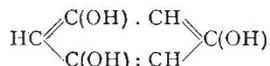
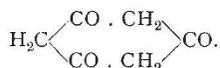


in a variety of ways corresponding to the allocation of one particular sodium atom to either of six chlorine atoms; the alternative modes of partitioning lead to the production of molecular units of identical configuration. In many cases, however, alternative methods of geometrically partitioning the assemblage representing the crystalline structure do not yield units of the same configuration; thus, the assemblage representing phloroglucinol can be geometrically partitioned in two distinct ways. Each of these gives a unit of the composition  $C_6H_6O_3$ , but the configuration of the unit of the one partitioning corresponds to the chemical structure of the 1:3:5-trihydroxybenzene,



whilst the other exhibits the structure of the symmetrical triketohexamethylene,



A new suggestion is thus made to the effect that tautomerism consists in the possibility of geometrically partitioning the close-packed assemblage in two or more alternative ways, each giving molecular units of the same composition but of different constitutions. The idea that in the occurrence of tautomerism some component atom wanders from one position to another in the molecule is thus rejected; the change in constitution arises from the transference of atoms as between two or more molecules. As the older conceptions of the mechanism of tautomerism do not provide a satisfactory explanation of the experimental facts, the suggestion now made is perhaps worthy of consideration.

The new line of work has many bearings upon the subject of chemical change; thus, the assemblage which is assigned to acetylene (or methylacetylene) is convertible, by symmetrical distortion, into that representing benzene (or the 1:3:5-trimethylbenzene, mesitylene. Further, the great change in chemical behaviour which accompanies many types of chemical substitution is possibly connected with the manner in which the actual atomic volumes are affected by the replacement; on converting benzene, in which the atomic volumes of carbon and hydrogen are as 4:1, into bromobenzene, a considerable increase in molecular volume occurs. The atomic volumes of carbon and hydrogen still, presumably, preserve the 4:1 ratio, and the volume appropriated by the entering bromine atom is approximately the same as that occupied by each hydrogen atom already present; the actual atomic volumes of carbon and hydrogen must thus be supposed to have increased during the production of bromobenzene. It can hardly be supposed that this fundamental volume change, even apart from a distortion of the aromatic ring arising from slight inequality of hydrogen and bromine atomic domains in the molecule, could occur without the exhibition of considerable differences in chemical properties as between benzene and bromobenzene.

Whatever view may be taken as to the accuracy of the conclusions concerning the relation between crystal structure and chemical constitution which are briefly discussed in the present address, no critic will be disposed to doubt that wide developments in chemical science will result from the cultivation of crystal study: it seems clear that any satisfactory theory of the solid state must be largely crystallographic in character. The chief hindrance to progress at present consists

in the lack of chemists trained in modern crystallographic methods; in my own country the only school in which chemical students were trained in crystallography, dissociated from mineralogy, was founded by Dr. Henry E. Armstrong and Sir Henry A. Miers in 1886. After doing a vast amount of valuable educational work this school has recently been allowed to become extinct.

In a presidential address to the Mineralogical Society in 1888, Mr. Lazarus Fletcher remarked that "a knowledge of the elements of crystallography, including the mechanics of crystal measurements, ought to be made a *sine qua non* for a degree in chemistry at every university." Twenty-five years later we find that no European university has applied this principle, and in consequence the chemical crystallographer has the greatest difficulty in making himself intelligible to his purely chemical colleagues. May I, in concluding, express the hope that the colonial universities, less fettered by tradition than their older sisters, may lead in the work of placing the subject of crystal structure in its legitimate position as one of the most important branches of modern physical chemistry?

#### UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

GLASGOW.—The Principal wishes it to be known that the University will do what it can to safeguard the academic interests of undergraduates on military duty. In relation to attendance on courses of instruction, to duration of study, to periods of notice required, etc., account will be taken of a student's absence on military duty to ensure, if possible, that his graduation shall not be unduly delayed.

THE authorities of the Royal Agricultural College, Cirencester, wish it to be known that every endeavour will be made to prevent students who are undertaking army or other patriotic work from being thereby penalised as regards their courses of study.

