HINTS

TO

METEOROLOGICAL OBSERVERS

BY

W. MARRIOTT, F.R.MET.SOC.

SEVENTH EDITION

1911

PRICE 1s. 0d.

CLOUD FORMS

CIRRUS
(MARE'S TAIL)
27,000 to 50,000 ft.

CIRRO-STRATUS
Average 29,500 ft.

CIRRO-CUMULUS
(MACKEREL SKY)
10,000 to 23,000 ft.

ALTO-CUMULUS
10,000 to 23,000 ft.

ALTO-STRATUS
10,000 to 23,000 ft.

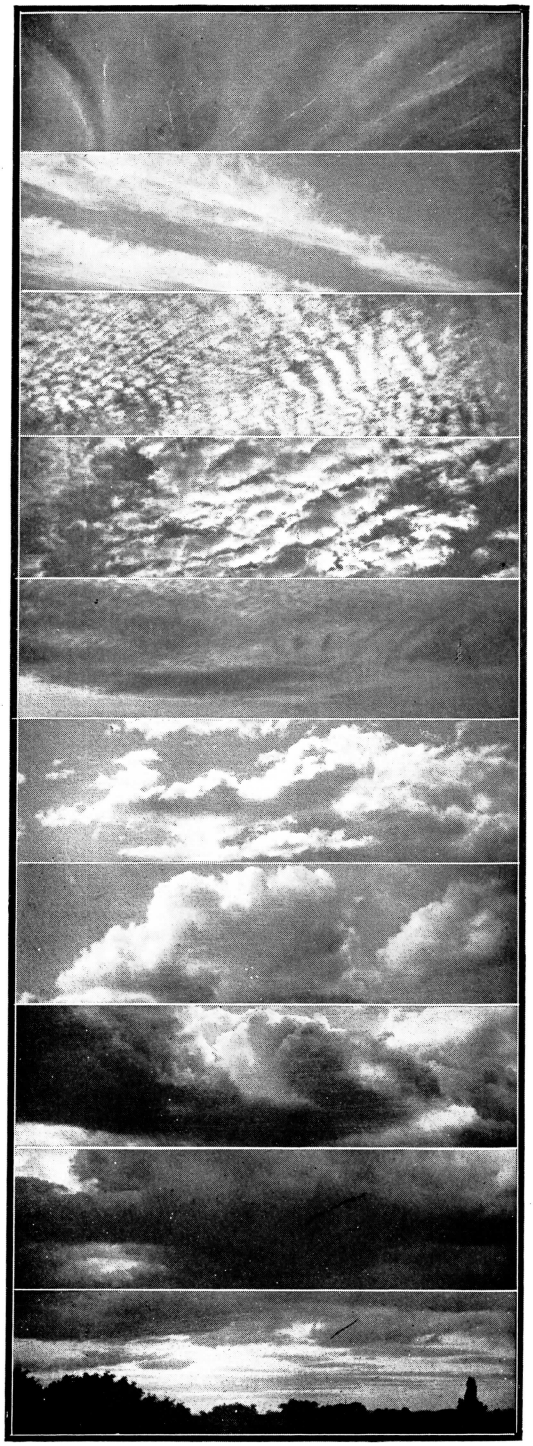
STRATO-CUMULUS
About 6,500 ft.

CUMULUS
4,500 to 6,000 ft.

CUMULO-NIMBUS
(STORM CLOUD)
4,500 to 24,000 ft.

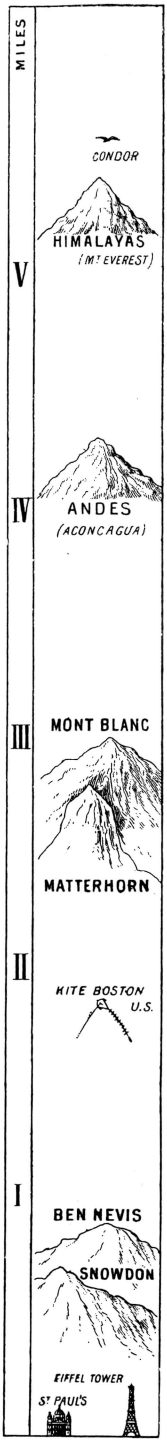
NIMBUS
(RAIN CLOUD)
3,000 to 6,400 ft.

STRATUS
0 to 3,500 ft.



From Photographs by
COL. H.M. SAUNDERS.

By Permission of
MR R INWARDS.



HINTS

TO

Meteorological Observers.

PREPARED UNDER THE DIRECTION OF
THE COUNCIL OF THE

ROYAL METEOROLOGICAL SOCIETY,

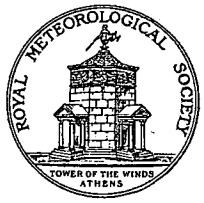
BY

WILLIAM MARRIOTT, F.R.Met.Soc.,
ASSISTANT-SECRETARY AND LECTURER.

SEVENTH EDITION,
REVISED AND ENLARGED.

WITH ILLUSTRATIONS.

LONDON:
EDWARD STANFORD, 12, 13 & 14 LONG ACRE, W.C.
1911


ROYAL METEOROLOGICAL SOCIETY
TOWER OF THE WINDS
ATHENS

CONTENTS.

TABLES

HINTS

TO

METEOROLOGICAL OBSERVERS.

METEOROLOGICAL observations to be of scientific value must be made on a uniform plan, otherwise the results will not be mutually comparable. The Royal Meteorological Society insists on such uniformity, and accepts observations from those persons only who comply with its requirements, and whose instruments on inspection are found to be satisfactory as regards both their quality and manner of exposure.

The Stations of the Royal Meteorological Society are: (1) "Second Order" Stations (sometimes called "Normal Climatological" Stations), at which the observations are taken twice daily, at 9 a.m. and 9 p.m.; (2) "Climatological" Stations, at which the observations are taken once daily, at 9 a.m.; and (3) Stations at which one or more elements only are observed.

When possible, observations are also taken at 3 p.m. at all stations.

Instruments.

The *necessary* instruments for a "Second Order" Station are:— Standard Barometer; Maximum Thermometer; Minimum Thermometer; Dry-bulb Thermometer; Wet-bulb Thermometer; Stevenson Thermometer Screen; and Rain Gauge.

At a "Climatological" Station the instruments required are:— Maximum Thermometer; Minimum Thermometer; Dry-bulb Thermometer; Wet-bulb Thermometer; Stevenson Thermometer Screen; and Rain Gauge. At each station the Stevenson Screen is to contain the four thermometers mentioned.

It is *desirable* to have also a Minimum Thermometer (graduated on the stem, without attached scale) for terrestrial radiation; one or more Earth Thermometers; and a Sunshine Recorder. A Barograph; a Self-recording Rain Gauge; and an Anemometer (or preferably, an Anemograph) are useful additions.

Intending observers should purchase only the best class of instruments, and not those of a cheap or worthless character. The instruments should be verified at the National Physical Laboratory, so that the corrections for index error may be known. The thermometers must have the scales etched on the tube.

Barometer.

The Barometer may be either of a Fortin or a Kew pattern. It should be mounted in a room not subject to sudden or great changes of temperature, must hang vertically, and should be in a good light, but not near a fire-place or stove. It is best to fix the instrument at such a height that the observer can read the vernier comfortably when standing upright. To facilitate readings a piece of opal glass or of white paper should be fixed immediately behind the part of the tube at which the readings are taken; and if the barometer is of the Fortin pattern, another piece should be placed behind the cistern. The verticality of the barometer should be occasionally tested by unscrewing the clamping-screws at the bottom and seeing that the cistern hangs in the middle of the ring.

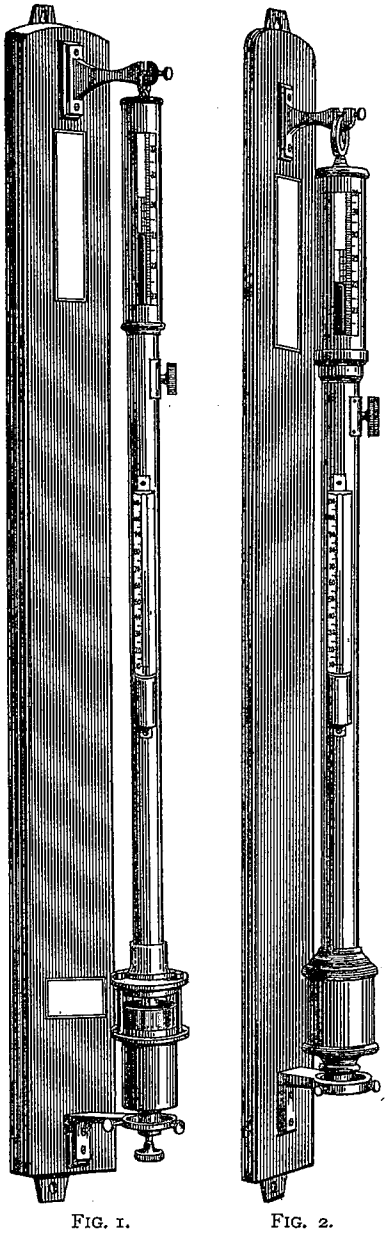


FIG. 1. Fortin Barometer.

FIG. 2. Kew Barometer.

As the mercury in the tube rises or falls, the level of that in the cistern changes in the opposite direction, and unless this change be taken into account, the readings will not be correct. In the Fortin barometer (Fig. 1) this is done by making the cistern adjustable, so that the surface of the mercury therein can always be brought into contact with the ivory point which forms the extremity of the scale. In the Kew barometer (Fig. 2) the cistern is rigid, but the error arising from the change of level in the cistern (technically termed "the error of capacity") is compensated for by contracting the divisions on the scale, which by this means represent very approximately inches of barometric pressure, though the divisions are actually somewhat shorter than true inches.

Every barometer has a thermometer attached, in order to

show the temperature of the mercury in the barometer and of the brass tube which serves as the standard of measurement. By its means the observer can determine the proper correction to be applied to the reading of the barometer to reduce it to the standard temperature, that of the freezing-point, 32° Fahr.

Before suspending the barometer it is desirable to test the vacuum. This may be done by gently inclining the instrument until the mercury touches the top of the tube, when a clear metallic sound should be heard. If no sound is heard, it may be inferred that some air has got into the tube, and consequently the readings of the barometer will be too low.

Method of Reading.

The mode of taking an observation is this:—First note the reading of the attached thermometer to the nearest degree; then (if the barometer is a Fortin) adjust the mercury in the cistern by turning the screw at the bottom of the cistern, so that the ivory point is *just* brought into contact with the surface of the mercury, but does not depress it; the ivory point and its reflected image in the mercury should appear to just touch each other and form a double cone. Then gently tap the tube with the finger, to prevent the mercury from adhering to the glass. Next adjust the vernier so that its two lower edges shall form a tangent to the *convex* surface of the mercury—in fact, the front and back edges of the vernier, the *top* of the mercury and the eye of the observer must be in the same plane (Fig. 3). Move the head up and down to make sure that this is so.

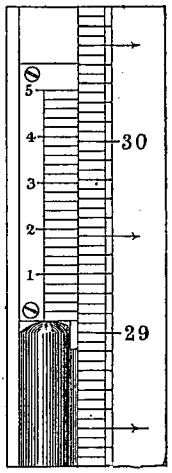


FIG. 3.—Scale and Vernier of Barometer.

The scale on the instrument is usually divided into inches, tenths, and half-tenths, and the vernier, being made equal in length to 24 divisions of the scale, is divided into 25 equal parts. Each division of the vernier is therefore shorter than each division of the scale, by the 25th part of ·05; which is ·002 in. First read off the division next below the lower edge of the vernier. Suppose it be between 29·05 ins. and 29·10 ins., the reading is 29·05 ins. *plus* the vernier indication. Next look along the vernier until one of its lines is found to agree with a line on the scale. Suppose this is at the fourth division on the vernier; as each of the figures marked on the vernier counts as a hundredth, and each intermediate division as two thousandths, the reading of the vernier will be ·008 in. The reading of the barometer is therefore 29·05 + ·008 = 29·058 ins. (Fig. 3). Should two lines on the vernier be in equally near agreement with two on the scale, the intermediate value should be adopted. For instance: suppose that the third and fourth divisions

above the figure 4 were one as much below, as the other is above, the lines on the scale, the vernier value would then be ·047 in. The barometer reading would consequently be 29·05 + ·047 = 29·097 ins. When it is difficult to say which division of the scale is that immediately *below* the lower edge of the vernier, the vernier reading will itself indicate which principal division should be taken.

After the reading has been taken, if the barometer is a Fortin, the mercury in the cistern should be lowered by turning the screw at the bottom until the surface is well below the ivory point, otherwise dirt will collect and the mercury will oxidise immediately underneath the ivory point, and its reflected image will become indistinct. If the barometer is of the Kew pattern, no adjustment of the cistern has to be made, and the vernier is read exactly as with the Fortin.

Corrections.

The actual reading of the barometer requires to be corrected for (1) index error, (2) temperature, and (3) height above sea-level, in order to obtain comparable values. There is also a correction for (4) gravity, when it is desired to compare the readings with those made in other parts of the world.

(1) The correction for index error is that given on the certificate of verification; if the barometer is a Fortin, the correction will be the same throughout the scale; but if of the Kew pattern, it will probably differ in different parts of the scale, and should be applied accordingly.

(2) As the mercury in the barometer and its brass scale both expand by heat, the height of the column is affected by change of temperature: it is therefore necessary to reduce the readings to a standard temperature; 32° Fahr. is that adopted. Table I.[1] (p. 44) gives these corrections for every half-inch, from 27·0 ins. to 31·0 ins., and for each degree of the attached thermometer from 20° to 100°. In using the Table, first find the temperature in the left- or right-hand columns corresponding to that of the attached thermometer, then run the eye along the horizontal line to the column corresponding to that of the reading of the barometer, and the value there found is the correction required. *Example:* Barometer reading 29·500 ins., attached thermometer 40°. On the line opposite to 40° and under 29·5 ins., is the correction −·030 in. Therefore the reading corrected for temperature is 29·500 − ·030 = 29·470 ins. If the barometer reading be intermediate between any two given in the Table, the correction can easily be found by interpolation.

(3) In comparing barometric observations made at different places, account must be taken of their respective heights above sea-level; for the higher the station the lower will be the reading of the

[1] Table I. has been extracted from Table II. in the *Report of the Royal Society Committee of Physics, including Meteorology, on the Objects of Scientific Inquiry in those Sciences.* London, 1840.

barometer. The height of the cistern of the barometer above sea-level must therefore be accurately ascertained, which is best done by levelling from the nearest Ordnance Bench Mark (⅄), the height of which above sea-level will be found on the Ordnance map of the district. The correction for height above sea-level depends not only on the altitude, but also on the temperature and the pressure of the air. Table II.[1] (p. 46) gives the corrections for reducing the barometer readings to sea-level for every 10 feet up to 1000 feet, for each ten degrees of air temperature from 20° to 80°, at the *sea-level pressures* of 28·0 ins., 29·0 ins., 30·0 ins., and 31·0 ins. From this Table another should be prepared for the height of the particular station for which it is to be used, giving the correction for altitude for every tenth of an inch pressure from 27·0 ins. to 31·0 ins., and each ten degrees of air temperature from 20° to 80°. Table III. (p. 50) is a specimen for a station 190 feet above sea-level. This Table has to be thus constructed: the form having been ruled, and the temperatures at the top, and the sea-level pressures in the left-hand column filled in, the corrections for 190 feet, at 28·0 ins., 29·0 ins., 30·0 ins. and 31·0 ins. are copied from Table II., and entered on the lines representing these values; the intermediate readings are then filled up by interpolation—that is, by equally apportioning the difference between the two sets of figures. When this has been done, it will be seen what is approximately the average correction —in the present case it is ·21; this may be taken as ·2, and by deducting ·2 from all the values in the left-hand column, and entering the results in the right-hand column, the reading at the station corresponding to that at the sea-level will be approximately obtained. This right-hand column is to be used for ascertaining the correction to be applied to the barometer reading to reduce it to sea-level; in fact, after completing the Table, to prevent mistakes, the left-hand column had better be erased.

The following *Example* will show the method of applying the foregoing corrections. Suppose the readings to be:

Attached thermometer.	Barometer.	Dry-bulb.	Correction for index error.
55°	29·526 ins.	53°	+·005 in.

	ins.
then	
Barometer reading	29·526
(1) Correction for index error	+·005
	29·531
(2) Correction for temperature 55° (Table I.) . .	−·070
	29·461
(3) Correction for altitude 190 feet, 53° (Table III.) .	+·206
Barometric pressure at sea-level . . .	29·667

[1] Table II. has been compiled from Table II. in *Instructions in the Use of Meteorological Instruments*, issued by the Meteorological Office. London, 1885.

When the correction for index error is the same throughout (as in the Fortin barometer) a Table may be prepared in which all three corrections are combined. This avoids the successive application of the several corrections, and saves much time and labour, besides greatly reducing the liability to mistake. It will be seen in Table III. that a change of 0·6 in. in the pressure produces the same amount of variation in the correction for altitude as is produced by an alteration of 10° in the temperature of the air. For instance, the correction for altitude when the pressure is at 30·0 ins., at the air temperature 50°, is the same as that when the pressure is 29·4 ins. and the air temperature 40°. So that taking, as regards the correction for temperature of the mercury, a mean reading of the barometer for the place of observation, this correction may be combined with that for altitude, including also the constant index error correction. Table V. (p. 52) is a specimen of this form of Table, made out for a station 190 feet above sea-level, for each ·06 in. of barometer-reading from 28·60 ins. to 30·40 ins. and every two degrees of temperature of the dry-bulb and attached thermometers. To use the Table: Look in the right-hand or left-hand column of the Table on p. 52 for the reading of the barometer at the station, and carry the eye horizontally to the temperature of the air (*i.e.* dry-bulb thermometer reading), and then vertically downwards, and through the corresponding column in the second half of the Table on p. 53, to the value horizontally opposite the temperature of the attached thermometer, where will be found the required correction.

The Table of combined corrections is intended only to be used for ordinary pressures and temperatures, as it is based upon average values. For extreme readings both of pressure and temperature the corrections should be worked out in detail from Tables I. and III.

(4) In order to render barometrical observations in various parts of the world intercomparable, they must be so expressed that equal heights may denote exactly equal pressures. The force of gravity is not quite the same in all latitudes, and hence it necessitates a correction with reference to the latitude of the point of observation. The standard value of gravity adopted is that prevailing at latitude 45°. Table IV. (p. 51) gives the corrections for each degree of latitude and for each half-inch of barometric pressure from 27 ins. to 31 ins.

Management.

Barometers should be very carefully handled, so as to avoid breakage, or admission of air into the tube. It is best to carry the instrument with the cistern end upwards. If the barometer has to be sent away, it should be securely packed in a properly prepared box with rubber strips which grip the tube when the lid is closed. The

lid of the box should be fastened with screws, and not nailed down. The cistern end should be clearly marked on the lid. In the case of a Fortin barometer the mercury should be screwed up so as to fill the tube and cistern, before the instrument is taken down.

Aneroid.

The Royal Meteorological Society does not accept readings of aneroid barometers from its observers. It is found that these are not to be relied upon for long periods, because the metal of which their mechanism is constructed is not perfectly elastic, and does not return precisely to its normal condition after being subjected to change of strain under large variations of atmospheric pressure. However, the self-recording aneroids, of which many are now in use, yield records of considerable interest, and when frequently checked or controlled by the readings of a standard barometer (see p. 37) they are of value in showing the variations and extremes of pressure. It must be remembered that the aneroid readings correspond to readings of the mercurial barometer reduced to 32°.

Thermometers.

The Maximum Thermometer may be on either Negretti and Zambra's, or on Phillips' principle. Negretti and Zambra's construction (Fig. 4) is as follows:—The bore of the tube is reduced

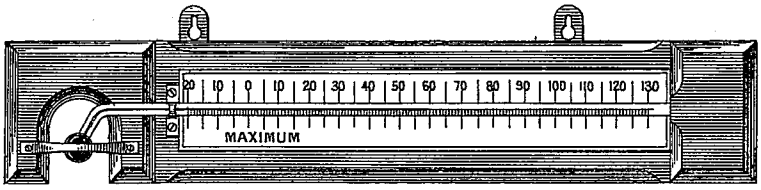


FIG. 4.—Negretti and Zambra's Maximum Thermometer.

in section near the bulb in such a way that whilst the expanding mercury forces itself into the tube, on contraction the column of mercury in the tube breaks off, so that its upper extremity shows the highest temperature that has been attained. The instrument is set by holding it bulb downwards and shaking it until the mercurial column becomes continuous throughout. It is to be mounted horizontally. Before reading, it is well to notice that the end of the column nearest the bulb has not run away from the point of contraction, through vibration or otherwise; if it has, the thermometer should be tilted *very* gently until the detached column comes in contact with the contraction in the tube.

In Phillips' construction (Fig. 5) the index is formed by a small portion of the mercurial column, separated from the main thread by a minute air-bubble; this portion is pushed on before the column when the temperature rises, but does not return with it when it falls. The detached portion of the column therefore rests at the extreme position to which it has advanced, and the end of it farthest from

the bulb registers the highest temperature which has been attained. The instrument is set by holding it bulb downwards and gently

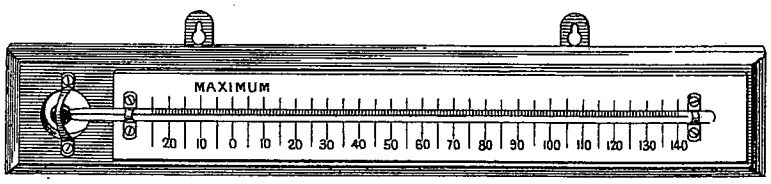


FIG. 5.—Phillips' Maximum Thermometer.

tapping the lower end so as to allow the detached portion of the mercury to approach the rest, from which it remains separated only by the air-bubble. This thermometer is also to be mounted horizontally.

The Minimum Thermometer generally used is that known as Rutherford's (Fig. 6). The fluid employed is spirit, and in it there is immersed a pin or index. When the temperature falls, the surface of the spirit draws the index along with it; but on rising again, the spirit passes the index, leaving it at the lowest point to which it has been drawn, the end farthest from the bulb thus

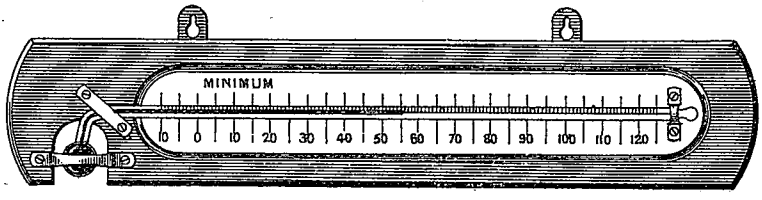


FIG. 6.—Minimum Thermometer.

registering the minimum temperature. The instrument is set by raising the bulb and allowing the index to slide to the end of the column of spirit.

The thermometer must be firmly fixed and mounted quite horizontally, so that the index may not be disturbed by vibration of the thermometer screen during wind.

The Dry-bulb and Wet-bulb Thermometers (Fig. 7) should be precisely alike, and have small bulbs, which should be 3 or 4 inches apart. The wet-bulb should be covered with a single piece of very thin and soft muslin. For a cylindrical bulb this covering should take the form of a close-fitting sewn jacket. A conductor consisting of four strands of No. 12 darning cotton in the form of a noose should be tied round the neck of the bulb over the muslin, and led through a small orifice in the cover of a water receptacle, which should be placed an inch or so from the bulb, below and on the outer side of it. Care should be taken not to fasten the cotton too tightly round the neck of the bulb, or the circulation of the water along the strands will be

checked at this point. A conical glass cup with a copper lid having a small hole in it should be used, as glass vessels of other forms are liable to be broken during frost. Care must be taken to keep the cup *filled* with water. Clean rain, or distilled, water should be employed. The muslin and conducting thread should be washed in boiling water prior to use, and changed at least once a month, and more frequently if there is any appearance of dirt or deposit upon them. It is a good plan when filling up the glass with water to pour some over the muslin, or to raise the water receptacle and immerse the bulb in the water so as to give the muslin a bath, as by these means dust will be readily removed and the muslin kept clean. In damp weather the dry-bulb thermometer should be carefully wiped dry a few minutes before observation.

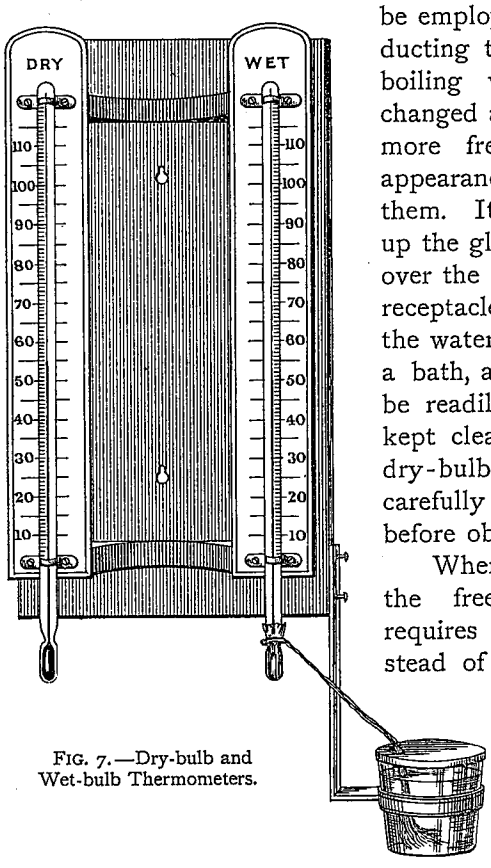


FIG. 7.—Dry-bulb and Wet-bulb Thermometers.

When the temperature is below the freezing-point, the wet-bulb requires careful management. Instead of a film of water round the bulb there must be a thin coating of ice, which can be produced by wetting the bulb with a camel's hair brush or by pouring a few drops of water over the muslin; this must be done about an hour before the time of observation, as when the water is poured on the muslin the mercury will run up to 32° and remain there until the freezing process is complete, after which it will descend below that of the dry-bulb. The process of freezing may sometimes be accelerated by fanning the bulb. Immediately after a frost the water in the receptacle should be thawed, and the muslin and conductor wetted to restore proper action.

Thermometer Screen.

The thermometers above described must be mounted in the Stevenson Screen of the pattern approved by the Royal Meteorological Society (Figs. 8 and 9). A free current of air can pass through the screen, and the sun cannot shine on the thermometers. The screen is a double louvred box, its internal dimensions being: length 18 inches, width 11 inches, and height 15 inches; with a

double roof, the upper one projecting 2 inches beyond the sides of the screen all round, and sloping from front to back. The front is hinged as a door, and opens downwards (Fig. 8).

The screen should be placed over short grass in a freely exposed situation, with the door opening to the north; it is desirable that it should never be in the shade or within 10 feet of any wall, especially of one having a southerly aspect. It is to be mounted on four stout posts, and at such a height that the bulbs of the dry and wet thermometers shall be 4 feet above the ground. The posts should be buried from 18 inches to 2 feet in the ground, and the soil carefully rammed down. In places exposed to much wind, it is also desirable to brace up the posts to prevent vibration of the screen. The thermometers should be suspended on uprights near the middle of the screen, the maximum and minimum being in front of the dry and wet, and arranged in such a way that the scales of the latter can be seen above the two former (Fig. 8). The screen must be painted white, the finishing coat being composed of white paint and copal varnish. It is desirable that the screen be repainted during the spring of each year.

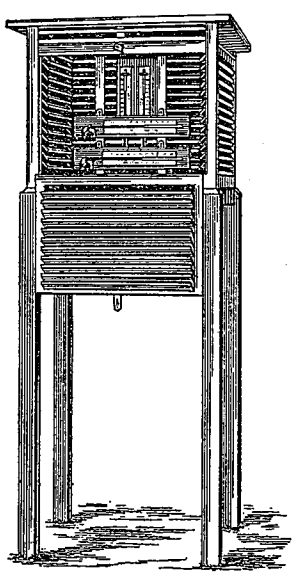


FIG. 8.

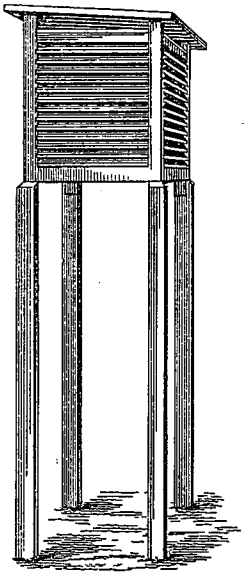


FIG. 9.

Royal Meteorological Society's pattern of Stevenson Thermometer Screen.

It will be a convenience to have a wooden rack placed on the grass immediately in front of the screen for the observer to stand on when reading the thermometers.

Thermometer Shelter for Tropical Countries.

The Stevenson Thermometer Screen is hardly suitable for use in tropical countries. It is therefore desirable for any one wishing to take temperature observations in such places to adopt the following arrangements recommended by the Committee of the British Association on the Climate of Tropical Africa :—The Thermometers should be placed within an iron cage, which should at all times be kept locked, so as to prevent interference with the instruments. This cage should be suspended under a thatched shelter which should be situated in an open spot at some distance from buildings, must

be well ventilated, and guard the instruments from being exposed to sunshine or rain. A simple hut, made of materials available on the spot, would answer this purpose. A gabled roof with broad eaves, the ridge of which runs from north to south, is fixed upon four posts, standing 4 feet apart. Two additional posts may be introduced to support the ends of the ridge beam. The roof, at each end, projects about 18 inches. In it are two ventilating holes. The tops of the posts are connected by bars or rails, and on a crossbar is suspended the iron cage with the thermometers. These will then be at a height of 6 feet above the ground. The gable ends may be permanently covered in with mats or louvre-work, not interfering with the free circulation of the air; or the hut may be circular. The roof may be covered with palm-fronds, grass, or any other material locally used by the natives as building material. The floor should not be bare, but covered with grass or low shrubs. Care must be taken to fix the cage firmly, so that the maximum and minimum thermometers may not be disturbed by vibration.

Readings.

The observations are made as follows:—Having let down the door of the Stevenson Screen, the dry-bulb and wet-bulb thermometers are to be read first, so that they may not be affected by the nearness of the observer. The maximum thermometer is to be read next by noting the point at which the end of the column of mercury is lying. The minimum thermometer is read last, by noting the position of the end of the *index* farthest from the bulb. (The end of the column of spirit shows the temperature at the time of observation.) When this has been done, and the figures written in the observation book, the instruments should be looked at again to see that no mistake has been made in entering their readings. The maximum and minimum should then be set. When set, the end of the mercury in the maximum, and the end of the index farthest from the bulb in the minimum, should indicate nearly the same temperature as the dry-bulb. The muslin and cotton on the wet-bulb should be examined, and the glass cup filled with water, after which the door of the screen should be closed.

