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REPORT OF THE INTERNATIONAL COMMITTEE ON ATOMIC WEIGHTS. 1907.

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Since the preparation of our last report, for 1906, a number of important memoirs upon atomic weights have appeared. The results obtained may be briefly summarized as follows:

Bismuth.—Work done at Erlangen under the direction of Gutbier[1] has been published in the form of three doctrinal dissertations.[2] Birckenbach, by synthesis of the oxide from the metal found in mean Bi = 208.05. A series of reductions of the oxide gave Bi = 208.08. Mehler determined the ratio $BiBr_3 : 3AgBr$, and found Bi = 208.05. By synthesis of the sulphate from the metal, Janssen obtained the value Bi = 208.074. These determinations are concordant, and also agree with the earlier measurements by Schneider and Löwe, and with a series by Marignac. The atomic weight of bismuth, therefore, is to be taken as 208.0 in round numbers, and the value 208.5, as hitherto given in our table, is too high.

Bromine.—Baxter's[3] determinations of this constant are based upon the antecedent values Ag = 107.93, and Cl = 35.473. 18 syntheses of silver bromide gave, in mean, Br = 79.953. 13 experiments upon the conversion of AgBr into AgCl, gave Br = 79.952.

Cadmium.—The memoir by Baxter, Hines and Frevert[4] is a continuation of the research which was noted last year. Four ratios were measured, with the following results; when Ag = 107.93 :

$CdBr_2 : 2Ag$.	Cd = 112.470
$CdBr_2 : 2AgBr$.	Cd = 112.464
$CdCl_2 : 2Ag$.	Cd = 112.471
$CdCl_2 : 2AgCl$.	Cd = 112.470

Copper.—A series of analyses and syntheses of copper oxide by Mur-

[1] Z. Elektrochem., 11, 831.
[2] L. Birckenbach, 1905. H. Mehler, 1905. R. L. Janssen, 1906.
[3] J. Am. Chem. Soc., 28, 1322.
[4] J. Am. Chem. Soc., 28, 770.

mann[1] gave the value Cu = 63.53. The data are not concordant, and the determinations are not entitled to much weight.

Iodine.—Gallo[2] has determined the atomic weight of iodine electrolytically; comparing the iodine liberated by a current with the silver deposited. His values range from 126.82 to 126.98, or, in mean, 126.89 when Ag = 107.93. This result is more nearly in accord with the determination by Stas, than with the later measurements.

Nitrogen.—Gray's[3] work upon the atomic weight of this element, noticed in our report for 1906, has since been published in full. His mean results are as follows: From the density of nitric oxide, N = 14.006. From the analysis of nitric oxide N = 14.010. From the density of nitrogen, N = 14.008. The mean of all the determinations is N = 14.0085, or very nearly, 14.01. This agrees sharply with the earlier measurements by Guye, Rayleigh, and Leduc, and leaves no reasonable doubt but that the new value should replace the 14.04 as given in our annual table. In a later paper[4] Gray has gathered corroborative data from various sources and has discussed Stas' ratios in order to discover their possible errors. Other discussions of similar purport are by Guye [5] and Scott [6], but they are not final. Experimental evidence alone can reveal the cause of discrepancy between the new figure and the old.

Palladium.—Amberg [7] has redetermined the atomic weight of palladium, by analysis of palladosamine chloride, $PdN_2H_6Cl_2$. The value obtained is Pd = 106.688, or 106.7 nearly. Five other analyses of the same salt by Krell [8] gave a mean of Pd = 106.694. Recalculated with Richards' value for Cl, and rejecting one experiment as defective, Krell concludes that Pd = 106.78, but this again would be lowered by the adoption of the newer value for N. Any change in this constant may well be deferred until the antecedent atomic weights are more definitely known.

Silver.—In an attempt to determine the source of error in Stas' figures for nitrogen, Guye and Ter Gazarian [9] examined the fundamental potassium chlorate ratio. They found that potassium chlorate crystallizes with a small quantity of chloride as an impurity, the amount being

[1] Monatsh. Chem. 27, 351.

