and thus, by aid of a screw acting on the bottom, the surface of the contained mercury can be adjusted to the *zero-point* of the fixed scale; when passes freely through the lid and case of the cistern. When the *index-rod* 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 *nerve*.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then *serve up* the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may 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 complete vacuum; this is the case when, on inclining the instrument so that the mercury strikes the top of the tube, a *slump top* is produced. If this is prevented by air it may be removed to the cistern, and got rid of, by inverting the Barometer, (care being taken to prevent the loss of mercury by tightening the ivory peg), and gently tapping it; and if this plan fails, the instrument must be repaired.

The Barometer should be suspended in a good light, which may be improved by putting a piece of white paper behind the tube. It must be perfectly perpendicular, and exposed to neither the Sun's direct rays nor the heat of a fire.

In taking an Observation, the attached Thermometer is first noted; the tube must then be gently tapped and the cistern adjusted carefully into the plane of the back and front of the index,—usually the lower edge of the vernier, which must be carefully adjusted 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 greatly facilitate an accurate adjustment and reading of the Barometer.

Protection of Thermometers.—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box, painted white outside, and black within, and fixed 4 feet above grass in an exposed position, free from rain and local influences. The laths forming the sides and doors of the Boxes are arranged so as to open to "protect" the Thermometers, and to allow a complete ventilation of the interior. The instruments are suspended on cross-laths, in the centre of the Box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had at the Society's Office.

Self-registering Thermometers.—Professor Phillips's, and Negretti and Zambra's Patent "Maximum" Thermometers are recommended; printed directions for their use may be obtained with each instrument. The "Minimum" Thermometer of Rutherford is recommended when graduated on the glass stem and affixed to a frame separate from the "Maximum." This Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by an observer. When the column of spirit breaks, it may be reunited by striking the instrument repeatedly against the palm of the hand; when part of the spirit distils by high temperature, it will be found in the upper lobe, and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. This instrument must be hung perfectly horizontal; the bulb end should incline slightly downwards, rather than the other.

The above remarks apply equally to the Thermometers for registering the greatest heat from the Sun's rays and the least from radiation during night. Their bulbs have a black coating, which may easily be made, or mended, by the application of a mixture of lamp black and pine'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 alcohol by distillation.

Verification of Thermometers.—No instrument ought to be used for Meteorological purposes that has not been carefully tested by comparison with a *Standard Thermometer*. When such Thermometers are not graduated on the stem, but merely on an attached scale, mid-gego repairs, they are very liable to be moved from their position on the Scale, and ought never afterwards to be used. "Minimum" Thermometers, eight frequently and especially the "Maximum" 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. For comparison of Thermometers, a properly-tested Thermometer may be had, on loan, by any observer, from the Meteorological Secretary.

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and well-tested form of this apparatus seriously vitiate these Hygrometric Deductions, 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 so adjusted as to hang the tubes forward by an inch, from the point on which it may be supported;—the water-cup must be covered, and placed to the side; and a little below the level of the wet bulb;—a notched under the bulb;—the mug 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 mug 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.

One form of "Mason's" Hygrometer is highly objectionable. The frame of the Thermometers is enclosed in a tin case, which also supports the water cup underneath. This arrangement must be immediately altered by pulling the boxwood frame out of the tin case, and hanging them side by side, so that the forementioned requirements shall be complied with, as far as possible.

Reading of the Thermometer.—Great care must be taken to avoid the effects of refraction, by bringing 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 58°·9, 40°·0, or 40°·1; or again, 40°·4, 40°·3, or 40°·6, according as it indicates a little under, an exact coincidence with, or a little over 40°; or 40°·5, respectively. So also 40°·4, and 40°·6, more or less, must be registered 40°·2 or 40°·8, and 40°·7 or 40°·3 respectively. In reading Rutherford's "Max." and "Min." Thermometers, the indication of that end of the index which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry bulbs, must be rapidly taken, being so readily affected by heat from the person of the observer.

How 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 3rd are those of a series of phenomena commencing at 9 P.M. on the 2nd, and extending till 9 P.M. on the 3rd.

Wind.—A wind-vane ought to be elevated 12 feet at least, above surrounding objects. When it oscillates incessantly, the mean direction must be taken; and when it is stationary, and always when the lower strata of clouds overhead, and to the direction of the wind, etc.

