UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—Dr. W. T. Brooks has been appointed Litchfield clinical lecturer in medicine.

Prof. H. A. Miers has been nominated to be a delegate of the University Press.

Mr. P. A. Barnett has been appointed an examiner in the theory, history and practice of education.

Profs. H. A. Miers and W. F. R. Weldon have been appointed examiners for the Burdett-Coutts Scholarship.

The Report of the Bodleian Library, just issued, shows that the accessions to the library during 1900 were the second largest on record.

The Junior Scientific Club held their 225th meeting on Friday, May 10. Prof. Odling read a paper upon the detection of arsenic.

Mr. E. L. Gill, of the Owens College, Manchester, has been appointed curator of the Hancock Museum by the committee of the Natural History Society of Northumberland, Durham and Newcastle-upon-Tyne.

The late Mrs. Morton Sumner has by her will bequeathed to Bedford College for Women 4000*l.* and a large number of books specially relating to geology, general literature and art; also a valuable collection of mineralogical specimens.

A FACULTY OF COMMERCE is to be established in connection with the University of Birmingham, and the council of the University are prepared to appoint a professor, at a salary of 750*l.* a year, to organise a course appropriate for students preparing to take a lead in commercial pursuits or to become consular representatives or holders of administrative posts abroad or in the colonies. The aims and scope of the work of the new Faculty are outlined in a document drawn up by the principal, Dr. Oliver Lodge, and containing suggestions which should meet with general approval. There can be no reasonable doubt as to the need for the cultivation of scientific sympathies among men engaged in manufacture, commerce and public affairs. "If our country is to keep pace with others," remarks Dr. Lodge, "we have to provide in every post a highly-educated man, skilled in many business relations, as Consul, whose duty it shall be to understand the conditions of each trade, to realise how it may be improved or increased, and to make annual or more frequent reports, either to the Board of Trade or to local Chambers of Commerce, or both." The more administrators, officials and men of business we have capable of realising this ideal the better it will be for our national welfare; but the best way to provide the educational basis has yet to be decided. Dr. Lodge suggests that commercial education must centre round a school of Economics—understood in its widest sense—but this may be doubted, and we believe that it would be better to keep this school out of the early stages of the scheme. Too much importance seems to be attached to preliminary knowledge of "Arts" and other subjects required of students in the Commercial Faculty. It is suggested that "The preparatory training in fact should be a wide and comprehensive one including a little science as well as a good deal of Arts." To our thinking, however, a little science is not enough, and what is essential in the preliminary education is not the accumulation of information so much as the training of the mind to acquire and assimilate knowledge. Geography is not to be considered as a separate science in the new Faculty, and its various aspects will be surveyed by the professors of history, economics and geology. Dr. Lodge makes a number of other suggestions which, if adopted, will give the new Faculty a character worthy of the new University.

The paper on "School Work in Relation to Business" read before the Society of Arts on May 8, by Sir Joshua Fitch, and printed in the Society's *Journal* for May 10, contained an expression of views with which many people will find themselves in agreement. The fundamental idea, illustrated by reference to several subjects, seems to be that too much attention is given in schools to the application of rules and too little to the development of common sense. For instance, in arithmetic the pupils are given a number of empirical rules and are drilled in working questions based upon them, but they are taught next to nothing of the theory of number or of arithmetical operations. The average pupil is happy if the teacher will tell him whether he has to multiply or divide to work a simple question, and he asks helplessly what rule he should use when he is given a problem. But the pupil who has learned arithmetic as a science rather than as a collection of artifices for the working out of problems is in a condition in which he can find his own rules. Instead of regarding such processes as multiplication of fractions and extraction of square roots as a kind of numerical conjuring and legerdemain, he feels that his operations have a reasonable basis. The advantage of such knowledge is that it enables the pupil to invent his own method of dealing with problems and to adapt himself readily to any arithmetical work he may have to do later in a business house. Arithmetic as usually taught does nothing but develop mechanical facility in working sums, whereas it ought to be used to bring out thought and inventiveness.

Passing to measurements of length, volume and mass, Sir Joshua Fitch held with most of us that the metric system ought to take a more prominent place in the arithmetic course than is usually assigned to it, because of its increasing use both in science and manufactures. Then geography is a subject which is held in small favour in the public schools and in most secondary schools, yet when well taught it can be made, both from the educational and commercial point of view, one of the most fruitful of school exercises. Finally, no subject consciously designed to meet the needs of the shop or office should be taught in a primary school. The chief object should be education and the development of originality, rather than the acquisition of information and manipulation of rules. According to Sir Joshua Fitch the course of work in such a school should include "arithmetic in its principles, rapid calculation, the metric system, oral and written composition, industrial geography, and also some exercises in thinking about social economics and the way in which conduct and character tell upon the future honour and usefulness of the citizen." At the other end of the educational ladder are the universities, to which, it was held, we ought to look for more guidance than they have yet ever afforded in the solution of the great problem—the relation of scholastic culture to the duties of active life.

