the influence of a lining within the experimental tube on the radiation. A ring of blackened paper, for example, not more than $1\frac{1}{2}$ inch in width, placed within a polished brass tube, radiated, when dry air was permitted to enter the tube, a quantity of heat sufficient to urge the needle of the galvanometer through an arc of 56°; while, when the ring was removed, the radiation from the whole surface of the tube produced a deflection of only 7°·5.

The author finally examines the diathermancy of the liquids from which the vapours made use of in his experiments were derived; and the result leaves no shadow of doubt upon the mind, that if any vapour be a strong absorber, the liquid of that vapour is also a strong absorber. The phenomenon is one in which the individual molecules are implicated, the molecule carrying its power as a radiant and an absorbent through all its states of aggregation. The order of absorption in liquids and vapours is precisely the same. These facts revive thoughts regarding the connexion between radiation and conduction, to which the author has already given expression. In a future memoir he hopes to throw additional light on this important subject.

## XXI. "Account of Observations of Atmospheric Electricity taken at Windsor, Nova Scotia." By Joseph D. Everett, M.A., F.R.S.E., Professor of Mathematics, &c. in King's College, Nova Scotia. Communicated by Professor William Thomson. Received June 18, 1863.

1. The observations here described were taken at my house, which is on the College hill, Windsor, in latitude 44° 58′ 34″ N., and longitude 64° 8′ 30″ E. They were taken at a landing-window looking N.E., whose sill is 27 feet above the ground. There is a very clear view from the window, and no trees, buildings, or other obstacles to screen it from the full effect of atmospheric electricity. The ground slopes away on the N.E., E., S.E., and S., and is nearly level in other directions, rising slightly, however, for the first 20 yards on the N.W. The surrounding country is undulating, with the exception of a stretch of flat alluvial soil which runs past the base of the College hill, and to which the ground slopes away from

my house in the directions above indicated, the fall amounting to from 60 to 70 feet. The flat in question connects the two rivers Avon and St. Croix, which unite just below Windsor, and is scarcely, if at all, above high-water mark, being protected from inundation by dykes. The view from my house is bounded in the distance on all sides by ranges of thickly wooded hills, whose average height is about 500 feet, and nearest distance about three miles.

2. The apparatus used for collecting the electricity of the air was Professor Thomson's water-dropping collector, which consists of an insulated can of copper, having a brass pipe leading from it, through which the water can be discharged by turning a tap. The can stands upon a shelf just inside the window, and the pipe projects through a hole $1\frac{1}{4}$ inch in diameter in a board which is inserted under the lower sash of the window. The pipe extends nearly horizontally outside the window to the distance of 3 feet 6 inches from the sill; and the water, when turned on, flows from the end in a stream so fine, that two or three hours are required to discharge a pailful of water. The end of the pipe is about level with the sill of the window. It is assumed that the effect of the stream of water flowing from the pipe is to reduce the pipe and can to the same electrical potential as the air at the place where the water breaks into drops. The time required to reduce the can to the potential of the air is not more than a minute. In my earlier observations I observed the electricity of the air as soon as I could after turning on the water; but in looking over my observation-book, I found the electricity recorded was uniformly weaker at the first observation than at the second, taken about a minute later. In my later observations I always allowed a full minute.

3. In the commencement of winter the frost interfered with the system of water-dropping. I first tried to obviate the difficulty by leaving the water running; but a little always remained in the pipe after the can was emptied, and by freezing burst the pipe. I then shortened the pipe by removing some joints of it. This prevented the bursting of the pipe, the remaining portion being of stouter material than that removed; and I continued to take observations, with the pipe thus shortened, from Nov. 17th to Dec. 2nd; but as the weather grew colder, the water froze in that portion of the pipe which was inside the window; and after thawing it on two or three

occasions by the heat of a spirit-lamp, I determined to dispense, if possible, with water-dropping, and collect the electricity of the air by a burning match. Accordingly, from Dec. 2nd to March 30th I employed matches such as are used with Professor Thomson's Portable Electrometer (consisting of rolls of blotting-paper prepared with nitrate of lead), the burning match being fixed on the end of the water-dropping pipe. The effect of shortening the pipe is to weaken the electricity collected, in a constant ratio, which I have ascertained, by observations taken alternately with the pipe shortened and restored to its full length, to be about 1 to 3·1. This difference has been allowed for in reducing the observations, as it was very desirable to furnish my tabulated results in a form easily admitting of comparison by inspection. I have, nevertheless, inserted the letter S in the column "Remarks" against all observations taken with pipe shortened.

I have in like manner compared, by alternate observations, the results obtained respectively by water-dropping and burning match, and my observations lead to the inference that the results obtained by both methods are the same. The letters M and W, when they occur in the column "Remarks," denote respectively that the observations against which they stand were taken with burning match and water-dropping. (See Table IV.)

4. For testing and measuring the electricity thus collected I have used the "Station Electrometer," except in a few cases, when I have employed the "Portable Electrometer." Both instruments are inventions of Professor Thomson. The former consists of a Leyden jar, having within it a needle of aluminum suspended by a glass fibre, and connected (by platinum wires dipping in sulphuric acid) with the inner coating of the jar. In the neighbourhood of the needle are two brass plates, also connected with the inner coating of the jar, called the "repelling plates," because their function is to repel the two ends of the needle, causing it to rotate, and thereby twist the glass fibre. A brass cage surrounds both the needle and the repelling plates. It hangs from glass pillars, which insulate it from the jar (and therefore also from needle and repelling plates); and an arm of brass attached to it projects through a hole to the outside of the jar, furnishing the means of connecting the cage with

the object to be tested. This projecting arm is surrounded by a hollow cylinder of pumice soaked in sulphuric acid, for the purpose of drying the air which enters the jar, and thus preserving insulation. The insulation thus obtained is so good that the jar loses, on the average, only 2 or 3 per cent. per diem.

5. The force of repulsion between the needle and the repelling plates depends not on the potential of the jar absolutely, but on the difference between this and the potential of the cage, being for any given position of the needle proportional to the square of the difference of potentials. In taking an observation, the force of repulsion is ascertained by applying torsion to the glass fibre until the near end of the needle is brought into a line between two sights, one of which is on the plate of glass which covers the jar, and the other on the bottom of the cage. The amount of torsion applied is read off, and is assumed to measure the force of repulsion in the sighted position of the needle; hence the square root of the number of degrees of torsion measures the difference between the potential of the inner coating of the jar and the potential of the cage (the latter being the same as that of the body tested) in terms of a unit which is constant for any one electrometer. In accordance with a convention which has been adopted by Professor Thomson, I have always multiplied the degrees of torsion by 10 before extracting the square root. Thus, if E denote the number of degrees of torsion required to bring the needle to the sights when the cage is connected with the earth, and A the number required when the cage is connected with a conductor to be tested, the potential of the inner coating of the jar will be $\sqrt{10\,\text{E}}$, and the potential of the conductor tested will be $\sqrt{10\,\text{A}}$; hence the potential of the body tested will be $\sqrt{10\,\text{E}} - \sqrt{10\,\text{A}}$. It is by this last formula that the numbers under the heading "Electricity of Air" in my tabulated results have been calculated. If A is greater than E, the formula still holds, and the negative sign indicates that the electricity of the conductor tested is of opposite kind to that with which the jar is charged. E is called the earth-reading, and A the air-reading.

6. The portable electrometer, which is more convenient for use when the electricity of the air is very strong, also contains a needle and repelling plates, surrounded by a cage which is insulated from them, the whole being enclosed in a Leyden jar; but the needle,

instead of hanging freely by a glass fibre, is attached to the middle of a fine wire of platinum, whose two ends are secured in such a manner as to keep it always tight. The needle and repelling plates are put in connexion with the body to be tested, the cage being connected with the inner coating of the jar, an arrangement which, though opposite to that adopted in the Station Electrometer, requires the same formula to be applied in reducing the readings.