[2] Gazz. chim. ital. 36, 116;

[3] J. Chem. Soc., 87, 1601.

[4] Ibid., 89, 1173.

[5] Ber., 39, 1470. For Guye and Bogdan's complete memoir upon nitrous oxide, see J. chim. phys., 3, 537.

[6] Chem. News, 93, 20.

[7] Ann. 341, 235.

[8] Doctoral Dissertation, Erlangen, 1906.

[9] Compt. Rend., 143, 411. See also J. chim. phys., 4, 174, for a paper by Guye on the need of a general recalculation of the atomic weights.

nearly constant and about 2.7 parts in ten thousand. Applying this correction to Stas' ratios, his value for silver is lowered from 107.93 to 107.89. A rediscussion of ten fundamental ratios gave figures for silver ranging from 107.871, to 107.908, or 107.89 in mean. If this conclusion is sustained, the Stas ratios for silver nitrate will give a value for nitrogen in harmony with the figures obtained by Guye and Gray.

Tantalum.—Hinrichsen and Sahlbom[1] have determined the atomic weight of tantalum, by conversion of the metal into the pentoxide. Five such syntheses gave Ta = 180.59 to 181.77, or 181.0 in mean. This value should replace the old determination by Marignac as given in our previous tables.

The rare earths.—On the metals of this group a notable amount of work has been published during 1906. From five determinations of water in terbium sulphate, Urbain[2] deduces the value Tb = 159.22 ; and this should supplant the older, questionable data. In another paper[3] Urbain gives an atomic weight of 162.49 to dysprosium, but without details or weighings.

By a volumetric method Feit and Przibylla[4] have determined the amount of sulphuric acid required to neutralize several of the oxides in this group, and have in that way obtained new estimates of the corresponding atomic weights. The final results, reduced to a vacuum standard are as follows :

Lanthanum	139.17	Europium	152.66
Praseodymium	140.62	Gadolinium	157.38
Neodymium	144.52	Ytterbium	173.52
Samarium	150.47	Yttrium	89.40

In Abegg's "Handbuch der anorganischen Chemie," Brauner has given full summaries of all atomic weight determinations. With these summaries, in connection with the rare earth metals,[5] he has cited some hitherto unpublished determinations of his own. His results are—

Praseodymium	140.97	Gadolinium	155.78
Neodymium	143.89	Erbium	167.14
Samarium	150.71	Ytterbium	173.08

Among these figures that for Gd is admittedly too low, and that for Sa is vitiated by the presence of europium in the material studied.

From the evidence presented in this report, and in preceding years, we now feel justified in recommending the following changes in the table :

[1] Ber. 39, 2600.

[2] Compt. rend., 142, 957.

[3] Ibid. 142, 785.

[4] Z. anorg. Chem., 50, 249.

[5] In Bd. 3, Abth. 1 pp. 263, 276, 284, 304, 318, 335.

Nitrogen,	from	14.04	to	14.01
Bismuth,	from	208.5	to	208.0
Tantalum,	from	183.	to	181.
Terbium,	from	160.	to	159.2

Other changes, which seem to be needed because of alterations in the atomic weights of silver and chlorine, cannot yet be made with safety. The atomic weight of silver, as deduced from Stas' data, is probably too high, but by an unknown amount and that will affect the entire table. If we assume, with Guye, that Ag = 107.89, with the proportional changes in Cl and Br, the atomic weight of barium, as determined by Richards, will be reduced by 0.05. Such a change, which is probably extreme, does not affect the utility of the accepted atomic weights at all seriously, and no important interest will suffer if we delay the suggested alterations until our knowledge of the corrections to be applied is more exact. Guye's conclusions, although strongly supported, are not final; and they should be neither accepted nor rejected except upon the basis of much more complete evidence than we now possess. The atomic weight of chlorine, as shown in our last report, is certainly too low; but it depends in part upon the undetermined change to be applied to silver. For that reason, as well as for the reason that a change in chlorine affects many other values, we prefer to leave the figures as they are, and to wait for fuller information. That information will doubtless be supplied by researches now known to be in progress, and the corrections which they will furnish ought not to be delayed very long.