Careful observations ought to be made on the changes in the direction of the wind; and during storms, extra observations ought to be made at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, will be likely to give highly interesting and important results. The Council would strongly recommend that every Observatory be furnished with a Hemispherical Cup Anemometer,—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the 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 Linds Anemometer is also recommended: the method of *Estimating Wind Force* by such tables as that given in the schedule is, to say the least, unsatisfactory.

Rain-gauges.—Many causes conspire to produce anomalies in rain returns. They arise, partly, from unfavourable situation for observation, and partly from the defective nature of the instruments used. It is, indeed, difficult to obtain an unexceptionable position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its edges are on a level with the close cut grass around its mouth. The rain-gauge ought to be read daily, and the readings entered in the returns on the day on which the rain fell.

Snow-falls may, for convenience, be registered in the rain columns, under the following conditions.—When a snow shower occurs it must 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 indicated 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 Luke Howard's nomen-

clature of clouds will be found on the other side. The amount of cloud in the atmosphere 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 appearances and changes ought to be noted among the "Remarks." The amount of cloud is entered from a scale of 0 to 10; thus, when the sky overhead is half-covered by clouds, 5 is entered as the *observation*, and so on.

Observations of 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:—In the column "Velocity and Direction," 6 S.W., (for example), will indicate that the upper strata of clouds travel with *extreme* velocity from S.W., and these in the lower regions from W., with one-third the (average) speed of the former. Again, in the second "Cloud" column, an entry of 2, on-st., (i.e.,) 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.

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

Indicating Thermometers.—As the germination and health of crops and plants greatly depend 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 placed in the earth, their bulbs being sunk to 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. Mention must be made of the geological formation, and agricultural condition of the soil in which these thermometers are placed. **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 very important branch of Meteorology. The Council, therefore, recommend that the temperature of the sea be carefully taken by a properly constructed apparatus, from the ends of piers and rocks round the coast, where it is not influenced by that of river water. At or near the time of high water, on the 5th, 15th, and 25th of each month, the thermometer ought to be sunk exactly six feet (one fathom), and after ten minutes have elapsed, drawn up and read. 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: and continuing to observe for particular depths.

Temperature of Wells.—The temperature of the water at the bottoms of wells ought, when practicable, to be taken, and the depth of the well and of the water noted.

Ozone.—Mention whether Schönbein's or Moffat's papers are used.—Moffat's are preferred. The paper is affixed by a pin to a board in the thermometer box, and the indication 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^{W.}, 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—6 is "4," i.e., that it is blowing *fresh*. Boxes of Papers may be had at the Society's Office.

Magnetism.—Too much importance cannot be attached to electro condition of the atmosphere in connection with terrestrial magnetism, and as a meteorological phenomenon. A proper Electrometer is necessary to every complete meteorological observatory.

Remarks.—The "Remarks" column is too narrow, but unavoidably so. 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 recognised and in use at Greenwich and Southampton, are 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, among boreales, remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain, the hour of storms of wind attaining their maximum, as well as such notes on storms as have been hinted at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the snow-line in winter ought to be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. ought to be registered, either in two columns otherwise unoccupied, or in two ruled off for the purpose, from that headed "Remarks." It is intended that observations by the Electrometer should be entered in this manner, or on the side-margin. Additional remarks may be made on the margin.

"Observations in connection with the periodic return of seasons" possess not only great scientific value, but are of considerable interest to the Agriculturist. The Council would direct the special attention of Observers to the registration of such phenomena; 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, on a selected piece of ground or farm.

The Council recommend that *term-day* observations be taken;—viz., on the 21st days of March, June, September, and December. For these hourly observations separate schedules will be furnished to observers.

Full directions for the use of the instruments mentioned above have been printed, and may be had along with them from the Society.

The Council have agreed to recommend that observers, before purchasing new instruments, should communicate with the Meteorological Secretary; and they consider it desirable that he should have full power to reject any instrument that, on being presented for comparison, does not afford him satisfaction.

(By Order,) A. H. B.

EDINBURGH, 24th Feb. 1860.

Observations in connection with the periodical return of the seasons.