7. The best possible test of the accuracy of the method of reduction above described is to observe the potential of the same conductor with two electrometers, and try whether their indications (thus reduced) differ in a constant ratio when the charges of their jars are varied. I have applied this test, giving charges of different strength, sometimes of the same kind and sometimes of opposite kinds, the conductor tested being a short wire of copper or brass connecting the electrodes of the two instruments. These experiments were performed for the purpose of ascertaining the ratio in question, with the view of reducing all my observations to a common standard; and I have also investigated this ratio by connecting the jars of the two instruments, and taking earth-readings; but this method is less convenient because it involves the admission of undried air into the jars, thus impairing insulation, and rendering accurate observation difficult; whereas in the former method of observing, if performed in favourable weather, the insulation is as good as perfect. As it is important to establish practically the accuracy of the method of reduction pursued, I give *in extenso* all the comparisons that I have made by the methods just described.

8. In using the Station Electrometer, I have given a fresh charge to its Leyden jar about once a week: when charged too highly, it is not sufficiently retentive; when not high enough, the instrument is not sufficiently sensitive. With a charge of fifty units, which is my average working charge, a difference of 1° in the angle of torsion is equivalent to ·1 of a unit of charge, so that if the difference between air-reading and earth-reading is 1°, the strength of atmospheric electricity is ·1. The average strength of atmospheric electricity observed has been from thirty to forty times greater than this, and has in a few cases been 800 times greater. Hence it is obvious that readings to whole degrees are abundantly sufficient; and I have not thought it necessary to aim at greater minuteness, more especially

as the variation generally amounts to two or three degrees every minute.

9. Of late each observation has consisted of an earth-reading, followed by five air-readings, taken at intervals of a minute. During the first three months of observation the number of consecutive readings was irregular, and the interval between them was not always the same. The loss of charge in ten minutes is practically insensible, and is sometimes more than counterbalanced by changes in the zero of torsion produced by the strain upon the fibre during the observation. The only case in which any considerable loss occurs is when the electricity of the air is very strong negative (that of the jar being positive), causing a very high air-reading. The jar holds very well when the reading is 360° (corresponding to 60 units); and I generally give it a charge of about this amount, renewing it when it has fallen a little below 250° (or 50 units).

10. The Station Electrometer stands on the shelf at the distance of about a foot from the can. In taking earth-readings, the electrode is connected with one of the brass foot-screws which support the instrument, the connexion being made by a brass wire. In taking air-readings, the electrode is connected with the can by means of a copper wire. The square roots are generally taken on the spot by a table which serves for all whole degrees from 0° to two revolutions.

11. The Station Electrometer has never been removed from its place except during very cold weather, when the sulphuric acid at the bottom of the jar sometimes became frozen over, so that the needle was prevented from turning; and it was necessary to remove the instrument to a warm room, sometimes to thaw the ice, and sometimes to prevent it from freezing. The ice in question is, I am informed, not frozen water, but a definite compound of sulphuric acid and water. It was most liable to form when the acid had been for a long time unchanged, but I have seen a little of it when the acid had been less than a week in the jar. It never formed unless the temperature of the instrument was as low as about 20°.

12. On the first occasion of its formation, being taken by surprise, and not using proper precautions, I broke the glass fibre which supported the needle: this was on the 3rd of December. A new fibre was put in on the 6th, and the sights were adjusted to suit the new fibre on the 8th, the observations of atmospheric electricity being

taken with the Portable Electrometer in the meantime. On several subsequent occasions the Portable Electrometer was used in consequence of ice having formed in the Station Electrometer. On all other occasions the observations have been taken with the Station Electrometer, except when the electricity was too strong or too variable to be conveniently measured by it. On one occasion, in the first month of the observations (Oct. 22nd), in showery weather, the earth-reading being one revolution and 19°, the negative electricity of the air was so strong that six revolutions were not nearly sufficient to bring the needle to the sight. Electricity of such strength is very common during showers either of rain, hail, or snow, being always positive during snow, generally negative during hail, and generally negative (in some instances alternating with positive) during heavy rain. On such occasions I have generally had recourse to the "Portable," which is less sensitive.

13. On some occasions, when the electricity of the air has been strong, it has been so violent in its fluctuations from second to second, that the needle of the "Station" was quite unmanageable from the extent and rapidity of its vibrations. On such occasions, which are denoted by the word "vibration" in the column "Remarks," I had recourse to the Portable Electrometer, whose needle, in the same state of the atmosphere, frequently exhibited no vibration. Sometimes, however, the needle of the "Portable" has been violently agitated, and on these occasions, which only occurred when the electricity observed was very strong and of opposite kind to that in the jar, I have always found that the jar was discharging. On a few occasions, especially on the 6th and 7th of January, the needle of the "Station," though not trembling as in the cases above alluded to, has been remarkably unsteady, the air-reading changing by several degrees every two or three seconds.

14. In the Table of Comparisons of Electrometers, "Station I." denotes the Station Electrometer with its first fibre; "Station II." denotes the Station Electrometer with its second fibre; and "Portable" denotes the Portable Electrometer. The most probable values of the ratios of their indications, as shown by their comparisons, may be assumed to be—

Portable : Station I. :: 1 : 8·5

Portable : Station II. :: 1 : 3·1

Hence Station I. : Station II. :: 1 : ·365.

If we assume, from the comparisons of long and short pipe, that

Short pipe : Long pipe : : 1 : 3·1,

we have

Station I. with short : Station II. with long : : 1 : 1·13

Portable with short : Station II. with long : : 1 : 9·6.

All the numbers in my tabulated results are given in terms of Station II. with long pipe, and the reductions have been effected by means of a Traverse Table to single degrees on the following assumptions:—

Station I : Station II. : : Distance : Departure for 22°

Portable : Station II. : : Distance : 10 × Departure for 18°

$$\left\{\begin{array}{c}\text{Station I.}\\\text{with short}\end{array}\right\} : \left\{\begin{array}{c}\text{Station II.}\\\text{with long}\end{array}\right\} :: \text{Diff. Lat. : Dist. for } 29^\circ$$

$$\left\{\begin{array}{c}\text{Portable}\\\text{with short}\end{array}\right\} : \left\{\begin{array}{c}\text{Station II.}\\\text{with long}\end{array}\right\} :: \text{Dist. : } 10 \times \text{Diff. Lat. for } 21^\circ.$$

These ratios, when stated in numbers, are respectively

1 : ·375, 1 : 3·09, 1 : 1·14, 1 : 9·34 ;

whereas those above, designated as most probable, are

1 : ·365, 1 : 3·1, 1 : 1·13, 1 : 9·6.

15. The cage of the Station Electrometer was taken out and replaced on January 13th and April 10th, an operation which involves a readjustment of the repelling plates, and may thus affect the sensitiveness of the instrument. On the latter occasion a slight change was also made in the position of the upper sight, tending to render the instrument rather less sensitive; but I do not think the effects of these changes have been sufficiently great to be worth taking into account. One at least of the electrometers seems to be affected by some uncertain disturbing cause, which renders it more sensitive on some days than on others. This is well exemplified by the comparisons of January 14th and January 19th, the mean results obtained on the two days respectively differing by 8 per cent. Even on the same day results obtained with different charges do not precisely agree, and the discrepancies are much greater than could arise from errors of reading. They do not follow any easily ascertained law; and I am inclined to attribute them to imperfect elasticity in one or both of the fibres—a cause which may also have produced discrepancies between results on different days, for the zero of torsion has not always been tested when the comparisons were made; and

as the instruments have been left standing with different amounts of torsion on the fibres at different times, the zero of torsion may have changed. This cause would principally affect the Portable Electrometer, whose zero of torsion has always been assumed to be 30°, except on May 2nd, when it was very carefully tested, and found to be 30°·1. The zero of torsion for the Station Electrometer has been so frequently tested, that no sensible correction can be needed for it beyond what has been made. That the Portable Electrometer is affected by some such disturbing cause will be seen by reference to the comparisons on February 11th, where the earth-readings of the "Portable" are 51·0, 51·8, 51·2, the increase from the first reading to the second apparently depending on the increased torsion which was applied in the interim, and the subsequent fall being assisted by the diminution which was made in the torsion between the second reading and the third. The "Portable" also seems to hang a little (see comparisons on November 4th).

