

block is worked into a paper-weight. A scribing block is then made, the castings and forgings being provided. This serves as exercise in chipping, filing, drilling, turning, and screwing. The student has afterwards to turn out a surface plate, hexagonal pattern, with handles. This work serves as exercise in planing, turning, drilling and screwing, filing and scraping. During the second year a ratchet brace is made, and a lathe; and third-year students make a shaping and a slotting machine. The course of study for engineering students is worth reprinting, for in it theory and practice are excellently combined:—

First year.	Second year.	Third year.	Fourth year.
Fitting and Machining (Shops).	Heat Engines, Advanced.	Smithing (Shops).	Smithing (Shops).
Engineering Lecture (Preliminary).	Mathematics (2nd stage).	Fitting and Erecting (Shops).	Pattern Making (Shops).
Applied Mechanics, Advanced.	Fitting and Machining (Shops).	Machine Construction (Special).	Smithing (Shops).
Machine Drawing, Elementary.	Machine Drawing, Advanced.	Engineering Lectures.	Engineering Lectures (Special).
Fitting and Machining (Shops).	Applied Mechanics, Advanced.	Pattern Making (Shops).	Pattern Making (Shops).
The Steam Engine, Elementary.	Fitting and Machining (Shops).	Finished Drawing and Design (Special).	Finished Drawing and Design (Special).
Mathematics (1st stage).	Drawing Practice (Special).		
Drawing Practice (Special).			

The course for building students is just as good. These courses are very popular, and they well deserve the success they have gained. Another successful class is one of carpentry for women; not merely Sloyd or woodwork, but real, practical carpentry. This is, we believe, the first class of the kind that has ever been held. The chemistry classes are specially good, and the laboratories the largest of all the Polytechnic Institutes.

Certain classes of the Goldsmiths' Institute are open to a limited number of *bonâ fide* artisans and handicraftsmen, on payment of half the ordinary fees. This is a rule well worth following in other institutes. Some of the trade classes are open to any one, irrespective of occupation. The clerk who has a taste for machine work may go through the same courses as fitters. If the clerk were allowed to waste his time in dabbling with the lathe and making pretty things, then he ought to be kept out; but when he is compelled to take up routine work, the case is different, for nothing but good can come of it. The young man who is willing to forego empty pleasures in order to obtain technical knowledge, is the one who will develop into an inventor. He works for the pure love of it, and something original may be confidently expected from him in time.

R. A. GREGORY.

(To be continued).

EXPLORATION OF THE HADRAMUT.

AT the last meeting of the Royal Geographical Society Mr. J. Theodore Bent gave an account of the archaeological tour recently made by him and Mrs. Bent in Southern Arabia. On account of the fanaticism of the people, only one European had previously been able to penetrate to the broad valley of the Hadramut, which runs for one hundred miles or more parallel to the south coast of Arabia, gathering in tributary valleys from north and south, and carrying their drainage to the sea at Saihut. Opposition to the expedition was offered, as in the case of Mr. Hirsch, by the British officials at Aden, but in spite of this the Bents, accompanied by the accomplished Indian surveyor, Imam Sharif, and by botanical and natural history collectors, travelled in safety without disguise, and, though there were some hostile appearances, without injury through a large tract of unmapped country.

The region they traversed consisted of three parts, the narrow coast strip or Sahil, backed by the high plateau or Akaba, and the Hadramut and other valleys on the north, which lies between the southern plateau and the high desert land farther north. The whole coast strip from Mekulla to Saihut was extremely arid, only fertilised in patches by occasional hot springs. No traces of antiquities were found along the coast. The plateau of

