SERIES II.

Weight H.	Weight Cl.	Weight HCl.	At. wt. Cl.	Mol. wt. HCl.
0.81608	28.71691	29.53167	35.188	36.187
0.83194	29.28055	30.11207	35.195	36.195
0.39074	13.74926	14.14078	35.187	36.188
0.75560	26.58427	27.33926	35.183	36.182
0.77518	27.26746	28.04110	35.177	36.175
		Mean	35.186	36.185
		Mean of all	35.184	36.183

With H = 1.00762, Cl = 35.452. With H = 1.00787 (Noyes), Cl = 35.461. The authors adopt 35.457 as the most probable value.

Edgar's[1] syntheses of hydrochloric acid were differently conducted. The hydrogen was weighed in palladium, but the chlorine was taken directly in the liquid form, having been prepared by the electrolysis of fused silver chloride. The chlorine was burned at the end of a quartz tip in an atmosphere of hydrogen, and the hydrochloric acid was also weighed. In three experiments the acid was condensed to solid and so weighed; in two others it was weighed after absorption in water. The corrected data are as follows; with H = 1.

Weight H.	Weight Cl.	Weight HCl.	At. wt. Cl.	Mol. wt. HCl.
2.1452	75.5026	77.6469	35.196	36.196
2.0387	71.7504	73.7880	35.194	36.194
1.7762	62.5004	....	35.188	......
1.9935	70.1638	72.1565	35.196	36.196
1.6469	57.9671	....	35.198	......
2.1016	73.9662	....	35.195	......
1.7254	60.7162	62.4401	35.190	36.189
2.0885	73.4991	75.5859	35.192	36.191
		Mean	35.194	36.193

With H = 1.00762, Cl = 35.462 and 35.461, in close agreement with the former work of Dixon and Edgar. This is higher by 0.01 than the determinations of Noyes and Weber.

There is also a preliminary note by Gray[2] on the density and volumetric composition of HCl. Twenty determinations gave for the weight of a normal liter of the gas the value 1.63885 grams. It was then analyzed volumetrically by passage over heated aluminum, and measurement of the volume of hydrogen set free. The ratio thus found is $H_2 \div HCl$ = 1.00790. From these data, combined with Morley's figures for the density and atomic weight of hydrogen, Cl = 35.453. The details of the investigations are yet to be published.

[1] *Phil. Trans.*, **209**, A, 1.

[2] *Proc. Chem. Soc.*, **24**, 215. Additional work on Cl by Guye and Fluss and by Oechsner de Coninck was received too late for use in this year's report.

Silver series.	Gold series.
112.37	112.41
112.56	112.45
112.45	112.65
112.38	112.47
......	112.48
......	112.40
......	112.42
......	112.41

These determinations, as the author admits, are only crude approximations. Still, they have some corroborative significance.

The atomic weight of cadmium has also been determined by Blum,[1] who converted the oxide into the sulphide by heating in a current of hydrogen sulphide. His figures, with vacuum weights, are as follows:

Weight CdO.	Weight CdS.	Atomic weight.
1.80552	2.03108	112.62
0.66349	0.74617	112.88
1.82460	2.05256	112.54
1.88424	2.11974	112.50
3.59206	4.04081	112.55
4.38093	4.92695	112.86

These results are discordant and entitled to very little consideration. Blum also tested several other methods of determination, and found them to be unsatisfactory. When silver was precipitated by cadmium from a nitrate solution, silver nitrite was formed, and the precipitate contained some cadmium.

Bismuth.—Three papers upon the atomic weight of bismuth have been published by Gutbier,[2] in collaboration with Birckenbach, Mehler, and Janssen. The data had previously appeared in Inaugural Dissertations by the three collaborators, and are given in my reports for 1906 and 1907.

Tellurium.—In a paper upon the homogeneity of tellurium Lenher[3] has given one analysis and one synthesis of TeO_2, as follows:

0.85635 TeO_2 gave 0.6845 Te. Hence Te = 127.52.

0.1694 Te gave 0.2119 TeO_2. Hence Te = 127.55.

These figures represent different fractions of the material investigated.

Rhodium.—Hüttlinger,[4] in order to determine the atomic weight of rhodium, reduced chloropentamminrhodium chloride by heating in hydrogen. His figures, which are preliminary in character, are as follows:

[1] *Thesis*, University of Pennsylvania, 1908.

[2] *J. prakt. Chem.*, **77**, 457; **78**, 409 and 421.

[3] THIS JOURNAL, **30**, 741. For a criticism of Marckwald's work on tellurium, see Baker, *Chem. News*, **97**, 209.

[4] Inaugural Dissertation, Erlangen, 1907.