All the thermometers should be read to tenths of degrees. This can readily be done by mentally dividing the space between each degree into ten parts and estimating at what tenth the end of the column or index stands.

Terrestrial Radiation.

For determining the intensity of terrestrial radiation a sensitive spirit minimum thermometer graduated on the stem, and without attached scale, should be used, and placed horizontally on short grass (Fig. 10). No blade of grass should ever be

allowed to shade the bulb of the thermometer. When the ground is covered with snow the thermometer should be placed on

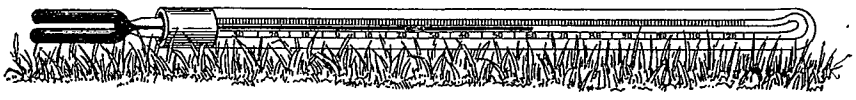


FIG. 10.—Grass Minimum Thermometer.

the surface of the snow instead of remaining buried underneath. It is desirable that the thermometer should be protected from being damaged or trodden upon. In order to secure this, a portion of the grass plot, 18 ins. long and 12 ins. wide, should be enclosed by fixing four stakes in the ground, one at each corner, and twisting a piece of wire round the top. The stakes should be about 8 ins. high. If the stakes and wire are painted white, they can easily be seen, and so will tend to keep anyone from treading on the thermometer.

Earth Temperatures.

The most convenient instrument for ascertaining the temperature of the soil is that known as Symons's Earth Thermometer (Fig. 11). This consists of a sluggish thermometer mounted in a short, weighted stick attached to a strong chain, and of a stout iron pipe which is drawn out at the bottom to a point and driven into the earth to any required depth. The thermometer, the bulb of which is usually surrounded by a thick piece of india-rubber, is lowered into the tube and the top closed by a copper cap which should be thoroughly water-tight. Care must be taken to see that the india-rubber band does not swell too much, otherwise it may prevent the thermometer being lowered to the proper depth in the tube. If only one thermometer be used, the bulb should be lowered to the depth of 1 foot below the surface; but if more than one be employed, the usual depths are 2 feet and 4 feet. The tubes should be inserted in the soil below short grass in a well-exposed position, and the portion of the tube above the soil (which should not exceed 6 inches) and also the cap should be painted white. When snow has fallen it should not be swept away from the ground round the earth thermometer, but left to melt in the same manner as the snow in the neighbourhood.

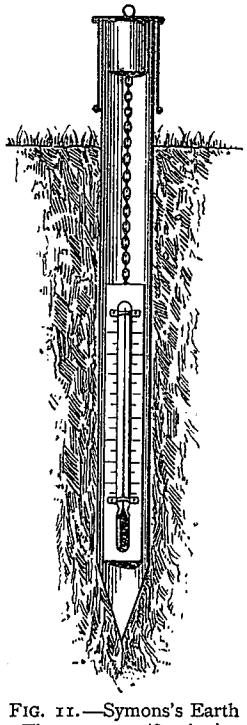


FIG. 11.—Symons's Earth Thermometer (Section).

Solar Radiation.

The Black-bulb and Bright-bulb Thermometers *in vacuo* may be used to furnish an estimate of the intensity of solar radiation. These consist of sensitive maximum thermometers, the former of which has the bulb and 1 inch of the stem coated with dull lamp black; each thermometer is enclosed in a glass jacket, from which the air has been exhausted as completely as possible. These instruments should be mounted on a post 4 feet above the ground (Fig. 12), with their bulbs directed to the south.

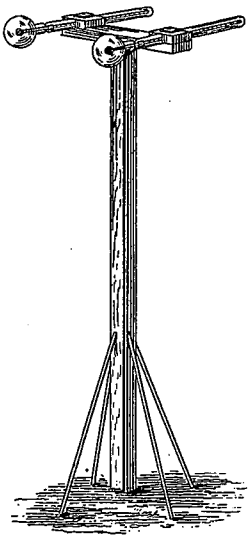


FIG. 12.—Black-bulb and Bright-bulb Thermometers *in vacuo*.

These thermometers ought to be tested *in sunshine* at the National Physical Laboratory *after* enclosure in their vacuum jackets, as the corrections usually given on the certificate of verification apply merely to the thermometer before the blackening and enclosing in the outer jacket.

Defects of Thermometers.

Spirit thermometers are liable to a serious defect, viz. the evaporation of a portion of the spirit from the column, and its condensation at the top of the tube. Extremely low temperatures at times reported as having been registered at certain places, have been often traced to this fault, for thermometers may have as much as 5° or 10° of spirit lodged at the top of the tube. To correct this, hold the instrument bulb downwards with one finger steadying the tube, and swing it sharply. If this be not successful, the thermometer should be held in the right hand about a third of the way up from the bulb, and the upper part of the tube gently tapped on the palm of the left hand. This will usually dislodge the spirit and cause it to flow down the sides of the tube, but patience and perseverance are to be recommended in the operation. The thermometer must then be placed in an upright position for an hour or so, to allow *all* the spirit to run down the tube and join the column. As it is not always possible to see the spirit at the top, it is very desirable occasionally to place all the thermometers in a basin of water and after the lapse of an hour compare them together, first well stirring the water.

With grass minimum thermometers it is a good plan to lay them on the grass with the scale downwards, as the enamel at the back will then act as a protection from the sun to the spirit in the tube and so render it less liable to get out of order.

Some instrument makers supply minimum thermometers with the end of the tube buried in, or covered over with, a piece of wood.

Such thermometers should not be used, as it is not possible to see whether any spirit has condensed at the top of the tube.

Dry-bulb and wet-bulb thermometers are sometimes supplied with a piece of wood fastened across the lower part of their scales to hold the tubes in position; and consequently when low temperatures occur this wood hides the end of the column of mercury, and so renders it impossible to get a reading of the thermometer. This piece of wood should be either cut through or removed entirely.

Phillips' maximum thermometer is liable to get out of order by the air-bubble working back into the bulb, and consequently rendering the instrument an ordinary thermometer. This can usually be set right by placing the bulb in a mixture of salt and ice. When the mercury has fallen to its lowest point (nearly at zero), the thermometer should be taken out of the freezing mixture and held slightly inclined, bulb uppermost, so that a portion of the mercury may be detached from that in the bulb. When the mercury rises out of the bulb on increase of temperature, it will be found that the detached portion will be separated from the main column by a bubble of air.

The divisions on the tubes of the thermometers should correspond with those on the attached scale. If they do not, the screws in the brass clips should be loosened and the tube readjusted and then wedged up by packing in pieces of cork.

The black marking of the divisions on the thermometer tubes sometimes gets washed out, and the graduation consequently becomes indistinct. It may easily be restored by rubbing a little printer's ink, lamp-black and oil, or the point of a common black-lead pencil, along the tube, which should be perfectly dry.

It is a good plan, when changing the muslin and cotton on the wet bulb, to rub the scales and tubes of all the thermometers with the old pieces before putting on the fresh ones, and then to wipe them with a dry duster. This will keep the scales clean. [If a black-lead pencil is at the same time rubbed over the divisions on the tubes, they will be made distinct and very easy to read.]

Suspension of Thermometers.

The brass plates for hanging the thermometers, which are screwed on to the back of the frames, should have a slot as well as a hole; and when the thermometers are hung in the screen, the heads of the screws should be driven close to the slots to prevent the thermometers vibrating in windy weather. In places exposed to much wind it is sometimes desirable to keep the thermometers rigid by means of wooden buttons placed underneath.

Thermometer Corrections.

The corrections for the index errors of the different thermometers are given on the certificates of verification for every ten degrees from 12° to 92°. The correction for the readings at the inter-

mediate parts of the scale can be readily found by equally apportioning the difference between the two sets of figures. Suppose the corrections to be as follows :—

12°	22°	32°	42°	52°	62°	72°	82°	92°
+0·3	+0·2	0·0	−0·1	−0·1	0·0	−0·1	−0·3	−0·2

These should be apportioned thus :—

Below 17°	+0°·3	57° to 67°	0°·0
17° to 25°	+0·2	67° to 75°	−0·1
25° to 29°	+0·1	75° to 79°	−0·2
29° to 37°	0·0	79° to 87°	−0·3
37° to 57°	−0·1	Above 87°	−0·2

Hygrometry.

From the readings of the dry-bulb and wet-bulb thermometers can be deduced the temperature of the Dew-point, the Elastic Force of Aqueous Vapour, and the Relative Humidity. Glaisher's *Hygrometrical Tables* are those in general use in this country. All deductions from observations of the dry-bulb and wet-bulb thermometers are open to some degree of doubt when near or below the freezing-point.

Dew-point.

By means of Table VI. (p. 54), based on Glaisher's factors, the Dew-point can be quickly calculated from the readings of the dry-bulb and wet-bulb thermometers. The arrangement of the Table is as follows :—The columns on the left and right give the reading of the dry-bulb thermometer for every degree from 10° to 20° and from 30° to 100°, and for every half degree from 20° to 30°. The other columns give, for each degree of difference between the readings of the dry-bulb and wet-bulb thermometers, the amount to be subtracted from the reading of the wet-bulb thermometer to obtain the temperature of the dew-point. The amount for tenths of degrees can be at once obtained by merely shifting the decimal point one place to the left.

The following examples will show the manner of using the Table :—

Example 1. Suppose the reading of the dry-bulb thermometer to be . . . . . 50°·0
And the reading of the wet-bulb thermometer to be 45°·0
The difference is . . . . . 5°·0
On looking at the Table, we find opposite 50° and under 5°·0, that the amount to be subtracted from the reading of the wet-bulb thermometer is . . . . . 5°·3
Therefore the dew-point is, 45°·0 − 5°·3 . . . . . 39°·7

Example 2. Suppose the reading of the dry-bulb thermometer to be . . . . . 55°·0
And the reading of the wet-bulb thermometer to be 48°·3
The difference is . . . . . 6°·7

On referring to the Table, we see opposite 55° and under 6°·0, that the amount to be subtracted is 5°·8 ; for the remaining 0°·7, take the tenth part of the value standing opposite 55° and under 7°·0, that is, the tenth part of 6°·7, which is nearly 0°·7. The total amount to be subtracted from the reading of the wet-bulb thermometer is thus 5°·8 + 0°·7 or . 6°·5
Therefore the dew-point is, 48°·3 − 6°·5 . . . . 41°·8

Example 3. Suppose the reading of the dry-bulb thermometer to be . . . . . 32°·5
And the reading of the wet-bulb thermometer to be 30°·8
The difference is . . . . . 1°·7

In the Table opposite 32° and under 1°·0, we find 2°·3, and under 7°·0 we find 16°·2, the tenth part of which is 1°·6, or the total amount to be subtracted for 32° of dry-bulb thermometer, and difference 1°·7, is 3°·9.

Similarly the amount to be subtracted for 33° of dry-bulb thermometer, and difference 1°·7, is 3°·4 ; consequently, by interpolation, the amount to be subtracted for 32°·5 of dry-bulb thermometer, and difference 1°·7, is . . . . 3°·7
Therefore the dew-point is, 30°·8 − 3°·7 . . . 27°·1

Elastic Force of Aqueous Vapour.

The Elastic Force of Aqueous Vapour is dependent upon the temperature of the dew-point. Table VII. (p. 56) gives the elastic force for every tenth of a degree of temperature, from 0°·0 to 100°·9, the whole degrees being given in the vertical columns headed 0°·0, and the tenths in the succeeding columns.

Relative Humidity.

This term is used to express the percentage of saturation of the air with aqueous vapour, and is calculated by dividing the elastic force of aqueous vapour at the temperature of the dew-point by that corresponding to the actual temperature of the air (*i.e.* the dry-bulb reading).

Example: Dry-bulb 55°·0, dew-point 46°·5 ; the Elastic Force corresponding to these will be ·433 in. and ·317 in. respectively. Therefore, dividing the latter by the former, the result is 0·73 ; and taking Saturation as 100, the Relative Humidity will be 73, *i.e.* 73 per cent.

In Table VIII. (p. 58) is given the Relative Humidity for every two degrees of temperature from 20° to 70°, and also at 10°, 75°, 80°, 90°, and 100°, and for every two-tenths of a degree of difference between the dry-bulb and wet-bulb readings from 0°·0 to 18°·0. This Table has been prepared according to the plan described in the *Quarterly Journal of the Royal Meteorological Society*, vol. vii. p. 2. The values contained therein may, however, occasionally differ from those obtained by the above method to the extent of 1 per cent.

For temperatures below 10° the humidity may be worked out

approximately by using the figures given at 10°, as changes below that temperature are very slight. Similarly for temperatures a few degrees above 100° the same method may be followed by using the figures given at 100°.

To use the Table: Look in the column on the left or right for the nearest degree to the dry-bulb reading; then carry the eye horizontally along until the column is reached corresponding to the difference between the readings of the dry-bulb and wet-bulb thermometers, when the Relative Humidity will be found. Intermediate readings can be interpolated in the usual way.

Example: Dry-bulb 58°·5, wet-bulb 51°·7, the difference is 6°·8. Having found 58° in the column on the left or right, run the eye along this line until the column under 6°·8 is reached, when the Relative Humidity will be found, viz. 62 per cent.

When the differences between the dry-bulb and wet-bulb readings are greater than those given in Table VIII., the Relative Humidity may be worked out from the elastic force at the temperature of the dry-bulb and that at the dew-point in the manner described above.

Rain Gauge.

The Rain Gauge is best made of copper, and should have a circular funnel of either five or eight inches diameter, with a can and a bottle (roughly marked with half-inches) inside to collect the water. It is very desirable that it should be of the Snowdon pattern—that is with a 6 in. cylinder on top of the funnel and a sharp brass rim (Fig. 13). It should be set in an open situation, away from trees, walls, and buildings—at the very least, as many feet from their base as they are in height—and it should be so firmly fixed that it cannot be blown over. The gauge should be planted in the earth and fixed by stakes or placed in a hole which exactly fits it in a block of cement. The top of the rim should be one foot above the ground and must be kept quite level.

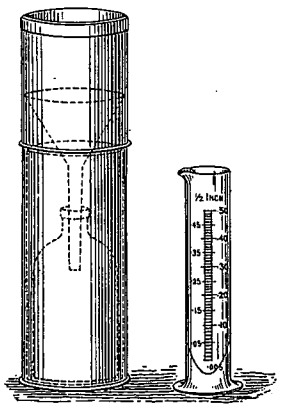


FIG. 13.—Rain Gauge (Snowdon pattern) and Measuring Glass.

The measurement of the rain is effected by pouring out the contents of the bottle into the glass measure, which must be placed quite vertical, and reading off the division to which the water rises; the reading is to be taken midway between the two apparent surfaces of the water. The glass measure is usually graduated to represent tenths and hundredths of an inch, and holds 0·50 inch of rainfall. Each division represents the one-hundredth of an inch, the longer divisions five one-hundredths, and the long divisions, having figures attached, tenths of an inch. If there be more than half-an-inch of

rain, two or more measurements must be made, and the amounts added together. The complete amount should always be written down before the water is thrown away. The gauge must be examined daily at 9 a.m., and the rainfall, if any, entered to the *previous* day; if none be found, a *line* or *dots* should be inserted in the register, instead of leaving the space blank or putting noughts. It is desirable that very heavy falls of rain should be measured immediately after their occurrence, entering the particulars in the remarks; but taking care that the amount be included in the next ordinary registration. A fall recorded as 0·01 in. or above is held to constitute a "rain day," or, to put it more accurately, a "day of precipitation." If the gauge contains less than one-hundredth (·01) of an inch, but more than half that amount, it should be entered as ·01, while if there is less than half that amount the few drops may be thrown away and the day entered as if no rain had fallen. The measurements of rainfall should be entered in the register in hundredths of an inch—that is, there should always be two figures to the right of the decimal point. If the amount is less than ·10 in. the decimal point and the figure 0 must always be inserted in order to avoid uncertainty—thus, ·01, etc.

Small amounts of water are at times deposited in the rain-gauge by dew, hoar frost, or fog. Whenever this occurs, the amount must be treated as rainfall and entered accordingly.

When self-recording rain-gauges are used, care must be taken to fix them in such a position that the water, when emptied by the syphon or tipping-bucket, can run away, otherwise the instrument will not work properly owing to the excess of water round the outflow pipe.

Snow.

When snow falls, that which is collected in the funnel of the gauge is to be melted and measured as rain. This melting may be quickly done by adding to the snow a measured quantity of warm water, and afterwards deducting this quantity from the total measurement. If the snow has drifted, or if the funnel cannot hold all that has fallen, a section of the snow should be obtained in several places where it has not drifted, by inverting the funnel, turning it round, lifting and melting what is enclosed. The section should, if possible, be taken from the surface of a flat stone. Care must be taken that the section is of the snow that has fallen during the twenty-four hours, and does not include any previously fallen snow. A convenient method is to have a cylinder of the same diameter as the rain-gauge and of considerable depth, for use in snowy weather.

It is also desirable to measure with a foot-rule the depth of snow in several places where it has not drifted, and to enter the same in the "Remarks" column.

A foot of snow may be considered as roughly equivalent to an inch of rain, but the proportion varies considerably in different falls.

Evaporation.

If practicable, an attempt should be made to determine the amount of evaporation. For this purpose it is desirable to have a galvanised iron tank four or six feet square, and two feet deep. This should be sunk in the ground, with the top level with the blades of the grass, and should be kept filled with water to within about three inches of the rim. The height of the water should be measured every day at 9 a.m. with a special measuring gauge reading to hundredths of an inch, such as Field's Hook gauge or Halliwell's Float gauge. The difference between the measurement on one day and the next will give the amount of evaporation. When rain has fallen, the amount, as shown by the rain-gauge, should be allowed for.

Percolation Gauges.

The amount of rain percolating into the ground may be ascertained by means of a water-tight tank filled with the earth of the locality. A convenient form of percolation gauge is one made of slate, and of a cubic yard in capacity, the upper edges being bevelled so as to leave the sharp edge inside the gauge. The top of the gauge should stand about two inches above the surface of the ground, and the gauge should be filled with earth to within two inches of the top. In some cases the ordinary turf of the district is laid on the top of the materials composing the percolation gauge—the gauge itself representing an exact section of the strata of the district—while in other cases the percolation gauges have no plants growing upon the surface. Gauges of this kind may be advantageously used in duplicate, one with the natural herbage of the district growing upon the surface, and the other without it. The water may be collected from the gauge by means of a drain or pipe at the bottom, and the collected water should be stored in a receptacle sufficiently large to hold not less than an equivalent of one inch of rain falling on the surface of the gauge. The quantity of water percolating can be measured in a graduated glass similar in principle to, but of larger capacity than, a rain-gauge glass. If very small quantities are required to be measured, and the percolation gauge is one yard square, the quantity may be measured in an 8-inch rain-gauge glass and divided by 26, when it will give the quantity passing through the percolation gauge. The quantity of water percolating into the ground in different years depends very much upon the period of the year in which the rain falls; and as it is such rain as passes through the ground that furnishes the supply to the perennial springs of the country, these observations will afford a valuable record of the quantity of water which will be available in any district.

Well Measurements.

Neither rain nor percolation gauges really represent the storage of water which occurs in the ground. Well measurements, there-

fore, afford very valuable information as to the quantity of water which has passed into the ground from time to time, and is stored there for future use. In making such observations it is desirable to select a well as remote as possible from other wells, especially those where steam-power is employed for constant pumping. The measurement should be made from a fixed point at the mouth of the well to the water surface, as owing to the common practice of deepening wells in dry times, errors are likely to occur if the depth of water only is taken. The water surface should be referred to Ordnance datum. Such measurements should not be taken less frequently than once a week, but in critical periods of the state of the water, usually in the autumn, when the water begins to rise after a period of heavy rain, more frequent observations should be made, in order to determine the exact period when the rise begins. In selecting a well for observation, the more distant it is from a stream the better, as the underground water escaping into an adjoining stream so influences the level of the water in such a well that the annual amount of fluctuation may be very small. On account of the difference in the fluctuation in various wells in the same district, observations in any well can be compared only with the same well and not with observations in other wells in the district, unless all the conditions with reference to the underground water of the district are known, and the differences in the fluctuation between various wells have been carefully compared.

Wind Direction.

The wind should be observed to sixteen points of the compass and capital letters should be entered in the register to indicate the directions, thus—

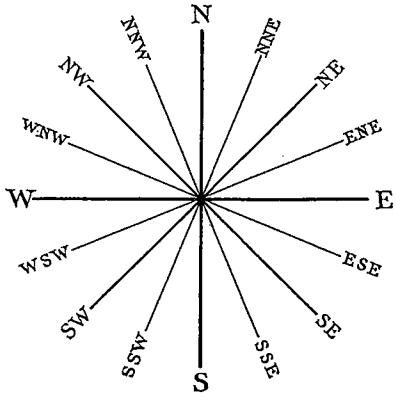


FIG. 14.—Points of the Compass.

N	North.
NNE	North-north-east.
NE	North-east.
ENE	East-north-east.
E	East.
ESE	East-south-east.
SE	South-east.
SSE	South-south-east.
S	South.
SSW	South-south-west.
SW	South-west.
WSW	West-south-west.
W	West.
WNW	West-north-west.
NW	North-west.
NNW	North-north-west.

The Direction of the Wind (which should be the "true" direction and not the "magnetic") may be ascertained from the indication of a freely moving vane; when such is not available, by observing the drift of smoke. By the direction of the wind is meant

that point of the compass *from* which it is blowing. Care must be taken by watching the vane for a few minutes to see that the direction is that of the general current of air passing over the place, and that the air current is not affected by local circumstances.

It is desirable to fix astronomically one cardinal point, and frequently to examine the position of the pointers of the vane (a pole carrying a vane is liable to twist owing to changes of humidity). This should be either the North point by means of the pole star, or the South point by means of the Sun, employing one of the following methods :—

The pole star, *Polaris*, is practically due North at the following times :—

In January and July			at	6 a.m. and 6 p.m.	
February	,,	August	,,	4 ,,	,, 4 ,,
March	,,	September	,,	2 ,,	,, 2 ,,
April	,,	October	,,	Noon	,, Midnight.
May	,,	November	,,	10 a.m.	,, 10 p.m.
June	,,	December	,,	8 ,,	,, 8 ,,

To determine when the Sun is due South, refer if possible to a good local sun-dial; when the dial shows 12h. 0m. the sun is due south. If this cannot be done, proceed as follows :—For any station situated in England, Wales, or Scotland, ascertain its longitude in time from the map on p. 26 (Fig. 15). Then obtain (from the nearest reliable railway station or postal telegraph office clock) the correct Greenwich time, and set a watch by adding the correction for longitude (which is 4 minutes of time for each degree of longitude) to the Greenwich time for places in east longitude, and subtracting it for places in west longitude. This gives Local time. Then apply a further correction for the Equation of Time, the amount of which may be taken to the nearest minute for the given day from the accompanying table, interpolating for intermediate days :—

Jan. 1	*subtract*	4 min.	May 1	*add*	3 min.	Sep. 1	*add*	0 min.
,, 11	,,	8 ,,	,, 11	,,	4 ,,	,, 11	,,	4 ,,
,, 21	,,	12 ,,	,, 21	,,	4 ,,	,, 21	,,	7 ,,
Feb. 1	,,	14 ,,	June 1	,,	2 ,,	Oct. 1	,,	10 ,,
,, 11	,,	14 ,,	,, 11	,,	1 ,,	,, 11	,,	13 ,,
,, 21	,,	14 ,,	,, 21	*subtract*	2 ,,	,, 21	,,	15 ,,
Mar. 1	,,	12 ,,	July 1	,,	4 ,,	Nov. 1	,,	16 ,,
,, 11	,,	10 ,,	,, 11	,,	5 ,,	,, 11	,,	16 ,,
,, 21	,,	7 ,,	,, 21	,,	6 ,,	,, 21	,,	14 ,,
Apr. 1	,,	4 ,,	Aug. 1	,,	6 ,,	Dec. 1	,,	11 ,,
,, 11	,,	1 ,,	,, 11	,,	5 ,,	,, 11	,,	6 ,,
,, 21	*add*	1 ,,	,, 21	,,	3 ,,	,, 21	,,	2 ,,

A watch thus set gives Local apparent time, such as would be shown by a properly adjusted sun-dial, and when the watch so adjusted indicates 12h. 0m. the sun will be *due* south.

Example.—Let the instant at which the sun is south at Penzance on February 21 be required. Penzance is west of Greenwich $5\frac{1}{2}° =$ 22 minutes, to be subtracted from Greenwich or Railway time. And

the Equation of Time on February 21 is 14 minutes, also to be subtracted. The total amount to be subtracted is therefore 36 minutes. If, on the day the watch is to be adjusted, the railway clock shows 10h. 20m., the watch must be set to 9h. 44m. Then at 12h. 0m. by the watch the sun will be due south.

For stations in Ireland the longitude must be reckoned from Dublin, as railway clocks in Ireland show Dublin time, which is 25 minutes after Greenwich time.

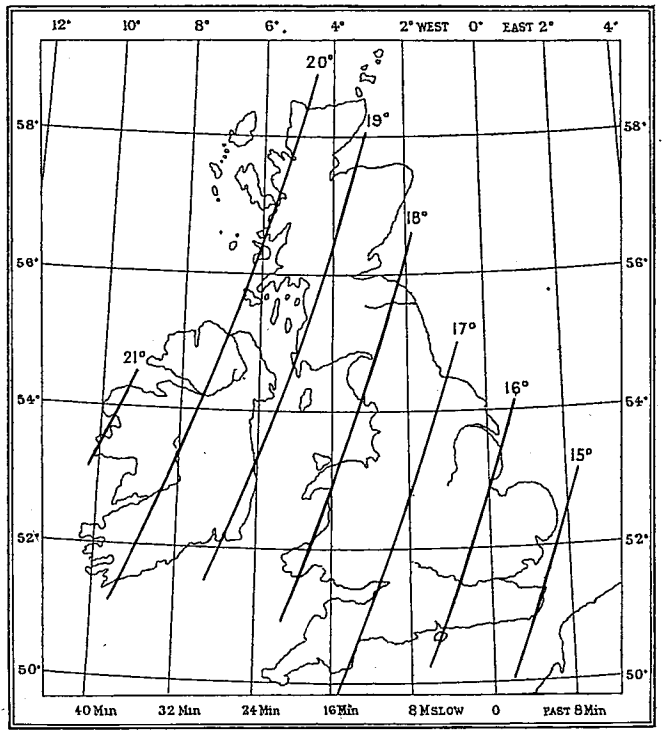


FIG. 15.—Approximate Westerly Variation of the Magnetic Needle, over the British Isles, 1912.

The true North point may be determined also by means of an azimuth compass, remembering that in the British Isles the magnetic north lies to the west of the true north, or the true north is east of the magnetic north. The amount of variation over the British Isles, which ranges from 15° to 21°, may be taken from the map (Fig. 15), which will serve for several years to come. Roughly speaking, in the British Isles a north and south line lies along the line NNE-SSW by compass.

Wind Force.

The Force of the Wind should be estimated according to Beaufort's scale. The following are the values, with the equivalent velocities in miles per hour, as recently adopted by the Meteorological Office :—

0	Calm	Equivalent velocity		0	miles per hour.
1	Light Air	,,	,,	1-3	,,
2	Light Breeze	,,	,,	4-7	,,
3	Gentle ,,	,,	,,	8-12	,,
4	Moderate ,,	,,	,,	13-18	,,
5	Fresh ,,	,,	,,	19-24	,,
6	Strong ,,	,,	,,	25-31	,,
7	High Wind (Moderate Gale)	,,	,,	32-38	,,
8	Gale	,,	,,	39-46	,,
9	Strong Gale	,,	,,	47-54	,,
10	Whole ,,	,,	,,	55-63	,,
11	Storm	,,	,,	64-75	,,
12	Hurricane	,,	,,	above 75	,,

In the Dines' Pressure-tube Anemometer advantage is taken of the fact that the air in blowing over an obstacle produces small

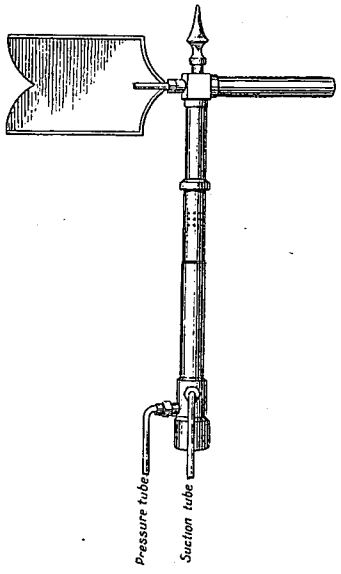


FIG. 16.—The "Head" of the Dines' Pressure-tube Anemometer.

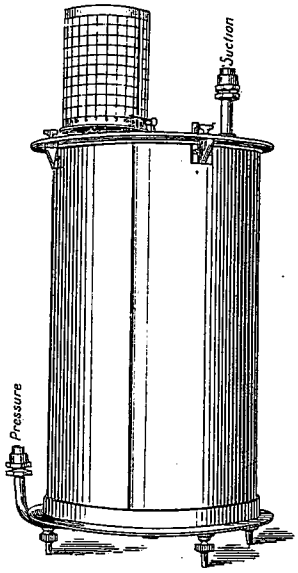


FIG. 17.—Recording Instrument.

differences of pressure on various sides of the obstacle, which are capable of exact measurement, and afford information of the velocity of the wind. The "head" consists of a piece of tube open at one end, which end is kept facing the wind by a vane (Fig. 16). The wind blowing into the tube produces an excess of pressure within it. There is also a piece of tube placed vertically, and pierced by a ring of small holes. The wind blowing over these holes produces a slight decrease of pressure inside. These differences of pressure are communicated by composition tubing, which may be of any length, to the place where the recording or indicating part of the instrument is placed. In the self-recording form of the instrument (Fig. 17) the registration is produced by means of a bell-shaped vessel which floats inverted in water in a closed chamber. The pressure-tube, *i.e.* the tube coming from the "head" in which there is an excess of

pressure, opens above the water-level inside the inverted floating vessel, and the other tube, *i.e.* that in which there is a decrease of pressure, communicates with the sealed chamber. Very trifling differences of pressure are sufficient to alter the level at which the inverted vessel floats, and a pen rigidly attached to this vessel makes a continuous record on a clock drum in the usual way. This instrument will register very light winds, down perhaps to 1 or 2 miles per hour, and is convenient, because being once erected, the "head" requires cleaning about once a year and very little attention of any other kind. A good exposure, however, is essential. If placed on an ordinary house the "head" should be quite 30 ft. above the ridge of the roof.

