In the memoirs of the Royal Academy of Berlin for 1782, there is an account of ſome experiments made by Mr Achard on the elaſtic force of ſteam, from the tem­perature 32⁰ 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 found, that when the elaſticity was equal to that of the vapour of water, the temperature was about 35⁰lower. Thus, when the elaſticity oſ both was measured by 28,1 inches of mercury, the temperature of the watery vapour was 209⁰, and that of the ſpirituous va­pour was 173⁰∙ When the elaſticity was 18,5, the temperature of the water was 189,5, and that of the alcohol 154,6. When the elaſticity was 11,05, the water was 168⁰, and the alcohol 134⁰,4. Obſerving the difference between the temperatures of equally elaſ­tic vapours of water and alcohol not to be constant, but gradually to diminiſh, in Mr Achard’s experiments, 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 ſcrupulous 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:

|  |  |
| --- | --- |
| Temp.  328 | Elast.  0,0 |
| 40 | **0,1** |
| 60 | 0,8 |
| 80 | c,8 |
| 100 | 3’9 |
| 120 | 6,9 |
| 140 | 12,2 |
| 160 | 21,3 |
| I 80 | 34, |
| 200 | 52,4 |
| 220  24.0 | 78,5  115, |

We say that the reſult was unexpected ; for as the natu­ral boiling point ſeemed by former experiments to be in all fluids about 120⁰ or more below their boiling point in the ordinary preſſure of the atmoſphere, it was reaſonable to expect that the temperature at which they ceaſed to emit ſenſibly elaſtic ſteam would have ſome relation to their temperatures when emitting ſteam of any determinate elaſticity. Now as the vapour of alco­hol of elaſticity 30 has its temperature about 36⁰ low­er than the temperature of water equally elaſtic, it was to be expected that the temperature at which it ceaſed to be ſenſibly affected would be ſeveral degrees lower than 32⁰. It is evident, however, that this is not the caſe. But this is a point that deferves more attention, becauſe it is cloſely connected with the chemical rela­tion between the element (if ſuch there be) of fire and the bodies into whoſe compoſition it ſeems to enter as a conſtituent part. What is the temperature 32⁰, to make it peculiarly connected with elaſticity ? It is a temperature affirmed by us for our own conveniency, on account of the familiarity of water in our experi­ments. Æther, we know, boils in a temperature far below this, as appears from Dr Cullen’s experiments narrated in the Eſſays Phyſical and Literary of Edin­burgh. On the faith of former experiments, we may be pretty certain that it will boil in vacuo at the tem- perature—14⁰, becauſe in the air it boils at +106⁰. Therefore we may be certain, that the ſteam or vapour of aether, when of the temperature 32⁰, will be very ſen­ſibly elaſtic. Indeed Mr Lavoiſier ſays, that it it be expoſed in an exhauſted receiver in winter, its vapour will ſupport mercury at the height of 10 inches. A ſeries of experiments on this vapour ſimilar to the above would be very inſtructive. We even with that those on alcohol were more carefully repeated. If we draw a curve line, of which the absciſſa is the line oſ tempera­tures, and the ordinates are the correſponding heights of the mercury in theſe experiments on water and alcohol, we ſhall obſerve, that although they both ſenſibly coin­cide at 32⁰, and have the abſcissa for their common tan­gent, a very ſmall error of obſervation may be the cauſe of this, and the curve which expreſſes the elaſticity of ſpirituous vapour may really interſect the other, and go backwards conſiderably beyond 32⁰.

This range of experiments gives rise to ſome curious and important reflections. We now ſee that no parti­cular temperature is necessary for water assuming the form of permanently elaſtic vapour ; and that it is high­ly probable that it affirmes this form even at the tempe­rature 32⁰ ; only its elaſticity is too ſmall to afford us any ſenſible meaſure. It is well known that even ice evaporates (ſee experiments to this purpoſe by Mr Wilſon in the Philosophical Tranſactions@@, when a piece of poliſhed metal covered with hoar froſt became perfectly clear by expoſing it to a dry froſty wind).

Even mercury evaporates, or is converted into elaſtic vapour, when all external preſſure is removed. The dim film which may frequently be obſerved in the upper part of a barometer which ſtands near a ſtream of air, is found to be ſmall globules of mercury ſticking to the inside of the tube. They may be ſeen by the help of a magnifying glaſs, and are the beſt teſt of a well made barometer. They will be entirely removed by causing the mercury to rise along the tube. It will lick them all up. They conſiſt of mercury which had evaporated in the void ſpace, and was afterwards condenſed by the cold glaſs. But the elaſticity is too ſmall to occaſion a ſenſible depreſſion of the column, even when conſider­ably warmed by a candle.

Many philoſophers accordingly imagine, that ſpontaneous evaporation in low temperatures is produced in this way. But we cannot be of this opinion, and muſt ſtill think that this kind of evaporation is produced by the diſſolving power of the air. When moiſt air is sud­denly rarefied, there is always a precipitation of water. This is moſt diſtinctly ſeen when we work an air-pump briſkly. A miſt is produced, which we ſee plainly fall to the bottom of the receiver. But by this new doc­trine the very contrary ſhould happen, becauſe the ten­dency of water to appear in the elaſtic form is promo­ted by removing the external pressure ; and we really imagine that more of it now actually becomes simple elaſtic watery vapour. But the miſt or precipitation ſhows incontrovertibly, that there had been a previous ſolution. Solution is performed by forces which act in the way of attraction ; or, to expreſs it more ſafely, ſo­lutions are accompanied by the mutual approaches of the particles of the menſtruum and ſolvend : all ſuch ten­dencies are *obſerved* to increaſe by a diminution of diſtance. Hence it *must* follow, that air of double denſi­ty will diſſolve more than twice as much water. There­fore when we ſuddenly rarefy ſaturated air (even tho’

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