Tables of Four-figure Logarithms.

FOR many scientific computations it is sufficiently accurate to work to four figures, but there have been complaints that the usual tables of four-figure logarithms are not accurate in the fourth figure. Thus, log 1·019 is given as 0·0080, whereas it ought to be 0·0082. The errors are met with only in numbers from 1000 to 2000. In consequence of this, some such tables are accompanied by a table specially intended for numbers between 1000 and 2000. Many physicists and chemists refuse to use four-figure tables for this reason, and advocate the use of five-figure tables, in spite of their greater size and the waste of time.

I beg to point out that Mr. J. Harrison has got over the difficulty in a very simple manner in the four-figure table published by him recently in his book, "Practical Plane and Solid Geometry." Even he, however, cannot avoid a possible error of 1 in the last figure. The first ten rows of differences have been replaced by twenty. The rest of the table is unaltered. I give a specimen of an old row of figures and how it is replaced. The cause of inaccuracy in the old system is apparent at once.

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
11	0414	0453	0492	0531	0569	0607	0645	0682	0719	0755	4	8	11	15	19	23	26	30	34
							This is replaced by												
11	0414	0453	0492	0531	0569						4	8	12	15	19	23	27	31	35
						0607	0645	0682	0719	0755	4	7	11	15	19	22	26	30	33

It is to be hoped that all four-figure logarithm tables will in future be printed in this way. The Board of Education is now printing tables of this kind for use in evening science classes.

JOHN PERRY.

Ship's Magnetism.

IN a review of my book on the subject of the "Deviations of the Compass in Iron Ships" which appeared in NATURE of June 18 and in the last paragraph, there are statements to which I would take exception. In this paragraph the reviewer finds "food for reflection" in that, after defining C.G.S. units in the introduction of my book, I stick to inches and to other units in the text and charts.

In view of the fact that every measurement in a ship is recorded in feet and inches, whether by constructors, engineers, gunners, or navigators, to have introduced the centimetre as a common unit of measurement in the text and tables would have been a serious drawback to the utility of the book.

Again, the values on the charts of horizontal and vertical force are given in terms which have been found most convenient in the several computations, whilst not detracting from their value as exponents of the changes of terrestrial magnetism which a ship may encounter during a voyage.

Whilst introducing the student to the modern C.G.S. units, the use of the British units is too recent for neglecting to mention them, hence their retention on the map at p. 16, accompanied by the necessary multiplier for converting them to C.G.S. units if required.

A table of errata has been published for some weeks, and sent to all known recipients of the book.

June 20. E. W. CREAK.

Mercury Bubbles.

RECENTLY during the course of an experiment I had occasion to boil water in presence of mercury. After ebullition had been going on for some time, I noticed that occasionally steam forming below the surface of the mercury carried with it a pellicle of mercury as it rose through the water in the form of a bubble. When it reached the surface of the water the pellicle usually burst, and the mercury fell back as a drop. By adjusting the intensity of ebullition, it was possible to bring the two liquids into such a state that, comparatively frequently—say ten times per minute—steam bubbles covered with mercury rose through the water and floated on its surface, and, hovering there for an instant, they cooled and contracted, and sank slowly down through the water. When the bubbles are formed in rapid succession, the phenomenon is one of great beauty, as their surfaces are extremely brilliant, being formed of mercury freshly drawn out before rising into the water. The mercury used in this experiment was the ordinary commercial article, and not freshly distilled. Grease had, however, been removed from it by boiling with a solution of caustic potash. Tap water was used.

I have since found that these mercury bubbles are easily produced in a variety of ways. The most striking form of the experiment is perhaps as follows:—About 30c.c. of mercury are poured into an evaporating dish and covered by a depth of about 1·7cm. of water. Bubbles are now formed in the mercury by forcing air under its surface through a bent glass tube drawn to a fine nozzle. When the bubbles reach a certain size they become pyriform and draw out from the surface of the mercury, and, rising through the water, float on its surface. The bubbles so formed have considerable stability, and usually last for 15–30 seconds before bursting. One having a diameter of about 1·9cm. was timed to have lasted for 75·6 seconds, floating on the water. When the break does occur, it has explosive violence, and drops of mercury are thrown through a considerable distance. The bubbles which reach the surface of the water intact do not vary, as a rule, much in size, the maximum diameter observed being 2·0cm. and the minimum 1·8cm. The weight of mercury in the bubbles may be determined by floating them into a watch glass, and weighing the mercury which falls down from them on bursting. There is always more than 0·150 gram in the pellicle, and rarely more than 0·200 gram. The mean of ten weighings gave 0·177 gram as the weight of mercury in these bubbles. From these data it appears that the mean thickness of the mercurial pellicle is 0·001cm. At the thinnest part, however, it must be much thinner, for, as the profile view shows, each bubble carries a drop of varying dimensions hanging from its lower pole. The bubbles float immersed nearly to their equator. In the majority of cases they remain covered with a skin of water, so that the meniscus of the water is not depressed round the floating bubble, but is raised round it. The skin of water may be made to retreat from the upper pole, or to aggregate itself into droplets on the surface of the bubble, without causing the rupture of the bubble, by the addition of a small amount of spirit to the water. The complete absence of the water skin from the mercury pellicle may be demonstrated by the dulling of the surface of the latter when breathed upon.

The high surface tension of the water does not seem necessary to the phenomenon. Mercury bubbles in every way similar to those just described may be formed under methylated spirit, and will float upon its surface; also the addition of a slight contamination to the water, such as oil or soap or spirit, does not make the mercury film of the bubble completely unstable. But when large quantities of these impurities are added, the bubbles seldom last more than a moment on the surface of the water, although even in the presence of these impurities they may last as long as 25 seconds.

The depth of the overlying water is of importance in the ease of producing stable bubbles by this method. If it is deeper than 2cm. the bubbles usually break before getting to the surface; this is probably due to the change of pressure during the rise of the bubble through the water, and consequent excessive expansion causing rupture. If the water is less than 1·5cm. deep the bubble formed swells up to a great size (2–3cm. in diameter) before it