If a Robinson Anemometer (Fig. 18) be used, it should be mounted on a pole in a fully exposed situation, so as to be inter-

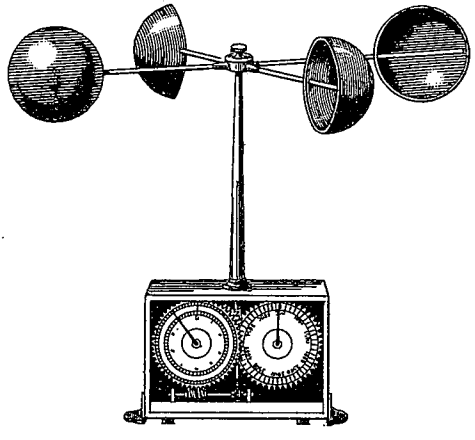


FIG. 18.—Robinson Anemometer.

fered with as little as possible by buildings, trees, etc. The bearings should always be kept well oiled. It should be remembered that the graduations on these instruments have been calculated on the supposition that the velocity of the wind is three times that of the motion of revolution of the cups, but recent experiments have shown that this value is too high, and varies also with the size of the instrument. For the Robinson Anemometer known as the "Kew pattern"—the dimensions of which are: distance of centre of cups from centre of axle 24 inches, and diameter of cups 9 inches—the correct factor (provided the instrument is in perfect working order) is very close to 2·2. For smaller instruments—distance of centre of cups from centre of axle 18 inches, and diameter of cups 6 inches —the factor is 2·8.

The following particulars should always be given as to a Robinson anemometer:—1. Length of arm (axis to centre of cup). 2. Diameter of cups. 3. How the registration is effected (mechani-

cally, electrically, or otherwise). 4. Name of maker. 5. Height above general surface of the ground.

Sunshine Recorders.

The instrument generally adopted for recording the duration of Sunshine is the Campbell-Stokes Sunshine Recorder. This consists of a sphere of crown glass 4 inches in diameter and 3 lbs. in weight, supported on a pedestal in a metal zodiacal frame (Fig. 19). It must be fixed in such a position that the sun can shine on the instrument the whole of the time it is above the horizon, a condition sometimes difficult to fulfil, but experience will soon indicate the best and most accessible spot where the recorder can be placed. The points requiring attention in the setting up of the instrument are that it shall be placed level as regards east and west, that the axis of the frame shall be inclined to the horizon by an angle equal to the latitude of the place, and that the image of the sun, when the sun is due south, shall fall on the meridian line marked on the frame, to which the noon hour line on the card is adjusted. The sunshine record is thus in hours of Local apparent time (such as is shown by a sun-dial), which it is convenient to use for sunshine observations in order to facilitate their discussion. To determine when the sun is due south see instructions under the section *Wind Direction* (p. 25). It would be well to make more than one determination of the meridional position, so as to ensure the accurate setting of the instrument. A prepared card being inserted in the proper groove (Fig. 20), according to the season of the year, the sun when shining burns away or chars the surface at the points on which its image

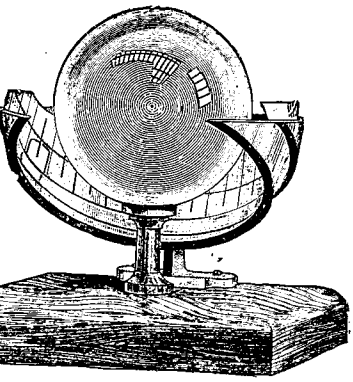


FIG. 19.—Campbell-Stokes Sunshine Recorder.

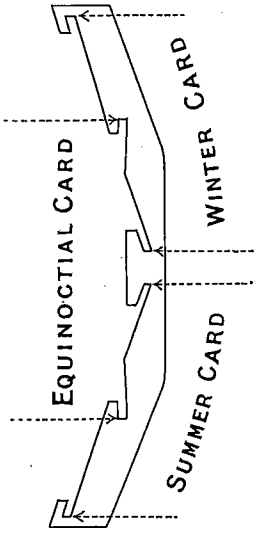


FIG. 20.—Section of Frame.

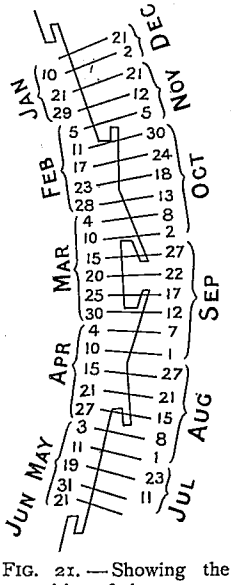


FIG. 21.—Showing the position of the trace on the cards according to the time of year.

successively falls, and so gives a record of the duration of bright sunshine. The spot of light must be at its proper position on the card, which may be determined by reference to Fig. 21, and the burnt trace must run parallel with the line on the card. The card should be removed after sunset (even if it has not been scored), and a new one inserted ready for the following day. Each card should be carefully dated, and the day of the week also written thereon.

The straight or equinoctial cards are to be used from March 1 to April 12, and again from September 1 to October 12. The long curved or summer cards are to be used from April 13 to August 31, and the short curved or winter cards from October 13 to February 28 or 29. The ends of the card projecting above the

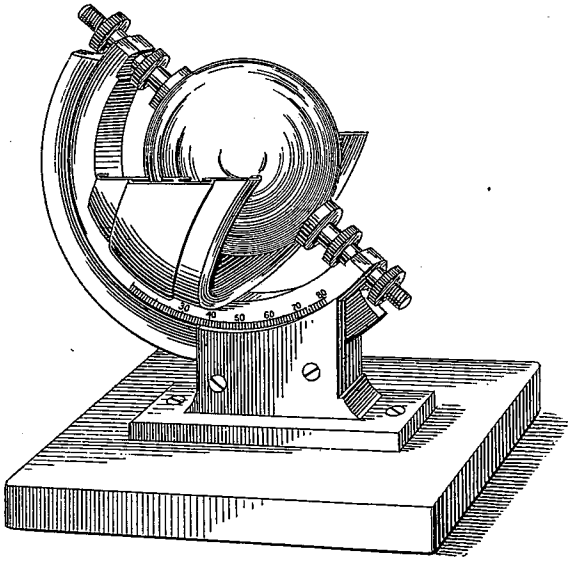


FIG. 22.—Campbell-Stokes Sunshine Recorder, universal pattern, with adjustment for latitude.

horizontal top of the frame should be cut off, so as not to intercept the sun's rays near sunrise and sunset.

A simple test for ascertaining whether the glass ball is in the centre of the frame is to pass a sovereign round between the ball and the card. If the sovereign can be passed round uniformly, the ball may be assumed to be in the centre of the frame; but if it sticks at any point, the instrument requires adjustment. This can be done by loosening the screw of the pedestal at the back of the slate slab, and moving the pedestal until the ball is quite in the centre of the frame. The screw should then be carefully tightened.

When the instrument has been properly adjusted it should not be disturbed, but should be firmly fixed either by cement or in some other way.

Fig. 22 shows the "universal pattern" of the Campbell-Stokes

Sunshine Recorder in which the frame is adjustable to any latitude. In this instrument the ball is kept in position by two clamping-screws. Care must be taken to see that the ball is exactly midway between the top and bottom ends of the frame, otherwise if it is too high or too low the sunshine trace will not run parallel with the card.

In time of snow, when there is any possibility of sunshine, the snow should be removed from the ball and from between the ball and the card. Hoar frost should also be removed from the ball as soon as possible; and the ball should always be kept clean. A chamois leather or a soft cloth should be used for this purpose.

Another form of Sunshine Recorder is the Jordan Photographic Recorder. In this instrument the record depends upon the intensity of the actinic rays, and is therefore not directly comparable with the record from a Campbell-Stokes Recorder, which depends upon the burning power of the sunshine.

The sunshine should be measured in hours and tenths of an hour, and not in minutes.

A "sunless day" is that on which the record of sunshine is less than three minutes.

Ozone.

The amount of Ozone present in the atmosphere is sometimes made the object of observation. There are, however, great difficulties in the way of accurately observing the ozone of the atmosphere, the test-papers employed being frequently unreliable. Therefore the determination of ozone is not now included by the Royal Meteorological Society in its scheme of ordinary observations.

Clouds.

The proportion of sky covered with cloud is to be observed. This is done by estimation, the scale adopted being 0 to 10; 0 indicating a cloudless sky, 5 half clear and half clouds, and 10 a sky which is covered with cloud or overcast.

It is also desirable to note the kind of cloud prevalent at the time, and the direction from which it is moving.

The different modifications and forms of cloud, as originally given by Luke Howard, were Cirrus, Cirro-cumulus, Cirro-stratus, Cumulus, Cumulo-stratus, Stratus, and Nimbus. It is desirable, however, to employ the nomenclature adopted by the International Meteorological Committee, and published in the *International Cloud Atlas*, which is as follows:—

1. CIRRUS (Ci.). Detached clouds of delicate and fibrous appearance, often showing a feather-like structure, generally of a whitish colour. Cirrus clouds take the most varied shapes, such as isolated tufts, thin filaments on a blue sky, threads spreading out in the form of feathers, curved filaments ending in tufts, sometimes called *Cirrus uncinus*, etc. They are sometimes arranged in parallel belts which cross a portion of the sky in a great circle, and by an effect of perspective appear to converge towards a point on the horizon, or if sufficiently

extended, towards the opposite point also. (Ci.-St. and Ci.-Cu. are sometimes arranged in similar bands.)

2. CIRRO-STRATUS (Ci.-St.). A thin, whitish sheet of clouds sometimes covering the sky completely and giving it only a milky appearance (it is then called *Cirro-nebula*), at other times presenting more or less distinctly a formation like a tangled web. This sheet often produces halos around the sun and moon.

3. CIRRO-CUMULUS (Ci.-Cu.). Mackerel Sky. Small globular masses or white flakes without shadows, or showing very slight shadows, arranged in groups and often in lines.

4. ALTO-STRATUS (A.-St.). A thick sheet of a grey or bluish colour, sometimes forming a compact mass of dark grey colour and fibrous structure. At other times the sheet is thin, resembling thick Ci.-St., and through it the sun or the moon may be seen dimly gleaming as through ground glass. This form exhibits all changes peculiar to Ci.-St. but from measurements its average altitude is found to be about one-half that of Ci.-St.

5. ALTO-CUMULUS (A.-Cu.). GREAT WAVES. Largish globular masses, white or greyish, partially shaded, arranged in groups or lines, and often so closely packed that their edges appear confused. The detached masses are generally larger and more compact (resembling St.-Cu.) at the centre of the group, but the thickness of the layer varies. At times the masses spread themselves out and assume the appearance of small waves or thin slightly curved plates. At the margin they form into finer flakes (resembling Ci.-Cu.). They often spread themselves out in lines in one or two directions.

6. STRATO-CUMULUS (St.-Cu.). Large globular masses or rolls of dark clouds often covering the whole sky, especially in winter. Generally St.-Cu. presents the appearance of a grey layer irregularly broken up into masses of which the edge is often formed of smaller masses, often of wavy appearance resembling A.-Cu. Sometimes this cloud-form presents the characteristic appearance of great rolls, arranged in parallel lines and pressed close up against one another. In their centres these rolls are of a dark colour. Blue sky may be seen through the intervening spaces which are of a much lighter colour ["Roll-Cumulus" in England, "Wulst-Cumulus" in Germany]. St.-Cu. clouds may be distinguished from Nb. by their globular or rolled appearance, and by the fact that they are not generally associated with rain.

7. NIMBUS (Nb.). RAIN-CLOUDS. A thick layer of dark clouds, without shape and with ragged edges from which steady rain or snow usually falls. Through the openings in these clouds an upper layer of Ci.-St. or A.-St. may be seen almost invariably. If a layer of Nb. separates up in a strong wind into shreds, or if small loose clouds are visible floating underneath a large Nb. the cloud may be described as *Fracto Nimbus* (Fr.-Nb.). ["Scud" of sailors.]

8. CUMULUS (Cu.). WOOL-PACK CLOUDS. Thick clouds of which the upper surface is dome-shaped and exhibits protuberances while the base is horizontal. These clouds appear to be formed by a diurnal ascensional movement which is almost noticeable. When the cloud is opposite the sun, the surfaces facing the observer have a greater brilliance than the margins of the protuberances; when the light falls aslant, as is usually the case, these clouds throw deep shadows; when, on the contrary, the clouds are on the same side of the observer as the sun, they appear dark with bright edges. True Cumulus has well-defined upper and lower limits, but in strong winds a broken cloud resembling Cumulus is often seen in which the detached portions undergo continual change. This form may be distinguished by the name of *Fracto-Cumulus* (Fr.-Cu.).

9. CUMULO-NIMBUS (Cu.-Nb.). THE THUNDER-CLOUD; SHOWER-CLOUD. Heavy masses of cloud rising in the form of mountains, turrets, or anvils, generally surmounted by a sheet or screen of fibrous appearance ("false Cirrus") and having its base a mass of cloud similar to Nimbus. From the base local showers of rain or snow (occasionally of hail or soft hail) usually fall. Sometimes the upper edges assume the compact form of cumulus, and form massive peaks

round which delicate "false Cirrus" floats. At other times the edges themselves separate into a fringe of filaments similar to Cirrus clouds. This last form is particularly common in spring showers. The front of thunder-clouds of wide extent frequently presents the form of a large arc spread over a portion of a uniformly brighter sky.

10. STRATUS (St.). A uniform layer of cloud resembling a fog, but not resting on the ground. When this sheet is broken up into irregular shreds in a wind, or by the summits of mountains, it may be distinguished by the name *Fracto-Stratus* (Fr.-St.).

The Frontispiece gives illustrations of various cloud forms, with their names and approximate altitudes. This has been reproduced by permission from Mr. R. Inwards' *Weather Lore*, 3rd edition, 1898.

The kind of cloud should be indicated by the initial letters of the name of the cloud as follows:—

Ci.	Cirrus.	Cu.-Nb.	Cumulo-nimbus.
Ci.-St.	Cirro-stratus.	St.	Stratus.
Ci.-Cu.	Cirro-cumulus.	Fr.-Cu.	Fracto-cumulus.
A.-St.	Alto-stratus.	Fr.-Nb.	Fracto-nimbus.
A.-Cu.	Alto-cumulus.	Fr.-St.	Fracto-stratus.
St.-Cu.	Strato-cumulus.	St.-cf.	Stratus-cumuliformis.
Nb.	Nimbus.	Nb.-cf.	Nimbus-cumuliformis.
Cu.	Cumulus.	M.-Cu.	Mammato-cumulus.

A cloud mirror or nephoscope is sometimes used for observing the direction of movement of the clouds, and ascertaining their apparent rate of motion.

Observers who are able to devote time to the study of the clouds should pay attention to the following points and enter the same in the register:—

(1) *The kind of cloud.* Indicated by the international abbreviations of the name of the cloud, as given above.

(2) *The direction from which the cloud comes.* By remaining perfectly still for several seconds the motion of clouds may be observed easily against a steeple or pole erected in an open space. If the motion of the cloud be very slow the head should be steadied by using a rest. This method of observing must be applied only to clouds near the zenith; in the case of clouds near the horizon perspective may lead to errors. In such cases a nephoscope or Mr. Besson's harrow should be used, and the instructions issued with these instruments should be followed.

These two observations are the most important. In addition, we may note, if there be opportunity—

(3) *The point of radiation of the upper clouds.* These clouds often take the form of narrow parallel lines, which, by reason of perspective, appear to converge towards a given point on the horizon. The "point of radiation" is the name given to the point where these belts or their prolongation meet the horizon. This point should be indicated in the same manner as the direction of the wind, N., N.N.E., etc.

(4) *Undulated clouds.* It often happens that the clouds have the appearance of regular parallel and equidistant stripes like waves on the surface of water. This occurs most frequently with Cirro-cumulus, Strato-cumulus (roll Cumulus), etc. It is important to note the direction of these stripes. When two distinct systems are apparent, as is often the case with clouds separated into globular

masses by stripes in two directions, the direction of both systems should be noted. As far as possible these observations should be confined to stripes near the zenith, so as to avoid errors caused by perspective.

(5) *The density and situation of a bank of Cirrus.* The upper clouds often assume the form of a tangled web or sheet which, as it appears above the horizon, looks like a thin bank of a light or greyish colour. As this form of cloud is closely connected with barometrical depressions, it is desirable to observe—(*a*) the density (for which the following scale is suggested: 0 = very thin and irregular; 1 = thin but regular; 2 = fairly thick; 3 = thick; and 4 = very thick and of a dark colour); and (*b*) *the direction* in which the sheet or bank appears thickest.

(6) *Remarks.* All interesting particulars should be noted, such as—(*a*) During summer all low clouds tend to assume forms resembling cumulus. In such cases an entry should be made in the column for "Remarks"—*Stratus or Nimbus cumuliformis.* (*b*) At times a cloud may present a mammillated lower surface. This appearance should be noted under the name of *Mammato-cumulus.* (*c*) The ovoid form with sharp edges assumed by certain clouds, particularly during the occurrence of sirocco, mistral, or föhn, should be designated *lenticularis*; for example, *Cumulus-lenticularis*, *Stratus-lenticularis* (Cu.-lent.), (St.-lent). Such clouds frequently show iridescence. (*d*) A note should always be made of the fact when clouds seem to be stationary or in very rapid motion.

Weather.

In addition to the foregoing observations, it is very desirable to note the state of the weather and any phenomena that may have occurred since the last observation, such as Thunderstorms, Halos, Fog, Snow, Hail, etc. These may be entered in the register in an abbreviated form by the letters of Beaufort's notation, or by the International symbols, as follows:—

BEAUFORT'S LETTERS AND INTERNATIONAL SYMBOLS.

	Aurora			Ice Crystals			Snow on Ground	
b	Blue Sky		l	Lightning			Soft Hail	△
c	Clouds (detached)			Lunar Corona			Solar Corona	○
w	Dew			Lunar Halo			Solar Halo	⊕
d	Drizzling Rain		m	Mist		q	Squally	
	Dust Haze	∞	o	Overcast (dull)		t	Thunder	⊤
f	Fog	≡	p	Passing Showers			Thunderstorm	
	Gale		r	Rain		u	Ugly (threatening)	
	Glazed Frost			Rainbow		v	Visibility	
g	Gloomy			Silver Thaw		e	Wet air	
h	Hail	▲	s	Snow				
	Hoar Frost			Snow Drift				

The intensity of any individual phenomenon may be distinguished by the figures of 0 and 2, which should be used as exponents of the symbols, so that 0 should indicate slight, and 2 strong, *e.g.* $▲^0$ = slight hail, $▲^2$ = heavy hail.

Hours of Observation.

At the Second Order Stations the hours of observation are 9 a.m. and 9 p.m. *local time*, which hours should be adhered to *punctually.* The maximum and minimum thermometers are to be read and set at 9 p.m., and the readings entered to the day on which they are observed.

At the Climatological and other Stations the observations are required to be made once each day, viz. at 9 a.m. *local time.* The reading of the maximum thermometer and the rainfall are to be entered to the *previous* day, but the reading of the minimum thermometer is to be entered to the day on which it is taken.

If possible, observations should also be taken at 3 p.m. These should at least include readings of the dry-bulb and wet-bulb thermometers and the amount of cloud. The maximum and minimum thermometers must not, however, be interfered with at that time.

At some stations observations are taken at 6 p.m. for newspaper reports or municipal purposes. When such is the case care must be taken not to impair the rainfall and maximum and minimum temperature records for the ordinary meteorological day.

Note-Book.

All the original observations should be written down at the time they are made in a properly ruled or printed note-book (not on loose slips of paper), so that they may be available for reference in case any question should arise about them afterwards. It is a very convenient plan to put an elastic band over each end of the note-book, as by that means it can be opened at once at the proper place, and in wet weather the other leaves will not be wetted by rain, or the figures smudged. If a lead pencil be tied to the note-book with a piece of string it will always be at hand for entering the observations.

Omissions must be carefully avoided, otherwise true means cannot be obtained: it is, therefore, necessary to have a well-trained deputy to take the observations in the absence of the usual observer.

Lamp.

When observations are taken after dark it is desirable to have a good and efficient lamp, which should always be kept well trimmed. Matches should on no account be used. An electric lamp is convenient for reading thermometers, as it is always ready and gives out no perceptible heat.

Register.

In entering the observations in the register it is absolutely essential that they be *correctly* copied from the original note-book; it is most desirable, therefore, that the entries be afterwards *checked* by reading against the originals. In filling in the barometer readings, the whole inches may be omitted when there are several of the same number together, except the first and the last. In no other case, however, should any figure be omitted in any column, even though it be a cypher, as it may thereby cause an error in the adding up.

In taking the means, the work of addition may be much simplified by adopting some number as constant or common. For instance in

the barometer column it will be readily seen which is the prevalent number, 29 or 30 ins.; if 29 be taken as the constant, it will be necessary only to add up the figures to the right of the decimal point, and then add 1 in. to this total for every inch above 29, and deduct 1 in. for every inch below. *Example:* If the total of the figures to the right of the decimal amount to 21·648, and to the left of the decimal 30 ins. occur 7 times, and 28 ins. 3 times, the other values being 29 ins.; then, by adding 7 for the 30 ins. and deducting 3 for the 28 ins., we get the following results: $7 - 3 = 4$ $+ 21{\cdot}648 = 25{\cdot}648$ ins. This would, therefore, be the total for the barometer column, taking 29 ins. as the constant. Dividing this total by 31, which we will presume to be the number of days in the month, and adding 29 ins., the mean will be 29·827 ins. In the same way constants may be employed in adding up the dry, wet, maximum, and minimum thermometers and other columns.

Great care should be taken to make the addition correct; it is therefore desirable that the columns be added twice, first *upwards* and then *downwards*; so that if a mistake be made one way, it will most probably be found out the other way. In dividing the sums to obtain the means, the last figure should always be increased by one if the remainder be one-half or more of the divisor.

The mean temperature of the month for the stations of the Royal Meteorological Society is determined by adding together the mean maximum and the mean minimum, and dividing the sum by 2. *Example:* Mean maximum, 63°·4, mean minimum, 46°·2 = 109°·6. This divided by 2 gives 54°·8.

The extreme range of temperature for the month is the difference between the absolute maximum and minimum readings. The mean range of temperature for the month is the difference between the mean maximum and mean minimum readings.

When the mean of the 9 a.m. and 9 p.m. observations of the amount of cloud is less than 2·0, this is called a Day of Clear Sky, but when the mean is above 8·0 it is called an Overcast Day.

When during any part of the day the force of the wind is 8 and above (on the Beaufort scale) this is counted as a day with Gale. Previous to 1911 force 7 was counted as a Gale, but the International Meteorological Committee has recently decided that the minimum value for a Gale should be raised to force 8.

In summarizing the observations of the direction of the wind, these should be taken out to eight points of the compass. If the wind has been observed to sixteen points, the intermediate points must be split up and apportioned to each side, *e.g.*—

3 NNE will become 1 N and 2 NE
6 SSE „ „ 3 SE „ 3 S
11 WSW „ „ 5 SW „ 6 W

In the "Remarks" column the special features of the day should

be noted, and any particular phenomena with the time of their occurrence. At the end of each month a brief account of the chief characteristics of the weather should also be given, with indication of their effects upon agriculture, health, etc.

A specimen of a Climatological Return is given on p. 65.

Self-Recording Instruments.

Much interesting and valuable information may be obtained from *self-recording* barometers, thermometers, hygrometers, and rain gauges. These are of great service in measuring the time, duration, intensity, and various phases of phenomena.

A brief description of this class of instruments is as follows :—

THERMOGRAPH.—The thermometer consists of a very thin curved metal case (a Bourdon tube) containing alcohol, one end being a fixture and the other movable. As the alcohol expands or contracts with the changes of temperature it alters the curvature of the tube,

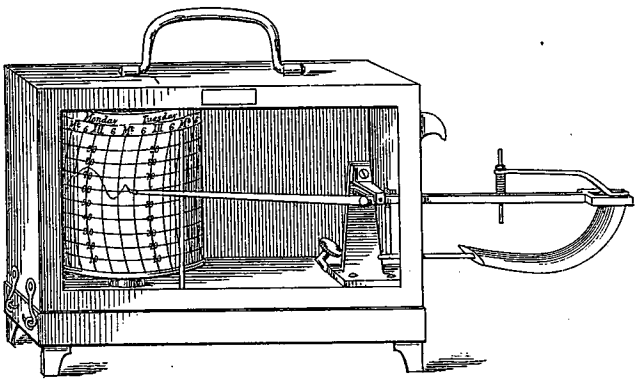


FIG. 23.—Thermograph.

making it flatter or otherwise. In another form the tube is replaced by a bimetallic spiral. The end of the tube communicates its motion by means of a metal rod to a lever carrying a pen, which marks a graduated paper wound on the cylinder. A clock turns the cylinder round once in seven days (Fig. 23).

DRY-BULB AND WET-BULB THERMOGRAPH.—This consists of a pair of thermometers, which are placed side by side ; but they are curved reversely, and are placed as far apart as possible. The wet-bulb thermometer is covered with muslin, and is kept moist by a water vessel below, into which the muslin dips, and also by a capillary siphon from a second water vessel above.

BAROGRAPH.—This instrument consists of a series of vacuum boxes by which the effects of variation of the atmospheric pressure are increased and transmitted by a system of levers to an arm carrying a pen (Fig. 24).

HAIR HYGROGRAPH.—The actuating portion is a wisp of about

a dozen hairs fastened at each end, and stretched laterally by a small weighted lever; the elongation and contraction of the hairs causes motion of the lever, and is thereby recorded on the cylinder.

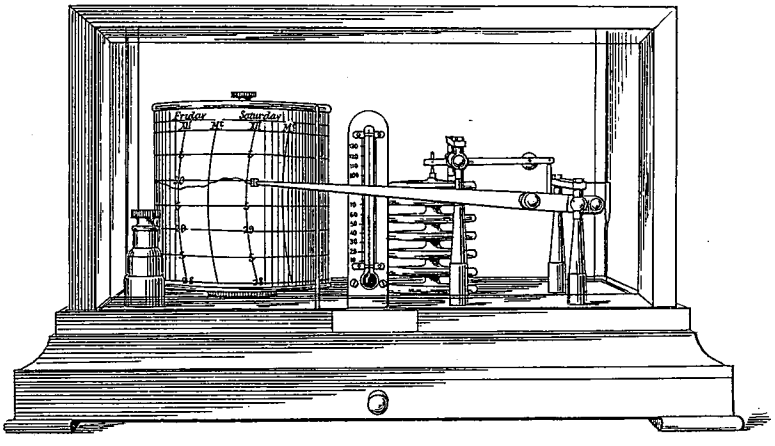


FIG. 24.—Barograph.

SELF-RECORDING RAIN GAUGE.—There are several patterns of self-recording rain gauges, *e.g.* Beckley's, Halliwell's, Casella's, and Negretti & Zambra's, etc., which give excellent results in careful hands.

The two principal types of self-recording rain gauges are the float pattern and the tipping bucket pattern. In the former the rain is collected in a reservoir in which there is a float carrying a pen, and as the float rises a trace is marked on the chart showing the rate at which the rain fell. In the tipping bucket pattern, the rain is collected in a small tilting bucket divided into two equal parts, which tip over alternately when ·01 in. has fallen. A lever carrying a pen is thus raised by means of an escapement wheel, and a trace resembling a series of steps is recorded on the chart.

The method of recording is practically the same in each of the above instruments, so the following directions for use will be applicable to all. First remove the pen from the chart by means of the lever at the base, then unscrew the thumb screw in the centre of the drum and lift the latter off the steel rod, and wind the clock. The brass band which holds the chart in position should be removed and a new chart placed on the cylinder, which should then be replaced on the steel rod, care being taken to see that the small wheel underneath gears into the large one. The cylinder should be turned round until the pen is in a line with the correct day and hour on the chart. The pen should then be refilled with ink and the lever turned to the left to bring the pen into contact with the chart. It is advisable to move the pen slightly to ensure a proper flow of ink.

Additional Observations.

The conditions prevailing in the upper atmosphere may be investigated by the use of suitable kites—such as the Hargreave or the Dines box kites—with a meteorograph attached. At the Blue Hill Observatory, U.S.A., records have been obtained at a height of 3 miles by means of kites.

Small pilot balloons may be sent up for determining the drift of the upper currents.

If the circumstances permit, a balloon carrying a very light Dines meteorograph should be sent up on the first Thursday of each month and the other days appointed by the International Aeronautical Committee. Such balloons sometimes reach an altitude of as much as 16 miles above the earth's surface.

On the occurrence of any exceptional phenomena, *e.g.* floods, whirlwinds, showers of dust, damage by lightning, hail, etc., steps should be taken at once to gather accurate information respecting the same, which should be carefully entered in the register. In the case of floods an effort should be made to have a permanent mark cut in a wall or on the pier of a bridge, recording the height and the date of the flood.

It is also desirable that photographs of meteorological phenomena should be taken whenever possible, and copies of these should be forwarded to the Royal Meteorological Society for preservation as a permanent record.

Much valuable information may be obtained from observations on the number of dust particles in the air by means of Aitken's Dust Counter, and also from analyses of air in different districts.

Phenological Observations.

A careful watch should be kept for the first flowering of uncultivated plants, the arrival and song of birds, the appearance of butterflies and other insects, etc. The Royal Meteorological Society is always glad to receive such observations.

The following is the list recommended for observations :—

PLANTS.

1. Hazel (*Corylus Avellana*).
2. Coltsfoot (*Tussilago Farfara*).
3. Wood Anemone (*Anemone nemorosa*).
4. Blackthorn (*Prunus spinosa*).
5. Garlic Hedge Mustard (*Sisymbrium Alliaria*).
6. Horse Chestnut (*Æsculus Hippocastanum*).
7. Hawthorn (*Cratægus Oxyacantha*).
8. White Ox Eye (*Chrysanthemum Leucanthemum*).
9. Dog Rose (*Rosa canina*).
10. Black Knapweed (*Centaurea nigra*).
11. Harebell (*Campanula rotundifolia*).
12. Greater Bindweed (*Convolvulus sepium*).
13. Ivy (*Hedera Helix*).

