fore, when the particles of ice are leaving the solid and taking the liquid form, and again passing out of the liquid into the vaporous state, a large accession of caloric passes into the substance without being detected by the thermo meter ; this heat, *insensible* to the thermometer, and manifested only by the calorimeter, is called LATENT **HEAT.** The doctrine of latent heat was discovered by Dr Black.

The quantity of heat thus latent in the mass of a solid, when it assumes the liquid state, is called the *caloric of fluidity.* The latent caloric of a liquid passing into va pour is called the caloric of elasticity or vaporization.

Caloric of Fluidity. Caloric of Vaporization.

Sulphur, . . 144° Water, . . 967°

Spermaceti, . 145 Alcohol, . , 442

Lead, . . 162 Ether, , . 302

Bees’ wax, . . 175 Petroleum, . . 178

Zinc, . , . 493 Oil of turpentine, 178

Tin, . ∙ ∙ 500 Nitric acid, . 532

Bismuth, . . 550 Liquid ammonia, 837

Ice, . . . 140 Vinegar, . . 875

60. The determination of the latent heat of ordinary steam is a problem of considerable practical difficulty. It may be obtained rudely by very simple contrivances. If a lamp, which burns with tolerable uniformity, be applied to a vessel containing cold water, at the temperature of 32°, so long as to heat it to 212°, the boiling point, and if the lamp be then weighed and the consumption of oil ascertained by the loss of weight ; and if the lamp be still applied to the boiling water so as to keep it constantly in ebullition until the whole has been converted into steam ; the steam passing off at the same temperature as the water, it will be found, when the whole water has been boiled away, or converted into steam, that 6 times as much oil has been consumed, or that 6 times as much heat has been employed in the conversion of the water into steam as was required formerly to heat the water from 32° to 212°, or to give it 180° of temperature ; so that 6 times 180° or 1080°, will appear to have been absorbed or carried off in the steam of 212°—that is, the latent heat of steam is 1080°.

Otherwise, the same determination may be obtained, if the steam, when passing off from the boiling water, be led carefully in a pipe to a vessel of cold water, so as to take from it the heat which it has thus carried off ; if the water to which the heat of the steam is given out be at a temperature of 32° and of 6 times the quantity of the water from which the steam was formed, the whole of it will be heated by the caloric of the steam to 212°, showing that the quantity of caloric of the steam amounts to what gives 180° to 6 times the quantity of water ; giving, as formerly, 6 times 180° or 1080° ns the amount of the latent heat of the steam.

It is to Mr Watt that we owe the earliest determination of the latent heat of steam. Dr Black endeavoured to ascertain this point by the first of the methods we have pointed out, by comparing the time of raising the temperature of water a certain number of degrees, with the time of boiling it off a certain number of degrees ; but his result was not correct, being only 800° Mr Watt’s result for the latent heat of steam was 1006° 79.

Mr Southern’s experiments were made in 1803 ; and he was assisted in them by Mr William Creighton, and communicated them to Mr Watt for an appendix to this article. He obtained the number 950°. The thermometers employ ed in his experiments were made and graduated with the greatest care, the tubes having been accurately measured as to the proportional capacity of their different parts.

A similar series of experiments was afterwards made by M. Schmidt, who determined the heat latent in steam to be about 5.33 times that necessary to heat water from 32° to 212° = 5.33 times 180o or 960 nearly.

Count Rumford determined the latent heat of steam by condensing it in a calorimeter formed by pushing a long spiral steam pipe through a vessel of cold water, by which he obtained 1040.8 as the latent heat of steam of water.

M. Despretz in the *Annales de Chimie et Physique,* gives 955.8° as the result of his experiments on the latent heat of steam.

Lavoisier and Laplace make the latent heat of steam 1000.o

From the experiments of Gay Lussac and of MM. Clement and Desormes, the number 990° is generally used by the French to represent the latent heat of steam. The diversity of the results obtained from experiments made by so many excellent experimenters, with so much precaution, is remarkable—to eliminate from them the precise truth with certainty is not within our present resources of analysis. There is high probability in favour of the numbers 990. or 1000., as representing nearly enough the latent heat of steam, being 5.555 times the caloric of boiling water, its whole caloric reckoned from 32° being 6.666 times that of boiling water.

61. A doctrine of great simplicity is now pretty gene rally held as expressing with an accuracy quite within the limits of experimental precision, the result of our knowledge of the heat latent in steam. It is found that in steam of great elasticity and of corresponding high temperature, the heat latent is in quantity less ; and that, on the contrary, when steam is of lower elastic force and of lower temperature that at 212°, its latent heat is greater than at 212°. And it appears that we are warranted in the conclusion first suggested by Mr Watt and afterwards by Dr Dalton, that the whole amount of caloric in a given quantity of elastic vapour remains the same at all tempe­ratures and under all pressures. When the volume of the vapour is great the greater is its capacity and the less its temperature ; while, by compressing it into smaller space, its elasticity is encreased and its temperature raised. The doctrine is thus expressed, *that the sum of the sensible and latent heat of vapour is a con­stant quantity.* M. Despretz has extended this to the vapours of several other fluids.

There is another expression for the law of the constitutional heat of the vapour, which is, in the language of the Atomic Theory, *that every atom of a fluid in the state of vapour possesses, under every degree of elasticity and pressure, the same quantity of caloric.* This doctrine leads to very important consequences both of a theoretical and practical nature.

It follows immediately from this doctrine, that if a quantity of vapour have once been formed by adding to the liquid the quantity of caloric necessary to the constitution of the vapour, the same particles of matter surrounded by the same spheres of caloric may pass through all grada­tions of density, and through all gradations of tempera ture, without either parting with caloric or obtaining fresh supplies. Vapour of the temperature of 212°, ns it rises from water boiling in the open air, may he collected in a vessel and compressed by the force of 30 inches of mercury into half, its bulk, it will become steam of a higher temperature,, viz., 250° from the increased quantity of caloric in the diminished volume, and in this case the latent heat will only be 970° instead of 1000°. If corn pressed still further into again one half of that bulk, the temperature will rise to 292°, and leave only 920° latent. Compressed still further into half of the lastmentioned space, that is into 1/8 of its original bulk, the temperature is raised to 339°, leaving only 873° latent; and another step would raise the temperature to 392°, leaving only 820° latent ; less than seven steps more would bring the steam into less than its original bulk of water, with a temperature of between 900° and 1000° of sensible heat, and