Akaba was ascended by the Wadi Howari, one of numerous short valleys which diversify the southern slope. The plateau presented the appearance of an unbroken plain with only a few flat-topped indications of a previously greater height to break its surface. This district was waterless except for tanks preserving precarious supplies of rain water along the paths. The highest point was found to be Haibel-gabrein, near the southern edge, its elevation being 5300 feet. The plateau was wandered over by a few Bedouins, and on its northern slope considerable numbers of frankincense trees occur, their produce being gathered not by the Bedouins but by Somalis, who come across in the season for that purpose. Where the plateau was trenched by the Hadramut valley the tributary valleys were found remarkably short and steep, cut out of the edge of plateau-like slices from a cake. All these valleys have their floors nearly on the same level as the main valley, and terminate at their heads in steep cliffs 700 or 800 feet high. Their appearance did not seem to justify the theory of water erosion, and Mr. Bent is inclined to consider them as lateral fjords excavated when the Hadramut was an arm of the sea. The rocks were exposed in steep cliffs of horizontally stratified red sandstone. The valley-bottoms are richly cultivated, thronged with villages shaded by palm groves, in effective contrast with the shadeless sterility of the plateau and the desert on either side. In this valley many archaeological finds were made, principally in the shape of Himyaritic monuments and inscriptions dating back, in some instances, to B.C. 300. The people of the part of Arabia visited formed four distinct classes. The wild tribes of Bedouins, scattered irregularly, living in isolated houses or caves, rear camels and do all the carrying work. Next are the Arabs proper, who dwell in towns, cultivate the surrounding lands, and engage in extensive trade, sometimes visiting India and the Straits Settlements. Thirdly, the Sayyids and Sherifs form a sort of aristocratic hierarchy, tracing their descent from the Prophet; they are the religious fanatics who object to the admission of foreigners. The last class is that of the slaves, all of African origin, acting as labourers, personal servants, and soldiers to the Sultans of the many independent tribes into which the other classes of the population are divided.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—In connection with the visit of the Royal Agricultural Society to Cambridge next month, the University will bestow honorary degrees on a number of the high officers of the Society and others who have distinguished themselves in promoting agricultural science. The Duke of Devonshire, Chancellor of the University, is President of the Society, and will probably himself confer the degrees. The list of names submitted to the Senate includes H.R.H. the Duke of York, the Duke of Richmond and Gordon, Lord Cathcart, Sir John Thorold, Sir Dighton Probyn, Sir Nigel Kingscote, Sir John B. Lawes, Sir Joseph H. Gilbert, Mr. A. Peckover, the Lord Lieutenant of Cambridgeshire, and Mr. Albert Pell. The Master and Fellows of Trinity College have issued invitations to a banquet in the College Hall for June 26, at which the Prince of Wales, the Chancellor, and the recipients of honorary degrees, will be entertained.

WE learn from the *Scotsman* that two important draft ordinances were issued on May 14 by the Scottish Universities Commission. One of these deals with the matter of the regulations for the encouragement of special study in research and for the institution of Research Fellowships. The ordinance provides that the Senatus Academicus of each university may make regulations under which graduates of Scottish universities, or of other universities recognised for the purposes of the ordinance, or other persons who have given satisfactory proof of general education and of fitness to engage in some special study or scientific investigation, may be permitted such study or research in the university. The University Court in each university may establish Research Fellowships, which shall be open to research students only, and may set aside out of the General University Fund such sums as it may think fit to provide for stipends of Research Fellowships. The Court may also provide such sums as it may think fit in aid of the expenses of special research. Research students may be admitted to the degrees of Doctor of Science or of Doctor of Letters of the university in

which they have studied as research students, under conditions prescribed in another ordinance of the Commission just issued dealing with the regulations for higher degrees in arts and science. In regard to the degree of Doctor of Science, it is provided that graduates who have taken the degree of Master of Arts with honours in mathematics and natural philosophy, may proceed to the degree of Doctor of Science in the same university after the expiry of five years from the date of their graduation in arts, under the same conditions as if they held the degree of Bachelor of Science. Research students within the meaning of the ordinance relating to the regulations for the encouragement of special study and research may offer themselves for the degree of Doctor of Science of the university in which they have pursued some special study under that ordinance, although they have not taken the degree of Bachelor of Science, or the degree of Master of Arts with honours in mathematics and natural philosophy in that University, under the following conditions:—

(1) That they hold the degree of Bachelor of Science or Bachelor of Medicine of a Scottish or any recognised university, or a degree of any such university, which the Senatus Academicus shall hold to be equivalent to the degree of Bachelor of Science or to the degree of Master of Arts with honours in mathematics and natural philosophy.

(2) That they have spent not less than two winter sessions or an equivalent period as research students in the university granting the degree, and that they produce evidence of satisfactory progress in the special study or research undertaken by them during that period.

(3) That a period of not less than five years shall have elapsed from the date of the graduation required in sub-section (1) of this section.

All candidates for the degree of Doctor of Science have to present a thesis or a published memoir or work, to be approved by the Senatus on the recommendation of the Faculty of Science; provided that, if required by the Senatus, the candidate shall also be bound to pass such an examination as may from time to time be determined. The thesis must be a record of original research undertaken by the candidate, and has to be accompanied by a declaration signed by him that the work has been done and the thesis composed by himself.

It will be noted with regret that no provision is made for the publication of the thesis. This is a serious omission, for scientific work, if worthy of a degree, is surely worthy of publication.

THE name of Dr. D. H. Scott should have been added last week to the list of Oxford men who are among the selected candidates for the Fellowship of the Royal Society.

