|  |  |  |  |
| --- | --- | --- | --- |
| Tempera­  ture. | Observed  Elasticities. | Calculated  Elasticities. | Differences. |
|  | Inches. | Inches. | Inches. |
| 32o |  | 0.18 |  |
| 42 |  | 0.25 |  |
| 52 |  | 0.35 |  |
| 62 | 0.52 | 050 | —0.02 |
| 72 | 0.73 | 0.71 | —0.02 |
| 82 | 1.02 | 1.01 | —0.01 |
| 92 | 1.42 | 1.42 | 0.00 |
| 102 | 1.95 | 1.96 | + 001 |
| 112 | 2.65 | 2 67 | + 0.02 |
| 122 | 3.57 | 358 | + 0.01 |
| 132 | 4.68 | 4.74 | + 0.06 |
| 142 | 6.06 | 6.20 | + 0.14 |
| 152 | 7∙85 | 7.99 | + 0.14 |
| 162 | 9∙99 | 10.19 | + 0.20 |
| 172 | 12.64 | 12.86 | + 0.22 |
| 182 | 15.91 | 1608 | + 0.17 |
| 192 | • ∙ ∙ | 19∙91 | . ∙ . |
| 202 | • . . | 24.45 | . . . |
| 212 | 29.80 | 29.80 | 0.00 |
| 250.3 | 59.60 | 59.69 | + 0.09 |
| 293.4 | 119.20 | 118.32 | —0.88 |
| 343.6 | 238.40 | 2.3760 | —0.80 |

“ I believe it is now generally considered that the temperature 212° is that of water boiling when the barometer is at 30 inches instead of 29∙8 ; and if, in the above algebraic expressions, the following alterations be made, the results from the formulæ will correspond with the adjustment of that point, and fully as well with the experiments generally.

“ Let T=∕ + 51.3 ; the index of the power and of the root be 5.13, instead of 5.14 ; and *m=* 87344,000000. So the two last equations will be : 5.13 LT—10.94123=LE;

and LE+10.94123/5.13 = LT.

“ The table will stand as follows, supposing the thermo meter had been graduated for 212° to correspond with 30 inches of the barometer :—

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Γemp. | Observd  Elastici­  ties. | Calcul.  Elastici­  ties. | Differ  ences. | Temp. | Observd. Elastici  ties. | Calcul  Elastici  ties. | Differ  ences. |
| 32 | Inches  @@\*0.16 | Inches.  0.18 | Inches.  + 0.02 | 142° | Inches.  6.10 | Inches.  6 22 | Inches + 0.12 |
| 42 | \*0.23 | 0.25 | +0.02 | 152 | 7∙90 | 8 03 | + 0.13 |
| 52 | \*035 | 0.35 | 0.00 | 162 | 10 05 | 10.25 | + 0.20 |
| 62 | 052 | 0.50 | —0.02 | 172 | 12.72 | 1294 | + 0.22 |
| 72 | 0.73 | 0.71 | —0 01 | 182 | 16.01 | 16.17 | + 0.16 |
| 82 | 1.02 | 1.01 | —0 01 | 192 | . . . | 20 04 | . . . |
| 92 | 1.42 | 1.42 | 0.00 | 202 | . . . | 24.61 | • ∙ . |
| 102 | 1.96 | 1.97 | + 0.01 | 212 | 30.00 | 30.00 |  |
| 112 | 2.66 | 2 68 | + 0 02 | 250.3 | 60.00 | 60.11 | + 0.11 |
| 122 | 3.58 | 3.60 | + 0.02 | 293.4 | 120.00 | 119.17 | —0.3 |
| 132 | 4.71 1 | 4.76 | + 0.05 | 143.6 | 240.00 | 239.28 | —02 |

“ I remain, with the greatest esteem and respect, Dear

Sir, Your very obedient Servant,

*“ Oakhill, 20th March,* 1811." « John SOUTHERN.

“ To James Watt, Esq., Heathfield.”

28. In the *Memoirs of the Royal Academy of Berlin*

for 1782, there is an account of some experiments made by M. Achard on the elastic force of steam, from the temperature 32° to 212°. They agree extremely well with those mentioned here, rarely differing more than two or three-tenths of an inch. He also examined the elasticity of the vapour produced from alcohol, and when the elasticity was equal to that of the vapour of water, he found that the temperature was about 35° lower. Thus, when the elasticity of both was measured by 28.1 inches

of mercury, the temperature of the watery vapour was 209°, and that of the spirituous vapour was 173°. When the elasticity was 18.5, the temperature of the water was 189.5o, and that of the alcohol 154.6°. When the elasticity was 11.05, the water was 168°, and the alcohol 134.4° Observing the difference between the temperature of equaIly elastic vapours of water and alcohol not to be con stant, but gradually to diminish, in M. Achard’s experi ments, along with the elasticity, it became interesting to discover whether, and at what temperature, this difference would vanish altogether. Experiments were accordingly made by the writer of this article, similar to those made with water. They were not made with the same scrunulous care, nor repeated as they deserved, but they fur­nished rather an unexpected result. The following table will give the reader a distinct notion of them.

|  |  |  |  |
| --- | --- | --- | --- |
| **Temperature.** |  | Temperature. | **Elasticity.** |
| 32° | 0.0 | 140 | 12 2 |
| 40 | 0.1 | 160 | 21.3 |
| 60 | 0.8 | 180 | 34. |
| 80 | 1.8 | 200 | 524 |
| 100 | 3.9 | 220 | 78.5 |
| 120 | 69 | 240 | 115. |

29. Dr Dalton appears to have been the first to escape from the natural enough error of assuming that the vapour of water at 32° would be = 0. His apparatus is the most simple and refined of any that have been employed for temperatures below 212°, and his experiments are those which, to the present day, have the greatest authority. Dr Dalton’s first experiments were published in 1793, in his *Meteorological Essays ;* afterwards, when more extended, in the *Manchester Memoirs,* 1802 ; then in the first volume of his *System of Chemistry,* 1808; and finally in the second volume of the same work, 1827. The following is the account given by himself, of his early experiments, in the *Manchester Memoirs.*

“ My method is this : I take a barometer tube AB, (Fig. 13,) perfectly dry, and fill it with mercury just boiled, marking the place (30) where it is stationary ; then, having graduated the tube, I pour a little water, or any other liquid, the subject of experiment, into it, so as to moisten the whole inside : after this I again pour in mercury, and carefully inverting the tube, exclude

all air ; the barometer, by standing

some time, exhibits a portion of water

of 1/8 or 1/10th of an inch, W, on the top

of the mercurial column ; because, be

ing lighter, it ascends by the side of the

tube, which may now be inclined, and

the mercury will rise to the top, mani

festing a perfect vacuum from air. I

next take a cylindrical glass tube CD,

open at both ends, of two inches dia

meter and fourteen inches in length,

to each end of which a cork is adapted,

perforated in the middle, so as to admit

a barometer tube to be put through,

and to be held fast by them ; the upper

cork, C, is fixed two or three inches be

low the top of the tube, and is one-half

cut away, so as to admit water, &c., to

pass by, its service being merely to keep the tube steady. Things being thus circumstanced ; water of any temperature may be poured into the wide tube, and thus made to surround the upper part or vacuum of the barometer, and the effect of temperature in the production of vapour within can be observed from the depression of the mercurial column at the top. In this way I have had water as high as 155° surrounding the vacuum ; but as the higher temperatures might endanger a glass apparatus, instead of it I used the following :—

@@@\* Γhese are inserted from numerous experiments made by Mr W. Creighton.