

processes, though it is applied only to that of Lorentz) "die ganze Rechnung doch nur bis auf Grössen der ersten Ordnung (wie b/v) genau ist" throws very grave doubt on the whole investigation. For in the most interesting part of the critical isothermal of CO_2 , the fraction b/v cannot be looked upon as a small quantity of the first order. In fact, without raising the question, either of Van der Waals's mode of interpreting the term $\frac{1}{2}\Sigma(mV^2)$ or of the paucity of constants in his equation, the above consideration would of itself render the results untrustworthy. Van der Waals has most opportunely and effectively called attention to an exceedingly promising mode of attacking a very difficult problem, and his methods are both ingenious and suggestive; but I do not think that his results can be regarded, even from the most favourable point of view, as more than "Guesses at Truth."

For, if we take the experimental test, there can be no doubt that (as I have stated in § 65 of my paper) "Van der Waals's curves cannot be made to coincide with those of Andrews." And I think I have given reasons for believing that "the term of Van der Waals's equation, which he took to represent Laplace's K , is not the statical pressure due to molecular forces but (approximately) its excess over the repulsion due to the speed of the particles." Of course I mean by this that, when Van der Waals, comparing his equation with experiment, assigns a numerical value to his term a/v^2 , he is not justified in regarding it as the value of Laplace's K ; though that quantity was, he tells us, the main object of his inquiry.

Believe me yours very truly,

P. G. TAIT.

St. Andrews, September 28.

THE EXISTING SCHOOLS OF SCIENCE AND ART.

AT a meeting of influential science and art teachers held at the Charterhouse School of Science and Art, Goswell Road, on the 3rd instant, the position of existing schools, with regard to the fierce opposition offered by highly-endowed Polytechnics, was calmly and broadly discussed.

For many years, under the system not only recognized but encouraged by the Science and Art Department, schools have been established in London and the provinces. The aid afforded by the Department has mainly been (1) to contribute largely to the building fund of schools intended for the exclusive teaching of science and art subjects, and (2) to remunerate by Government grant the services of the teachers engaged. The regulations of the Department provide that such aid is given to any centre where the need of it is apparent. It is, however, perfectly well known that the teacher, in the majority of cases, was the person upon whom the duty fell to organize the classes and set the ball rolling, and it would be difficult to mention any school or institute in which the motive spirit was not a teacher.

By recent Acts of Parliament a great impetus has been given to that side of science and art instruction known as technical education. Funds which in past times could only have been raised by persistent begging are now forthcoming almost as a matter of routine. In the provinces there is every sign that the authorities having the administration of the grant of public moneys intend to recognize existing schools. In London it is not so. Schemes for the erection of new buildings are pushed forward without due regard to those institutions already doing a good work. At the meeting of teachers already referred to several instances were cited. The People's Palace, erected almost in the very shadow of the Bow and Bromley Institute, has, by reason of its endowment, greatly hampered and harassed the older institution.

NO. 1145, VOL. 44]

The West London School of Art succumbed two years ago to the attack of the Regent Street Polytechnic; and now the St. Martin's School of Art, one of the best known centres of instruction in the metropolis, has closed its doors. Without endowment it could not compete with its more favoured rivals. The closing of this school is the more to be regretted because of the high tone of the work carried on within its walls.

Unfortunately, it cannot be denied that many so-called schools of science and art are simply carried on as "grant-earning" establishments, and the country would lose little or nothing if they were closed at once. But there are others affording excellent science and art instruction; and though these may not be affected by the present Polytechnics, it is evident that the schemes yet in embryo for the erection of other buildings will, if not properly checked, raise an undignified competition with the older schools. It is therefore a matter of great public importance that the established institutions should not be overlooked by the London County Council. If new buildings are deemed to be necessary, the old school of science and art should be treated as the nucleus of the enlarged scheme.

Two points of error seem to be apparent in the plan of campaign of the supporters of Polytechnics—(1) that educational work must be associated with recreation; and (2) that technical education has a very limited area, and that science and art education in its fullest sense is unnecessary.

