melted, or of water that can be evaporated, or the change in temperature of a given layer of air is readily calculated. Sir Napier's book is so interesting that it is likely that many people ignorant of dynamics will read it, and I think such readers have a claim to have the difficulties that arise from the inevitable use of technical terms reduced as much as possible.

I agree with what Sir Napier says about the principle of the conservation of energy, excepting that I do not see why it should be belittled by the use of a heat unit as well as a dynamical unit. We commonly use gallons and cubic feet without confusion according to which is the more convenient.

The day as a unit is open to objection, inasmuch as there are three kind of days, polar, mean solar, and astronomical, but I think that if the term 'day' be used without comment, few would suppose that it meant anything excepting a mean solar day.

I must confess to having had to look up the definition of a gram calorie in a book of reference; I found three definitions, but they all give the same factor for converting gram calories into joules to the third significant figure, so that the ambiguity in the value of the unit is not at present such as to be of much importance in the measurement of radiation.

W. H. DINES.

The Reflection of Atomic Hydrogen from Ice Crystals.

DAVISSON and Germer (NATURE, April 16, p. 558) have shown that electrons are reflected from a nickel crystal in the directions which would be taken by X-rays of wave-length $\lambda = h/mv$ if they were reflected from a slightly modified crystal lattice. This result, which is in accord with the ideas of L. de Broglie, indicates that the diffractive nature of the reflection is to be associated with the momentum rather than with the structure of the electron. One is therefore led to think that the same phenomenon may exist when atoms are reflected from a crystal surface. Although the investigation of this reflection is not yet completed, the preliminary results support this view and are therefore thought to be of sufficient interest for immediate publication.

The experiment consists in finding the intensity of reflection in different directions when a narrow beam of hydrogen atoms strikes a surface of small ice crystals oriented at random. The geometrical arrangement of the collimating slits, reflecting surface, and the detecting plate is shown in Fig. 1. Atomic hydrogen

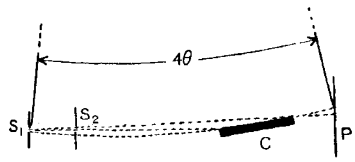

FIG. 1.

from a Wood tube is formed into a beam by the slits S_1 and S_2 in a manner similar to that used by Phipps and Taylor (*Phys. Rev.*, **29**, 309; 1927). The detecting plate P is also similar to that used by the same authors. The reflector C is a plane polished glass surface cooled by liquid air and covered with a thin coat of frost which, to prevent contamination, is continually renewed by the condensation of water vapour supplied by a suitably cooled side tube containing water.

The result of a typical exposure is represented by Fig. 2. The shading shows the relative intensities of the hydrogen beams. The lower dark line is the upper edge of the primary beam which passes above C without reflection. The other darkened portions, which are due to reflected atoms, exhibit the following principal features. There is an undarkened band at deflecting angles less than 6° followed by a relatively intense dark band between 6° and 12° which shades off into a uniform darkening at larger angles. The position of the intense reflected band is not affected by changing the inclination of C from 30′ to 3° 30′, but there is a somewhat doubtful change in definition, the line appearing sharper with C set at the larger angles. This point is not quite certain, however, because of a possible illusion due to the difference in the intensities of various plates. In this regard it is well to point out that if the surface C is placed tangentially to a circle passing through S_1 of such a radius that an arc 4θ is included between S_1 and P, all specular reflections from the individual crystal surfaces of glancing angle θ will come to a focus on P. If the reflected band corresponds to intense reflection at some critical angle between 3° and 6°, a sharper focus would be expected with C set at 3° 30′ than at any other smaller angle.

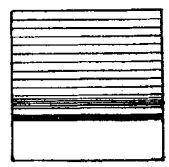

FIG. 2.

Calculating the wave-length of the average hydrogen atom at the probable discharge tube temperature of 400° C., we find $\lambda = h/mv = 0{\cdot}98 \times 10^{-8}$ cm. The exact structure of the ice crystal is not well known and still less certain is the nature of the reflection, for it seems reasonable that the surface structure of the crystal should play a more important part than in the reflection of X-rays. If we take 4·3 Å.U. (the probable edge of the unit cell of ice) as the distance between reflecting centres, a wave of the above length should be intensely reflected at a deflecting angle of about 12°, agreeing with the upper edge of the reflected band.

Although more accurate measurements are necessary to establish the exact nature of the phenomenon, it is now quite certain that some sort of a selective reflection is present at small angles. These measurements are being extended, together with an investigation of the effect of the discharge tube temperature on the position of the reflected band. It is also desirable to study the phenomenon with uni-velocity atoms, and it is thought that this may be possible.

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Biological Fact and Theory.

WITHOUT the slightest hope of modifying or mollifying Dr. Charles Walker's opinions, yet may I point out to readers of NATURE that my previous letter (July 2, p. 12) was not intended to explain or defend in detail the chromosome theory of Mendelian inheritance, as that has been done more or less adequately in every recent text-book dealing with cytology or heredity. I merely directed attention to the fact that this theory is the only one in the field and that it is proving of great service in stimulating biological research. Its value to the student of practical breeding is acknowledged by Prof. Adametz in his "Lehrb. d. allgem. Tierzucht" in the following words: "Die zytologische Begründung der Mendelschen Vererbungstheorie erwies sich, wie im folgenden . . . kurz gezeigt werden soll, von ausserordentlich grossem Wert für das Verständnis verschiedener bis nun wenig verständlicher Vererbungsvorgange."

J. S. DUNKERLY.