Weight cyanide.	Weight Pd.	Atomic weight.
0.85860	0.47463	106.41
1.19378	0.66002	106.45
1.41818	0.78408	106.45
1.05254	0.58206	106.51
1.39510	0.77153	106.51
1.66196	0.91881	106.42
		Mean, 106.458

The mean of the 15 determinations is Pd = 106.434, when Cl = 35.473, N = 14.01, and H = 1.008. Recalculation with Cl = 35.46 would lower this value slightly.

Uranium.—In two brief notes Oechsner de Coninck[1] has given determinations of the molecular weight of uranous oxide, UO_2. First, by calcination of UO_2Br_2 to UO_2 he obtained values ranging from 271.19 to 274.09. Second, by reducing UO_2Cl_2 in hydrogen he found UO_2 = 270.3, 270.1, and 270.4. Figures of this character are evidently not entitled to serious consideration.

Columbium.—The atomic weight of columbium has been determined by Balke and Smith[2] upon exceptionally pure material. The chloride, $CbCl_5$, was decomposed by water, with the aid of a little nitric acid, and the oxide so produced was finally ignited and weighed. The results, with vacuum weights, and with Cl = 35.45, are as follows:

Weight $CbCl_5$.	Weight Cb_2O_5.	Atomic weight.
9.56379	4.71539	93.49
5.42242	2.65730	93.42
5.15992	2.54364	93.44
9.64854	4.75641	93.44
7.24572	3.57222	93.47
8.00559	3.94746	93.51
9.60763	4.73852	93.58
9.19732	4.53638	93.58
		Mean, 93.50

This value should supplant all the older determinations. With Cl = 35.46, Cb = 93.54.

Europium.—Jantsch[3] has redetermined the atomic weight of europium, by calcination of the octohydrated sulphite, using very pure material furnished by Urbain. The data are subjoined:

Weight sulphate.	Weight oxide.	Atomic weight.
1.3501	0.6455	152.032
1.5054	0.7197	152.009
1.5213	0.7274	152.054
1.2881	0.6159	152.056
		Mean, 152.038

[1] *Bull. Acad. Roy. Belg., Classe des Sciences*, **1907**, 1041, and **1908** (2), 163.

[2] THIS JOURNAL, **30**, 1644.

[3] *Compt. rend.*, **146**, 473.

very pure material, have been made by Thorpe,[1] who measured the ratio between $RaCl_2$ and $2AgCl$. His data are as follows:

Weight $RaCl_2$.	Weight AgCl.	Atomic weight.
0.0627	0.0604	226.8
0.0639	0.0618	225.7
0.0784	0.0753	227.7
	Mean,	226.7

Thorpe regards the atomic weight as now known to within a unit, and notes the agreement between his work and that of Mme. Curie. In order to check his method of determination, which involved the use of very small quantities of material, he made similar analyses of barium chloride and bromide, and obtained results in accord with those of Richards.

Krypton and Xenon.—Moore,[2] from the residues from 120 tons of liquid air, has isolated krypton and xenon in considerable quantities. The densities, referred to O = 16, and the corresponding atomic weights were as follows:

	Kr.	Xe.
Density	41.506	65.35
Atomic weight	83.012	130.70

In this connection it may be stated that Boltwood[3] assigns to his "ionium" an atomic weight of about 230.

Miscellaneous Notes.

The subject of atomic weights in general has been treated by several authors. There is a useful summary by Richards[4] of the Harvard work, and an essay by Lemoine[5] on the unity of matter and the determination of atomic weights. Also a lecture by Jaquerod on modern researches upon atomic weights.[6] Comstock[7] has discussed the variability of these constants, and the evolution and devolution of the elements is considered by A. C. and A. E. Jessup.[8] Bernoulli[9] has attempted to compute the atomic weights on purely theoretical grounds, and so too has Stevens.[10]

On the calculation of atomic weights there are papers by Noyes,[11] Hin-

[1] *Proc. Roy. Soc.*, A, **80**, 298; *Chem. News*, **97**, 229. H. Wilde has argued on theoretical grounds, that Ra = 184. See *Mem. Manchester Lit. Phil. Soc.*, No. 1, 1908, and *Phil. Mag.* [6], **15**, 280, and **16**, 825.

[2] *Proc. Chem. Soc.*, **24**, 273.

[3] *Am. J. Sci.* [4], **25**, 380. A. T. Cameron, in *Science Progress*, **2**, 525, has given estimates of probable atomic weight for a number of radioactive emanations.

[4] *J. Chim. Phys.*, **6**, 92.

[5] *Revue des Questions Scientifiques, Bruxelles* [3], **14**, 182.

[6] *Rev. Gén. des Sciences*, **19**, 443.

[7] *Phil. Mag.* [6], **15**, 12.

[8] *Ibid.*, p. 21.

[9] *Phys. Z.*, **9**, 745.

[10] The Massing of Spheres. London, 1908. Privately published.

[11] THIS JOURNAL, **30**, 4.