Lowering the Freezing Point.

At a recent meeting of the Chemical Society, London, a paper was read on the application of Raoult's depression of melting point method to alloys, by Messrs. C. T. Heycock and E. H. Neville.

As a result of some preliminary experiments on the change in the solidifying point of tin caused by the addition of small quantitie of other metals, the authors conclude that the dissolution of a metal in tin follows the same laws as that of compounds in other solvents, *i. e.*: 1. That the fall in temperature of the solidifying point is directly proportional to the weight of metal added; and 2, that the fall of temperature is inversely as the atomic (molecular ?) weight of the metal added. With tin, copper, silver, cadmium, lead, and mercury, the dissolution of one atomic proportion in 100 atomic proportions of tin caused a fall in temperature of the solidifying point varying from 2·16° to 2·67°, with aluminum a fall of 1·34°, and with antimony a rise of 2·0°.

In the discussion which followed the reading of these papers, Professor Armstrong said that notwithstanding the apparent regularity and simplicity of the results, he was not prepared to accept them as in the least degree final. There was not sufficient evidence in his opinion that the effect observed was not in part at least the outcome of a change in the molecular composition of the solvent. The results obtained by Raoult's methods were, he thought, comparable with those obtained by determining the specific heats of the elements. In the latter case the observations were undoubtedly made with masses of molecules, which probably were of varying degrees of atomic complexity, and yet the results were found to be such as to justify conclusions being drawn as to the relative magnitudes of their fundamental constituents—the atoms. In the same way it was possible that the results obtained by Raoult's method by means of observations on the behavior of molecular complexes might afford the means of deducing the relative magnitudes of the fundamental molecules comprising the complexes, but not of the actual complexes operated with.

Mr. Crompton drew attention to Beckmann's recent experiments on the lowering of the freezing point. These show that the true molecular weight was only obtained when solutions were used the concentration of which was allowed to vary only within certain narrow limits, and that if the solutions were too dilute the molecular weight obtained from the lowering of the freezing point was too low, while if the solutions were too concentrated, it was too high. In some cases the variation of the number obtained with the concentration was enormous.

Professor Carey Foster remarked that much depended on the definition given of a molecule, whether it is defined as that smallest quantity capable of existence *per se*, or as that quantity which produces a given effect in depressing vapor pressure, or freezing point, etc. The two mganitudes were not necessarily the same. The relation observed could hardly be accidental, yet he thought that the value obtained might be a quantity connected with the molecular weight, but not necessarily identical with it. Professor Ramsay, in replying, said that substances in dilute solutions must be regarded as in the gaseous state, their molecules being so far distant from each other as not to exert appreciable attraction on each other, and as occupying but a small portion of the space they inhabit. It has long been argued that the molecular complexity of the gases, hydrogen, oxygen, and nitrogen, must be the same, inasmuch as these elements have equal coefficients of expansion within the widest limits of temperature.

A similar argument applies to substances in dilute solutions. It is much more probable that they have a simple and similar molecular structure than that the molecules, if complex, dissociate to an equal extent on equal rise of temperature, or on equal alteration of concentration. As regards the empirical nature of Raoult's laws, it is paralleled by the empirical nature of Boyle's and Gay-Lussac's laws—that is, such laws are merely approximations to truth, and depend on the fact that the molecules are sensibly beyond the sphere of each other's attraction, and themselves occupy no appreciable space. Hence their inapplicability at high concentrations.

Low Level Health Resorts.

