letters

Error in lithium

E. E. McMurphy and R. S. Newbury's letter (July, page 66) suggests that an error in the atomic weight of lithium in some widely used reference works[1,2] might be due to transposing digits in the calculation using isotopic abundances and nuclidic masses. In this case, these standard references have merely failed to update their atomic-weight tables according to the latest revision[3] of the International Commission on Atomic Weights (ICAW). This Commission meets bi-annually, reviews the latest published information pertaining to atomic weights, and revises the atomic-weight table accordingly.

In 1961, when the discrepancy between the physicist's standard, $O^{16} = 16$, and the chemist's standard, $O^{\mathrm{Natural}} = 16$, was eliminated by the introduction of the $C^{12} = 12$ standard, all atomic-weight values were recalculated.[4] In the case of lithium, the recommended value was 6.939 on the C^{12} scale. New published data was used to revise the lithium atomic weight to 6.941 in 1969. No significant changes in this value have been made since that time.

It might be noted that the IUPAC Commission on Symbols, Terminology for Physicochemical Quantities and Units defines atomic weight (relative atomic mass) of an element as "the ratio of the average mass per atom of a natural nuclidic composition of an element to $1/12$ of the mass of an atom of nuclide C^{12}." As such, the atomic weight is unitless and should not be given in amu.

Also, I would like to clear up some confusion that exists in the scientific community whereby it is thought that the atomic weight of an element is determined solely from the nuclidic masses and isotopic abundances. This is merely one method used to determine the atomic weight. Prior to the discovery of isotopes, all determinations of atomic weights were by chemical methods, the foremost of these methods being the titrimetric determination of the equivalence of soluble halides to silver, the so-called "Harvard Method." With the advent of mass spectrographs and mass spectrometers, an alternative physical method for determining atomic weights became available. The ICAW reviews both physical and chemical method determinations when revising

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TABLE 7a-3. PROPERTIE

Symbol (2)	Element (3)	Atomic wt.† (4)	Valency (5)
H	Hydrogen	1.00797	1
He	Helium	4.0026	0
Li	Lithium	6.939	1
Be	Beryllium	9.0122	2
B	Boron	10.811	3
C	Carbon	12.01115	±4, 2
N	Nitrogen	14.0067	−3, 5, 2
O	Oxygen	15.9994	−2
F	Fluorine	18.9984	−1
Ne	Neon	20.183	0
Na	Sodium	22.9898	1
Mg	Magnesium	24.312	2
Al	Aluminum	26.9815	3
Si	Silicon	28.086	4
P	Phosphorus	30.9738	5, ±3
S	Sulfur	32.064	6, 4, −2
Cl	Chlorine	35.453	±1, 7, 5
A	Argon	39.948	0
K	Potassium	39.102	1
Ca	Calcium	40.08	2
Sc	Scandium	44.956	3

atomic-weight values. In the case of lithium, the 1961 value of 6.939 was based on a recalculation of a "Harvard Method" paper[5] to the C^{12} scale. The 1969 revision to 6.941 was based on a new physical determination of the isotopic abundances.[6]

In the physical method, a "calibrated" measurement is preferred, that is, absolute isotopic abundances independent of instrument bias. This is extremely difficult in the case of elements with many stable nuclides. As a result, ten elements have atomic-weight values based on chemical measurements. For these elements, discrepancies between the recommended atomic weights and values calculated from isotopic abundances would not be unexpected.

In the past, ICAW has not recommended isotopic-abundance values but merely used what it considered the best available values in its review of data. At the present time, the best evaluated set of isotopic abundance data is published on the 1972 G. E. Chart of The Nuclides.[7]

References

1. *American Institute of Physics Handbook* (Dwight E. Gray, ed), McGraw-Hill, New York (1974); 3rd edition, page 7–6.
2. Handbook of Chemistry and Physics (Robert C. Weast, ed), The Chemical Rubber Co., Cleveland, Ohio (1972); 53rd edition, page B247.
3. IUPAC Commission on Atomic Weights, "Atomic Weights of the Elements, 1973," Pure Appl. Chem. **37**, 591 (1974).
4. Report of the International Commission on Atomic Weights 1961, A. E. Cameron, E. Wichers, J. Am. Chem. Soc. **84**, 4175 (1962).
5. T. W. Richards, H. H. Willard, J. Am. Chem. Soc. **32**, 4 (1910).
6. H. J. Svec, A. R. Anderson Jr, Geochim et Cosmochim Acta **29**, 633 (1965).
7. N. E. Holden, F. W. Walker, *Chart of The Nuclides*, Educational Relations, General Electric Company, Schenectady, N.Y. (Oct. 1972).

