resolution amended so as to leave the exact definition to be supplied by the council later. Another change, also strongly challenged before being adopted, was that giving the council "power at their discretion to elect as associates chemists not of British nationality who would otherwise be qualified for full membership." This was objected to as if it were against the economic interests of British chemists, but the president, Professor E. C. C. Baly, according to the correspondent, made it perfectly clear that the intention was simply to enable that association to be courteous and friendly to the alien chemists who are admitted to England by the Ministry of Labor under special license for limited periods and for particular jobs. The proposed new rule was therefore amended so as to limit such associateship of alien members to the period of their stay. The new rules came into force on December 1.

DISCUSSION

SYMBOLS AND NAMES FOR THE HYDROGEN ISOTOPES

RECENT discussion[1, 2] concerning names and symbols for the hydrogen isotopes illustrates a typical difficulty in scientific nomenclature. The problem continually arises of choosing or compromising between conflicting ideals: (1) maximum brevity, simplicity and euphony in important individual names; (2) maximum explicitness, completeness and consistency of characterization of individuals or individual types as members of a class or system; (3) the principle that well-established nomenclature, even if not particularly good, should not be too hastily set aside; but if, for sufficient reasons, it is replaced, the new nomenclature should not contain old names or symbols used with new meanings. In connection with (1), there is a tendency to prefer names, which give a feeling of qualitative individuality, to numbers; while with (2), there is a tendency toward complex symbols, often including numbers.

The use of different names for different isotopes of an element is natural when the isotopes have appreciably distinct individualities. Among radioactive elements, such individual names are very natural from the standpoint of radioactive family relationships, although uncalled for from a purely chemical view-point. The assignment of names to the hydrogen isotopes is based on the expected existence of appreciable differences in chemical behavior, together with the not irrelevant fact that the heavy isotope can be isolated in quantity.[1]

Logically, we might name isotopes like plants and animals. We speak of *Quercus alba* and *Q. rubra;* why not *Hydrogen protium* and *Hydrogen deuterium* as complete systematic names for the hydrogen isotopes? In practise, of course, the complete names would seldom be used, but instead usually just the genus or just the species name. Or one might adopt as standard nomenclature the generic name hydrogen and the individual names hydroprotium and hydrodeuterium, the latter abbreviated ordinarily to the terms protium and deuterium proposed by Urey, Murphy and Brickwedde.[1]

Turning to symbols, we find H^1, H^2, Cl^{35}, Cl^{37}, and so on, in common use. These, however, especially H^2 because the small number two occurs often for another purpose, as in $H^2{}_2O$, tend to be somewhat confusing and hard to read. Moreover, they make extra work in typewriting and typesetting and, especially with the hydrogen isotopes, are liable to confusing misprints, *e.g.*, $H_2{}^2O$, $H_2{}^1$. The form $(H^2)_2O$ is clear but too cumbersome. H^2_2O involves difficulties and expense in typesetting. Most of the troubles just mentioned could be avoided by using H1, H2, Cl35; $H1_2O$, H1H2O, $H2_2O$; $H1_2O16$, H1H2O17; $Cl35_2$; $C_6H1_3H2_3$; and so on. With a little practise, H1, H2 or O16 is recognized as a single symbol, just as are the two letters in Cl.

Whatever practise may be followed for isotopes in general, it seems clear that, at least for hydrogen, new symbols must be adopted. As Professor Urey has pointed out in correspondence, even H1, H2 will very likely not do, because of confusion sometimes arising when these are spoken as parts of complex formulas.[1] Some investigators[3] now use H and D for H^1 and H^2. This practise is open to serious objection in that it provides no means of distinguishing between the genus hydrogen (H) and the species *H. protium* (here also H). Usually, to be sure, there may be no danger of confusion, but it seems likely that in the future we shall wish to speak sometimes of the properties of, for example, H_2O, other times of the (more sharply defined) properties of $H1_2O16$, so that it would be far wiser to introduce a new symbol for protium, leaving H for the genus hydrogen (*cf.* ideal 3).

Unfortunately, we can not use P for protium. Pm might be used, or perhaps M or Z. We could then speak of H_2O, Z_2O, D_2O. The use of Z and D makes maximum concessions to ideal (1), but at the expense of ideal (2), since Z and D look like symbols for

[1] Urey, Murphy and Brickwedde, *Jour. Chem. Physics*, 1, 513, 1933.

[2] R. W. Wood, SCIENCE, 78, 532, 1933; Urey, Brickwedde and Murphy, and F. C. Whitmore, *ibid*, 78, 602–3, 1933; and later discussion in SCIENCE and *Nature*.

[3] *Cf.*, *e.g.*, H. C. Taylor and J. C. Jungers, *Jour. Am. Chem. Soc.*, 55, 5057, 1933.

new elements. This objection would be much weakened by using Hp, Hd for *H. protium, H. deuterium.* It could be entirely overcome by using H^p, H^d, or better by the simpler symbols $H\pi$, $H\delta$. These would at the same time make a clear and obvious distinction between the genus or element symbol H and the species or isotope symbols π, δ. Still simpler would be Π, Δ. Their use would not seriously violate ideal (2), since the Greek letters would make it clear that we were dealing with isotope, not element symbols. Π and Δ would be easy to pronounce, and would ordinarily add little or nothing to the cost of typesetting, either in ordinary or in structural formulas.