16. Besides errors from want of exactness in reducing all the observations, except those taken with Station II., to units of that instrument, and those arising from changes in the Electrometers themselves, it is probable that others have been produced by circumstances affecting the collection of the electricity from the air, the place where the water-stream breaks into drops being subject to small variations, depending on the wind and the head of water in the can. In like manner, when burning matches are used, the place where the smoke breaks away depends upon the wind and the length of the match, the latter being sometimes six and sometimes only three inches at the commencement of an observation. Rain or snow falling on the pipe has also doubtless a disturbing effect, equivalen to a shortening of the pipe; but the effect cannot be great; for I have tested that during a shower of rain, when the water in the can was not allowed to flow out, a strong artificial charge given to the can and pipe, though of the opposite kind to that of the rain, was dissipated with extreme slowness; but when the water was turned on and a fresh charge given, the loss was extremely rapid—say thirty times as fast as before. This observation has been confirmed by observing that even when the electricity of the air during heavy snow or rain was excessively strong, as collected by water-dropping, very feeble indications were obtained if the water was turned off. It is

obvious that the law of distribution of electricity on the surface of a conductor gives the end of the pipe a great advantage over other portions of it as regards power of collecting electricity from the air. Notwithstanding that the tendency of rain or other downfall is to make the electricity appear weaker than it really is, by virtually shortening the pipe, the observed electricity is generally much stronger during heavy showers than at any other time.

17. The errors resulting from these various causes, though not insignificant in themselves, are very small in comparison with the variations which really occur in the electrical potential of the air, as will be seen by the most cursory glance at the tabulated observations.

18. My observations have generally been taken regularly at three stated times in the day, viz., between 8 and 9 A.M., between 2 and 2½ P.M., and between 9 and 9½ P.M.; and in many instances observations have been taken at other hours as well. On Sundays some of the observations have generally been omitted. Either during or immediately before or after each electrical observation, I have also observed barometer, dry- and wet-bulb thermometer, cloud, wind, and state of weather generally. The barometer used is an Aneroid of the usual size, nearly new and in good condition. I have ascertained, by experiment, that it is affected by temperature, the disturbance being in the same direction as for a mercurial barometer. It has also an index error of about ·06, reading too low by this amount; but I have not applied any correction for either cause; and it would scarcely be worth while to do so, as very little connexion appears to exist between the fluctuations of the barometer and those of atmospheric electricity.

19. My two thermometers (dry- and wet-bulb) are mercurial with unusually long degrees. They are placed outside the window of a room in the second story, in which there is never any fire; and are read through the window, from which they are about six inches distant. The window faces the north-west, and the thermometers are well protected from radiation except from the window, while at the same time exposed to a free current of air.

I have carefully tested the thermometers in melting snow, which showed that at 32° the dry-bulb read ·4 too high, and the wet-bulb ·7 too high. I have also tested them in water at various tempera-

tures beside a thermometer which has been tested at Kew Observatory; and as the errors at other points of the scale were found not to differ much from those at 32°, I have applied a uniform correction of —·4 to the readings of the dry-bulb, and of —·7 to those of the wet-bulb. In the tabulated observations I have entered the corrected reading of the dry-bulb thermometer, and the corrected difference between dry and wet.

My observations of cloud are recorded in the usual way, the figure in the column "Amount" denoting the number of tenths of the sky that are covered with cloud. In the column "Kind" the abbreviations ci., cu., st., nim., are used to denote cirrus, cumulus, stratus, nimbus.

The direction of the wind has been inferred from observations of smoke and clouds, or from other obvious sources. The force of the wind has generally been set down by estimation, 1 denoting a light breath, 2 a moderate wind, 3 a rather high wind, 4 a gale, 5 a violent gale. Where the velocity is given in inches per hour in the column "Remarks," it has been observed with a hemispherical cup-anemometer.

20. The entries of electricity are in three columns. The first contains the mean of all the observations which compose the group, these observations being generally taken at intervals of a minute; the second column contains the highest potential observed (that is, the strongest positive or the weakest negative); and the third column contains the lowest potential observed (that is, the strongest negative or weakest positive).

When a greater number of observations have been taken consecutively, they have been broken up into groups; and in grouping I have been careful, as far as practicable, to avoid including positive and negative in the same group; but sometimes, when the electricity was weak and oscillating, I have allowed them to enter the same group; and in these instances I have obtained the mean by dividing the algebraic sum by the number of observations. As regards the number of observations to be combined in one group, my arrangement has been somewhat irregular, depending generally on convenience as regards the pages of my observation-book.

The time entered corresponds nearly to the centre of each group. It is sometimes given in hours and quarters, sometimes in hours and minutes.

21. For the sake of showing the variations of atmospheric electricity from minute to minute, I subjoin all the observations taken on the 10th day of each month, from October to March. With the exception of the evening of February 10th, these are fair samples of ordinary observations. I also subjoin the observations which were taken on the 26th of November, as a specimen of very great and rapid changes in atmospheric electricity. In all these instances the electrical potential of the air is given in units of the electrometer with which it was observed. The readings of dry and wet bulb are also given without correction. (See Table I.)

22. I also subjoin Tables of all the observations (or rather the mean highest and lowest of each group) taken during rain, snow, hail, sleet, and fog. These numbers are merely copied from the complete Table of observations already given, and thus collected for greater convenience of reference. (See Table II.)

It will be observed that the electricity found is almost invariably positive during snow. Out of 25 days on which observations were taken during snow, there were 23 on which positive electricity only was observed, on the remaining 2 days both positive and negative being observed.

Of 28 days on which observations were taken during rain, there were 9 on which positive only was observed, 7 on which negative only, and 12 on which both kinds were observed.

There were only 2 days on which observations were taken during hail, and on both of these both kinds of electricity were observed, but with a great preponderance of negative.

On 2 days observations were taken during sleet. In one instance the electricity found was positive, and in the other it changed from weak positive to weak negative.

On 5 days observations have been taken during fog, and the electricity found was always positive, generally much above the average strength.

Light rain, unless accompanied by mist, has never shown strong electricity; but heavy rain, as also moderate rain with mist, is in the majority of instances marked by very strong electricity.

I have not been able to ascertain, by inspection, any connexion between the direction of the wind during rain and the accompanying electricity.

23. Altogether there are 20 days (out of about 170) on which negative electricity has been observed; but on every one of these days positive electricity was observed also. With the exceptions of December 10th and 19th, negative electricity has only been observed either during downfall (*i. e.* rain, hail, sleet, or snow) or immediately before or after it. In these two exceptional instances the sky was entirely covered with nimbi, and the negative electricity observed was weak. In the latter the observation was taken about 9 P.M.; and the next following observation, taken between 8 and 9 A.M. the next morning, showed positive electricity of unusual strength.

There are only 2 days (February 4th and March 14th) on which the strength of electricity, when there was no downfall or fog, has been as high as 10, and on these two occasions the temperature of the air was below zero. The average strength of electricity, giving equal weight to all observations, and excepting those taken during downfall or fog, has been 4·2 or 4·3,—the averages for the respective months being—Oct. 3·3, Nov. 3·1, Dec. 4·0, Jan. 4·2, Feb. 5·6, March 5·5.

24. With the view of investigating the diurnal range of atmospheric electricity, I have added, for each month, all observations taken during the same hour, and have divided the sums by the numbers of observations. By "observations" I mean, here and during the remainder of this section, the numbers representing the mean electrical potential for each group of readings, as entered in the complete tabular statement already given, except when there are two or more such entries for the same hour, in which case their arithmetical mean has been adopted and reckoned merely as one observation.

Again, dividing the day into three portions—before noon, noon to 6 P.M., and after 6 P.M.,—I have divided the sum of all observations taken in the same portion of the day, for each month, by the number of observations; and I have, in the same manner, found the mean potential "at all hours" by dividing the sum of all observations taken during a month by the number of observations.

It will be seen that for every month of the six the electricity is weaker after 6 P.M. than in either of the previous portions of the day. (See Table III.)

25. The average potential at each hour for the 6 months may be found either (1) by dividing the sum of all observations taken at the

same hour during the 6 months by the number of observations, or (2) by taking the arithmetical means of the monthly means. Whichever method be adopted, the results for some of the hours will, from paucity of observations, be liable to much uncertainty. As a check upon results obtained by these two methods, and to remove errors arising from the greater average strength of electricity in some months than in others, I have (3) divided the sum of observations at each hour for each month by the mean of observations "at all hours" for that month, and, after adding the corresponding sums for the 6 months, have divided by the number of observations. This method of reduction I conceive to be the fairest of the three, as it amounts to multiplying each observation by a factor inversely proportional to the mean electrical potential for the month in which it is taken. It gives the mean potential at each hour, supposing the general mean derived from observations at all hours to be unity. The means obtained in this way are headed "Reduced Means" in the annexed Table of Diurnal Range, those obtained by the other two methods being given in the two preceding columns.

