report that there are 75 higher seats of learning in Germany, Austria proper, and Switzerland, having altogether 5963 professors, 67,062 students, and 6628 foreign students. There is in Germany one professor for 12·1 students, and an average of 78·4 professors and 926·3 students (of whom 67·2 are foreigners) to one seat of learning. Austria has one professor for 11·7 students, and an average of 80·5 professors and 949·4 students (of whom 91·1 are foreigners) to one higher seat of learning. Switzerland has one professor for 5·9 students, and an average of 96·2 professors and 569·6 students (of whom 208·3 are foreigners) to one higher seat of learning. Among other subjects of articles in the report are: the comparative study of popular education among civilised nations; education in France; education in Mexico and Central America; commercial education in Europe, particularly in Austria, France, and Germany; and the correlation of studies.

ONE of the most gratifying signs of educational progress is the increasing efficiency of technical institutions in the provinces as well as in London. These schools are not only far better equipped than they were a few years ago, but in many cases the members of the teaching staffs are better qualified to impart instruction. The prospectuses and calendars which come before us from time to time testify to a real development of facilities for education in science and technology, and we are glad to observe the advances which technical schools are making all over the country. A prospectus just received from the Technical College, Huddersfield, furnishes an instance of valuable work being done in a large technical college outside London. This college provides full courses, both theoretical and practical, and of an advanced type, in physics, chemistry, biology, art, engineering, weaving and dyeing. There are also separate departments for mathematics, languages ancient and modern, and commercial subjects; whilst a mining section is in process of formation. Of especial importance is the fact that the college library consists of some 10,000 volumes, an annual sum of 160*l.* being devoted towards the purchase and binding of books, periodicals, &c. At the present time an extension, calculated to cost about 13,000*l.*, is being carried out. Improved accommodation will thus be provided for chemistry and physics, and engineering; a room 105 feet by 27 feet has also been set aside for a museum for biology and mineralogy. The number of students of both sexes for the last two or three years averages about twelve hundred. Students can at present take up at the college all the subjects required by the London University for a degree in art or science, and they will be able to continue to their D.Sc. work when the new chemical and physical laboratories are completed. In all departments we notice that practical work is carried on as well as lectures. Dr. S. G. Rawson, the principal, appears to be developing the college on the right lines, and Huddersfield will doubtless benefit by the work he is doing. Financially the college is also in a satisfactory condition. We think both council and staff are to be congratulated upon the care and energy which has been displayed in building up so strong and useful an institution.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, October 29.—Mr. Shelford Bidwell, President, in the chair.—Prof. Stroud exhibited and described the Barr and Stroud "range-finder." The problem of finding the distance of a given object at sea, or in the field, is complicated by shortness of the trigonometrical "base," and by restrictions of time. As a rule, the apparatus must be self-contained, and "snap-shot" readings are obligatory, *i.e.