passed over the platform of this bridge without the slightest undulatory or oscillating motion having been produced.

We are hence enabled to infer, without looking to improvements in detail, which will naturally be introduced, that a platform so constructed and so suspended as the one at Kieff, is capable of sustaining the passage of railway trains at a moderate velocity, and within a reasonable cost of construction; and taking the example of the wire bridge in America, and of this wrought-iron chain bridge in Russia, it may be legitimately concluded, that the adapting of suspension bridges to railway purposes is perfectly practicable.

The extent to which this application may be made can scarcely be defined *à priori*, but the writer ventures, from his own experience, to state his opinion, that where the span of the required bridge must exceed 300 feet, the suspension principle should be adopted for the sake of economy.

It would be extending these observations far beyond the bounds assigned to such meetings as these, to go further into the details, and therefore, however tempting the opportunity, we must abstain from entering upon the subject of the modern mode of obtaining foundations and forming river-piers, which mode would greatly influence any selection between a fixed or a suspension bridge. Neither must we even touch upon the choice between the wire-rope and the wrought-iron plate chain, as the means of suspending the platform, though it is obvious that where the span becomes very large, the superior lightness of the wire is a great inducement to decide the preference for it over the wrought iron.

The proportion between the chord and the versed sine of the curve of the suspending chain is another point of the highest interest, as relating to the questions of more or less oscillation, and of increase or decrease in the amount of tension, as this proportion varies.

It is sufficient to have brought the general subject of the practicability of adapting suspension bridges to sustain the passage of railway trains before the Mechanical Section of the British Association; and it is to be hoped that this opportunity will not pass away without engineers and the other scientific and practical men now assembled, bringing their judgement and experience to an examination of this very important question.

On Electro-Chemistry. *By* Professor W. A. Miller, *M.D., F.R.S.*

In reporting upon the recent progress of electro-chemical research, the author stated that the inquiries made of late years in the field of electro-chemistry were characterized rather by modifications of the laws previously admitted, than by any fundamental additions to the existing stock of knowledge upon the subject.

Faraday's observations on the exceptional conducting power of solid sulphide of silver, and one or two other substances when heated, had been traced, by the researches of Beetz and Hittorf, to true electrolytic decomposition, which is rendered possible by the somewhat viscous condition produced by heating these bodies. The true electrolytic nature of the decomposition was proved, first by the rise in conducting power, occasioned by rise of temperature (whereas in metals the effect is exactly the reverse); and secondly by the effects of polarization observed upon the electrodes between which such bodies are placed.

Allusion was then made to the experiments by Bunsen on the insulation of metallic bodies by electricity; in the course of which he had shown that in many instances, as in the decomposition of a solution of sesquichloride of chromium, the deposit upon the negative electrode could be made to assume the metallic form by reducing the surface of this plate to dimensions considerably smaller than those of the positive electrode, a result probably owing in part to the secondary decomposition produced in the limited portion of liquid around the wire, whereby the sesquichloride was reduced to the protochloride of chromium and subsequently the metal itself was deposited. This view was rendered probable by observing the effects obtained during the electrolysis of sesquichloride of iron, in which these successive steps could be distinctly observed. In cases in which, like the chloride of manganese, the compound was already in the condition of protochloride, it was unimportant whether or not the negative electrode presented a smaller area than the positive electrode. Attention was called to the fact pointed out by Faraday of the non-existence of more than one electrolyte in a multiple series; thus in the case of the two chlorides of tin, the fused protochloride is an electrolyte, but the bichloride, although a liquid at ordinary temperatures, is not an electrolyte if anhydrous. Yet the bichloride when dissolved in water, itself also not an electrolyte, conducts freely; and a similar result is obtained in other analogous cases.

Referring to the decomposition of salts in solution, the bearings of electrolysis upon Davy's binary theory of the composition of salts were briefly alluded to, and some of the difficulties attending the adoption of this theory in the case of the subsalts were mentioned; these facts, taken in conjunction with those already alluded to in the case of the bichloride of tin, leading the author rather to the view that a salt is to be regarded as a whole, susceptible of decomposition in various modes (just as a crystal may admit of cleavage in two or three different directions according to the method in which the force is applied), and therefore admitting of representation under two or three different rational formulæ, each of which may, under particular circumstances, be advantageously employed.

Results of Thermometrical Observations made at the 'Plover's' Wintering-place, Point Barrow, latitude 71° 21′ *N., long.* 156° 17′ *W., in* 1852–54. *By* John Simpson, *Esq., R.N., F.R.C.S., F.R.G.S., Surgeon of H.M.S. 'Plover.'*

[With a Plate.]

At p. 331 of the ninth volume of the 'Royal Geographical Society's Journal,' 1839, Sir J. Richardson, in reference to Sir David Brewster's discussions of an hourly register of the temperature at Leith Fort, says:—

"Convinced of the importance of investigating the phænomena of diurnal temperature in various latitudes, I have thought that a discussion of the thermometrical observations made on Sir E. Parry's several voyages would be a service rendered to science." Following the lead thus indicated, it has appeared to me that the results of the observations made at Point Barrow would be a valuable though small addition to those given by Sir J. Richardson, to whose form of tables I have adhered, only making additions, as the means of the *decades* or three divisions of each month, where I thought this could be done without marring the original purpose of the table.

The observations now offered were made with great accuracy, and possess the advantage of having been registered every hour at one spot from the 3rd of September 1852 to the 7th of August 1853, and for a few days before and after these dates in the neighbourhood, making a complete year, less 21 days. Again, in precisely the same locality, from the 7th of September 1853 to the 19th of July 1854, to which have been added the six first days of September, and one day, the 20th of July, during which the ship was in the immediate neighbourhood, making a second complete year, less 42 days. The ship returned again to the same spot on the 27th of August 1854, and remained four whole days, for which the hourly register gave a mean temperature of 39°·448, serving as a fair guide in estimating the temperature of the last eleven days of August, which accordingly has been assumed to be 39°·448, thus reducing the interval in the last year to thirty-one days.

To fill up the interval of twenty-one days' absence in 1853, the mean temperature of these has been assumed at something between the decades last preceding and first following that period. Thus, the first ten days of August giving a mean of 38°·441, and the first ten of September giving a mean of 32°·146, the second and third decades of August have been assumed as 37° and 35° respectively. In the same manner, to fill up the interval of thirty-one days in the summer of 1854, the second decade of July giving a mean of 38°·287, the mean of the last eleven days is assumed to be 39°. The last eleven days of August having been calculated to give a mean of 39°·448, as already stated, the intervening two decades can, without much risk of error, be assumed at 40°.

The thermometers used throughout the period of observation were made by Adie and Co. of Edinburgh, in February 1848; and having been returned to the Hydrographer's Office, Admiralty, in April 1855, I have no doubt some of them could be obtained there, if required for comparison with any acknowledged standard. There were six of them, numbered from 10 to 15, and remarkably alike in appearance and size. To each was attached a graduated glass scale, on which, besides the number, was cut the maker's name. On application at Messrs. Adie's establishment, Edinburgh, I obtained the following information as to their mode of construction:—

"For spirit thermometers constructed February 1848,—

Before use, colourless alcohol, sp. gr. ·79465.
Before use, coloured „ „ ·79537.
After use, „ „ „ ·79541.

"Points fixed from standard mercury thermometer 62° and 32°. Scale then run down to −56°."

They were on several occasions exposed together to different degrees of cold, and were very uniform in their indications down to the lowest temperatures registered. Subjoined is a table of thermometers compared (p. 161).

It appears from this Table that five of the instruments by Adie indicated a mean of 35°·5 nearly as the freezing-point of mercury, whilst that by Cox of Devonport stood at −41°, and that by Pastorelli at −48°.

Pastorelli, No. 419, had an error of −1°·5 at the freezing-point of water; and at our lowest temperature its indications were 13° below Adie's.

Cox's thermometer, No. 1, had an error of 2° at the freezing-point of water, but at lower temperatures corresponded much more nearly with Adie's. Like Pastorelli's, however, it had the disadvantage of a heavy box-wood scale, preventing it from indicating rapid changes of temperature, which the glass scales of Adie's instruments permitted. Both these were rejected for ordinary use.

The mercurial thermometer used as a standard was Pastorelli, No. 406. This also had a heavy box-wood scale, but I believe was otherwise a good instrument, and, if sufficiently long exposed to a uniform temperature, could be trusted as low as 32° below the zero of Fahrenheit. At that point the

Comparison of Thermometers at low Temperatures.