"Schools of art," said a gentleman to me recently, "are dead." Surely nothing could be more absurd. As I understand technical education, it is the application of general principles to a specific purpose. Schools of science and art—*i.e.* schools for the study of science as science, and art as art—should be encouraged as much as before. This can be done without interfering with the specific application of such study to a particular purpose.

With regard to the question of recreation, I think it would be found that, although those institutes which make much of athleticism and such matters attract the largest proportion of students, the attendance *pro rata* in the classrooms, and the results obtained there, would not favourably compare with an institute carrying out a purely educational programme. At the meeting referred to, one teacher stated that, although at a Polytechnic with which he had been connected only seven students entered the class, scores of young men could be found in the billiard-room and gymnasium. At the Science and Art Institute, Wolverton, one of the best and most practical schools in the country, it was decided to close the billiard-room in consequence of the serious effect it had upon the attendance of students at the classes. I am personally acquainted with the science and art work carried on at the Regent Street Polytechnic. Excellent as it is, it would be still better if it could be relieved of the recreative element.

The London County Council has shelved for a time the appropriation of the funds provided by the Excise Act, 1890, for the promotion of technical education. But the matter must soon come up again. Healthy competition is excellent, but in this matter it is clearly not to the interest of the public that its money should be used for pushing on a new venture as a competitor to, and in antagonism with, an existing institution. The best butcher's shop in London would stand a poor chance if a rival establishment run with money raised by taxation, and not of necessity expected to pay its way, opened its doors on the opposite side of the road; and this is practically the state of affairs. The teachers, moreover, have a perfect right to be heard on this question. Devoting their best years to the training necessary for science and art teaching, it may be urged that they have a moral, if not a legal, claim to be considered.

In concluding, I would point out that the exponents of technical instruction are too keen on "centralization."

Let us have large buildings with costly apparatus and every convenience, but do not entirely crush the small schools. To the working man with limited time and means, weary with his day's toil, a modest school close at hand is of greater service than a huge building six miles away involving railway fare and loss of time. By careful arrangements such smaller schools can be preserved, and largely used as "feeders" for the institutes of magnitude.

The whole matter, therefore, of science and art schools and future Polytechnics should be referred to duly qualified men. There is no reason why existing machinery should not fit in with the new plan to make an harmonious whole.

OLIVER S. DAWSON.

NOTES.

THE autumn meeting of the Iron and Steel Institute was opened at the Royal Arsenal, Woolwich, on Tuesday, the greater part of the day being devoted to an examination of the various departments of the Arsenal. On Wednesday papers were discussed, and to-day visits are to be made to the Naval Exhibition, the Enfield Small Arms Factory, and the Thames Iron Works. We hope to print next week an account of the proceedings.

AN exhibition of cone-bearing trees and shrubs, asters, and sunflowers, and a conference upon them, were opened in the Royal Horticultural Society's Gardens, Chiswick, on Tuesday. Large numbers of conifers were sent from various parts of the country, no fewer than 30 collections coming from Scotland. The first prize was awarded to the Dowager Marchioness of Huntly for her collection of conifers, the second to Lord Wimborne. The largest araucarian cones were sent from Lady Fortescue's, at Dropmore, Maidenhead, where there is an araucaria 68 feet high—the tallest male araucaria in this country. Kew Gardens contributed about 200 different conifers. On Tuesday papers were read on asters and sunflowers. The conference on conifers began on Wednesday, and is being continued to-day.

A COMMISSION of engineers representing the various European Powers is to meet shortly at Cairo to consider the question of a storage reservoir, and to advise the Egyptian Government on the subject. The Commission will be required to select a site to the north of Wady Halfa, or within the present limits of Egypt.

THE organizers of the International Folk Lore Congress are to be congratulated on the success of their undertaking. The attendance was good; many excellent papers were read; and there were animated and suggestive discussions on most of the problems which are now of especial interest to students of folklore. Mr. Andrew Lang, as President, delivered the opening address, in which he presented a most interesting statement of what he conceives to be the fundamental principles of the science. Admirable addresses were also delivered by Mr. Sidney Hartland, Prof. Rhys, and Sir Frederick Pollock, who presided respectively over the Sections devoted to folk-tales, mythology, and institutions and customs. The members of the Congress dined together at the Criterion Restaurant on Tuesday evening.

