EIGHTH ANNUAL REPORT OF THE COMMITTEE ON ATOMIC WEIGHTS. DETERMINATIONS PUBLISHED IN 1900.

BY F. W. CLARKE.

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DURING the year 1900, fewer new determinations of atomic weight than usual, have appeared. The data are given in the following pages, together with Herzfeld's research upon calcium, which appeared three years ago. It was unfortunately published through an unusual channel, and was therefore overlooked at the time. Attention may also be called to the presidential address[1] of Professor Morley before the American Chemical Society, which is a valuable discussion of the probable accuracy of our knowledge as to the ratio between hydrogen and oxygen.

NITROGEN.

Dean's research[2] upon the atomic weight of nitrogen, which was noticed in abstract in the report for 1899, has now appeared in full. Weighed quantities of silver cyanide were dissolved in nitric acid, and the nitrate solutions were titrated with a standard solution of potassium bromide. As the latter was not absolutely pure its silver value was independently determined, and the titrations give therefore the quantity of silver proportional to the cyanide. The last experiment of the series was made by solution of the cyanide in sulphuric acid instead of the nitric acid previously used. Attempts to reduce silver cyanide in hydrogen gave unsatisfactory results, due to the formation of paracyanogen and silver carbide. The final data are subjoined.

	Weight AgCN.	Weight Ag.	Equivalent of CN.
	6.2671	5.0490	26.039
	17.60585	14.18496	26.026
	17.1049	13.7801	26.049
	17.9210	14.43881	26.030
	12.11215	9.75875	26.028
	14.6672	11.81727	26.029
Sum,	85.67820	69.02889	26.032

[1] This Journal, **22**, 51.

[2] *J. Chem. Soc.*, **77**, 117.

If C = 12.001, then N = 14.031, the value finally adopted. All weights were reduced to a vacuum standard.

Another determination of the atomic weight of nitrogen has also been announced by Scott.[1] From ammonium bromide he finds $NH_4Br = 97.996$. For the chloride, $NH_4Cl = 53.516$. The first value is lower than that found by Stas, the second is in agreement with Stas. The full paper will appear early in 1901.

CALCIUM.

The following determinations by Herzfeld,[2] made in 1897, were overlooked at the time, and are now recorded here for the sake of completeness. Calcium carbonate was prepared from the bicarbonate, and reduced to oxide by ignition at a temperature of from 1300° to 1400°.

Weight $CaCO_3$.	Weight CO_2.	Weight CaO.	Atomic weight Ca.
3.9772	1.7504	2.2268	39.687
2.3614	1.0396	1.3218	39.655
3.2966	1.4510	1.8456	39.677
			Mean, 39.673

Calculated with H = 1, C = 11.92, O = 15.879. With O = 16, Ca = 39.975.

IRON.

The determinations by Richards and Baxter[3] of the atomic weight of iron are based upon the reduction of pure Fe_2O_3 in a current of electrolytic hydrogen. Two series of results are given, representing ferric oxide prepared by two distinct methods. For details of manipulation the original paper must be consulted.

First Series.—Ferric oxide obtained by calcination of ferric hydroxide :

Weight Fe_2O_3.	Weight Fe.	Atomic weight Fe.
3.17485	2.22096	55.885
3.61235	2.52750	55.916
		Mean, 55.900

Second Series.—Ferric oxide obtained by calcination of ferric nitrate :

[1] *Proc. Chem. Soc.*, **16**, 205.
[2] *Ztschr. des Vereins für die Rübenzucker-Industrie*, **47**, Heft 497.
[3] *Ztschr. anorg. Chem.*, **23**, 245.

Weight Fe_2O_3.	Weight Fe.	Atomic weight Fe.
3.97557	2.78115	55.883
4.89655	3.42558	55.891
4.35955	3.04990	55.891
7.14115	4.99533	55.870
6.42021	4.49130	55.882
		Mean, 55.882

Mean of all seven determinations, 55.89, when O = 16. With H = 1, Fe = 55.47. All weights were reduced to a vacuum.