All three methods agree in furnishing the following results:—

1. That between 7 and 8 A.M. the strength of electricity is below the mean.

2. That between 8 and 9 A.M. its strength is above the mean, and takes a very decided maximum.

3. There is apparently a minimum between 10 and 11 A.M.; but observations are few.

4. That from 1 to 7 P.M. the strength is above the mean, with the apparent exception of the hour 4–5.

5. That from 7 P.M. to midnight the strength is below the mean.

The mean here referred to is the mean of all observations, and is probably not the true mean value for the 24 hours.

[Subjoined is a selection from the Tables which accompany the Paper; the complete series is preserved in the Archives of the Royal Society.]

## Table I.—*Extracts from the Observations.*

October 10, 1862.
Station Electrometer with first fibre.

| | Electricity. | Remarks. |
|---|---|---|
| h. m. | | |
| 9 38 A.M. | + 7·9 | |
| 39 | + 8·8 | |
| 40 | + 9·4 | |
| 41 | +10·1 | Dry bulb, 56 |
| 43 | + 8·6 | Wet bulb, 48 |
| 44 | +12·2 | Sky nearly |
| 45 | +11·0 | covered with |
| | | cirro-cumuli; |
| 10 1 A.M. | + 6·3 | bright, but not |
| 3 | + 7·1 | sunshine. |
| 4 | + 9·2 | |
| 5 | + 8·7 | |
| 2 5 P.M. | +12·5 | Dry bulb, 57 |
| 7 | +13·3 | Wet bulb, 50 |
| 11 | +14·0 | |
| 12 | +16·1 | |
| 13 | +17·7 | |
| 14 | +18·1 | |
| 16 | +13·4 | |
| 17 | +15·5 | |
| 18 | +14·9 | |
| 18½ | +16·4 | |
| 19 | +15·5 | |
| 20 | +15·8 | |
| 21 | +14·4 | |
| 23 | +13·2 | Dry bulb, 55·5 |
| 24 | +14·1 | Wet bulb, 48·5 |
| 6 55 P.M. | + 4·1 | Very cloudy |
| 56 | + 5·2 | and dark, not- |
| 57 | + 5·7 | withstanding full |
| 59 | + 6·1 | moon. |
| 7 1 | + 5·7 | Dry bulb, 53 |
| 2 | + 6·1 | Wet bulb, 48½ |
| 8 47 P.M. | + 7·6 | Still very dark. |
| 49 | + 7·7 | |
| 52 | + 7·3 | |
| | | Dry bulb, 52 |
| 10 38 P.M. | + 4·5 | Wet bulb, 48 |
| 40 | + 5·5 | Sky entirely |
| 41 | + 6·6 | clouded, but |
| 42 | + 7·5 | light; moon |
| 43 | + 8·1 | just visible be- |
| 46 | + 6·0 | hind clouds. |

Much rain, with wind, during the night.

November 10, 1862.
Portable Electrometer.

| | Electricity. | Remarks. |
|---|---|---|
| h. m. | | |
| 7 49 A.M. | −9·7 | Bar. 29·43 |
| 49½ | −6·9 | Dry, 40·5 |
| 50 | −4·7 | Wet, 39·0 |
| 52 | −5·2 | Overcast, |
| 52½ | −5·9 | nimbi, |
| 53 | −5·4 | cumuli, and |
| 54 | −4·7 | blue sky. |
| 55 | −3·1 | W.S.W. 1 |
| 56 | −2·2 | |
| 57 | −1·9 | |
| 58 | −2·0 | |
| 59 | −1·3 | Clearing up. |
| 8 0 | −0·5 | |
| 1 | +0·2 | Bar. 29·45 |
| 1½ | +0·7 | Dry, 39·6 |
| 2 | +1·0 | Wet, 37·8 |
| 8 42 A.M. | +0·8 | Heavy cum., |
| 43 | +0·8 | nim., and |
| | | blue sky. |
| | | Bar. 29·47 |
| | | Dry, 38·9 |
| | | Wet, 36·8 |
| 2 14 P.M. | +0·2 | Bar. 29·58 |
| 15 | +0·6 | Dry, 37·2 |
| 15½ | +0·7 | Wet, 34·1 |
| 3 48 | +0·3 | |
| 49 | +0·3 | |

Station Electrometer.

| | Electricity. | Remarks. |
|---|---|---|
| 3 54 | +2·1 | Overcast. |
| 55 | +2·8 | W. 2 |
| 55½ | +2·7 | Bar. 29·61 |
| 56 | +2·8 | Dry, 36·7 |
| | | Wet, 33·4 |
| 9 3 P.M. | +2·4 | Snowing lightly. |
| | | N.W. 1 |
| | | Bar. 29·72 |
| | | Dry, 33·2 |
| | | Wet, 32·3 |

TABLE I. (*continued*).

December 10, 1862.
Station Electrometer with second fibre.

| h. m. | Electricity. | Remarks. |
|---|---|---|
| 7 57 A.M. | +1·0 | |
| 58 | −0·2 | 10 nim., &c. |
| 59 | −0·8 | Calm. |
| 8 0 | −0·7 | Bar. 29·96 |
| 1 | −0·1 | Dry, 28·6 |
| | | Wet, 27·2 |
| | | A little snow has fallen during the night. |
| 2 51 P.M. | +3·0 | |
| 52 | +3·5 | 9 nim. |
| 53 | +4·1 | 1 S.W. |
| 54 | +4·0 | |
| 55 | +3·7 | |
| 56 | +3·4 | |
| 57 | +3·3 | |
| 9 1 P.M. | +2·5 | |
| 2 | +2·9 | |
| 3 | +2·9 | |
| 4 | +2·9 | |
| 5 | +2·9 | |
| 6 | +3·0 | Bar, 29·90 |
| 7 | +3·0 | Dry, 32·6 |
| 8 | +2·8 | Wet, 29·7 |
| 9 | +2·5 | |
| 10 | +2·8 | |

January 10, 1863.
Station Electrometer with second fibre.

| | | |
|---|---|---|
| 8 21 A.M. | +6·1 | 4 cum. and ci.-cum., calm. |
| 22 | +7·5 | |
| 23 | +7·3 | |
| 24 | +6·7 | Bar. 30·45 |
| 25 | +6·8 | Dry, 10·0 |
| 26 | +7·1 | Wet, 9·4 |
| 27 | +7·1 | |
| 28 | +7·3 | |
| 29 | +7·3 | |
| 11 50 | +2·8 | |
| 51 | +3·4 | |
| 51½ | +3·5 | |
| 52 | +3·7 | |
| 52½ | +3·9 | |
| 53 | +4·2 | |
| 53½ | +3·8 | |

January 10, 1863.
Station Electrometer with second fibre.

| h. m. | Electricity. | Remarks. |
|---|---|---|
| 1 47 P.M. | +2·9 | Bar. 30·38 |
| 47½ | +2·9 | Dry, 23·9 |
| 48 | +3·2 | Wet, 21·0 |
| 49 | +3·1 | |
| 50 | +2·8 | 9 str. |
| 51 | +3·3 | 1 W. |
| 4 16 P.M. | +3·8 | 10 str. and ci.-cum. |
| 15 | +3·3 | |
| 17 | +3·4 | Calm. |
| 18 | +2·9 | |
| 19 | +2·6 | Bar. 30·36 |
| 20 | +2·9 | Dry, 22·0 |
| | | Wet, 20·3 |
| 9 15 P.M. | +2·7 | |
| 16 | +2·9 | |
| 17 | +2·8 | 10 cloud. |
| 18 | +2·8 | 1 S. |
| 20 | +2·5 | Bar. 30·17 |
| 21 | +2·5 | Dry, 27·0 |
| 22 | +2.1 | Wet, 25·3 |
| 23 | +2·1 | |

February 10, 1863.
Station Electrometer with second fibre.

| | | |
|---|---|---|
| 8 51 A.M. | +24·0 | Snowing fast. |
| 52 | +23·5 | Calm. |
| 53 | +25·7 | Bar. 29·86 |
| 54 | +30·1 | Dry, 27·8 |
| 55 | +32·1 | Wet, 27·4 |
| 56 | +31·4 | |
| 2 9 P.M. | + 1·7 | Not snowing. |
| 10 | + 1·7 | 10 nim. |
| 11 | + 1·3 | (snow-clouds.) |
| 12 | + 1·3 | Calm. |
| 13 | + 1·5 | Bar. 29·46 |
| 14 | + 1·6 | Dry, 39·1 |
| 15 | + 2·2 | Wet, 38·6 |
| 16 | + 2·6 | |

Portable Electrometer.

