the help of a hint or two to put him on the right track, solve them for himself.

I am told that at a school which of late years has been one of the most successful in turning out good mathematicians, the older boys are under the impression that they get very little teaching in the higher parts of mathematics; they work in a class-room together at the text-book, abuse its obscurity, argue out with each other what it really means, while the master appears to take very little part in the proceedings; as a matter of fact, if he sees that a wrong conclusion is likely to be come to by the little parliament, by an apparently casual remark he gives the argument a push in the right direction. This seems to me the very best kind of education when the boys are of fairly equal ability.

Work of this kind, when the student tries to puzzle out his own difficulties, takes time, and the student cannot cover the ground so quickly as when his difficulties are solved for him by his teacher as fast as they arise. If the examination for which he is preparing covers a wide range of subjects, he is almost compelled, or at any rate he is very strongly tempted, to adopt the quicker and easier methods. The temptation is especially strong in the case of students of science. For the Natural Sciences Tripos at Cambridge, for example, the majority of the students take four subjects in part i.; there is really no need for them to do so, and the better students are in many cases strongly advised by their tutors to take only three; if they did so I feel sure they would not prejudice their chance of getting a first class. They think, however, that it is safer to take four, and as playing for safety is a very characteristic feature of the modern undergraduate, the majority of them take this course. As they have now to do a very large amount of practical work in each subject, the study of four subjects means if they take the first part of the tripos in the second year that the whole of their mornings and many of their afternoons are spent in lecture-rooms and laboratories, and that they have very little time to spend in thinking quietly over their subject. It may be said that they have the vacations in which to do this. But, as a matter of experience, it is found, I think, that this habit is either continuous or else non-existent; it is not one that can be flung aside in term time and then resumed as soon as term is over. We cannot all emulate the heroes in the Bab Ballads:—

> These men were men who could
> Hold liberal opinions,
> On Sundays they were good,
> On week days they were minions.

It is, I think, most important that they should form this habit of independent thought at school, for if they have not done so the conditions are not very favourable for them to do so at the university.

The popularity of science, the great increase in the numbers attending lessons, lectures, and laboratories makes it more and more difficult to arrange that our students shall have the opportunity of thinking out their own difficulties and developing their independence and power of relying on their own resources. Let me contrast the conditions under which I began in the 'seventies the study of practical physics at the Owens College, Manchester, with those which prevail at the Cavendish Laboratory at the present time. When I was a student there were perhaps a dozen working at practical physics in the laboratory; there was no need for any elaborate organisation; we used to work at an experiment until we were satisfied we had done as much as we could, by what we thought, generally erroneously, were improvements on the methods shown to us, and acquired in this way a lively interest in our subject and some facility in devising experiments to test various points which arose in the course of our work. This, I think, is the best kind of laboratory training it is possible to have, but it is only available when the number of students is small. If we adopted it at the Cavendish Laboratory, where last term there were above three hundred students doing practical physics, the result would be chaos; while the students would not learn physics, independence, or anything except proficiency in free fighting. With such numbers elaborate organisation and preparation are unavoidable, and we have necessarily to limit ourselves to trying to make the elementary demonstrations teach the students how to make accurate measurements, to give them a knowledge of methods, and to make the experiments as illustrative as possible of the fundamental principles of physics.

I think, however, that in some of our schools the number of boys taking practical work is small enough to make the other method possible, and when this is the case I would urge as strongly as I can the danger of excessive organisation and the importance of developing as much as possible the independence and self-reliance of their pupils, and I think they might do so with safety to a small number of subjects.

I cannot refrain from alluding to the remarkable and very gratifying increase which has taken place in the last few years in mathematical knowledge possessed by the students of science sent up from the schools, and is growing rapidly from year to year. When I first went to the Cavendish Laboratory the knowledge of mathematics possessed by many of the students was so meagre that I had to start classes to teach them the elements of the differential calculus; that class has gone on until the present year; but the number who required such teaching has diminished so rapidly during the last few years that I have decided it will not be necessary to continue these classes any longer.

In conclusion, I would like to offer a suggestion, which I make with great diffidence, but it is one which, if it were possible to carry out, would increase the efficiency of the student, especially in after life, to a very considerable extent. I mean, would it be possible to teach science students enough German to enable them to translate an ordinary text-book or paper? I do not ask that they should all know German—that I realise is, at present, impracticable. I do not ask that they should be able to write German, or even pronounce it, but merely that they should be able to make sense of a straightforward sentence.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

IT is announced in *The Jewish Chronicle* that a wealthy Jew, a native of India, has bequeathed a sum of 80,000*l.* for the endowment of a Jewish college in Jerusalem. This sum is likely to form the nucleus of an endowment for a university in Palestine.