One addition to the table seems to be legitimate. Europium, with an approximate atomic weight of 152, appears to be a definite element, as shown by the investigations of Demarçay, Urbain and Lacombe, Eberhard, and Feit and Przibylla. Its existence is recognized in Abegg's Handbuch and its claims to a place in the table are certainly as great as those of erbium, thulium, or terbium. As for dysprosium, its admittance to the table may well be delayed until a better determination of its atomic weight shall have been made.

In conclusion, we urge upon all chemists who are engaged in the determination of atomic weights to send copies of their publications to all the members of this committee, in order that their work may be promptly recognized and not overlooked. Data published in standard journals are of course easily found; but publications of local societies and doctoral dissertations might readily escape our notice.

Professor Seubert, an original member of this committee, has resigned. Professor Ostwald has been designated as his successor.[1]

The table offered for 1907 is appended hereto.

(Signed.) F. W. Clarke.
T. E. Thorpe.
H. Moissan.
W. Ostwald.

NOTE

Since this report was written, several other memoirs on atomic weights have appeared, namely, Urbain and Demenitroux on dysprosium, Norris on tellurium, Baxter and Hines on manganese, Baxter and Coffin on cobalt, and Richards and Staehler on potassium.

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Aluminum	Al	27.1
Antimony	Sb	120.2
Argon	A	39.9
Arsenic	As	75.0
Barium	Ba	137.4
Bismuth	Bi	208.0
Boron	B	11.0
Bromine	Br	79.96
Cadmium	Cd	112.4
Caesium	Cs	132.9
Calcium	Ca	40.1
Carbon	C	12.00
Cerium	Ce	140.25
Chlorine	Cl	35.45
Chromium	Cr	52.1
Cobalt	Co	59.0
Columbium	Cb	94.
Copper	Cu	63.6
Erbium	Er	166.
Europium	Eu	152.
Fluorine	F	19.0
Gadolinium	Gd	156.
Gallium	Ga	70.0
Germanium	Ge	72.5
Glucinum	Gl	9.1
Gold	Au	197.2
Helium	He	4.0
Hydrogen	H	1.008
Indium	In	115.
Iodine	I	126.97
Iridium	Ir	193.0
Iron	Fe	55.9
Krypton	Kr	81.8
Lanthanum	La	138.9
Lead	Pb	206.9
Lithium	Li	7.03
Magnesium	Mg	24.36
Manganese	Mn	55.0
Mercury	Hg	200.0
Molybdenum	Mo	96.0
Neodymium	Nd	143.6
Neon	Ne	20.
Nickel	Ni	58.7
Nitrogen	N	14.01
Osmium	Os	191.0
Oxygen	O	16.00
Palladium	Pd	106.5
Phosphorus	P	31.0
Platinum	Pt	194.8
Potassium	K	39.15
Praseodymium	Pr	140.5
Radium	Rd	225.
Rhodium	Rh	103.0
Rubidium	Rb	85.5
Ruthenium	Ru	101.7
Samarium	Sa	150.3
Scandium	Sc	44.1
Selenium	Se	79.2
Silicon	Si	28.4
Silver	Ag	107.93
Sodium	Na	23.05
Strontium	Sr	87.6
Sulphur	S	32.06
Tantalum	Ta	181.
Tellurium	Te	127.6
Terbium	Tb	159.2
Thallium	Tl	204.1
Thorium	Th	232.5
Thulium	Tm	171.
Tin	Sn	119.0
Titanium	Ti	48.1
Tungsten	W	184.0
Uranium	U	238.5
Vanadium	V	51.2
Xenon	Xe	128.
Ytterbium	Yb	173.0
Yttrium	Yt	89.0
Zinc	Zn	65.4
Zirconium	Zr	90.6