

account for all the known facts. At present we offer no theory, but wish for further evidence. The subject is a new one, and may prove wider in its suggestiveness than at present appears.

### Scientific Gossip.

EXHIBITION OF COLOURED FLAMES TO AN AUDIENCE.—ILLUMINATING A LABORATORY WITH YELLOW LIGHT.—ESTIMATION OF ORGANIC MATTER IN WATER.—READY FORMATION OF BINOXIDE OF HYDROGEN.—EXAMINATION OF COLOURED GLASS.

AN easy way of exhibiting to many persons at once the striking phenomena of coloured flames, has long been wanted. Some metallic compounds need simply to be placed in a colourless gas-and-air flame on a platinum wire, for them to evolve the characteristic colour in sufficient copiousness to be plainly visible to a large audience; of these, sodium and its compounds, must be first mentioned, the readiness with which they give rise to the well-known yellow light being often painfully antagonistic to other experiments of this character; next follows lithium, the vividness of whose red light (when not eclipsed by the accompanying soda) is almost equally striking, and then perhaps may be ranged barium, strontium, &c. By employing, according to Mr. Crookes' suggestion, the various metallic chlorates, considerably better results may be obtained, but for demonstrations to an audience this plan is hardly applicable, in as much as the light, very vivid though it be at the time, is too much of a flash. What is wanted is some means of evolving a steady uniform light from each peculiar metal, unmixed with any other colour. Messrs. Wolf and Diacon have lately proposed a plan which seems to fulfil all the desired conditions in a very perfect manner. They state that on passing a current of hydrogen through a slightly bent tube containing a volatile body in the lower part of the bend, and heating this strongly, the gaseous jet escaping at the open extremity is charged with the vapours of this body, increasing in quantity with the increased heat applied to the tube. By igniting the hydrogen a coloured flame is produced, which in some instances becomes dazzling, when the combustion is stimulated by a jet of pure oxygen.

Many metallic chlorides, but especially alkaline metals, and their volatile compounds, produce, under these conditions, perfectly distinct, and very lasting coloured flames, by placing in the tube a sufficient quantity of material. Upon examining these flames in the spectroscope very curious appearances are produced. A globule of sodium heated in an iron tube, through which a hydrogen current is passed, gives an intensely bright jet, in the spectrum of which appear six well-defined rays, all being clearly marked upon a slightly coloured ground. This ground is not continuous, but has two sudden variations in intensity; the first of these tints is remarkable for its correspondence with a green line, which appears to depend upon the existence of an excess of sodium vapours. By raising the temperature of the iron tube so as to increase the quantity of metallic vapour carried off by the hydrogen, the green band makes its appearance, limited by a very fine green line between  $\beta$  of calcium and  $\delta$  of barium, and at the same time is observed the effect, remarked by Fizeau, the reversing of the brilliant yellow ray, due to the sodic vapours, surrounding the flame. Potassium, slightly heated under the same conditions gives a magnificent flame, which can easily be maintained for a long time by the successive addition of metallic globules. The rays composing the spectrum of this metal are ten in number, and have for the most part been described by MM. Grandeau and Debray. When potassium and sodium are introduced together into the tube, the spectrum of the potassium at first appears alone, but as it fades the sodium rays appear with glowing intensity. By observing the two spectra thus superposed, it is easy to decide upon

the relative position of the rays of the two metals. It is then seen that the blue lines of sodium and potassium in no way coincide. In trying their experiments they had no metallic lithium, but the same method applied to the chlorides of the preceding metals having given very clear spectra, though not so brilliant as with isolated metals, these experimenters were enabled to replace this metal by one of its volatile compounds. Instead of the iron tube, a small tube was used formed of platinum plate rolled round on itself; by heating in it pure chloride of lithium, four characteristic and very brilliant lines are obtained, one of the lines, a blue one, corresponding almost exactly with the faintest of the two blue caesium lines. Numerous experiments made upon these various bodies, and particularly on sodium, yielded identical results, whatever method was employed to volatilize either the metal or one of its compounds. By using sodium electrodes in Ruhmkorff's induction apparatus, the sparks exhibit all the above-mentioned rays, on which is superposed the spectrum of the circumambient gas whenever the spark is accompanied by a luminous atmosphere.

Volatilisation in a hydrogen current seems to be applicable generally. It has been successfully applied to chloride of calcium; and though with chlorides of strontium and barium, which are not sufficiently notable, the results are not superior to those obtained by the ordinary method, it is very successful with the chlorides of copper, zinc, &c., which give spectra so distinct and intense as to render the study of them exceedingly easy. With some metallic compounds this light is so brilliant that it may be advantageously employed for the projection of the phenomena on to a screen for lecture demonstrations.

To the photographer these results possess considerable interest. The hydro-sodium flame is luminous enough to illuminate a laboratory with brilliancy, whilst its actinic power is absolutely *nil*. It would thus be invaluable in the photographer's dark room; the only drawback would be the alkaline character of the vapours arising from the combustion. These could, however, be easily removed by a chimney.

Organic matter in water is always a serious impurity, but few suffer so much from its presence as photographers. Dr. Woods has recently devised a very simple method of determining the amount of organic matter so present, which appears likely to be useful. The method is based upon the reducing action exerted by the organic matters dissolved in the water upon permanganate of potash, employed as a standard solution. A litre of water is mixed with a decided excess of pure sulphuric acid, and warmed in a porcelain basin to a temperature of 140° Fahr.; the solution of permanganate is then added, drop by drop, from the burette, until the pink tinge is permanent for half an hour. The "chameleon solution" contains one millegramme of crystallised permanganate in a cubic centimetre of distilled water; with this strength, the water supplied to Chatham requires from 2.4 to 7.5 cubic centimetres to produce a permanent coloration. It is necessary to exclude the interfering influence of iron in the state of protoxide, so that when this constituent is present the water should be evaporated to dryness, the residue ignited, dissolved in sulphuric acid, and reduced by sulphurous acid, when the same standard solution will give the amount of iron, and a deduction can be made accordingly. Thus in possession of a method of determining the amount of organic matter of a transitional nature or reducing character, it becomes necessary to institute a standard of comparison, for it would be practically impossible in each instance to identify the kind of organic impurity. Dr. Woods selects for his standard oxalic acid, and with weighed quantities he estimates the volume of permanganate required to destroy it; the results of analysis are therefore stated directly in accordance with this standard, and can at any future time be translated whenever the specific character of the organic matter present in any other sample shall have been ascertained. As instance of the kind of