STUDENTS of psychology and philosophy will read with regret Prof. Croom Robertson's "valedictory" words in *Mind*, from the editorship of which the state of his health makes it necessary for him to retire. For sixteen years he has done his work as editor with conspicuous ability and success. A second series of the Review will be begun next quarter. It will be under a co-operative direction which promises, Prof. Croom Robertson thinks, "a far more effective covering of the ground of psychology and philosophy than has hitherto been attained."

NO. 1145, VOL. 44]

THE seventh of the series of One Man Photographic Exhibitions is now being held at the Camera Club. It is open to visitors from 10 a.m. to 4 p.m. on presentation of cards, which can be obtained from members or from the Hon. Secretary. The exhibition consists of photographs by Mr. Ralph W. Robinson.

WE learn from the *Botanical Gazette* that Mr. O. F. Cook, Instructor in Biology at the University of Syracuse, U.S.A., intends starting about November 1 in charge of an expedition to Liberia and other parts of Africa, with the object of studying the natural history of the country, especially the plants and insects. Mr. Cook will be glad to hear from anyone who would like to have material from that region.

YESTERDAY evening a meeting of the Medical Society, University College, London, was held in the Botanical Theatre, University College. Dr. W. H. Gaskell, F.R.S., delivered an address on a new theory of the origin of Vertebrates, deduced from the study of vertebrate anatomy and physiology.

THE Belgian Minister of Public Instruction offers a prize of 25,000 francs for the best memoir on the meteorological, hydrological, and geological conditions of the countries of equatorial Africa, regarded from the sanitary point of view. The subject must be studied with special reference to the welfare of Europeans resident in the Congo State.

IN the Proceedings of the Academy of Natural Sciences of Philadelphia for 1891, some parts of which have just reached us, there is an excellent memoir of the late Dr. Joseph Leidy, by Dr. Henry C. Chapman. It is followed by a list of Dr. Leidy's numerous writings.

IN a valuable paper on the "Rapakiwi," J. J. Sederholm, of the Geological Survey of Finland, has furnished petrographers with a trustworthy description of the mode of occurrence and minute structure of a granitic rock which has excited much interest, but has hitherto been very imperfectly understood. The official maps of the district where the Rapakiwi is found, with the accompanying memoirs, were published about a year ago; and the last number of Tschermak's *Mineralogischen und Petrographischen Mittheilungen*, now edited by Dr. F. Becke contains a full discussion of the petrological peculiarities of the rock. Writing from the famous laboratory of Heidelberg, Herr Sederholm naturally adopts the nomenclature of Prof. Rosenbusch, and it would appear from his description that the Rapakiwi will have to take its place among the numerous types of "granophyre" (using this term as Rosenbusch does, and not as originally defined by Vogelsang) which constitute links between the plutonic granites and the volcanic rhyolites. The excellent photographic illustrations accompanying the memoir give an admirable idea of the peculiar nodular structure of the rock, which has attracted so much attention to it. In the same journal, we find a second memoir by Herr Sederholm, on the Archæan rocks of South-West Finland, describing a varied series of igneous rocks, and discussing the effect of dynamo-metamorphic action upon them. The general conclusions of the author agree with those to which the study of similar rocks in other districts has led Lossen, Roland, Irving, Lehmann, Williams, Reusch, and Teall.

EXCELLENT arrangements have been made for the establishment of a good system of technical instruction in Essex. An organizing joint committee of the County Council and the Essex Field Club was lately appointed to deal with the question, and funds were placed at its disposal. This body has now issued a preliminary schedule of subjects to be taught. Local technical instruction committees are invited to select from the list one or more subjects which they may deem specially suitable for their respective neighbourhoods. When several such bodies, representing adjacent districts, have chosen a particular subject, the