V. Table and formulæ for reducing registers of the height of the barometer to the standard temperature and level

Mr. J. Nixon

To cite this article: Mr. J. Nixon (1827) V. Table and formulæ for reducing registers of the height of the barometer to the standard temperature and level , Philosophical Magazine Series 2, 1:1, 15-18, DOI: [10.1080/14786442708674197](https://doi.org/10.1080/14786442708674197)

To link to this article: <http://dx.doi.org/10.1080/14786442708674197>

Published online: 10 Jul 2009.

Submit your article to this journal [↗](#)

Article views: 2

View related articles [↗](#)

Being partly aware of the transverse strength from the former experiment, the time used for applying the first part of the load was shortened; but towards the conclusion the additions were cautious and slow, and the whole time occupied in the experiment was $57\frac{1}{4}$ minutes; the breaking weight was 506 pounds, which gives 59,950 pounds per square inch, for the cohesion, or in round numbers 60,000 pounds, and the mean of both 60,500 pounds. Yours truly,

Leighton, Dec. 11, 1826.

B. BEVAN.

P.S. I have lately seen in the public papers, under the title of *Curious Weather-gauge*, an account of a machine invented by Mr. Donovan, capable of showing the commencement and termination of every shower, and the rate of raining, with the quantity fallen.

I beg leave to say, that I have several rain-gauges of such a nature as to exhibit all these particulars; one of which has been in constant use for fifteen years.—Further particulars I perhaps may give at another time.

V. *Table and Formulæ for reducing Registers of the Height of the Barometer to the Standard Temperature and Level.*
By Mr. J. NIXON.

To the Editors of the Philosophical Magazine and Annals.

Gentlemen,

ONE of the many obstacles to the advancement of the degraded science of Meteorology, is confessedly the difficulty of an immediate comparison of the pressure of the atmosphere, as registered at places differing in elevation and temperature. So intolerably irksome to the man of genius, anxious to devote his talents to this obscure branch of philosophy, must be the unintellectual toil of rendering a vast number of similar registers comparable with each other, that the true lover of the science cannot but indulge in the wish, that the editors of scientific journals would invariably decline the insertion of meteorological registers unreduced to the standard level and temperature.

To render the task thus imposed on the observer as easy and brief as is compatible with the requisite accuracy, I have taken the liberty of transmitting you the annexed Table, derived from the following formulæ: in which h denotes the observed height of the barometer corrected for the varying height of the surface of the mercury in the cistern, and for the effect of capillary attraction; T the height of the detached thermometer (or temperature of the mercury); a the elevation
of

16 Mr. Nixon on reducing *Barometrical Registers to the*

of the barometer in *feet* above the level of the sea; and t the observed temperature of the air.

Formula No. 1.—Reduction of the pressure h to its value at the standard temperature of 32° Fahr. = h' .

$$h' = h \pm \frac{\overline{T \infty 32} \times h}{11121 + T};$$

additive or subtractive as T is below or above 32° Fahr.

No. 2.—Reduction of the pressure at 32° Fahr. = h' to its value at the level of the sea = H .

$$\log. H = \log. h' + \frac{a}{56054. \left(1 + \frac{t + \frac{a}{500}}{418} \right)}$$

No. 3.—Reduction of the observed pressure h to its value at the level of the sea, and standard temperature of 32° Fahr. = H .

$$\log. H = \log. h \pm \frac{69.8 \left(1 + \frac{t + \frac{a}{500}}{418} \right) + a \infty 2.2 \left(1 + \frac{t + \frac{a}{500}}{418} \right) \times T}{56054. \left(1 + \frac{t + \frac{a}{500}}{418} \right)};$$

the upper or lower sign to be used as 69.8 &c. + a is greater or less than 2.2 &c. $\times T$ *.

Explanation of the Use of the Table.

For formula No. 3.—1°. To the observed temp. of the air add $\frac{1}{500}$ part of the alt. which term the *mean* temp.

2°. With the *mean* temp. enter the col. A, and take out the corresponding quantity in col. B, which add to the altitude.

3°. With the *mean* temperature for the first column take out the corresponding quantity in column C, which *multiply* by the height of the detached thermometer.

4°. Note the *difference* of this *product* and the *sum* last found, marking it positive or negative as the *sum* is greater or less than the *product*.

5°. Multiply this *difference* by the quantity given in the column D corresponding to the *mean* temperature found in the first column, and divide the product by 1000.

6°. To the logarithm of the observed pressure, (corrected for capacity and capillarity,) add or subtract, according to the sign prefixed to the *difference*, the quotient just found, which

$$\text{* Approximately,} \quad \log. H = \log. h \pm \frac{a + 78 \infty 2.4 \times T}{56054. \left(1 + \frac{t + \frac{a}{500}}{418} \right)}.$$

will

will be the logarithm of the pressure required, at the standard temperature of 32° Fahr.—Example:

$h = 29\cdot500$ inches; $T = 60^\circ$; $t = 59^\circ$; $a = 500$ feet.

