THURSDAY, AUGUST 14, 1879

THE DISSOCIATION OF CHLORINE

DURING the past few years the well-known chemist, Prof. V. Meyer of Zurich, has rendered signal service to his brother workers by the introduction of numerous improvements in methods of determining vapour densities. At about the close of last year, in conjunction with Herr C. Meyer, he described a simpler method than any hitherto introduced, available for high temperatures, and yielding results of very considerable accuracy.

This method consisted in heating a vessel to a temperature at which the substance whose vapour density was to be determined was completely converted into gas, then introducing a small weighed quantity of the substance in question, and subsequently measuring, at the ordinary atmospheric temperature and pressure, the air displaced from the vessel by the vapour of the substance. In this manner, the volume of vapour, measured at the atmospheric temperature and pressure, generated by a known weight of substance is ascertained, and the density deduced from these data by a simple calculation. The great advantage of the method is that it does not require a knowledge of the temperature of the vapour, and the entire series of operations may be performed in a very short space of time.

The apparatus employed is also extremely simple, and consists of a cylindrical bulb of about 100 c.c. capacity, sealed to which is a glass tube about 6 mm. in diameter and 600 mm. long; this tube is widened out at the open end, so as to admit of the introduction of a caoutchouc stopper, and has a side tube, 1 mm. in diameter and 140 mm. long, sealed on to it about 100 mm. below the open end. The side tube is once bent nearly at right angles and the end slightly turned up, so that, when dipped into water, it will deliver gas into a graduated glass vessel inverted over it. For determinations at high temperatures the bulb is constructed of porcelain and is heated in a gas furnace; when operating at lower temperatures the bulb is heated either by means of a vapour bath or in a bath of molten lead. The operation consists in heating the bulb until it acquires a constant temperature, which is indicated by the non-appearance of air-bubbles at the orifice of the side tube which is plunged under water; the stopper is then removed, the weighed quantity of substance introduced and allowed to fall into the bulb, the stopper quickly reinserted, and the end of the side tube then brought under the measuring vessel; directly air ceases to issue from the extremity of the tube, the stopper is removed, and the air thus collected is afterwards measured in the usual manner. In the case of substances which undergo oxidation when heated in air, the air is first displaced from the apparatus by a current of pure nitrogen.

Operating in this manner, the Messrs. Meyer have determined the vapour density of a variety of inorganic compounds, such as indium chloride, stannous chloride, cuprous chloride, zinc chloride, ferric chloride, phosphorus pentasulphide, and arsenious anhydride, and have obtained results showing the molecular formulæ of these substances to be as follows:—

$$InCl_3,\ Sn_2Cl_4,\ Cu_2Cl_2,\ ZnCl_2,\ Fe_2Cl_6,\ P_2S_5,\ As_4O_6.$$

They then directed their attention to elementary bodies, and in a recent communication to the Berlin Chemical Society, they describe the results of experiments, showing that at a temperature as high as about 1,567° C. the molecular composition of mercury, oxygen, nitrogen, and sulphur is correctly represented by the formulæ—

$$Hg,\ O_2,\ N_2,\ S_2,$$

which are those generally adopted.

But with chlorine they obtained very different results. They employed platinous chloride as the source of this body, as it can be obtained perfectly dry and readily splits up into chlorine and platinum when moderately heated; a known weight of the chloride was introduced into the bulb in each experiment, the air having been previously expelled by a current of nitrogen. The numbers obtained in a first experiment at about 620° C. agreed with those required on the assumption that the chlorine molecule has the formula Cl_2, which is that generally accepted; but on determining the density at about 800° C. a lower number was obtained, and a still lower density resulted from experiments at about 1,028° C. and 1,242° C., but no further change of density was observed on making determinations at temperatures of about 1,392° C. and 1,567° C. The density (referred to air) observed at the various temperatures was as follows:—

Approximate temp.	Density.	
620°	2·42	2·46
808°	2·21	2·19
1028°	1·85	1·89
1242°	1·65	1·66
1392°	1·66	1·67
1567°	1·60	1·62

The density at about 1,200° and above, it will be observed, is two-thirds of the density at 600°; the change in volume undergone by chlorine when heated is therefore precisely similar to that undergone by oxygen in its passage from the condition of ozone to its ordinary condition, and it might therefore be supposed that a similar change had taken place. The researches of Sir B. Brodie have placed it beyond doubt that if we regard ordinary oxygen as having a diatomic molecule represented by the formula O_2, ozone has a triatomic molecule of the formula O_3, the conversion from ozone into oxygen being represented by the equation—

$$2O_3 = 3O_2.$$

Inasmuch, however, as chlorine has the atomic weight 35·4, such an explanation of the change in density of this gas is inadmissible; it would only be possible if what we at present regard as the atom of chlorine is a compound of 3 sub-atoms each of the weight $\frac{35·4}{3}$. The only other explanation, however, which can be given is that chlorine after all is not an element but a compound of at least two elements which are dissociated by heat. Mr. Watson Smith in a letter from Zurich, printed in the *Chemical News* of last week, states that the Messrs. Meyer incline to this latter explanation, and that in all probability *oxygen is one of the components of chlorine*; we hear also from another source that they have actually separated oxygen from it, but hitherto no description of this part of the investigation has reached us.

