

out. Why does the bubble expand as it rises? The pressure upon its surface varies as the depth; and therefore the nearer the surface the less the pressure.

How is it then, if you place water in an open saucepan on the fire to heat, we see at first bubbles form themselves at the bottom, like pieces of glass, rise up a little way, and are then lost before coming to the surface.

The air in that part of the water in contact with the bottom of the saucepan, immediately it begins to feel additional warmth, forms a bubble, rises up a little way, and although the pressure is diminished, it becomes again compressed, in consequence of coming in contact with cooler water as it rises. This it is, I believe, which causes what is called the hissing of the kettle.

If you were to boil a quart of water until it has all, as you call it, boiled away, what has become of it?—All turned into steam.—If water with chalk or salt in it?—The water would go into vapour, and the chalk or salt be left behind at the bottom of the kettle.

Did you ever see a white crust at the bottom of your tea-kettle? Yes, Sir; but we don't know what it is?—Don't you know we live upon what is called a chalk soil here, and the rain that falls makes its way through the chalk and comes out underneath it, having taken up some of the chalk in its way through. If our hills had been of iron ore, lead, or salt, the water would have taken up some of these substances in passing through them, as it always takes up some of the earth through which it filters—as it is a fluid in which many things are soluble; thus, we get water with chalk in it—when you boil it, the pure water goes off in vapour, and leaves the chalk behind, which falls to the bottom of the kettle: besides this, although hot water will hold up or melt more sugar or salt than cold, yet it will not hold more chalk, on the contrary, less, as the heating drives off a particular gas or air (called carbonic acid gas), which has a great liking for the chalk, and holds it up in the water, so that what falls to the bottom partly belongs to the water which is driven off, and partly to that which is left in the kettle. These are two reasons, therefore, why your kettle has a white mass of chalk at the bottom.

Taking off the lid of a kettle when the water is boiling, turning it up, what do you observe? Drops of water. These are formed by the steam coming against the lid, cooling it down so that it becomes water—the lid being in contact with the atmosphere conducts off the heat from the steam—this is distilled water or pure water, containing no lime, salt, etc.

Two fluids mixed together, which become vapours at different temperatures, may be easily separated—thus a mixture of spirit and water; heat the mixture up to the temperature at which spirit becomes vapour, it goes off and may be collected, the water remaining behind.

That the boiling point of water or any other fluid varies with the atmospheric pressure—how this may be applied to find the altitude of mountains—that water at the top of Mont Blanc, for instance, boils at a temperature of about 187°—that a difference of 1° in the boiling-point corresponds to about 530 feet of ascent, and this difference in boiling will denote a fall of about 0.589 inch of barometric pressure—that, under the receiver of an air-pump, water may be made to boil at a very much lower temperature than in the air. This and other things of a similar kind I find, from experience, may be made most instructive and useful to them, and more particularly if a school is provided with philosophical apparatus with which the experiments can be shown. A table of the temperatures at which different fluids boil and freeze, should be suspended on the wall.

Heat water to boiling in a Florence flask, cork it well when boiling, and turn the flask upside down, having removed it from the lamp it now ceases to boil; sprinkle water on the surface of the bottle, the steam within is condensed, and it again begins to boil; when it again ceases to boil, from the elasticity of the steam within, repeat the sprinkling and it commences boiling again. Thus the application of cold makes the water boil.

Archdeacon Wollaston invented an apparatus of such delicacy for ascertaining this, that the difference of the height of a common table from the ground would produce a difference in the boiling-point, which was clearly shown by the instrument.

The different ways in which water and metals are heated—hot current ascending, the cold water descending, and metals from particle to particle; point out also the difference in the process, in attempting to heat water by placing the fire above and not under the vessel containing it. The conducting power of fluids is very small, and it has been found that water may be made to boil in the upper part of a tube, without imparting much heat to the water below it, and that it may be brought to the boiling-point within one fourth of an inch of ice without the latter immediately melting; and that ice is

melted eighty times slower when it is fixed at the bottom of a cylindrical vessel with water above it, than when it floats upon the surface of warm water.

Salt is got from sea water by exposing it to the air in large pans; the water goes off in vapour and leaves the salt behind: the greater the surface exposed to the air the more rapidly the water goes off. Shallow pans better than deep, and why? Do you not observe the water lessens very much in summer in your sheep-ponds, even when you do not take cattle to drink at them? It is taken up by the air; in the same way a good brisk wind rapidly dries the hay, corn, and clothes after washing; and if you want anything that has been washed to dry fast, you unfold it as much as you can in order to expose all its surface to the air. For the same reason you spread out the grass and leave the corn in the field, in order that the fluid matter contained in them may be taken off.

Salt also is found as a mineral in Cheshire, Poland, etc.; and salt-springs are very often found in the coal-mines in some districts, particularly in Durham and Newcastle, where a great part of the salt used by the miners for their own domestic purposes is supplied by the salt springs in the mines.

The following is an easy instructive experiment: Take a small quantity of rock-salt and also of saltpetre, the crystals of which differ very much, dissolve them together in water, they form a clear limpid fluid. Pour this solution of the two into a small dish and let it evaporate; crystals of pure salt and saltpetre will be the result, the beautiful long crystals of saltpetre being totally devoid of salt. This shows clearly that the atoms of salt have an attraction for, and seek for, their own atoms—the same of the saltpetre, and that if there is any attraction of the one for the other, it is less than that among themselves.

(To be continued.)

The Man that knows how to Read and to Write. (1)

(Translated from the French of Mr. Emile Souvestre.)

When the children of men wanderers on the face of the earth, had to seek for their flocks the richest pasture lands, one of the sons of Japhet wearied, had fallen in the midst of the vast solitude and near his bleating sheep into a gentle slumber.

But a dream came over him, and the following vision passed before his eyes:

He imagined that he was borne aloft to a high mountain, from whence he could see extending in the distance the white tents of his own tribe, and the friendly habitations of many kindly clans. Beholding them his heart leaped with joy, and stretching forth his arms he raised his voice and called on his parents and his kinsmen; but the distance was great, neither could he be heard, nor could the welcome tones of their voices reach him. In vain he prays the passing clouds to take him up in their folds and carry him to his brethren, in vain he asks the birds of the air to lend him their wings, in vain he solicits the wind to carry his message; the clouds throw their shadows over him, the birds sing a mournful note, and the wind sighing passes on, unheeded is his request, and a gloom spreads over his countenance.

The eyes of the shepherd fill with tears; he cries aloud to the God of his fathers:

—Almighty being! free me from space and from time! so dispose that in my solitude, I may be enabled to speak to other men and make known to them my thoughts and they make known to me theirs!

Then an angel descended from heaven, placed into his hands a tablet, and said: "Learn first to recognise these characters, then to imitate them, and your wish shall be fulfilled."

It was the Alphabet that God was giving to the human race, and with it, the arts which are most useful for its progress and most conducive to its happiness, the art of reading and the art of writing.

With these, what is solitude, what is distance?

The man who knows how to read converses with the absent; he becomes the confidant of their joys and of their sorrows, he hears their assurances of esteem and of affection, and the soft breathing of their sympathies melts his heart: he is acquainted with what they do, with what they think, with what they desire, and with what they suffer. The scrip, which he receives covered with the

(1) For the original, see our *Journal de l'Instruction Publique*, for February last.