The same individual trees and shrubs should be observed each

year, and as regards herbaceous plants, those growing in precisely the same spots—this is of the greatest importance. In the case of trees and shrubs they must be of mature growth. The particular plants selected for observation should be situated neither in very sheltered nor, on the other hand, in very exposed positions, and should neither be abnormally early nor late in their flowering for the district. When from any cause any of the selected plants cease to be available, other specimens of the same variety similarly situated should be observed instead of them.

A plant is to be considered "in flower" when the stamens of the first blossom on it first become visible. As soon as the date of one plant has been secured, watch for the appearance of the next on the list. If, unfortunately, the first flowering be missed by a day or two, the estimated date of first flowering should be given and an asterisk placed against the entry. Should the plant be estimated to have been in flower more than four days, no entry at all should be made.

BIRDS.

14. Song Thrush (*Turdus musicus*), first heard.
15. Swallow (*Hirundo rustica*), first seen.
16. Cuckoo (*Cuculus canorus*), first heard.
17. Nightingale (*Daulias luscinia*), first heard.
18. Flycatcher (*Muscicapa grisola*), first seen.
19. Swallow (*Hirundo rustica*), last seen.

The date on which the note of the Song Thrush is first heard after January 1st should be given. It must not be mistaken for that of the Missel Thrush. The notes of the Missel Thrush are less musical and connected, the strain is altogether much shorter, and, being repeated many times in succession, it wants the variety of that of the Song Thrush.

The Swallow may be distinguished from the House Martin and Sand Martin by its back being of a uniform glossy steel-blue, almost black, by its long forked tail, and by the dingy white colour of its lower parts. The House Martin has the rump and lower parts pure white, while the Sand Martin is of a mouse colour above. The Swift differs from the Swallow in its more rapid flight, the peculiar narrowness of its outspread wings, and its general sooty colour.

The observer should be certain that it is the Nightingale that is heard, as the Song Thrush also often sings late in the evening.

The Flycatcher is a little greyish-brown bird, fond of sitting on a post, rail, or perch, whence it can readily dart off and seize a fly, usually returning at once to its former station.

INSECTS.

20. Honey Bee (*Apis mellifica*), first seen.
21. Wasp (*Vespa vulgaris*), first seen.
22. Small White Butterfly (*Pieris rapæ*), first seen.
23. Orange-tip Butterfly (*Anthocaris cardamines*), first seen.
24. Meadow-brown Butterfly (*Epinephile Janira*), first seen.

Books and Publications on Meteorology.

The following is a brief list of works on meteorological subjects which observers may consult with advantage :—

ABERCROMBY, Hon. R.—Weather. A Popular Exposition of the Nature of Weather Changes from Day to Day. 8vo. 1887. 5s.

ALLINGHAM, W.—A Manual of Marine Meteorology. 8vo. 1900. 3s. 6d.

Barometer Manual for the Use of Seamen. Published by the Meteorological Office. 8vo. 6th edition. 1909. 3d.

BARTHOLOMEW'S Atlas of Meteorology. Folio. 1899. 52s. 6d.

Bulletin of the Mount Weather Observatory (U.S.). 8vo.

CLAYDEN, A. W.—Cloud Studies. 8vo. 1905. 12s.

Climatological Atlas of India. Published under the direction of Sir John Eliot. Folio. 1906. 36s.

Daily Weather Reports of the Meteorological Office. 4to. Subscription 5s. per quarter.

DAVIS, W. M.—Elementary Meteorology. 8vo. 1894. 10s.

DEXTER, E. G.—Weather Influences. 8vo. 1904. 8s. 6d.

DICKSON, H. N.—Meteorology. The Elements of Weather and Climate. 8vo. 1893. 2s. 6d.

FERREL, W.—A Popular Treatise on the Winds. 8vo. 1889. 16s.

GLAISHER, J.—Hygrometrical Tables adapted to the use of the Dry- and Wet-bulb Thermometer. 8vo. 2s. 6d.

HANN, J.—Lehrbuch der Meteorologie. 8vo. 2nd edition. 1906. 24s.

HANN, J.—Handbuch der Klimatologie. 8vo. 3rd edition. 1908-11.

HANN, J.—Handbook of Climatology. Translated by R. de C. Ward. 8vo. 1903. 12s. 6d.

International Catalogue of Scientific Literature. F. Meteorology. Published annually. 8vo. 15s.

International Cloud Atlas. 4to. 1896. 16s.

International Meteorological Tables. 4to. 1890. 28s.

INWARDS, R.—Weather Lore. A Collection of Proverbs, Sayings, and Rules concerning the Weather. 3rd edition. 8vo. 1898.

Journal of the Scottish Meteorological Society. 8vo. Published annually. 12s. 6d.

LEY, Rev. W. CLEMENT.—Cloudland. A Study on the Structure and Characters of Clouds. 8vo. 1894. 7s. 6d.

MARRIOTT, W.—Some Facts about the Weather. 8vo. 2nd edition. 1909. 6d.

Meteorological Office. The Observer's Handbook. 8vo. Published annually. 3s.

Meteorological Record. Monthly Results of Observations made at the Stations of the Royal Meteorological Society. 8vo. Published quarterly. 1s. 6d.

Meteorologische Zeitschrift. 4to. Published monthly. Annual subscription 20s.

MILL, H. R.—British Rainfall. 8vo. Published annually. 10s.

Monthly Weather Review (U.S.). 4to.

MOORE, Sir J. W.—Meteorology, Practical and Applied. 8vo. 2nd edition. 1910. 10s. 6d.

MOORE, WILLIS L.—Descriptive Meteorology. 8vo. 1910. 12s. 6d.

PERNTER, J. M., and EXNER, F. M.—Meteorologische Optik. 8vo. 1910.

Quarterly Journal of the Royal Meteorological Society. 8vo. 5s.

SCOTT, R. H.—Weather Charts and Storm Warnings. 8vo. 3rd edition. 1887.

SCOTT, R. H.—Elementary Meteorology. 8vo. 6th edition. 1893. 5s.

SHAW, W. N., and LEMPFERT, R. G. K.—The Life History of Surface Air Currents. 4to. 1906. 7s. 6d.

Smithsonian Meteorological Tables. 3rd edition. 8vo. 1907.

Symons's Meteorological Magazine, edited by Dr. H. R. Mill. 8vo. Published monthly. 4d.

WALDO, F.—Modern Meteorology. 8vo. 1893.

WALDO, F.—Elementary Meteorology. 8vo. 1896.

WARD, R. de C.—Practical Exercises in Elementary Meteorology. 8vo. 1899.

WARD, R. de C.—Climate considered especially in relation to Man. 8vo. 1908. 6s.

Weekly Weather Reports of the Meteorological Office. 4to. Annual subscription (which includes the Monthly Weather Report) 30s.

English and Metrical Scales.

As the observations from foreign countries are made according to the metrical scales, it is convenient to be able to readily convert the English values into the metrical. Five tables for this purpose are given on pages 61-64.

Meteorological Terms.

The International Meteorological Congress held at Rome in 1879 expressed the opinion that an "International Dictionary of

Meteorology" should be published. As a step towards the carrying out of this Resolution, a "Glossary of Meteorological Terms" has been prepared and will be found on p. 66. The name of the person to whom it is believed the term is due and the date of its first use are given in square brackets.

The author desires to acknowledge the assistance which he has received in the preparation of this Glossary from Members of the Council of the Royal Meteorological Society, and also from Bartholomew's *Atlas of Meteorology* and other sources.

TABLE I.—CORRECTIONS TO BE APPLIED TO BAROMETERS WITH *Brass Scales* EXTENDING FROM THE CISTERN TO THE TOP OF THE MERCURIAL COLUMN TO REDUCE THE OBSERVATIONS TO 32° FAHRENHEIT.

Attached Thermometer.	READING OF BAROMETER.									Attached Thermometer.
	Ins. 27·0	Ins. 27·5	Ins. 28·0	Ins. 28·5	Ins. 29·0	Ins. 29·5	Ins. 30·0	Ins. 30·5	Ins. 31·0	
20°	+·021	+·021	+·021	+·022	+·022	+·023	+·023	+·023	+·024	20°
21	·018	·019	·019	·019	·020	·020	·020	·021	·021	21
22	·016	·016	·016	·017	·017	·017	·018	·018	·018	22
23	·013	·014	·014	·014	·014	·015	·015	·015	·015	23
24	·011	·011	·011	·012	·012	·012	·012	·012	·013	24
25	·009	·009	·009	·009	·009	·009	·009	·010	·010	25
26	·006	·006	·006	·006	·007	·007	·007	·007	·007	26
27	·004	·004	·004	·004	·004	·004	·004	·004	·004	27
28	+·001	+·001	+·001	+·001	+·001	+·001	+·001	+·001	+·001	28
29	−·001	−·001	−·001	−·001	−·001	−·001	−·001	−·001	−·001	29
30	·004	·004	·004	·004	·004	·004	·004	·004	·004	30
31	·006	·006	·006	·006	·007	·007	·007	·007	·007	31
32	·008	·009	·009	·009	·009	·009	·009	·010	·010	32
33	·011	·011	·011	·012	·012	·012	·012	·012	·012	33
34	·013	·014	·014	·014	·014	·015	·015	·015	·015	34
35	·016	·016	·016	·017	·017	·017	·018	·018	·018	35
36	·018	·019	·019	·019	·020	·020	·020	·021	·021	36
37	·021	·021	·021	·022	·022	·022	·023	·023	·024	37
38	·023	·023	·024	·024	·025	·025	·026	·026	·026	38
39	·025	·026	·026	·027	·027	·028	·028	·029	·029	39
40	·028	·028	·029	·029	·030	·030	·031	·031	·032	40
41	·030	·031	·031	·032	·033	·033	·034	·034	·035	41
42	·033	·033	·034	·034	·035	·036	·036	·037	·037	42
43	·035	·036	·036	·037	·038	·038	·039	·040	·040	43
44	·037	·038	·039	·040	·040	·041	·042	·042	·043	44
45	·040	·041	·041	·042	·043	·044	·044	·045	·046	45
46	·042	·043	·044	·045	·045	·046	·047	·048	·049	46
47	·045	·046	·046	·047	·048	·049	·050	·051	·051	47
48	·047	·048	·049	·050	·051	·052	·052	·053	·054	48
49	·050	·050	·051	·052	·053	·054	·055	·056	·057	49
50	·052	·053	·054	·055	·056	·057	·058	·059	·060	50
51	·054	·055	·056	·057	·058	·059	·060	·061	·062	51
52	·057	·058	·059	·060	·061	·062	·063	·064	·065	52
53	·059	·060	·061	·063	·064	·065	·066	·067	·068	53
54	·062	·063	·064	·065	·066	·067	·068	·070	·071	54
55	·064	·065	·066	·068	·069	·070	·071	·072	·073	55
56	·066	·068	·069	·070	·071	·073	·074	·075	·076	56
57	·069	·070	·071	·073	·074	·075	·076	·078	·079	57
58	·071	·073	·074	·075	·077	·078	·079	·081	·082	58
59	·074	·075	·076	·078	·079	·080	·082	·083	·085	59
60	−·076	−·077	−·079	−·080	−·082	−·083	−·085	−·086	−·087	60

TABLE I.—CORRECTIONS TO BE APPLIED TO BAROMETERS WITH *Brass Scales* EXTENDING FROM THE CISTERN TO THE TOP OF THE MERCURIAL COLUMN TO REDUCE THE OBSERVATIONS TO 32° FAHRENHEIT.—*Continued.*

Attached Thermometer.	READING OF BAROMETER.									Attached Thermometer.
	Ins. 27·0	Ins. 27·5	Ins. 28·0	Ins. 28·5	Ins. 29·0	Ins. 29·5	Ins. 30·0	Ins. 30·5	Ins. 31·0	
60°	−·076	−·077	−·079	−·080	−·082	−·083	−·085	−·086	−·087	60°
61	·078	·080	·081	·083	·084	·086	·087	·089	·090	61
62	·081	·082	·084	·085	·087	·088	·090	·091	·093	62
63	·083	·085	·086	·088	·089	·091	·093	·094	·096	63
64	·086	·087	·089	·090	·092	·094	·095	·097	·098	64
65	·088	·090	·091	·093	·095	·096	·098	·100	·101	65
66	·090	·092	·094	·096	·097	·099	·101	·102	·104	66
67	·093	·095	·096	·098	·100	·102	·103	·105	·107	67
68	·095	·097	·099	·101	·102	·104	·106	·108	·109	68
69	·098	·100	·101	·103	·105	·107	·109	·110	·112	69
70	·100	·102	·104	·106	·108	·109	·111	·113	·115	70
71	·102	·104	·106	·108	·110	·112	·114	·116	·118	71
72	·105	·107	·109	·111	·113	·115	·117	·119	·120	72
73	·107	·109	·111	·113	·115	·117	·119	·121	·123	73
74	·110	·112	·114	·116	·118	·120	·122	·124	·126	74
75	·112	·114	·116	·118	·120	·122	·125	·127	·129	75
76	·114	·117	·119	·121	·123	·125	·127	·129	·131	76
77	·117	·119	·121	·123	·126	·128	·130	·132	·134	77
78	·119	·122	·124	·126	·128	·130	·133	·135	·137	78
79	·122	·124	·126	·128	·131	·133	·135	·137	·140	79
80	·124	·126	·129	·131	·133	·136	·138	·140	·143	80
81	·126	·129	·131	·134	·136	·138	·141	·143	·145	81
82	·129	·131	·134	·136	·138	·141	·143	·146	·148	82
83	·131	·134	·136	·139	·141	·143	·146	·148	·151	83
84	·134	·136	·139	·141	·144	·146	·149	·151	·154	84
85	·136	·139	·141	·144	·146	·149	·151	·154	·156	85
86	·138	·141	·144	·146	·149	·151	·154	·156	·159	86
87	·141	·143	·146	·149	·151	·154	·157	·159	·162	87
88	·143	·146	·149	·151	·154	·157	·159	·162	·165	88
89	·146	·148	·151	·154	·156	·159	·162	·165	·167	89
90	·148	·151	·153	·156	·159	·162	·164	·167	·170	90
91	·150	·153	·156	·159	·162	·165	·167	·170	·173	91
92	·153	·156	·158	·161	·164	·167	·170	·172	·175	92
93	·155	·158	·161	·164	·167	·170	·172	·175	·178	93
94	·157	·161	·163	·166	·169	·172	·175	·177	·180	94
95	·160	·163	·166	·169	·172	·175	·178	·180	·183	95
96	·162	·165	·168	·171	·174	·178	·181	·183	·185	96
97	·165	·168	·171	·174	·177	·180	·183	·186	·188	97
98	·167	·170	·173	·176	·179	·183	·186	·188	·191	98
99	·169	·173	·176	·179	·182	·185	·188	·191	·194	99
100	−·172	−·175	−·178	−·181	−·184	−·188	−·191	−·194	−·197	100

TABLE II.—Corrections for Reducing Observations of the Barometer to Sea-level.

Height.	Barometer at Sea-level, 28·0 inches.							Barometer at Sea-level, 29·0 inches.							Height.
	Temperature of External Air.							Temperature of External Air.							
	20°	30°	40°	50°	60°	70°	80°	20°	30°	40°	50°	60°	70°	80°	
Feet.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	Feet.
	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
10	·011	·011	·010	·010	·010	·010	·009	·012	·012	·011	·011	·011	·011	·010	10
20	·022	·022	·021	·020	·020	·019	·019	·023	·022	·022	·021	·021	·021	·020	20
30	·033	·032	·031	·030	·030	·029	·029	·034	·033	·033	·032	·031	·031	·030	30
40	·044	·043	·042	·041	·040	·039	·038	·045	·044	·044	·043	·042	·041	·040	40
50	·055	·054	·053	·051	·050	·049	·048	·057	·056	·055	·053	·052	·051	·050	50
60	·066	·064	·063	·061	·060	·059	·058	·068	·067	·066	·064	·063	·061	·060	60
70	·077	·075	·073	·071	·070	·068	·067	·079	·078	·076	·074	·073	·071	·070	70
80	·088	·086	·084	·082	·080	·078	·077	·091	·089	·087	·085	·083	·081	·080	80
90	·098	·096	·094	·092	·090	·088	·087	·102	·100	·098	·096	·094	·092	·090	90
100	·109	·107	·104	·102	·100	·098	·096	·113	·111	·108	·106	·104	·102	·100	100
110	·120	·117	·115	·113	·111	·108	·106	·125	·122	·119	·117	·115	·112	·110	110
120	·131	·128	·125	·123	·121	·118	·116	·136	·133	·130	·127	·125	·122	·120	120
130	·142	·139	·136	·133	·131	·128	·125	·147	·144	·141	·138	·135	·132	·130	130
140	·153	·149	·146	·143	·141	·138	·135	·159	·155	·152	·149	·146	·143	·140	140
150	·164	·160	·157	·154	·151	·148	·145	·170	·166	·163	·160	·157	·153	·150	150
160	·175	·171	·168	·164	·161	·157	·154	·181	·177	·174	·170	·167	·163	·160	160
170	·186	·182	·178	·174	·171	·167	·164	·192	·188	·184	·181	·177	·173	·170	170
180	·197	·193	·189	·185	·181	·177	·174	·204	·199	·195	·191	·188	·183	·179	180
190	·208	·203	·199	·195	·191	·187	·183	·215	·210	·206	·202	·198	·193	·189	190
200	·219	·214	·209	·205	·201	·197	·193	·226	·221	·217	·212	·208	·203	·199	200
210	·230	·225	·220	·215	·211	·206	·202	·238	·233	·228	·223	·219	·214	·209	210
220	·241	·235	·230	·225	·221	·216	·212	·249	·244	·238	·233	·229	·224	·219	220
230	·251	·246	·241	·236	·231	·226	·222	·260	·255	·249	·244	·239	·234	·229	230
240	·262	·256	·251	·246	·241	·236	·231	·272	·266	·260	·254	·249	·244	·239	240
250	·273	·267	·261	·256	·251	·246	·241	·283	·277	·271	·265	·260	·254	·249	250
260	·284	·278	·272	·266	·261	·255	·250	·294	·288	·281	·275	·270	·264	·259	260
270	·295	·288	·282	·276	·271	·265	·260	·305	·299	·292	·286	·280	·274	·269	270
280	·306	·299	·293	·287	·281	·275	·270	·317	·310	·303	·297	·291	·285	·279	280
290	·317	·310	·303	·297	·291	·285	·279	·328	·321	·314	·307	·301	·295	·289	290
300	·328	·320	·313	·307	·301	·295	·289	·339	·332	·325	·318	·312	·305	·299	300
310	·339	·331	·324	·317	·311	·304	·298	·351	·343	·335	·328	·322	·315	·309	310
320	·350	·342	·334	·327	·321	·314	·307	·362	·354	·346	·339	·332	·325	·318	320
330	·360	·352	·344	·337	·331	·324	·317	·373	·365	·357	·349	·342	·335	·328	330
340	·371	·363	·355	·348	·341	·334	·327	·384	·376	·367	·360	·353	·345	·338	340
350	·382	·373	·365	·358	·351	·343	·336	·396	·387	·378	·370	·363	·355	·348	350
360	·392	·384	·376	·368	·361	·353	·346	·407	·398	·389	·381	·373	·365	·358	360
370	·403	·394	·386	·378	·371	·363	·355	·418	·409	·400	·392	·384	·376	·368	370
380	·414	·405	·396	·388	·381	·373	·365	·429	·420	·411	·402	·394	·386	·378	380
390	·425	·416	·407	·398	·390	·382	·374	·440	·431	·422	·413	·404	·396	·388	390
400	·436	·426	·417	·408	·400	·392	·384	·451	·442	·432	·423	·415	·406	·398	400
410	·446	·437	·427	·418	·410	·402	·393	·462	·453	·443	·434	·425	·416	·407	410
420	·457	·447	·438	·429	·420	·411	·402	·473	·464	·454	·444	·435	·426	·417	420
430	·468	·458	·448	·439	·430	·421	·412	·485	·475	·464	·455	·445	·436	·427	430
440	·479	·468	·458	·449	·440	·431	·422	·496	·486	·475	·465	·455	·446	·437	440
450	·490	·479	·469	·459	·450	·440	·431	·507	·497	·486	·476	·466	·456	·447	450
460	·501	·490	·479	·469	·460	·450	·441	·519	·508	·497	·486	·476	·466	·457	460
470	·512	·501	·490	·479	·469	·459	·450	·530	·519	·508	·497	·486	·476	·466	470
480	·522	·511	·500	·489	·479	·469	·460	·541	·529	·518	·507	·497	·486	·476	480
490	·533	·521	·510	·499	·489	·479	·470	·552	·540	·529	·518	·507	·496	·486	490
500	·544	·532	·521	·510	·499	·489	·479	·563	·551	·540	·528	·517	·506	·496	500

TABLE II.—CORRECTIONS FOR REDUCING OBSERVATIONS OF THE BAROMETER TO SEA-LEVEL.—*Continued.*

Height.	BAROMETER AT SEA-LEVEL, 30·0 INCHES.							BAROMETER AT SEA-LEVEL, 31·0 INCHES.							Height.
	Temperature of External Air.							Temperature of External Air.							
	20°	30°	40°	50°	60°	70°	80°	20°	30°	40°	50°	60°	70°	80°	
Feet.	In. +	In. +	In. +	In. +	In. +	In. +	In. +	In. +	In. +	In. +	In. +	In. +	In. +	In. +	Feet.
10	·012	·012	·011	·011	·011	·011	·010	·012	·012	·011	·011	·011	·011	·010	10
20	·023	·023	·023	·022	·022	·021	·021	·024	·024	·023	·022	·022	·022	·021	20
30	·035	·034	·034	·033	·032	·032	·031	·036	·036	·035	·034	·033	·033	·032	30
40	·047	·046	·045	·044	·043	·042	·041	·048	·048	·047	·045	·044	·044	·042	40
50	·059	·058	·056	·055	·054	·053	·052	·060	·060	·059	·057	·056	·055	·053	50
60	·070	·069	·068	·066	·065	·063	·062	·072	·071	·070	·068	·067	·066	·064	60
70	·082	·081	·078	·077	·076	·074	·072	·084	·083	·081	·079	·078	·077	·075	70
80	·094	·092	·090	·088	·086	·084	·082	·096	·095	·093	·090	·089	·087	·085	80
90	·105	·104	·101	·099	·097	·095	·093	·108	·107	·104	·102	·101	·098	·096	90
100	·117	·115	·112	·110	·108	·105	·103	·120	·119	·115	·113	·112	·108	·106	100
110	·129	·126	·123	·121	·119	·116	·113	·132	·130	·127	·124	·123	·119	·117	110
120	·140	·138	·134	·132	·129	·126	·124	·144	·142	·139	·136	·134	·130	·128	120
130	·152	·149	·146	·143	·140	·137	·134	·157	·154	·151	·147	·145	·141	·138	130
140	·164	·161	·157	·154	·151	·147	·144	·169	·166	·162	·158	·156	·152	·149	140
150	·176	·172	·168	·165	·162	·158	·155	·182	·178	·173	·169	·167	·163	·160	150
160	·187	·183	·179	·176	·172	·168	·165	·194	·190	·185	·181	·178	·174	·170	160
170	·199	·195	·190	·187	·183	·179	·175	·206	·202	·196	·192	·189	·185	·181	170
180	·211	·206	·202	·198	·194	·189	·185	·218	·214	·208	·203	·200	·195	·191	180
190	·222	·218	·213	·209	·204	·200	·196	·230	·226	·220	·215	·211	·206	·202	190
200	·234	·229	·224	·220	·215	·210	·206	·242	·237	·231	·226	·222	·217	·212	200
210	·246	·240	·235	·231	·226	·221	·216	·254	·249	·243	·237	·233	·228	·223	210
220	·257	·252	·246	·242	·236	·231	·227	·266	·261	·254	·249	·244	·239	·234	220
230	·269	·263	·257	·253	·247	·242	·237	·278	·273	·265	·260	·255	·250	·245	230
240	·281	·275	·269	·264	·258	·252	·248	·290	·285	·277	·271	·266	·261	·256	240
250	·293	·285	·280	·275	·269	·263	·258	·302	·297	·289	·283	·277	·271	·266	250
260	·304	·297	·291	·285	·279	·273	·268	·314	·308	·300	·294	·288	·282	·277	260
270	·316	·309	·302	·296	·290	·284	·278	·327	·319	·312	·306	·299	·293	·287	270
280	·328	·320	·314	·307	·301	·294	·288	·339	·331	·324	·317	·310	·304	·298	280
290	·339	·332	·325	·318	·311	·305	·299	·351	·343	·336	·329	·321	·315	·309	290
300	·351	·343	·336	·329	·322	·315	·309	·363	·354	·347	·340	·332	·326	·319	300
310	·363	·354	·347	·340	·333	·326	·319	·375	·366	·359	·352	·343	·337	·330	310
320	·374	·366	·358	·351	·343	·336	·329	·387	·378	·370	·363	·354	·347	·340	320
330	·386	·377	·369	·362	·354	·347	·340	·399	·389	·381	·374	·365	·358	·351	330
340	·397	·389	·380	·373	·365	·357	·350	·411	·401	·393	·386	·377	·369	·361	340
350	·409	·400	·392	·384	·376	·368	·360	·423	·413	·405	·397	·388	·380	·372	350
360	·421	·411	·403	·394	·386	·378	·370	·435	·425	·417	·408	·399	·391	·382	360
370	·432	·423	·414	·405	·397	·389	·380	·447	·437	·428	·419	·410	·402	·393	370
380	·444	·434	·425	·416	·408	·399	·391	·459	·449	·439	·430	·421	·413	·404	380
390	·455	·446	·436	·427	·418	·410	·401	·471	·461	·451	·441	·432	·424	·414	390
400	·467	·457	·447	·438	·429	·420	·411	·483	·473	·462	·452	·443	·434	·424	400
410	·479	·468	·458	·449	·440	·430	·421	·495	·484	·473	·463	·454	·445	·435	410
420	·490	·480	·469	·460	·450	·441	·431	·507	·496	·485	·475	·465	·456	·446	420
430	·502	·491	·480	·470	·461	·451	·442	·519	·507	·496	·486	·476	·466	·456	430
440	·513	·502	·491	·481	·471	·462	·452	·531	·519	·508	·497	·487	·477	·467	440
450	·525	·513	·503	·492	·482	·472	·462	·543	·531	·520	·509	·498	·488	·478	450
460	·537	·525	·514	·503	·493	·482	·472	·555	·542	·531	·520	·509	·498	·488	460
470	·548	·536	·525	·514	·503	·493	·482	·566	·554	·543	·531	·520	·509	·498	470
480	·560	·547	·536	·524	·514	·503	·493	·578	·565	·554	·542	·531	·520	·509	480
490	·571	·559	·547	·535	·524	·514	·503	·590	·577	·565	·553	·542	·531	·519	490
500	·583	·570	·558	·546	·535	·524	·513	·602	·589	·576	·564	·553	·542	·530	500

TABLE II.—Corrections for Reducing Observations of the Barometer to Sea-level.—*Continued.*

Height.	Barometer at Sea-level, 28·0 inches.							Barometer at Sea-level, 29·0 inches.							Height.
	Temperature of External Air.							Temperature of External Air.							
	20°	30°	40°	50°	60°	70°	80°	20°	30°	40°	50°	60°	70°	80°	
Feet.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	Feet.
	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
510	·554	·542	·531	·520	·509	·498	·488	·574	·562	·550	·538	·527	·516	·506	510
520	·565	·553	·541	·530	·519	·508	·498	·586	·573	·561	·549	·537	·526	·516	520
530	·576	·564	·552	·540	·528	·517	·507	·597	·584	·572	·559	·547	·536	·526	530
540	·587	·574	·562	·550	·538	·527	·517	·608	·595	·582	·570	·557	·546	·536	540
550	·597	·584	·572	·560	·548	·537	·527	·619	·606	·593	·580	·568	·556	·546	550
560	·608	·595	·582	·570	·558	·547	·536	·630	·616	·603	·590	·578	·566	·555	560
570	·619	·605	·592	·580	·568	·556	·545	·641	·627	·614	·601	·588	·576	·565	570
580	·630	·616	·603	·590	·577	·566	·555	·652	·638	·625	·611	·598	·586	·575	580
590	·641	·627	·613	·600	·587	·575	·564	·663	·649	·635	·621	·608	·596	·585	590
600	·652	·637	·623	·610	·597	·585	·574	·675	·660	·646	·632	·619	·606	·594	600
610	·662	·648	·634	·620	·607	·595	·583	·686	·671	·657	·643	·629	·616	·604	610
620	·673	·658	·644	·630	·617	·604	·592	·697	·682	·667	·653	·639	·626	·614	620
630	·683	·668	·654	·640	·627	·614	·602	·708	·693	·678	·663	·649	·636	·624	630
640	·694	·679	·665	·650	·636	·623	·611	·719	·704	·689	·674	·659	·646	·633	640
650	·705	·690	·675	·660	·646	·633	·621	·730	·714	·699	·684	·669	·656	·643	650
660	·716	·700	·685	·670	·656	·643	·631	·741	·725	·709	·694	·680	·666	·653	660
670	·726	·710	·695	·680	·666	·653	·640	·752	·736	·720	·705	·690	·676	·663	670
680	·737	·721	·705	·690	·676	·662	·649	·763	·747	·731	·715	·700	·686	·673	680
690	·748	·732	·716	·700	·686	·672	·659	·774	·758	·742	·726	·710	·696	·683	690
700	·759	·742	·726	·710	·695	·681	·668	·786	·769	·752	·736	·720	·706	·692	700
710	·769	·752	·736	·720	·705	·691	·677	·797	·780	·763	·746	·730	·716	·702	710
720	·780	·763	·746	·730	·715	·701	·687	·808	·791	·774	·757	·741	·726	·712	720
730	·790	·773	·756	·740	·725	·710	·696	·819	·801	·784	·767	·751	·736	·721	730
740	·801	·784	·767	·751	·735	·720	·706	·830	·812	·795	·778	·761	·746	·731	740
750	·812	·794	·777	·761	·745	·730	·716	·841	·823	·805	·788	·771	·756	·741	750
760	·822	·804	·787	·771	·755	·739	·725	·852	·833	·815	·798	·781	·766	·751	760
770	·833	·815	·797	·781	·765	·749	·734	·863	·844	·826	·808	·791	·776	·761	770
780	·843	·825	·807	·791	·775	·759	·744	·874	·855	·836	·818	·801	·786	·770	780
790	·854	·835	·818	·801	·784	·768	·753	·885	·866	·847	·829	·811	·796	·780	790
800	·865	·846	·828	·811	·794	·778	·762	·896	·877	·858	·840	·822	·806	·790	800
810	·875	·856	·838	·821	·804	·787	·772	·907	·888	·868	·850	·832	·816	·800	810
820	·886	·867	·848	·831	·814	·797	·781	·918	·898	·879	·860	·842	·826	·809	820
830	·897	·877	·858	·840	·823	·806	·790	·929	·909	·889	·870	·852	·836	·819	830
840	·908	·888	·868	·850	·833	·816	·800	·940	·920	·900	·881	·862	·846	·829	840
850	·919	·898	·878	·860	·842	·825	·809	·951	·930	·910	·891	·872	·855	·838	850
860	·929	·908	·888	·870	·852	·835	·818	·962	·941	·920	·901	·882	·865	·848	860
870	·940	·919	·899	·880	·862	·845	·828	·973	·952	·931	·912	·892	·875	·858	870
880	·950	·929	·909	·890	·871	·854	·837	·984	·962	·941	·922	·902	·885	·867	880
890	·961	·940	·919	·900	·881	·864	·846	·995	·973	·952	·932	·912	·895	·877	890
900	·972	·950	·929	·910	·891	·874	·856	1·006	·984	·963	·943	·923	·905	·887	900
910	·982	·961	·940	·920	·901	·883	·865	1·017	·995	·973	·953	·933	·915	·896	910
920	·993	·971	·950	·930	·911	·892	·874	1·028	1·006	·984	·964	·943	·925	·906	920
930	1·004	·982	·960	·940	·920	·902	·884	1·039	1·017	·994	·974	·953	·935	·916	930
940	1·014	·992	·970	·950	·930	·911	·893	1·050	1·028	1·005	·985	·964	·945	·925	940
950	1·025	1·002	·980	·960	·940	·921	·902	1·061	1·039	1·016	·995	·974	·955	·935	950
960	1·035	1·013	·991	·970	·949	·930	·912	1·072	1·049	1·026	1·005	·984	·965	·945	960
970	1·045	1·023	1·001	·980	·959	·940	·921	1·083	1·060	1·036	1·015	·994	·974	·954	970
980	1·056	1·033	1·011	·990	·969	·949	·930	1·094	1·071	1·047	1·026	1·004	·984	·964	980
990	1·067	1·044	1·021	1·000	·979	·959	·940	1·105	1·081	1·057	1·036	1·014	·994	·974	990
1000	1·077	1·054	1·031	1·009	·988	·968	·949	1·116	1·092	1·068	1·046	1·024	1·004	·983	1000