THE Vice-Chancellor of the University of Liverpool states that although the Council and Senate have not met since the declaration of war, it may be assumed (1) that the University courses will begin on the appointed day; (2) that in due time everything will be done that can be done to safeguard the interests of members of the staff and of students who have offered themselves for national service at home or abroad. It is also announced that at Durham University the term will begin as usual in October, and that no member of the Durham Colleges will suffer any academic disability by reason of absence on any form of national service.

THE fifty-fifth annual report of the Cooper Union for the Advancement of Science and Art has been received from New York. The union governs and finances many departments of higher education, and in the report its director gives full particulars of the work done during the year ending June, 1914, and directs special attention to the development of the technical school. We notice the resignation of Prof. Robert Spice, after twenty-five years' service in Cooper Union as professor of chemistry and head of the department of chemistry. Since 1900 Prof. Spice has devoted the whole of his time to the Cooper Union; beginning with some twenty students the attendance has steadily increased until now the limits of the capacity of his department have been reached.

THE Vice-Chancellor of the University of Wales has written to the Press to say that he is prepared to undertake that the University will arrange that, in the case of students who entered the University in 1911, the coming session shall not be reckoned as the last of the four years beyond which honours in the B.A. or B.Sc. degree cannot be obtained, so that they may complete honours schemes in the session 1915-16 under the same conditions under which they would have completed them in the coming session. He says it will be understood that, as pursuance of qualifying courses is essential for initial degrees, a year of absence cannot be reckoned as a year of the qualifying period; but, subject to this proviso, he has no doubt that the University will be anxious to consider cases of disability arising, other than the one above provided for, with the view of making special arrangements for their relief.

THE former circular on geometry, issued five years ago by the Board of Education, has exercised a marked and unquestionably beneficial influence on elementary education. We do not know of any geometrical text-book, published since that date, which has not taken account of it, and we have frequently directed attention to it in these columns. That circular is now out of print, and the Board has, therefore, drawn up the present memorandum (*Memorandum on the Teaching of Geometry in Secondary Schools*) which covers the same ground, slightly more elaborately. Now that it is generally recognised that Euclid's postulates are far from being exhaustive, and that any philosophically complete set involves abstract considerations, wholly unsuitable for immature minds, there seems to be a growing consensus of opinion in favour of widening the basis of deduction, and including in it such spatial ideas as the ordinary boy (when he appreciates the significance of the statements made) regards as obvious. A proof which is not the cause of intellectual conviction, if only because belief exists independently, stands *ipso facto* condemned. The basis which has been suggested includes the fundamental properties of angles at a point, parallelism, and congruence. This provides a perfectly intelligible system of postulates and requires nothing which will present any difficulty to a boy who is capable of geometrical work of any kind, if the facts are presented to him in a satisfactory manner; and it enables him to proceed to apply deductive methods to the establishing of properties of which he realises the need of proof, thus arousing in him that interest which springs from a recognition of the utility of his work.

#### BOOKS RECEIVED.

The Vaccination Question in the Light of Modern Experience. By Dr. C. K. Millard. Pp. xvi+244+ 10 plates. (London: H. K. Lewis.) 6s. net.

Suggestions for a Course in Climatology in Correlation with Geography. By W. E. Whitehouse. Pp. 31. (Aberystwyth: University College.) 1s.

Report on Scottish Ornithology in 1913, including Migration. By E. V. Baxter and L. J. Rintoul. Pp. 96. (Edinburgh: Oliver and Boyd.) 1s. 6d. net.

General Report on the Operations of the Survey of India during the Survey Year 1912-13. Pp. x+43+ maps. (Calcutta: Survey of India.) 3s.

Memoirs of the Geological Survey of India. Vol. xli. Part 2: On the Geology and Coal Resources of Korea State, Central Provinces. By Dr. L. L.

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Fermor. Pp. iv+148-245. Vol. xlii. Part 1: The Burma Earthquakes of May, 1912. By J. C. Brawn. Pp. vi+147. (Calcutta: Geological Survey of India; London: Kegan Paul and Co., Ltd.) 4s. each.

Annals of the South African Museum. Vol. x.: Descriptions of New Species of Lepidoptera Heterocera in the South African Museum. By W. Warren. Pp. 467-510+2 plates. (London: West, Newman and Co.) 6s.

Ninth Annual Report of the Meteorological Committee, for the year ended March 31, 1914. Pp. 69. (London: Wyman and Sons, Ltd.) 4d.

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