About 10h. 56m. P.M. the mean of five minutes' observation was +27·0, the highest observed being above +30·0, and the lowest being +24·0.

TABLE I. (*continued*).

February 10, 1863.
Station Electrometer with second fibre.

Before and after the observation I drew sparks in abundance from the can.

The electricity was extremely rapid in its variations during the observation. The mean was set down from estimation, only the mean, highest, and lowest being recorded.

| | Electricity. | Remarks. |
|---|---|---|
| h. m. | | |
| 11 15 P.M. | +14·3 | |
| 16 | +15·0 | |
| 17 | +16·2 | Bar. 29·70 |
| 18 | +12·8 | Dry, 13·8 |
| 19 | + 8·3 | Wet, 13·2 |
| 20 | + 7·6 | |

Snowing, with violent wind (4 N.), the whole time, from 10h. 56m. to 11h. 20m.

March 10, 1863.
Station Electrometer with second fibre.

| | Electricity. | Remarks. |
|---|---|---|
| 8 42 A.M. | +6·4 | |
| 43 | +7·0 | 7 cum. and nim. |
| 44 | +6·7 | Calm. |
| 45 | +6·3 | Bar. 29·98 |
| 46 | +5·4 | Dry, 25·7 |
| 47 | +5·3 | Wet, 24·3 |
| 11 44 A.M. | +5·5 | 8 cum.. |
| 45 | +5·3 | 1 W. |
| 46 | +5·2 | Bar. 30· |
| 47 | +5·0 | Dry, 27·4 |
| 48 | +4·4 | Wet, 24·2 |
| 1 26 P.M. | +4·4 | 8 cum. |
| 27 | +3·9 | 1 W. |
| 28 | +3·8 | Bar. 30· |
| 29 | +3·7 | Dry, 28·9 |
| 30 | +3·5 | Wet, 25·2 |
| 9 18 P.M. | +3·9 | 10 nim. at beginning of observation. |
| 19 | +4·1 | Sky almost entirely clear at end of observation. |
| 20 | +4·3 | Calm. |
| 21 | +4·5 | Bar. 30·10 |
| 22 | +4·7 | Dry, 20·0 |
| 23 | +4·9 | Wet, 19·0 |
| 24 | +4·6 | |

November 26, 1862.
Station Electrometer.
All these observations taken with short pipe.

| | Electricity. | Remarks. |
|---|---|---|
| h. m. | | |
| 7 53 A.M. | −5·8 | Raining steadily, but not heavily. |
| 54 | −5·4 | 10 nim. |
| 55 | −4·8 | 1 E. |
| 56 | −3·6 | Bar. 29·88 |
| 57 | −3·5 | Dry, 38·0 |
| 58 | −3·0 | Wet, 37·4 |
| 59 | −3·0 | |
| 8 32 | −20·2 | Rain and cloud as above. |
| 33 | −22·0 | 1 S.E. |
| 34 | −22·0 | Bar. 29·88 |
| 35 | −22·0 | Dry, 38·7 |
| | | Wet, 38·1 |
| 2 19 P.M. | +12·8 | Thick mist, calm. |
| 20 | + 4·0 | Bar. 29·64 |
| 20½ | + 7·9 | Dry, 40·5; Wet, 40·1 |
| 21 | +14·2 | Raining. |
| 21½ | +17·2 | |
| 22 | +41·7 | |
| 23 | +68·5 | |
| 23½ | +75·6 | Rain heavier. |
| 24 | +70·1 | |
| 24½ | +70·1 | |
| 25 | negative out of range, stronger than −28·3 | Rain still heavy. |

Portable Electrometer.

| | Electricity. | Remarks. |
|---|---|---|
| h. m. | | |
| 2 29½ P.M. | −3·6 | Raining lightly. |
| 30 | −3·8 | |
| 31 | −3·1 | |
| 32 | −3·3 | |
| 33 | −3·3 | |
| 34 | −4·0 | |
| 35 | −4·0 | |
| 36 | −4·0 | |
| 37 | −4·0 | |
| 38 | −4·1 | |
| 39 | −4·1 | |
| 40 | −4·1 | Not raining. |
| 41 | −4·1 | |
| 42 | −3·3 | |
| 43 | −2·6 | |

TABLE I. (*continued*).

November 26, 1862.
Portable Electrometer.
All these observations taken with short pipe.

| | Electricity. | Remarks. |
|---|---|---|
| h. m. | | |
| 2 44 | −3·4 | |
| 45 | +2·6 | |
| 45½ | +5·0 | Rain beginning. |
| 46 | +2·1 | |
| 47 | +1·3 | |
| 48 | +1·4 | |
| 51 | +0·6 | Rain heavy. |
| 52 | −0·1 | Rain lighter. |
| 53 | −0·8 | |
| 54 | −0·8 | |
| 55 | −0·8 | Bar. 29·62 |
| 56 | −0·8 | Dry, 41·0 |
| 57 | −0·6 | Wet, 40. |
| 3 3 P.M. | −2·0 | Raining. |
| 4 | −2·8 | Mist clearing up. |
| 5 | −2·7 | |
| 6 | +4·5 | Mist gone. |
| 7 | +6·9 | Very heavy rain. |
| 7½ | +6·9 | ” ” |
| 8 | +6·1 | ” ” |
| 9 | +6·9 | Heavy rain. |
| 10 | −4·7 | Very heavy rain. |
| 11 | −8·7 | ” ” |
| 12 | +0·8 | ” ” |
| 13 | +6·9 | ” ” |
| 14 | +5·0 | Heavy rain. |
| 15 | −0·2 | ” ” |
| 16 | −0·9 | Very heavy rain. |
| 17 | −1·9 | ” ” |
| 18 | −2·5 | ” ” |
| 19 | −3·5 | ” ” dark. |
| 20 | −3·5 | ” ” |
| 21 | −2·6 | ” ” |
| 22 | −3·1 | ” ” |
| 23 | −1·5 | Heavy rain. |

November 26, 1862.
Portable Electrometer.
All these observations taken with short pipe.

| | Electricity. | Remarks. |
|---|---|---|
| h. m. | | |
| 3 24 | +0·2 | Wind N.W. 1 |
| 25 | −0·9 | Heavy rain. |
| 26 | −3·1 | Very heavy rain. |
| 27 | −2·6 | ” ” |
| 28 | −3·5 | ” ” |
| 29 | −3·5 | ” ” |
| 30 | −2·6 | Very heavy rain. Bar. 29·61 Dry, 41·4 Wet, 41·6 Rather misty. Flash of lightning and peal of thunder at 4h. 2m. P.M. |
| 4 4 | −5·4 | Needle trembling. |
| 5 | −3·9 | Very heavy rain. |
| 6 | −0·4 | ” ” |
| 7 | −0·4 | Heavy rain. |
| 8 | −0·1 | Moderate rain. |
| 9 | −0·4 | |

Peal of thunder at 4h. 17m.
·6 of rain fell before 6 P.M.