Maker's Name.	No.	Immersed in Snow and Water.	Exposed to the air, suspended. 15th Oct. 1852.	19th Oct. 1852.	17th Jan. 1853.	19th Jan. 1853.	1st Feb. 1853, a.m.	1st Feb. 1853, p.m.	Feb. 1854.	Mercury freezing and melting.		
		+°	+°	−°	−°	−°	−°	−°	−°	−°	−°	−°
Spirit Thermometers.												
Cox, Devonport. Colour of spirit deep red; boxwood scale	1	30	12	18	32	44	27·5	25	35	41	46·5	49
Pastorelli & Co. Colour deep red; boxwood scale	419	30·5	11	23·5	38	53	34	31·5	41·5	48	56	59
Adie & Son, Edinburgh. Colour pale red; glass scale	10	32	13·5	15·5	32	42	25	22·5	31·2	36	43	46
Ditto ditto	11	32·3	14·5	14	28*	40*	24	22	31·7	34*	43	45·5
Ditto ditto	12	32	14·5	15	30	42	25	22·5	...	...	...	...
Ditto ditto	13	32	14·5	15	...	...	25	22·5	31·2	35·2	43	46
Ditto ditto	14	32	14·5	15	29	41	25	22·5	31·2	35·7	43	46
Ditto ditto	15	32	14	15	28	40	25	22·5	30·5	35·5	42·5	45·5
Mercurial Thermometers.												
Pastorelli & Co. Boxwood scale	406	32·5	9	17	32	...	...	...	...	...	...	...
Simpson, Strand. Boxwood scale	...	32	13	17	32	...	...	...	...	...	...	...

* Adie & Co., No. 11, was the instrument in constant use, and on the 17th and 19th of February, 1853, was in its usual place attached to a post, whilst the others were suspended a little apart. On a subsequent occasion its bulb was immersed in the freezing and melting mercury, when its indication was −34°.

tube seemed to become irregular; and on solidifying, the mercury sank completely into the bulb.

A curious circumstance happened with this instrument on one occasion. Believing the quicksilver in it to be pure, I placed it beside one of Adie's, exposed to the air at a temperature about the freezing-point of mercury, for the purpose of ascertaining the exact degree indicated by Adie's at the moment of solidifying. Whilst attentively watching it, to my surprise the column of mercury suddenly shot up the stem to $-4°$, then slowly but steadily descended into the bulb. Though I heard no sound of the glass cracking, I thought the bulb had given way, and the entrance of air had forced the mercury up the tube; but in this I was mistaken, for having taken it on board and thawed it, nothing wrong could be detected, and it worked as well as before. The explanation which offered itself to my mind was, that the surface of the mercury in the bulb becoming at once solidified, its contracting pressed the central and still fluid portion of the metal into the stem with a jerk, and thence again gradually absorbed it as the process of freezing approached the centre.

Whether these instruments by Adie were absolutely correct seems doubtful. In my Journal I find the following remarks regarding them:—

"Feb. 2, 1854.—Temperature fell to $-39°$ in the night, when I had a good comparison of the thermometers, those of Adie's remaining within a degree of $-39°$, whilst a quantity of quicksilver in a teacup partially froze. The quicksilver remained out all night, and did not become completely fluid again until 9 a.m., when the temperature had been some hours at $-36°$, $-35°$, and $-34°$. A mercurial thermometer placed in it also stood at $-34°$, and the same one now blackened for exposure to the sun's rays and enclosed in a glass case has fallen to $-52°$, *i. e.* become solid, whilst the one (Adie, 11) in constant use shows only $-37°{\cdot}5$."

"Feb. 3, 1854.—One of the new thermometers was kept in the vessel in which the quicksilver was exposed; and it remained all day at $-36°$, whilst its fellows showed $-39°$ and $-40°$. On removing it a small portion of the solidified metal adhered to the bulb and still remains attached, although the temperature indicated by it and the others is $-37°$. The result of this is either that the mercury is impure, which I believe is not the case, or the instruments have an error of 3 or 4 degrees."

"Feb. 4.—The mercury adhering in the solid state to the bulb of the spirit thermometer remained in the same state until half-past two this morning, when it dropped off, that and the four other thermometers by Adie showing $-36°$."

From these experiments, I incline to the belief that an error of 3 or 4 degrees will be found to exist in these instruments at the freezing-point of mercury. The quantity of metal in the teacup was several ounces, and therefore too large, unless its indications be taken while partially solid either in freezing or melting. I have considered the dropping off of the small portion adhering to the bulb of the spirit thermometer as the best index.

The mercurial thermometer alluded to as descending to $-52°$, was one attached to a scale apparently graduated regardless of accuracy; but from some experiments made with it, I considered the tube was tolerably uniform in calibre; I therefore removed the scale, and attached another reaching down to within half an inch of its bulb. This scale was graduated by comparison with Pastorelli (mercurial), as low as $-32°$, and thence the graduation was continued to the bottom of the scale in the same proportion, bringing it down to $-50°$, about two degrees below which the mercury always stood when solid.

The spirit thermometer for use was placed in a tin cylinder $2\frac{1}{2}$ inches in diameter, with a longitudinal opening through which it could be easily read; this cylinder was kept in another of the same material which was painted white, seven inches in diameter, having a conical projecting roof, and a flat bottom, with numerous small openings in both, and a door opening like a common tin lantern: this again, with its door facing the north, was fixed to a stout stake, placed in the ice at a distance of 90 feet to the eastward of the ship. The arrangement so made was to protect the instrument from the wind and snow-drift, and from the influence of the sun, while admitting the easy access of air. To have placed it further from the ship would have been to put it in the way of natives, who might steal or break it; and as the ship's hull was banked round with snow, and the prevailing winds came in from the N.E., it was thought the effect of her presence on the thermometer at that distance would be little or none.

The position of the ship at Point Barrow was at the extremity of a narrow point or spit of gravel, which at no part rose more than 6 feet above the ordinary sea-level, and about five miles distant from the mainland of the American continent. The coast trended on one side to the S.W., and on the other to the E.S.E., and was uniformly low and flat in the latter direction for 150 miles, whilst to the S.W. there was no elevation near the coast approaching 100 feet for a like distance. The mainland to the south had not been explored for more than twenty or thirty miles, to which extent it was perfectly flat, and the natives described it as quite level for several days' journey further, beyond which it became hilly, and far south mountainous. The climate, therefore, may be described as maritime or almost insular, and was not subject to such extremes of temperature as the land. This was ascertained by the register kept by Capt. Maguire on a journey to the hunting-grounds during the coldest part of the year, the temperatures recorded by him being generally lower than those taken at the ship during his absence. In the summer the shooting-parties recorded higher temperatures on the land than were observed at the ship.

The long polar night, or observed absence of the sun, was 69 days, from November to January; and the continued presence of the luminary in the summer, owing to refraction, embraced a period of 74 days.

The calculations for the following Tables were made at intervals of leisure, and, though simple enough, were very tedious and open to error; but this, I think, has been successfully avoided by the various cross checks I used. Each mean in the first twelve Tables is deduced from the sums of the observations, and in no instance from results already obtained. Some exceptions to this rule were made in producing the means of the two years combined.

Table I. gives the mean temperature of each day, and the mean of every 10 days (or, when the month consists of 31 days, the last division is the mean of 11, and the latter portion of February is the mean of only 8 days); at the foot of the table the mean of each month, and at the foot of the page the mean temperature of the whole year, as ascertained from 8760 observations, those of the last 21 days of August having been intercalated as already stated.

In this Table a remarkable rise of temperature will be observed before and after the winter solstice. The month of December set in cold the first 10 days, giving a mean of $22\frac{1}{2}$ degrees below zero, whilst the second decade presented a mean of only half a degree below that point; and the last 11 days rose to $6\frac{1}{3}$ above it. The mean of December is little more than one-tenth of a degree lower than that of October, and is nearly 4 degrees higher than November: this was owing to a southerly gale which almost produced a thaw for 3 days at the winter solstice, and had the effect of driving the ice completely off the coast, leaving nothing visible from the beach to the furthest range of vision, east, north and west, but the open ocean and a water sky. This was succeeded by intense cold in January, when the sea speedily froze over again.

The periods at which the mean temperature of the year occurred in spring and autumn were at the middle of October and April, or rather more than 20 days after the equinoxes; but the period of greatest cold was a month after the winter solstice, and the greatest summer heat appears to have occurred in the beginning of August, or 40 days after midsummer.

TABLE II. gives the highest and lowest single temperatures of each month, the means of the highest and lowest daily temperatures for each month, and the means of these or of the daily extremes.

This Table shows that the greatest monthly range of temperature occurred in April, and was no less than 73 degrees, only 22 short of the range for the whole year, which was 95; running from $+52^\circ$ in summer to -43° in winter. The mean of these two single temperatures was 3 degrees below the true mean of the year, whilst the mean of the daily maxima and minima accorded with the true means to nearly within half a degree.

