students such as attend the Royal College of Chemistry and other science schools, but rather for those who take up chemistry either as a branch of general education or as an evening study, and for this purpose it seems to be well fitted; at the same time there is the danger of cram to be guarded against. The author evidently feels this and has endeavoured to provide against it in a somewhat original manner. Pages 102–121 are divided into double columns, the left hand one on each page containing the preparation or reaction formulæ of one of the non-metallic elements and their more simple compounds; the right hand column is left blank, and the student is requested to note the conditions under which each substance is prepared either from the lecture or from a text-book. This device would if conscientiously carried out by the teacher, probably prevent cram of a certain sort, and compel the student to know a little more than the mere formula of a reaction or preparation. At the same time we must confess that we must still regard this knowledge as only another form of cram which is infinite in its varieties and made to suit the idiosyncrasies of each individual examiner, and which will exist as long as any form of knowledge continues to be looked on as something to "pass" an examination in; and as long as examiners continue to look only to a set of answers given on a certain day in a certain time to a particular set of questions, and not to the general character and capacity of the student. We therefore think that Mr. Eltoft will meet with failure in his well-meant effort; we trust, however, that he will continue to persevere.

The rest of the book is divided into double pages, meant for notes on particular elements, the pages being divided according to a scheme in which specific gravity, in the state of solid, liquid, or gas, colour, melting-point, and boiling-point, are successively considered. Another space is reserved for the description of the experiment, a third for sketches of apparatus, and a fourth for tests for the identification of the body. These pages will no doubt teach the student to systematise his notes to a very considerable extent and indicate to him a detailed method of observation.

In conclusion, we note that Mr. Eltoft, in his short preface, expressly states that his "note-book" is "not in any way supposed to take the place of a text-book, but to act as an adjunct to it." We regard it in this light as an honest effort to assist the large class of students for whom it is intended, and we hope that the author will watch the effect of the book on the classes he is teaching, look on his present effort as experimental, and come forward again with the aid of his increased experience to still further improve his work.

R. J. FRISWELL

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.*]

Solar Physics at the Present Time

IN reference to Prof. C. P. Smyth's letter in NATURE, vol. xv. p. 157, I think it my duty to state that Prof. Smyth's remark on the priority of his exhibited results of observations of deep-sunk thermometers (as bearing on the question of transmission of waves of temperature into or from the interior of the earth) is perfectly correct.

It was only in the last summer that, having occasion to inspect some parts of Prof. Smyth's printed "Observations," I became acquainted with the extensive series of diagrams illustrating this matter. I have not yet been able to refer to his cited paper in the "Philosophical Transactions." G. B. AIRY

Royal Observatory, Greenwich, S.E.,
1877, January 1

Just Intonation, &c.

UNDER this heading your correspondent "A. R. C.," while explaining Mr. Colin Brown's "natural finger-board," writes thus:—"The vibration numbers of the diatonic scale being represented by—

$$1,\ \frac{9}{8},\ \frac{5}{4},\ \frac{4}{3},\ \frac{3}{2},\ \frac{5}{3},\ \frac{15}{8},\ 2.$$

If we build upon the dominant $\frac{3}{2}$, the vibration numbers will be—

$$1,\ \frac{9}{8},\ \frac{5}{4},\ \frac{45}{32},\ \frac{3}{2},\ \frac{27}{16},\ \frac{15}{8},\ 2,$$

and if we build upon the subdominant $\frac{4}{3}$ the vibration numbers will be—

$$1,\ \frac{10}{9},\ \frac{5}{4},\ \frac{4}{3},\ \frac{3}{2},\ \frac{5}{3},\ \frac{16}{9},\ 2."$$

Unless "A. R. C." proposes some new system of tuning, I submit that he is in error in the first steps of his two examples. The dominant of C is G, and from G to A is a minor, and not a major, tone. Also the subdominant to C is F, and from F to G is a major, and not a minor, tone. I do not pursue the analysis, not desiring to criticise oversights, but to draw attention to a not uncommon misconception of the figures in the above scale, and to the general adoption of a miscalculation as to the so-called "Comma of Pythagoras."

An eminent mathematician, not long deceased, derived our diatonic scale from the one note F, by the following process:—"F A C—C E G—G B D," thus taking the common chords of three different keys. Had he followed out his system of adding on a new scale from the Fifth of the preceding, he would have gone the round of the keys, and have derived them all from F, which would have been the *reductio ad absurdum*.

Nothing can be clearer than the history of the scale, and it carries with it conviction of its truth. The octave was formed out of two Greek conjoined tetrachords, such as B C D E and E F G A, the E being common to both. Then the lower A was added at the bottom, to complete the octave, and it was called "the added note" (*prosλambanomenos*) because it did not form part of any tetrachord. The reduction from the eight notes of the two tetrachords to seven is attributed to a superstition in favour of the number seven. Thus came our A B C D E F G A—a minor scale with a minor Seventh—and from it came our truer major scale, by commencing on the third note, C, but carrying with it all the imperfections of the double root of the original. No improvement has been made in the scale since the days when Archytas, the friend of Plato, introduced the consonant major Third, and Eratosthenes the minor Third. Our present scale is therefore absolutely anterior to the Christian era; the ratios of its intervals given by Greek authors prove the identity irresistibly. Let us then look to the figures which represent our scale as "A. R. C." has justly given them. The large 1 and 2 refer to C as the fundamental note and its octave. The 3 to 2, the 5 to 4, the 9 to 8, and the 15 to 8 represent octaves of the key-note (2, 4, or 8); but the 4 to 3 (the interval of a Fourth) and the 5 to 3 (the interval of a major Sixth) refer to C only as the so-called "Twelfth" above F, and not to C as the octave. If we play either of these two notes, F or A, with C, we cannot use C as a consonant bass. We must take F, and thus we have the old tetrachord system, with its double root, running in our present scale. In all keys the tonic and the subdominant are both necessary basses. F and A belong exclusively to F; but B and D have no relation to F, not being aliquot parts of the F string. They belong to the scale of C, but more intimately to that of G. The F string exceeds the length of the C string by 3 to 2, because its sound is that of a Fifth below C; therefore any attempts to bring the sounds of our scale to a common denominator are fallacious, the first law of Proportion being that "Ratio can subsist only between quantities *of the same kind*." Thus the "24, 27, 30, 32, 36, 40, 45, 48," cannot be accepted, because the 32 intended for the 4 to 3 of the scale, and the 40 for 5 to 3, represent other intervals. The 4 to 3 of C is the Fourth from C down to G, and the 5 to 3 of C is the major Sixth from E down to G. The 32 and 40 are not applicable to the interval of a Fourth from F down to C, nor to the major Sixth from A down to C.

And now as to the so-called "comma of Pythagoras," a strange name for the interval of 531441 to 524288! Can the modest inventor, who has concealed his own name, have supposed that the Greeks had musical instruments so very far