TABLE II.—CORRECTIONS FOR REDUCING OBSERVATIONS OF THE BAROMETER TO SEA-LEVEL.—*Continued.*

Height.	BAROMETER AT SEA-LEVEL, 30·0 INCHES.							BAROMETER AT SEA-LEVEL, 31·0 INCHES.							Height.
	Temperature of External Air.							Temperature of External Air.							
	20°	30°	40°	50°	60°	70°	80°	20°	30°	40°	50°	60°	70°	80°	
Feet.	In. +	In. +	In. +	In. +	In. +	In. +	In. +	In. +	In. +	In. +	In. +	In. +	In. +	In. +	Feet.
510	·594	·581	·569	·557	·545	·534	·523	·614	·600	·587	·575	·563	·552	·540	510
520	·606	·593	·580	·568	·556	·545	·533	·626	·612	·599	·587	·574	·563	·551	520
530	·617	·604	·591	·578	·566	·555	·544	·638	·624	·611	·598	·585	·574	·562	530
540	·629	·615	·602	·589	·577	·565	·554	·650	·636	·622	·609	·596	·584	·572	540
550	·640	·626	·613	·600	·587	·575	·564	·662	·648	·633	·620	·607	·595	·583	550
560	·652	·638	·624	·611	·598	·586	·574	·674	·660	·645	·632	·618	·605	·593	560
570	·663	·649	·635	·622	·608	·596	·584	·685	·671	·656	·643	·629	·616	·604	570
580	·675	·660	·646	·632	·619	·606	·595	·697	·682	·667	·654	·639	·626	·614	580
590	·686	·672	·657	·643	·629	·617	·605	·709	·694	·679	·665	·650	·637	·625	590
600	·698	·683	·668	·654	·640	·627	·615	·721	·706	·691	·676	·661	·647	·635	600
610	·709	·694	·679	·665	·650	·637	·625	·732	·717	·702	·687	·672	·658	·646	610
620	·721	·705	·690	·675	·661	·648	·635	·744	·729	·713	·698	·683	·669	·656	620
630	·732	·717	·701	·686	·671	·658	·645	·756	·741	·724	·709	·694	·680	·667	630
640	·744	·728	·712	·697	·682	·668	·655	·768	·753	·736	·720	·705	·691	·678	640
650	·755	·739	·723	·708	·692	·679	·666	·780	·764	·747	·731	·715	·701	·688	650
660	·767	·750	·734	·718	·703	·689	·676	·792	·776	·759	·742	·726	·712	·699	660
670	·778	·761	·745	·729	·713	·699	·686	·804	·787	·770	·753	·737	·722	·709	670
680	·790	·773	·756	·740	·724	·709	·696	·816	·799	·782	·764	·748	·733	·719	680
690	·801	·784	·767	·750	·734	·720	·706	·828	·810	·793	·775	·759	·744	·730	690
700	·813	·795	·778	·761	·745	·730	·716	·840	·822	·804	·786	·770	·755	·740	700
710	·824	·806	·789	·772	·755	·740	·726	·852	·833	·815	·797	·780	·765	·750	710
720	·836	·817	·800	·782	·766	·751	·736	·864	·845	·827	·808	·791	·776	·761	720
730	·847	·829	·811	·793	·776	·761	·746	·876	·857	·839	·820	·802	·787	·771	730
740	·859	·840	·822	·804	·787	·771	·756	·888	·868	·850	·831	·813	·797	·781	740
750	·870	·851	·833	·815	·797	·782	·767	·899	·879	·861	·842	·824	·808	·792	750
760	·881	·862	·843	·825	·808	·792	·777	·910	·890	·871	·853	·834	·818	·802	760
770	·893	·873	·854	·836	·818	·802	·787	·922	·902	·882	·864	·845	·829	·813	770
780	·904	·885	·865	·847	·829	·812	·797	·934	·914	·893	·875	·856	·839	·823	780
790	·916	·896	·876	·857	·839	·823	·807	·946	·926	·905	·886	·867	·850	·834	790
800	·927	·907	·887	·868	·850	·833	·817	·958	·938	·917	·897	·878	·861	·845	800
810	·938	·918	·898	·878	·860	·843	·827	·969	·949	·928	·908	·888	·871	·855	810
820	·950	·929	·909	·889	·871	·854	·837	·981	·960	·939	·919	·899	·881	·865	820
830	·961	·940	·920	·900	·881	·864	·847	·993	·972	·951	·930	·910	·892	·875	830
840	·973	·951	·931	·911	·892	·874	·857	1·005	·983	·962	·941	·921	·903	·886	840
850	·984	·962	·942	·922	·902	·885	·867	1·017	·995	·973	·952	·932	·914	·897	850
860	·995	·974	·952	·932	·913	·895	·877	1·028	1·006	·984	·963	·943	·924	·907	860
870	1·007	·985	·963	·943	·923	·905	·887	1·040	1·018	·996	·975	·955	·935	·917	870
880	1·018	·996	·974	·954	·934	·915	·897	1·052	1·029	1·007	·986	·966	·946	·927	880
890	1·030	1·007	·985	·964	·944	·926	·907	1·064	1·041	1·018	·997	·976	·956	·937	890
900	1·041	1·018	·996	·975	·955	·936	·917	1·076	1·052	1·029	1·008	·987	·967	·948	900
910	1·052	1·029	1·007	·986	·965	·946	·927	1·088	1·063	1·040	1·019	·998	·978	·958	910
920	1·064	1·040	1·018	·996	·976	·956	·937	1·100	1·075	1·052	1·030	1·009	·989	·969	920
930	1·075	1·051	1·029	1·007	·986	·967	·947	1·111	1·086	1·063	1·041	1·019	·999	·979	930
940	1·086	1·062	1·040	1·017	·997	·977	·957	1·123	1·098	1·075	1·052	1·030	1·010	·990	940
950	1·098	1·074	1·051	1·028	1·007	·987	·967	1·135	1·110	1·086	1·063	1·041	1·020	1·000	950
960	1·109	1·085	1·061	1·039	1·017	·997	·977	1·146	1·121	1·097	1·073	1·051	1·030	1·010	960
970	1·120	1·096	1·072	1·049	1·028	1·007	·987	1·158	1·133	1·108	1·084	1·062	1·041	1·020	970
980	1·131	1·107	1·083	1·060	1·038	1·018	·997	1·169	1·144	1·119	1·095	1·073	1·052	1·031	980
990	1·143	1·118	1·094	1·070	1·049	1·028	1·007	1·180	1·155	1·130	1·106	1·084	1·063	1·041	990
1000	1·154	1·129	1·105	1·081	1·059	1·038	1·017	1·192	1·167	1·142	1·117	1·094	1·073	1·051	1000

TABLE III.—SPECIMEN OF THE TABLE TO BE PREPARED FOR REDUCING OBSERVATIONS OF THE BAROMETER TO SEA-LEVEL. ASSUMED ALTITUDE, 190 FEET.

Sea-level Pressure.	Temperature of External Air (*i.e.* Dry-bulb Reading in Screen).							Reading of Barometer at 190 Feet.
	20°	30°	40°	50°	60°	70°	80°	
Ins.	In.	In.	In.	In.	In.	In.	In.	Ins.
27·0	+ ·200	+ ·196	+ ·192	+ ·188	+ ·184	+ ·180	+ ·177	26·8
27·1	·200	·196	·192	·188	·184	·180	·177	26·9
27·2	·201	·197	·193	·189	·185	·181	·178	27·0
27·3	·202	·198	·194	·190	·186	·182	·179	27·1
27·4	·203	·199	·195	·191	·187	·183	·179	27·2
27·5	·204	·199	·195	·191	·187	·183	·180	27·3
27·6	·204	·200	·196	·192	·188	·184	·181	27·4
27·7	·205	·201	·197	·193	·189	·185	·181	27·5
27·8	·206	·202	·198	·194	·190	·186	·182	27·6
27·9	·207	·202	·198	·194	·190	·186	·182	27·7
28·0	·208	·203	·199	·195	·191	·187	·183	27·8
28·1	·209	·204	·200	·196	·192	·188	·184	27·9
28·2	·210	·205	·201	·197	·193	·188	·184	28·0
28·3	·210	·205	·201	·197	·193	·189	·185	28·1
28·4	·211	·206	·202	·198	·194	·190	·186	28·2
28·5	·212	·207	·203	·199	·195	·190	·186	28·3
28·6	·213	·208	·204	·200	·196	·191	·187	28·4
28·7	·213	·208	·204	·200	·196	·191	·187	28·5
28·8	·214	·209	·205	·201	·197	·192	·188	28·6
28·9	·215	·210	·206	·202	·198	·193	·189	28·7
29·0	·215	·210	·206	·202	·198	·193	·189	28·8
29·1	·216	·211	·207	·203	·199	·194	·190	28·9
29·2	·217	·212	·208	·204	·199	·195	·191	29·0
29·3	·217	·213	·208	·204	·200	·195	·191	29·1
29·4	·218	·214	·209	·205	·200	·196	·192	29·2
29·5	·219	·215	·210	·206	·201	·197	·193	29·3
29·6	·220	·216	·211	·207	·202	·198	·194	29·4
29·7	·220	·216	·211	·207	·202	·198	·194	29·5
29·8	·221	·217	·212	·208	·203	·199	·195	29·6
29·9	·222	·218	·213	·209	·204	·200	·196	29·7
30·0	·222	·218	·213	·209	·204	·200	·196	29·8
30·1	·223	·219	·214	·210	·205	·201	·197	29·9
30·2	·224	·220	·215	·211	·206	·202	·198	30·0
30·3	·224	·220	·215	·211	·207	·202	·199	30·1
30·4	·225	·221	·216	·212	·207	·203	·199	30·2
30·5	·226	·222	·217	·212	·208	·203	·200	30·3
30·6	·227	·223	·218	·213	·209	·204	·201	30·4
30·7	·227	·223	·218	·213	·209	·204	·201	30·5
30·8	·228	·224	·219	·214	·210	·205	·202	30·6
30·9	·229	·225	·220	·215	·211	·206	·202	30·7
31·0	+ ·230	+ ·226	+ ·220	+ ·215	+ ·211	+ ·206	+ ·202	30·8

TABLE IV.—CORRECTIONS FOR REDUCING THE BAROMETER READINGS FOR GRAVITY AT LATITUDE 45°.

For Latitudes 0° to 44° the correction is to be *subtracted.*
,, 46° to 90° ,, ,, *added.*

Latitude.		HEIGHT OF THE BAROMETER IN INCHES.								
		27·0	27·5	28·0	28·5	29·0	29·5	30·0	30·5	31·0
°	°	In.	In.	In.	In.	In.	In.	In.	In.	In.
45	45	·000	·000	·000	·000	·000	·000	·000	·000	·000
44	46	·002	·002	·003	·003	·003	·003	·003	·003	·003
43	47	·005	·005	·005	·005	·005	·005	·005	·006	·006
42	48	·007	·007	·008	·008	·008	·008	·008	·008	·008
41	49	·010	·010	·010	·010	·010	·011	·011	·011	·011
40	50	·012	·012	·013	·013	·013	·013	·013	·014	·014
39	51	·015	·015	·015	·015	·016	·016	·016	·016	·017
38	52	·017	·017	·018	·018	·018	·018	·019	·019	·019
37	53	·019	·020	·020	·020	·021	·021	·021	·022	·022
36	54	·022	·022	·022	·023	·023	·024	·024	·024	·025
35	55	·024	·024	·025	·025	·026	·026	·027	·027	·027
34	56	·026	·027	·027	·028	·028	·029	·029	·030	·030
33	57	·028	·029	·029	·030	·031	·031	·032	·032	·033
32	58	·031	·031	·032	·032	·033	·033	·034	·035	·035
31	59	·033	·033	·034	·035	·035	·036	·036	·037	·038
30	60	·035	·036	·036	·037	·038	·038	·039	·039	·040
29	61	·037	·038	·038	·039	·040	·040	·041	·042	·043
28	62	·039	·040	·041	·041	·042	·043	·043	·044	·045
27	63	·041	·042	·043	·043	·044	·045	·046	·046	·047
26	64	·043	·044	·045	·045	·046	·047	·048	·049	·049
25	65	·045	·046	·047	·047	·048	·049	·050	·051	·052
24	66	·047	·048	·049	·049	·050	·051	·052	·053	·054
23	67	·049	·049	·050	·051	·052	·053	·054	·055	·056
22	68	·050	·051	·052	·053	·054	·055	·056	·057	·058
21	69	·052	·053	·054	·055	·056	·057	·058	·059	·060
20	70	·054	·055	·056	·057	·058	·059	·060	·061	·062
19	71	·055	·056	·057	·058	·059	·060	·061	·062	·063
18	72	·057	·058	·059	·060	·061	·062	·063	·064	·065
17	73	·058	·059	·060	·061	·062	·063	·064	·065	·067
16	74	·059	·060	·061	·063	·064	·065	·066	·067	·068
15	75	·061	·062	·063	·064	·065	·066	·067	·068	·070
14	76	·062	·063	·064	·065	·066	·067	·069	·070	·071
13	77	·063	·064	·065	·066	·068	·069	·070	·071	·072
12	78	·064	·065	·066	·067	·069	·070	·071	·072	·073
11	79	·065	·066	·067	·068	·070	·071	·072	·073	·074
10	80	·066	·067	·068	·069	·071	·072	·073	·074	·075
9	81	·067	·068	·069	·070	·071	·073	·074	·075	·076
8	82	·067	·068	·070	·071	·072	·073	·075	·076	·077
7	83	·068	·069	·070	·072	·073	·074	·075	·077	·078
6	84	·068	·070	·071	·072	·073	·075	·076	·077	·079
5	85	·069	·070	·071	·073	·074	·075	·077	·078	·079
4	86	·069	·071	·072	·073	·074	·076	·077	·078	·080
3	87	·070	·071	·072	·073	·075	·076	·077	·079	·080
2	88	·070	·071	·072	·074	·075	·076	·078	·079	·080
1	89	·070	·071	·072	·074	·075	·076	·078	·079	·080
0	90	·070	·071	·073	·074	·075	·076	·078	·079	·080

TABLE V.—Specimen of the Table Combining the Corrections for Index Error, Temperature, and Altitude. Assumed Height above the Sea-level 190 feet. Index error correction + ·005 in.

Barometer Reading	Temperature of External Air (*i.e.* Dry-bulb Reading in Screen).																									Barometer Reading
Ins.	10°	12°	14°	16°	18°	20°	22°	24°	26°	28°	30°	32°	34°	36°	38°	40°	42°	44°	46°	48°	50°	52°	54°	56°	58°	60°	Ins.
28·60	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	28·60
28·66	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	28·66
28·72	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	28·72
28·78	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	28·78
28·84	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	28·84
28·90	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	28·90
28·96	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	28·96
29·02	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	29·02
29·08	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	29·08
29·14	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	29·14
29·20	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	29·20
29·26	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	29·26
29·32	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	29·32
29·38	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	29·38
29·44	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	29·44
29·50	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75	29·50
29·56	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	29·56
29·62	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75	77	29·62
29·68	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	29·68
29·74	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75	77	79	29·74
29·80	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	29·80
29·86	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75	77	79	81	29·86
29·92	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	29·92
29·98	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75	77	79	81	83	29·98
30·04	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	30·04
30·10	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75	77	79	81	83	85	30·10
30·16	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	30·16
30·22	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75	77	79	81	83	85	87	30·22
30·28	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	30·28
30·34	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75	77	79	81	83	85	87	89	30·34
30·40	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	30·40

Attached Thermo-meter.	Correction to be *added* to the Reading of the Barometer.																									Attached Thermo-meter.
	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	
30°	·219	·218	·218	·217	·216	·215	·214	·213	·212	·211	·210	·209	·209	·208	·207	·206	·205	·205	·204	·203	·202	·201	·200	·199	·198	·197	30°
32	·214	·213	·213	·212	·211	·210	·209	·208	·207	·206	·205	·204	·204	·203	·202	·201	·200	·200	·199	·198	·197	·196	·195	·194	·193	·192	32
34	·208	·207	·207	·206	·205	·204	·203	·202	·201	·200	·199	·198	·198	·197	·196	·195	·194	·194	·193	·192	·191	·190	·189	·188	·187	·186	34
36	·203	·202	·202	·201	·200	·199	·198	·197	·196	·195	·194	·193	·193	·192	·191	·190	·189	·189	·188	·187	·186	·185	·184	·183	·182	·181	36
38	·197	·196	·196	·195	·194	·193	·192	·191	·190	·189	·188	·187	·187	·186	·185	·184	·183	·183	·182	·181	·180	·179	·178	·177	·176	·175	38
40	·192	·191	·191	·190	·189	·188	·187	·186	·185	·184	·183	·182	·182	·181	·180	·179	·178	·178	·177	·176	·175	·174	·173	·172	·171	·170	40
42	·187	·186	·186	·185	·184	·183	·182	·181	·180	·179	·178	·177	·177	·176	·175	·174	·173	·173	·172	·171	·170	·169	·168	·167	·166	·165	42
44	·181	·180	·180	·179	·178	·177	·176	·175	·174	·173	·172	·171	·171	·170	·169	·168	·167	·167	·166	·165	·164	·163	·162	·161	·160	·159	44
46	·176	·175	·175	·174	·173	·172	·171	·170	·169	·168	·167	·166	·166	·165	·164	·163	·162	·162	·161	·160	·159	·158	·157	·156	·155	·154	46
48	·171	·170	·170	·169	·168	·167	·166	·165	·164	·163	·162	·161	·161	·160	·159	·158	·157	·157	·156	·155	·154	·153	·152	·151	·150	·149	48
50	·165	·164	·164	·163	·162	·161	·160	·159	·158	·157	·156	·155	·155	·154	·153	·152	·151	·151	·150	·149	·148	·147	·146	·145	·144	·143	50
52	·160	·159	·159	·158	·157	·156	·155	·154	·153	·152	·151	·150	·150	·149	·148	·147	·146	·146	·145	·144	·143	·142	·141	·140	·139	·138	52
54	·155	·154	·154	·153	·152	·151	·150	·149	·148	·147	·146	·145	·145	·144	·143	·142	·141	·141	·140	·139	·138	·137	·136	·135	·134	·133	54
56	·149	·148	·148	·147	·146	·145	·144	·143	·142	·141	·140	·139	·139	·138	·137	·136	·135	·135	·134	·133	·132	·131	·130	·129	·128	·127	56
58	·144	·143	·143	·142	·141	·140	·139	·138	·137	·136	·135	·134	·134	·133	·132	·131	·130	·130	·129	·128	·127	·126	·125	·124	·123	·122	58
60	·139	·138	·138	·137	·136	·135	·134	·133	·132	·131	·130	·129	·129	·128	·127	·126	·125	·125	·124	·123	·122	·121	·120	·119	·118	·117	60
62	·134	·133	·133	·132	·131	·130	·129	·128	·127	·126	·125	·124	·124	·123	·122	·121	·120	·120	·119	·118	·117	·116	·115	·114	·113	·112	62
64	·128	·127	·127	·126	·125	·124	·123	·122	·121	·120	·119	·118	·118	·117	·116	·115	·114	·114	·113	·112	·111	·110	·109	·108	·107	·105	64
66	·123	·122	·122	·121	·120	·119	·118	·117	·116	·115	·114	·113	·113	·112	·111	·110	·109	·109	·108	·107	·106	·105	·104	·103	·102	·101	66
68	·118	·117	·117	·116	·115	·114	·113	·112	·111	·110	·109	·108	·108	·107	·106	·105	·104	·104	·103	·102	·101	·100	·099	·098	·097	·096	68
70	·113	·112	·112	·111	·110	·109	·108	·107	·106	·105	·104	·103	·103	·102	·101	·100	·099	·099	·098	·097	·096	·095	·094	·093	·092	·091	70
72	·107	·106	·106	·105	·104	·103	·102	·101	·100	·099	·098	·097	·097	·096	·095	·094	·093	·093	·092	·091	·090	·089	·088	·087	·086	·085	72
74	·102	·101	·101	·100	·099	·098	·097	·096	·095	·094	·093	·092	·092	·091	·090	·089	·088	·088	·087	·086	·085	·084	·083	·082	·081	·080	74
76	·097	·096	·096	·095	·094	·093	·092	·091	·090	·089	·088	·087	·087	·086	·085	·084	·083	·083	·082	·081	·080	·079	·078	·077	·076	·075	76
78	·091	·090	·090	·089	·088	·087	·086	·085	·084	·083	·082	·081	·081	·080	·079	·078	·077	·077	·076	·075	·074	·073	·072	·071	·070	·069	78
80	·086	·085	·085	·084	·083	·082	·081	·080	·079	·078	·077	·076	·076	·075	·074	·073	·072	·072	·071	·070	·069	·068	·067	·066	·065	·064	80
82	·081	·080	·080	·079	·078	·077	·076	·075	·074	·073	·072	·071	·071	·070	·069	·068	·067	·067	·066	·065	·064	·063	·062	·061	·060	·059	82
84	·076	·075	·075	·074	·073	·072	·071	·070	·069	·068	·067	·066	·066	·065	·064	·063	·062	·062	·061	·060	·059	·058	·057	·056	·055	·054	84
86	·071	·070	·070	·069	·068	·067	·066	·065	·064	·063	·062	·061	·061	·060	·059	·058	·057	·057	·056	·055	·054	·053	·052	·051	·050	·049	86
88	·065	·064	·064	·063	·062	·061	·060	·059	·058	·057	·056	·055	·055	·054	·053	·052	·051	·051	·050	·049	·048	·047	·046	·045	·044	·043	88

TABLE VI.—For Calculating the Dew-point Temperature.

Dry-bulb Thermometer.	Difference between the Readings of the Dry-bulb and Wet-bulb Thermometers.										Dry-bulb Thermometer.
	1°0	2°0	3°0	4°0	5°0	6°0	7°0	8°0	9°0	10°0	
	Amount to be *subtracted* from the Wet-bulb Reading to obtain the Dew-point.										
10°0	7°8	15°6	23°3	31°1	38°9	46°7	54°5	62°2	70°0	77°8	10°0
11°0	7·8	15·6	23·3	31·1	38·9	46·7	54·5	62·2	70·0	77·8	11·0
12·0	7·8	15·6	23·3	31·1	38·9	46·7	54·5	62·2	70·0	77·8	12·0
13·0	7·8	15·5	23·3	31·1	38·9	46·6	54·4	62·2	69·9	77·7	13·0
14·0	7·8	15·5	23·3	31·0	38·8	46·6	54·3	62·1	69·8	77·6	14·0
15·0	7·8	15·5	23·3	31·0	38·8	46·5	54·3	62·0	69·8	77·5	15·0
16·0	7·7	15·4	23·1	30·8	38·5	46·2	53·9	61·6	69·3	77·0	16·0
17·0	7·6	15·2	22·9	30·5	38·1	45·7	53·3	61·0	68·6	76·2	17·0
18·0	7·5	15·0	22·5	30·0	37·5	45·0	52·5	60·0	67·5	75·0	18·0
19·0	7·3	14·7	22·0	29·4	36·7	44·0	51·4	58·7	66·1	73·4	19·0
20·0	7·1	14·3	21·4	28·6	35·7	42·8	50·0	57·1	64·3	71·4	20·0
20·5	7·0	14·0	21·0	28·0	35·1	42·1	49·1	56·1	63·1	70·1	20·5
21·0	6·9	13·8	20·6	27·5	34·4	41·3	48·2	55·0	61·9	68·8	21·0
21·5	6·7	13·5	20·2	27·0	33·7	40·4	47·2	53·9	60·7	67·4	21·5
22·0	6·6	13·2	19·8	26·4	33·0	39·6	46·2	52·8	59·4	66·0	22·0
22·5	6·4	12·9	19·3	25·8	32·2	38·6	45·1	51·5	58·0	64·4	22·5
23·0	6·3	12·6	18·8	25·1	31·4	37·7	44·0	50·2	56·5	62·8	23·0
23·5	6·1	12·2	18·3	24·4	30·5	36·6	42·7	48·8	54·9	61·0	23·5
24·0	5·9	11·8	17·8	23·7	29·6	35·5	41·4	47·4	53·3	59·2	24·0
24·5	5·7	11·5	17·2	22·9	28·7	34·4	40·1	45·8	51·6	57·3	24·5
25·0	5·5	11·1	16·6	22·1	27·7	33·2	38·7	44·2	49·8	55·3	25·0
25·5	5·3	10·6	15·9	21·2	26·6	31·9	37·2	42·5	47·8	53·1	25·5
26·0	5·1	10·2	15·2	20·3	25·4	30·5	35·6	40·6	45·7	50·8	26·0
26·5	4·9	9·7	14·6	19·4	24·3	29·1	34·0	38·8	43·7	48·5	26·5
27·0	4·6	9·2	13·8	18·4	23·1	27·7	32·3	36·9	41·5	46·1	27·0
27·5	4·4	8·7	13·1	17·4	21·8	26·2	30·5	34·9	39·2	43·6	27·5
28·0	4·1	8·2	12·4	16·5	20·6	24·7	28·8	33·0	37·1	41·2	28·0
28·5	3·9	7·7	11·6	15·5	19·4	23·2	27·1	31·0	34·8	38·7	28·5
29·0	3·6	7·3	10·9	14·5	18·2	21·8	25·4	29·0	32·7	36·3	29·0
29·5	3·4	6·8	10·2	13·6	17·0	20·3	23·7	27·1	30·5	33·9	29·5
30·0	3·2	6·3	9·5	12·6	15·8	18·9	22·1	25·2	28·4	31·5	30·0
31·0	2·7	5·4	8·1	10·8	13·5	16·2	18·9	21·6	24·3	27·0	31·0
32·0	2·3	4·6	7·0	9·3	11·6	13·9	16·2	18·6	20·9	23·2	32·0
33·0	2·0	4·0	6·0	8·0	10·0	12·1	14·1	16·1	18·1	20·1	33·0
34·0	1·8	3·5	5·3	7·1	8·9	10·6	12·4	14·2	15·9	17·7	34·0
35·0	1·6	3·2	4·8	6·4	8·0	9·6	11·2	12·8	14·4	16·0	35·0
36·0	1·5	3·0	4·5	6·0	7·5	9·1	10·5	12·0	13·5	15·0	36·0
37·0	1·4	2·8	4·3	5·7	7·1	8·5	9·9	11·4	12·8	14·2	37·0
38·0	1·4	2·7	4·1	5·4	6·8	8·2	9·5	10·9	12·2	13·6	38·0
39·0	1·3	2·6	4·0	5·3	6·6	7·9	9·2	10·6	11·9	13·2	39·0
40·0	1·3	2·6	3·9	5·2	6·5	7·7	9·0	10·3	11·6	12·9	40·0
41·0	1·3	2·5	3·8	5·0	6·3	7·6	8·8	10·1	11·3	12·6	41·0
42·0	1·2	2·5	3·7	4·9	6·2	7·4	8·6	9·8	11·1	12·3	42·0
43·0	1·2	2·4	3·6	4·8	6·0	7·2	8·4	9·6	10·8	12·0	43·0
44·0	1·2	2·4	3·5	4·7	5·9	7·1	8·3	9·4	10·6	11·8	44·0
45·0	1·2	2·3	3·5	4·6	5·8	7·0	8·1	9·3	10·4	11·6	45·0
46·0	1·1	2·3	3·4	4·6	5·7	6·8	8·0	9·1	10·3	11·4	46·0
47·0	1·1	2·2	3·4	4·5	5·6	6·7	7·8	9·0	10·1	11·2	47·0
48·0	1·1	2·2	3·3	4·4	5·5	6·6	7·7	8·8	9·9	11·0	48·0
49·0	1·1	2·2	3·2	4·3	5·4	6·5	7·6	8·6	9·7	10·8	49·0
50·0	1·1	2·1	3·2	4·2	5·3	6·4	7·4	8·5	9·5	10·6	50·0

