shortly before that of the Ulloa's ring, 38° 48′ ± 48′, and 38° 28′ ± 22′ Thus the agreement between theory and observation is singularly perfect. JAMES C. MCCONNEL.

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## "The Teaching of Elementary Chemistry."

IN reply to Prof. M. M. P. Muir's letter, I wish to say that, judging from his answer, Prof. Muir does not seem to consider it necessary in books of which he is senior author to secure that accuracy of which, from his criticisms of the writings of others, one would expect to find him the champion.

The first extract from the books mentioned sounds curiously to chemists. I consider the statement misleading inasmuch as it appears to convey an idea as to the constitution of caustic soda which is not that generally entertained by chemists; that this is not the intention of the authors, however, is manifest from p. 247 of the "Elementary Chemistry," where the usual view is stated.

It is utterly untrue and misleading to state that, "inasmuch as the result of passing chlorine over yellow mercuric oxide dried at about 100° is to evolve oxygen without forming chlorine monoxide, . . . . it may still be justly said that in making chlorine monoxide 'we carry out a reaction in which oxygen is produced in presence of chlorine.'"

The facts are briefly these:—

(*a*) When chlorine gas is passed at ordinary temperature over yellow mercuric oxide, which has been previously heated to 300°–400°, chlorine monoxide is obtained.

(*b*) When a large quantity of chlorine gas at ordinary temperature comes rapidly into contact with yellow mercuric oxide which has been previously dried at ordinary temperature, a violent reaction, accompanied with evolution of light and heat, ensues, and nearly pure oxygen is the only gaseous product. If both the chlorine and the mercuric oxide be kept cool by means of a freezing mixture, chlorine monoxide is the only gaseous product obtained. With intermediate conditions of temperature, &c., mixtures in varying proportions of oxygen and chlorine monoxide are obtained. (Pelouze, *Annalen der Chem. und Pharm.* Bd. xlvi. 196.)

The formation of oxygen in the second case must therefore be due to the decomposition of already formed chlorine monoxide, or to the occurrence of a reaction the conditions of which render the existence of part of the chlorine monoxide impossible. I think the majority of chemists will agree with me that the appearance of oxygen under conditions which insure the non-existence of (or as itself a product of the decomposition of) chlorine monoxide, can scarcely be admitted as in any measure explaining the *formation* of the latter.

I do not consider it a "verbal quibble" to object to the use of the term "volatilized" as applied to the mechanical removal of particles of a solid substance.

As to the chemical properties of chlorine, bromine, and iodine, I should indeed be open to the gravest charges of non-acquaintance with chemical classification, had I suggested anything so idiotic as that, say, potassium hypobromite and potassium hypoiodite (if the latter exists) could be *identical*.

I called the passages I quoted misleading, because some of them at least were inaccurate. What amount of inaccuracy is required to make a statement misleading may be a matter for difference of opinion. Apparently it is so.

Prof. Muir states that he will decline to take any notice of my anonymous communications. This, at least, is safe ground; but I can wait for the second editions of the two books, and see if the inaccuracies are eliminated. In the second edition of "Elementary Chemistry" I hope Messrs. Muir and Slater will also describe the methods (omitted on p. 19) for removing air from oxygen. Whilst these methods remain unpublished, I prefer to remain Z.

## "Kinematics and Dynamics."

MAY I ask a short space in your columns to refer to a few points in Prof. Greenhill's review of my book on "Kinematics and Dynamics," published in your issue of February 16 (p. 361). I shall be as brief as possible.

(1) "In questions involving the size of the earth (pp. 74 and 80), it is the circumference and not the diameter which should be given in metres, the circumference being 40,000,000 metres," the reason being, I suppose, that in illustrative problems round numbers should be employed as data, with the object of facilitating arithmetical calculation. There are doubtless advantages in this course, and in many problems I have adopted it. But should it be made an invariable rule? Problems based on exact data, such as the ones referred to, on pp. 74 and 80, have for many students a greater interest than those based on approximations.

(2) "The expression 'knots an hour' (p. 60) is irritating to a sailor." But the expression "knots" simply would be either misleading or puzzling to a student unacquainted with nautical abbreviations.

(3) "The formula $\frac{1}{2}v^2 = \frac{1}{2}v_0^2 + as$ is to be preferred to that on p. 34, $v^2 = v_0^2 + 2as$; in all cases the factor $\frac{1}{2}$ should go with the $v^2$ in the equation of energy." The formula quoted is not an equation of energy, but a kinematical equation. Equations of energy (see pp. 253, 256, 328) have in all cases the form approved by Prof. Greenhill.

(4) "In dealing with rotation, the author would do well to study Maxwell's geometrical representation of the direction by means of the screw, right-handed or left-handed." I have done so; but I find that students more readily grasp a specification of the direction of a rotation when it is made by reference to the face of a clock; probably because few of them are so familiar with right-handed and left-handed screws as they are with clock-faces.

(5) "In a linear strain the increment of distance of two points in the line of the strain is properly their *elongation*; while the ratio of the elongation to the original distance is called the *extension*, not the *elongation*, as on p. 167." And yet Thomson and Tait ("Elements of Natural Philosophy," § 139), Clifford ("Elements of Dynamic," p. 158), Minchin ("Uniplanar Kinematics of Solids and Fluids," § 78), and Ibbetson ("Mathematical Theory of Elasticity," § 53), all define elongation exactly as I have done.

(6) "The author, disregarding the vernacular use of the word 'weight,' defines the weight of a body as the force with which it is attracted by the earth" [I don't (see § 290); but let that pass], "but is at variance with his own definition in the statement of the majority of the subsequent examples, relapsing into the language of ordinary life." No references are given to these instances of backsliding. I have looked pretty carefully through the subsequent examples, and can find no case in which I have used the term referred to in any other sense than that given it by definition. I should be glad to have such slips pointed out to me, if there are any.

(7) "A collection of 500 different ways of spelling the name of the town of Birmingham has been made, and a similar collection could be made from the present treatise of different ways of expressing the simple ideas of the pound *weight* and the pound *force*." It is true that these ideas are expressed by English writers in various ways. And it seems to me desirable that a student should be made acquainted with them. Surely in holding that I should choose one phrase and stick to it, your reviewer is blaming me for not being one of the "mathematical precisionists" at whom he sneers.

(8) "This terminology culminates in the solecisms that on p. 477 we must suppose pressure to be measured in poundals on the square foot in hydrostatical problems; and that if the equation $w = mg$ is supposed to be used with absolute units, the weight of a body is measured in poundals; as if a mathematician asked in a shop for 'half a poundal of tea, or tobacco.'" It is not quite correct to say that, in the hydrostatical equations referred to, pressure must be supposed to be measured in poundals per square foot. In fact it may be supposed to be measured in terms of the unit of pressure of any derived system, as, *e.g.*, the dyne per square centimetre, or even the pound-weight per square foot, provided only the density be measured in terms of the corresponding unit. I am aware that this mode of expressing hydrostatical equations is unusual, but it seems to me to have great advantages, and it was adopted both for this reason and for the sake of making the section on hydrostatics uniform with the rest of the book. With regard to the units in which weight should be measured, the practice of the tobacconist or the tea merchant is surely not our best guide.

(9) "Thus a mathematical precisionist, to express the simple idea of a force of 10 pounds, to be consistent should call it 'a force equal to the weight of the mass of 10 pound weights,' the absurdity of which is evident." The phrase inclosed in quotation marks is not quoted from my book. In my terminology the most precise of mathematicians would express the idea referred to