$$\begin{array}{rcl}
 300 \overline{)500} & & 79\cdot9 \text{ (See column B.)} \\
 \underline{300} & & + 500\cdot0 \\
 200 & & 579\cdot9 \text{ Sum} \\
 + 59 & & \underline{2\cdot5 \times 60 = 150\cdot0} \text{ Product} \\
 \text{mean temp. } 60^\circ & & + 429\cdot9 \text{ Difference} \\
 & & \times \cdot 015601 \text{ (See column C.)} \\
 & & 1000 \overline{)6\cdot7069} \\
 & & + \cdot 0067069 \\
 & & \log. \text{ of } 29\cdot500 = 1\cdot4698220 \\
 & & \log. \text{ of } 29\cdot959 = \underline{1\cdot4765289}
 \end{array}$$

For formulæ Nos. 1 and 2.—If we prefer to reduce the observed pressure in the first instance to its value at 32° Fahr. the process of calculation will be as follows:

$$\begin{array}{rcl}
 \text{By Formula No. 1. } \frac{60 - 32 \times 29\cdot5}{11121 + 60} = \frac{826}{11181} = - \cdot 0739 \\
 h = 29\cdot5000 \\
 h' = \underline{29\cdot4261}
 \end{array}$$

Entering the first column of the table with the mean temperature, take the corresponding number in the last column, which multiply by the altitude. Divide the product by 1000, and add the quotient to the logarithm of the pressure at 32° Fahr.—Example:

$$\begin{array}{rcl}
 \cdot 015601 \\
 \times 500 \\
 1000 \overline{)7\cdot8005} \\
 + 0\cdot0078005 \\
 \log. \text{ of } 29\cdot4261 = 1\cdot4687327 \\
 \log. \text{ of } 29\cdot959 = \underline{1\cdot4765332}
 \end{array}$$

The elevation of the barometer, when placed in the vicinity of the sea, may be readily ascertained by levelling, trigonometrically, or by the portable barometer. When the situation is inland, its height relative to the nearest canal, mountain, or other object of which the absolute elevation has been well determined, may be obtained by one or other of the methods above mentioned. As a last resource,—extract from the different scientific journals the annual *mean* pressures furnished by barometers placed at *given* elevations above the sea in the vicinity of the observer, which data, in addition to the annual *mean* height of his own instrument, will enable him to ascertain on calculation the required difference of level.

I have the honour to be, &c.

Leeds, Dec. 5, 1826.

J. NIXON.

New Series. Vol. 1. No. 1. Jan. 1827.

D Table.

TABLE.

A	B	C	D	A	B	C	D
3° F.	70·3	2·2	0·017713	43° F.	77·0	2·4	0·016176
4	70·5	2·2	·017671	44	77·2	2·4	·016141
5	70·7	2·2	·017629	45	77·4	2·4	·016106
6	70·8	2·2	·017587	46	77·5	2·4	·016071
7	71·0	2·2	·017546	47	77·7	2·4	·016037
8	71·2	2·2	·017505	48	77·9	2·4	·016002
9	71·3	2·2	·017464	49	78·0	2·4	·015968
10	71·5	2·2	·017423	50	78·2	2·4	·015934
11	71·7	2·2	·017383	51	78·4	2·4	·015900
12	71·8	2·2	·017342	52	78·5	2·5	·015866
13	72·0	2·3	·017302	53	78·7	2·5	·015832
14	72·2	2·3	·017262	54	78·9	2·5	·015799
15	72·3	2·3	·017222	55	79·0	2·5	·015765
16	72·5	2·3	·017182	56	79·2	2·5	·015732
17	72·7	2·3	·017143	57	79·4	2·5	·015699
18	72·8	2·3	·017103	58	79·5	2·5	·015666
19	73·0	2·3	·017064	59	79·7	2·5	·015633
20	73·2	2·3	·017025	60	79·9	2·5	·015601
21	73·4	2·3	·016987	61	80·0	2·5	·015568
22	73·5	2·3	·016948	62	80·2	2·5	·015536
23	73·7	2·3	·016910	63	80·4	2·5	·015503
24	73·9	2·3	·016871	64	80·5	2·5	·015471
25	74·0	2·3	·016833	65	80·7	2·5	·015439
26	74·2	2·3	·016795	66	80·9	2·5	·015407
27	74·4	2·3	·016758	67	81·0	2·5	·015375
28	74·5	2·3	·016720	68	81·2	2·5	·015344
29	74·7	2·3	·016683	69	81·4	2·5	·015312
30	74·9	2·3	·016645	70	81·5	2·5	·015281
31	75·0	2·3	·016609	71	81·7	2·6	·015250
32	75·2	2·3	·016571	72	81·9	2·6	·015219
33	75·4	2·4	·016535	73	82·0	2·6	·015187
34	75·5	2·4	·016498	74	82·2	2·6	·015157
35	75·7	2·4	·016462	75	82·4	2·6	·015126
36	75·9	2·4	·016425	76	82·5	2·6	·015095
37	76·0	2·4	·016389	77	82·7	2·6	·015065
38	76·2	2·4	·016353	78	82·9	2·6	·015034
39	76·4	2·4	·016318	79	83·0	2·6	·015004
40	76·5	2·4	·016282	80	83·2	2·6	·014974
41	76·7	2·4	·016246	81	83·4	2·6	·014944
42	76·9	2·4	·016211	82	83·5	2·6	·014915

VI. Further