

The Influence of Water in Physical Change.

PROF. H. E. ARMSTRONG has long insisted on the view that chemical action is a species of reversed electrolysis and that an electrolyte, generally water in terrestrial systems, is a *sine qua non* for chemical action. Whether we should regard modifications in the 'molecular' weights of a liquid, alteration in the 'constants' of the Van der Waal's equation of state for a vapour or gas, change in the surface tension or vapour pressure of a liquid, all due to association or dissociation, as caused by the operation of physical or chemical change, might be debated by the purist.

At least three different types of union can readily be recognised; such as the cluster of polar molecules round charged ions, the association of molecules which are either dipolar or possess poles of a higher order, and thirdly, the definite electrovalent bond in which one or more electrons have been definitely transferred from the orbit of one atom to another; chemical union is certainly not restricted to the third class. In the second there appear to be all gradations in strength of union between polar molecules with increasing mutual distortion of the valence electron orbits and consequent alteration in the electric moments of the molecules. The enormous chemical reactivity of charged ions as well as the influence of water on chemical reactions indicates that water may function not only as an electrolyte but also in virtue of the fact that it consists of molecules of high electric moment; the latter may promote, as observed by Sir J. J. Thomson, the formation of clusters or addition compounds in reaction, and also render more polar, and in consequence more reactive, the molecules clustered in the primary addition compound.

Similar conclusions as to the necessity of stages in compound formation may be drawn from a consideration of the phenomenon of adsorption as well as the energies of 'catalysed' and non-catalysed reactions. It is clear that such compound formation included in the term 'association' is not necessarily an electrolytic process as generally understood, for in at any rate simple systems it is no more than the clustering of polar molecules around an ion, and, in somewhat more complicated cases, the effect of mutual attraction of molecules possessing definite electric moments being either dipolar or polar of a higher order. Such considerations involve inclusion of both mutual and interaction of ions and of polar molecules each possessing finite electric moments, as well as of reactions

involving two electrodes and an electrolyte, in our system of chemical reaction mechanism.

The delivery and publication of the presidential address to the Chemical Society on Mar. 24, by Prof. H. B. Baker, represents this further stage in the experimental development of the idea associated with the action of water in chemical change ("Experiments on Molecular Association," *Jour. Chem. Soc.* (April), 949; 1927). Since the president was one of the first to investigate experimentally the functions of water in chemical change in gas reactions, so it is only to be anticipated that he would be the first to investigate its functions in physico-chemical changes involved in molecular association.

Prof. Baker has shown that all the liquids which he has examined may be regarded as analogous to an associable gas such as nitrogen dioxide, association increasing with decrease in temperature. The position of equilibrium in liquids is thus influenced by alteration in temperature, and the rate of attainment of the new equilibrium is greatly affected by the presence of catalysts, of which water is one of the most important. The necessity for some type of catalyst is clear when the thermal energies involved are considered. Thus the mean thermal energy at 0° C. of a molecule is some 0.035 volt, the process of disintegration of a binary complex of two hydrogen molecules requires only some 0.01 volt, but for vaporisation of liquids such as liquid bromine, benzene, or water, energies equivalent to 0.3 to 0.5 volt are required. Hydrogen complexes evidently would be rapidly broken up by thermal agitation alone at ordinary temperatures, but the destruction of complexes in these liquids, although possible by thermal agitation, will evidently proceed at a slow rate in the absence of a catalyst necessarily polar in character.

The existence of such complexes in solution and the gradual transformation of one type into another has been amply demonstrated by Prof. Baker in numerous experiments which have been considerably extended in this address. He has shown, *inter alia*, by vapour pressure and surface tension measurements, that the rate of attainment of equilibrium is affected not only by water but also by solid catalysts such as charcoal, platinum black, and thoria. If these catalysts were actually as dry as the liquids employed, we note again further evidence in the process of adsorption for the operation of forces causing reaction in the absence of water.