TABLE III. shows the mean temperature of every hour for each month. By this, the hottest and coldest periods of the day may be seen, as well as the mean daily range for the month. The coldest and hottest times of the day were usually a little after 2 o'clock a.m., and a little before 2 o'clock p.m.; but the time at which the mean temperature of the month occurred was rather before 7 a.m. and p.m. In this the daily changes of temperature corresponded with the annual, in the intervals between the periods of the extremes and the means *following being shorter* than the intervals between the periods of the extremes and the means *preceding* them. The greatest range between the day and night temperatures took place in April, and was 11 degrees.

TABLE IV. shows the mean temperature of every pair of opposite hours. From this Table it does not appear at first sight that any pair of similar hours can be selected as corresponding to the monthly mean; but on closer examination, the pairs of 3 and 9 generally give a mean nearer that of the month than any others. This appears more distinctly in the succeeding tables, where the whole year is given.

TABLE V. gives the hourly mean for the seasons, for the summer and winter *halves* of the year, and for the whole 344 days, at the same locality. From the omission of the 21 days in August, the summer temperatures appear somewhat below the truth, and the same remark applies to the summer half and to the whole year. But this does not materially affect the main object of the Table, which is to exhibit the progressive change of temperature from hour to hour.

TABLE VI. shows the mean temperature of every pair of similar hours for the seasons, half-years, and year, as in the last Table. In the last column it will be seen that the pairs of hours giving a mean nearest the mean of the year are 3 and 9, or a little after; or at very nearly equal periods before and after noon and midnight, and not intermediate between the periods of the extremes and evening and morning means.

These first six Tables refer to the year 1852–53, beginning with September and ending with August; and the six following are corresponding ones for the year 1853–54.

TABLE VII. differs from No. I. in the periods before referred to being generally later, in the extremes being more marked, and in the mean temperature of the whole year being lower than that of the preceding one. Thus the periods of the mean temperature in the autumn and spring were nearer the end of October and April, or about 24 to 30 days after the equinoxes; the extreme of cold was experienced in the first part of February, and the extreme of summer heat was probably about the end of the first decade of August.

The usual interruption to the winter cold was less decided, and took place at the beginning of the second decade of January, raising the mean of that month above December, as December in the preceding season had been raised above November.

TABLE VIII. corresponds to Table II. By it the range between the highest and lowest single temperatures will be seen to be 1 degree more than the previous year, and give a mean 3 degrees below the true one of the year, whilst the means of the daily extremes accord very nearly with it. The greatest monthly range took place in March, and was 65 degrees: 11 less than that of April of the preceding year, and 31 less than the annual range.

TABLE IX. is similar to Table III., from which it presents no very remarkable difference. In it April again shows the most marked range between the day and night extremes, amounting to more than $12\frac{1}{2}$ degrees.

TABLES X., XI. and XII. agree in their general features with Nos. IV., V. and VI., and are defective in the July and August columns from the absence of the ship.

The succeeding Tables are compiled to give the means of two years, for which purpose the observations for the omitted summer intervals have been intercalated.

TABLE XIII. gives the means of the decades or third parts of each month, and of the whole month. Also, the highest and lowest single temperature noted during the two years, the extreme thermometric range being 97 degrees. The mean of these two extremes was $+3^\circ{\cdot}5$, and the true mean of the two years was $+6^\circ{\cdot}882$, or 25 degrees below the freezing-point of water. The autumnal and vernal periods at which these temperatures occur, by this Table, are about 14 and 23 days after their respective equinoxes; but the extremes of heat and cold, which occur on the 8th of August (probably) and on the 8th of February, are more than double that number, or about 48 days, after the solstice. Here the interval between the summer extreme and the occurrence of the annual mean in autumn is 67 days, and from the latter to the time of the winter extreme is 117 days; from the winter extreme to the vernal period at which the annual mean occurs is 74 days, and from this to the summer extreme 107 days.

TABLE XIV. gives the mean temperature for two years, of every hour for each month.

TABLE XV. gives the mean of every pair of similar hours of Table XIV.

TABLE XVI. gives the mean temperature for two years of every hour for each of the four seasons, for the half-years, and for the year. In this Table it will be observed that the interval of time between the extremes and that at which the annual mean *following* takes place is perceptibly shorter than between either extreme and the time of the mean preceding it.

TABLE XVII. gives the mean of every pair of similar hours in Table XVI.

TABLE XVIII. gives the mean temperature of every hour for the month of June, for 22 days in July, and for the 21 days both before and after the 21st of June, from hourly observations taken with a blackened thermometer exposed to the sun's rays. This Table, though so limited, may be of some interest in regard to the growth of vegetation during the short summer of the Arctic regions.

TABLE XIX. gives the means of the pairs of similar hours in the first and third columns of Table XVIII.

TABLE I.—Containing the Daily, Ten-daily, and Monthly Mean Temperatures for One Year, from hourly observations made on board H. M. S. 'Plover,' at Point Barrow. Lat. 71° 21′ N.; Long. 156° 17′ W.

Day.	1852. September.	1852. October.	1852. November.	1852. December.	1853. January.	1853. February.	1853. March.	1853. April.	1853. May.	1853. June.	1853. July.	1853. August.
1	+32.75	+16.12	+ 1.66	−21.42	−16.25	−24.54	−25.75	−20.29	+18.25	+31.62	+32.83	+43.08
2	33.60	14.29	− 6.16	30.87	28.00	9.83	25.62	31.62	9.54	28.00	36.45	37.70
3	40.21	10.45	9.21	15.38	23.92	0.87	15.79	24.96	9.79	29.25	33.62	35.91
4	34.00	11.41	7.12	14.33	16.37	6.29	8.95	11.50	7.54	27.50	32.29	36.16
5	38.17	6.20	4.08	15.17	30.08	3.41	15.16	16.25	5.41	29.41	32.95	34.33
6	38.29	4.25	0.62	22.29	28.83	14.83	13.12	15.37	8.16	30.12	32.08	38.79
7	34.12	5.54	+ 3.83	27.55	28.08	17.20	1.58	4.79	10.45	33.58	32.16	38.58
8	33.41	7.87	12.16	35.00	15.50	19.83	+ 8.79	+ 9.87	25.45	34.54	30.75	38.66
9	32.41	10.91	− 1.79	25.33	17.54	20.20	6.04	4.12	25.50	29.83	30.87	37.20
10	30.46	7.79	7.04	18.37	16.71	20.58	12.08	− 4.42	19.12	27.83	31.83	43.95
Means ...	+34.742	+ 9.487	+ 1.837	−22.571	−22.127	−13.762	−10.342	−11.521	+13.925	+30.170	+32.587	+38.441
11	31.46	11.87	+ 1.79	+ 1.33	17.29	28.62	19.04	+ 3.79	14.00	28.75	32.70	....
12	28.91	17.41	4.29	− 1.33	14.92	31.71	18.46	1.54	17.33	29.00	33.50	....
13	26.58	13.52	−14.41	18.04	13.75	26.87	22.37	− 5.66	25.85	27.37	34.00	....
14	22.08	5.12	22.00	15.04	24.08	24.50	24.96	+ 6.08	19.25	29.16	32.45	....
15	32.79	5.96	15.33	17.92	32.54	25.41	26.71	9.91	15.04	31.58	35.25	....
16	28.87	8.20	19.79	+ 0.42	36.62	14.20	22.12	21.00	26.87	31.87	34.87	....
17	30.41	8.91	29.75	20.25	36.89	17.33	29.89	20.16	19.75	32.75	36.50	....
18	28.66	−10.12	30.00	5.68	31.58	20.46	18.79	17.00	20.54	33.41	34.16	....
19	34.00	15.83	27.79	− 2.00	38.46	20.75	12.16	10.87	18.91	36.75	37.91	....
20	32.91	16.45	6.62	+20.71	38.58	19.25	17.62	6.08	17.08	35.29	38.70	....
Means ...	+30.687	+ 2.860	−15.962	− 0.594	−28.471	−22.912	−21.212	+ 9.079	+19.462	+31.595	+35.008	+37.000
21	32.39	−13.75	+ 3.33	+24.08	35.58	13.71	16.66	3.83	13.79	35.00	39.20	....
22	23.83	1.16	5.21	24.96	33.58	11.83	+16.20	5.45	17.00	36.16	36.66	....
23	19.75	+ 5.33	− 2.96	22.29	18.87	13.54	8.91	7.37	21.45	32.62	35.62	....
24	21.06	12.75	10.71	14.96	16.50	12.92	7.62	18.33	29.29	35.79	35.04	....
25	21.50	20.46	10.17	− 2.62	31.21	14.04	− 6.00	19.25	28.58	34.29	36.16	....
26	21.92	9.58	14.54	12.42	35.33	19.12	6.83	16.95	30.41	33.33	35.87	....
27	21.17	− 0.75	12.71	+10.96	35.08	19.25	12.58	23.79	24.58	32.75	40.00	....
28	18.33	+ 4.20	11.17	+ 9.08	29.50	15.29	13.87	22.16	23.79	33.37	34.16	....
29	15.37	0.29	17.33	−14.83	+ 1.33	....	17.12	25.33	23.95	33.83	36.37	....
30	14.96	2.70	27.66	+ 1.46	8.91	....	2.00	21.75	24.75	33.41	41.91	....
31	....	1.45	....	−14.92	− 5.17	....	2.08	....	26.95	....	45.45	....
Mean......	+21.027	+ 3.729	− 9.871	+ 6.300	−21.039	−11.971	− 6.295	+16.425	+24.053	+34.058	+37.872	+36.00
Monthly Mean ...	+28.813	+ 5.307	− 9.223	− 5.441	−23.787	−17.373	−12.392	+ 4.661	+19.305	+31.941	+35.240	+37.00

By intercalating the temperature of the last 21 days of August at the rate given for the two decades, the mean temperature of the year would be:—Sum of observations +85331,−16812,÷8760, = +7°.821 Fahr.