TABLE VI.—For Calculating the Dew-point Temperature.—*Continued.*

Dry-bulb Thermometer.	Difference between the Readings of the Dry-bulb and Wet-bulb Thermometers.														Dry-bulb Thermometer.
	1°0	2°0	3°0	4°0	5°0	6°0	7°0	8°0	9°0	10°0	11°0	12°0	13°0	14°0	15°0	
	Amount to be *subtracted* from the Wet-bulb Reading to obtain the Dew-point.														
50°	1°1	2°1	3°2	4°2	5°3	6°4	7°4	8°5	9°5	10°6	11°7	12°7	13°8	14°8	15°9	50°
51	1·0	2·1	3·1	4·2	5·2	6·2	7·3	8·3	9·4	10·4	11·4	12·5	13·5	14·6	15·6	51
52	1·0	2·0	3·1	4·1	5·1	6·1	7·1	8·2	9·2	10·2	11·2	12·2	13·3	14·3	15·3	52
53	1·0	2·0	3·0	4·0	5·0	6·0	7·0	8·0	9·0	10·0	11·0	12·0	13·0	14·0	15·0	53
54	1·0	2·0	2·9	3·9	4·9	5·9	6·9	7·8	8·8	9·8	10·8	11·8	12·7	13·7	14·7	54
55	1·0	1·9	2·9	3·8	4·8	5·8	6·7	7·7	8·6	9·6	10·6	11·5	12·5	13·4	14·4	55
56	0·9	1·9	2·8	3·8	4·7	5·6	6·6	7·5	8·5	9·4	10·3	11·3	12·2	13·2	14·1	56
57	0·9	1·8	2·8	3·7	4·6	5·5	6·4	7·4	8·3	9·2	10·1	11·0	12·0	12·9	13·8	57
58	0·9	1·8	2·7	3·6	4·5	5·4	6·3	7·2	8·1	9·0	9·9	10·8	11·7	12·6	13·5	58
59	0·9	1·8	2·7	3·6	4·5	5·3	6·2	7·1	8·0	8·9	9·8	10·7	11·6	12·5	13·4	59
60	0·9	1·8	2·6	3·5	4·4	5·3	6·2	7·0	7·9	8·8	9·7	10·6	11·4	12·3	13·2	60
61	0·9	1·7	2·6	3·5	4·4	5·2	6·1	7·0	7·8	8·7	9·6	10·4	11·3	12·2	13·1	61
62	0·9	1·7	2·6	3·4	4·3	5·2	6·0	6·9	7·7	8·6	9·5	10·3	11·2	12·0	12·9	62
63	0·9	1·7	2·6	3·4	4·3	5·1	6·0	6·8	7·7	8·5	9·4	10·2	11·1	11·9	12·8	63
64	0·8	1·7	2·5	3·3	4·2	5·0	5·8	6·6	7·5	8·3	9·1	10·0	10·8	11·6	12·5	64
65	0·8	1·6	2·5	3·3	4·1	4·9	5·7	6·6	7·4	8·2	9·0	9·8	10·7	11·5	12·3	65
66	0·8	1·6	2·4	3·2	4·1	4·9	5·7	6·5	7·3	8·1	8·9	9·7	10·5	11·3	12·2	66
67	0·8	1·6	2·4	3·2	4·0	4·8	5·6	6·4	7·2	8·0	8·8	9·6	10·4	11·2	12·0	67
68	0·8	1·6	2·4	3·2	4·0	4·7	5·5	6·3	7·1	7·9	8·7	9·5	10·3	11·1	11·9	68
69	0·8	1·6	2·3	3·1	3·9	4·7	5·5	6·2	7·0	7·8	8·6	9·4	10·1	10·9	11·7	69
70	0·8	1·5	2·3	3·1	3·9	4·6	5·4	6·2	6·9	7·7	8·5	9·2	10·0	10·8	11·6	70
71	0·8	1·5	2·3	3·0	3·8	4·6	5·3	6·1	6·8	7·6	8·4	9·1	9·9	10·6	11·4	71
72	0·8	1·5	2·3	3·0	3·8	4·5	5·3	6·0	6·8	7·5	8·3	9·0	9·8	10·5	11·3	72
73	0·7	1·5	2·2	3·0	3·7	4·4	5·2	5·9	6·7	7·4	8·1	8·9	9·6	10·4	11·1	73
74	0·7	1·5	2·2	2·9	3·7	4·4	5·1	5·8	6·6	7·3	8·0	8·8	9·5	10·2	11·0	74
75	0·7	1·4	2·2	2·9	3·6	4·3	5·0	5·8	6·5	7·2	7·9	8·6	9·4	10·1	10·8	75
76	0·7	1·4	2·1	2·8	3·6	4·3	5·0	5·7	6·4	7·1	7·8	8·5	9·2	9·9	10·7	76
77	0·7	1·4	2·1	2·8	3·5	4·2	4·9	5·6	6·3	7·0	7·7	8·4	9·1	9·8	10·5	77
78	0·7	1·4	2·1	2·8	3·5	4·1	4·8	5·5	6·2	6·9	7·6	8·3	9·0	9·7	10·4	78
79	0·7	1·4	2·1	2·8	3·5	4·1	4·8	5·5	6·2	6·9	7·6	8·3	9·0	9·7	10·4	79
80	0·7	1·4	2·0	2·7	3·4	4·1	4·8	5·4	6·1	6·8	7·5	8·2	8·8	9·5	10·2	80
81	0·7	1·4	2·0	2·7	3·4	4·1	4·8	5·4	6·1	6·8	7·5	8·2	8·8	9·5	10·2	81
82	0·7	1·3	2·0	2·7	3·4	4·0	4·7	5·4	6·0	6·7	7·4	8·0	8·7	9·4	10·1	82
83	0·7	1·3	2·0	2·7	3·4	4·0	4·7	5·4	6·0	6·7	7·4	8·0	8·7	9·4	10·1	83
84	0·7	1·3	2·0	2·6	3·3	4·0	4·6	5·3	5·9	6·6	7·3	7·9	8·6	9·2	9·9	84
85	0·7	1·3	2·0	2·6	3·3	3·9	4·6	5·2	5·9	6·5	7·2	7·8	8·5	9·1	9·8	85
86	0·7	1·3	2·0	2·6	3·3	3·9	4·6	5·2	5·9	6·5	7·2	7·8	8·5	9·1	9·8	86
87	0·6	1·3	1·9	2·6	3·2	3·8	4·5	5·1	5·8	6·4	7·0	7·7	8·3	9·0	9·6	87
88	0·6	1·3	1·9	2·6	3·2	3·8	4·5	5·1	5·8	6·4	7·0	7·7	8·3	9·0	9·6	88
89	0·6	1·3	1·9	2·5	3·2	3·8	4·4	5·0	5·7	6·3	6·9	7·6	8·2	8·8	9·5	89
90	0·6	1·3	1·9	2·5	3·2	3·8	4·4	5·0	5·7	6·3	6·9	7·6	8·2	8·8	9·5	90
91	0·6	1·2	1·9	2·5	3·1	3·7	4·3	5·0	5·6	6·2	6·8	7·4	8·1	8·7	9·3	91
92	0·6	1·2	1·9	2·5	3·1	3·7	4·3	5·0	5·6	6·2	6·8	7·4	8·1	8·7	9·3	92
93	0·6	1·2	1·8	2·4	3·1	3·7	4·3	4·9	5·5	6·1	6·7	7·3	7·9	8·5	9·2	93
94	0·6	1·2	1·8	2·4	3·0	3·6	4·2	4·8	5·4	6·0	6·6	7·2	7·8	8·4	9·0	94
95	0·6	1·2	1·8	2·4	3·0	3·6	4·2	4·8	5·4	6·0	6·6	7·2	7·8	8·4	9·0	95
96	0·6	1·2	1·8	2·4	3·0	3·5	4·1	4·7	5·3	5·9	6·5	7·1	7·7	8·3	8·9	96
97	0·6	1·2	1·8	2·4	3·0	3·5	4·1	4·7	5·3	5·9	6·5	7·1	7·7	8·3	8·9	97
98	0·6	1·2	1·8	2·3	2·9	3·5	4·1	4·6	5·2	5·8	6·4	7·0	7·5	8·1	8·7	98
99	0·6	1·2	1·8	2·3	2·9	3·5	4·1	4·6	5·2	5·8	6·4	7·0	7·5	8·1	8·7	99
100	0·6	1·1	1·7	2·3	2·9	3·4	4·0	4·6	5·1	5·7	6·3	6·8	7·4	8·0	8·6	100

TABLE VII.—Elastic Force of Aqueous Vapour in Inches of Mercury.

Temperature.	0°0	0°1	0°2	0°3	0°4	0°5	0°6	0°7	0°8	0°9	Temperature.
	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	
0°	0·044	0·044	0·044	0·045	0·045	0·045	0·045	0·045	0·046	0·046	0°
1	·046	·046	·046	·047	·047	·047	·047	·047	·048	·048	1
2	·048	·048	·048	·049	·049	·049	·049	·049	·050	·050	2
3	·050	·050	·050	·051	·051	·051	·051	·051	·052	·052	3
4	·052	·052	·052	·053	·053	·053	·053	·053	·054	·054	4
5	·054	·054	·055	·055	·055	·055	·056	·056	·056	·056	5
6	·057	·057	·057	·058	·058	·058	·059	·059	·059	·059	6
7	·060	·060	·060	·060	·060	·061	·061	·061	·061	·062	7
8	·062	·062	·062	·063	·063	·063	·063	·064	·064	·064	8
9	·065	·065	·065	·066	·066	·066	·066	·067	·067	·067	9
10	·068	·068	·068	·069	·069	·069	·069	·070	·070	·070	10
11	·071	·071	·071	·072	·072	·072	·072	·073	·073	·073	11
12	·074	·074	·075	·075	·075	·076	·076	·077	·077	·077	12
13	·078	·078	·078	·079	·079	·080	·080	·081	·081	·081	13
14	·082	·082	·082	·083	·083	·084	·084	·085	·085	·085	14
15	·086	·086	·086	·087	·087	·088	·088	·089	·089	·089	15
16	·090	·090	·090	·091	·091	·092	·092	·093	·093	·093	16
17	·094	·094	·094	·095	·095	·096	·096	·097	·097	·097	17
18	·098	·098	·099	·099	·100	·100	·101	·101	·102	·102	18
19	·103	·103	·104	·104	·105	·105	·106	·106	·107	·107	19
20	·108	·108	·109	·109	·110	·110	·111	·111	·112	·112	20
21	·113	·113	·114	·114	·115	·115	·116	·116	·117	·117	21
22	·118	·118	·119	·119	·120	·120	·121	·121	·122	·122	22
23	·123	·124	·124	·125	·125	·126	·127	·127	·128	·128	23
24	·129	·130	·130	·131	·131	·132	·133	·133	·134	·134	24
25	·135	·136	·136	·137	·137	·138	·139	·139	·140	·140	25
26	·141	·142	·142	·143	·143	·144	·145	·145	·146	·146	26
27	·147	·148	·148	·149	·149	·150	·151	·151	·152	·152	27
28	·153	·154	·154	·155	·156	·156	·157	·158	·158	·159	28
29	·160	·160	·161	·162	·162	·163	·164	·165	·166	·166	29
30	·167	·168	·168	·169	·170	·170	·171	·172	·172	·173	30
31	·174	·174	·175	·176	·176	·177	·178	·179	·179	·180	31
32	·181	·182	·182	·183	·184	·184	·185	·186	·186	·187	32
33	·188	·188	·189	·190	·191	·192	·193	·193	·194	·195	33
34	·196	·196	·197	·198	·199	·199	·200	·201	·202	·203	34
35	·204	·204	·205	·206	·207	·208	·208	·209	·210	·211	35
36	·212	·213	·214	·214	·215	·216	·217	·218	·218	·219	36
37	·220	·221	·222	·223	·224	·225	·225	·226	·227	·228	37
38	·229	·230	·231	·231	·232	·233	·234	·235	·236	·237	38
39	·238	·238	·239	·240	·241	·242	·243	·244	·245	·246	39
40	·247	·248	·249	·250	·251	·252	·253	·254	·255	·256	40
41	·257	·258	·259	·260	·261	·262	·263	·264	·265	·266	41
42	·267	·268	·269	·270	·271	·272	·273	·274	·275	·276	42
43	·277	·278	·279	·280	·281	·283	·284	·285	·286	·287	43
44	·288	·289	·290	·292	·293	·294	·295	·296	·297	·298	44
45	·299	·301	·302	·303	·304	·305	·306	·307	·308	·309	45
46	·311	·312	·313	·315	·316	·317	·318	·319	·321	·322	46
47	·323	·324	·325	·327	·328	·329	·330	·331	·333	·334	47
48	·335	·336	·338	·339	·340	·342	·343	·344	·345	·346	48
49	·348	·349	·351	·352	·353	·355	·356	·357	·358	·360	49
50	0·361	0·362	0·364	0·365	0·366	0·367	0·369	0·370	0·371	0·373	50

TABLE VII.—Elastic Force of Aqueous Vapour in Inches of Mercury.—*Continued.*

Temperature.	0°0	0°1	0°2	0°3	0°4	0°5	0°6	0°7	0°8	0°9	Temperature.
	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	
50°	0·361	0·362	0·364	0·365	0·366	0·367	0·369	0·370	0·371	0·373	50°
51	·374	·375	·377	·378	·379	·381	·382	·384	·385	·386	51
52	·388	·389	·391	·393	·394	·396	·397	·399	·400	·401	52
53	·403	·404	·406	·407	·409	·410	·412	·413	·415	·416	53
54	·418	·419	·421	·422	·424	·425	·427	·428	·430	·431	54
55	·433	·434	·436	·437	·439	·441	·443	·444	·446	·447	55
56	·449	·451	·453	·454	·456	·457	·459	·461	·462	·464	56
57	·465	·467	·469	·470	·472	·473	·475	·477	·479	·480	57
58	·482	·483	·485	·487	·489	·491	·492	·494	·496	·498	58
59	·500	·501	·503	·505	·507	·509	·511	·512	·514	·516	59
60	·518	·520	·522	·524	·526	·528	·529	·531	·533	·535	60
61	·537	·539	·541	·543	·545	·546	·548	·550	·552	·554	61
62	·556	·558	·560	·562	·564	·566	·568	·570	·572	·574	62
63	·576	·578	·580	·582	·584	·586	·588	·590	·592	·594	63
64	·596	·598	·601	·603	·605	·607	·609	·611	·613	·615	64
65	·617	·620	·622	·624	·626	·628	·630	·633	·635	·637	65
66	·639	·641	·644	·646	·648	·650	·652	·655	·657	·659	66
67	·661	·664	·666	·668	·671	·673	·675	·678	·680	·682	67
68	·684	·687	·689	·692	·694	·697	·699	·701	·704	·706	68
69	·708	·711	·713	·716	·718	·721	·723	·726	·728	·731	69
70	·733	·736	·738	·741	·744	·746	·749	·751	·754	·756	70
71	·759	·761	·764	·766	·769	·772	·774	·777	·779	·782	71
72	·785	·788	·790	·793	·796	·799	·801	·804	·807	·810	72
73	·812	·815	·818	·820	·823	·826	·829	·832	·834	·837	73
74	·840	·843	·846	·848	·851	·854	·857	·860	·863	·865	74
75	·868	·871	·874	·877	·880	·883	·885	·888	·891	·894	75
76	·897	·900	·903	·906	·909	·912	·915	·918	·921	·924	76
77	·927	·930	·934	·937	·940	·943	·946	·949	·952	·955	77
78	·958	·961	·965	0·968	0·971	0·974	0·977	0·981	0·984	0·987	78
79	0·990	0·994	0·997	1·000	1·003	1·007	1·010	1·013	1·016	1·020	79
80	1·023	1·026	1·030	1·033	1·037	1·040	1·043	1·047	1·050	1·053	80
81	1·057	1·060	1·064	1·067	1·070	1·074	1·077	1·081	1·084	1·088	81
82	1·092	1·095	1·099	1·103	1·106	1·110	1·114	1·117	1·121	1·124	82
83	1·128	1·131	1·135	1·139	1·142	1·146	1·150	1·154	1·157	1·161	83
84	1·165	1·169	1·173	1·176	1·180	1·184	1·188	1·192	1·196	1·200	84
85	1·203	1·207	1·211	1·215	1·219	1·222	1·226	1·230	1·234	1·238	85
86	1·242	1·246	1·250	1·254	1·258	1·262	1·266	1·270	1·274	1·278	86
87	1·282	1·286	1·290	1·295	1·299	1·303	1·307	1·311	1·315	1·319	87
88	1·323	1·328	1·332	1·336	1·340	1·345	1·349	1·353	1·357	1·361	88
89	1·366	1·370	1·375	1·379	1·384	1·388	1·393	1·397	1·401	1·406	89
90	1·410	1·415	1·419	1·424	1·428	1·433	1·437	1·442	1·446	1·451	90
91	1·455	1·460	1·464	1·469	1·473	1·478	1·483	1·487	1·492	1·496	91
92	1·501	1·505	1·510	1·515	1·519	1·524	1·529	1·534	1·538	1·543	92
93	1·548	1·553	1·557	1·562	1·567	1·572	1·577	1·581	1·586	1·591	93
94	1·596	1·601	1·606	1·611	1·616	1·621	1·626	1·631	1·636	1·641	94
95	1·646	1·651	1·657	1·662	1·667	1·672	1·677	1·682	1·687	1·692	95
96	1·697	1·703	1·708	1·714	1·719	1·724	1·730	1·735	1·741	1·746	96
97	1·751	1·757	1·762	1·768	1·773	1·779	1·784	1·790	1·795	1·801	97
98	1·806	1·811	1·817	1·822	1·828	1·833	1·839	1·845	1·850	1·856	98
99	1·862	1·868	1·873	1·879	1·884	1·890	1·896	1·901	1·907	1·912	99
100	1·918	1·923	1·929	1·935	1·941	1·947	1·953	1·959	1·965	1·971	100

TABLE VIII.—FOR CALCULATING THE RELATIVE HUMIDITY.

Dry-bulb Reading.	DIFFERENCE BETWEEN THE READINGS OF THE DRY-BULB AND WET-BULB THERMOMETERS.																												Dry-bulb Reading.
	0°0	0°2	0°4	0°6	0°8	1°0	1°2	1°4	1°6	1°8	2°0	2°2	2°4	2°6	2°8	3°0	3°2	3°4	3°6	3°8	4°0	4°2	4°4	4°6	4°8	5°0	5°2	5°4	5°6	5°8	6°0	
10°	100	92	85	78	72	67	62	57	52	48	44	41	38	35	32	30	27	25	23	20	18	16	14	12	11	10	9	9	8	8	7	10°
20	100	93	86	80	74	68	63	59	55	51	47	44	41	37	34	32	29	27	25	23	21	19	18	17	16	15	14	13	12	11	10	20
22	100	94	88	82	76	70	65	60	56	53	50	47	44	41	38	36	33	31	29	27	25	23	21	19	18	17	15	14	13	12	11	22
24	100	94	88	83	78	73	69	65	61	57	53	50	47	44	42	39	36	34	32	30	29	27	25	23	21	19	18	17	16	15	14	24
26	100	95	90	85	80	76	72	68	64	61	57	54	51	48	45	43	41	39	37	35	33	31	29	27	26	25	23	21	20	19	18	26
28	100	96	92	88	84	80	76	72	69	66	63	60	57	54	52	50	48	46	44	42	40	38	36	34	33	32	30	29	27	26	25	28
30	100	96	93	90	87	84	81	78	75	72	70	67	64	62	60	58	55	53	51	49	47	45	44	42	40	39	37	36	35	33	32	30
32	100	97	94	91	89	87	84	82	80	78	76	73	71	69	67	65	63	61	60	58	56	54	53	51	50	48	47	45	44	42	41	32
34	100	97	95	93	91	89	87	85	83	81	80	78	76	74	72	71	69	67	65	63	62	60	59	57	56	55	53	52	51	50	49	34
36	100	98	96	94	93	91	89	87	86	84	82	80	79	77	76	74	72	71	69	68	66	64	63	61	60	59	58	57	55	54	53	36
38	100	98	96	94	93	91	89	87	86	85	83	81	80	78	77	76	74	73	71	70	69	67	66	64	63	62	61	60	58	57	56	38
40	100	98	97	95	94	92	90	88	87	86	84	82	81	79	78	76	75	74	72	71	70	68	67	65	64	63	62	61	60	59	58	40
42	100	98	97	95	94	92	90	88	87	86	84	83	81	80	78	77	76	75	73	72	70	69	68	66	65	64	63	62	61	60	59	42
44	100	98	97	95	94	92	90	88	87	86	84	83	82	81	79	78	77	76	74	73	72	71	70	68	67	65	64	63	62	61	60	44
46	100	99	97	95	94	92	91	89	88	87	85	84	82	81	79	78	77	76	74	73	72	71	70	68	67	66	65	64	63	62	61	46
48	100	99	97	95	94	92	91	89	88	87	85	84	82	81	80	79	78	77	75	74	73	72	71	69	68	67	66	65	64	63	62	48
50	100	99	97	96	94	93	92	90	89	88	86	85	83	82	80	79	78	77	75	74	73	72	71	70	69	68	66	65	64	63	62	50
52	100	99	97	96	94	93	92	90	89	88	86	85	83	82	81	80	79	78	76	75	74	73	72	71	70	69	67	66	65	64	63	52
54	100	99	97	96	94	93	92	90	89	88	86	85	83	82	81	80	79	78	77	76	75	73	72	71	70	69	68	67	66	65	64	54
56	100	99	97	96	94	93	92	90	89	88	87	86	84	83	82	81	80	79	77	76	75	74	73	72	71	70	69	68	67	66	65	56
58	100	99	97	96	94	93	92	90	89	88	87	86	85	84	83	82	81	80	78	77	76	75	74	73	72	71	70	69	68	67	66	58
60	100	99	97	96	94	93	92	91	90	89	88	86	85	84	83	82	81	80	78	77	76	75	74	73	72	71	70	69	68	67	66	60
62	100	99	98	96	95	94	93	91	90	89	88	86	85	84	83	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	62
64	100	99	98	96	95	94	93	91	90	89	88	86	85	84	83	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68	68	64
66	100	99	98	96	95	94	93	91	90	89	88	87	86	85	84	83	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68	66
68	100	99	98	96	95	94	93	92	91	90	89	87	86	85	84	83	82	81	80	79	78	77	76	75	74	73	72	71	70	69	69	68
70	100	99	98	96	95	94	93	92	91	90	89	87	86	85	84	83	82	81	80	79	78	77	76	75	74	74	73	72	71	70	69	70
75	100	99	98	96	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80	79	78	77	76	75	74	73	72	71	70	70	75
80	100	99	98	97	96	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80	79	78	77	76	76	75	74	73	72	72	80
90	100	99	98	97	96	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	81	80	79	78	77	77	76	75	74	74	73	90
100	100	99	98	97	96	95	94	93	92	91	90	89	88	87	86	86	85	84	83	82	82	81	80	79	78	78	77	76	75	75	74	100

TABLE VIII.—For Calculating the Relative Humidity.—*Continued.*

Dry-bulb Reading.	Difference between the Readings of the Dry-bulb and Wet-bulb Thermometers.																													Dry-bulb Reading.
	6°0	6°2	6°4	6°6	6°8	7°0	7°2	7°4	7°6	7°8	8°0	8°2	8°4	8°6	8°8	9°0	9°2	9°4	9°6	9°8	10°0	10°2	10°4	10°6	10°8	11°0	11°2	11°4	11°6	11°8	12°0	
10°	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	10°
20	10	9	8	7	6	6	6	5	5	5	5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	20
22	11	10	9	9	8	8	7	7	6	6	5	5	5	5	4	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	22
24	14	13	12	11	10	10	9	9	8	8	7	7	6	6	6	5	5	5	5	5	4	...	...	...	...	...	...	...	...	...	...	24
26	18	17	16	15	14	14	13	12	11	10	10	9	9	8	8	7	7	6	6	6	5	5	5	5	5	4	...	...	...	...	...	26
28	25	24	23	21	20	19	18	17	16	15	15	14	14	13	13	12	12	11	10	10	9	9	8	8	7	7	7	6	6	6	5	28
30	32	31	30	29	28	28	27	26	25	24	23	22	21	20	19	18	17	16	15	15	14	14	13	13	12	12	12	11	11	10	10	30
32	41	39	38	37	36	35	34	33	32	31	30	29	29	28	27	27	26	25	24	23	23	22	21	20	20	19	19	18	17	17	16	32
34	49	47	46	45	44	43	41	40	39	38	37	36	36	35	34	33	33	32	31	30	30	29	28	27	27	26	26	25	24	24	23	34
36	53	52	51	49	48	47	46	45	44	43	42	41	40	39	39	38	37	36	35	34	34	33	32	31	31	30	30	29	28	28	27	36
38	56	55	54	52	51	50	49	48	47	46	45	44	43	42	42	41	40	39	38	37	36	35	34	33	33	32	32	31	30	30	29	38
40	58	57	56	54	53	52	51	50	49	48	47	46	45	44	44	43	42	41	40	39	38	37	36	35	35	34	34	33	32	32	31	40
42	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	40	39	38	37	36	36	35	34	33	32	32	42
44	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	46	45	44	43	42	41	41	40	39	39	38	37	36	35	34	34	44
46	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	47	46	45	44	43	43	42	41	40	39	39	38	37	36	35	35	46
48	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	48	47	46	45	44	44	43	42	41	40	40	39	38	37	36	36	48
50	62	61	60	59	58	58	57	56	55	54	53	52	51	50	49	49	48	47	46	45	45	44	43	42	41	41	40	40	39	39	38	50
52	63	62	61	60	59	59	58	57	56	55	54	53	52	51	50	50	49	48	47	46	46	45	44	44	43	43	42	41	40	40	39	52
54	64	63	62	61	60	59	58	57	56	55	55	54	53	52	51	51	50	49	48	47	47	46	45	45	44	44	43	42	41	41	40	54
56	65	64	63	62	61	60	59	58	57	56	56	55	54	53	52	52	51	50	49	48	48	47	46	46	45	45	44	43	42	42	41	56
58	66	65	64	63	62	61	60	59	58	57	57	56	55	54	53	53	52	51	50	49	49	48	47	47	46	46	45	45	44	44	43	58
60	66	65	64	63	62	62	61	60	59	59	58	57	56	55	54	54	53	52	51	50	50	49	48	47	46	46	45	45	44	44	43	60
62	67	66	65	64	63	63	62	61	60	59	58	57	56	56	55	55	54	53	52	51	51	50	49	48	47	47	46	46	45	45	44	62
64	68	67	66	65	64	63	62	61	60	59	59	58	57	57	56	55	55	54	53	52	52	51	50	49	48	48	47	47	46	46	45	64
66	68	67	66	65	64	64	63	62	61	60	60	59	58	58	57	56	55	54	53	52	52	51	51	50	49	49	48	48	47	47	46	66
68	69	68	67	66	65	65	64	63	62	61	60	59	58	58	57	56	56	55	54	53	53	52	52	51	50	50	49	48	47	47	46	68
70	69	68	67	66	65	65	64	63	62	61	61	60	59	59	58	57	57	56	55	54	54	53	52	51	50	50	49	49	48	48	47	70
75	70	69	68	67	66	66	65	64	63	62	62	61	61	60	59	59	58	57	56	55	55	54	54	53	52	52	51	51	50	49	49	75
80	72	71	70	69	68	67	67	66	65	64	64	63	62	62	61	60	60	59	58	57	57	56	55	54	53	53	52	52	51	51	50	80
90	73	72	71	70	70	69	68	67	66	66	65	64	64	63	63	62	61	61	60	60	59	58	58	57	57	56	55	55	54	54	53	90
100	74	73	72	71	71	70	69	69	68	68	67	66	66	65	65	64	63	63	62	62	61	60	60	59	59	58	57	57	56	56	55	100

TABLE VIII.—For Calculating the Relative Humidity.—*Continued.*

Dry-bulb Reading.	Difference between the Readings of the Dry-bulb and Wet-bulb Thermometers.																												Dry-bulb Reading.
	12°0	12°2	12°4	12°6	12°8	13°0	13°2	13°4	13°6	13°8	14°0	14°2	14°4	14°6	14°8	15°0	15°2	15°4	15°6	15°8	16°0	16°2	16°4	16°6	16°8	17°0	17°2	17°4	17°6	17°8	18°0	
10°	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	10°
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	20
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	22
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	24
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	26
28	5	5	5	5	5	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...	28
30	10	10	9	9	9	8	8	7	7	7	6	6	6	6	5	5	5	5	5	4	4	...	...	...	...	...	...	...	...	...	...	30
32	16	16	15	15	15	14	14	13	13	13	12	12	11	11	11	10	10	10	10	9	9	8	8	8	7	7	7	7	6	6	32
34	23	23	22	21	21	20	20	19	18	18	17	17	16	16	15	15	15	14	14	14	13	13	13	12	12	12	11	11	11	10	10	34
36	27	27	26	25	25	24	24	23	23	23	22	22	21	21	20	20	19	19	18	18	17	17	16	16	15	15	14	14	14	13	13	36
38	29	29	28	27	27	26	26	25	25	24	24	23	23	22	22	21	21	20	20	20	19	19	18	18	17	17	16	16	16	15	15	38
40	31	31	30	29	29	28	28	27	27	26	25	25	25	24	24	23	23	22	22	22	21	21	20	20	19	19	18	18	18	17	17	40
42	32	31	31	30	30	29	29	28	28	27	26	26	26	25	25	24	24	23	23	23	22	22	21	21	20	20	19	19	19	18	18	42
44	34	33	33	32	32	31	31	30	30	29	28	28	27	26	26	25	25	24	24	24	23	23	22	22	21	21	20	20	20	19	19	44
46	35	34	34	33	33	32	32	31	31	30	29	29	28	27	27	26	26	25	25	25	24	24	23	23	22	21	21	21	21	20	20	46
48	36	35	35	34	34	33	33	32	32	31	30	30	29	29	29	28	27	27	26	26	25	24	23	23	22	22	22	21	21	20	20	48
50	38	37	36	35	35	34	34	33	33	32	32	31	31	30	30	29	28	28	27	27	26	26	25	25	24	24	23	22	22	21	21	50
52	39	38	38	37	37	36	36	35	35	34	33	32	32	31	31	30	29	29	28	28	27	27	26	26	25	25	24	24	24	23	23	52
54	40	39	39	38	38	37	37	36	36	35	34	33	33	32	32	31	30	30	29	29	28	28	27	27	26	26	25	25	25	24	24	54
56	41	40	40	39	39	38	37	36	36	35	35	34	34	33	33	33	32	32	31	31	30	29	29	28	28	27	27	26	26	25	25	56
58	43	42	41	40	40	39	39	38	38	37	36	35	35	34	34	34	33	33	32	32	31	31	30	30	29	29	28	28	28	27	27	58
60	43	42	42	41	41	40	39	38	38	37	37	36	36	35	35	35	34	34	33	33	32	32	31	31	30	30	29	29	28	28	27	60
62	44	43	43	42	42	41	40	39	39	38	38	37	37	36	36	35	35	34	34	33	33	33	32	32	31	31	30	30	29	29	28	62
64	45	44	44	43	43	42	41	40	40	39	39	38	38	37	37	36	36	35	35	34	34	33	32	32	31	31	30	30	29	29	29	64
66	46	45	45	44	44	43	42	41	41	40	40	39	39	38	38	37	36	36	35	35	34	34	33	33	32	32	32	31	31	30	30	66
68	46	45	45	44	44	43	42	41	41	40	40	39	39	38	38	38	37	37	36	36	35	35	34	34	33	33	33	32	32	31	31	68
70	47	46	46	45	45	44	43	42	42	41	41	40	40	39	39	38	38	37	37	36	36	35	35	35	34	34	33	33	32	32	31	70
75	49	48	48	47	47	46	46	45	44	44	43	42	42	41	41	40	40	39	39	38	38	37	37	36	36	35	35	35	34	34	33	75
80	50	49	49	48	48	47	47	46	46	45	45	44	44	43	43	42	41	41	40	40	39	39	38	38	37	37	36	36	35	35	35	80
90	53	52	52	51	51	50	49	49	48	48	47	46	46	45	45	44	44	43	43	42	42	42	41	41	40	40	40	39	39	38	38	90
100	55	54	54	53	53	52	51	51	50	50	49	49	48	48	48	47	47	46	46	45	45	45	44	44	43	43	43	42	42	41	41	100

TABLE IX.—Comparison of the English and Metrical Barometer Scales.