PROF. J. G. HIBBEN has been elected president of Princeton University in succession to Dr. Woodrow Wilson. Prof. Hibben has been professor of logic at Princeton University since 1893, and is known as the author of works on logic and philosophy.

IT is announced that Sir Charles Chadwyck-Healey, K.C., who is a member of the governing body of Cranleigh School, has expressed his desire to present a laboratory to the school, and the offer has been accepted by the governors. The work has been put in hand, and it is expected that the cost will be about 4000*l.*

A REUTER telegram from Cape Town on January 13 states that, speaking at Moorresburg, Mr. F. S. Malan, Minister of Education, said he hoped to introduce and pass in the forthcoming session of Parliament a Bill dealing with higher education and the foundation of a university. Mr. Malan expects shortly to receive from Messrs. Wernher, Beit and Co., who have given half a million sterling towards the university scheme, a notification of their acceptance of the Bill, which will then be published.

AT a meeting of the executive committee of the governing body of the Imperial College of Science and Technology, held on Friday last, Prof. W. A. Bone, F.R.S., professor of applied chemistry (fuel and metallurgy), University of Leeds, was appointed professor of fuel and refractory materials in a new department of chemical technology now being established in the Imperial College at South Kensington. He will take up his new duties at the Imperial College about September of this year.

IN connection with the Francis Galton Laboratory for National Eugenics, a course of eight lectures will be given at University College, London, on Tuesday evenings at 8.30 p.m., beginning on January 30. The first two lectures will be delivered by Prof. Karl Pearson, and will deal with "Sir Francis Galton: his Life and Parentage, Work and Teaching." These will be followed by two lectures on "Infantile Mortality," by Miss Ethel Elderton and Dr. M. Greenwood, jun. The fifth lecture will be on "Alcoholism," by Dr. David Heron; the sixth on "Physical Degeneracy," by Mr. Bishop Harman; and the seventh and eighth on "Heredity and Environment" and on "Social Problems," by Prof. Karl Pearson. Further particulars may be obtained on application to the secretary of the college.

AT the annual general meeting of the Royal College of Science Old Students' Association, held on January 13 at the college, Sir William Crookes, O.M., F.R.S., was elected as president of the association on the motion of Captain John Spiller, who shares with Sir William the honour of being the oldest students connected with the college. Prof. R. A. Gregory was elected as one of the vice-presidents in succession to Sir William Crookes, the remaining five vice-presidents being re-elected. Mr. T. Ll. Humberstone and Mr. A. T. Simmons were re-elected secretary and treasurer. The evidence relating to the college presented to the Royal Commission on University Education in London was to have been considered at this meeting, but owing to the lateness of the hour it was decided to adjourn the meeting, and another general meeting will be called shortly, on a date to be fixed by the committee, at which the principal business will be the discussion of this evidence. The report of the committee showed that the membership of the association had increased to 665, of whom 595 are associates of the college.