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Archæology in Greece.¹

IF this issue of the "Annual of the British School at Athens" bears its name by covering two yearly sessions, it is nevertheless true to its pre-War tradition both in the interest of its contents and the dignity of its appearance. First in importance must be placed the report of the excavations of two seasons, 1924 and 1925, at Sparta. In both years the main work was concentrated on the site of the theatre, where considerable portions of the stage and orchestra have been cleared and trials made in the *cavea*. This section of the work is described by the Director of the School, Mr. A. M. Woodward: the most interesting part of his description is that which deals with the *scenae frons* and the difficult problems connected with it. He shows that the *cavea* is a Roman construction, probably of Augustan age, doubtless on the site of an earlier and much smaller theatre. The evidence for

the date of the stage-buildings is less clear, for remains of several periods exist, the earliest of which may possibly be earlier than Augustus. The inscriptions from this site, fully published here by Mr. Woodward, are both long and important, for the marble facing-blocks of the east *parodos*-wall of the theatre at its west end literally formed a single inscribed monument.

The other portion of the site attacked was the Acropolis, more particularly the area between the Hieron of Athena Chalkioikos and the retaining wall of the *cavea* of the theatre. Here a mixed deposit of various dates was cleared which yielded some of the best finds made during the excavations. The most important are the remains of a marble statue, slightly larger than life size, of a bearded warrior wearing a helmet with cheek-pieces decorated each with a ram's head. The arms are lost, but otherwise the statue is complete to the waist. The section in which Mr. Woodward dates this statue to about 480-470 B.C. and seeks to demonstrate that the subject is no other

¹ "The Annual of the British School at Athens," No. 26; Sessions 1923-24, 1924-25. Pp. viii+392+22 plates. (London: Macmillan and Co., Ltd.; n.d.) 63s. net.

than the hero of Thermopylae, is among the most interesting in the volume.

Messrs. Casson and Heurtley write on the excavations which the British School has for several years past been conducting in the mounds of Macedonia. The former describes a burial mound at Chauchitsa with numerous interments of the iron age, beginning about 1150-1100 B.C., and the latter classifies and describes pottery picked up on mounds in western Macedonia and west Chalcidice.

It is a far cry from these prehistoric finds to the Finlay Library, some of the contents of which are described by William Miller in an article which is very attractive reading. The other contents of the volume well indicate how wide is the range of the School's activities and those of its students, past and present. Mr. Lawrence writes on Hellenistic sculpture from Rhodes, and Miss Lamb on stamped pithos fragments in the collection of the School, mostly from Melos. Mr. Tillyard discusses the difficult problem of the signature or *Martyria* in the Byzantine modes and its relation to the cadence; Mr. Seltman deals with the early cult of Eros in Athens and its representation in art, and Mr. Tod makes an invaluable contribution to Laconian epigraphy by giving a list (with references) of inscriptions omitted from the Corpus, or published since its appearance, and by supplementing its bibliographies.

University and Educational Intelligence.

BIRMINGHAM.—The degree of D.Sc. in chemistry has been awarded to the following: John Alfred Valentine Butler for numerous papers on "Studies in Heterogeneous Equilibria"; and Harold Archibald Scarborough, for papers on "Saponification and Properties of Mixed Solvents."

LONDON.—Sir William Beveridge has been re-elected vice-chancellor for the year 1927-28.

The title of emeritus professor of anatomy in the University has been conferred on Prof. Edward Barclay-Smith as from the end of the session 1926-27, when he retires from the University chair of anatomy tenable at King's College.