FOREST TREES.	In	Leaf buds	First appearance.	Flower.	First in blossom.
Alder,					
Beech,					
Birch,					
Elm,					
Larch,					
Lime,					
Oak,					
Sycamore or Plane,					

CROPS.	First in blossom.	First in leaf.	First in fruit.	First in blossom.	First in leaf.
Barley,					
Battle,					
Corn,					
Wheat,					
Oats,					
Beans,					
Peas,					
Turnips,					
Rye Grass,					

SHRUBS, ETC.	First in blossom.	First in leaf.	First in fruit.	First in blossom.	First in leaf.
Barberry,					
Battle or Elder,					
Black Currant,					
Cherry,					
House-Swallow,					
Lapwing,					
Plover,					
Sand-Martin,					
Starling,					
Swan,					
Rail or Corn Crake,					
Other Birds, naming them—					

MIGRATORY BIRDS.	First in blossom.	First in leaf.	First in fruit.	First in blossom.	First in leaf.
Apple,					
Black Currant,					
Cherry,					
House-Swallow,					
Lapwing,					
Plover,					
Sand-Martin,					
Starling,					
Swan,					
Rail or Corn Crake,					
Other Birds, naming them—					

FRUITS.	First in blossom.	First in leaf.	First in fruit.	First in blossom.	First in leaf.
Apple,					
Black Currant,					
Cherry,					
House-Swallow,					
Lapwing,					
Plover,					
Sand-Martin,					
Starling,					
Swan,					
Rail or Corn Crake,					
Other Birds, naming them—					

SHRUBS, ETC.	First in blossom.	First in leaf.	First in fruit.	First in blossom.	First in leaf.
Barberry,					
Battle or Elder,					
Black Currant,					
Cherry,					
House-Swallow,					
Lapwing,					
Plover,					
Sand-Martin,					
Starling,					
Swan,					
Rail or Corn Crake,					
Other Birds, naming them—					

FRUITS.	First in blossom.	First in leaf.	First in fruit.	First in blossom.	First in leaf.
Apple,					
Black Currant,					
Cherry,					
House-Swallow,					
Lapwing,					
Plover,					
Sand-Martin,					
Starling,					
Swan,					
Rail or Corn Crake,					
Other Birds, naming them—					

SHRUBS, ETC.	First in blossom.	First in leaf.	First in fruit.	First in blossom.	First in leaf.
Barberry,					
Battle or Elder,					
Black Currant,					
Cherry,					
House-Swallow,					
Lapwing,					
Plover,					
Sand-Martin,					
Starling,					
Swan,					
Rail or Corn Crake,					
Other Birds, naming them—					

FRUITS.	First in blossom.	First in leaf.	First in fruit.	First in blossom.	First in leaf.
Apple,					
Black Currant,					
Cherry,					
House-Swallow,					
Lapwing,					
Plover,					
Sand-Martin,					
Starling,					
Swan,					
Rail or Corn Crake,					
Other Birds, naming them—					

SHRUBS, ETC.	First in blossom.	First in leaf.	First in fruit.	First in blossom.	First in leaf.
Barberry,					
Battle or Elder,					
Black Currant,					
Cherry,					
House-Swallow,					
Lapwing,					
Plover,					
Sand-Martin,					
Starling,					
Swan,					
Rail or Corn Crake,					
Other Birds, naming them—					

FRUITS.	First in blossom.	First in leaf.	First in fruit.	First in blossom.	First in leaf.
Apple,					
Black Currant,					
Cherry,					
House-Swallow,					
Lapwing,					
Plover,					
Sand-Martin,					
Starling,					
Swan,					
Rail or Corn Crake,					
Other Birds, naming them—					

SHRUBS, ETC.	First in blossom.	First in leaf.	First in fruit.	First in blossom.	First in leaf.
Barberry,					
Battle or Elder,					
Black Currant,					
Cherry,					
House-Swallow,					
Lapwing,					
Plover,					
Sand-Martin,					
Starling,					
Swan,					
Rail or Corn Crake,					
Other Birds, naming them—					

FRUITS.	First in blossom.	First in leaf.	First in fruit.	First in blossom.	First in leaf.
Apple,					
Black Currant,					
Cherry,					
House-Swallow,					
Lapwing,					
Plover,					
Sand-Martin,					
Starling,					
Swan,					
Rail or Corn Crake,					
Other Birds, naming them—					

SHRUBS, ETC.	First in blossom.	First in leaf.	First in fruit.	First in blossom.	First in leaf.
Barberry,					
Battle or Elder,					
Black Currant,					
Cherry,					
House-Swallow,					
Lapwing,					
Plover,					
Sand-Martin,					
Starling,					
Swan,					
Rail or Corn Crake,					
Other Birds, naming them—					