TABLE II.—Containing the Highest and Lowest Temperatures for each Month, the Means of the Daily Maxima and Minima for each Month, and the Means of these, or of the Extreme Daily Temperatures, from the 'Plover's' Register, Point Barrow, 1852–53.

Months.	Highest temperature in the month.	Lowest temperature in the month.	Means of maxima.	Means of minima.	Means of the extremes.
1852. September..	+42	+12	+31.56	+26.23	+28.90
October ..	+27	−21	+ 9.50	− 1.70	+ 3.90
November..	+25	−37	+ 0.50	−16.10	− 7.80
December..	+28	−37	+ 1.20	−18.60	− 8.70
1853. January ..	+16	−43	−17.60	−30.10	−23.85
February ..	+ 3	−36	−13.30	−21.60	−17.45
March	+24	−37	− 4.80	−20.70	−12.75
April	+33	−40	+11.80	− 4.10	+ 3.85
May	+44	− 6	+25.08	+11.30	+18.55
June......	+45	+17	+37.00	+27.20	+32.10
July	+52	+26	+39.23	+31.70	+35.45
August....	+49	+31	+43.20	+34.20	+38.70
Means	+32.33	−14.25	+12.84	+ 1.47	+ 7.159

The highest single temperature occurred 31st July, and was +52°.

The lowest single temperature occurred 19th Jan., and was −43°.

The extreme range for the year therefore was 95°.

And the mean of these extremes was +4°.5

TABLE III.—Showing the Mean Temperature of every Hour for each Month, from hourly observations made on board the 'Plover' at Point Barrow. Lat. 71° 21′ N.; Long. 156° 17′ W.

Hour.	1852.				1853.							
	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.
A.M. 1	+28·48	+ 4·58	− 9·06	− 6·06	−23·64	−18·11	−15·22	− 0·56	+13·93	+28·26	+32·84	+36·20
2	28·45	4·83	8·83	6·16	23·48	18·46	15·58	0·96	13·80	28·16	33·00	36·30
3	28·40	4·51	8·63	6·55	23·22	18·71	16·00	0·96	14·00	28·40	33·03	36·20
4	28·45	4·19	8·40	6·45	23·29	18·75	16·09	0·93	14·51	28·60	33·22	36·00
5	28·70	4·35	8·60	5·77	23·29	18·50	16·32	0·63	15·50	29·76	33·58	36·30
6	28·91	4·58	8·90	5·55	23·26	18·11	15·61	+ 0·76	17·77	30·60	34·09	36·70
7	28·91	4·70	8·96	5·58	23·35	17·71	14·71	2·13	19·19	31·56	34·58	37·30
8	28·90	5·00	9·16	5·64	23·45	17·32	13·38	4·26	20·32	32·43	35·45	37·80
9	28·85	5·48	8·90	5·58	23·84	16·78	11·55	6·10	21·84	33·24	35·80	38·80
10	29·07	6·16	8·86	5·29	23·93	16·53	9·77	7·76	22·77	34·16	36·51	38·90
11	29·25	6·80	8·73	5·35	23·64	16·17	8·67	9·60	23·55	35·16	36·84	39·70
Noon. 12	29·42	7·29	9·03	5·45	23·51	16·07	7·77	9·96	24·16	35·26	36·84	40·90
P.M. 1	29·18	7·03	8·90	5·13	23·74	15·82	7·32	10·33	24·19	35·86	37·25	40·80
2	29·13	6·70	9·06	5·09	23·93	15·96	6·83	10·26	24·06	36·10	37·48	41·10
3	29·10	6·29	8·93	5·03	24·13	16·00	7·19	9·83	24·12	35·23	37·55	41·30
4	29·27	5·93	9·83	4·77	24·16	16·32	8·45	9·50	22·97	34·76	37·22	41·10
5	28·97	5·96	9·90	4·87	24·19	17·21	9·93	9·40	22·42	33·90	36·67	40·20
6	28·87	5·90	9·83	5·16	23·87	17·71	11·54	8·13	21·64	33·06	36·42	40·40
7	28·0	5·54	9·90	5·06	24·19	17·92	12·93	5·80	20·25	32·30	35·93	39·10
8	28·70	5·25	9·56	4·87	24·35	17·82	13·74	4·16	18·98	31·33	35·29	38·40
9	28·55	4·24	9·46	5·13	24·09	17·58	14·06	2·93	17·54	30·70	34·80	37·90
10	28·50	4·12	10·00	4·97	24·06	17·53	14·64	2·40	16·03	29·76	34·22	37·40
11	28·52	4·03	9·93	5·22	24·00	17·89	15·00	1·50	14·93	29·13	33·79	37·00
12	28·25	3·87	9·93	5·77	24·22	17·93	15·22	1·06	14·48	28·76	33·38	36·80
Means ..	+28·813	+ 5·309	− 9·223	− 5·441	−23·787	−17·373	−12·392	+ 4·661	+19·306	+31·941	+35·240	+38·441

TABLE IV.—Showing the Mean Temperature of every Pair of similar Hours for each Month, and for comparison the Mean of each Month; from the 'Plover's' Register, at Point Barrow.

Hours.	1852.				1853.							
	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.
A.M. P.M. 1 and 1	+28·83	+ 5·80	− 8·98	− 5·59	−23·69	−16·96	−11·27	+ 4·88	+19·06	+32·06	+35·05	+38·50
2 and 2	28·79	5·77	8·95	5·63	23·73	17·21	11·21	4·65	18·93	32·13	35·24	38·70
3 and 3	28·75	5·40	8·78	5·79	23·68	17·33	11·59	4·43	19·06	31·81	35·29	38·75
4 and 4	28·86	5·06	9·11	5·61	23·72	17·53	12·27	4·28	18·74	31·68	35·22	38·55
5 and 5	28·83	5·16	9·25	5·32	23·77	17·86	13·13	4·38	18·96	31·83	35·13	38·25
6 and 6	28·89	5·24	9·36	5·35	23·53	17·91	13·58	4·45	19·71	31·83	35·25	38·55
7 and 7	28·81	5·12	9·43	5·32	23·74	17·82	13·82	3·96	19·72	31·93	35·25	38·20
8 and 8	28·80	5·12	9·36	5·25	23·90	17·57	13·56	4·21	19·64	31·88	35·37	38·10
9 and 9	28·69	4·86	9·18	5·35	23·97	17·18	12·79	4·51	19·69	31·98	35·30	38·35
10 and 10	28·78	5·14	9·43	5·13	24·00	17·03	12·21	5·08	19·40	31·96	35·37	38·15
11 and 11	28·88	5·41	9·33	5·29	23·82	17·03	11·83	5·55	19·24	32·15	35·31	38·35
12 and 12	28·83	5·58	9·48	5·61	23·87	17·00	11·50	5·51	19·32	32·01	35·11	38·85
Means ..	+28·813	+ 5·309	− 9·223	− 5·441	−23·787	−17·373	−12·392	+ 4·661	+19·306	+31·941	+35·240	+38·441

TABLE V.—Showing the Mean Temperature of every Hour for each Season, for the Summer and Winter halves of the year, and for the whole Year, without intercalating the last 21 days of August. H. M. Ship 'Plover,' Point Barrow.