NORMAN HOLDEN
Brookhaven National Laboratory
Upton, New York

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The letter by McMurphy and Newbury is useful in pointing out an error that has propagated unnecessarily in the literature. However their explanation of its origin is a fortuitous coincidence. The 1961 Report of the International Commission on Atomic Weights [A. E. Cameron, Wichers, J. Am. Chem. Soc. **84**, 4175, (1962)] states "The recommended atomic weight of lithium has been 6.940 since 1925, based on chemical ratios determined by Richards and Willard [T. W. Richards, H. H. Willard, J. Am. Chem. Soc. **32**, 4 (1910)]. The recalculated ratios are [*see table on page 11*]:

Obviously these measurements predated the knowledge of the existence of lithium isotopes.

The 1969 report [Commission on Atomic Weights, Pure and Applied Chemistry **21**, No. 1, 91 (1970), Butterworths, London] states "The atomic weight of lithium recommended in the 1961 revision of the Table of Atomic Weights was 6.939 and was based upon a recalculation of the chemical ratios determined by Richards and Willard. There were no calibrated determinations of the isotopic composition at that time. Recently, some mass-spectrometric measurements were reported which showed that lithium was variable in isotopic composition in nature. Svec and Anderson have reported measurements of the absolute abundance of the

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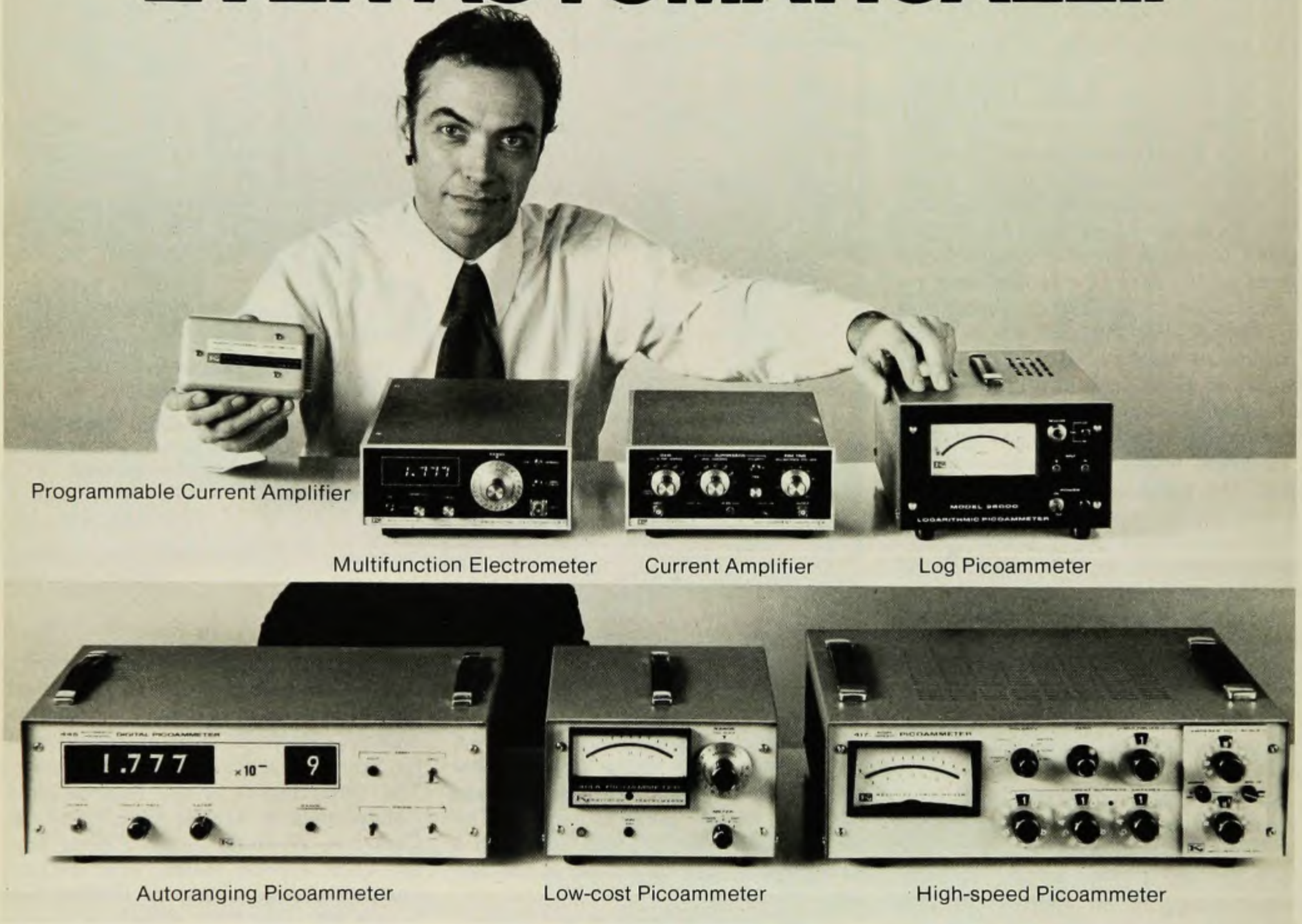

