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Standard Atomic Weight Values for the Mononuclides Elements - 1995

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The 1993 Atomic Mass Evaluation has a major impact on the values of the atomic weights for the mononuclidic elements. Of the twenty elements, nine values changed and seven had a change in uncertainty. In addition, one of the elements, Thorium, with no stable nuclides but a characteristic terrestrial isotopic composition has a value change as a result of the new atomic mass evaluation.

I. Introduction

In 1993, Audi and Wapstra[1] published a new Atomic Mass Table. For most chemical elements, the uncertainty in the isotopic composition of the stable nuclides of the elements greatly exceeds the uncertainty in the atomic masses of the nuclides. Thus, the revision of the atomic mass has no impact on the atomic weight for that element.

In the case of mononuclidic elements with no stable isotope, the atomic weight value is determined directly from its one stable nuclidic mass. There are twenty such chemical elements. In additions, there are two elements, Thorium and Protactinium, which have no stable nuclides, but do have a stable characteristic terrestrial isotopic composition involving just one nuclide.

The Commission on Atomic Weights and Isotopic Compositions has a policy[2] for determining atomic weight values and uncertainties for such elements. The uncertainty quoted in the publication on the atomic mass is increased by a factor of six and adjusted upward to give a single digit certainty.

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II. Discussion

In Table I, the results are presented for the twenty-two elements mentioned above. The 1995 values and uncertainties are compared with those for the present 1993 Standard Atomic Weights[3]. For ten elements, the value has changed. As significant digit has been added for manganese, cobalt and thorium. The last significant digit has changed by two units for sodium and caesium. For the remaining five elements, the last significant digit has changed by one unit. However, the uncertainty has also changed for all by arsenic.

For seven elements, the value has remained the same but the uncertainty has improved. Only in the case of scandium is the present uncertainty less than fifty percent larger than the new uncertainty.

Only four elements have not undergone a change.

III. Conclusion

When the policy for mononuclidic element atomic weights was changed a decade ago[2], it was argued that new mass tables would only be produced about once a decade. This is consistent with recent experience, since there have only been two new atomic mass evaluations[4] since the 1971 Atomic Mass Table[5].

Because of these infrequent changes, I would recommend that the seventeen changes noted in Table I be incorporated into the 1995 Table of Standard Atomic Weights.

IV. References

1. G. Audi, A.H. Wapstra, Nucl. Phys. A565 (1) 1 (1993).
2. J.R. De Laeter, Technical Booklet, IUPAC Commission on Atomic Weights and Isotopic Abundances, September 4, 1990.
3. IUPAC Commission on Atomic Weights and Isotopic Abundances, Pure Appl. Chem. 66, 2423-2444 (1994).
4. A.H. Wapstra, G. Audi, Nucl. Phys. A432 1 (1985).
5. A.H. Wapstra, N.B. Gove, Atomic Data Nucl. Data Tables 9, 265 (1971).

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Standard Atomic Weight Values for 1995

Atomic Number	Name	1993 Atomic Weight	1995 Atomic Weight	Change
4	Beryllium	9.012182(3)	9.012182(3)	No
9	Fluorine	18.9984032(9)	18.9984032(5)	Uncertainty
11	Sodium	22.989768(6)	22.989770(2)	Value
13	Aluminum	26.981539(5)	26.981538(2)	Value
15	Phosphorus	30.973762(4)	30.973761(2)	Value
21	Scandium	44.599510(9)	44.599510(8)	Uncertainty
25	Manganese	54.93805(1)	54.938049(9)	Value
27	Cobalt	58.93320(1)	58.933200(9)	Value
33	Arsenic	74.92159(2)	74.92160(2)	Value
39	Yttrium	88.90585(2)	88.90585(2)	No
41	Niobium	92.90638(2)	92.90638(2)	No
45	Rhodium	102.90550(3)	102.90550(2)	Uncertainty
53	Iodine	126.90447(3)	126.90447(3)	No
55	Caesium	132.90543(5)	132.90545(2)	Value
59	Praseodymium	140.90765(3)	140.90765(2)	Uncertainty
65	Terbium	158.92534(3)	158.92534(2)	Uncertainty
67	Holmium	164.93032(3)	164.93032(2)	Uncertainty
69	Thulium	168.93421(3)	168.93421(2)	Uncertainty
79	Gold	196.96654(3)	196.96655(2)	Uncertainty
83	Bismuth	208.98037(3)	208.98038(2)	Value
90	Thorium	232.0381(1)	232.03805(2)	Value
91	Protactinium	231.03588(2)	231.03588(2)	No