* the range has to be determined from a single instrument and from a single observation. At 3000 yards the errors must not exceed 3 per cent. In foggy weather, or when viewing a nebulous object, this degree of precision is difficult to attain, but under favourable circumstances the authors have determined ranges, at that distance, within 1 per cent. of accuracy. At shorter ranges measurement is more exact; thus an object at about 2000 yards may be estimated to within about 12 yards. Prof. Stroud gave some account of the history and of the general methods employed in these instruments. Two images of the distant object, preferably of a line such as a flag-staff, are received respectively upon two mirrors, two lenses, or two prisms, placed one at each end of a fixed support. From each of these, the light is then directed towards the middle of the instrument, where the two images, after further reflection, are viewed by one eye-piece. The optical system has finally to be adjusted so that the two images, as now seen in the eye-piece, lie in the same straight line. In the instrument designed by the authors this coincidence is attained by translating a small prism parallel to the axis of the supporting rod. The extent of this translation is a measure of the range. Both eyes are used: the right for bringing the two images into alignment; the left for "finding" the object through a small field-glass, and for reading the scale of distances. At night, sightings have to be taken from "points" of light, and as these are unsuited for measurement, the authors convert them into "lines" by the use of cylindrical lenses. Various devices are introduced to prevent overlapping of the images. The instrument is about five feet long, and tubular in form; it is made of copper, so as to have high thermal conductivity to reduce differential heating. Within the outer tube is the interior supporting rod, designed to equalise so far as possible the effects of interior radiations. Several forms of "separating" prisms were exhibited, the best for the purpose consists of two "reflecting" prisms; these receive the two rays and direct both of them into a third prism, whose angle lies in the space between the angles of the others. Mr. Barr drew attention to the gimbal arrangement and the three struts that keep the supporting rod centred in the tube. To give some idea of the precision and scope of the range-finder, he observed that they were there using the equivalent of a 25-feet "circle," and their measurements were comparable to the measurement of 20 secs. of angle on such a circle. The instrument is handled by ordinary seamen, and stands rough usage on board ship for years without injury.—Prof. Stroud then exhibited "a folometer and spherometer." He explained that in determining curvatures and focal lengths, some telemetric method was necessary, and that, owing to want of parallelism of the beam, and duplication of images, a short-focus telescope was always an inefficient telemeter. For the measurement of inaccessible lengths it was therefore better to use some simple form of "range-finder." Such an apparatus could be made with a set of small mirrors arranged in such a manner as to direct two images of the distant object into an eye-piece, with a fixed prism in the path of one of the incident beams. By sliding this instrument along the optical bench one position could always be found at which the two images, as seen through the eye-piece, were in coincidence. He also described a method for determining curvature by interposing a plate of plane glass between the curved mirror and a source of light.—Mr. Ackermann exhibited two experiments. (1) The blowing-out of a candle-flame by the air from a deflating soap-bubble. The bubble was blown at the mouth of an inverted beaker by breathing into a hole cut out at the top. This hole was then presented to the flame, and the flame was immediately quenched. But if the bubble was blown from ordinary air, with bellows, the flame was merely deflected without being extinguished. (2) It was shown that a miniature boat, provided with a false stern, consisting of a linen diaphragm, could be propelled by filling the hollow stern-space with ether, or with some liquid similarly miscible with water. The motion is due to the continuous release of surface-tension behind the boat. Prof. Boys said that when he tried, some years ago, to blow out a candle with a soap-bubble filled with common air, he found the operation very difficult—so difficult that, having once succeeded, he never repeated the attempt. It had not occurred to him, as it had to Mr. Ackermann, that the CO_2 present in the breath played a part in the quenching. With regard to the second experiment, he had seen a small boat propelled by dissolving camphor astern, but he thought the use of a liquid for that purpose was a novelty.—The President proposed votes of thanks, and the meeting was adjourned until November 12.