The following doctorates have been conferred: D.Sc. in Chemistry on Mr. F. H. McDowall (University College), for a thesis entitled "Constituents of *Myoporum laetum* Forst (The 'Ngaio')"; Mr. I. R. McHaffie (University College), for a thesis entitled "The Effect of the Presence of an Indifferent Gas on the Concentration and Activity of a Vapour in Equilibrium with a condensed Phase or System of Condensed Phases"; Mr. S. O. Rawling (University College), for a thesis entitled "The Sensitivity of Photographic Emulsions"; and Mr. F. Tattersfield (Rothamsted Experimental Station), for a thesis entitled "The Relationship between the Chemical Constitution of Organic Compounds and their Toxicity to Insects"; D.Sc. in Geology on Mr. S. W. Wooldrige (King's College), for a thesis entitled "Contributions to the Study of the Structure, Stratigraphy, and Geo-morphology of the London Basin"; D.Sc. (Engineering), on Mr. Bernard Hague (Imperial College—City and Guilds College), for a thesis entitled "Studies in the Theory of the Magnetic Field in Dynamo-Electric Machinery"; D.Sc. in Physics on Mr. J. W. T. Walsh, for a thesis entitled "The Theory of Luminescence in Radioactive Luminous Compound," and other papers.

A University postgraduate travelling studentship has been awarded to Dr. R. Purcell (Imperial College Science and Technology—Royal College of Science), who proposes to carry on chemical research at the

University of Amsterdam under Prof. A. Smits, and to visit German universities.

The purchase for the sum of £525,000 of the Bloomsbury site by the University from the Duke of Bedford has been completed. The site, including roads, comprises about 11½ acres, bounded by Montague Place, Malet Street, Gordon Square, Woburn Square, Upper Montague Street, and Russell Square. £400,000 has been provided by the donation from the Rockefeller Foundation and £125,000 is derived from a Special Government Grant in respect of improved accommodation for the University.

~~DURING~~ the celebrations at Louvain on June 28 and 29 to commemorate the five hundredth anniversary of the foundation of the University, the honorary degree of D.Sc. was conferred on Prof. E. G. Coker, professor of civil and mechanical engineering, University of London, University College.

~~A VACATION~~ course for open-air work in geography, regional survey, geology, botany, and sketching will be held in Snowdonia on Aug. 19-Sept. 2. The centre will be Llanberis, and excursions to selected parts of Snowdonia will provide training in all branches of open-air work. Further particulars may be obtained by sending a stamped addressed envelope to Mr. Valentine Davis, Cheshire County Training College, Crewe.

~~THE~~ Royal Commissioners for the Exhibition of 1851 have made the following appointments to Senior Studentships for 1927, the recommending bodies being indicated in brackets after the names: Mr. R. C. Blackie (University of Liverpool), for research in geology; Miss P. A. Hicks (University College of South Wales and Monmouthshire), for research in botany; Mr. R. Hill, for research in bio-chemistry, Mr. D. C. Rose, for research in physics, and Mr. L. H. Thomas, for research in theoretical physics (University of Cambridge); Dr. E. J. Williams (University College of Swansea and the Victoria University of Manchester), for research in physics.

~~POST-WAR~~ depreciation in the value of available funds has been keenly felt by those responsible for important libraries. The initial cost of books has largely increased, and the cost of binding has been more than doubled. Such expenditure, essential if the institution is to be up-to-date, presents therefore a difficult problem; and in a library such as that of University College, London (which ranks in point of size third among the libraries of London and fifth among the university libraries of the Empire), the problem takes on a very serious aspect. Already the University Grants Committee has indicated the inadequacy of present library provision (see also NATURE, May 21, p. 733). So insufficient are the available funds at University College that a capital fund of £24,000 is being sought. Without it the usefulness of the library will be seriously impaired, not only by lack of means for purchase and binding, but also because of the difficulty of printing subject catalogues and other aids which are almost indispensable to the scholar. It is to be noted, too, that £7000 was recently expended on structural alterations to the Science Library, which is also absorbing part of a special grant of £10,000 for its completion. While the libraries are arranged primarily to meet the needs of staff and students, it should not be forgotten that they are available for all genuine students who make application, and that members of the British Association and of the Geologists' Association, whose libraries form part of the Science Library, have the right to use that Library. All interested are invited to co-operate in providing the required sum of £24,000.