—a department which should be presided over, if not by a Cabinet Minister, at all events by a member of the Government who can be appealed to in Parliament."

Mr. J. Mansergh, C.E., states that "altitude and geological structure of a district on the two principal factors which determine what the source of water-supply must be in each district." He divides source of supply into (*a*) aboveground, and (*b*) underground. The former he subdivides, into—1. Water taken from heads of streams by pipes, just when it ceases to be underground water, as in the case of Lancaster. 2. Water obtained from natural lakes, as in the case of Glasgow. 3. Water collected from high-lying moorland watershed areas, as at Manchester. 4. Water taken from a large river flowing past a town, as the Thames and Lea, near London. His second class (*b*) he does not subdivide, and includes all waters taken from all classes of stratification; he appears to take twelve degrees of hardness of Dr. Clark's scale as the maximum limit of safety for health, and regards a pure soft supply as preferable to a pure hard supply, using the word "pure" to mean absence from organic impurity. Speaking of towns which are compelled by position, and on the score of expense to be content with a water-supply derived from an adjacent river, he states that such sources "would be inadmissible but for the great rehabilitating process which nature silently carries on in a river, and to which chemists apply the term 'oxidation.'" In this wonderful process the polluting organic matters which the water contains are converted by the agency of oxygen into harmless inorganic salts, and the water again becomes fit for the use of man. He here refers to the burning controversy between the two schools of opinion on this matter, which have at their heads Dr. Frankland and Dr. Meymott Tidy respectively; the former admits that oxidation is effective in converting the most vile contamination into a harmless condition, but does not admit it destroys the organised germs, which he believes cause the virulent zymotic diseases, and which, being indestructible, may travel scores of miles in a running stream without being deprived of their fatal potency. Dr. Tidy, on the other hand, denies the existence of the germs, and affirms, after a run of a few miles, a river is fully oxygenated. Mr. Mansergh observes that, though Dr. Frankland's opponents appear to have the facts in their favour—as London, a city chiefly supplied from a polluted river, being one of the healthiest cities in the world—yet the "germ" theory is making steady advances under the investigations and researches of competent men.

Since the London water companies have come under the official supervision of Sir Francis Bolton, large sums of money have been spent in increasing the efficiency of the subsidence tanks, by greatly augmenting their capacity, in fact, their operations have converted them into storage reservoirs; from these the water is delivered into filter beds, the varieties in the construction of which, adopted by the different companies, are shown in the angle of the very interesting water pavilion erected in the Health Exhibition, under the auspices of Sir Francis Bolton, and which is full of interest to the student of the subject, and is decorated with some very artistic representations of the various waterworks on the banks of the Thames.

Any scheme of new legislation, and construction of a new department to carry out its provisions should, in the opinion of the writer, be made to include underground water supplies, the state of the law at the present time being exceedingly unsatisfactory, and the decisions of parliamentary committees being uncertain and contradictory. The law places underground water in the category of wild and free creatures, that he who can catch can hold, and just as one landowner can shoot a hare on his own property that has been bred on his neighbour's land, so can he take, by sinking a well, the water that has been received on his neighbour's property, notwithstanding his neighbour may be wholly dependent upon it for water supply, and it may have been used from time immemorial, and further than this, on the principle "of doing what you like with your own," he may actually pour poison down his own well, and destroy the value of the water in the well on his neighbour's land without hindrance and without compensation. Two of the essayists at the congress referred to the recent judgment of Justice Pearson confirming this view.

Considering the opinions expressed in the papers read at this congress, and the statements made in the discussion upon them, it appears to be generally believed by those who have made the water question a special study, that the existing complex legislation, sanctioning various and often antagonistic authorities in our water-basin, is productive of the greatestharm to the community, and can only be remedied by the constitution of an hydraulic department with absolute control over streams from their source to their outfall; that such department should at once make systematic arrangements for taking rain-gauge observations, the gauging of the whole of our streams, and the height and seasonal variation of the water stored in the rocks beneath the surface.

C. E. DE RANCE

THE CITY AND GUILDS OF LONDON INSTITUTE

FROM the Report on the Technological Examinations, 1884, we learn that a considerable increase is shown in the number of candidates at the recent examination, May 28, 1884, as compared with that of the previous year. In 1883, 2397 candidates were examined, of whom 1498 passed. In 1884, 3635 were examined, of whom 1829 passed. There is also shown a satisfactory increase in the number of centres at which the examinations have been held.

From the returns received at the office of the Institute in November last, it appears that 5874 persons were receiving instruction, with a view to these examinations, in the registered classes of the Institute. The number of students at the corresponding period of the previous year was 4052, this being 585 in excess of the number in 1882. Of the candidates who received instruction in the registered classes of the Institute, about one-half presented themselves for examination; of the remaining candidates who came up, some had received instruction in colleges the Professors in which do not accept payment on results, whilst others had supplemented their workshop practice by private study.