FRUITS.	First in blossom.	First in leaf.	First in fruit.	First in blossom.	First in leaf.
Apple,					
Black Currant,					
Cherry,					
House-Swallow,					
Lapwing,					
Plover,					
Sand-Martin,					
Starling,					
Swan,					
Rail or Corn Crake,					
Other Birds, naming them—					

SHRUBS, ETC.	First in blossom.	First in leaf.	First in fruit.	First in blossom.	First in leaf.
Barberry,					
Battle or Elder,					
Black Currant,					
Cherry,					
House-Swallow,					
Lapwing,					
Plover,					
Sand-Martin,					
Starling,					
Swan,					
Rail or Corn Crake,					
Other Birds, naming them—					

FRUITS.	First
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SCOTTISH METEOROLOGICAL SOCIETY.

35

Observations taken at *March Hill Fort*, County of *Midlothian*, 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 *December* 186*9*.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read daily, at 9 P.M.				HYGROMETER. No.				WIND.				RAIN.		CLOUDS.				SUNSHINE. Hours.	THERMOMETERS. under Ground.			Temperature of WELL at Depth of feet. No.	SEA. Temperature at 1 fathom and Density.	OZONE. 0-10.	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 began and ended.	Days of Month.	
		9 h. A.M.		9 h. P.M.		Protected, in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		9 A.M.		P.M.													
		Barometer. + No.	Attach- ed Ther- mometer	Barometer. No.	Attach- ed Ther- mometer	Max. No.	Min. No.	Max. in Sun's rays No.	Min. on Grass. No.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force	Direction.	Force	Readings of the H-Cup Anemo- meter, at 9 P.M. No.	No. of hours in which it fell.	Amount in inches. No.	Velocity (0-6), and Direction.	Amount (0-10), and Species.	Velocity (0-6), and Direction.		Amount (0-10), and Species.								
		inches.	"	inches.	"	No.	No.	No.	No.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force	Direction.	Force	No.	No.	No.	No.	No.	No.		No.	No.							
		inches.	"	inches.	"	No.	No.	No.	No.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force	Direction.	Force	No.	No.	No.	No.	No.	No.		No.	No.							
	1					46	38			40.8	40	46	45.8							1												1	
	2					46.2	41			45.2	43	46.2	42.8																			2	
	3					43	38.4			42.5	42	41	40.3																			3	
	4					41	36.8			40	40	41	40.8																			4	
	5					44	40			41	40.4	44	43.8																			5	
	6					44.3	39			42.2	42	44	43.5																			6	
	7					48	41.7			44.7	44.2	46	45.6																			7	
	8					45.3	37			40.3	40	42	41.8							1 1/2												8	
	9					44.4	40			45	44.8	44	43.9																			9	
	10					44	41			43.7	43.2	44	43.8																			10	
	11					43	39.5			42	42	42	41.7																			11	
	12					40.3	34.2			36.1	36.1	39.2	39																			12	
	13					40	32.1			37.5	37	38	34.8																			13	
	14					43	33			41	40.5	43	43																			14	
	15					42.5	35.2			37	36.9	38.2	30							3 1/2												15	
	16					39.8	35			35.7	38	37.8	37																			16	
	17					37	32			35.2	29.8	36	38.4																			17	
	18					38	29			32	32.0	30	29.8																			18	
	19					32	26.4			32.3	32	22	32.2																			19	
	20					32	27			30.7	31	29.5	29.5																			20	
	21					32	26			31.7	32	29	28.9																			21	
	22					30.1	21.5			3	—	30.1	30.1							7/10												22	
	23					3.0	21.6			26	26	—	—																			23	
	24					19.8	5			—	—	—	—																			24	
	25					19	13			—	—	—	—																			25	
	26					23	8.8			—	—	—	—																			26	
	27					26.7	18.8			—	—	—	—																			27	
	28					29.2	17			—	—	29	29.1																			28	
	29					32	25.8			34.4	34.2	28.2	28																			29	
	30					35	26			31.7	32	36.2	36																			30	
	31					36	23.4			35.8	35	35.2	35							6 90												31	
Sums.						13 4 157	143 6 92 4 2																										
Means.						36.9	29.8																										
* Total Corrections for Instrumental Errors.																																	
+ 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.	" meteor.
ci-cu.	" cirro-cumulus.	h.	" 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.	sl.	" sleet.
h.-fr.	" hoar-frost.	sn.	" snow.
h.	" haze.	so. ha.	" solar halo.
h. d.	" heavy dew.	sq.	" squall.
hl.	" hail.	sq.	" 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 hard
1	Light air	3	Very fresh	6	Violent gale

