International Union of Pure and Applied Physics

REPORT OF THE COMMISSION OF SYMBOLS, UNITS AND NOMENCLATURE

IN 1931, the International Union of Pure and Applied Physics appointed a commission consisting of Profs. Keesom, Kennelly and Fabry under the chairmanship of Sir Richard Glazebrook, with Dr. Ezer Griffiths as secretary, to deal with the general questions of symbols, units and nomenclature. This Commission submitted its report to the General Assembly of the Union at its meeting in London on October 5 last, and the following resolutions were authorised for publication.

THE STANDARD THERMAL UNIT

(1) The unit of heat when measured in units of energy shall be the Joule, defined as equivalent to 10^7 ergs.

(2) The gram-calorie is the amount of heat required to raise the temperature of one gram of water from 14·5° to 15·5° of the International Scale of Temperature under normal atmospheric pressure.

As a note on recommendation (2), it is stated that according to existing measurements, the gram-calorie is equivalent to $4{\cdot}18_6$ Joules, and that pending a decision by the International Convention of Weights and Measures as to the relation between the International and the C.G.S. electrical units, the value of the International Watt Second may be taken as 1·0003 Joules.

ELECTRICAL AND MAGNETIC UNITS

The accompanying table was accepted as defining the units in terms of which the electromagnetic quantities required for practical purposes are measured.

TABLE 1. ELECTROMAGNETIC UNITS

Quantity designated	C.G.S. units			Practical units in terms of	
	Symbol	Defining equation	Name	C.G.S. units	Volt-ampere units
Flux	Φ	$\frac{d\Phi}{dt} = -E$	Maxwell	10^8 Maxwells	Volt second
Magnetic Induction or Flux Density	B	$\int B\, dS = \Phi$	Gauss	10^8 Gauss	Volt second per cm.^{2}
Magnetomotive Force round a circuit	F	$F = 4\pi NI$	Gilbert = Oersted cm.	10^{-1} Gilbert	$1/4\pi$ ampere-turn
Intensity of Magnetising Field	H	$\int H \cos\varepsilon\, dl = F = 4\pi NI$	Oersted	10^{-1} Oersted	$1/4\pi$ ampere-turn per cm. of path of H
Permeability	μ	$\mu = \frac{B}{H}$	Permeability*	$\frac{10^8 \text{ Gauss}}{10^{-1} \text{ Oersted}}$	$\frac{\text{Volt second per cm.}^2}{1/4\pi \text{ ampere-turn per cm. length of path of } H}$

* The unit of 'permeability' on the C.G.S. system is the permeability of free space—in practice that of the air. This unit has received no special name. The statement that the permeability of a given medium is μ implies that it is μ times the permeability of free space.

Complete agreement as to the definitions of B and H has not yet been reached. For the definition of B we are not far from it, but the definition of H still remains somewhat uncertain. If in the future, definitions should be adopted which would imply that B and H are quantities of the same kind, Table 1 would still hold. It would then be understood that the names Gauss and Oersted were two different names given to the same quantity determined by experiment. In these circumstances either one or the other of the two synonymous words might be employed as found more convenient.

In the report mention is made of the decisions of the International Electrotechnical Commission at its meeting in Paris in 1933, one of which was the statement that the formula $B = \mu_0 H$ represents the modern concepts of the physical relations for magnetic conditions *in vacuo*, it being understood that in this expression μ_0, the permeability of free space, possesses physical dimensions.

In the case of magnetic substances, the above formula becomes $B = \mu_1 H$, in which μ_1 has the same dimensions as μ_0. It follows that the specific or relative permeability of a magnetic substance is a number equal to μ_1/μ_0.

As a consequence of this, the International Electrical Commission recommended that the symbol μ_0 should be introduced into certain formulæ employing magnetic units.

The report also includes a number of appendixes dealing with the basic definitions of the system of electrical units ; alternative methods of definition ; the resolutions adopted by the International Electrical Commission at Oslo in 1930 ; and the Giorgi system, in which the metre and the kilogram replace the centimetre and the gram in the system of fundamental units, whilst the ohm is taken as the fourth. There is also a supplement by Prof. Abraham entitled "Note sur ce que pourraient être les définitions des grandeurs magnétiques", which has been prepared by him in response to a request made at a meeting in Paris in July 1932.