Station Electrometer.

| | | |
|---|---|---|
| 9 47 P.m. | +0·1 | 10 nim. |
| 48 | +0·1 | 3 S.W. |
| 49 | +0·3 | Bar. 29·42 |
| 52 | +0·3 | Dry, 50·5 |
| 53½ | +0·5 | Wet, 50·0 |
| 54½ | +0·5 | |

TABLE II.—*Observations during Rain.*

| | | Electricity. | | | |
|---|---|---|---|---|---|
| | | Mean. | Highest. | Lowest. | Remarks. |
| Oct. | h m | | | | |
| 11 | 8 11 A.M. | + 5·0 | + 5·5 | + 4·6 | Light rain. |
| | 9 56 | + 2·4 | + 3·1 | + 1·6 | Light rain. |
| 13 | 4 21 P.M. | + 2·3 | + 2·6 | + 2·1 | Light rain. |
| | 7 23 | + 0·9 | + 1·0 | + 0·8 | Rain. |
| | 8 57 | + 0·4 | + 0·7 | + 0·3 | Rain. |
| 14 | 7 3 A.M. | + 3·8 | ...... | ...... | Fine rain. |
| | 9 37 | + 5·3 | + 5·3 | + 5·2 | Scotch mist. |
| 17 | 2 15 P.M. | + 2·0 | + 2·7 | + 1·3 | Fine rain. |
| | 10 15 | + 2·6 | + 3·2 | + 2·1 | Light rain. |
| 20 | 7 30 A.M. | − 1·3 | − 0·1 | − 2·7 | Light rain. |
| | 7 52 | + 6·2 | + 7·4 | + 4·6 | Rain and mist. |
| | 3 15 P.M. | − 5·2 | + 0·4 | −11·6 | Light shower. |
| 22 | 1 15 | + 0·2 | + 1·0 | − 0·1 | Rain. |
| | 2 45 | + 3·6 | + 4·1 | + 3·0 | Mist and fine rain. |
| | 4 0 | + 3·9 | + 5·8 | + 2·6 | Light rain. |
| 23 | 2 0 P.M. | + 2·6 | + 2·9 | + 1·9 | A few drops. |
| 27 | 2 25 P.M. | − 6·5 | − 3·1 | − 9·9 | Heavy rain. |
| | 2 32 | −13·8 | −10·8 | −18·5 | Heavy rain. |
| | 2 43 | −19·8 | −13·9 | −24·7 | Shower at end of observation. |
| Nov. | | | | | [and close. |
| 6 | 3 58 P.M. | − 1·8 | − 1·1 | − 2·0 | Heavy rain, gloomy, |
| | 5 31 | − 1·0 | − 0·9 | − 1·2 | Heavy rain. |
| | 9 8 | + 0·9 | + 1·1 | + 0·6 | Rain ceasing. |
| 8 | 8 0 A.M. | + 2·5 | + 3·0 | + 1·9 | Rain. [ing to heavy. |
| | 11 47 | + 3·0 | + 3·9 | + 1·6 | Light rain, increas- |
| | 11 52 | + 2·5 | + 4·0 | + 0·1 | Rain lighter. |
| | 11 57 | − 0·7 | + 0·5 | − 1·5 | Rain lighter. |
| 12 | 4 8 P.M. | + 1·9 | + 2·0 | + 1·8 | Light rain. |
| | 9 4 | + 1·4 | + 1·7 | + 1·1 | Light rain. |
| 13 | 7 41 A.M. | − 1·6 | − 0·2 | − 2·3 | Light rain. |
| | 7 48 | + 0·8 | + 1·6 | + 0·1 | Light rain. |
| 17 | 2 13 P.M. | −20·4 | −13·2 | −25·0 | Rain. |
| | 2 23 | −20·1 | −11·4 | −29·7 | Rain. |
| | 2 30 | −38·5 | −31·5 | −42·5 | Rain. |
| | 2 36 | −41·5 | −34·5 | −46·1 | Heavy rain. |
| | 8 42 | − 5·6 | − 4·2 | − 7·2 | Rain. |
| 19 | 9 8 P.M. | − 2·2 | + 0·3 | − 5·6 | Heavy rain. [and close). |
| 20 | 7 37 A.M. | + 4·1 | + 5·0 | + 3·4 | Rain (very dark |

TABLE II. (*continued*).

| | | Electricity. | | | |
|---|---|---|---|---|---|
| | | Mean. | Highest. | Lowest. | Remarks. |
| Nov. | h m | | | | |
| 20 | 9 5 A.M. | −21·6 | −21·4 | −24·2 | Heavy rain. |
| | 9 22 | −32·0 | −28·9 | −34·3 | Heavy rain. |
| | 9 51 | −29·2 | −27·6 | −30·9 | Heavy rain. |
| | 9 5 P.M. | + 3·3 | + 3·5 | + 3·0 | Rain; very dark. |
| 22 | 2 2 P.M. | + 1·8 | + 1·8 | + 1·8 | Rain. |
| | 5 37 | − 1·6 | − 1·4 | − 1·9 | Heavy rain. |
| | 8 36 | + 0·5 | + 0·7 | + 0·3 | Heavy rain. |
| 26 | 7 56 A.M. | − 4·8 | − 3·4 | − 6·6 | Rain. |
| | 8 34 | −24·7 | −23·1 | −25·2 | Rain. |
| | 2 23 P.M. | +43·7 | +86·4 | + 4·6 | Heavy rain and thick mist, changing in a minute from +86·4 to strong negative. |
| | 2 34 | −34·7 | −28·9 | −38·3 | Light rain and mist. |
| | 2 42 | −33·6 | −24·3 | −38·3 | Not raining; mist. |
| | 2 47 | +20·3 | +24·3 | + 5·6 | Rain and mist. [up. |
| | 2 56 | −11·9 | − 0·9 | −26·1 | Rain; mist clearing |
| | 3 8 | +58·5 | +64·4 | +42·0 | Very heavy rain; mist gone. |
| | 3 10 | −43·9 | ...... | ...... | Very heavy rain. |
| | 3 11 | −81·2 | ...... | ...... | Very heavy rain. |
| | 3 13 | +39·5 | +64·4 | + 7·5 | Very heavy rain. |
| | 3 18 | −21·2 | − 1·9 | −32·7 | Very heavy rain. |
| | 3 26 | −20·5 | + 1·9 | −32·7 | Very heavy rain; dark. A flash of lightning and peal of thunder between these observations. |
| | 4 6 | −16·5 | − 0·9 | −50·4 | Heavy rain. A peal of thunder at 4h. 17m. P.M., being after the observation. Needle agitated during the early part of observation. |
| Dec. 16 | 1 56 P.M. | + 1·4 | + 1·5 | + 1·2 | Mist and fine rain. |
| Jan. 6 | 9 15 P.M. | + 3·3 | + 4·2 | + 2·5 | Drizzle. |
| 7 | 10 30 A.M. | − 3·4 | + 0·8 | −11·1 | Light rain. |
| 11 | 9 30 A.M. | −23·9 | −11·9 | −30·4 | Raining. |
| | 2 0 P.M. | −13·6 | −10·7 | −14·9 | Raining. |
| 16 | 4 15 P.M. | + 1·2 | + 1·9 | − 0·6 | Raining. |
| | 11 30 | − 7·7 | − 6·5 | − 8·6 | Raining. |

TABLE II. (*continued*).

| | | Electricity. | | | |
|---|---|---|---|---|---|
| | | Mean. | Highest. | Lowest. | Remarks. |
| Jan. | h m | | | | |
| 29 | 8 15 A.M. | − 6·7 | − 4·8 | − 9·8 | Very heavy rain. |
| | 2 15 P.M. | + 2·7 | + 4·7 | − 0·9 | Rain. |
| | 9 15 | − 5·7 | − 5·4 | − 6·0 | Light rain. |
| Feb. | | | | | |
| 6 | 6 0 P.M. | −30·8 | −27·5 | −36·5 | Pouring rain. |
| | 7 15 | −32·6 | −31·2 | −35·2 | Pouring rain. |
| | 9 15 | −21·8 | −18·9 | −24·4 | Pouring rain. |
| 20 | 8 40 A.M. | − 3·1 | − 1·2 | − 3·9 | Rain. |
| 27 | 2 41 P.M. | −20·9 | −19·1 | −24·3 | Rain. |
| | 2 46 | − 8·9 | − 2·8 | −12·0 | Rain. |
| | 2 57 | +16·4 | +21·5 | +12·1 | Rain. |
| April | | | | | |
| 5 | 5 11 P.M. | + 4·3 | + 4·6 | + 3·7 | Drizzle, rather misty. |
| 6 | 8 45 A.M. | −25·7 | −21·0 | −33·2 | Rain, rather misty. |