(1 inch = 25·39954 millimetres.)

English inches.	Milli-metres.	English inches.	Milli-metres.	English inches.	Milli-metres.	English inches.	Milli-metres.
27·00	685·8	28·00	711·2	29·00	736·6	30·00	762·0
27·02	686·3	28·02	711·7	29·02	737·1	30·02	762·5
27·04	686·8	28·04	712·2	29·04	737·6	30·04	763·0
27·06	687·3	28·06	712·7	29·06	738·1	30·06	763·5
27·08	687·8	28·08	713·2	29·08	738·6	30·08	764·0
27·10	688·3	28·10	713·7	29·10	739·1	30·10	764·5
27·12	688·8	28·12	714·2	29·12	739·6	30·12	765·0
27·14	689·3	28·14	714·7	29·14	740·1	30·14	765·5
27·16	689·9	28·16	715·3	29·16	740·7	30·16	766·1
27·18	690·4	28·18	715·8	29·18	741·2	30·18	766·6
27·20	690·9	28·20	716·3	29·20	741·7	30·20	767·1
27·22	691·4	28·22	716·8	29·22	742·2	30·22	767·6
27·24	691·9	28·24	717·3	29·24	742·7	30·24	768·1
27·26	692·4	28·26	717·8	29·26	743·2	30·26	768·6
27·28	692·9	28·28	718·3	29·28	743·7	30·28	769·1
27·30	693·4	28·30	718·8	29·30	744·2	30·30	769·6
27·32	693·9	28·32	719·3	29·32	744·7	30·32	770·1
27·34	694·4	28·34	719·8	29·34	745·2	30·34	770·6
27·36	694·9	28·36	720·3	29·36	745·7	30·36	771·1
27·38	695·4	28·38	720·8	29·38	746·2	30·38	771·6
27·40	696·0	28·40	721·4	29·40	746·8	30·40	772·2
27·42	696·5	28·42	721·9	29·42	747·3	30·42	772·7
27·44	697·0	28·44	722·4	29·44	747·8	30·44	773·2
27·46	697·5	28·46	722·9	29·46	748·3	30·46	773·7
27·48	698·0	28·48	723·4	29·48	748·8	30·48	774·2
27·50	698·5	28·50	723·9	29·50	749·3	30·50	774·7
27·52	699·0	28·52	724·4	29·52	749·8	30·52	775·2
27·54	699·5	28·54	724·9	29·54	750·3	30·54	775·7
27·56	700·0	28·56	725·4	29·56	750·8	30·56	776·2
27·58	700·5	28·58	725·9	29·58	751·3	30·58	776·7
27·60	701·0	28·60	726·4	29·60	751·8	30·60	777·2
27·62	701·5	28·62	726·9	29·62	752·3	30·62	777·7
27·64	702·0	28·64	727·4	29·64	752·8	30·64	778·2
27·66	702·6	28·66	728·0	29·66	753·4	30·66	778·8
27·68	703·1	28·68	728·5	29·68	753·9	30·68	779·3
27·70	703·6	28·70	729·0	29·70	754·4	30·70	779·8
27·72	704·1	28·72	729·5	29·72	754·9	30·72	780·3
27·74	704·6	28·74	730·0	29·74	755·4	30·74	780·8
27·76	705·1	28·76	730·5	29·76	755·9	30·76	781·3
27·78	705·6	28·78	731·0	29·78	756·4	30·78	781·8
27·80	706·1	28·80	731·5	29·80	756·9	30·80	782·3
27·82	706·6	28·82	732·0	29·82	757·4	30·82	782·8
27·84	707·1	28·84	732·5	29·84	757·9	30·84	783·3
27·86	707·6	28·86	733·0	29·86	758·4	30·86	783·8
27·88	708·1	28·88	733·5	29·88	758·9	30·88	784·3
27·90	708·7	28·90	734·1	29·90	759·5	30·90	784·9
27·92	709·2	28·92	734·6	29·92	760·0	30·92	785·4
27·94	709·7	28·94	735·1	29·94	760·5	30·94	785·9
27·96	710·2	28·96	735·6	29·96	761·0	30·96	786·4
27·98	710·7	28·98	736·1	29·98	761·5	30·98	786·9

TABLE X.—Comparison of the Fahrenheit and Centigrade Thermometer Scales.

(1° Fahrenheit = 0°·556 Centigrade.)

Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.
°	°	°	°	°	°	°	°	°	°
−20·0	−28·9	+10·0	−12·2	+40·0	+ 4·4	+70·0	+ 21·1	+100·0	+37·8
−19·5	−28·6	10·5	−11·9	40·5	4·7	70·5	21·4	100·5	38·1
−19·0	−28·3	11·0	−11·7	41·0	5·0	71·0	21·7	101·0	38·3
−18·5	−28·1	11·5	−11·4	41·5	5·3	71·5	21·9	101·5	38·6
−18·0	−27·8	12·0	−11·1	42·0	5·6	72·0	22·2	102·0	38·9
−17·5	−27·5	12·5	−10·8	42·5	5·8	72·5	22·5	102·5	39·2
−17·0	−27·2	13·0	−10·6	43·0	6·1	73·0	22·8	103·0	39·4
−16·5	−26·9	13·5	−10·3	43·5	6·4	73·5	23·1	103·5	39·7
−16·0	−26·7	14·0	−10·0	44·0	6·7	74·0	23·3	104·0	40·0
−15·5	−26·4	14·5	− 9·7	44·5	6·9	74·5	23·6	104·5	40·3
−15·0	−26·1	15·0	− 9·4	45·0	7·2	75·0	23·9	105·0	40·6
−14·5	−25·8	15·5	− 9·2	45·5	7·5	75·5	24·2	105·5	40·8
−14·0	−25·6	16·0	− 8·9	46·0	7·8	76·0	24·4	106·0	41·1
−13·5	−25·3	16·5	− 8·6	46·5	8·1	76·5	24·7	106·5	41·4
−13·0	−25·0	17·0	− 8·3	47·0	8·3	77·0	25·0	107·0	41·7
−12·5	−24·7	17·5	− 8·1	47·5	8·6	77·5	25·3	107·5	41·9
−12·0	−24·4	18·0	− 7·8	48·0	8·9	78·0	25·6	108·0	42·2
−11·5	−24·2	18·5	− 7·5	48·5	9·2	78·5	25·8	108·5	42·5
−11·0	−23·9	19·0	− 7·2	49·0	9·4	79·0	26·1	109·0	42·8
−10·5	−23·6	19·5	− 6·9	49·5	9·7	79·5	26·4	109·5	43·1
−10·0	−23·3	20·0	− 6·7	50·0	10·0	80·0	26·7	110·0	43·3
− 9·5	−23·1	20·5	− 6·4	50·5	10·3	80·5	26·9	110·5	43·6
− 9·0	−22·8	21·0	− 6·1	51·0	10·6	81·0	27·2	111·0	43·9
− 8·5	−22·5	21·5	− 5·8	51·5	10·8	81·5	27·5	111·5	44·2
− 8·0	−22·2	22·0	− 5·6	52·0	11·1	82·0	27·8	112·0	44·4
− 7·5	−21·9	22·5	− 5·3	52·5	11·4	82·5	28·1	112·5	44·7
− 7·0	−21·7	23·0	− 5·0	53·0	11·7	83·0	28·3	113·0	45·0
− 6·5	−21·4	23·5	− 4·7	53·5	11·9	83·5	28·6	113·5	45·3
− 6·0	−21·1	24·0	− 4·4	54·0	12·2	84·0	28·9	114·0	45·6
− 5·5	−20·8	24·5	− 4·2	54·5	12·5	84·5	29·2	114·5	45·8
− 5·0	−20·6	25·0	− 3·9	55·0	12·8	85·0	29·4	115·0	46·1
− 4·5	−20·3	25·5	− 3·6	55·5	13·1	85·5	29·7	115·5	46·4
− 4·0	−20·0	26·0	− 3·3	56·0	13·3	86·0	30·0	116·0	46·7
− 3·5	−19·7	26·5	− 3·1	56·5	13·6	86·5	30·3	116·5	46·9
− 3·0	−19·4	27·0	− 2·8	57·0	13·9	87·0	30·6	117·0	47·2
− 2·5	−19·2	27·5	− 2·5	57·5	14·2	87·5	30·8	117·5	47·5
− 2·0	−18·9	28·0	− 2·2	58·0	14·4	88·0	31·1	118·0	47·8
− 1·5	−18·6	28·5	− 1·9	58·5	14·7	88·5	31·4	118·5	48·1
− 1·0	−18·3	29·0	− 1·7	59·0	15·0	89·0	31·7	119·0	48·3
− 0·5	−18·1	29·5	− 1·4	59·5	15·3	89·5	31·9	119·5	48·6
0·0	−17·8	30·0	− 1·1	60·0	15·6	90·0	32·2	120·0	48·9
+ 0·5	−17·5	30·5	− 0·8	60·5	15·8	90·5	32·5	120·5	49·2
1·0	−17·2	31·0	− 0·6	61·0	16·1	91·0	32·8	121·0	49·4
1·5	−16·9	31·5	− 0·3	61·5	16·4	91·5	33·1	121·5	49·7
2·0	−16·7	32·0	0·0	62·0	16·7	92·0	33·3	122·0	50·0
2·5	−16·4	32·5	+ 0·3	62·5	16·9	92·5	33·6	122·5	50·3
3·0	−16·1	33·0	0·6	63·0	17·2	93·0	33·9	123·0	50·6
3·5	−15·8	33·5	0·8	63·5	17·5	93·5	34·2	123·5	50·8
4·0	−15·6	34·0	1·1	64·0	17·8	94·0	34·4	124·0	51·1
4·5	−15·3	34·5	1·4	64·5	18·1	94·5	34·7	124·5	51·4
5·0	−15·0	35·0	1·7	65·0	18·3	95·0	35·0	125·0	51·7
5·5	−14·7	35·5	1·9	65·5	18·6	95·5	35·3	125·5	51·9
6·0	−14·4	36·0	2·2	66·0	18·9	96·0	35·6	126·0	52·2
6·5	−14·2	36·5	2·5	66·5	19·2	96·5	35·8	126·5	52·5
7·0	−13·9	37·0	2·8	67·0	19·4	97·0	36·1	127·0	52·8
7·5	−13·6	37·5	3·1	67·5	19·7	97·5	36·4	127·5	53·1
8·0	−13·3	38·0	3·3	68·0	20·0	98·0	36·7	128·0	53·3
8·5	−13·1	38·5	3·6	68·5	20·3	98·5	36·9	128·5	53·6
9·0	−12·8	39·0	3·9	69·0	20·6	99·0	37·2	129·0	53·9
+ 9·5	−12·5	+39·5	+ 4·2	+69·5	+20·8	+99·5	+37·5	+129·5	+54·2

TABLE XI.—Comparison of English Inches and Millimetres, for Rainfall Observations.

(·01 inch = ·254 millimetres.)

Inches.	Millimetres.	Inches.	Millimetres.	Inches.	Millimetres.	Inches.	Millimetres.	Inches.	Millimetres.
0·05	1·3	2·55	64·8	5·05	128·3	7·55	191·8	11·0	279·4
0·10	2·5	2·60	66·0	5·10	129·5	7·60	193·0	12·0	304·8
0·15	3·8	2·65	67·3	5·15	130·8	7·65	194·3	13·0	330·2
0·20	5·1	2·70	68·6	5·20	132·1	7·70	195·6	14·0	355·6
0·25	6·4	2·75	69·8	5·25	133·3	7·75	196·8	15·0	381·0
0·30	7·6	2·80	71·1	5·30	134·6	7·80	198·1	16·0	406·4
0·35	8·9	2·85	72·4	5·35	135·9	7·85	199·4	17·0	431·8
0·40	10·2	2·90	73·7	5·40	137·2	7·90	200·7	18·0	457·2
0·45	11·4	2·95	74·9	5·45	138·4	7·95	201·9	19·0	482·6
0·50	12·7	3·00	76·2	5·50	139·7	8·00	203·2	20·0	508·0
0·55	14·0	3·05	77·5	5·55	141·0	8·05	204·5	21·0	533·4
0·60	15·2	3·10	78·7	5·60	142·2	8·10	205·7	22·0	558·8
0·65	16·5	3·15	80·0	5·65	143·5	8·15	207·0	23·0	584·2
0·70	17·8	3·20	81·3	5·70	144·8	8·20	208·3	24·0	609·6
0·75	19·1	3·25	82·5	5·75	146·0	8·25	209·5	25·0	635·0
0·80	20·3	3·30	83·8	5·80	147·3	8·30	210·8	26·0	660·4
0·85	21·6	3·35	85·1	5·85	148·6	8·35	212·1	27·0	685·8
0·90	22·9	3·40	86·4	5·90	149·9	8·40	213·4	28·0	711·2
0·95	24·1	3·45	87·6	5·95	151·1	8·45	214·6	29·0	736·6
1·00	25·4	3·50	88·9	6·00	152·4	8·50	215·9	30·0	762·0
1·05	26·7	3·55	90·2	6·05	153·7	8·55	217·2	31·0	787·4
1·10	27·9	3·60	91·4	6·10	154·9	8·60	218·4	32·0	812·8
1·15	29·2	3·65	92·7	6·15	156·2	8·65	219·7	33·0	838·2
1·20	30·5	3·70	94·0	6·20	157·5	8·70	221·0	34·0	863·6
1·25	31·7	3·75	95·2	6·25	158·7	8·75	222·2	35·0	889·0
1·30	33·0	3·80	96·5	6·30	160·0	8·80	223·5	36·0	914·4
1·35	34·3	3·85	97·8	6·35	161·3	8·85	224·8	37·0	939·8
1·40	35·6	3·90	99·1	6·40	162·6	8·90	226·1	38·0	965·2
1·45	36·8	3·95	100·3	6·45	163·8	8·95	227·3	39·0	990·6
1·50	38·1	4·00	101·6	6·50	165·1	9·00	228·6	40·0	1016·0
1·55	39·4	4·05	102·9	6·55	166·4	9·05	229·9	41·0	1041·4
1·60	40·6	4·10	104·1	6·60	167·6	9·10	231·1	42·0	1066·8
1·65	41·9	4·15	105·4	6·65	168·9	9·15	232·4	43·0	1092·2
1·70	43·2	4·20	106·7	6·70	170·2	9·20	233·7	44·0	1117·6
1·75	44·4	4·25	107·9	6·75	171·4	9·25	234·9	45·0	1143·0
1·80	45·7	4·30	109·2	6·80	172·7	9·30	236·2	46·0	1168·4
1·85	47·0	4·35	110·5	6·85	174·0	9·35	237·5	47·0	1193·8
1·90	48·3	4·40	111·8	6·90	175·3	9·40	238·8	48·0	1219·2
1·95	49·5	4·45	113·0	6·95	176·5	9·45	240·0	49·0	1244·6
2·00	50·8	4·50	114·3	7·00	177·8	9·50	241·3	50·0	1270·0
2·05	52·1	4·55	115·6	7·05	179·1	9·55	242·6	51·0	1295·4
2·10	53·3	4·60	116·8	7·10	180·3	9·60	243·8	52·0	1320·8
2·15	54·6	4·65	118·1	7·15	181·6	9·65	245·1	53·0	1346·2
2·20	55·9	4·70	119·4	7·20	182·9	9·70	246·4	54·0	1371·6
2·25	57·1	4·75	120·6	7·25	184·1	9·75	247·6	55·0	1397·0
2·30	58·4	4·80	121·9	7·30	185·4	9·80	248·9	56·0	1422·4
2·35	59·7	4·85	123·2	7·35	186·7	9·85	250·2	57·0	1447·8
2·40	61·0	4·90	124·5	7·40	188·0	9·90	251·5	58·0	1473·2
2·45	62·2	4·95	125·7	7·45	189·2	9·95	252·7	59·0	1498·6
2·50	63·5	5·00	127·0	7·50	190·5	10·00	254·0	60·0	1524·0

TABLE XII.—CONVERSION OF ENGLISH MILES PER HOUR INTO MÈTRES PER SECOND.

Miles per Hour.	Mètres per Second.	Miles per Hour.	Mètres per Second.	Miles per Hour.	Mètres per Second.	Miles per Hour.	Mètres per Second.	Miles per Hour.	Mètres per Second.
1	0·45	11	4·92	21	9·39	31	13·86	41	18·33
2	0·89	12	5·36	22	9·83	32	14·31	42	18·78
3	1·34	13	5·81	23	10·28	33	14·75	43	19·22
4	1·79	14	6·26	24	10·73	34	15·20	44	19·67
5	2·24	15	6·71	25	11·18	35	15·65	45	20·12
6	2·68	16	7·15	26	11·62	36	16·09	46	20·56
7	3·13	17	7·60	27	12·07	37	16·54	47	21·01
8	3·58	18	8·05	28	12·52	38	16·99	48	21·46
9	4·02	19	8·49	29	12·96	39	17·43	49	21·90
10	4·47	20	8·94	30	13·41	40	17·88	50	22·35

TABLE XIII.—CONVERSION OF MÈTRES PER SECOND INTO ENGLISH MILES PER HOUR.

Mètres per Second.	Miles per Hour.	Mètres per Second.	Miles per Hour.	Mètres per Second.	Miles per Hour.	Mètres per Second.	Miles per Hour.	Mètres per Second.	Miles per Hour.
1	2·24	11	24·61	21	46·98	31	69·35	41	91·72
2	4·47	12	26·84	22	49·21	32	71·58	42	93·95
3	6·71	13	29·08	23	51·45	33	73·82	43	96·19
4	8·95	14	31·32	24	53·69	34	76·06	44	98·43
5	11·18	15	33·55	25	55·92	35	78·29	45	100·66
6	13·42	16	35·79	26	58·16	36	80·53	46	102·90
7	15·66	17	38·03	27	60·40	37	82·77	47	105·14
8	17·90	18	40·27	28	62·64	38	85·01	48	107·37
9	20·13	19	42·50	29	64·87	39	87·24	49	109·61
10	22·37	20	44·74	30	67·11	40	89·48	50	111·85

TABLE XIV.—SPECIMEN OF A CLIMATOLOGICAL RETURN.

ROYAL METEOROLOGICAL SOCIETY.

CLIMATOLOGICAL OBSERVATIONS at 9 a.m. (Local Time) made at Hodsock Priory, Worksop, during July 1905. Height above Sea Level, 56 feet.

Date.	Thermometers (Corrected).				Amount of Cloud.	Rain.	Sunshine (Campbell-Stokes).	Earth Thermometers. (Corrected).			Remarks.
	Dry.	Wet.	Max.	Min.				1 Ft.	2 Ft.	4 Ft.	
	°	°	°	°	0–10	in.	hrs.	°	°	°	[T ◍° 12 p.
1	57·0	56·8	67·4	55·0	10	·34	0·6	60·1	59·5	56·5	◍² 5 a, ◍9 a-1 p, cloudy p,
2	63·0	59·7	73·3	57·0	6	...	6·6	60·6	59·0	56·4	Cloudy a, overcast p.
3	64·4	57·1	68·6	56·0	7	...	6·1	61·6	59·6	56·3	Cloudy.
4	64·5	55·2	70·5	42·5	3	...	7·0	60·3	59·7	56·6	Fine, cloudy.
5	65·1	58·9	71·9	45·4	7	...	6·4	60·2	59·5	56·7	Cloudy.
6	63·5	55·7	69·4	48·5	2	...	11·5	60·9	59·4	56·7	Cloudy, fine.
7	66·5	59·1	80·0	45·9	0	...	14·6	60·6	59·4	56·7	Very bright.
8	68·7	60·7	79·9	46·3	0	...	15·1	61·8	59·7	56·7	Very bright.
9	69·6	63·0	80·9	47·3	0	·35	8·8	62·9	60·1	56·9	Bright a, ⊼◍ p.
10	69·9	65·5	78·8	56·2	8	...	5·6	63·1	60·3	57·0	Fine, cloudy, dull evening.
11	71·0	65·0	79·3	58·9	3	·02	5·2	63·8	60·8	57·2	Fine early, cloudy, ◍ 7 p.
12	69·0	63·4	79·9	62·0	10	...	3·9	64·1	61·0	57·4	Fine, cloudy, T° p.
13	72·2	67·4	79·0	66·0	7	...	8·1	64·7	61·3	57·6	Fine, cloudy.
14	73·1	65·7	83·5	54·5	0	...	13·5	64·8	61·6	57·8	Very fine and bright.
15	70·3	64·4	78·6	58·7	8	...	7·2	65·4	62·2	58·1	Fine, cloudy.
16	63·4	57·4	71·5	54·7	9	...	5·5	64·5	62·4	58·3	Fine, cloudy.
17	60·0	54·4	68·8	51·7	10	·09	2·6	63·3	62·0	58·4	Cloudy a, dull p.
18	68·4	62·3	75·5	55·8	6	...	7·4	63·1	61·6	58·6	◍° 1 a, fine, cloudy p.
19	65·6	56·8	74·7	44·3	1	...	10·4	63·0	61·5	58·4	Bright a, cloudy p, fine night.
20	71·3	62·3	75·4	47·2	7	...	6·5	63·0	61·4	58·5	Bright a, cloudy, hazy p.
21	71·1	64·1	79·7	56·0	1	...	6·5	63·1	61·2	58·5	Fine, cloudy.
22	68·4	62·5	75·2	52·6	10	·08	1·6	63·1	61·2	58·4	Cloudy.
23	63·7	60·3	70·3	59·7	8	·03	1·6	63·7	61·3	58·4	◍ 3 a, overcast, ◍° 8 p.
24	63·3	58·0	75·1	50·7	5	...	11·6	63·2	61·2	58·5	Fine.
25	69·7	63·3	77·8	58·7	2	...	10·8	63·5	61·3	58·6	Fine day, overcast night.
26	63·0	59·3	70·6	55·2	10	·37	0·5	63·8	61·7	58·6	Overcast, ◍° a, ◍² evening.
27	63·6	59·9	71·5	57·3	8	...	4·6	63·0	61·6	58·7	Cloudy, fine night.
28	64·1	56·1	70·9	48·0	1	·01	7·6	62·1	61·5	58·7	Cloudy, fine.
29	59·5	58·5	68·6	48·2	10	·02	3·0	62·0	61·3	58·7	Overcast, ◍°, fine evening.
30	62·8	57·2	69·9	56·3	7	...	4·5	61·6	60·9	58·7	Cloudy.
31	61·3	55·8	67·3	47·9	6	...	3·2	61·0	60·8	58·6	Overcast, fine night.
Sums	187·0	5·8	133·8	94·5	172	1·31	208·1	81·9	26·0	24·2	
Means	66·0	60·2	74·3	53·0	5·5	...	° Sunless Days.	62·6	60·8	57·8	
Corrections for Index Errors.	...	...	Applied daily.			...	...	...	...	...	
Means Corrected.	...	...	...	...	...	...	...	...	...	...	

Highest Temperature (corrected) 83°·5 on 14th.
Lowest Temperature (corrected) 42°·5 on 4th.
Mean Temperature . . . . . 63°·7
Mean Range of Temperature . . 21°·3
Relative Humidity 69%
No. of Rainy Days 9

(Signed) HENRY MELLISH.

(It is requested that this Form be returned *unsealed* by the 10th of the month following that to which it belongs.)

A GLOSSARY OF METEOROLOGICAL TERMS

Absolute Temperatures. These are degrees Centigrade above the absolute zero -273° C. Thus 273° A., 0° C., and 32° F. all correspond with the freezing-point of water.

Accumulated Temperature. This is the combined amount and duration of the excess or defect of the air temperature above or below the base temperature of 42°. It is considered that the temperature above that value is mainly effectual in starting and maintaining the growth and in completing the ripening of agricultural crops. [DE CANDOLLE.]

Actinometer. An instrument for measuring the intensity of solar radiation. [HERSCHEL, 1826.]

Adiabatic. Changes which occur in the pressure, volume, and temperature of a mass of gas, which is subject to the condition that it neither parts with, nor receives, heat during the process, are said to be "adiabatic."

Advective Region. *See* Stratosphere. (Advektion is also used by Zenker to denote the difference between actual and "solar" temperature.) [GOLD, 1909.]

After-glow. The radiance or glow seen in the western sky for a longer period than usual after the sun has set.

Alto-Cumulus. *See* Clouds, p. 32.

Alto-Stratus. *See* Clouds, p. 32.

Anemo-cinemograph. An instrument for recording the velocity of the wind each second.

Anemo-clinograph. An instrument for recording the angular deviations of wind movement from a horizontal path, or from one parallel to the surface of the ground.

Anemogram. The trace marked on paper by an anemograph.

Anemograph. A self-recording anemometer.

Anemometer. An instrument for measuring the pressure or velocity of the wind.

Anemoscope. An instrument for recording the direction of the wind.

Aneroid. An instrument consisting essentially of an elastic metal box, exhausted of air, which indicates on a dial the changes due to variations of external pressure on the box, and therefore acting as a barometer. [VIDI, 1848.]

Aneroidograph. A self-recording aneroid barometer.

Anthelion. Coloured rings seen round the shadow of an observer, projected on to a cloud or fog lying below him. Also called "Glory."

Anticyclone. An area of relatively high barometric pressure increasing towards the centre, in which the wind blows spirally outwards, and in the northern hemisphere, in the direction of the movement of the hands of a watch. [GALTON, 1863.]

Anticyclonic Belts. These belts are composed of the successive so-called permanent anticyclonic systems of the atmosphere, between the trade winds and the circulation of temperate latitudes.

Anti-Trades. Winds circulating on the Polar sides of the Trade-winds, the prevailing directions being South-west in the northern hemisphere and North-west in the southern hemisphere. [HERSCHEL, 1862.]

Aqueous Vapour. *See* Elastic Force of Vapour.

Arched Squall. A squall off the west coast of Africa, in which the clouds take the shape of an arch.

Aspiration Psychrometer. The dry-bulb and wet-bulb thermometers with a special contrivance for passing a current of air of definite velocity over the bulbs. [ASSMANN, 1884.]

Atmometer. An instrument for measuring the amount of evaporation of water.

Atmospheric Pressure. Pressure produced by the weight of the air.

Audibility. Unusual distinctness of distant sounds.

Aurora Australis. A luminous electrical display of much beauty appearing in the sky in the southern hemisphere, sometimes taking the form of an arch, streamers, corona, glow, etc.

Aurora Borealis. A similar display to the Aurora Australis, only appearing in the northern hemisphere.

Average. *See* Mean.

Azimuth. The angle which the vertical plane passing through an object makes with the plane of the meridian.

Backing-Wind. A wind which changes in a direction contrary to that of the sun's apparent course, as *e.g.* from W. through S. to E., etc.

Baguio. The Philippine name for a revolving storm or cyclone.

Bai-U. The rainy season in Japan during the latter half of June and the first half of July. It means the "plum rain season," as it comes when the plums are getting ripe.

Ball Lightning. A luminous ball or globe which moves slowly and sometimes bursts, giving rise to flashes of lightning.

Ballon Sonde. A small, free rubber balloon employed for raising a meteorograph to obtain a record of the conditions prevailing in the upper regions of the atmosphere.

Balneology. The science or study of mineral springs and baths.

Barocyclonometer. An instrument for ascertaining the position, distance, and direction of advance of a cyclone or revolving storm. [ALGUÉ, 1898.]

Barogram. The trace marked on paper by a barograph.

Barograph. A self-recording barometer.

Barometer. An instrument for measuring the pressure of the atmosphere. [BOYLE, 1665.]

Beaufort's Scale. Devised by Admiral Sir F. Beaufort, and now in general use for estimating the force of the wind. [See p. 26.]

Bize. A cold, piercing wind of Languedoc.

Blackthorn Winter. The cold weather, accompanied by keen North-east winds, which sometimes occurs about the second week in April, when the blackthorn is in bloom.

Blizzard. A violent and bitterly cold wind accompanied with blinding snow.

Blood Rain. *See* Red Rain.

Bloxamize. The method adopted by Mr. J. C. Bloxam to obtain smoothed mean values. [1858.]

Bora. A violent, cold, anticyclonic wind, blowing down from mountains close to the coast, if a chilled tableland lies behind them. The Bora of the Adriatic is best known, but a similar wind is observed elsewhere.

Breezes, Land and Sea. Winds which blow near the coast, from sea to land during the day, and from land to sea during the night.

Brickfielder. A very hot, dust-laden wind blowing from the North in New South Wales.

Brocken Spectre. *See* Anthelion *or* Glory.

Brontometer. An instrument to show the sequence of the various phenomena occurring during thunderstorms. [SYMONS, 1890.]

Buran. Gale from the North-east, accompanied with drifting snow, in the Steppes of Central Asia. *See* Purga.

Burst of the Monsoon. The sudden change of weather accompanying the setting in of the South-west Monsoon.

Buys-Ballot's Law. In the northern hemisphere, "Stand with your back to the wind and the barometer will be lower on the left hand and higher on the right." [Directions are reversed in the southern hemisphere.] [BUYS BALLOT, 1860.]

