combinations, such as H_2SO_4 and Na, H_2SO_4 + Zn, HNO_3 and K, &c., were tried, and in most cases irregular deflections such as those above described were obtained. Ultimately I got two constant and definite results: (1) Na thrown on strong and pure acetic acid invariably left a positive charge on the insulated dish, the escaping hydrogen being negative; (2) a fragment of zinc thrown into strong HCl invariably left a negative charge on the insulated dish, the escaping hydrogen being positive.

This last is a gross and unmistakable result. In fact its very magnitude was for some time a source of embarrassment. I shall not stop to describe the steps by which the next experiment was reached, but shall proceed at once to describe it; and I shall venture to give it somewhat in detail, as the title at the head of the paper is mainly founded on it.

The electrometer was not in a very sensitive state. The high-resistance Daniell aforesaid gave a deflection of 38 divisions on either side. A glass beaker 7½ inches high and 5 inches in diameter was placed on the insulated stand. A porcelain dish, 2¾ inches in diameter and 1⅛ inches high, was nearly filled with a 10 per cent. solution in distilled water of strong HCl, and placed at the bottom of the glass beaker just described. The insulated stand was now connected to one pair of quadrants, the other pair were put to earth. The "spot" stood at 378 on the scale. Three small fragments of granulated zinc were now dropped into the dilute HCl in the insulated dish. A very slight effervescence at once appeared. This gradually increased but never became violent. No trace of spray could be detected at the end of the experiment above the lower half of the beaker. In 4 minutes from dropping the zinc the spot could be perceived moving, and in 4½ minutes more it moved 28 divisions to the left, indicating the charge on the dish negative and the escaping hydrogen positive. The insulated stand, &c., was now disconnected from the quadrants. The spot maintained its position on the scale. In 1½ minute after, the quadrants were again connected to the insulated stand: the spot moved instantly 20 divisions more to the left. In 1½ minute more it had moved 10 divisions further to the left, but with a slower pace, and it presently stopped and turned back, at first slowly, taking 5 minutes to go back the 68 divisions to the zero. In 4 minutes more it had moved 80 divisions to the right. The insulated stand was once more disconnected from the quadrants, and at the end of 2 minutes they were re-connected, when the spot instantly bounded up 55 divisions further to the right. It continued to move in the same direction until the effervescence ceased owing to the acid being exhausted. A quantity of the zinc survived. On short-circuiting the quadrants the spot returned to within 4 divisions of the original zero.

As the reaction between zinc and hydrochloric acid proceeds, the quantity of chloride of zinc in solution continually increases, and so it appears demonstrated that when hydrogen passes through hydrochloric acid it acquires a positive charge, when it passes through chloride of zinc it acquires a negative charge. I believe that this inference may be safely very much generalized, but for the present I forbear. In confirmation of it, however, it may be well to mention that at any stage of the last experiment a deflection may be obtained to right or left as required by adding an excess of saturated chloride of zinc (for the first), or of hydrochloric acid (for the second).

When it is known that the sign of the charge on escaping hydrogen depends upon the substance it has been in contact with, the very irregular results with K and Na already mentioned become less mysterious. J. ENRIGHT.

Newton's Laws of Motion.

THERE is a point in connection with Newton's laws of motion which the text-books on dynamics, which found the science upon those laws, seem to me to leave very inconveniently and unnecessarily mysterious. The point to which I allude is the meaning of the words "rest or uniform motion in a straight line" in the first law. The difficult words are "uniform" and "straight," which of course are each of them meaningless until it is explained what the motion is with reference to; but this explanation is not given explicitly in any of the books on dynamics which I am acquainted with; and a comparison of their various statements leaves me in some doubt as to what is intended to be implied. May I therefore appeal to those of your readers who accept Newton's laws to say whether the following is correct?

I find that Law III. is interpreted by the most influential authorities, such as Maxwell and Tait, to mean that force occurs only as one side of a mutual action, consisting of two equal and opposite forces between two portions of matter. I am therefore led to suppose that the freedom from force action, which is spoken of in Law I., should be explained (by means of Law III.) as meaning isolation from the influence of all other matter; and that Law I. must be considered as containing a definition of an arbitrary meaning to be given in dynamics to the words "rest or uniform motion in a straight line," namely, that it is the motion possessed by any particle isolated from the influence of all other matter, which influence is to be traced by its mutual character. Law I. would then go on to say, as an experimental result, that all isolated particles move with reference to one another in a way consistent with this definition.

In order to reach this conclusion I find it necessary to interpret some statements in text-books in a somewhat awkward fashion (*e.g.* Maxwell, "Matter and Motion," article xl.), and to suppose some others to be incorrect; hence my doubts, and my appeal for their resolution. W.

August 9.

On the Constant P in Observations of Terrestrial Magnetism.

ON page 304 of vol. ii. of their excellent treatise on "Practical Physics," Messrs. Stewart and Gee give the usual expression for the constant depending upon the distribution of magnetism in a pair of magnets employed for measuring terrestrial horizontal force; namely—

$$P = \frac{A - A'}{\frac{A}{r^2} - \frac{A'}{r_1^2}}.$$

Instead of this awkward and troublesome form, I would suggest

$$P = \frac{r_1^2 r^2}{r_1^2 - r^2}\left(1 - \frac{A'}{A}\right),$$

which can be readily deduced from Gauss's original equations, and is much better adapted to logarithmic computation; especially when r and r_2 remain constant throughout a series of observations, and Gaussian logarithms are used to form the factor $(1 - A'/A)$. WM. HARKNESS.

Washington, D.C., August 1.

The Stature of the Human Race.

IN your "Notes" of last issue, p. 348, you mention General Pitt-Rivers conducting a party of the Royal Archæological Institute to Woodcutts, where skeletons dug out show that the people who inhabited the ancient Romano-British village were of very inferior stature, the males being only on an average 5 feet 2 inches, and the females 4 feet 10 inches. I think it would be a very interesting inquiry to ascertain the average height of the human race in the past, as it appears to me from such data as I have been able to collect that the human race has continuously increased in average stature. I have measured a great many Roman coffins, where I happened to come across them, and my average shows that the Roman could not have greatly exceeded 5 feet 5 inches. In taking measurements of ancient armour, I find that the English aristocracy have decidedly increased in average height within 500 years. For a paper I read before our local Society, I measured twenty-five mummies in the British Museum as nearly as I could through the cases, making estimate for wrapping, and I found the average height of males 61 inches, females 55 inches. The mummy of the celebrated Cleopatra measures about 54 inches, about the height of the present average European girl of 13. The most ancient mummy of an Egyptian king yet discovered measured 52 inches. With research I have no doubt interesting data could be obtained on this subject. Limiting the matter to my own observations, I have formed the idea that the average stature of the human race increases at about the rate of 1·25 inches per 1000 years.

WM. F. STANLEY.

Cumberton, South Norwood, August 13.

A Spider allowing for the Force of Gravity.

THE manœuvres of the small hunting spider, so common on the West Coast of Africa, are always attractive, and my interest