## LETTERS TO THE EDITOR.

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Expansion Curves.

EVERY man who has studied steam or gas or oil engines knows that if there is one construction more important than another it is to draw a curve representing the law

$$pv^n = \text{constant}$$

through any given point. Here is an exceedingly simple, ingenious method of doing this which I have just found in a pamphlet by Mr. E. J. Stoddard, of Detroit. Let A be the given point so that AB represents a given volume,
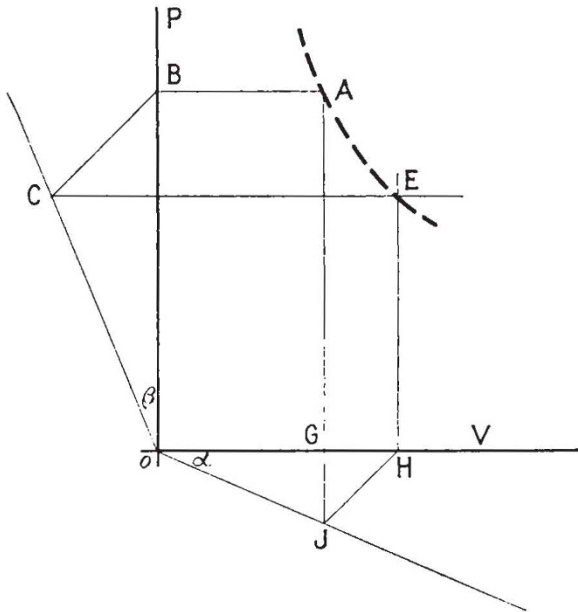
and AG a given pressure. Set off any convenient angle, VOJ = α say. Compute an angle β such that

$$1 + \tan \beta = (1 + \tan \alpha)^n,$$

and set off BOC = β. Produce AG to J. Now make OBC = JHO = 45°, and project from C and H to find E a point in the curve. The proof is obvious.

It is evident that OC may be drawn to the right of OB, and OJ above OV, to save paper if necessary.

　　　　　　　　　　　　　　　　　　　　J. PERRY.

Royal College of Science, S.W., September 23.

Botany in Boys Schools.

PROF. W. W. WATTS said in his address to the Geology Section of the British Association, " there is no science in which materials for elementary teaching are so common, so cheap, and everywhere so accessible."

In the light of this statement I sought material for the teaching of another science—botany—in a north London playground last week.

The Angiosperms were represented by thirteen natural orders. With a single representative each of the algæ and fungi, thirty-eight species in all were found growing in or on a soil which is almost entirely ballast !

It seems a pity that botany should be so rarely taught in boys' schools when a single playground yields materials " so cheap and so accessible."　　　H. J. GLOVER.

Stationers' School, Hornsey, N., September 23.

Radium and the Cosmical Time Scale.

CERTAIN letters have appeared in NATURE upon the bearing of the properties of radium upon the cosmical time scale. These letters are based on the assumption that radium, or some equally active body, exists in the sun and contributes materially to the output of solar energy. If this assumption were true, we ought, I think, to be able to detect the rays peculiar to radio-active bodies on the surface of the earth—they should bear some proportion to the great stream of light and heat waves which reaches us.

Now a solution of iodoform in chloroform is very sensitive to the β and γ rays. A purple coloration is produced by the rays from 5mg. of radium bromide even after filtering through 1cm. of lead. On the other hand, I find that direct sunlight (if heating be obviated) has no action when the thinnest opaque screen is interposed even after many days. Some of my solutions are now nearly two months old, and they have been exposed in light-tight cardboard boxes to such sunshine as has reached us during that period. They are quite unchanged.

It is, of course, possible that the stream of rays needs to be above a certain critical density in order to decompose the iodoform, but in any case my experiments prove that the β and γ rays reach us at most only in faint quantities from the sun.　　　　　　　　　W. B. HARDY.

Gonville and Caius College, Cambridge.

Loss of Weight of Musk by Volatilisation.

I SHOULD like to direct the attention of your correspondent " S. W." (p. 496) to *N. Cimento* for May, 1902 (or abstract 1986, *Science Abstracts*, 1902), in which E. Salvioni says that he has shown the loss of weight of musk by volatilisation.

The measurements were made by a special form of balance.　　　　　　　　　　　　　F. R. SEXTON.

Park Lodge, Kingston-on-Thames, September 5.

CONDENSATION NUCLEI.[1]

IN a previous paper under the not very appropriate title " Experiments with Ionised Air," Prof. Barus has described observations, made by means of his modified steam-jet methods, upon the nuclei found in air which has passed over phosphorus, together with measurements of the electrical leakage through air thus treated. The first chapter of the present volume is taken up with a continuation of the work by the methods there described.

There is no reason to expect the properties of air which has been exposed to phosphorus to be characteristic of ionised air generally; the recent experiments of Harms, and of Elster and Geitel, have, it is true, shown that ions are probably present, but the conditions are much more complicated than in cases of simple ionisation, such as that due to X-rays, owing to the presence of the products of the oxidation of the phosphorus. It is probably to the presence of the products of the oxidation of phosphorus vapour, as was pointed out in 1866 by Schmid, that the formation of the phosphorus cloud is due. The cloud nuclei are not free ions; in the " experiments with ionised air " it was found that the number of nuclei was undiminished by even a strong electric field; additional evidence is brought forward in the first chapter of the present paper, where experiments are described showing different temperatures for the maxima of nucleation and of ionisation. But such evidence was not required to show that these nuclei are not ordinary free ions, for in dust-free air ionised by X-rays or the rays from radio-active substances (in all cases, indeed, in which the ions have the normal velocity under