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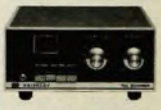
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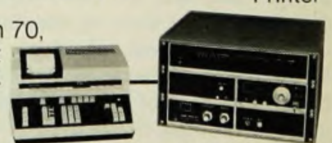
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lithium isotopes in natural sources. From their work the atomic weight of lithium is taken as 6.941 (with a limit of ±0.002 to account for the variability with origin and to some extent with variability introduced in purification procedures)."

As for the persistence of the error, this is an example of authors and editors repeating outdated material without checking. Singling out the *Handbook of Chemistry and Physics* (55th ed., 1974–75) only because I have a copy readily available, I find that the atomic weight of lithium is given as 6.941 on the fly-leafs, but 6.939 in the table of the isotopes (page B-249).

On a slightly different level, there are discrepancies between the adopted chemical atomic weights and the values computed from nuclidic masses and isotopic abundances (in some cases as large as 1 millimass unit), which arise because no extensive effort has ever been made to provide a consistent set for these obviously closely related data.

E. RICHARD COHEN
Rockwell International
Thousand Oaks, Calif.

THE AUTHORS RESPOND: We thoroughly agree with Norman Holden's and Richard Cohen's analyses of the problem. Our scenario was intended to be "theater" only. We are glad to see this tragical–historical production come to its rightful end: a clear and complete explanation of the error.

F. E. MCMURPHY
R. S. NEWBURY
Lawrence Livermore Laboratory
Livermore, Calif.

		Ratio	Atomic Weight
Comparison of chloride with Ag	LiCl/Ag	0.392992	6.9390
Comparison of chloride with AgC	LiCl/AgCl	0.295786	6.9399
Chloride converted to perchlorate	$2O_2$/LiCl	1.50968	6.9385

New journals not needed?

We thought your readers might be interested in the following letter, which we have sent to the editors and publishers of a proposed new letters journal, *Communications on Physics*. We have sent a similar letter to the editors and publishers of *Letters in Mathematical Physics*.

As physicists sitting as members of the Cornell University Physical Sciences Library Committee, we are responding to your recent notice announcing a new journal, *Communications on Physics*.

For many reasons, foremost among which are cutbacks in the University budget, shortages of space, large and repeated increases in price, and the fact that existing journals are, at present, more than adequate to accommodate the present output of articles of quality, our library is abandoning its former policy of subscribing indiscriminately to all new physics journals. In major new areas where existing journals are demonstrably inadequate, we shall, of course, plan to subscribe. We do not believe that *Communications on Physics* meets this criterion, and are therefore recommending that the Cornell University Physical Sciences Library not subscribe.

We believe that publishers should no longer be able to count on all (or even many) libraries subscribing to whatever new physics journals they bring forth, even if these promise to be of high quality. We believe that the present array of physics journals is more than enough to accommodate worthwhile scientific literature, and that such deficiencies as they possess should be remedied from within, rather than by further diluting the quality of all journals and putting further strains on overburdened libraries by introducing even more avenues of scientific publication.

In a time of rising costs and falling budgets, we suspect that ours will not be the only physics library taking such steps. Prospective authors for new journals might therefore consider not only whether it is in the interests of the physics community to encourage their proliferation, but also whether they wish their work to appear in publications which may not be reaching a nontrivial fraction of their colleagues.

N. D. MERMIN
K. G. WILSON
Cornell University
Ithaca, N.Y.

THE EDITORS REPLY: The point Merman and Wilson make about the proliferation of journals is one to which we gave much thought. Nor did it escape the attention of the publishers, Taylor and Francis, Ltd.

The issue is whether another quality letter journal, which is what we intend *Communications on Physics* to be, is needed. For it to be successful, it must