SCIENTIFIC SERIALS.

American Journal of Science, May.—Studies of Eocene mammalia in the Marsh collection, Peabody Museum, by J. L. Wortman.—On the velocity of chemical reactions, by W. Duane. A description of two physical methods for following the velocity of a chemical change occurring in solution. In one of these the solution to be studied is placed in a wedge-shaped hollow prism and compensated with a similar wedge, the chemical change being followed photographically. A diagram is given showing the inversion of sugar as followed by this method. In the second method the change of volume of the solution is followed in a large thermometer.—The transmission of sound through porous materials, by F. L. Tufts.—On a yoke with intercepted magnetic circuit for measuring hysteresis, by Z. Crook. A description of a new form of yoke possessing certain advantages over the ordinary types. It gives practically a perfect hysteresis cycle, and can be used for studying the demagnetising action of electric currents without interrupting the magnetic circuit or varying it by means of a solenoid.—Mineralogical notes, by C. H. Warren. Crystallographic measurements and chemical analyses of anorthite crystals from Franklin Furnace, felspar crystals from Raven Hill, Colorado, iron wolframite from Dakota, and pseudomorphs of wolframite after scheelite from Trumbull, Conn.—On the expansion of certain metals at high temperatures, by L. Holborn and A. L. Day. Bars of metal 500 millimeters long were used, and enclosed in a porcelain tube heated electrically. The temperatures were measured with the thermocouple and ranged from 250° C. up to 1000° C. in the case of platinum, and in other cases to as high a temperature as the properties of the metal under examination would permit. Results are given for platinum, palladium, silver, nickel, constantan, wrought iron and steel.

American Journal of Mathematics, xxiii. 2, April.—The cross-ratio group of 120 quadratic cremona transformations of the plane. Part 2: Complete form-system of invariants, by H. E. Slaught, is the continuation of a memoir by the author which appeared in vol. xxii. (pp. 343-388). The text is accompanied by a large number of tables.—Memoir on the algebra of symbolic logic, by A. N. Whitehead, is a purely mathematical investigation, taking its rise in Boole's laws of thought. The

credit of perfecting its laws of operation is assigned to C. S. Peirce and to Schröder. The keynote, according to the author, is the prominence given in his memoir to three ideas, viz that of the "invariants" of a function of independent variables, that of "prime functions of independent variables," and that of the theory of "substitutions" of independent variables for independent variables. The last idea connects the algebra with the theory of groups and opens out a large field for investigation in that direction. The memoir, which occupies much space (27 pp.), is to be concluded in a subsequent number.—V. Snyder contributes a short note on a special form of annular surfaces. —On the transitive substitution groups whose order is a power of a prime number, by G. A. Miller, is a further contribution to a branch of mathematics for which the author has already done so much excellent work.—Geometry on the cubic scroll of the second kind, by F. C. Ferry, is a first instalment. Its object is to give a detailed treatment of several of the more interesting questions connected with the geometry of this scroll, and especially to consider the surfaces which can be passed through any curve on the scroll, so far as the order of those surfaces and the natures of the residual intersections are concerned. References are given to many memoirs bearing on the subject.

SOCIETIES AND ACADEMIES.

Royal Society, March 7.—"On the Heat dissipated by a Platinum Surface at High Temperatures. Part iv.—High-pressure Gases. By J. E. Petavel, A.M.I.C.E., A.M.I.E.E., John Harling Fellow of Owens College, Manchester. Communicated by Prof. Schuster, F.R.S.

The rate of cooling of a hot body in gases at pressures up to one atmosphere has received considerable attention, but with regard to gases at high pressures practically no data were up to the present available.

The present experiments were carried out with a horizontal cylindrical radiator contained in a strong steel enclosure, the enclosure being maintained at about 18° C. by a water circulation.

It is shown that the rate at which heat is dissipated by the radiator may be expressed by the following formula—

$$E = ap^{\alpha} + bp^{\beta}\vartheta,$$

where E = emissivity in C.G.S. units = total amount of heat dissipated expressed in therms (water-gramme-degrees) per square centimetre of surface of radiator per second; p = pressure in atmospheres; ϑ = the temperature of the radiator minus the temperature of the enclosure, or in other words the temperature interval in degrees Centigrade.

The gases studied are oxygen, hydrogen, air, nitrous oxide and carbon dioxide. In the case of the first three the formula holds good between 7 and 120 atmospheres and between 100 and 1100° C.

All the gases studied showed a rapid increase of the effective conductivity with the pressure.