GADOLINIUM.

Atomic weight determined by Benedicks,[1] by synthesis of the sulphate from the oxide. Data as follows :

Weight oxide.	Weight sulphate.	Atomic weight gadolinium.
0.4308	0.7171	156.57
0.5675	0.9451	156.35
0.5726	0.9534	156.44
0.6785	1.1301	156.29
0.7399	1.2329	156.10
1.3253	2.2063	156.52
		Mean, 156.38

Calculated with O = 16, and S = 32. The final result agrees well with the determination by Bettendorf, who found Gd = 156.33.

THORIUM.

Atomic weight redetermined by Urbain.[2] The thoria was purified by conversion into the acetyl acetonate, which was crystallized from solution in chloroform. It was then converted into sulphate. The atomic weight determinations (with O = 16), were made by calcination of anhydrous $Th(SO_4)_2$. Data as follows :

Weight sulphate.	Weight ThO_2.	Atomic weight Th.
1.0925	0.6815	233.30
0.5926	0.3699	233.75
1.0230	0.6384	233.58

Calcination of the hydrous sulphate gave lower values, probably because the octohydrated salt used contained traces of the sulphate with 9 molecules of water.

1 *Ztschr. anorg. Chem.*, **22**, 393.
2 *Ann. chim. phys.*, (7), **19**, 223.

MISCELLANEOUS NOTES.

Muthmann and Böhm[1] have prepared pure yttria by fractional precipitation with neutral potassium chromate. The final sample was practically pure, and gave a good atomic weight determination. 2.46585 grams sulphate yielded 1.19523 grams of oxide. Hence Yt = 88.97, when O = 16.

Samarium has been studied by Demarçay.[2] By synthesis of the sulphate he finds the atomic weight of the metal to range from 147.2 to 148.0, when O = 16. The higher values, about 150, obtained by other investigators, he attributes to the presence of other earths. In a second paper[3] he describes one of these earths, which is intermediate between samarium and gadolinium, with an atomic weight of the metal equal to 151, nearly. This, however, is only a rough approximation, as the oxide was not sufficiently pure for exact work.

The density of krypton has been carefully determined by Ladenburg and Krügel.[4] From it the atomic weight of the element becomes, in two experiments, 58.67 and 58.81, or 58.74 in the average.

Ramsay and Travers[5] give density determinations and atomic weights for the new gases of the atmosphere as follows:

	Density.	Atomic weight.
Helium	1.98	3.96
Neon	9.97	19.94
Argon	19.98	39.96
Krypton	40.88	81.76
Xenon	64.00	128.00

Metargon is abandoned, as non-existent. Why the value for krypton should diverge so widely from that found by Ladenburg and Krügel, is unexplained. It will be noticed that most of these gases fall between the halogens and the alkali metals in the periodic system, although argon is still slightly divergent from theory.

Mme. Curie has continued her studies upon radium,[6] which were referred to in the report for 1899. She now describes a

1 *Ber. d. chem. Ges.*, **33**, 42.
2 *Compt. rend.*, **130**, 1185.
3 *Ibid.*, **130**, 1469.
Chem. News, **81**, 205.
Ibid., **82**, 257.
6 *Compt. rend.*, **131**, 382.

radiferous barium chloride in which the mixed metals have a mean atomic weight of 173.6 to 174. In this sample, judging from spectroscopic evidence, there was probably rather more radium than barium.

TABLE OF ATOMIC WEIGHTS.

The following table of atomic weights differs but little from that issued last year. First, your committee gives its own list, in two columns, representing both standards of value, H = 1, and O = 16. The only change here is in iron, due to the work of Richards and Baxter. Richards' table is unchanged, except in the same item. The table of the German Committee is that which was issued in January, 1901, as an insert to the first number of the *Berichte*.