Returning to nomenclature, one wonders whether such names as ammonia, methane, benzene should refer to $N\Pi_3$, $C\Pi_4$, $C_6\Pi_6$, or to NH_3, CH_4, C_6H_6. This is of importance because we expect soon to be able to experiment rather freely with mixtures of varied isotopic composition. It would seem logical (ideal 2) to use "benzene" as a generic name for all the isotopes and their mixtures. On the other hand, a simpler nomenclature (ideal 1) can be developed if we regard C_6Hp_6 as the orthodox benzene, from which isotopes can be obtained by various substitutions of Hd for Hp.

It seems likely that the two view-points may be combined in a practicable way somewhat as follows. The terms benzene, ammonia, *m*-dinitrobenzene, etc., will be used in a generic sense, covering the ordinary present-day materials as well as other isotopic mixtures. At the same time a more specific nomenclature, somewhat as follows, will be used in cases where the isotopic composition is known and is important: $N\Pi_3$, protiumammonia; $N\Pi_2\Delta$, deuteroprotiumammonia; $N\Pi\Delta_2$, dideuteroprotiumammonia; $N\Delta_3$, trideuteroprotiumammonia. In order to avoid constant repetition of the word protium, the brief letter Π or π could be used instead: Π-ammonia, deuteroΠ-ammonia, etc. Complete omission of the word protium or Π, while allowable if the context leaves no doubt as to what is meant, would in some cases lead to confusion or at least make understanding more difficult, and should therefore not be indulged in too freely.

Just as logical as the preceding would be the scheme $N\Delta_3$, deuteriumammonia; $N\Delta_2\Pi$, protodeuteriumammonia, and so on (abbreviations Δ-ammonia, protoΔ-ammonia, etc.). In these schemes, there seems to be no danger of confusion between the prefixes protium- and proto-, or deuterium- and deutero-, if each is used consistently in a definite way. It is entirely natural to use proto-, deutero-, like nitro- in nitrobenzene, in order to refer to substitutions made in an initial or standard substance. The nouns protium, deuterium, on the other hand, are used descriptively in much the same way as "house" or "sheep" in houseboat or sheep-ranch. Protiumbenzene means all-protium benzene (no deuterium) just as sheep-ranch, strictly interpreted, means all sheep (no cattle).

Both the above schemes might be used interchangeably, but it would probably be wiser to keep to a single set of standard names. Preference would naturally be given to the first scheme, except that perhaps one might adopt deuteriumammonia, etc., from the second, for the pure Δ compounds.[4]

Thus we should have: Π-ammonia (*i.e.*, protiumammonia), deuteroΠ-ammonia; Π-benzene, deuteroΠ-benzene, *o*-, *m*- and *p*-dideuteroΠ-benzene, . . . hexadeuteroΠ-benzene or deuteriumbenzene (Δ-benzene). Further: chloroΠ-benzene, *m*-deuterochloroΠ-benzene; Π-methyl chloride, deuteroΠ-methyl chloride: *cis*-dideuteroΠ-ethylene; Π-chloroform, deuteroΠ-chloroform or Δ-chloroform. The use of Δ- as a prefix may be open to some objection because δ- is frequently used for another purpose in organic chemistry.

It has been proposed[5] that "deuton" be replaced by "diplon" for the H^2-particle, and deuterium by diplogen for the H^2 atomic species. Although a close relation between particle and species names (*cf.* proton and protium) has advantages, it does not seem essential, especially since the names are used in quite different fields of research. Moreover, strong objections exist to diplogen, since its ending could suggest oxygen or nitrogen just as well as hydrogen. The set of names hydrogen (H), protium (Π), diplogen (Δ) is recommended by no good systematic argument. Better would be hydrogen, (hydro)protium, (hydro)diplium. There seems, however, to be no sufficient reason for giving up "deuterium" even if deuton is replaced by diplon, H2-particle, or some other name.[6]

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TALUS SLOPES OF THE GASPE PENINSULA

THE Syracuse University Museum of Natural Science maintained a group of scientists in the field during the months of July and August. The members carried on collecting activities for the museum in the various branches of natural science and pursued scien-

[4] Another scheme would be to use hexaprotiumbenzene, deuteriumpentaprotiumbenzene, and so on, but it seems unnecessary to go to such lengths for the sake of ideal 2. In some cases, *e.g.*, diprotiumwater, protiumdeuteriumwater, diprotium, this scheme would be fairly simple, but it would nevertheless make less confusion if it were avoided, especially since the alternatives (Π-water, deutero Π-water, Π-hydrogen) are also simple.

[5] *Cf.* SCIENCE, 79, 26, 1934; Lord Rutherford, *Nature*, 132, 955 (1933).

[6] A simple although meaningless name would be delton; the corresponding species name (hydro)deltium would also be not unpleasant.