are principally considered, objects suitable for examination with larger ones up to seven inches are given.

Much trouble has been taken with a very convenient result; and as the author shows what corrections to apply to make the volume useful in future years, we must regard it as one of the most useful books an amateur astronomer can possess.

Practical Introduction to Chemistry. By W. A. Shenstone. Lectures on Chemistry in Clifton College. (London: Rivingtons, 1886.)

ALTHOUGH several courses of practical chemistry for beginners have lately been introduced the author has not found any of them suitable for school work, and so he has undertaken to write one himself.

In his selection of experiments, he says he has been guided by two main considerations. First, that they should be suitable for the young boys who chiefly will have to perform them, and who will have but a limited amount of time to do them in. Secondly, that when completed they shall constitute a body of experience which shall be as valuable as possible to appeal to when the students pass to the classes which have lecture teaching.

The first three chapters deal briefly with the elements, compounds, acids, &c. Chapters IV. and V. deal with the law of chemical combination and the classification of chemical changes; Chapters VI. and VII. with the decomposition of water and air. Chapter VIII. is devoted to a few very elementary experiments on the relations between solids, liquids, and gases. In Chapters IX. and X. attention is drawn to the use made of these differences in experiment.

The appendixes contain a list of apparatus and also a description of the balance and how to use it.

The book is divided into two sections. In the first section the student is given instructions how to perform the experiments, but he is not told how they will "come out," so that as the experiment proceeds, he has to observe and note what takes place, and when it is finished he can compare his notes with those given in Section II., where full explanations are afforded. Certainly if this method is well carried out we shall have a vast improvement upon the ordinary "test tubing" process, in which, as a rule, little theoretical construction is given to the beginner. W.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.*]

Permanent Magnetic Polarity

SINCE the subject of the permanent polarity of quartz has been brought prominently forward by the researches of Dr. Tumlirz, published in the January number of *Wiedemann's Annalen*, and by the recent discussion of it in your pages, it is perhaps allowable for me to put on record the fact that I have been engaged during the course of this winter with very similar experiments, and have obtained very similar results. Quartz indeed does not happen to be one of the substances I have examined,—I rather dreaded the complexity of crystalline substances,—but my observations have led me to the conclusion that most likely *every* substance possesses some trace of permanent magnetisability or retentivity.

The set of experiments were not indeed begun with the object of looking for permanent polarity, but with a wholly different object, viz. this:—According to the Ampère-Weber theory of magnetism and diamagnetism, wherein magnetism is explained by means of specific molecular currents flowing in channels of no resistance, and diamagnetism by induced currents excited in those same channels by the magnetic field, it is obvious that the permeability of a magnetic body ought to become negative when the magnetising force applied oversteps a certain amount. Because an increasing magnetising force must weaken the specific currents, even though it is unable to excite contrary ones and so cause diamagnetism.

This result of the theory is pointed out by Clerk-Maxwell (vol. ii. § 844, 1st edit.), who further says: "If it should ever be experimentally proved that the temporary magnetisation of any substance first increases and then diminishes as the magnetising force is continually increased, the evidence of the existence of these molecular currents would, I think, be raised almost to the rank of a demonstration."

There are many circumstances now known which point more or less distinctly to such a maximum, but my ambition has been to not only establish a falling off of induced magnetism, but actually to reverse it; to convert, in fact, a feebly-magnetic substance into a diamagnetic substance by immersing it in a sufficiently intense magnetic field.

Accordingly, in October last, I set up a fairly large magnet, with specially-pointed pole-pieces about a centimetre or less apart, and arranged that various strengths of current, ranging from very weak to very strong, might be sent round its coils; the weakest current being given by a Leclanché or two, an intermediate strength by 3 or 4 secondary lead cells, a strong current by 24 such cells, and the greatest strength by about 40 secondary batteries, some of them zinc-lead with $2\frac{1}{2}$ active volts apiece between their terminals, kept charged in two batches by a dynamo.

I then instructed my workshop-assistant, Mr. Benjamin Davies, to fill up his odd time by cutting ellipsoids of all manner of substances (axes about ·6, ·3, ·3), to finish them off with glass-paper, when practicable to boil them in acid, and then to examine their behaviour between the poles of the magnet in a specified way.

The dimensions of the magnet were:—

Diameter of iron core ... ... 5 centims.
Length of each leg ... ... 21 ,,
Distance from centre to centre ... 15 ,,
Total number of turns of No. 12 B.W.G. wire, 1868, on both legs together.
Resistance of wire 1·1 ohm.
Usual strengths of current, from $\frac{1}{4}$ ampere to 50 amperes.

The thing intended was to discover by trial some substance so feebly magnetic that, though it could just set itself axially with the weakest current, it might lie equatorially with the strongest. But failing this actual change of property it was thought that the rate of oscillation between the poles might diminish for some (non-conducting) substances when the highest powers were applied, instead of increasing.

And meanwhile the behaviour of all the substances was to be noted and carefully recorded, whatever it might be.

In this way a large number of substances, various kinds of wood, all sorts of metal, glass, coke, charcoal, wax, chalk, cardboard, ebonite, &c., have been passed under review; and some one or two of them seemed to behave exactly in the way hoped for. One piece of coke, for instance, vibrated in the intense field more slowly than it did in the feeble one; while another, which vibrated axially in a weak field, set itself nearly equatorially in the strong one. Its behaviour was thus sufficiently like what we wanted to justify a more careful examination.

Soon after this, however, Davies of his own accord inserted a reversing key into the circuit of the Leclanché, and thus made an important observation.

When the *strong* current was reversed, the deportment of the substance remained unaltered, as is natural enough; but directly the *weak* current was reversed, the little suspended piece turned in the magnetic field through 120° or so, and pointed in a symmetrically situate direction on the other side the magnetic axis. The piece of coke, for instance, which may have been pointing some 60° on the one side of the magnetic axis, changed its position when the magnet was reversed, and pointed some 60° on the other side. The suspending thread was not wholly devoid of torsion though it was extremely minute. A piece of electrolytic copper, and a piece of boxwood with the grain longways, were soon afterwards found, which set themselves almost exactly equatorially, and on reversing the magnet turned through very nearly 180°.

I was a little excited about this result at first, because I thought