*Observations during Snow.*

| | | | | | |
|---|---|---|---|---|---|
| Nov. | h m | | | | |
| 10 | 9 3 P.M. | + 0·9 | ...... | ...... | Snowing lightly. |
| 27 | 1 0 P.M. | − 0·5 | − 0·1 | − 0·7 | Snowing lightly. |
| | 1 7 | + 0.5 | + 0·6 | + 0·3 | Snowing heavily. |
| | 2 14 | + 1·9 | + 2·3 | + 1·7 | Snowing lightly. |
| Dec. | | | | | |
| 1 | 2 16 P.M. | + 0·3 | + 0·6 | + 0·2 | Snowing. |
| 4 | 8 44 A.M. | + 2·7 | + 2·8 | + 2·5 | Snowing lightly. |
| | 1 53 P.M. | + 3·8 | + 4·0 | + 3·4 | Snowing lightly. |
| 6 | 8 7 A.M. | +24·8 | +26·0 | +22·6 | Snowing fast. |
| | 9 25 | +31·2 | +35·8 | +30·0 | Snowing fast. |
| 9 | 8 13 A.M. | + 4·0 | + 5·1 | + 3·4 | Snowing. |
| 20 | 9 5 P.M. | + 6·9 | + 8·2 | + 6·1 | Snowing lightly. |
| | 9 13 | +13·1 | +21·5 | + 6·8 | Snowing lightly. |
| Jan. | | | | | |
| 7 | 2 30 P.M. | +19·3 | +31·2 | +14·8 | A little snow. |
| | 3 0 | +22·1 | +34·3 | +15·6 | A little snow. |
| 12 | 3 0 P.M. | + 2·6 | + 3·0 | + 2·1 | Snowing lightly. |
| 14 | 9 15 P.M. | +18·9 | +20·1 | +18·4 | Snowing lightly. |

**Table II.** (*continued*).

| | | Electricity. | | | |
|---|---|---|---|---|---|
| | | Mean | Highest. | Lowest. | Remarks. |
| Jan. | h m | | | | |
| 27 | 8 30 A.M. | + 7·6 | + 7·8 | + 7·4 | Snowing. |
| | 2 15 P.M. | +16·4 | +17·3 | +15·6 | Snowing. |
| | 4 45 | +11·0 | +12·1 | + 9·9 | Snowing. |
| | 9 30 | + 2·7 | + 2·7 | + 2·6 | Snowing. |
| Feb. | | | | | |
| 3 | 9 30 A.M. | +35·0 | +49·3 | +27·5 | Snowing lightly. |
| 6 | 2 15 P.M. | +26·4 | +30·6 | +23·2 | Snowing. |
| 10 | 9 0 A.M. | +27·8 | +31·4 | +23·5 | Snowing fast. |
| | 11 0 P.M. | +83·4 | +92·7 | +74·2 | Snowing, with violent N. wind. |
| | 11 15 | +38·3 | +46·4 | +23·5 | |
| 12 | 2 13 P.M. | +10·1 | +10·7 | + 9·5 | Snowing without intermission. |
| | 4 24 | + 3·6 | + 3·7 | + 3·5 | |
| 13 | 8 56 A.M. | +13·3 | +17·6 | + 9·6 | Snowing & drifting. |
| 21 | 8 44 A.M. | + 8·2 | +11·2 | + 5·1 | Snowing lightly. |
| | 2 38 P.M. | +35·7 | +48·6 | +27·6 | Snow directly after. |
| 28 | 9 2 A.M. | + 4·9 | + 5·7 | + 4·1 | Snowing lightly. |
| | 2 26 P.M. | + 5·2 | + 7·2 | + 3·6 | Snowing lightly. |
| March | | | | | |
| 3 | 2 29 P.M. | + 8·7 | +10·0 | + 7·9 | Snowing. |
| | 9 28 | +17·5 | +30·6 | + 7·6 | Snowing lightly. |
| | 9 41 | +15·6 | +21·3 | +12·7 | Snowing lightly. |
| 8 | 5 12 P.M. | +11·1 | +13·2 | + 7·2 | Snowing. |
| | 8 46 | + 7·5 | + 8·1 | + 6·6 | Snowing. |
| 11 | 9 6 A.M. | + 8·8 | + 9·7 | + 8·1 | Snowing. |
| | 2 33 P.M. | + 7·0 | + 7·9 | + 6·4 | Snowing. |
| | 9 35 | + 5·4 | + 6·3 | + 4·7 | Snowing lightly. |
| 31 | 9 35 P.M. | Positive, out of range, violent agitation of needle, sparks passing spontaneously. | | | Snowing, with stiff breeze from S.E. |
| | 9 43 | +63·3 | +85·3 | +24·1 | |
| April | | | | | |
| 2 | 2 7 P.M. | +35·0 | +42·2 | +28·5 | Snowing. |
| | 4 9 | +26·5 | +31·7 | +24·8 | Snowing. |
| | 4 21 | +28·7 | +31·7 | +26·5 | Snowing. |
| | 4 25 | +20·1 | +20·8 | +18·6 | Snowing. |
| | 4 30 | +29·8 | +30·6 | +29·0 | Snowing. |
| | 4 35 | +37·0 | +40·3 | +34·5 | Snowing. |
| | 4 40 | +41·3 | +43·2 | +39·5 | Snowing. |
| | 4 46 | +41·5 | +45·0 | +37·0 | Snowing. |

TABLE II. (*continued*).

| | | Electricity. Mean. | Highest. | Lowest. | Remarks. |
|---|---|---|---|---|---|
| April 7 | h m<br>8 19 A.M. | −(29·9) | −10·9 | −(65·2) | Snowing. |
| | 9 6 | +57·5 | +65·7 | +53·5 | Snowing. |
| | 9 32 | +22·6 | +28·7 | + 6·5 | Snowing. |
| | 10 5 | + 1·5 | + 1·6 | + 1·5 | Snowing very lightly. |
| | 2 42 P.M. | − 1·1 | − 0·9 | − 1·3 | Snowing lightly. |
| | 2 53 | + 3·1 | + 4·7 | + 1·4 | Snowing. |
| | 9 25 | + 8·6 | + 9·3 | + 7·9 | Snowing lightly. |
| | | *Observations during Hail.* | | | |
| Nov. 7 | 2 28 P.M. | + 4·1 | + 4·5 | + 3·5 | Hail. |
| | 4 30 | strong negative. | | | Hail. |
| | 4 56 | + 3·9 | + 4·0 | + 3·7 | Hail. |
| | 6 1 | −13·3 | 0·0 | −20·4 | Hail. |
| | 6 10 | − 6·2 | − 3·4 | − 9·9 | Hail. |
| | 6 25 | −10·5 | − 2·2 | −21·0 | Hail. |
| | 6 41 | −13·3 | − 9·9 | −19·8 | Hail. |
| | 6 50 | − 7·4 | − 5·6 | − 9·6 | Hail. |
| | 7 1 | −16·1 | − 9·9 | −19·8 | Hail. |
| | 7 8 | −28·4 | −25·3 | −30·0 | Hail lighter. |
| | 11 12 | + 1·8 | + 1·9 | + 1·6 | Hail light. |
| March 9 | 8 47 A.M. | −22·1 | −10·2 | −33·0 | Hail. |
| April 8 | 8 47 A.M. | − 3·2 | − 1·2 | −11·1 | Hail immediately [after. |
| | | *Observations during Sleet.* | | | |
| Feb. 6 | 3 45 P.M. | + 5·4 | + 7·1 | + 4·3 | Sleet. |
| March 9 | 1 8 P.M. | + 1·0 | + 1·1 | + 0·2 | Sleet. |
| | 1 11 | − 0·5 | − 0·4 | − 0·6 | Sleet. |
| | | *Observations during Fog.* | | | |
| Nov. 28 | 11 7 P.M. | + 7·8 | + 7·9 | + 7·7 | Fog. |
| 29 | 8 28 A.M. | +10·6 | +13·8 | + 8·1 | Dense fog. |
| | 10 22 | + 7·1 | + 7·1 | + 7·1 | Dense fog. |
| Dec. 27 | 8 45 P.M. | + 7·1 | + 8·3 | + 6·1 | Dense fog. |
| Jan. 3 | 9 45 A.M. | +13·1 | +15·1 | +10·7 | Fog. |
| | 12 45 P.M. | +18·4 | +19·7 | +16·2 | Fog. |
| | 2 0 | + 1·2 | + 2·0 | + 0·6 | Mist. |
| | 5 0 | +12·8 | +18·6 | + 5·3 | Fog. |
| | 9 15 | +20·0 | +23·2 | +16·7 | Very dense fog. |
| 4 | 9 0 A.M. | +10·7 | +11·3 | + 9·5 | Fog. |
| | 2 15 P.M. | +18·8 | +22·0 | +17·0 | Fog. |
| | 5 0 | +24·8 | +26·2 | +22·3 | Dense fog. |

