

puzzling. It is suggested as possible that hydrogen dispersed throughout the lattice of iron crystals—not at lattice points—may act catalytically in the following way. Some of the iron atoms immediately adjacent to hydrogen atoms are thereby strained in a manner that favours increase in magnetisation by their reversal along the direction of the applied field. We know nothing of the manner in which hydrogen atoms conduct themselves in iron at room temperature, but it is at least possible that a single hydrogen atom may wander about sufficiently to strain in the favourable way a great many iron atoms in succession at each low value of the applied field. If this is the process involved, the hydrogen atoms must repeatedly lose their energy of thermal agitation, and therefore the iron must be cooled during the process and the energy must be supplied from outside by thermal conduction and by the magnetic field. If, as is the case, the reduction of area of the hysteresis loop is by more than 50 per cent, there will be a net cooling during each cycle, the hydrogenised iron being a refrigerating engine worked by cyclic magnetisation. Experiments with alternating magnetic fields should be competent to fix not only the amount of cooling integrated over many cycles, but also the time interval required for the complete promotion of magnetisation at each increment in magnetic field by the necessary random migration of hydrogen atoms.

This explanation would be much more fanciful if we had not recently learned from the experiments of Ellwood⁹ that cooling may occur at certain stages in a hysteresis cycle, and that the heat developed in the whole cycle may be less if the cycle is traversed in many steps so that there are periods of ageing under the important applied fields. In Ellwood's case, carbon, not hydrogen, is known to have been present, and carbon is also known to enter the lattice of iron not at lattice points but by crowding into interatomic spaces. Its diffusion rate in iron at room temperature would be expected to be much less than that of hydrogen.

On these views, the possible ways in which magnetisation may change are two: (1) by reversals, without sensible magneto-resistance changes or magnetostriction, and with small but definite hysteresis losses probably closely conditioned by electrical conductivity; and (2) by rotations through less than 180°, with magneto-resistance and magnetostriction, with hysteresis losses of important amount largely controlled by mechanical strains inherent or induced by applied stresses, and possibly subject to catalytic acceleration.

L. W. McKEEHAN.

Sloane Physics Laboratory,
Yale University, Oct. 15.

- ¹ R. Becker, *Zeits. f. Physik*, **62**, 253-269; 1930.
- ² R. Becker, M. Kirsten, *Zeits. f. Physik*, **64**, 660-681; 1930.
- ³ J. Frenkel, J. Dorfman, *NATURE*, **126**, 274-275; Aug. 23, 1930.
- ⁴ N. S. Akulov, *Zeits. f. Physik*, **64**, 559-562; 1930.
- ⁵ W. Gerlach, *Zeits. f. Physik*, **64**, 502-506; 1930.
- ⁶ P. P. Cioffi, *NATURE*, **126**, 200-201; Aug. 9, 1930.
- ⁷ L. W. McKeenan, *Phys. Rev.* [2], **36**, 948-977; 1930.
- ⁸ L. W. McKeenan, O. E. Buckley, *Phys. Rev.* [2], **33**, 636; 1929.
- ⁹ W. B. Ellwood, *Phys. Rev.* [2], **36**, 1066-1082; 1930.

Unit of Atomic Weight.

THE discovery of the complexity of oxygen clearly necessitates a reconsideration of the scale on which we express the weights of atoms. Owing to the occurrence of O¹⁷ and O¹⁸, now generally accepted, it follows that the mean atomic weight of this element, the present chemical standard, is slightly greater than the weight of its main constituent O¹⁶. The most recent estimate of the divergence is 1.25 parts per 10,000.

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This quantity, even apart from its smallness, is not of much significance to chemists, for the experience of the last twelve years has shown that complex elements do not vary appreciably in their isotopic constitution in natural processes or in ordinary chemical operations. Physics, on the other hand, is concerned with the weights of the individual atoms, and by the methods of the mass-spectrograph and the analysis of band spectra it is already possible to compare some of these with an accuracy of 1 in 10,000. Furthermore, the theoretical considerations of the structure of nuclei demand an accuracy of 1 in 100,000, which there is reasonable hope of attaining in the near future. The chemical unit is clearly unsuitable, and it seems highly desirable that a proper unit for expressing these quantities should be decided upon.

The proton, the neutral hydrogen atom, one-quarter of the neutral helium atom, one-sixteenth of the neutral oxygen atom 16, and several other possible units have been suggested. None of these is quite free from objection. It is desirable that this matter should be given attention, so that when a suitable opportunity occurs for a general discussion of the subject, each point of view may be afforded its proper weight in arriving at a conclusion.

F. W. ASTON.

Trinity College,
Cambridge, Dec. 4.

The Geological Importance of the Radioactivity of Potassium.

DR. A. HOLMES and Dr. R. W. Lawson in their paper on "The Radioactivity of Potassium and its Geological Significance" (*Phil. Mag.*, Dec. 1926, p. 1218) have estimated the heating effect of potassium by multiplying the average energy of the emitted β -ray by the number emitted per second. The energy can be obtained from the β -ray absorption coefficient, and the number emitted per second from the half value period. From the best data at the time available, they decided that the energy was 7.3×10^{-7} erg, and the half value period 1.5×10^{12} years; that is, about 225 β -rays are emitted per second per gram of potassium.

The recent work of W. Muhlhoff (*Annalen der Physik*, vol. 7, p. 205; and *NATURE*, Nov. 22, 1930, p. 823) leads, however, to a very much lower value. By the use of a Geiger and Müller sensitive particle counter he counts directly the number of β -rays emitted per gram of potassium; and obtains a value of 23 β -rays per second: not 225. This means that the heating effect will be reduced to one-tenth of its previously estimated value.

This result is important in connexion with a theory of the surface history of the earth advanced by me. For it increases the estimated period required for the thermal development of a 'revolution'; and in this manner contributes towards agreement with estimates of geological time based on the lead ratios of uranium and thorium as found in the rocks. J. JOLY.

Trinity College, Dublin,
Nov. 25.

Internal Conversion of Nuclear Energy.

WHEN a nucleus passes from an excited state into a state of lower energy, two different processes may occur: either a γ -quantum is emitted or one of the extra-nuclear electrons thrown out of the atom (with an energy equal to that of the γ -quantum minus the ionisation energy of the electronic level); in this case we speak of internal conversion of nuclear energy.