1852-3.				
Hour.	Autumn. Sept., Oct., Nov.	Winter. Dec., Jan., Feb.	Spring. Mar., April, May.	Summer. June, July, Aug. 10th.
A.M. 1	+ 7·96	−15·86	− 0·51	+31·38
2	8·11	15·95	0·91	31·42
3	8·05	16·07	0·99	31·52
4	8·04	16·07	0·84	31·66
5	8·11	15·76	0·38	32·35
6	8·16	15·55	+ 0·98	32·98
7	8·17	15·47	2·20	33·69
8	8·21	15·42	3·73	34·50
9	8·44	15·35	5·47	35·15
10	8·76	15·21	6·91	35·86
11	9·08	15·02	8·14	36·53
Noon. 12	9·19	14·97	8·77	36·74
P.M. 1	9·08	14·86	9·05	37·17
2	9·90	14·96	9·15	37·41
3	8·70	15·02	8·91	37·09
4	8·43	15·04	7·88	36·73
5	8·32	15·36	7·27	36·00
6	8·29	15·51	6·05	35·56
7	8·09	15·65	4·36	34·84
8	8·09	15·61	3·12	34·05
9	7·73	15·53	2·13	33·50
10	7·50	15·45	1·25	32·79
11	7·50	15·63	0·47	32·24
12	7·36	15·91	0·09	31·91
Means ..	+ 8·268	−15·472	+ 3·851	+34·297

1852-3.		
Hour.	Winter. Sept. to Feb., 181 days.	Summer. Mar. to Aug., 163 days.
A.M. 1	− 3·88	+13·43
2	3·85	13·17
3	3·94	13·17
4	3·95	13·32
5	3·76	13·87
6	3·63	14·92
7	3·58	15·92
8	3·54	17·14
9	3·39	18·39
10	3·15	19·52
11	2·90	20·50
Noon. 12	3·82	29·95
P.M. 1	2·82	21·28
2	2·91	21·46
3	3·05	21·18
4	3·24	20·50
5	3·46	19·75
6	3·55	18·90
7	3·71	17·63
8	3·69	16·59
9	3·83	15·76
10	3·91	14·98
11	4·00	14·30
12	4·21	13·95
Means ..	− 3·537	+17·113

1852-3.	
Hour.	Year of 344 days.
A.M. 1	+ 4·29
2	4·21
3	4·16
4	4·23
5	4·59
6	5·15
7	5·65
8	6·25
9	6·93
10	7·58
11	8·19
Noon. 12	8·44
P.M. 1	8·60
2	8·60
3	8·43
4	8·01
5	7·55
6	7·09
7	6·40
8	5·92
9	5·46
10	5·04
11	4·67
12	4·39
Mean ..	+ 6·250

TABLE VI.—Showing the Mean Temperature of every Pair of similar Hours for each Season, the Half Years, and the Year. H. M. Ship 'Plover,' Point Barrow.

1852-3.				
Hours.	Autumn.	Winter.	Spring.	Summer.
A.M. P.M. 1 and 1	+ 8·52	−15·36	+ 4·27	+34·27
2 and 2	8·50	15·46	4·12	34·41
3 and 3	8·41	15·55	3·96	34·31
4 and 4	8·23	15·56	3·52	34·19
5 and 5	8·21	15·56	3·44	34·17
6 and 6	8·22	15·53	3·51	34·27
7 and 7	8·13	15·56	3·28	34·26
8 and 8	8·15	15·51	3·42	34·28
9 and 9	8·08	15·44	3·79	34·33
10 and 10	8·13	15·33	4·08	34·32
11 and 11	8·28	15·32	4·30	34·38
12 and 12	8·28	15·44	4·43	34·33
Means ..	+ 8·268	−15·472	+ 3·851	+34·297

1852-3.		
Hours.	Winter half.	Summer half.
A.M. P.M. 1 and 1	− 3·35	+17·35
2 and 2	3·41	17·31
3 and 3	3·49	17·18
4 and 4	3·59	16·91
5 and 5	3·51	16·83
6 and 6	3·59	16·91
7 and 7	3·64	16·77
8 and 8	3·61	16·86
9 and 9	3·61	17·09
10 and 10	3·53	17·25
11 and 11	3·45	17·40
12 and 12	3·51	17·45
Means ..	− 3·537	+17·113

1852-3.	
Hours.	Year of 344 days.
A.M. P.M. 1 and 1	+ 6·45
2 and 2	6·41
3 and 3	6·30
4 and 4	6·12
5 and 5	6·07
6 and 6	6·12
7 and 7	6·02
8 and 8	6·08
9 and 9	6·20
10 and 10	6·31
11 and 11	6·43
12 and 12	6·42
Mean	+ 6·250

TABLE VII.—Containing the Daily, Ten-daily, and Monthly Mean Temperatures for One Year, from hourly observations made on board H. M. S. 'Plover,' at Point Barrow. Lat. 71° 21′ N.; Long. 156° 17′ W.

Day.	1853.				1854.							
	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.
1	+33·62	+11·00	−10·33	−15·87	−25·00	−32·62	−11·29	− 2·08	+ 7·66	+41·16	+32·45	....
2	32·25	8·25	+ 6·92	15·50	22·29	34·75	12·12	+ 0·66	10·16	37·75	31·83	....
3	32·54	5·79	− 0·96	13·70	+ 2·04	37·08	14·25	2·00	12·37	37·41	32·08	....
4	31·33	1·87	+ 4·12	22·58	− 8·58	28·20	12·95	0·87	10·70	39·54	35·63	....
5	37·45	3·37	− 5·08	29·12	11·25	25·12	7·91	1·91	6·00	32·37	39·79	....
6	35·84	3·95	15·42	17·95	+ 1·12	37·83	3·29	− 1·37	4·37	32·16	40·20	....
7	31·46	9·66	3·75	11·95	−21·58	43·04	8·95	5·91	7·62	33·08	38·41	....
8	31·04	12·04	3·71	17·33	28·50	43·45	12·45	6·41	7·66	29·83	35·87	....
9	29·95	10·58	+ 8·33	33·45	27·50	42·41	20·62	6·16	11·16	27·58	36·33	....
10	25·46	5·66	−14·96	28·75	4·75	42·70	23·87	5·96	10·04	28·25	38·66	....
Means ..	+32·146	+ 7·221	− 3·533	−30·625	−14·633	−36·725	−12·775	− 2·245	+ 8·779	+33·916	+36·129	+40·00
11	33·04	0·50	10·50	34·75	+ 5·91	36·25	14·12	+ 0·41	14·41	32·00	36·66	....
12	24·71	− 0·46	14·67	31·47	19·12	24·33	20·95	3·66	21·66	33·91	34·78	....
13	24·16	+ 0·54	20·75	30·29	−13·87	12·79	20·70	− 2·20	26·50	29·66	36·41	....
14	23·96	− 0·08	15·17	35·33	+16·58	30·25	19·75	+ 7·79	26·91	28·87	41·16	....
15	22·89	0·12	17·04	18·91	−11·25	34·95	27·66	2·89	33·41	28·87	40·25	....
16	23·29	2·75	20·25	18·00	7·75	31·12	32·12	2·37	27·50	26·50	35·41	....
17	24·96	+ 4·12	0·46	24·70	+ 8·83	18·50	35·08	8·83	29·56	26·66	35·29	....
18	24·83	5·79	12·04	26·83	− 6·16	28·62	34·04	6·66	28·87	28·58	36·29	....
19	25·25	− 5·21	4·36	18·50	16·50	36·66	32·62	3·00	23·37	32·70	41·91	....
20	24·87	4·96	3·96	5·08	7·20	29·12	28·95	1·12	23·20	33·16	44·66	....
Means ..	+24·196	− 0·263	−11·951	−24·383	− 1·229	−28·262	−26·604	+ 3·454	+25·545	+30·095	+38·287	+40·00
21	+24·62	− 5·54	−20·16	− 0·29	−16·66	−28·25	−26·50	+ 7·37	+25·58	+37·95	....	....
22	27·08	7·25	9·83	4·91	14·62	25·25	23·12	7·25	26·66	36·62	....	....
23	19·75	4·04	+ 0·28	14·91	20·25	20·58	19·20	13·54	26·41	34·83	....	....
24	11·75	3·21	3·16	20·00	32·75	14·83	28·87	2·29	25·95	34·37	....	....
25	14·96	6·50	−12·91	22·25	19·79	12·87	18·91	4·58	25·91	34·79	....	....
26	11·37	10·91	+ 2·62	21·83	17·54	9·91	10·75	1·00	23·33	32·15	....	....
27	3·21	7·35	2·33	19·62	35·12	6·79	+ 7·66	3·33	26·95	29·58	....	44·70
28	4·46	15·04	−11·50	19·08	29·16	6·75	10·12	6·00	29·83	33·12	....	37·08
29	0·50	7·79	15·45	22·00	27·04	....	−13·33	5·08	32·79	32·87	....	34·12
30	7·33	12·29	16·50	27·79	25·54	....	14·04	8·16	30·16	31·00	....	42·04
31	....	18·04	....	28·75	26·70	....	1·37	....	34·62	....	....	....
Mean	+13·003	− 8·905	− 7·804	−20·145	−26·520	−15·656	−12·030	+ 5·862	+30·625	+33·729	+39·000	+39·448
Monthly mean.	+23·115	− 0·915	− 7·762	−21·010	−13·673	−27·683	−16·971	+ 2·356	+20·951	+32·580	+37·805	+39·816

By intercalating the temperatures of the 38 days' interval in July and August, at the rates given for the four decades, the Mean Temperature of the Year would be:—Sum of observations +86178, −34039, ÷8760,=5°·951 Fahr.