THE report of the principal of the Huddersfield Technical College, read at the prize distribution on December 21 last, has been published in pamphlet form. We find that the age of admission to evening classes was raised by one year, and the total of student hours was well maintained, in spite of the fall in the number of students which followed the raising of the age of entry. Although a number of individual students engaged in local industries attend day classes for one or more mornings or afternoons in the week, the conditions of employment seem to be unfavourable to the release of young persons during working hours for the purpose of attending classes. As yet, little success has attended efforts to make systematically organised arrangements for such students. In making recommendations with regard to the award of college diplomas, the staff has not hitherto had the advantage of any outside help or advice, such as is rendered in many university examinations by an external examiner acting conjointly with members of the university staff. To remedy this defect, the governors have sanctioned a scheme for the appointment of honorary assessors, whose cooperation and assistance will, it is expected, prove to be of value in determining these awards. There is an increasingly satisfactory relationship of the college with employers of all kinds. Cases are frequent in which students are allowed to leave work early on class nights, or are given help towards the payment of class fees or the cost of books or instruments. Much interest is displayed from time to time by employers and others in proposals for new classes, as well as in attempts to improve the existing instruction.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, January 11. — Sir Archibald Geikie, K.C.B., president, in the chair.—Lord **Rayleigh**: The propagation of waves through a stratified medium, with special reference to the question of reflection.—Prof. F. T. **Trouton**: The mechanism of the semi-permeable membrane and a new method of determining osmotic pressure. The amount of water taken up by a liquid, such as ether, from an aqueous solution, the solute of which is insoluble in the liquid, diminishes as the strength of the solution increases, the maximum amount taken up being from pure water. Reasons are given in the paper for expecting that the amount of water taken up from a given solution would increase under pressure, and further, that at the osmotic pressure of the solution the amount taken up would be the same as that from pure water at the atmospheric pressure. An account is also given of an experimental investigation which has verified these conclusions in the case of a 60 per cent. solution of cane sugar when osmotic pressure is about 80 atmospheres.—Dr. Alois F. **Kovarik**: Mobility of the positive and negative ions in gases at high pressures. Rutherford and Child have shown that the current i per sq. cm., between two parallel plates when an intense ionisation is confined to the surface of one plate, is given by $i=9V^2K/32\pi d^3$, where V is potential difference, d distance between plates, and K mobility of ion. When theoretical conditions are fulfilled, the current through the gas in the two directions affords a direct measure of mobility of positive and negative ions. The surface ionisation was obtained by covering one of the plates with an active preparation of *ionium*, separated by Prof. Boltwood from the uranium residues lent by the Royal Society to Prof. Rutherford. Using high pressures, ionisation is mainly confined within a very short distance of the plate. The theory was tested experimentally, and it was found that over a considerable range i varied as V^2 and inversely as d^3. The results for the mobilities of the ions in these gases are as follows:—in dry air and dry hydrogen mobility varies inversely as pressure up to 75 atmospheres, the highest used; in moist carbon dioxide the product of mobility and pressure is constant up to 40 atmospheres, but for higher pressures the product decreases as the gas approaches the liquid state. The mean values for the products of mobility and pressure in atmospheres, for the range of pressures for which the product was constant, are for negative and positive ions, respectively, in dry air 1·89 and 1·346, in dry hydrogen 8·19 and 6·20, and in moist carbon dioxide 0·67 and 0·705 cm. per sec., for a potential gradient of one volt per cm.—G. A. **Shakespear**: A new method of determining the radiation constant. The rate of loss of heat of a silvered surface at a temperature of 100° C. in surroundings at 15° C. is observed (*a*) when the surface is polished, (*b*) when it is lamp-blacked. The difference is due to difference in radiation losses. The ratio of the rates of radiation is obtained by exposing the two hot surfaces in turn to a radiomicrometer. The rate of radiation from the lamp-black is assumed to be proportional to the difference between the fourth powers of the absolute temperatures 373 and 288. The lamp-black at 100° C. is compared with a full radiator at the same temperature by means of the radiomicrometer. Certain corrections are necessary, and these are dealt with in the paper. As a check on the comparison given by the radiomicrometer, an instrument which constitutes a closer approximation to a full receiver was devised and used. It was found, incidentally, that the apparent radiation from lamp-black depends upon the surface upon which the lamp-black is deposited. The value obtained for σ is $5{\cdot}67\times10^{-5}$ ergs per sq. cm. per sec. per deg^4.—Dr. R. A. **Houston**: The mechanics of the water molecule. Suppose that a hydrogen atom loses one electron to a second hydrogen atom, and that the second hydrogen atom loses two electrons to an oxygen atom. Then the oxygen atom has two negative charges, each hydrogen atom one positive charge, there will be one line of force between the first and second hydrogen atoms and two lines of force between the second hydrogen atom and oxygen atom. Let the three lines of force act as equally strong spiral springs, and let a wave of light pass through a medium composed of such molecules. It is shown in the paper, by means of the ordinary theory of dispersion, that the absorption spectrum of such a medium consists of two bands, the ratio of the wave-lengths of which is 2·32. Also from the intensity and width of each band it is possible to calculate e/m, the ratio of unit charge to the mass of the hydrogen atom. Water is transparent in the ultra-violet and visible spectrum, and has two great bands in the infra-red at 3·07 μ and 6·15 μ, which are not present in oxygen or hydrogen. It is shown in the paper that the values of e/m calculated from these bands are respectively 7110 and 1550 electromagnetic units. Hence the structure assumed for the molecule cannot be far off the truth.