THERMODYNAMIC SYMBOLS

The Commission in its report points out the diversity of practice as regards thermodynamic symbols, and is of the opinion that it is desirable to make an effort to remedy the existing confusion.

The following resolutions were accepted by the General Assembly.

(1) That Table II be put forward for the National Committees as a satisfactory series of symbols and nomenclature for the thermodynamic quantities referred to, and

(2) That E, φ and I be accepted as alterna-

tive symbols for Internal Energy, Entropy and Heat Content respectively.

(3) That thermodynamic quantities should always be expressed in the Centigrade scale of temperature.

TABLE II. SYMBOLS FOR THERMODYNAMIC QUANTITIES

Name	Entropy	Internal Energy	Free Energy	Thermal Potential or Gibbs' Function	Heat Content or Enthalpy	Work
Formula	—	—	$U - TS$	$U - TS + PV$	$U + PV$	
Symbol	S or φ	U or E	F	G	H or I	W

In the above formulæ, P and V should be interpreted as representing a generalised force and generalised co-ordinate respectively.

FUTURE WORK OF THE COMMISSION

Consideration was given to the policy which should govern the future activities of the Commission and its relationship to those other international bodies which deal, among other matters, with the definitions and nomenclature of their subjects.

The International Union of Pure and Applied Physics decided that the S.U.N. Commission might usefully continue to work:

(1) By co-operating with existing international bodies in the preparation of glossaries or lists of definitions with the view of making them more useful to physicists in general.

(2) By preparing, for general adoption, lists of terms occurring in two or more branches of physics.

(3) By assisting those who, in any country, are engaged in preparing such lists, with the view of bringing workers in different countries into contact and securing harmony in the results of their work.

Copies of the complete report of the Commission will be obtainable from the Physical Society (1 Lowther Gardens, London, S.W.7) at a price of 2*s.* 9*d.* in paper covers and 5*s.* bound in cloth.

E. G.

The Eider Duck (*Somateria mollissima mollissima*)

By SETON GORDON

THE eider duck, because of the handsome and striking plumage of the drake, is a familiar object off the coasts of Britain. It is more numerous in Scottish than in English waters, but is plentiful throughout the year off the coast of Northumbria, where the eider is known as St. Cuthbert's duck, because of the tradition in the district that St. Cuthbert, who had his cell on one of the Farne Islands, tamed the eiders of old.

In Scotland the eider duck is found both east and west, and is particularly numerous during the winter months on the sheltered sea lochs on the east side of the Isle of Skye. On the open waters of the Minch it is not really plentiful, nor is it often seen in winter on the open Atlantic west of the Hebrides. When the eider is seen at close quarters the striking beauty of both drake and duck is apparent. The drake with his black head, pale sea-green cheeks, and white breast with its faint rosy flush, is a striking object as he courts his more sober-coloured mate, but she, too, is beautiful, for a warm rosy flush is upon the rich brown feathers of her breast and back, and to relieve the monotony of her colouring there are two white bars on her wings.

The late Viscount Grey of Fallodon had an eider drake in his bird sanctuary at Fallodon for twenty-one years, and up to the last the old eider, although he was blind in one eye, delighted in courting the mallard ducks on the pond, and their rightful mates, aware that the old fellow's intentions were harmless, watched him with amused tolerance.

In very early spring, sometimes even in winter, the eider drake can be seen courting the duck that has attracted his fancy. Swimming round her, he raises himself on the water and utters soft cooing notes. It is indeed possible that the eider remains paired throughout the year, and the late Viscount Grey told me that on seeing a large flock of eiders off the coast of Northumberland one winter day he carefully counted the sexes in the flock, and found that ducks and drakes were present in exactly equal numbers.

It is a characteristic of drakes which have an 'eclipse' plumage that they take no part in the rearing of the brood, and the British eider drake is never seen near the nest. In this characteristic he is different from the eider of Spitsbergen, which nests in colonies. I visited some of these Spitsbergen colonies in the summer of 1921, and found the drakes on the island with the ducks, and in some instances standing guard while the ducks brooded their eggs. The drakes may have kept off the Arctic skuas which were present at most of these colonies of eiders, ready to swoop down and suck the eggs of any unprotected nest. Sometimes when an eider duck left her nest, after having covered it carefully with the down which lined it, she apparently thought that her eggs would be safe from the marauding skua gulls, but the skua