TABLE VIII.—Containing the Highest and Lowest Temperatures for each Month, the Means of the Daily Maxima and Minima for each Month, and the Means of these or of the Extreme Daily Temperatures; from the 'Plover's' Register, Point Barrow, 1853–54.

Month.	Highest temperature in the month.	Lowest temperature in the month.	Means of daily Maxima.	Means of daily Minima.	Means of the extremes.
1853. September..	+41	− 3	+26·03	+20·10	+23·06
October ..	14	22	3·45	− 5·09	− 0·82
November..	22	26	0·50	15·35	7·38
December..	7	40	−16·41	21·02	18·72
1854. January ..	27	37	6·03	21·35	13·67
February ..	− 3	45	23·25	32·64	27·94
March	+23	42	10·25	25·45	17·85
April	26	17	+ 9·93	6·76	+ 1·58
May	42	3	26·03	+15·00	20·51
June	47	+24	36·20	29·36	32·78
July	51	28	42·05	32·40	37·22
August....	48	29	43·50	34·75	39·12
Means	+28·750	+12·833	+10·970	+ 0·328	+ 5·657

The highest single temperature occurred 20th July, and was +51°.

The lowest single temperature occurred 8th to 10th February, and was −45°.

The extreme range for the year therefore was 96°.

And the mean of these extremes was +3°.

TABLE IX.—Showing the Mean Temperature of every Hour for each Month, from hourly observations made on board the 'Plover' at Point Barrow. Lat. 71° 21′ N.; Long. 156° 17′ W.

Hour.	1853.				1854.							
	September.	October.	November.	December.	January.	February.	March.	April.	May.	Jun	July.	August.
A.M. 1	+23.40	− 1.35	− 7.80	−20.90	−14.61	−28.82	−20.90	− 3.50	+16.45	+30.53	+34.00	+36.20
2	23.20	1.19	7.23	21.25	14.51	28.74	20.93	3.56	16.48	30.53	33.85	36.30
3	22.97	1.39	7.10	21.12	14.29	28.39	20.61	3.60	16.71	30.63	34.15	36.20
4	22.77	1.42	7.23	20.90	13.80	28.07	20.22	3.56	17.45	30.90	34.55	36.00
5	22.33	1.45	7.10	20.64	13.61	27.71	20.48	2.56	18.26	31.53	35.05	36.30
6	22.40	1.35	7.10	20.87	13.48	27.53	20.22	0.60	19.26	31.93	36.95	36.70
7	22.90	1.22	7.27	20.90	13.00	27.75	19.06	+ 1.43	20.77	32.33	37.95	37.30
8	23.03	1.03	7.67	20.70	12.80	27.92	17.03	3.36	21.77	33.36	38.75	37.80
9	23.30	0.42	7.73	20.67	12.84	27.78	15.49	4.86	22.61	33.76	39.15	38.80
10	23.63	0.09	7.70	20.77	12.93	27.35	13.87	6.56	23.48	33.86	40.00	38.90
11	23.70	+ 0.26	7.87	20.61	12.98	26.89	12.51	7.63	24.26	34.16	40.00	39.70
Noon. 12	23.77	0.45	8.17	20.94	13.09	26.57	11.97	8.73	24.35	34.46	39.70	40.90
P.M. 1	23.77	0.68	7.67	21.32	12.90	26.64	11.64	9.04	24.87	34.53	39.65	40.80
2	23.83	0.45	7.73	21.35	13.25	26.60	11.34	8.70	24.45	35.00	39.50	41.10
3	23.77	− 0.32	7.83	21.16	13.28	27.00	12.29	8.10	24.19	34.73	39.05	41.30
4	23.73	0.93	7.97	21.35	13.45	27.21	12.90	7.86	24.09	34.56	38.55	41.10
5	23.20	1.26	8.17	21.29	13.77	27.53	14.09	6.70	23.61	34.06	38.50	40.20
6	22.97	1.45	8.50	21.22	13.95	27.75	15.61	4.83	23.03	33.10	38.35	40.40
7	22.67	1.52	8.40	21.12	14.29	27.78	17.61	2.63	21.84	32.26	38.10	30.10
8	22.63	1.52	8.20	21.09	14.06	28.00	18.55	0.86	20.84	32.10	37.00	38.40
9	22.70	1.52	8.00	21.06	14.38	28.17	19.13	− 0.63	19.64	31.43	35.95	37.90
10	22.73	1.29	8.03	21.09	14.32	28.03	19.80	1.60	18.74	31.00	35.15	37.40
11	22.77	1.35	7.97	21.03	14.32	28.03	20.00	2.30	18.38	30.76	34.50	37.00
12	22.60	1.71	7.87	20.93	14.16	27.85	20.58	2.86	17.58	30.33	34.60	36.80
Means ..	+23.115	− 0.915	− 7.762	−21.010	−13.673	−27.683	−16.971	+ 2.356	+20.951	+32.580	+37.258	+38.441

TABLE X.—Showing the Mean Temperature of every Pair of similar Hours for each Month (and for comparison the Mean of each Month repeated), from the 'Plover's' Register at Point Barrow.

Hours.	1853.				1854.							
A.M. P.M.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.
1 and 1	+23.55	− 0.33	− 7.73	−21.11	−13.75	−27.73	−16.26	+ 2.78	+20.66	+32.53	+36.82	+38.50
2 and 2	23.52	0.37	7.48	21.30	13.88	27.67	16.38	2.56	20.46	32.76	36.67	38.70
3 and 3	23.36	0.85	7.47	21.13	13.79	27.69	16.45	2.25	20.45	32.68	36.60	38.25
4 and 4	23.25	1.17	7.60	21.13	13.65	27.64	16.56	2.15	20.77	32.73	36.55	38.55
5 and 5	22.77	1.35	7.63	20.97	13.69	27.62	17.29	2.07	20.93	32.80	36.77	38.25
6 and 6	22.68	1.40	7.80	21.04	13.71	27.64	17.91	2.11	21.14	32.51	37.65	38.55
7 and 7	22.78	1.37	7.83	21.01	13.64	27.76	18.33	2.03	21.30	32.30	38.02	38.20
8 and 8	22.83	1.27	7.93	20.91	13.45	27.96	17.79	2.11	21.30	32.73	37.87	38.10
9 and 9	23.00	0.96	7.87	20.87	13.61	27.98	17.27	2.11	21.12	32.60	37.55	38.35
10 and 10	23.18	0.69	7.87	20.93	13.62	27.69	16.83	2.48	21.11	32.43	37.57	38.15
11 and 11	23.23	0.54	7.93	20.82	13.65	27.46	16.25	2.66	21.32	32.46	37.25	38.35
12 and 12	23.18	0.63	8.01	20.93	13.62	27.21	16.27	2.93	20.96	32.40	37.15	38.85
Means ..	+23.115	− 0.915	− 7.762	−21.010	−13.673	−27.685	−16.971	+ 2.356	+20.951	+32.580	+37.205	+38.400

TABLE XI.—Showing the Mean Temperature of every Hour for each Season, for the Summer and Winter halves of the year, and for the whole Year (without intercalating the last 11 days of July or any part of August). H. M. S. 'Plover,' Point Barrow.