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction† = _____
for Temp. (Col. 2), = _____"Corrected Mean" of Barometer at 9 P.M., minus the Correction† = _____
for Temp. (Col. 4), = _____

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

Correction for Height, feet, above Mean Sea-level, = _____

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

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

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

Difference, or Monthly Range, = _____

S.-R. THERMOMETER, (in shade, etc.), Highest in Month (corrected for Index errors), on the _____ th, = 48.0

Lowest in Month, corrected for Index errors, on the _____ th, = 5.0

Difference, or Monthly Range, = 43.0

"Corrected Mean" of all the Highest, (Col. 5), = 36.9

"Corrected Mean" of all the Lowest, (Col. 6), = 29.8

Difference, or Mean Daily Range, = 7.1

** Calculated Mean Temperature of Month, = 33.4

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 the _____ th, = _____

Difference of above Means or Range ("exposed"), = _____

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, = _____

Mean (corrected) A.M. and P.M. Reading of Wet Bulb, = _____

†† Computed Temperature of Dew-point, = _____

†† Do. Elastic Force of Vapour, = _____

†† Do. Weight of Vapour in a Cubic Foot of Air, = _____

†† Relative Humidity, (Saturation = 100), = _____

RAIN fell on _____ Days; Amount in Inches, = 6.90

WIND.		SUMMARY.					
Direction.		N	NE	E	SE	S	SW
A.M.							
P.M.							
Mean.							

A

N.B.—The Sums to be correctly added, and the Means deduced. Returns from the "Principal Towns" should be in Edinburgh not later than the 2nd; those from Other Places, not later if possible than the 6th. This Schedule not to be Gummed or Fastened, and Forwarded by Book Post, prepaid.

Observations made and
Return verified by _____

(Signed) _____

Greatest daily range = 14.8 on the 26th.

B

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

ONE of the objects of immediate importance, that the Scottish Meteorological Society has proposed to itself, is to secure a perfect uniformity in the system of observation pursued at all its Stations. A certain degree of uniformity is absolutely necessary to justify the publication of Monthly Results from different observations; and it is found that differences between the Returns from any 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 persons 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 comprehensiveness 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 o'clock, (Greenwich or Railway Time only), twice a day for some, and once, (morning or evening), for other instruments, as specified, in the following remarks, or at the top 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 at what time it was taken, if not at 9 o'clock.

Barometrical—Weather-glasses and Aneroids.—Though admirably adapted, as the latter certainly are, to indicate variations of atmospheric pressure, are not well fitted for scientific purposes. Nor can any Barometer be used for Meteorological Observations that is not supplied with such means of adjustment or compensation, as will secure the height of the mercury in the tube being accurately measured from the fluctuating surface of the mercury in the cistern. It is also necessary that every Barometer shall have been compared with a Standard.

Two moderate-priced Barometers have been approved of by the Council; if properly tested and attended to, they are both well adapted to Meteorological purposes.

An excellent Barometer is constructed by Mr. Adie of London, the use of which is attended with 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 form of instrument has been adopted by the Board of Trade, and has received the approval of the Meteorological Committee of the British Association. In another form, by the Barometer, the sites of the cistern are of leather, and thus by aid of a screw acting on the bottom, the surface of the contained mercury can be adjusted to the zero-point of the fixed scale; their co-incidence being 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 screws, 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.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then screw up the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may 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 when, on inclining the instrument so that the mercury strikes the top of the tube, a sharp tap is produced. If this is prevented by air it may be removed to the cistern, and got rid of, by inverting the Barometer, (care being taken to prevent the loss of mercury by tightening the ivory peg), and gently tapping it; and if this plan fails, the instrument must be repaired.

The Barometer should be suspended in a good light, which may be improved by putting a piece of white paper behind the tube. It must be perfectly perpendicular, and exposed to neither the Sun's direct rays nor the heat of a fire.