Calm. A quiescent state of the air.

Calm Belt. *See* Doldrums.

Calm Centre. The vortex of a cyclonic storm.

Cape Doctor. The name given to the cool Southerly gales which often blow in summer at Cape Town.

Centigrade. The thermometer scale, frequently called after Celsius, in general use on the Continent, in which the interval between the freezing and boiling points is divided into 100°, the freezing-point being 0° and the boiling-point 100°.

Centres of Action of Atmosphere. The term includes the so-called permanent anticyclonic belts of the atmosphere as well as the well-defined and somewhat durable cyclonic systems. [Some writers make a distinction between the centres of action of the atmosphere and the centres of action of individual anticyclonic or cyclonic systems.] [TEISSERENC DE BORT, 1881.]

Chinook. A warm, dry wind at the eastern base of the Rocky Mountains, similar to the Föhn.

Cirro-Cumulus. *See* Clouds, p. 32.

Cirro-Stratus. *See* Clouds, p. 32.

Cirrus. *See* Clouds, p. 31.

Climate. The average condition of meteorological phenomena at a given place.

Climatological Station. A station at which observations are made only once a day, usually at 9 a.m. [TRIPE, 1879.]

Climatology. The science or study of climate.

Cloud. Moisture in the air condensed into a visible form. [For names of clouds, see p. 32.]

Cloud-Burst. Sudden precipitation of a great amount of rain or hail in a short time.

Col. A neck of low pressure between two anticyclones. [ABERCROMBY, 1882.]

Comozants. *See* St. Elmo's Fire.

Convective Region. *See* Troposphere. [GOLD, 1909.]

Corona. A series of small coloured rings, due to refraction through thin clouds, round the sun or moon. The order of the colours is the reverse of that in the rainbow.

Corposants. *See* St. Elmo's Fire.

Crepuscular Rays. Diverging beams seen when the sun is near the eastern or western horizon, and clouds are gathered round its disc.

Cumulo-Nimbus. Thunder cloud. *See* Clouds, p. 32.

Cumulus. Wool-pack cloud. *See* Clouds, p. 32.

Cyclone. An area of relatively low barometric pressure, decreasing towards the centre, in which the wind blows spirally inwards, and in the northern hemisphere, in the opposite direction to the movement of the hands of a watch. The name is usually applied to tropical revolving storms. [PIDDINGTON, 1839.]

Day Degree. The accumulated temperature is expressed in "Day Degrees"—a day degree signifying 1° of excess or defect of temperature above or below 42° continued for 24 hours, or any other number of degrees for an inversely proportional number of hours. [STRACHEY, 1881.]

Depression. *See* Cyclone.

Dew. Condensation of moisture on solid objects caused through cooling by radiation.

Dew-Point. The temperature at which dew begins to be deposited.

Diathermancy. The property in virtue of which the solar rays pass through a medium without raising its temperature.

Diurnal Inequality or **Diurnal Variation.** Changes due to the time of day.

Diurnal Range. The amount of variation between the maximum and minimum of any element during the 24 hours.

Doldrums. The belt of calms near the equator.

Drizzle. Rain in very small drops.

Drought. A long continuance of dry weather. *Absolute Drought*, a period of 15 or more consecutive days absolutely without rain. *Partial Drought*, a period of 29 or more consecutive days the aggregate rainfall of which does not exceed 0·01 in. per diem. [SYMONS, 1887.]

Dust-Counter. An instrument for counting the number of dust particles in a given volume of air. [AITKEN, 1889.]

Dust-Storm. A whirlwind passing over a dry or sandy district and carrying up the dust into the air.

Dynamic Cooling. The cooling produced by the expansion of air when it passes into a region of decreased pressure.

Dynamical Meteorology. This deals with the motions of the atmosphere, their causes, and the conditions arising therefrom, and also of the modification which these motions produce in the statical conditions.

Elastic Force of Vapour. Pressure of the water vapour in the atmosphere.

Electrometer. An instrument for measuring the electrification of the air.

Error of Capacity. The error in the height of a mercurial barometer arising from the change of level of the mercury in the cistern.

Etesian Winds. Northerly winds which prevail in summer over the Mediterranean.

Evaporation. The process of vapour passing into the air from water and moist surfaces.

Evaporimeter. An instrument for measuring the amount of evaporation.

Eye of the Storm. The vortex or calm centre of a tropical revolving storm.

Fahrenheit. The thermometer scale in general use in English-speaking countries, in which the interval between the freezing and boiling points is divided into 180°, the freezing-point being 32° and the boiling-point 212°. [FAHRENHEIT, 1714.]

Five-Day Means. Frequently employed on the Continent, by which the year is subdivided into 73 pentads or periods of 5 days each.

Flood. An inundation caused by heavy rainfall or the overflow of a river.

Fog. A cloud in contact with or close to the ground.

Fog-Bow. White rainbow seen on a thick fog.

Föhn. A warm, dry wind descending from the mountains, most frequent in Alpine valleys, and elsewhere in mountainous districts. It owes its dryness to the circumstance that the air is descending from a mountain ridge, and is warmed by compression in its descent.

Forked Lightning. The branched or sinuous flashes of lightning.

Freezing-Point. The temperature at which water freezes or ice melts — viz. 32° Fahrenheit, 0° Centigrade, and 0° Réaumur.

Fulgurites. Silicious tubes of various sizes, vitrified internally by lightning striking the ground and fusing the sand.

Gale. Strong wind with a minimum velocity of over 39 miles an hour.

Glazed Frost. The coating of ice produced either by a frost setting in after a partial thaw, or by rain falling during hard frost and congealing as it falls.

Globular Lightning. *See* Ball Lightning.

Gloom. The darkness occasioned by a dense pall of cloud.

Glory. Coloured rings seen round the shadow of an observer, projected on to a cloud or fog lying below him. (Also called "Anthelion.")

Gradient. The difference in pressure, temperature, or other meteorological element per unit of distance. [STEVENSON, 1867.]

Graupel (German). Soft hail.

Green Ray. A flash of greenish-blue light seen, when the sun's disc appears or disappears, in a sunrise or sunset on a clear horizon.

Gregale. A cold, dry, unhealthy, North-easterly wind blowing over Malta in spring and early summer.

Grésil (French). Soft hail.

Ground Frost. This is taken to be when the minimum thermometer exposed on the grass falls to 30° or below that point [30°·4 if the thermometer is read to tenths of a degree].

Haar. The name given to a sea-fog

accompanying an Easterly drift of air on the east coast of Britain. The phenomenon is more common in the Firth of Forth than elsewhere.

Hail. Frozen rain. Large hailstones sometimes consist of alternate deposits of hoar-frost and ice.

Halo. Large circle of coloured light surrounding the sun or moon, commonly of about 44° in diameter.

Harmattan. Hot Easterly wind on the west coast of Africa. It is loaded with red dust.

Haze. Obscuration of the atmosphere produced by the presence of dust particles.

Helm-Wind. A violent, cold Easterly wind blowing down the western slope of Crossfell, Cumberland.

High, A. A term used mostly in America to denote an anticyclone or high-pressure system.

High-Pressure System. *See* Anticyclone.

Hoar-Frost. Frozen dew.

Humidity. *See* Relative Humidity.

Hurricane. The name usually applied to the tropical revolving storms which visit the West Indies and the islands of the South Pacific.

Hyetograph. A self-recording rain gauge.

Hyetometry. The determination of the amount of water condensed out of the atmosphere in the form of rain, hail, or snow.

Hygrograph. A self-recording hygrometer.

Hygrometer. An instrument for measuring the humidity of the air. [LAMBERT.]

Hygrometry. The determination of the amount of water present in the air in a vaporous form.

Hypsometer. A thermometer for measuring altitudes by the lowering of the boiling-point of water consequent upon the reduction of atmospheric pressure at high altitudes.

Index Error. The error made in laying off the scale of an instrument.

Indian Summer. Fine weather for a few days about September 30, in North America.

Insolation. Solar radiation.

Inversion of Temperature. A warmer stratum of air above a colder one.

Invierno. The rainy season in tropical America.

Ion. Any minute material particle which carries an electrical charge.

Ionisation. The process by which ions are produced.

Iridescent Clouds. The under-surface of cirrus or cirro-cumulus clouds illuminated with rings or patches of iridescent colours.

Isabnormal Lines. Lines drawn through places having the same anomaly, *e.g.* the same difference between the actual mean temperatures and the theoretical mean temperatures for places in a given latitude. [DOVE, 1852.]

Isanakatabars. Lines of equal pressure amplitudes. [SHAW, 1909.]

Isobars. Lines on maps showing equal atmospheric pressure. [RENOU, 1864.]

Isobrontal Lines. Lines on maps showing equal times or hours of thunderstorms.

Isohels. Lines on maps showing equal amounts of bright sunshine.

Isohyets. Lines on maps showing equal amounts of rainfall.

Isonephs. Lines on maps showing equal amounts of cloudiness.

Isopleths. This strictly should include isobars, isotherms, or other form of "iso" lines; in practice it is applied to diagrams which express the variation of hourly values throughout the year.

Isothermal Layer. A term often used to denote the upper region of the atmosphere in which the temperature changes very little with altitude. [TEISSERENC DE BORT, 1899.]

Isotherms. Lines on maps showing equal temperatures. [HUMBOLDT, 1817.]

Khamsin. Hot, dry wind of Egypt, supposed to last for 50 days at a time.

Killing Frost. A term used in America to denote a frost sufficiently severe to be injurious to vegetation.

Kilometre. 0·62 mile (a mile is 1·61 kilometre).

Kite. The form most used in meteorology is the Hargreave or box-kite, and it is employed for raising a meteorograph to obtain a record of the conditions prevailing in the upper regions of the atmosphere.

Lammas Floods. A term used to denote a wet period about the first week in August.

Land Breeze. *See* Breezes.

Larry. A local name for a dense sea-fog at Teignmouth, Devon.

Lenticular Cloud. A cloud which assumes an ovoid or flat spheroid form with sharp edges.

Leste. Hot, dry, dust-bearing wind of Madeira. It blows from between North-east and South-east.

Levanter. *See* Solano.

Leveche. The Spanish name for the Scirocco.

Lightning. Disruptive discharge of electricity during thunderstorms.

Lightning Conductor. A mode of protection against lightning.

Line Squalls. The line of squalls which are associated with the trough of a cyclone or V-depression. [ABERCROMBY, 1884.]

London Fog. The dry, gloomy, irritating fog peculiar to London and other large towns, aggravated by smoke.

Low, A. A term used mostly in America to denote a cyclone or low-pressure system.

Low-Pressure System. *See* Cyclone.

Lunar Halo. *See* Halo.

Lunar Rainbow. *See* Rainbow.

Mackerel Sky. Cirro-cumulus clouds.

Mares' Tails. Long, wispy, cirrus clouds.

Mean. The arithmetical average or mean is the sum of all the values forming the series of figures under consideration divided by their number. *Average* is the

term used for results extending over a long period, while *Mean* is used for short periods, *e.g.* a day, month, or year.

Meniscus. The convexity of the mercury in the barometer tube.

Meteorograph. An instrument for recording the changes of pressure, temperature, humidity, etc., on one sheet of paper.

Meteorology. The science of the atmosphere.

Metre. 39·37 inches (an inch is ·025 metre).

Metre per Second. 2·24 miles per hour (a mile per hour = ·45 metre per second).

Micro-Barograph. A very sensitive statoscope which combines the recording of variations of atmospheric pressure upon a magnified scale with the practical obliteration of the general surges through the operation of a small leak. [WHITEHOUSE, 1871.]

Millimetre = 0·039 inch.

Mirage. An appearance produced by the successive bending of rays of light in passing through strata of air of varying densities.

Mist. A cloud in contact with the ground, wetting objects exposed to it.

Mistral. A violent, cold, dry North-westerly wind, of similar origin to the Bora, which sweeps the shores of the Gulf of Lyons.

Mock Suns and Moons. Bright patches of light seen at the points where the vertical or horizontal bands of light from the sun or moon intersect a halo.

Monsoons. Periodical winds blowing from sea to land in summer, and from land to sea in winter. The South-west or summer Monsoon, and the North-east or winter Monsoon of India, China, and the neighbouring seas, are the best known examples.

Nephoscope. An instrument for observing the direction and rate of motion of clouds.

Nimbus. Rain cloud. *See* Clouds, p. 32.

Noah's Ark. A cloud formed by stripes of cirrus which (owing to perspective) appear to coalesce at opposite points of the horizon.

Northers. Dry, cold winds over the Gulf of Mexico. Similar winds at Valparaiso have the same name.

Nor'-Westers. The föhn-like dry warm winds which blow east of the mountains of the middle island of New Zealand.

Ombrometer. A rain gauge.

Ozone. An exceptionally active condition of oxygen.

Pampero. A sudden cold, squally, Southerly wind blowing in the rear of a low-pressure system over the pampas of Argentina, and in the neighbourhood of the River Plate.

Paraselenæ. Mock-moons.

Parhelia. Mock-suns.

Peg-top Sunset. When the sun is setting over the sea it sometimes assumes the shape of a peg-top owing to refraction.

Pentad. A period of five days.

Percolation. The penetration of rain into the soil.

Periodical Variations. The variations which recur at regular intervals, such as a day or a year.

Phenology. A term indicating the observation of natural periodical phenomena, such as the flowering of plants, the migration and song of birds, etc. [1874.]

Pilot Balloon. A small free balloon employed for ascertaining the drift and the velocity of the upper currents of the atmosphere.

Pluviograph. A self-recording rain gauge.

Pluviometer. A rain gauge.

Pocky Cloud. The base of a cumulus cloud when it assumes a festooned appearance.

Ponente. A Westerly wind in the Mediterranean.

Pressure Plate. A form of anemometer for registering the pressure of the wind.

Pressure Tube. A form of anemometer by which the force of the wind is measured. [DINES, 1892.]

Prognostics. Premonitory signs of good or bad weather.

Psychrometer. The dry-bulb and wet-bulb thermometers. [AUGUST, 1825.]

Pumping of Barometer. Unsteadiness of the mercury in the barometer tube caused by the temporary reduction of pressure in a room, produced by gusts of wind.

Punos. Intensely cold, dry winds in the Puna regions of South America, blowing chiefly from South and South-west.

Purga. A very violent Buran (which see).

Pyrheliometer. An instrument for measuring the intensity of solar radiation. [POUILLET, 1856.]

Radiation. The interchange of heat between bodies which are not in contact.

Rain. Condensed moisture which falls from the clouds in a liquid form.

Rainband. A dark band or shading seen on the red side of the double line D in the atmospheric absorption spectrum.

Rainbow. An arc of prismatic colours seen opposite the sun or moon when rain is falling.

Rainfall. This term includes all forms of atmospheric precipitation.

Rain Gauge. An instrument for measuring rainfall.

Rainy Day or **Rain Day.** This is defined in the British Isles to be a day on which 0·01 inch, or more, of rain is recorded. [SYMONS, 1862.]

Réaumur. The thermometer scale formerly in use in Germany and Russia, but now abandoned officially, in which the interval between the freezing and boiling points is divided into 80°; 0° is at the freezing-point. [RÉAUMUR, 1730.]

Red Rain. Rain charged with dust carried often for great distances from sandy deserts.

Registering Balloon. *See* Ballon Sonde.

Relative Humidity. The ratio or percentage

of the actual vapour pressure to that of saturated water vapour at the temperature of the air.

Ridge. A high-pressure area between two contiguous areas of low pressure.

Rime. Frozen moisture on trees, etc., resembling thick hoar-frost. It occurs mostly during fog.

Roaring Forties. The regions between lat. 40° and 50° S., where the "brave West winds" blow.

St. Elmo's Fire. A luminous, electrical display, similar to the brush-discharge of an electrical machine, visible at night at the extremities of pointed objects, such as mast-heads and yard-arms of ships, tops of trees, etc., during unsettled weather.

St. Luke's Summer. A period of fine, quiet weather about the middle of October.

St. Martin's Summer. A period of exceptionally mild, quiet weather in November.

Saturation. The condition of the air when fully charged with moisture.

Scotch Mist. The name given to the fine rain or drizzle which is of frequent occurrence in hilly country.

Scud. Fragmental clouds driven along by stormy winds beneath heavy clouds.

Sea-Breeze. *See* Breezes.

Second Order Station. A station at which observations are made at least twice a day, usually at 9 a.m. and 9 p.m.

Secondary Cyclone. A small depression accompanying a larger or primary cyclone.

Seismograph. An instrument for recording earth-tremors or earthquakes.

Serein. Fine rain falling from a cloudless sky.

Sheet Lightning. The reflection of distant flashes of lightning.

Silver Thaw. The phenomenon of a large quantity of frozen moisture on trees, walls, etc., sometimes consisting of ice, but more frequently crystallized and presenting a beautiful snow-like appearance.

Simoom. A hot, suffocating wind, bearing clouds of sand, in the Sahara.

Sirocco. A hot South-east wind blowing from the heated Sahara, dry on the coast of Africa, but moist on the coast of Europe.

Sleet. A mixture of snow and rain.

Sling Thermometer. A thermometer tied to a string and swung round the head to determine the temperature of the air. Readings obtained in this manner, even in full sunshine, agree very closely with the true shade temperature. [ARAGO.]

Snow. Minute crystals of water, the crystals being hexagonal or six-pointed.

Snow Rollers. Cylinders of snow formed and driven along by the wind, something like a lady's muff.

Soft Hail. Pyramidal soft pellets of ice, like miniature snowballs, which fall in cold weather in spring.

Soft place in the Monsoon. A tract in the North Indian Ocean between the Equator and 9° N., and between Cloney and Socotra, where the Monsoon is weaker than elsewhere.

Solano. The East wind in Spain.

Solar Halo. *See* Halo.

Solar Radiation. The term used for heat which is received from the sun.

Southerly Burster. A sudden strong, cool, rain-bringing South wind in the rear of a low-pressure system in Australia.

Squall. A sudden, short storm of gusty wind.

Statoscope. An instrument consisting of a series of very sensitive metal boxes (something like the vacuum boxes of an aneroid) contained in a hermetically-sealed reservoir which is placed in a box thickly surrounded by wool, to prevent the disturbing influence of change of temperature. A very sensitive form of barometer.

Stephanome. An instrument for measuring the angular size of halos, fog-bows, glories, etc. [TAIT.]

Storm. A violent commotion of the atmosphere.

Strato-Cumulus. *See* Clouds, p. 32.

Stratosphere. *See* Isothermal Layer. [TEISSERENC DE BORT, 1908.

Stratus. *See* Clouds, p. 33.

Sulphur Rain. A deposit of the pollen of pine trees often carried by wind for long distances and brought down by rain.

Sultry. Hot and close condition of the atmosphere.

Sun-Dogs. Mock-suns.

Sunless Day. A day on which the duration of sunshine is less than 3 minutes.

Sun Pillar. A perpendicular column of light, of the breadth of the sun's disc, seen projecting upwards from the sun about the time of sunrise or sunset.

Sunshine Recorder. An instrument for recording the duration of bright sunshine.

Sympiesometer. An instrument formerly in use for showing the variations of atmospheric pressure. Its indications result partly from the pressure and partly from the temperature of the atmosphere. [ADIE, 1819.]

Synoptic Chart. A map showing, by means of isobars, isotherms, etc., the general distribution of atmospheric conditions over a considerable area.

Temperature. The state of a body with regard to heat.

Tension of Vapour. *See* Elastic Force of Vapour.

Terrestrial Radiation. The term used for heat which is given out from the Earth.

Thermogram. The trace marked on paper by a thermograph.

Thermograph. A self-recording thermometer.

Thermometer. An instrument for measuring the temperature. [BACON, 1587.]

Thermometer Screen. A louvre-boarded box for protecting the thermometers from the sun's rays and also from rain. [STEVENSON.]

Thermomètre Fronde. *See* Sling Thermometer.

Thermo-sychropherus. An apparatus for illustrating the cooling effect by the communication of heat under certain conditions to a mass of air in the free atmosphere. [SHAW, 1905.]

Thunder. The noise heard after the discharge of lightning.

Thunderstorm. An atmospheric disturbance accompanied by lightning, thunder, and frequently hail.

Tornado. Originally a severe squall on the coast of Senegambia and Guinea, but of late years applied to whirlwinds on shore.

Tornado Cloud. A funnel-shaped cloud which accompanies violent and destructive tornadoes, and most frequent in the United States.

Trade-Winds. Constant winds which blow towards the Equator from the North-east and South-east between the latitudes of about 30° N. and 30° S. [HALLEY, 1686.]

Trajectory of Air. The supposed path taken by a definite mass of air in a travelling storm. [SHAW, 1903.]

Tramontana. A general name for Northerly winds in Italy.

Troposphere. The lower region of the atmosphere in which the temperature falls rapidly with increasing altitude. [TEISSERENC DE BORT, 1908.]

Trough. The line of lowest barometer readings during the passage of a cyclone, at right angles to its path.

Tule Fog. The term used in California to denote fogs over marshes and swamps, or the fogs of the lowlands and the valleys.

Typhoon. A violent revolving storm in the China Seas and Eastern Pacific.

Upbank Thaw. A rise of temperature with height during severe frost, when the cold air collects in the valleys, while the adjacent summits are warmed by the descending air from the centre of an anticyclone.

V-Depression. A low-pressure area between two contiguous areas of high pressure. [ABERCROMBY, 1882.]

Vapour Tension. *See* Elastic Force of Vapour.

Vector Diagram. A wind diagram traced out by a vector which represents the wind by its length and direction.

Veering-Wind. A wind which changes in the same direction as the apparent course of the sun, *i.e.* from E. by S. to W., etc.

Velocity of Wind. The rate at which the wind travels in miles per hour.

Vendavales. South-west winds in the Straits of Gibraltar very troublesome to navigation; the term is also used for Westerly winds in New Granada.

Veranillo. The short, dry season near mid-summer in tropical America.

Verano. The long, dry season near mid-winter in tropical America.

Vernier. A small movable scale for taking minute readings, attached to instruments.

Visibility. Unusual clearness of distant objects.

Vortex. The calm centre of a cyclonic storm.

Waterspout. A whirlwind passing over the sea, in which a spout or trunk is formed, joining the cloud and sea.

Weather. The condition of the atmosphere at any moment with regard to wind, temperature, cloud, moisture, and precipitation.

Weather Forecast. A prediction of coming weather based on meteorological observations. [FITZROY.]

Wedge. *See* Ridge. [ABERCROMBY and MARRIOTT, 1882.]

Whirlwind. A small local cyclonic whirl in which there is a very strong upward motion of the air.

White Frost. *See* Hoar Frost.

White Squall. A sudden squall of wind which only becomes visible through the commotion on the sea surface, which is lashed up into white spoon-drift.

Williwaws. Sudden violent squalls in the Straits of Magellan.

Willy Willy. The name applied to a cyclone in Western Australia.

Wind. Air in motion.

Wind Rose. A diagram showing the proportions of winds observed from each point of the compass.

Wind Vane. An instrument employed for showing the direction of the wind.

Zonda. A wind of the sirocco type blowing in the pampa of Argentina.

ROYAL METEOROLOGICAL SOCIETY

THE Society was founded for the promotion of the Science of Meteorology in all its branches on April 3, 1850, under the title of "The British Meteorological Society." On its incorporation by Royal Charter on January 27, 1866, the name was altered to "The Meteorological Society"; and in 1883, by permission of Her late Majesty QUEEN VICTORIA, it became "THE ROYAL METEOROLOGICAL SOCIETY."

It is now under the distinguished Patronage of His Majesty KING GEORGE V.

Meetings are held on the third Wednesday in each month from November to June inclusive—those in the evening being usually (by permission) at the Institution of Civil Engineers, Great George Street, and those in the afternoon in May and June at the Society's Rooms, 70 Victoria Street, Westminster. These occasions afford an opportunity for social intercourse between those interested in Meteorology, tea being served after the evening meetings or before the meetings in the afternoon.

Popular Lectures on meteorological subjects by eminent authorities are arranged for on special occasions. Exhibitions of new and of special classes of meteorological instruments, as well as of diagrams, charts, and photographs, are also held from time to time.

The Papers read at the Meetings, together with the Discussions, in which every Fellow is entitled to take part, are printed in the *Quarterly Journal*, which also contains Notes, Correspondence, Notices of Recent Publications, and the titles of such papers as appear to be of general interest bearing on Meteorology in the periodicals which are received in the Society's Library. It thus serves to keep Fellows residing at a distance from London in touch with the meteorological work of the world.

In 1874 the Society commenced the organisation of a series of

"Second Order Stations," at which observations of pressure, temperature, humidity, rainfall, and wind are made on a uniform plan, so that the results may be strictly comparable. In addition to these, another class of station, termed "Climatological," was organised on January 1, 1880, at which the observations, although of equal accuracy, are less exacting. These stations, which number about 130, are well distributed throughout the country; they are regularly inspected on behalf of the Society, and the results of the observations are published in the *Meteorological Record.*

In 1874 a Conference on the observation of Periodical Natural Phenomena was organised, and as the result of their deliberations the Society instituted the series of "Phenological Observations" which have been continued since that time, first under the superintendence of the late Rev. T. A. Preston, and since 1888 under that of Mr. E. Mawley.

A Lightning Rod Conference was organised in 1878, which in 1882 published a valuable Report embodying a code of Rules for the erection of Lightning Conductors.

The Society has initiated and carried out various scientific investigations, of which the following may be mentioned:—(1) Systematic Investigations of the Thunderstorms of 1888 and 1889, and the Classification of the various forms of Lightning; (2) Inquiry into the Phenomenon of the Helm-Wind of Crossfell, Cumberland; (3) Investigation into the relation between Beaufort's Scale of Wind Force and the Equivalent Velocity in Miles per Hour; (4) The Investigation of the Meteorological Conditions of the Upper Air by means of Kites and small Balloons.

The SYMONS GOLD MEDAL, founded in 1901, in memory of the late Mr. G. J. Symons, F.R.S., is awarded biennially by the Council for distinguished work done in connection with Meteorological Science. The Medal was presented to Dr. A. Buchan, F.R.S., in 1902; to Dr. J. Hann, of Vienna, in 1904; to Lieut.-Gen. Sir R. Strachey, F.R.S., in 1906; to M. L. Teisserenc de Bort, of Paris, in 1908; and to Dr. W. N. Shaw, F.R.S., in 1910.

The Society possesses a valuable Meteorological Library of about 24,000 books and pamphlets, and about 1000 manuscripts, unequalled by any collection of works on this science in the world. Many of the earlier books are very rare, and in several cases the only known copy in existence is that in the Library. The Society also possesses a unique Bibliography, which contains the titles of all books, pamphlets, papers and articles bearing on Meteorology, of which any notice can be found. This Bibliography is kept up to date, about 5000 entries being added to it every year.

In addition to these, there is a large and interesting collection of photographs and lantern slides illustrating meteorological phenomena and instruments.

With the view of advancing the general knowledge of Meteorology, and promoting an intelligent public interest in the science, the Council in 1905 appointed Mr. W. Marriott as their Lecturer to act in co-operation with scientific societies, institutions, and public schools. Lectures have been given at many of the leading public schools and local scientific institutions in various parts of the country. Exhibitions, instruments, photographs, drawings, diagrams, and charts illustrating meteorological phenomena, are shown, under the charge of a member of the staff, at gatherings of local scientific societies, or on other occasions when they are likely to prove of interest.

Candidates for the Fellowship are elected by ballot, after recommendation by three Fellows, one of whom must certify from personal knowledge. Ladies are eligible for the Fellowship. Fellows are entitled to the designation F.R.Met.Soc.

Fellows have the privilege of attending the Meetings and introducing visitors; they have the free use of the Library and receive gratis the *Quarterly Journal*, the *Meteorological Record*, and the other publications of the Society. The Council of the Society is elected by the Fellows annually, and reports to the Fellows at the Annual General Meeting.

The Library and Offices at 70 Victoria Street, Westminster, are open daily between the hours of 10 a.m. and 5 p.m., excepting on Saturdays, when they are closed at 1 p.m. Fellows are always welcomed at the Society's rooms, and the Office staff is always ready to assist in supplying any meteorological information which is desired.

Every Fellow pays an annual subscription of £2, or a life composition of £25, and in addition an entrance fee of £1. For Fellows elected in November and December the payment of the first subscription exempts them from any contribution for the next succeeding year.

In addition to the Fellows, there is a class (limited to twenty) of Honorary Members, which is confined to distinguished Meteorologists not resident within the United Kingdom.

PUBLICATIONS

OF THE

Royal Meteorological Society.

REPORTS OF THE COUNCIL. 1st, 1851, to 11th, 1861. Mostly out of print.

PROCEEDINGS. Vol. I., 1861-63, to Vol. V., 1869-71. Price £1 : 5s. each.

QUARTERLY JOURNAL. Vol. I., 1872-73, to Vol. XXXVI., 1910. Price £1 each. Quarterly Nos., 5s. each.

THE METEOROLOGICAL RECORD. Monthly Results of Observations made at the Stations of the Royal Meteorological Society, with Remarks on the Weather for each Quarter. By WILLIAM MARRIOTT, Assistant-Secretary. Price 1s. 6d. each. (Commenced 1881.)

HINTS TO METEOROLOGICAL OBSERVERS. Instructions for taking Observations, and Tables for their Reduction; together with a Glossary of Meteorological Terms. By WILLIAM MARRIOTT, Assistant-Secretary. Seventh Edition, Revised and Enlarged. With Illustrations. Price 1s. 6d.

SOME FACTS ABOUT THE WEATHER. A Popular Meteorological Handbook. By WILLIAM MARRIOTT, Assistant-Secretary. Second and Revised Edition. Price 6d.

POCKET REGISTER FOR ORIGINAL METEOROLOGICAL OBSERVATIONS. Price 1s. 6d.

INSTRUCTIONS FOR THE OBSERVATION OF PHENOLOGICAL PHENOMENA. Second Edition. Price 6d.

CATALOGUE OF THE LIBRARY OF THE ROYAL METEOROLOGICAL SOCIETY. Complete to September 1890. Price 10s. (*To Fellows*, 5s.)

INDEX TO THE PUBLICATIONS OF THE ENGLISH METEOROLOGICAL SOCIETIES, 1839 to 1881. Price 2s.

INDEX TO THE QUARTERLY JOURNAL OF THE ROYAL METEOROLOGICAL SOCIETY, Vols. VIII. to XXVI., 1882-1900. Price 2s.

The above may be had at the Office of the Society,
70 VICTORIA STREET, LONDON, S.W.

Printed by R. & R. CLARK, LIMITED, *Edinburgh.*