1853–4.				
Hour.	Autumn. Sept., Oct., Nov.	Winter. Dec., Jan., Feb.	Spring. March, April, May.	Summer. June, July, 50 days.
A.M. 1	+ 4.68	−21.20	− 2.40	+31.92
2	4.85	21.23	2.40	31.86
3	4.76	21.03	2.13	32.04
4	4.63	20.68	1.83	32.36
5	4.53	20.42	1.30	32.94
6	4.58	20.40	0.39	33.94
7	4.73	20.31	+ 1.08	34.58
8	4.60	20.24	2.69	35.52
9	5.09	20.18	4.01	35.92
10	5.22	20.12	5.38	36.32
11	5.30	19.93	6.44	36.50
Noon. 12	5.29	19.98	7.02	36.56
P.M. 1	5.53	20.07	7.41	36.58
2	5.35	20.20	7.09	36.80
3	5.14	20.26	6.65	36.46
4	4.88	20.45	6.33	36.16
5	4.54	20.65	5.39	35.84
6	4.27	20.74	4.14	35.20
7	4.18	20.93	2.43	34.60
8	4.13	20.93	1.27	34.06
9	4.33	20.97	0.29	33.24
10	4.41	20.92	− 1.53	32.66
11	4.41	20.80	1.09	32.26
12	4.16	20.75	1.79	32.04
Means ..	+ 4.750	−20.561	− 2.241	+34.431

1853–4.		
Hour.	Winter Half-year.	Summer Half, 142 days.
A.M. 1	− 8.18	+ 9.68
2	8.11	9.66
3	8.06	9.90
4	7.95	10.20
5	7.88	10.75
6	7.84	11.69
7	7.71	12.88
8	7.69	14.25
9	7.52	15.24
10	7.38	16.27
11	7.24	17.02
Noon. 12	7.27	17.42
P.M. 1	7.20	17.68
2	7.30	17.54
3	7.49	17.14
4	7.78	16.83
5	7.98	15.40
6	8.17	14.37
7	8.30	13.76
8	8.27	12.81
9	8.25	11.82
10	8.18	11.15
11	8.12	10.64
12	8.17	10.12
Means ..	− 7.836	+13.566

1853–4.	
Hour.	Year of 323 days.
A.M. 1	− 0.33
2	0.30
3	0.16
4	+ 0.02
5	0.31
6	0.74
7	1.33
8	1.95
9	2.48
10	3.01
11	3.42
Noon. 12	3.58
P.M. 1	3.73
2	3.62
3	3.34
4	3.07
5	2.60
6	2.05
7	1.39
8	0.99
9	0.60
10	0.31
11	0.13
12	− 0.13
Mean	+ 1.577

TABLE XII.—Showing the Mean Temperature of every Pair of similar Hours for each Season, the Half Years, and the Year. H. M. S. 'Plover,' Point Barrow.

1853–4.				
Hours. A.M. P.M.	Autumn.	Winter.	Spring.	Summer, 50 days.
1 and 1	+ 5.11	−20.64	+ 2.50	+34.25
2 and 2	5.16	20.71	2.34	34.33
3 and 3	4.95	20.65	2.26	34.25
4 and 4	4.76	20.57	2.25	34.26
5 and 5	4.52	20.53	2.04	34.39
6 and 6	4.42	20.57	1.87	34.57
7 and 7	4.46	20.62	1.76	34.59
8 and 8	4.37	20.59	1.98	34.79
9 and 9	4.66	20.58	2.15	34.58
10 and 10	4.81	20.52	2.42	34.49
11 and 11	4.86	20.36	2.67	34.38
12 and 12	4.78	20.57	2.61	34.30
Means ..	+ 4.750	−20.561	+ 2.241	+34.431

1853–4.		
Hours. A.M. P.M.	Winter half.	Summer half, 142 days.
1 and 1	− 7.69	+13.68
2 and 2	7.70	13.60
3 and 3	7.77	13.52
4 and 4	7.83	13.52
5 and 5	7.93	13.43
6 and 6	8.00	13.38
7 and 7	8.01	13.32
8 and 8	7.98	13.53
9 and 9	7.88	13.57
10 and 10	7.78	13.71
11 and 11	7.68	13.83
12 and 12	7.72	13.77
Means ..	− 7.836	+13.566

1853–4.	
Hours. A.M. P.M.	Year of 323 days.
1 and 1	+ 1.70
2 and 2	1.66
3 and 3	1.58
4 and 4	1.55
5 and 5	1.45
6 and 6	1.40
7 and 7	1.36
8 and 8	1.47
9 and 9	1.54
10 and 10	1.66
11 and 11	1.77
12 and 12	1.72
Mean	+ 1.577

TABLE XIII.—Showing the Mean Temperature of each Month, and the Mean of each "Decade" or third part of a Month for the Two Years, at Point Barrow. Also the Highest and Lowest single Temperatures, the Mean of these, and the Extreme Range of the Thermometer, observed during the same period; and the Mean Temperature of the whole 24 Months, deduced from the aggregate sum of the observations.

Means of	1852-53.				1853-54.							
	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.
1st decade	+33·44	+ 8·35	− 2·68	−21·59	−18·38	−25·24	−11·55	− 6·88	+11·35	+32·04	+34·35	+39·22
2nd decade	27·44	1·29	15·95	12·48	14·85	25·58	23·90	+ 6·26	22·50	30·84	36·64	38·50
3rd decade	17·01	− 2·58	8·83	6·92	23·77	13·81	18·32	11·14	27·33	33·89	38·43	37·72
Whole Month } ..	+25·964	+ 2·197	− 8·492	−13·225	−18·730	−22·528	−14·681	+ 3·508	+20·128	+32·260	+36·522	+38·158

Highest single temperature during two years occurred 31st July 1853 .... +52°
Lowest single temperature during two years occurred 8th to 10th February 1854 .... −45°
Extreme range of Thermometer during the two years .... 97°
Mean of these two extremes +3°·5.

Mean temperature of the Air for the two years at Point Barrow, deduced from the sums of the hourly observations, those of the months of July and August having been intercalated:—

1852–53. 1853–54.
Sums, +68519 +52139 = +120628, ÷17520 = +6°·886 Mean temp.

TABLE XIV.—Showing the Mean Temperature of every Hour for each Month, the Mean of Two Years from hourly observations made on board the 'Plover' at Point Barrow. Lat. 71° 21′ N.; Long. 156° 17′ W.

Hour.	1852-53.				1853-54.							
	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.
A.M. 1	+25·94	+ 1·61	− 8·43	−13·48	−19·12	−23·46	−18·06	− 2·03	+15·19	+29·39	+33·22	+36·22
2	25·82	1·82	8·03	13·70	18·99	23·60	18·25	2·26	15·14	29·34	33·72	36·32
3	25·68	1·50	7·86	13·83	18·75	23·50	18·30	2·28	15·35	29·51	33·89	36·22
4	25·61	1·38	7·81	13·67	18·54	23·41	18·15	2·24	15·98	29·75	34·18	36·02
5	25·51	1·45	7·85	13·20	18·45	23·10	18·40	1·59	16·88	30·64	34·61	36·32
6	25·65	1·61	8·00	13·21	18·37	22·82	17·91	+ 0·08	18·51	31·26	35·82	36·72
7	25·90	1·74	8·11	13·24	18·17	22·73	16·88	1·78	19·98	31·94	36·56	37·32
8	25·96	1·98	8·41	13·17	18·12	22·62	15·20	3·81	21·04	32·89	37·40	37·82
9	26·07	2·53	8·31	13·12	18·34	22·28	13·52	5·48	22·22	33·51	37·77	38·82
10	26·35	3·03	8·28	13·03	18·43	21·93	11·82	7·16	23·12	34·01	38·55	38·92
11	26·47	3·53	8·30	12·98	18·31	21·53	10·59	8·61	23·90	34·66	38·72	39·72
Noon. 12	26·59	3·87	8·60	13·19	18·30	21·32	9·87	9·34	24·25	34·86	38·57	40·92
P.M. 1	26·27	3·89	8·28	13·22	18·32	21·23	9·48	9·68	24·53	35·19	38·75	40·82
2	26·48	3·57	8·39	13·22	18·59	21·28	9·33	9·48	24·25	35·55	38·79	41·12
3	26·43	2·98	8·40	13·09	18·70	21·50	9·69	8·96	24·15	34·98	38·60	41·32
4	26·50	2·50	8·90	13·06	18·80	21·76	10·67	8·68	23·53	34·66	38·18	41·12
5	26·08	2·35	9·03	13·08	18·98	22·37	12·01	8·05	23·01	33·98	37·88	40·22
6	25·92	2·22	9·16	13·19	18·90	22·73	13·57	6·96	22·33	33·08	37·68	40·42
7	25·68	2·01	9·15	13·09	19·24	22·85	15·27	4·21	21·04	32·28	37·31	39·12
8	25·66	1·86	8·83	12·98	19·20	22·91	16·14	2·51	19·91	31·71	36·44	38·42
9	25·62	1·36	8·73	13·09	19·23	22·87	16·59	1·15	18·57	31·06	35·67	37·92
10	25·61	1·41	9·61	13·03	19·19	22·78	17·22	0·40	17·38	30·38	34·98	37·42
11	25·64	1·34	8·95	13·12	19·16	22·96	17·50	− 0·40	16·65	29·94	34·44	37·02
12	25·42	1·08	8·90	13·35	19·19	22·89	17·90	0·90	16·03	29·54	34·29	36·82
Means ..	+25·964	+ 2·197	− 8·492	−13·225	−18·730	−22·528	−14·681	+ 3·508	+20·128	+32·260	+36·522	+38·158

TABLE XVII.—Two Years, showing the Mean Temperature of every Pair of similar Hours for each Season, the Half Years and the Year. H. M. S. 'Plover,' Point Barrow.