In taking an Observation, the attached Thermometer is first noticed; the tube must then be gently tapped and the cistern adjusted carefully made. By raising and lowering the eye, 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 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 greatly facilitate an accurate adjustment and reading of the Barometer.

Protection of Thermometers.—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box, painted white outside, and black within, and fixed 4 feet above grass in an exposed position, free from merely local influences. The laths forming the sides and doors of the Boxes are arranged so as at once to "protect" the Thermometers, and to allow a complete ventilation of the interior. The instruments are suspended on cross-laths, in the centre of the Box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had at the Society's Office.

Self-registering Thermometers.—Professor Phillips's and Negretti and Zambra's Patent "Maximum" Thermometers are recommended; printed directions for their use may be obtained with each instrument. The "Minimum" Thermometer of Rutherford is recommended when graduated on the glass stem and affixed to a frame separate from the "Maximum." This Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by an observer. When the instrument of spirit breaks, it may be re-united by striking the instrument repeatedly against the palm of the hand; when part of the spirit distils by high temperature, it will be found in the upper lobe, and must be dislodged from thence by heating that part with the body of the liquid. This instrument must be hung perfectly horizontal; the bulb end should incline slightly downwards, rather than the other.

The above remarks apply equally to the Thermometers for registering the greatest heat from the Sun's rays and the least from radiation during night. Their bulbs have a black coating, which may easily be made, or mended, by the application of a mixture of lamp black 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 alcohol by distillation.

Verification of Thermometers.—No instrument ought to be used for Meteorological purposes that has not been carefully tested by comparison with a Standard Thermometer. When such Thermometers 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 and 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. For comparison of Thermometers, a properly-tested Thermometer may be had, on loan, by any observer, from the Meteorological Secretary.

The Hygrometer consists of two Thermometers, usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and well-tested form of this apparatus seriously vitiate the "Hygrometrical Deductions," 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 placed to the side, and a little below the level of the wet bulb;—in no case under the bulbs;—the mullin 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 mullin 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.

One form of "Mason's" Hygrometer is highly objectionable. The frame of the Thermometers is enclosed in a tin case, which also supports the water cup underneath. This arrangement must be immediately altered by pulling the boxwood frame out of the tin case, and hanging them side by side, so that the forementioned requirements shall be complied with, as far as possible.

Reading of the Thermometer.—Great care must be taken to avoid the effects of refraction, by bringing 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, or 40.6, according as it indicates a little under, an exact coincidence with, or a little over 40° or 40.5 respectively. So also 40.4, and 40.7 or 40.8 respectively. In reading Rutherford's "Max." and "Min." Thermometers, the indication of that end of the index which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry bulbs, must be rapidly taken, being so really 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 record their occurrence to their proper meteorological day. In the Society's schedules, the indications registered on the 3rd are those of a series of phenomena commencing at 9 P.M. on the 2nd, and extending till 9 P.M. on the 3rd.

Wind.—A wind-vane ought to be elevated 12 feet at least, above surrounding objects. When it oscillates incessantly, the mean direction must be taken; and when it is stationary, and always when the wind is feeble, reference must be made to the direction of the lower strata of clouds overhead, and to the direction of smoke, etc.

Careful observations ought to be made on the changes in the direction of the wind; and during storms, extra observations ought to be made at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, would be likely to give highly interesting and important results. The Council would strongly recommend that every Observatory be furnished with a Hemispherical-Cup Anemometer.—A self-registering instrument which shows the amount of the Wind that passes in per day; from which also the 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, Lind's Anemometer is also recommended: the method of Examining Wind Force by such tables as that given in the schedule is, to say the least, unsatisfactory.

Rain-gauges.—Many causes conspire to produce anomalies in rain returns. They arise, partly, from unfavourable situation for observation, and partly from the defective nature of the instruments used. It is, indeed, difficult to obtain an unexceptionable position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its edges are on a level with the close cut grass around its mouth. The rain-gauge ought to be read daily, and the readings entered in the returns on the day on which the rain fell.

Snow-falls may, for convenience, be registered in the rain columns, under the following conditions.—When a snow shower occurs it must 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 Luke Howard's nomenclature, have been printed, and may be had along with them from the Council.

climate of clouds will be found on the other side. The amount of cloud in the atmosphere 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 among the "Remarks." The amount of cloud is entered from a scale of 0 to 10; thus, when the sky overhead is half-covered by clouds, 5 is entered as the observation, 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:—In the column "Velocity and Direction," 2, W., (for example,) 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 (extreme) speed of the former. Again, in the second "Cloud" column, an entry of 2, cu-st., (e.g.) 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.