	Clarke.			
	H = 1.	O = 16.	Richards.	German.
Aluminum	26.9	27.1	27.1	27.1
Antimony	119.5	120.4	120.0	120.
Argon	?	?	39.9?	39.9
Arsenic	74.45	75.0	75.0	75.
Barium	136.4	137.40	137.43	137.4
Bismuth	206.5	208.1	208.0	208.5
Boron	10.9	11.0	10.95	11.
Bromine	79.34	79.95	79.955	79.96
Cadmium	111.55	112.4	112.3	112.4
Caesium	131.9	132.9	132.9	133.
Calcium	39.8	40.1	40.1	40.
Carbon	11.9	12.0	12.001	12.00
Cerium	138.0	139.0	140.	140.
Chlorine	35.18	35.45	35.455	35.45
Chromium	51.7	52.1	52.14	52.1
Cobalt	68.55	59.00	59.00	59.
Columbium	93.0	93.7	94.	94.
Copper	63.1	63.6	63.60	63.6
Erbium	164.7	166.0	166.	166.
Fluorine	18.9	19.05	19.05	19.
Gadolinium	155.8	157.0	156. ?	156.
Gallium	69.5	70.0	70.0	70.
Germanium	71.9	72.5	72.5	72.
Glucinum	9.0	9.1	9.1	9.1
Gold	195.7	197.2	197.3	197.2
Helium	?	?	4.0?	4.
Hydrogen	1.000	1.008	1.0075	1.01
Indium	113.1	114.0	114.	114.
Iodine	125.89	126.85	126.85	126.85
Iridium	191.7	193.1	193.0	193.
Iron	55.5	55.9	55.9	56.

	Clarke. H = 1.	Clarke. O = 16.	Richards.	German.
Krypton	....	....	....	81.8
Lanthanum	137.6	138.6	138.5	138.
Lead	205.36	206.92	206.92	206.9
Lithium	6.97	7.03	7.03	7.03
Magnesium	24.1	24.3	24.36	24.36
Manganese	54.6	55.0	55.02	55.
Mercury	198.50	200.0	200.0	200.3
Molybdenum	95.3	96.0	96.0	96.
Neodymium	142.5	143.6	143.6	143.6
Neon	...	....	....	20.
Nickel	58.25	58.70	58.70	58.7
Nitrogen	13.93	14.04	14.045	14.04
Osmium	189.6	191.0	190.8	191.
Oxygen	15.88	16.000	16.0000	16.00
Palladium	106.2	107.0	106.5	106.
Phosphorus	30.75	31.0	31.0	31.
Platinum	193.4	194.9	195.2	194.8
Potassium	38.82	39.11	39.140	39.15
Praseodymium	139.4	140.5	140.5	140.5
Rhodium	102.2	103.0	103.0	103.
Rubidium	84.75	85.4	85.44	85.4
Ruthenium	100.9	101.7	101.7	101.7
Samarium	149.2	150.3	150.0	150.
Scandium	43.8	44.1	44.	44.1
Selenium	78.6	79.2	79.2	79.1
Silicon	28.2	28.4	28.4	28.4
Silver	107.11	107.92	107.930	107.93
Sodium	22.88	23.05	23.050	23.05
Strontium	86.95	87.60	87.68	87.6
Sulphur	31.83	32.07	32.065	32.06
Tantalum	181.5	182.8	183.	183.
Tellurium	126.5	127.5?	127.5 ?	127.
Terbium	158.8	160.	160.	....
Thallium	202.61	204.15	204.15	204.1
Thorium	230.8	232.6	233.	232.5
Thulium	169.4	170.7	170.?	171.
Tin	118.1	119.0	119.0	118.5
Titanium	47.8	48.15	48.17	48.1
Tungsten	182.6	184.	184.4	184.
Uranium	237.8	239.6	240.	239.5
Vanadium	51.0	51.4	51.4	51.2
Xenon	....	....	....	128.
Ytterbium	171.9	173.2	173.	173.
Yttrium	88.3	89.0	89.0	89.
Zinc	64.9	65.4	65.40	65.4
Zirconium	89.7	90.4	90.5	90.7