TABLE III.—*Diurnal Range.*

| Hour. | October. | | November. | | December. | | January. | | February. | | March. | | All six months. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Number of Observations. | Mean Potential. | Number of Observations. | Mean Potential. | Number of Observations. | Mean Potential. | Number of Observations. | Mean Potential. | Number of Observations. | Mean Potential. | Number of Observations. | Mean Potential. | Whole Number of Observations. | Mean of all Observations. | Mean of Means. | Reduced Mean. |
| 6 to 7 A.M. | 1 | +2·1 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 1 | +2·1 | +2·1 | + ·63 |
| 7 to 8 | 13 | +2·7 | 12 | +3·1 | 5 | +2·5 | ... | ... | ... | ... | 3 | +4·1 | 33 | +3·0 | +3·1 | + ·85 |
| 8 to 9 | 5 | +5·0 | 7 | +3·8 | 15 | +4·9 | 15 | + 4·7 | 16 | +7·0 | 13 | +5·9 | 71 | +5·4 | +5·2 | +1·20 |
| 9 to 10 | 11 | +3·6 | 6 | +3·8 | 3 | +3·6 | 9 | + 3·6 | 9 | +4·9 | 10 | +7·8 | 48 | +4·8 | +4·6 | +1·09 |
| 10 to 11 | 3 | +3·5 | 1 | +3·1 | 1 | +2·0 | 5 | + 3·3 | 1 | +4·1 | ... | ... | 11 | +3·3 | +3·2 | + ·85 |
| 11 to 12 | ... | ... | 3 | +4·2 | 1 | +2·6 | 1 | + 4·0 | 2 | +5·3 | 3 | +4·9 | 10 | +4·4 | +4·2 | +1·03 |
| 12 to 1 P.M. | ... | ... | 1 | +2·5 | ... | ... | 3 | + 3·8 | 1 | +6·3 | 1 | +4·8 | 6 | +4·2 | +4·4 | + ·92 |
| 1 to 2 | 2 | +4·2 | 5 | +2·7 | 6 | +6·4 | 7 | + 5·2 | 2 | +6·0 | 3 | +4·4 | 25 | +4·9 | +4·8 | +1·19 |
| 2 to 3 | 13 | +4·1 | 19 | +3·1 | 15 | +4·5 | 19 | + 4·1 | 19 | +5·6 | 18 | +5·2 | 103 | +4·5 | +4·4 | +1·04 |
| 3 to 4 | 1 | +3·1 | 5 | +2·2 | 1 | +3·8 | 2 | +12·4 | ... | ... | ... | ... | 9 | +4·7 | +5·4 | +1·27 |
| 4 to 5 | 6 | +3·0 | 1 | +2·8 | ... | ... | 3 | + 4·2 | 2 | +5·4 | 4 | +5·3 | 16 | +4·1 | +4·1 | + ·94 |
| 5 to 6 | 5 | +3·3 | ... | ... | ... | ... | 2 | + 5·9 | 2 | +7·2 | 1 | +4·0 | 10 | +4·7 | +5·1 | +1·12 |
| 6 to 7 | 2 | +4·4 | 1 | +5·6 | ... | ... | 4 | + 4·2 | ... | ... | 1 | +4·7 | 8 | +4·5 | +4·7 | +1·18 |
| 7 to 8 | 3 | +2·3 | ... | ... | ... | ... | 1 | + 2·9 | 1 | +6·0 | ... | ... | 5 | +3·2 | +3·7 | + ·78 |
| 8 to 9 | 6 | +3·0 | 6 | +3·0 | 7 | +3·5 | ... | ... | 1 | +5·1 | ... | ... | 20 | +3·3 | +3·6 | + ·91 |
| 9 to 10 | 12 | +2·4 | 9 | +2·1 | 13 | +2·3 | 20 | + 3·2 | 22 | +5·1 | 13 | +5·4 | 89 | +3·6 | +3·4 | + ·79 |
| 10 to 11 | 4 | +2·8 | 2 | +2·0 | ... | ... | 1 | + 2·5 | 1 | +3·8 | 4 | +4·3 | 12 | +3·2 | +3·1 | + ·77 |
| 11 to 12 | 1 | +1·9 | ... | ... | 1 | +4·4 | 3 | + 4·7 | 2 | +3·6 | 2 | +4·0 | 9 | +3·9 | +3·7 | + ·87 |
| Before noon. | 33 | +3·4 | 29 | +3·5 | 25 | +4·1 | 30 | + 4·1 | 28 | +6·1 | 29 | +6·3 | 174 | +4·3 | | |
| Noon to 6 P.M. | 27 | +3·7 | 31 | +2·9 | 22 | +5·0 | 36 | + 4·9 | 26 | +5·8 | 27 | +5·1 | 169 | +4·5 | | |
| After 6 P.M. | 28 | +2·7 | 18 | +2·6 | 21 | +2·8 | 29 | + 3·4 | 27 | +5·0 | 20 | +5·0 | 143 | +3·6 | | |
| At all hours. | 88 | +3·3 | 78 | +3·1 | 68 | +4·0 | 95 | + 4·2 | 81 | +5·6 | 76 | +5·5 | 486 | +4·3 | | |

TABLE IV.—*Comparisons of Match and Water.*

April 2nd, 1863. Snowing. 2 st. 10 nim. Barom. 29·49. Dry, 30·7; Wet, 29·4.

| Match. h m | | | Water. h m | | |
|---|---|---|---|---|---|
| 4 20 P.M. | +31·7 | 28·72 | 4 24 P.M. | +20·7 | 20·08 |
| 20½ | 28·7 | | 24½ | 18·6 | |
| 21 | 28·7 | | 25 | 19·9 | |
| 21½ | 28·0 | | 25½ | 20·8 | |
| 22 | 26·5 | | 26 | 20·4 | |
| 4 29 P.M. | +29·0 | 29·80 | 4 33½ | +38·3 | 37·00 |
| 29½ | 29·7 | | 34 | 40·3 | |
| 30 | 29·6 | | 34½ | 37·2 | |
| 30½ | 30·6 | | 35 | 34·7 | |
| 31 | 30·1 | | 35½ | 34·5 | |
| 4 39 P.M. | +40·7 | 41·28 | 4 45 | +42·5 | 41·54 |
| 39½ | 43·2 | | 45½ | 45·0 | |
| 40 | 40·5 | | 46 | 44·5 | |
| 40½ | 39·5 | | 46½ | 37·0 | |
| 41 | 42·5 | | 47 | 38·7 | |

$$\text{Mean for Match} = \frac{99·80}{3} = 33·27.$$

$$\text{Mean for Water} = \frac{98·62}{3} = 32·87.$$

April 28th, 1863. Calm. 2 ci.-cu. Barom. 29·74. Dry, 36·6. Wet, 34·6.

| Water. h m | | | Match. h m | | |
|---|---|---|---|---|---|
| 7 47 A.M. | +7·3 | 7·28 | 7 55 A.M. | +6·9 | 6·82 |
| 48 | 7·4 | | 55½ | 6·8 | |
| 49 | 7·2 | | 56 | 6·8 | |
| 50 | 7·2 | | 56½ | 6·8 | |
| 51 | 7·3 | | 57 | 6·8 | |
| 8 0 A.M. | +6·7 | 6·44 | 8 6 A.M. | +7·7 | 7·96 |
| 0½ | 6·6 | | 6½ | 7·8 | |
| 1 | 6·3 | | 7 | 7·9 | |
| 1½ | 6·3 | | 7½ | 8·1 | |
| 2 | 6·3 | | 8 | 8·3 | |
| 8 11 A.M. | +8·4 | 8·34 | | | |
| 11½ | 8·4 | | | | |
| 12 | 8·3 | | | | |
| 12½ | 8·4 | | | | |
| 13 | 8·2 | | | | |

$$\text{Mean for Match} = \frac{14·78}{2} = 7·39.$$

$$\text{Mean for Water} = \frac{22·06}{3} = 7·35.$$