Sunshine.—The 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 health of crops and plants greatly depend 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 placed in the earth, their bulbs being sunk to 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. Mention must be made of the geological formation, and agricultural condition of the soil in which these thermometers are placed.

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 very important branch of Meteorology. The Council, therefore, recommend that the temperature of the sea be carefully taken by a properly constructed apparatus, from the ends of piers and rocks round the coast, where it is not influenced by that of river water. At or near the time of high water, on the 5th, 15th, and 25th of each month, the thermometer ought to be sunk exactly six feet (one fathom), and after ten minutes have elapsed, drawn up and read. 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; and continuing to observe for particular depths.

Temperature of Wells.—The temperature of the water at the bottoms of wells ought, when practicable, to be taken, and the depth of the well and of the water noted.

Ozone.—Mention whether Schönbein's or Moffat's papers are used.—Moffat's are preferred. The paper is affixed by a pin to a board in the thermometer box, and the indication 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 33%, as an ozone entry in the schedule, will indicate that the ozone paper is tried as "33" on the scale, that the wind is from the N.W., and that its force on the scale 0—6 is "4.5," i.e., that it is blowing fresh. Boxes of Papers may be had at the Society's Office.

Electricity.—Too much importance cannot be attached to electric condition of the atmosphere in connection with terrestrial magnetism, and as a meteorological phenomenon. A proper Electrometer is necessary to every complete meteorological observatory.

Remarks.—The "Remarks" column is too narrow, but unavoidably so. 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 recognised and in use at Greenwich and Southampton, are 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 borealis, remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain, the hour of storms of wind attaining their maximum, as well as such notes on storms as have been hinted at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the snow-line in winter ought to be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. ought to be registered, either in two columns otherwise unoccupied, or in two ruled off for the purpose, from that headed "Remarks." It is intended that observations by the Electrometer should be entered in this manner, or on the side margin. Additional remarks may be made on the margin.

Observations in connection with the periodic return of the seasons. possess not only great scientific value, but are of considerable interest to the Agriculturist. The Council would direct the special attention of Observers to the registration of such phenomena; that the published Summaries may fairly represent the whole of Scotland. Observation 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 Council recommend that term-day observations be taken;—viz., on the 21st days of March, June, September, and December. For these hourly observations separate schedules will be furnished to observers.

Full directions for the use of the instruments mentioned above have been printed, and may be had along with them from the Council.

The Council have agreed to recommend that observers, before purchasing new instruments, should communicate with the Meteorological Secretary; and they consider it desirable that he should have full power to reject any instrument that, on being presented for comparison, does not afford him satisfaction.

(By Order,) A. H. B.

EDINBURGH, 24th Feb. 1860.

March Hill Park
Edinburgh

DEC
1960

To

Mr A. H. BURGESS,

Secretary of the Meteorological Society of Scotland,

10, St Andrew Square,

EDINBURGH.

BOOK-POST.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.									
FOREST TREES.	In flower.	In leaf.	Discoloured leaves.	CROPS.	Soiling or above ground.	In ear or in flower.	First or last cut.	First or last ripe.	First or last ripe.
Alder,				Barley,					
Ash,				Bare or Bigg,					
Beech,				Oats,					
Birch,				Wheat,					
Elm,				Beans,					
Larch,				Pears,					
Oak,				Potatoes,					
Sycamore or Plane,				Rye Grass,					
SHRUBS, ETC.	First in blossom.	First in blossom.	First in blossom.	First in blossom.	First in blossom.	First in blossom.	First in blossom.	First in blossom.	First in blossom.
Barberry,				Apple,					
Boulevard or Elder,				Black Currant,					
Broom,				Cherry,					
Hazel,				Gemm,					
Hawthorn,				Gooseberry,					
Holly,				Pear,					
Laburnum,				Peach,					
Lilac,				Plum,					
Mezerium,				Strawberry,					
Mountain Ash or Rowan,				Other Birds, naming them,					
Red Flowering Currant,									
Rhododendron Pourtoisum,									
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 blights, diseases, etc., Whether Epizootic disease prevails among Cattle; and the Agricultural condition of the district generally.