This year, as last year, Glasgow heads the list of centres from which the largest number of candidates have passed, the number being 139, as compared with 123 in 1883. Of the other centres, Manchester sent up 115 successful candidates, as against 76 in the previous year; Bolton 98, as against 117; Bradford 90, as against 51; Leeds 70, as against 64 (50 coming from the Yorkshire College, as against 43); Preston 59, as against 46.

In carpentry and joinery, which was added this year to the examination programme, 369 candidates were examined, of whom 125 passed. Nottingham sent up this year for the first time 19 candidates in lace manufacture, of whom 13 succeeded in satisfying the examiner.

Examinations were held this year in 43 subjects, as against 37 in 1883, the only subjects included in the programme in which no examinations were held being the Mechanical Preparation of Ores and Salt Manufacture.

Practical examinations were held this year for the first time in weaving and pattern designing, and in metal plate work, and owing to an alteration in the arrangements for the conduct of the Practical Examination in Mine Surveying, the results of the examination in this subject are also included in the accompanying tables.

Of the 23 candidates for honours who, besides undergoing a written examination in pattern designing and weaving, sent up specimens of their work, 13 succeeded in obtaining a certificate. In metal plate work, two candidates presented themselves for honours, but neither succeeded in obtaining the institute's certificate. In all subjects of examination, the honours certificate of the Institute is intended to be regarded as a diploma of proficiency, and is awarded in those cases only, in which the candidate shows a sound theoretical and practical knowledge of the subject.

The percentage of failures on the results of the examinations in all the subjects has increased from 37·5 in 1883 to 49·7 in 1884. This increase in the number of failures is due to many causes, which are referred to in the separate reports of the examiners, prominent among which is the want of skill in drawing, and of previous science teaching on the part of the candidates. In many subjects, too, there is still experienced the serious want of competent teachers, which it is hoped will to some extent be remedied when the Central Institution is in working order.

The large accession to the total number of candidates is due mainly to the increase in the number of candidates in cloth and cotton manufacture, in weaving and in mechanical engineering, and to the addition of the subject of carpentry and joinery to the programme. In 28 subjects there has been an increase in the number of candidates; in nine subjects, chiefly chemicals,

there has been a slight decrease, and in the remaining subjects the number has remained the same.

Table III. shows the proportion of candidates in each subject who have attended classes the teachers of which receive payment on results. By reference to this table it is seen that of the 1829 successful candidates, 1387 were taught in such classes, and of these, 176 have obtained certificates in honours.

Of the 1829 successful candidates, 1362 were examined this year for the first time. Of the remainder, 189, who had previously obtained an ordinary certificate, have this year gained an honours certificate; 98 have gained a higher place in the same grade; 180 have obtained a second class only in the same grade in which they previously passed, or have competed for a prize and failed to obtain it, and their names are consequently not included in the pass list. Last year, the number of candidates who passed the examination, but in the same class and grade as in the previous year, was 128.

A satisfactory feature of this year's examination is the increase, although small, in the proportion of candidates who, having already passed examinations under the Science and Art Department, are qualified to receive the Institute's full technological certificate. Although the returns of the candidates have not yet been verified, it may be assumed that at least 570 of the successful candidates will be entitled to the full certificate. The corresponding number last year was 420, and comparing these numbers with the total number of successful candidates, it will be seen that the percentage of those to whom full certificates will be awarded has increased from 28 per cent. last year to 31·2 per cent. this year.

In several subjects the full complement of prizes has not been awarded, the merits of the candidates not having justified the examiners in awarding them, whilst in other subjects additional prizes have been given. We see that 156 prizes have been granted, including 137 money prizes, 44 silver medals, and 112 bronze medals. Last year 143 prizes were granted, including 129 money prizes, 48 silver medals, and 95 bronze medals.

Looking at the general results of the examination, the large increase in the number of students under instruction and of the candidates who presented themselves for examination, may be considered satisfactory, as indicating the more general desire of artizans and of those engaged in manufacturing industry to take advantage of the opportunities now offered to them of receiving technical instruction. At the same time, the large proportion of failures consequent upon the accession of candidates, the majority of whom are already familiar with the practice of their trades, but possess a very imperfect knowledge of the application thereto of the principles of science, shows the need that still exists of improved and of more systematic technical instruction for those who are employed in factories and workshops.

Although the Royal Commissioners on Technical Instruction, the Report states, have spoken encouragingly of the facilities now offered to artizans of obtaining in evening classes good scientific and technical teaching, it would appear that the number of persons engaged in manufacturing industry, who avail themselves of the Science and Art Classes under the Department, is still comparatively small, and that the proportion of children who learn drawing in the public elementary schools is, as yet, inconsiderable. These causes doubtless prevent our artizans from deriving the full advantage of the Technical Classes now organised in different parts of the kingdom.

In considering the foregoing results, the inadequate supply of competent teachers in technology must also be taken into account.