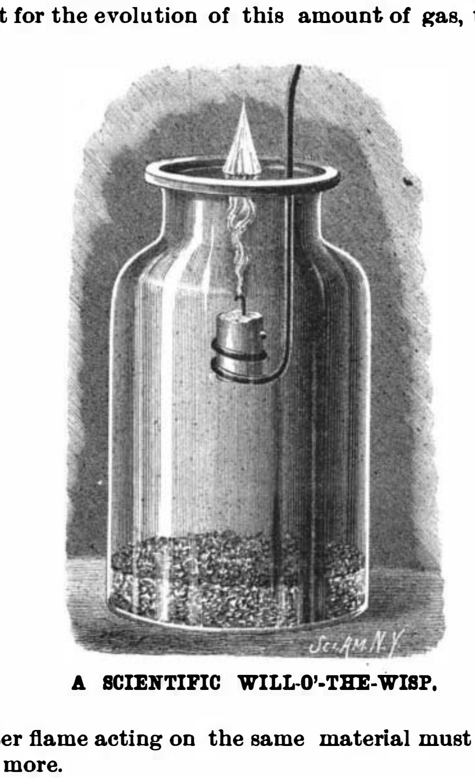
Attention has lately been called by Dr. Lindsey to the therapeutic value of regions below the sea level, for asthmatical or consumptive patients, who there have continuously higher atmospheric pressure than at the sea level. Excellent effects have been thus obtained in the valley of Conchilla, near Los Angeles, in California about 273 feet under the sea (barometric pressure only about 7 mm. higher). The most noteworthy place of the kind on the earth's surface is probably the Dead Sea district (—1289 feet), and the following are some others: Lake Asal in East Africa (—639 feet), the oasis of Araj in the desert of Lybia (—270 feet), the Arroyo del Muerto in California (—230 feet), the oasis of Siwah in Lybia (—123 feet), the borders of the Caspian (—86 feet).

A SCIENTIFIC WILL-O'-THE-WISP.

T. O'CONOR SLOANE, PH.D.

A very interesting experiment that illustrates the phenomena of combustion, destructive distillation, and the relative specific gravity of gases is illustrated in the cut accompanying this article. The experiment depends upon the well known fact that an organic substance containing hydrogen when heated to a high temperature evolves gas. This is seen in the candle. The body of the flame is composed of gas evolved by destructive distillation from the organic material of which the candle is composed. This material is melted by the heat of the flame, is drawn by capillary action into the wick, and is there heated to so high a degree as to evolve a large amount of gas. A well known experiment used to prove the presence of this gas consists in lowering into the flame the end of a glass tube held nearly vertical. The hot gas from the interior of the flame rises through this and can be lighted at its top several inches distant from the flame.

There is a simpler way of showing it, which requires still less apparatus. If a candle is lighted and allowed to burn a few minutes, the wick becomes very hot. If it is now blown out, enough heat will be present in the wick and its contents to cause the evolution of combustible vapor. It can be recognized by a white column of vesicular matter rising like a fine mist from the candle. If a lighted match is held in this rising column a few inches above the candle flame, the vapor will ignite and will carry the flame down to the wick with a quick flash, and the candle will be relighted. It follows that, if the residual heat left in the wick is sufficient for the evolution of this amount of gas, the far



A SCIENTIFIC WILL-O'-THE-WISP.

hotter flame acting on the same material must evolve still more.

In the experiment shown in the cut some features of the last described phenomenon are utilized to produce what may be called a parlor will-o'-the-wisp or *ignis-fatuus*. A wide mouthed bottle, such as a pickle or preserve jar, is filled with carbonic acid gas. To do this a quantity of sodium bicarbonate or baking soda is placed in it and more acid is poured over the dry salt as it lies on the bottom of the jar. Dilute sulphuric acid is perhaps the best, but muriatic acid or even vinegar may be used. A very rapid evolution of gas begins, and in a few seconds the jar is filled and overflowing. A candle should have previously been attached to a piece of wire and should be lighted before the acid is introduced. This will give it time to get hot and into full combustion. The jar being filled with gas, the candle is gently lowered into it. The flame surrounding the wick is extinguished as it reaches and is lowered down into the carbonic acid gas, but if all is rightly managed, the flame will continue to burn on the surface of the gas like a veritable *ignis-fatuus*. The residual heat of the wick and material absorbed by it is sufficient to cause the evolution of a quantity of gas. For several seconds this rises up through the heavier carbonic acid gas, and burns upon its surface. A faint cloud of vapor may sometimes be seen, which indicates the ascending column.

After a few seconds the disconnected floating flame disappears for want of nutriment. The candle may now be removed and relighted, and a variation upon the experiment may be shown. It is again lowered into the gas in the jar, and is extinguished, leaving the same floating flame. But before the latter expires the candle is steadily raised. As it reaches the flame and emerges from the jar, it is lighted again, and continues to burn as before. The flame that it left behind it on the surface of the carbonic acid gas acts like the match in the experiment last alluded to, and relights the wick.

