LETTERS TO THE EDITOR.

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The Disaster to Submarine A1.

AT the inquest on the victims of the disaster to submarine A1, Commander Bacon is reported to have expressed the opinion that as the result of the collision every soul on board was instantly stunned, since the failure to set in action the mechanism for bringing the boat to the surface could not otherwise be accounted for. It is surprising that this opinion should have been received and adopted without comment by both the coroner and the lay Press, seeing that such a result is contrary to all experience of collisions at sea. The occupant of the conning tower, which was the part struck, was no doubt stunned, probably killed, by the blow, but it is difficult to believe that the same fate should have befallen every other person on board, however remote from the point of concussion.

The fact that the naval authorities can suggest no other reason for the failure to rise to the surface after the collision is not in itself a sufficient justification for the acceptance of an opinion which, from the physiological point of view, is, to say the least, highly improbable, and certainly requires confirmation by experiment.

University, Edinburgh, May 1. E. A. SCHÄFER.

The Life-history of Radium.

EVIDENCE of a convincing nature is rapidly accumulating to the effect that helium may be produced as a result of the disintegration of the radium atom. On the other hand, it has been suggested by Rutherford and others that radium is analogous to the first products of the disintegration of uranium and thorium—to the substances known as uranium X and thorium X—rather than to those elements themselves. Such an idea points to a search for the parent atom, by the dissolution of which radium is formed.

In Prof. Rutherford's recent book on radio-activity, reasons are given for suspecting that in uranium itself we shall find the origin of radium. The atomic weight of uranium is greater than that of radium. Radium is discovered in minerals rich in uranium, and the amount of radium in good pitchblende is about that to be expected on the view that a balance exists between the rate of development of the radium by the uranium present and the rate at which it decays by the ordinary process of radio-activity.

My wife and I have been investigating lately the slight amounts of radium emanation that are almost invariably found in samples of salts and oxides of uranium sold as chemically pure. By the kindness of Mr. H. J. H. Fenton we have been able to examine several specimens of uranium compounds, known to have been preserved in the Cambridge University Chemical Laboratory for periods of from seventeen to twenty-five years. In all cases greater amounts of radium emanation have been obtained from these old specimens than from more recently prepared samples of the corresponding compounds.

It is, of course, possible that a limited number of such results may be accidental, and, in order that indirect evidence of this kind should possess any weight, enough specimens must be examined to enable us to deal with the subject statistically. I should be very grateful if anyone possessing uranium compounds of known pedigree, prepared thirty years ago or upwards, would either test them quantitatively for radium emanation, or send a few grammes of them to me for examination.

If, in most cases, an excess of radium is discovered in the older samples, it would be presumptive evidence in favour of the view that radium is formed by the disintegration of uranium, but the possibility of some general change in the methods of preparation of uranium salts renders even such a confirmation of doubtful validity.

The only convincing evidence would be supplied by tracing the gradual growth of radium in a mass of a compound of uranium. At first sight, it would seem that the time required for such growth would put the possibility of such a confirmation beyond the reach of one human life. But a short calculation shows that the attempt is not so hopeless as might be imagined.

The average life of a radium atom is taken by Rutherford, on a minimum estimate, as about fifteen hundred years. The process of decay occurs in a geometrical progression, and thus in one year about half a milligramme per gramme of radium should disintegrate. On a maximum estimate for the life, the fraction disintegrated per year is $1/100$ milligramme. Taking this maximum estimate as the least favourable for our purpose, we see that in one year the one hundred thousandth part will break up.

If in pitchblende, radium is in radio-active equilibrium with its source of supply, the same fraction must be replaced in the year by the disintegration of uranium. In presence of a large excess of uranium, the production of radium would go on at a constant rate. Thus in one year about the one hundred thousandth part of the proportion of radium in pitchblende would be developed in an equivalent mass of uranium.

We find that, using a good electroscope, it is easy to detect with certainty the radio-activity from the radium emanation evolved on heating a milligramme of good pitchblende. In order to produce from uranium an amount of radium large enough to detect by its radio-activity in a reasonable time—let us say one year—it is merely necessary to work with a sufficient quantity of uranium to give, in that time, a mass of radium of which the emanation has an activity equal to that evolved from a milligramme of pitchblende. The requisite quantity of uranium is clearly about $0{\cdot}001 \times 100000 = 100$ grammes. This, as we said, is a maximum estimate; it is probable that less would suffice.

In this manner, by putting on one side a few hundred grammes of some compound of uranium, carefully freed from radium and tested for emanation, it should be possible to detect the growth of radium in a time measured in months, or, on the other hand, to show that it is necessary to look elsewhere for the parent atom of radium.

At the present time we have such an investigation in progress, and trust that eventually we may obtain definite results. But, in the hope that others may undertake a similar task, I venture to place the principles of the method before your readers. On such a fundamental point, several independent experiments are greatly to be desired.

W. C. D. WHETHAM.

Upwater Lodge, Cambridge, April 30.

Graphic Methods in an Educational Course on Mechanics.

THOUGH no one, I venture to think, will gainsay Mr. W. Larden's main contention that "analytical methods give a grasp of the principles of statics, while graphical methods disguise them," yet it should not be forgotten that the analytical treatment has its own set of snares and pitfalls.

Mechanics is a physical science, and like other sciences should be approached from the experimental side. If the initial stages are treated experimentally, the principles underlying the subject will come prominently into view. One need only mention the principle of moments, which every boy has surely grasped, in a general sort of way, long before he has opened a text-book on statics. He has only to carry out a few simple experiments on levers to find out the law for himself in its exact form. Let the beginner hang up two spring balances from nails and then attach a weight by a couple of strings to the hooks of the balances, and he will soon discover for himself whether or not the pulls in the strings are proportional to their lengths.

The graphical treatment lays stress on the empirical and tentative side, which in the symbolical is completely lost sight of. But the superlative advantage of graphical work is its essentially practical character. All cases of a problem can be solved with equal facility. Ladders are not as a rule inclined to the ground at an angle of 60°, coefficients of friction are never quadratic surds, and weights of $\sqrt{2}$ poundals belong to some other world which is not the one in which we live. Again, the question is on a screw jack, and a boy taking $\pi = 22/7$ has worked out an answer