SCIENTIFIC SERIALS

American Journal of Science, July.—Contributions to meteorology, twentieth paper: reduction of barometric observations to sea-level, by Prof. Elias Loomis. The results embodied in this paper have been determined by an extensive comparison of observations at five mountain stations, three in the United States and two in Europe. The reductions thus obtained were compared with those computed from the theories of Laplace and Plantamour, and exhibited very great discrepancies for all the stations, especially at the lowest pressures. The cause of these discrepancies is referred to the pressure coefficient in the Laplace formula, which appears to be too small.—Light of comparison stars for Vesta, by Edward C. Pickering. The light of the planet is here determined from comparison with the two stars $D M_1 + 22^\circ$ 2163 and 2164, observed with the large meridian photometer of the Harvard College Observatory. The mean result thus obtained for the magnitude of Vesta is 6·64, as compared with 6·49 and 6·45 of previous observations at the same Observatory.—Mineral notes from the laboratory of the United States' Geological Survey, by F. W. Clarke and T. M. Chatard. The paper embodies a complete analysis of the jade or nephrite and pectolite implements in use amongst the Eskimo of Point Barrow, Alaska, and obtained from a region to the east, not yet visited by civilised man. Analyses are also given of Saussurite from Shasta County, California; of Allanite from Topsham, Maine; of Damourite from Stoneham, Maine; of Margarite from Gainesville, Georgia; of Halloysite from near Lake Mono, California; and several other rare minerals.—On the occurrence of alkalies in beryl, by Samuel L. Penfield. The results of numerous investigations show that alkalies are always present, undoubtedly replacing the beryllium, that water is also present, and cannot be disintegrated in the formula, and that the formula

$$Al_4Be_5H_2Si_{11}O_{34}$$

is the one best agreeing with the analyses.—The Niagara River and the Glacial Period, with map, by Prof. G. F. Wright. The author infers that the Niagara River itself has worn the whole of the Gorge, from Queenston to the falls, with perhaps some little help from pre-Glacial erosion above the whirlpool. The rate of erosion, calculated at about 3 feet a year, would make the time required not over 10,000 or 12,000 years.—Note on the discovery of primordial fossils in the town of Stuyvesant, Columbia County, New York, by S. W. Ford. The fossils obtained from the stratified rocks of this region show that they belong to the Lower Potsdam formations. Amongst the species obtained were *Palæophycus incipiens*, *Obolella crassa*, *Stenotheca rugosa*, *Hyolithes Americanus*, *H. impar*, *Hyolithellus micans*.—Notes on some apparently undescribed forms of freshwater infusoria (ten illustrations), by Dr. Alfred C. Stokes. The species named and described are: *Loxodes vorax*, *Apgaria undulans*, *A. ovata*, *A. elongata*, *Ileonema dispar*, *Solenatus apocamptus*, *S. orbicularis*.—On the causes of variation of species, by Romyn Hitchcock. The author combats Dr. Carpenter's view, published in the Reports of the *Challenger* Expedition, that variation in the orbolites group is the expression of a not understood "progressive tendency along a definite line towards a higher specialised type of structure in the calcareous fabric." He contends that the highly complex form of shell developed by this simple sarcode organism is not due to any inherent tendency towards a definite plan, but to change of environment and other easily understood causes.—Remarks on the crustacea of the *Albatross* dredgings off Cape Hateras, and thence to the region of George's Banks in the year 1883, by Sidney J. Smith. The whole number of species of Decapoda determined from these dredgings was 72, of which 40 were taken below 500 fathoms, 29 below 1000, 13 below 2000, and 6 at a single haul in 2949 fathoms. Striking characteristics of the deep-sea specimens are their red or reddish colour and distinctly faceted eyes in the normal position, showing conclusively against the arguments of physicists that some rays of light must penetrate to depths of over 2000 fathoms.—Crystallised gold in prismatic forms, by Wm. P. Blake.—Mode of action of shell- and rock-boring molluscs, by Prof. F. H. Storer. The author argues that it is not a drilling or other mechanical action, but a distinctly chemical process, the solvent being probably free muriatic acid.—Memorials of the late George Engelmann and Oswald Heer, Associate Fellows of the American Academy, Botanical Section, by Asa Gray.

Journal of the Chemical and Physical Society, vol. xvi. fasc. 4.—On the action of aldehydes on zinc-organic compounds, and the formation of secondary alcohols, by G. Wagner. Aldehydes of the fatty and aromatic series give, with zinc-ethyl, alcoholates of secondary alcohols, these last being the exclusive, or nearly exclusive, produce of the reaction, which circumstance gives an easy means for preparing secondary alcohols; the speeds of the the reactions are, however, very different. On the influence of temperature on the acceleration of certain reactions, a preliminary communication by M. Menschutkin.—Quantitative determination of zinc in zinc-powder, by Th. Beilstein and G. Javein.—On anhydride of erythrite, by S. Prybitek.—On canarine, a new tinctorial substance discovered by O. Müller, by W. Markovnikoff. It is not soluble in water, spirit, ether, and benzene, but only in bases, according to the strength of which it gives different colours from pale yellow to red.—On anhydrides of