1852–54.				
Hours. A.M. P.M.	Autumn.	Winter.	Spring.	Summer.
1 and 1	+ 6.81	−18.00	+ 3.38	+35.51
2 and 2	6.83	18.08	3.23	35.62
3 and 3	6.68	18.10	3.11	35.53
4 and 4	6.49	18.06	2.91	35.48
5 and 5	6.37	18.05	2.74	35.53
6 and 6	6.32	18.09	2.69	35.67
7 and 7	6.29	18.05	2.52	35.68
8 and 8	6.31	18.05	2.70	35.78
9 and 9	6.37	18.09	2.97	35.70
10 and 10	6.47	17.92	3.25	35.66
11 and 11	6.56	17.84	3.49	35.63
12 and 12	6.53	17.90	3.52	35.56
Means ..	+ 6.508	−18.017	+ 3.046	+35.616

1852–54.		
Hours. A.M. P.M.	Winter half.	Summer half.
1 and 1	− 5.52	+19.45
2 and 2	5.55	19.43
3 and 3	5.63	19.32
4 and 4	5.71	19.20
5 and 5	5.77	19.14
6 and 6	5.79	19.13
7 and 7	5.83	19.10
8 and 8	5.80	19.24
9 and 9	5.75	19.34
10 and 10	5.66	19.42
11 and 11	5.56	19.56
12 and 12	5.62	19.64
Means ..	− 5.686	+19.335

1852–54.	
Hours. A.M. P.M.	Year.
1 and 1	+ 6.96
2 and 2	6.94
3 and 3	6.84
4 and 4	6.74
5 and 5	6.68
6 and 6	6.67
7 and 7	6.03
8 and 8	6.72
9 and 9	6.79
10 and 10	6.88
11 and 11	7.00
12 and 12	7.01
Mean ..	+ 6.821

TABLE XVIII.—Showing the Mean Temperature of every Hour for the month of June, part of the month of July and for June, and the twelve first days of July combined, from observations taken hourly with a blackened Thermometer at the 'Plover's' winter quarters, Point Barrow.

	1853.		
Hour.	June.	July 22nd.	42 days of June and July.
A.M. 1	34.50	+35.72	+35.02
2	36.26	36.90	36.85
3	38.66	39.09	39.62
4	43.43	42.54	44.19
5	48.66	43.31	48.14
6	53.90	46.59	53.28
7	59.26	52.59	58.57
8	63.00	54.90	61.92
9	66.00	58.36	64.67
10	67.66	62.31	65.21
11	72.03	65.00	70.30
Noon. 12	71.86	64.99	70.30
P.M. 1	72.16	63.31	69.83
2	71.43	62.72	69.30
3	69.40	65.81	68.21
4	67.56	63.18	65.95
5	63.14	56.13	61.07
6	58.10	50.68	56.04
7	54.13	52.09	53.38
8	49.06	46.13	48.40
9	47.06	37.31	45.45
10	42.26	37.40	41.26
11	37.20	35.63	37.12
12	36.16	34.54	35.95
Means	54.994	....	54.120

TABLE XIX.—Showing the Mean Temperature of every Pair of similar Hours in first and third columns of Table XVIII.

	1853.		
Hours. A.M. P.M.	June.	July 22nd.	June and July.
1 and 1	+53.33	....	+52.42
2 and 2	53.85	....	52.57
3 and 3	54.03	....	53.41
4 and 4	55.50	....	54.57
5 and 5	54.50	....	54.55
6 and 6	56.00	....	54.86
7 and 7	56.70	....	55.47
8 and 8	56.03	....	55.16
9 and 9	56.53	....	55.06
10 and 10	54.80	....	53.23
11 and 11	54.61	....	53.71
12 and 12	54.01	....	53.12
Means	54.994	....	54.120

Highest single temperature in the sun +106° on 7th June 1853.

Explanation of Plate II.

Fig. 1 represents the mean daily curve for each month, as deduced from Table XIV. From among the almost straight lines representing the winter months, March is observed to rise in a bold curve, showing the rapidly increasing power of the solar rays, which had hardly produced any effect in shaded places during February. April exceeds March by 2 degrees in the height of its curve; but that of each summer month in succession becomes flatter in consequence of the summer warmth being attended by more cloudy weather, and a lessened fall of temperature during the nights. September presents a curve of great flatness, the difference of temperature between noon and midnight scarcely exceeding 1 degree. The almost continued foggy state of the weather then prevents the sun effecting much rise in the day, and the great extent of sea, river, and lake surface, still unfrozen during the earlier part of the month, prevents any great fall of temperature during the night. With the exception of a slight rise in the October curve, the whole six representing autumn and winter are remarkably flat.

Fig. 2 shows the mean daily curves of the four seasons, deduced from Table XVI.; also the curve of the winter half of the year, or the autumn and winter combined, the curve of the summer half, which is spring and summer combined, and the curve of the whole year, each being the mean of two years. The flat curve of autumn has nearly the same form as September, and in position occupies the place of the mean temperature of the year. The winter line nearly coincides both in form and position with January, and is very flat. Spring has nearly the form of March and the position of April; and the summer curve, either in shape or position, does not differ much from July. With the exception of autumn, the curve of each season bears a striking resemblance to that of its middle month.

Fig. 3 indicates the curve of mean daily temperature shown by a blackened thermometer exposed to the sun. The black line represents the month of June, and the dotted one three weeks before and after the 21st of June. In both, the extremes seem to be very near noon and midnight, and the bold character of the curve is very striking.

On the Algebraic Couple; and on the Equivalents of Indeterminate Expressions. By Charles James Hargreave, *LL.D., F.R.S.*

In a paper entitled "Analytical Researches concerning Numbers," which was published in the Philosophical Magazine some years ago (vol. xxxv. p. 36), I had occasion to avail myself of a principle, which, though it has not yet taken rank amongst recognized forms of mathematical reasoning, appears to be capable of extensive application and calculated to lead to true and useful results. This principle may be expressed by stating simply, that the analytical equivalent of an indeterminate expression is the arithmetical mean of all its possible values. The accuracy of the results to which I was conducted by the application of this principle in the paper above referred to, led me to the conclusion, that the principle might probably to some extent be introduced into mathematical science, without departing from or unduly extending doctrines heretofore admitted. Since that period, I have not had the opportunity of pursuing this interesting subject; but I find that it is one

which has not failed to attract the attention of eminent mathematicians; and I trust I may be permitted to avail myself of this Meeting of the British Association in Dublin, as a convenient opportunity for the publication of the views which I had in contemplation on the occasion of my former paper. These views having suggested themselves in the course of a brief investigation relating to the interpretation of the Algebraic Couple, I propose to introduce this subject also, in the hope that it may prove interesting to those who have given their attention to the various systems of Multiple Algebra which have been from time to time propounded.

On the Geometrical Interpretation of the Algebraic Couple.

The object of this section is to apply and interpret the Algebraic Couple to and by means of the geometry of angular magnitude and position.

The couple in its ordinary form, $x+y\sqrt{-1}$, is the argument of the arbitrary function, $f(x+y\sqrt{-1})$, which represents a value of u in the partial differential equation

$$\frac{d^2u}{dx^2}+\frac{d^2u}{dy^2}=0.$$

If we take the corresponding differential equation of three variables,

$$\frac{d^2u}{dx^2}+\frac{d^2u}{dy^2}+\frac{d^2u}{dz^2}=0,$$

and effect its integration, not generally, but under the restrictive condition

$$x^2+y^2+z^2=r^2 \text{ (a constant)},$$

we obtain

$$u=\phi\left(\tan^{-1}\frac{y}{x}\pm\tan^{-1}\frac{z\sqrt{-1}}{r}\right);$$

which may be regarded as an integration of the equation upon the surface of a sphere whose radius is r. If l be the longitude of a point computed from any origin, and λ its distance in latitude from the equator, the integral assumes the form

$$u=\phi\left(l\pm\cos^{-1}\frac{1}{\cos\lambda}\right),$$

or

$$u=\phi\left(l\mp\sqrt{-1}\log\tan\frac{\mu}{2}\right),$$

where μ is the co-latitude. The argument of this function is now in the form of an ordinary algebraic couple, the constituents of which are angular magnitudes; and my object will be to show that the couple in this form is an adequate symbolical representation of position on a sphere, or of angular position in space, in the same manner as the ordinary couple adequately represents position on a plane.

It will be convenient for the sake of comparison to consider the algebraic couple, when geometrically interpreted, rather as an operation, than as a quantity or result. Let us regard $x+y\sqrt{-1}$ not merely as denoting the *position* of a point (x, y), but implying also the process of arriving at such a point from the origin by progressing along an unvarying course, viz. that course which is constantly inclined to the unit-line at an angle whose tangent is $\frac{y}{x}$.