theory of evolution," somewhat like that of the botanist Reinke. Man, the growing-point of progressive life, is conscious of directive control. Is there anything more real and certain to him, and is it not the x factor in all life and evolution? "The master-word is nature's will to live," and as man is not an outside observer of the universe, but an organic part of it, the author goes on to show, in very interesting chapters, that ethics is for life, and that art is man's expression of life. J. A. T.

A Course of Pure Mathematics. By G. H. Hardy. Pp. xvi+428. (Cambridge: University Press, 1908.) Price 12*s.* net.

THE title of this book is rather a misnomer. As a matter of fact, the most interesting part of it is in the last two chapters, which contain an excellent discussion of the logarithmic and exponential functions based upon the definition of $\log z$ as an integral. The preceding eight chapters deal with real and complex variables, limits, convergence of series, and the fundamental theorems of the differential and integral calculus. They are chiefly interesting as an illustration of the fact that there is a growing number of university teachers who are resolved that, if they have to teach elementary calculus, they will do it in the most rigorous way that they can, exposing the fallacies which used to be calmly ignored. There is a large number of examples, many of which show how much more attention has been given of late years in Cambridge to the elements of general function-theory. Mr. Hardy's book is more likely to be regarded as a work on the calculus than anything else; as such, it will be a useful companion to such treatises as those of Lamb and Gibson. M.

Clay Modelling in Manual Training from Plan, Elevation, and Section. By F. W. Farrington. With an Introduction by J. W. T. Vinall. Pp. 47; plates xl. (London: Blackie and Son, Ltd., 1908.) Price 3*s.* net.

Clay Modelling in Manual Training. Scholars' Handbook. (Same publishers.) Intermediate and Senior, plates xl., price 4*d.* net. Junior, plates xvi., price 3*d.* net.

ANY practical pursuit which leads to a scientific training of the hands and eyes of young pupils should receive encouragement in the schools; and modelling in clay can, in the hands of a skilful teacher, become a very useful aid in teaching several subjects. Mr. Farrington indicates how clay modelling may assist school teaching in arithmetic and geography, but hardly develops sufficiently these and similar practical applications of this form of manual work. The books will serve to provide young teachers and pupils with helpful guidance.

Handbook to the Technical and Art Schools and Colleges of the United Kingdom. Compiled from Official Information. With an Index to Courses of Instruction. Pp. xii+140. (London: Scott, Greenwood and Son, 1909.) Price 3*s.* 6*d.* net.

THIS useful directory of some of the most important schools and colleges in the British Isles providing instruction in science, technology, and art gives information as to the governing authority, principal, and secretary of each of the institutions dealt with, and particulars as to the courses of instruction arranged at each centre. Though comprehensive, the directory is not complete, and it may be hoped that the request made by the publishers for data of schools omitted will be complied with by the respective authorities, so that the omissions may be rectified in the second edition.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Ionisation in the Atmosphere.

THE apparatus designed by Ebert has been widely used to determine the total charges per c.c. of the positive and negative ions in the atmosphere. Except under unusual conditions, the measurement of the positive charge exceeds that of the negative charge by an amount very variable, which averages perhaps about 20 per cent. Thus the ratio of the charges has an average value not far different from the ratio of the mobilities of the ions or from the ratio of their coefficients of diffusion.

The apparatus consists of a metal cylindrical testing vessel with an insulated axial rod connected with the central system of an electroscope. Air is drawn through the testing vessel at a known speed by a small turbine driven by clockwork. The quantity of electricity received by the central charged rod is determined from a knowledge of the electrical capacity and observations of the loss of potential.

The following simple experiments by Mr. F. W. Bates and the writer led to unexpected results. A large hollow cone of cardboard was placed so that the air entering the testing vessel all passed through the cone, and the air during its passage was strongly ionised by the β and γ rays of radium, or by the γ rays alone. The instrument itself was well screened from the rays, and the radium bromide (14 mg.) was carefully sealed in a test-tube so that no emanation escaped. The position of the radium was varied, so that the number of ions detected in different experiments covered a wide range.

Assuming the value of the ionic charge to be $3{\cdot}4\times10^{-10}$ E.S.U., and supposing that every ion carried unit charge, then the values obtained, after necessary small corrections, gave the following average number of ions per c.c.:—

Series	Positive ions	Negative ions	Ratio
1 ...	37,570	34,300	1·09
2 ...	19,900	10,100	1·99
3 ...	22,320	16,820	1·33
4 ...	14,350	11,850	1·21
5 ...	7,280	5,800	1·25
		Mean	1·39
Without radium	1,280	1,050	1·22

The variation in the ratio may be due to changes in the humidity or to the presence of dust.

The main point is, however, strongly marked. Whilst the γ rays of radium produce equal quantities of positive and negative electricity when they ionise gas in a closed vessel, we find that on ionising air near Ebert's apparatus there appears to be a large excess of positive electricity.

Care has been taken in designing the apparatus to avoid an external field. Since negative ions are under almost all conditions more mobile than positive ions, we should expect the negative ions to be captured more readily than the positive in the testing vessel, unless, indeed, some of the positive ions had a double charge. Again, it is possible that a large number of the negative ions diffuse to the top and sides of the testing vessel before entering it. In that case the diffusion is unexpectedly rapid. Moreover, the ratio, positive to negative, remained unchanged when the air was drawn through an earthed wide-meshed wire cylinder, when the loss by diffusion of the negative ions might be expected to show a relative large increase.

The details require further investigation, but the main and important result seems to be well established, namely, that the Ebert apparatus, and others of like type, are misleading in indicating a large excess of positive over negative electricity in the atmosphere. Thus when observers have recorded the average ratio as 1·2 there may really have existed equality, and the apparent excess may be due to the inequality of the rate of diffusion of the two