PARIS.

Academy of Sciences, October 26.—M. A. Chatin in the chair.—Apparatus for measuring the altitudes attained by balloons. Verification of the results furnished by barometers, by M. L. Cailletet. The dial of the aneroid is placed exactly in the focus of a photographic camera, to which such a mechanism is fitted that every two minutes two photographs are taken simultaneously, one of the barometer and another of the earth. From the focal length of the photographic objective, the distance of any two points on the earth, and the distance of these two points on the negative, the calculation of the true height is easily calculated. The apparatus worked perfectly in a preliminary balloon ascent made by MM. Hermite and Besancon.—Report on a memoir of M. Hadamard, entitled

"On the geodesic lines of surfaces of opposite curvatures," by M. H. Poincaré.—Observations on the new Perrine comet (1897, October 16), made at the Observatory of Paris, by M. G. Bigourdan.—Observations of the same comet made at the Observatory of Toulouse, by M. F. Rossard.—On the deformation of quadrics, by M. C. Guichard.—On systems completely orthogonal in space of n dimensions, and on the reduction of more general differential systems, by M. Jules Drach.—On Weingarten surfaces, by M. A. Pellet.—On a new method of reducing the time of exposure in radiography, by M. Gaston Séguy. A thin glass plate is coated on both sides with an emulsion of gelatino-silver bromide, and allowed to dry. This is then enclosed between two flexible screens, formed by M. Becquerel's calcium violet in suspension in celluloid, and the whole pressed together between cards. A photograph of the thorax, using a six-inch coil, with thirty seconds' exposure, was completely satisfactory, every detail being shown with great clearness.—On a new bianodic bulb, with a red phosphorescence. The glass of the bulb is tinged with didymium chloride. The fluorescence is red instead of green, giving twice as much of the X-rays as ordinary glass. The effects on the screen are very brilliant, and can be seen by persons colour-blind to green.—Researches on saline solutions; lithium chloride, by M. Georges Lemoine. Thermal data, showing the heat of dilution of solutions of lithium chloride in water, methyl and ethyl alcohols.—On some basic salts of magnesium, by M. Tassilly. The preparation and properties of the oxybromide $MgBr_2.3MgO.12H_2O$ is described.—The separation and direct estimation of chlorine and bromine in a mixture of alkaline salts, by MM. H. Baubigny and P. Rivals. The separation is effected by potassium permanganate in presence of a large excess of copper sulphate. Analytical results are given, showing the trustworthiness of the method under varying conditions.—On some combinations of metallic acetates with phenylhydrazine, by M. J. Moitessier. Double salts are formed with phenylhydrazine by the acetates of zinc, cadmium, manganese, cobalt, and nickel.—The methods of estimating diabetic sugar, by M. Frédéric Landolph. A comparison of the results obtained in the estimation of diabetic sugar by the polariscopic, fermentation, and copper reduction methods, showed that only the optical can be depended upon.—Optical and reducing power of the flesh of flies, by the same.—Action of the X-rays upon the cutaneous evaporation, by M. L. Lecercle. In the rabbit, the evaporation of a given portion of the skin can be almost completely suppressed, and the effects continue for some time after the exposure. On the human hand, evaporation is somewhat checked, but the action is fugitive, and the evaporation rapidly recovers its original value.—On yellow fever, by M. le Dr. Domingos Freire. A description of the habits and mode of growth of the bacillus, *Micrococcus xanthogenicus* Attenuated cultures of this bacillus, injected into animals and man, produce a mild form of yellow fever, which confers immunity from the disease. Since 1883 some 13,000 persons have been inoculated, of all ages and nationalities. The subsequent mortality from yellow fever, in spite of violent epidemics which have raged, has not exceeded six per thousand.—Observations on the circulation of the Amphictenia, by M. Pierre Fauvel.—On the differentiation and development of the woody elements, by M. L Jules Léger. The discovery of a Miocene bat at Grive-Saint-Alban, by M. Claude Gaillard. A complete humerus, and some fragments were discovered.—On the Armand cave, by MM. E. A. Martel and A. Viré. A description of the results of the exploration of a subterranean cave, 207 metres deep, the most remarkable feature being a forest of two hundred stalagmitic columns, of heights varying between three and thirty metres.

DIARY OF SOCIETIES.

THURSDAY, NOVEMBER 4.

LINNEAN SOCIETY, at 8.—The Attraction of Flowers for Insects: Sir John Lubbock, Bart.—Transfusion-Tissue: its Origin and Function in the Leaves of Gymnospermous Plants: W. C. Worsdell.

CHEMICAL SOCIETY, at 8.—The Properties of Liquid Fluorine: Prof. Moissan and Dewar.—The Liquefaction of Air and the Detection of Impurities: Prof. Dewar.—The Absorption of Hydrogen by Palladium at High Temperatures and Pressures: Prof. Dewar.

INSTITUTION OF MECHANICAL ENGINEERS, at 7.30.—Mechanical Features of Electric Traction: Philip Dawson.