To perform the experiment successfully, the air of the room must be very still and undisturbed. In place of the candle a small glass jet may be used connected to a gas burner. The gas will rise from the jet immersed in the jar and will burn upon the surface as in the case of the candle. But the experiment is not as full or complete as when the candle is used, and it is not easy to obtain so distinct and marked a separation between the source of gas and the flame when ordinary gas is employed.

Funeral of M. Chevreul.

The public funeral of M. Chevreul, which took place in Paris, on April 13, was one of great splendor. This was due in part, no doubt, to the interest excited by M. Chevreul's extraordinary age; but it must also be taken as a striking indication of the respect felt in France for men who achieve eminence in science. In front of the house in which M. Chevreul died, beside the Jardin des Plantes, a tent was fitted up as a chapel, and here the body was placed in state. The procession to the Cathedral of Notre Dame was headed by a detachment of police, who were followed by a platoon of cuirassiers, the 103d Infantry Regiment, with flags, and a band of ushers, carrying wreaths presented by the stearine makers of France, the stearine makers of Lyons, the Friendly Society of Natives of Anjou, living in Paris, and a large number of other public and private bodies. Last of all came a wreath sent by the Gobelin Works surrounded by a woolen fringe dyed by M. Chevreul himself. The pall bearers were MM. Fallieres, Minister of Public Instruction, Louis Passy, President of the Society of Agriculture, Chaumeton, President of the Students' Association, Des Cloizeaux, of the Academy of Sciences, Quatrefages, of the Academy of Sciences, Chautemps, president of the Municipal Council of Paris, and Roy, manager of the Society of Arts and Manufactures. Next came the members of M. Chevreul's family, grandchildren and great-grandchildren; and they were followed by the representatives of the President of the Republic, by several of the ministers, the presidents of the Senate and the Chamber, and representatives of all the great educational and scientific bodies and administrative departments. At Notre Dame there was an impressive religious service. The interior of the church was hung with black, and over the porch, which was also hung with black, was a scroll bearing the dates "1786–1889." In the center of the choir was a catafalque resting on silver columns, and surmounted by a canopy with bands of ermine. After the religious ceremony, the body was removed to L'Hay, and interred in the family vault. In compliance with M. Chevreul's last wishes, no speech was made over his grave.

The New Subway, London.

A paper was read lately before the Junior Engineering Society, London, by Mr. W. T. Dunn, hon. secretary, on "The Southwark and City of London Subway," in connection with which a visit took place to the works of the undertaking, permission having been granted by Mr. J. H. Greathead, the engineer. Entrance was obtained to the underground workings at the New Street station of the line, Kennington Park road, the visitors being accompanied by Mr. Basil Mott, resident engineer, who explained the construction of the workings, the position and proposed fittings of the platforms, and arrangements for entrance and exit, and the general manner in which the work at present completed had been carried out. The party then proceeded for a short distance along the down tunnel cityward, afterward passing through a connecting passage into the up tunnel. From thence they passed to the section of the tunnel leading in the direction of Kennington, and during their progress the method of constructing the tunnel was fully seen and explained, the principal features of interest being the boring shield, worked by hydraulic rams, the manner of fixing the segments of the cast iron tunnel lining, and the apparatus employed for injecting the cement grouting under air pressure.

The Great San Diego Flume.

It is claimed that the recently completed San Diego flume, described in the SCIENTIFIC AMERICAN of October 27, 1888, is the most stupendous ever constructed in the world, being only a little short of thirty-six miles long. An idea of the gigantic character of the work may be obtained from the fact that the amount of lumber consumed was more than nine millions of feet, or, allowing the very considerable yield of 1,000 feet to each tree, not less than 9,000 trees were required. In the course of the flume there are some 315 trestles, the longest of these being 1,700 feet in length, eighty-five feet high, and containing one-quarter of a million feet of lumber. Another trestle is of the same height, and 1,200 feet long, the main timbers used in both of these being ten by ten and eight by eight, being put together on the ground and raised to their position by horse power. The number of tunnels in the course of the flume is eight, the longest of which is 2,100 feet, the tunnels being in size six by six feet, with convex-shaped roofing; each mile of the flume required an average of one-fourth of a million feet of lumber for its construction, and the redwood used entirely in the box is two inches in thickness throughout.