Physical Society, May 10.—Prof. S. P. Thompson, president, in the chair.—A paper on applications of elastic solids to metrology was read by Dr. Chree. The object of the present paper is to exemplify the bearing of elasticity on physical measurements. Many of the results depend ultimately on a previous paper by the author, in which expressions were obtained for the mean strains and for the change in total volume of any homogeneous elastic solid acted on by any given system of forces throughout its mass or over its surface. The effect of the pressure of a surrounding medium of constant density upon the shape and volume of an isotropic solid is considered, and the theory is extended to the case of an æolotropic solid in a medium of varying density. The change in volume of the material of the walls of a flask containing liquid is next investigated, and it is shown that the change is independent of the thickness of the walls, the mean expansion per unit of volume being inversely proportional to the whole volume. Whether the alteration consists of an increase or a decrease depends upon the dimensions of the vessel. We cannot, in general, determine the effect on the internal capacity of a vessel due to the pressure of contained liquid, but if the walls are coaxial right circular cylinders, the common axis being vertical, the solution is possible. As a numerical example a glass tube 12·7 cm. high, 10 cm. internal diameter and 1·5 mm. thick would hold 0·11 grammes more mercury than it would if inelastic. The solution is possible in the case of a spherical shell, and this problem is also investigated in the paper. The author next considers the application of the theory of elasticity to standards of length, and to give a more exact idea of the problems actually occurring in metrology he deals particularly with five forms—the standard yard, the international prototype metre of X section, a working standard belonging to the Bureau International, and two deflection bars used in magnetometers. Most modern standards are supported, not over the whole lower surface, but either on two symmetrical rollers or on three points. In using standards of length it is the horizontal projection of the graduated surface that usually concerns us, and it is proved that unless we deal with a very long bar the difference between the chord and the arc is very small. The curvatures and lengths of bars supported in various ways, both loaded and unloaded, are treated at length, and it is shown that by a proper arrangement of supports the alteration in length between two points due to bending can be rendered so small as to be of no practical importance. In the metre prototypes of X section the divisions occur on the neutral surface and their distance apart is unaffected by stretching of the material. In the case of magnetometer deflection bars it is advisable to have the magnet light and as near to the bar as possible. Mr. Watson said that it was usual in deducing the radius of a coil from the measurement of its circumference with a steel tape to diminish the result by half the thickness of the tape. He would like to know if this was the right correction to apply. In measuring the circumference of a cylinder it is necessary to wind the tape in a spiral so as to bring the divisions side by side. This gives a result which is too great, and not too small as might at first sight be imagined. Dr. Lehfeldt asked if the work of the author could be used to determine the pressure corrections of thermometers. He would like to ask why it was necessary to use supports instead of allowing a standard to rest on a flat surface. The chairman said that the paper was important because of its bearing on the question of the relation between the units of different nations. He drew attention to the alteration of the factor converting metres into inches, and asked if it was due to alterations in the properties of matter or to errors of observation. The two legal definitions of the gallon differ by an appreciable amount, and it would be interesting to know if this discrepancy could be due to changes in the volume of measures due to the liquids contained by them. Dr. Chree, in reply to Mr. Watson, said the correction would depend upon the diameter measured, because that determined the curvature of the tape and, therefore, the stretching produced. In reply to Mr. Campbell, the author stated that direct experiments had been made upon the bending of bars and they agreed well with theory. The correction formula obtained for a thermometer is similar to the ordinary one used. A bar is usually supported so as to remove the uncertainty of the distribution of surface pressure when it rests on a flat surface not a true plane. In reply to the president, Dr. Chree said that the alteration of the factor converting metres into inches was probably due to errors of observation on account of the width of the divisions of the standard yard, and on account of the difficulty of obtaining the bar at the standard temperature of 62° F.—A paper by J. Rose-Innes and Prof. S. Young, on the thermal properties of isopentane compared with those of normal pentane, was read by Mr. Rose-Innes. In previous papers the authors have investigated experimentally the thermal properties of isopentane and normal pentane and have stated certain conclusions from their observations. The present paper gives the conclusions reached after a more exhaustive examination of the experimental results of the former papers. The quantity $RT - pv$ at any volume and temperature is called the departure from Boyle's Law at that point, and it is found that there is a constant ratio between the departures from Boyle's Law of isopentane and normal pentane at the same volume and temperature. To test the law a probable value of the ratio was determined, and by means of it a large number of values of pv for isopentane were calculated from results for normal pentane. These calculated values fall upon the same curve as the observed values and agree with them to within about 1 per cent. The authors are confirmed in their previous conclusion that the difference of pressure between two isomeric substances at the same temperature and volume involves the same power of the density as the first deviation from Boyle's Law, *i.e.* the second power. Mr. J. M. Gray said the numbers obtained