FRIDAY, NOVEMBER 5.

RÖNTGEN SOCIETY, at 8.—Address by Prof. S. P. Thompson.

MONDAY, NOVEMBER 8.

ROYAL GEOGRAPHICAL SOCIETY (Queen's Hall, Langham Place), at 8.45.—Introductory Address by the President.—The Jackson-Harmsworth Arctic Expedition: Frederick G. Jackson.

TUESDAY, NOVEMBER 9.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Manchester Ship Canal; Sir E. Leader Williams.—The Mersey Estuary Embankments—Eastham Division: Whately Eliot.—The Mersey Estuary Embankments and other Works—Runcorn Division: Sir E. Leader Williams.—The Irlam Division: W. O. E. Meade-King.

ANTHROPOLOGICAL INSTITUTE, at 8.30.—Works of Art from Benin City C. H. Read and O. M. Dalton.

ROYAL PHOTOGRAPHIC SOCIETY, at 8.—The Spectroscope: E. W. Maunder.

THURSDAY, NOVEMBER 11.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Accumulator Traction on Rails and Ordinary Roads: L. Epstein.

MATHEMATICAL SOCIETY, at 8.—On the Poncelet Polygons of a Limaçon: Prof. F. Morley.—On an Extension of the Exponential Theorem: J. E. Campbell.—The Integral $\int P_n^2\,dx$ and Allied Forms in Legendre's Functions, between Arbitrary Limits: R. Hargreaves.—The Character of the General Integral of Partial Differential Equations: Prof. Forsyth. F.R.S.

FRIDAY, NOVEMBER 12.

ROYAL ASTRONOMICAL SOCIETY, at 8.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

BOOKS.—Light, Visible and Invisible: Prof. S. P. Thompson (Macmillan).—Chauncy Maples, D.D., F.R.G.S. (Longmans).—Cheltenham as a Holiday Resort: S. S. Buckman (Cheltenham, Norman).—Twentieth Annual Report of the Local Government Board, 1895–96: Supplement containing the Report of the Medical Officer for 1895–96 (Eyre).—Die Wissenschaftlichen Grundlagen der Analytischen Chemie: W. Ostwald, Zweite Vermehrte Auflage (Leipzig, Engelmann).—The Works of Xenophon, translated by H. G. Dakyns, Vol 3, Part 2 (Macmillan).—Hints to Teachers and Students on the Choice of Geographical Books for Reference and Reading, with Classified Lists: Dr. H. R. Mill (Longmans).—Das Kleine Botanische Practicum für Anfänger: Dr. E. Strasburger, Dritte Umgearbeitete Auflage (Jena, Fischer).—A Geological Map of the Southerg Transvaal: Dr. F. H. Hatch (Stanford).—Map of the Transvaal, showinn Physical Features, &c.: Dr. F. H. Hatch (Stanford).—My Fourth Tour in Western Australia: A. F. Calvert (Heinemann).

PAMPHLETS.—A Popular Introduction to the Study of the Sun: G. M. Knight (Philip).—Reforms needed in our System of Elementary Education: T. C. Horsfall (Manchester, Cornish).

SERIALS.—Chambers's Journal, November (Chambers)—The Record of Technical and Secondary Education, October (Macmillan).—Natural Science, November (Dent).—Mittheilungen der Prähistorischen Commission der Kais. Akademie der Wissenschaften, 1 Band, No. 4 (Wien).—Journal of the Royal Microscopical Society, October (Williams).—Contemporary Review, November (Isbister)—Good Words, November (Isbister).—Sunday at Home, November (Isbister).—The Transactions of the Royal Irish Academy, Vol. xxxi. Part 4 (Dublin).—National Review, November (Arnold).—Humanitarian, November (Hutchinson).—An Illustrated Manual of British Birds: H. Saunders, 2nd edition, Part 1 (Gurney).

CONTENTS.