height by this method is too low. The average determined from reflected lights (845 metres) is probably most nearly correct.

I think it is apparent that the observations with theodolites and photogrammeters at the international cloud-stations should be supplemented by other methods, if correct averages are to be obtained, and if clouds which cover the sky with a uniform veil are to be measured at all. Small balloons turned loose and followed with theodolites, suggested by Kremser, is a good method in such cases. H. HELM CLAYTON.

Blue Hill Meteorological Observatory, December 7.

Radiography.

YOUR correspondent, Mr. G. M. Lowe, asks for information as to the best methods of working direct on to sensitised paper to save the time and expenses involved in taking glass negatives. "Nikko" paper, as supplied by the Eastman Company, is a good substitute for glass plates, and the results on it are much superior to the smooth bromide papers. Eikonogen is a suitable developer—say five or six ounces of water to the contents of an eikonogen cartridge, and fix in clean hypo solution. Of course, to show the palma-surface of the hand when using a glass plate, the film side is *up* and the palm *down*; but in using paper direct, the film should be down, and the X-rays, therefore, pass through the paper before reaching the sensitive surface.

Radiographs made direct on paper are *negatives*, the bones being shown white. It has been stated that this is the correct way to show the bones, but it is quite a mistake. Bones are white by reflected light; by transmitted light they are black, more or less, and if X-rays are light rays, then the light is transmitted, and radiographs ought to be as usually shown printed from a glass negative; but for surgical purposes, for such as foreign bodies in the hand, negative or positive makes little or no difference. By the direct "Nikko" paper method the exposure must be longer, but to locate a needle in the hand thirty to forty seconds is sufficient. Two, three, or up to a dozen sheets of "Nikko" paper may be exposed at one time. Between the first and second sheet very little difference in exposure will be noticed, but between the first and, say, the twelfth the difference will be considerable. To extend this difference when only a few sheets are used, insert a piece of suitable black paper between each. W. I. CHADWICK.

The Heating of Anodes in X-ray Tubes.

I SHALL be much obliged if any of your readers who work with the X-rays will give me their experience with the 10-inch coils. I have one by Apps, which is excellent in every way; but whether I take from it a 2-inch or a 10-inch spark, the anode of the tube invariably becomes red or white hot within a few seconds.

The tubes are by leading makers, and exhausted for 8 or 10-inch sparks; but, as I have said, even a 2-inch spark makes the anodes red hot.

On the other hand a German coil I have, does not perceptibly heat the anode of the tube even when I use a 5-inch spark.

Is this the experience of others; and why should a $2\frac{1}{2}$-inch spark from one coil make the anode red hot immediately, when a 5-inch spark from another coil does not do so?

This difficulty at present prevents me employing the Apps 10-inch coil at all for X-ray work. WALTER CHAMBERLAIN.

Harborne Hall, near Birmingham, December 19.

Units of Force.

IN your issue of December 10, Prof. O. J. Lodge makes several curious statements.

He speaks of "inertia multiplied by the square of a velocity." He might as well speak of "shapelessness multiplied by the cube of a length." Inertia is a word best left unused, but usually means a property of what is called matter—like whiteness, hardness, inextensibility.

He also speaks of natural formulæ "independent of every system of units that can be devised," and, though he only gives one formula, implies that every mathematical relation can be expressed in a similar manner. Will he be so good as to give a formula connecting the weight, volume, and specific gravity of a body which is "independent of every system of units"?

As to the poundal, the objection to it is that no one uses it in actual work. There may be other objections, but that is a sufficient one.

As to teaching elementary mechanics, I am convinced that we should avoid "mass" as much as possible. When dealing with a particle, express Newton's Second Law by the formula $P/Q = f/a$, where P and Q are the forces producing accelerations f, a, respectively. This will usually take the form $P/W = f/g$. Then you may use any unit of force you choose, and the energy formula becomes $P \times s = W\frac{v^2}{2g}$, which may be in inch tons, foot pounds, or what you please. Is it too much to hope that the poundal may be shortly relegated, even in text-books, to that place, wherever it is, where grades are employed for measuring angles? C. S. JACKSON.

R.M. Academy, Woolwich.

The Distance of the Visible Horizon.

HAS not Prof. Lodge in his enthusiasm, which I fully share, for an absolute system of measurement rather overstepped the mark when in the equation $2R\,h=d^2$ for the distance of the visible horizon, he says that "h is not the number of feet, or of metres, or anything else, it is the actual height; d is not the number of miles or of inches to the horizon, but it is the distance itself; and similarly 2 R is the diameter of the earth, and not any numerical specification of that diameter (see NATURE, vol. lv. page 125). Surely the equation as written is an algebraical equation, and, as such, the symbols it contains express numbers and not things. The multiplication as he implies of one length (2 R) by another length (h), is abhorrent to the mind of "the Cambridge mathematician." The superiority of the formula over the mutilated apology for it which Prof. Lodge quotes, lies in the fact that the equation is true in terms of any conceivable unit of length in which the three lengths involved in it are measured. I am of course aware that the particular formula given may be regarded as an abbreviated statement of the approximate geometrical proposition that the rectangle contained by the diameter of the earth and the height of the observer above its surface equals the square on a line equal to the distance of the visible horizon, in which case, of course, Prof. Lodge's description of the symbols would be accurately true; but I do not think that the formula with this interpretation really illustrates his meaning.

I wish to associate myself with Prof. Lodge in his condemnation, for educational purposes, of all formulæ of the engineer's pocket-book type, should it unfortunately happen, that they gain a footing on the scientific side of school instruction it will do much to justify the slur, still too often cast, on science teaching at schools and at the universities, that it is not education. This must be my apology to Prof. Lodge for thus emphasising a mere *lapsus calami*. L. CUMMING.

Rugby, December 12.

Position of Boughs in Summer and Winter.

THE following measurements may perhaps be of interest. They have been made with a view to ascertaining how much the weight of leaves and fruit depressed the branches of a tree. The first measurements were taken on August 3, the second on December 14, 1896:—

Height from Ground in inches.

	August 3.	December 14.
Mulberry tree—		
Lowest twig	0 in. ...	31 in.
Higher branch	59 in. ...	72 in.
Another branch	20 in. ...	39 in.
Walnut tree—		
Lowest twig	15 in. ...	34 in.
Higher branch	60 in. ...	76 in.

In the case of the first branch of the mulberry tree, it was found in December that a weight of 35 pounds was not sufficient to lower it to its summer position. AGNES FRY.

Failand, near Bristol, December 15.

The Cultivation of Woad.

WITH reference to the letter of Rosa M. Barrett, in NATURE of November 26, p. 79, I formerly lived for many years, and my father before me, in the part of Somerset to which your correspondent alludes, viz. the neighbourhood of Bath, and within a few miles of Mells, I never remember to have seen or