THE "D-LINES" SPECTRA.—ARE THEY DUE TO WATER?

By Lieut-Colonel W. A. Ross, late R. A.

In the year 1834, Mr. Fox Talbot, F. R. S., attributed the all but omnipresent rays affording the above-named spectra to water, on account of its universality ; but the celebrated experiment of Kirchoff has, since then, reversed that opinion, and bestowed the power of emitting orange rays upon sodium alone.

Is it not more reasonable, however, to suppose that sodium has more attraction for water than any other substance, than to imagine sodium contained in every possible substance, from the eternally-burning Sun himself, down to every particle of our atmosphere ?

A man need not be a chemist, or pyrologist, to observe that, if he holds in platinum tongs a fragment of marble, or artificial carbonate of lime, or magnesia, before the blowpipe, a strong orange flame affording "D-lines" spectra is emitted by the fragment, *only so long as it is imperfectly calcined*, or, in other words, has lost its carbonic acid gas. When calcination is complete, it begins to glow brightly, and emits no colored "flame" at all. Let us call this orange flame (a) in this case. According to modern chemical theories (a) can only be one of two things ; carbonic acid gas or sodium. It cannot be carbonic acid, which so far from being combustible, is used to "put out" flame. It can be proved not to be sodium by making it impinge upon a bead of pure transparent boric acid, in which it causes, after a time, *opalescence*. This opalescence is *removed* by the similar impingement upon the bead of an indubitable sodium orange flame. Reasonable chemists, therefore, will not be inclined to contradict Euclid that the same cause producing precisely opposite effects is a *reductio ad absurdum*. Moreover, for the supposed sodium to have been with the marble, and not with the marble after calcination—"*hic et ubique*," like the ghost of Hamlet's papa—is another absurdity, which no modern chemist would require us to believe, although some are very exacting if not always exact. May I hope that most chemists will be now inclined to admit, first, that (a) can be due neither to sodium nor to carbonic acid ; and secondly, that it must, therefore, be due to something else : and this is the very impression that occurred to me after thinking profoundly over the matter for several years.

Indeed, I suggested to Mr. Hennessy, who was engaged in making atmospheric observations at Mussooree, in India, with a spectroscope belonging to the Royal Society—and who was elected an F.R.S. for his pains—that the "D-lines" were due to water, not sodium, so long ago as 1871, and he was very much struck by the suggestion.

The methods I adopted to prove the truth (or improbability) of the suspicion which thus arose in my mind were as follows :

1.—The whole of (a) in a weighed fragment of pure marble was obtained by fusing it carefully before the blowpipe in a transparent bead of boric acid, when the carbonic acid gas, which we may call (b), escaped in bubbles with great effervescence, (a) remaining behind as opalescence, and the lime (c) combining with a portion of the boric acid to form a ball contained in the bead—let us call the bead (d). I found the weight of the lime borate ball $(c\,a)$ bore the same relative proportion to that of the marble $(a\,b\,c)$ whether the latter had been previously calcined or not, so that the opalescence in (d) could not possibly have been part of (c) while (b) escaped in bubbles ; therefore the opalescence *must* have been due to (a) or—

$$(a\,b\,c) + 2\,(d) - (b) = \left\{\begin{matrix}\text{(ball)}\\(c\,d)\end{matrix}\right\} + \left\{\begin{matrix}\text{(hydrated boric acid)}\\(a\,d)\end{matrix}\right\}$$

I could not isolate (a) any further than this, because $(a\,d)$ or what I believed to be *hydrated boric acid* is, naturally, as soluble in water as ordinary boric acid, so I tried—

2.—Observing that platinum in considerable bulk also produces (a) in a ratio increasing with the decrease of temperature down to a dull red heat, I fused an ounce of crystallised boric acid in an open platinum dish at red heat, and obtained a new kind of boric acid, which turns brown with a strong *resinous smell*, on being ignited, like that of burning sealing-wax, affords a slightly-oranged "flame"—for the green pyrochrome of the boric acid overpowers that of (a),—and forms an opalescent bead, which reacts, as I believe, with much greater acidity before the blowpipe than ordinary boric acid does.

This I call *platinised* or *hydrated boric acid*, and shall be happy to show it to any chemist who may consider the matter to be sufficiently interesting.—*English Mechanic.*

AN IMPORTANT DISCOVERY.

A discovery in chemistry has just been published, which bids fair to influence agriculture in a manner that may be well described as revolutionary. It must soon compel the attention of farmers and manufacturers of artificial manures everywhere. The essential part which ammonia plays in vegetation need not here be dwelt upon, and no one will question the desirability of securing it cheaply and in quantity. The importance of the recent feat of Messrs. Rickman & Thompson, of England, disclosing a plan by which ammonium sulphate can be made and sold with profit at two cents a pound, will not, therefore, be liable to be overestimated. The following account of the process is taken from the *Chemical News :*

Within the last twenty years the manufacture of ammonia synthetically has been several times attempted, and though in every attempt it is probable that ammonia has been made, it has never been produced on a commercial scale. In all these attempts the process has been to combine the nitrogen and hydrogen directly at a low temperature, and receive the ammonia in solution in water, or by substitution, first forming a cyanide at a higher heat, and then indirectly producing ammonia by the decomposition of the cyanide, the result in both cases being ammonia in solution with water. Rickman & Thompson's procedure is altogether different, they produce ammonium chloride direct, either in dry powder or in solution, and this by the simplest and most inexpensive means. Instead of employing retorts, as in all other places, they merely use a closed brick furnace, the ash-pan of which regulates the supply of air, and they cause the vapor of water to be produced by the waste heat of the furnace itself. With the exception of about a bushel of coke for starting the furnace, the deoxidizing material and only fuel used is coal-dust. The great difficulty in making ammonia from the nascent hydrogen of water and the nitrogen of the air is the restricted limits of temperature between generation and decomposition, it being necessary that carbon, however used, should be at a full red heat to decompose the vapor of water, and at a bright-red heat to decompose ammonia. Now, ammonium chloride under the same conditions is simply volatilized and not decomposed. As chloride of sodium or of calcium is decomposed at a full red heat in presence of nascent ammonia, therefore one of these chlorides is mixed with the coal that ammonium chloride may be formed ; so that if by chance the heat should be raised to a bright red, no loss will be sustained—the ammonium chloride is simply volatilized. By these means a greater range of working temperature is obtained. At the present time, with the consumption of from 20 to 28 lbs. of coal-dust and salt mixed, from two or three lbs. of ammonium chloride is formed.

A New Audiphone.—Further experiments on the timbre of musical instruments as rendered by the audiphone have led me to the selection of the following as a distinct improvement on the birchwood veneer, both for musical purposes and also for ordinary conversation. It has the same advantage as my previous form in not requiring to be held by the hand, it costs nothing, and requires no making. Take a sheet of stiff brown paper about 11 x 15 inches, the paper being such as is ordinarily used for making up heavy parcels. Put the ends together, the middle forming a loop, and hold the ends between the teeth. The paper must be pretty stiff, as the loop must stand out round and full, and of course the paper must be without folds or creases. Thomas Fletcher.