It needs not to be pointed out that such a discovery as is here foreshadowed is of the highest importance. There can hardly be a doubt that if chlorine be found to give way so easily, other so-called elements, and especially those which, like bromine and iodine, are closely related to chlorine, will not long resist the attacks to which they will now be subjected; indeed, the Messrs. Mayer already state in their paper that the behaviour of iodine is similar to that of chlorine.

In concluding this notice I cannot refrain from stating that to my knowledge Mr. Lockyer has for several months past been engaged in the spectroscopic investigation of the non-metals, and that he has repeatedly assured me that the views he has already published with regard to the metals are equally applicable to the non-metals. He has shown me, moreover, that with the spark at a particular tension the *red line of oxygen* is one of the most prominent lines in the spectrum of chlorine, the freedom from which of admixed air and moisture is attested by the absence of the characteristic nitrogen and hydrogen lines. Mr. Lockyer regards this as confirmatory of the Meyers' discovery. HENRY E. ARMSTRONG

SCIENCE IN THE ARGENTINE REPUBLIC

Description physique de la République Argentine; d'après des Observations personelles et étrangères. Par le Dr. H. Burmeister, Directeur du Museo Público de Buénos-Ayres. Tome Cinquième: Lépidoptères, 1re Partie, contenant les Diurnes, Crépusculaires et Bombycoides. (Buénos-Ayres, Paris, et Halle, 1878, 8vo.; Atlas de xxiv.[1] Planches, 1879, 4to.)

IN commencing a notice of this work it is impossible to avoid an expression of admiration for the persistent energy displayed by its septuagenarian author. Half a century has elapsed since his "inaugural dissertation" (on an entomological subject) was read at Halle, and during this time a continuous flow of valuable works and articles has appeared from his pen, not only in the long period of his professorship at Halle but also since he became permanently located in Buenos Ayres. Now, at an age when most men who have attained it have lapsed into "the sere and yellow leaf," so far as laborious work is concerned, we find him undertaking a gigantic enterprise, of which entomology is only a portion. All those who have had occasion to consult his former works will heartily acquiesce in the hope that he may live to complete this.

Without doubt the most valuable features of the volume under consideration consist in the numerous direct observations by the author and his son, on the structure and life-histories of the insects treated upon, from living subjects, in contradistinction to what may be termed mere museum work. In one respect disappointment will be felt. It might have been expected that an author of such vast experience, and with such admirable opportunities, would have been explicit in expression of opinion on those important subjects of philosophical inquiry that now occupy the attention of all entomologists, and for which South America furnishes such notable materials.

On the question of mimicry he appears to be absolutely silent, contenting himself by occasional remarks on the fact of resemblances, but without comment. On the theory of evolution he is scarcely more explicit, and the only remarks that bear, even indirectly, on this subject are those that appear in the "Avertissement" to the description of the plates, where he says:—

"I am unable to share the views of those specialists who augment the number of species indefinitely by slight variations; on the contrary, I am a partisan of the opinion, well founded on experience, that each species, although from a scientific point of view fixed and up to a certain point invariable, is forced to modify itself under different external influences of climate and food, and that these influences may, to a certain extent, alter some of the subordinate specific qualities. This faculty will be greater in proportion as the territory over which the species is spread may be more vast, and one will only find altogether invariable, those local species that have never quitted their place of origin. From this restricted point of view I am a partisan of the theory of the variability of species."

From this it will naturally be understood that our author is no advocate for the reckless creation of "species" now so alarmingly put in practice, to apparently little other purpose than the gratification of the vanity of those species-makers who wish to see their names attached to an endless list of synonyms. That the author is right in his reductions in the case of those species inhabiting the region immediately under his observation, possibly few only will dispute, and, above all, not those who know the exactitude of his critical powers in this respect; but other reductions concerning forms from the more northern parts of the South American Continent may be open to question, unless on the standpoint taken as to the value of the term "species."

The existence in the southern portion of the vast continent of South America of certain genera belonging to the nearctic fauna, has not escaped the author's notice. He alludes to the subject more than once, even in connection with the purely Argentine fauna, but without further comment.

The introductory anatomical portion is, as might have been expected, of the utmost value, and may be studied with advantage by students of Lepidoptera generally. Exception might probably be taken to too great importance being attached to the covering of scales as an attribute of the order. Instances (p. 1) might have been cited of the existence of "scales" in other orders, such as the well-known *Podura* and *Thysanura*, many *Curculionidæ*, some *Trichoptera*, certain forms of *Psocidæ*, &c., if not on the trunk itself, at any rate on the wings and other appendages.[1] An entire chapter is devoted to the structure of the scales, and the conclusion arrived at is that the well-known longitudinal striations exist only on the *upper* surface; if the writer mistake not, microscopists have arrived at the same conclusion from an examination of that favourite "test-object," the "*Podura*-scale."

As in all his works, the author shows himself a rigid advocate for "purity of nomenclature," and does not hesitate to adopt the spelling he considers the more correct. On the question of priority we read (p. 110): "The strict observance of priority of nomenclature appears to me an exaggeration of scientific law; I prefer names given by masters, such as Linné, Fabricius, Latreille, &c., to those of simply collectors, as Cramer, Drury Donovan, &c., following the axiom *au mérite la couronne.*" Regarding these words from a sentimental point of view,

[1] Of these only sixteen have as yet appeared.

[1] The neuropterous genus, *Coniopteryx*, cited by the author (p. 1, footnote), has no scales; the covering is apparently a waxy secretion, soluble in ether.