### SCIENTIFIC SERIALS.

*American Journal of Science*, May.—Observations on the derivation and homologies of some Articulatæ, by James D. Dana. It is probable that all Articulatæ are successional to the Rotifers. There is reason for believing further that the types of Annelids, Crustaceans, and probably that of Limuloids, had their independent Rotifer origin. The line to the lower and earlier Arachnoids, that is to the Scorpions, leads up from the early Pterygotus—like Limuloids. A line of succession from Worms to Myriapods and from these to Insects, although not proved geologically, is suggested by the fact that in low-grade insects there is no proper metamorphosis, while in the higher the larval stage is lower and lower in embryonic level. The larval stage would result from an attendant retrograde embryonic change to a line parallel with the Myriapod, and beyond to the memberless condition of a worm.—Notes on apparatus for the geological laboratory, by J. E. Wolff. This paper contains instructions for making diamond saws, for sawing thin sections of rock specimens, and for the management of the arc light for purposes of projection.—An elementary expression in thermoelectrics, by Carl Barus. Two metals are thermoelectrically identical when the sign and the number of available molecular paths which the current (or better, the elementary charge) is free to take, is the same in both metals.—Gases in Kilauea, by William Libbey. Observations of bluish-green flames bursting out from the lava, made with a pocket spectro-scope, revealed what was probably carbonic oxide and some hydrocarbons, shown by a band in the green, and bands in the red and blue.—Transformations of mechanical into chemical energy,

III. Action of shearing stress continued, by M. Carey Lea. The most instructive experiment was that with mercuric oxide. Half a gram was taken, and after trituration the unchanged oxide was dissolved out by repeated digestions with hydrochloric acid. The reduction products were dissolved out by a few drops of aqua regia, filtered, and precipitated by hydrogen sulphide. The amount of sulphide obtained correspond to the reduction of 0.329 gram of mercuric oxide. The amount of mechanical energy transformed into chemical was found to be 322 gram meters. Silver oxide, potassium ferricyanide, ferric ammonia, alum, silver carbonate and sulphite, and sodium chloroaurate were also successfully reduced by grinding, but not cupric chloride. A porcelain mortar was found much more efficient than one made of agate.

*Bulletin of the New York Mathematical Society*, vol. iii. No. 7, April 1894. (New York: Macmillan.) Prof. H. Maschke, in a thorough analysis of Harkness and Morley's "Theory of Functions"—it occupies pp. 155-167 of the present number—records the opinion that "the great merits of this valuable work will secure it a high rank in modern mathematical literature." Dr. G. A. Miller, in a note on substitution groups of eight letters (pp. 168-9), makes an important addition to Dr. Cole's list in vol. ii. which is suitably acknowledged by him. Prof. J. McMahon writes on the general term in the reversion of series (pp. 170-2). In the notes the Simson-Lines are printed Simpson's lines. Dr. J. S. Mackay's discovery that no such property has been found in R. Simson's published writings, has not yet "caught on." There is a long list of new publications.

*L'Anthropologie*, tome v. No. 2, March-April, 1894.—M. Ed. Piette contributes some notes to be used for the history of primitive art. The bulk of the accumulations found in caves are composed of broken bones of animals eaten by man, and a cursory examination of the débris suffices to show that whilst the remains of Equidæ predominate in the lower strata, those of Cervidæ are more abundant in the upper strata. Hence, the Glyptic period, as M. Piette calls the age in which quaternary man was in the habit of ornamenting bone, horn, ivory, and stone with sculpture or engraving, has two primary divisions—the Equidian age and the Cervidian age. The former of these may be considered to have two subdivisions, namely the elephantine, or ivory epoch, and the epoch of the horse, called by M. Piette the Hippic epoch; two subdivisions are also comprised in the Cervidian age, viz. the epoch of the reindeer and that of the red-deer, or the Rangiferian epoch and the Elaphian epoch.—In a paper on the female deity and the sculptures of the Allée Couverte of Épône, M. Emile Cartailhac describes several blocks and menhirs from various parts of the country on which a female figure is sculptured with more or less detail. On the breast of one of these figures is the representation of an implement or weapon much like the ancient Egyptian boomerang. In a dolmen, excavated by Canon Greenwell at Folkstone, there were found two small cylindrical blocks of limestone, covered with geometrical designs, in the middle of which, in a prominent place, is seen a human face, confined to the forehead, nose and eyes, but, so far, identical with the French sculptures.—M. Maurice Delafosse gives an account of the Hamites of Eastern Africa, in a brief summary of the ethnographical parts of the most recent works that have appeared on the subject. He refers more particularly to the valuable monograph by Dr. Philipp Paulitschke, entitled "Ethnographie Nordost-Afrikas, die materielle Cultur der Danakil, Galla und Somäl" (Berlin, 1893). The Danakil, Somal and Galla peoples, each comprising a large number of tribes, divide the eastern horn of Africa between them. The Danakil dwell along the coast of the Red Sea and to the east of Abyssinia, the Somal occupy the whole of that point of Africa which projects into the Indian Ocean, while the Galla tribes inhabit the country west of the Somal and to the south of the Danakil and Abyssinia. They are all of Hamitic origin, and differ as much from their neighbours, the Berbers and the Semites of the north, as they do from the negroes and the Bantu of the south. Their hair is not frizzly, but only woolly, and sometimes it attains to a considerable length, especially among the women. The nose is not flat; it is frequently broad and short, but it is sometimes even aquiline. The lips are rarely protuberant, though they are almost always thick. M. Salomon Reinach continues his account of sculpture in Europe prior to Greco-Roman influence; and M. E. Vouga discusses the probable age