Twelfth Report of the Committee on Atomic Weights of the International Union of Chemistry.

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OWING to delays in communication it was impossible for the Committee to publish a report in 1942. The following report therefore covers the two-year period from September 30, 1940, to September 30, 1942. No changes have been made in the table, although the new values for samarium and ytterbium appear to be more reliable than those given in the table.

Carbon.—Murphy and Nier (*Physical Rev.*, 1941, **59**, 771) have determined with a mass spectrometer the abundance ratio of ^{12}C to ^{13}C in carbon from different sources to fall between 88·8 and 93·1, corresponding to the values 12·0117 and 12·0112 for the atomic weight of carbon. Both values support the existing chemical evidence that the atomic weight of carbon is very close to 12·01.

Oxygen.—Murphy (*ibid.*, p. 320) with a mass spectrometer finds the abundance ratio of ^{16}O to that of ^{18}O to be 500 ± 15 to 1. This confirms the value of Smythe, 503 ± 10, and the conversion factor 1·000275.

Fluorine.—Hutchison and Johnston (*J. Amer. Chem. Soc.*, 1941, **63**, 1580) have computed the atomic weight of fluorine from density and *X*-ray data of lithium fluoride and calcite, using the equation

$$\mathrm{LiF} = \left[\frac{\mathrm{CaCO_3} \times d_{\mathrm{LiF}}}{d_{\mathrm{calcite}} \times \phi_{\mathrm{calcite}}} \times R^3\right]$$

where ϕ_{calcite} denotes the volume of a calcite cleavage rhombohedron for which the distance between opposite faces is unity and R denotes the ratio between the true grating spaces for lithium fluoride and calcite.

The following data (20°):

d_{LiF}	2·64030 g./c.c.	Ca	40·075
d_{calcite}	2·71030 g./c.c.	Li	6·939
ϕ_{calcite}	1·09594	C	12·010
R	0·663045		

yield 18·994 for fluorine. If the atomic weight of calcium found by Hönigschmid and Kempter, 40·085, is used, fluorine becomes 18·996.

Zinc.—Hönigschmid and v. Mack (*Z. anorg. Chem.*, 1941, **246**, 363) have compared zinc chloride with silver. The zinc chloride was prepared by the action of hydrogen chloride on metal which had been purified by distillation in high vacuum and had been found by Gerlach by optical spectroscopy to be free from all metallic impurities. Further purification by two distillations in hydrogen chloride followed. Comparison of weighed quantities of the chloride with equivalent weights of silver was made by the conventional nephelometric method and the resulting silver chloride also was weighed. Weights are corrected to vacuum.

The Atomic Weight of Zinc.

Wt. of $ZnCl_2$, g.	Wt. of Ag, g.	$ZnCl_2$: 2Ag.	At. wt. of Zn.	Wt. of AgCl, g.	$ZnCl_2$: 2AgCl.	At. wt. of Zn.
Preliminary Series.						
2·26845	3·59116	0·631676	65·377	4·77125	0·475411	65·383
2·62763	4·15980	0·631672	65·376	5·52705	0·475413	65·374
4·62252	7·31790	0·631673	65·376	9·72300	0·475421	65·377
1·94421	3·07788	0·631672	65·376	4·08936	0·475431	65·380
3·81948	6·04655	0·631679	65·377	8·03341	0·475449	65·385
1·78151	2·82023	0·631690	65·379	3·74741	·0475398	65·370
1·94043	3·07193	0·631665	65·374	4·08179	0·475387	65·367
2·31880	3·67098	0·631657	65·372	4·87719	0·475430	65·382
Average		0·631673	65·376	—	0·475422	65·377
Final Series.						
2·08378	3·29875	0·631692	65·380	4·38304	0·475419	65·376
2·39497	3·79141	0·631684	65·378	5·03743	0·475435	65·391
3·25457	5·15229	0·631675	65·376	—	—	—
2·33816	3·70151	0·631678	65·377	4·91803	0·475426	65·378
2·23578	3·53951	0·631664	65·374	4·70270	0·475425	65·378
2·54724	4·03245	0·631686	65·379	5·35790	0·475418	65·376
2·32850	3·68614	0·631691	65·380	4·89779	0·475418	65·376
2·03634	3·22369	0·631680	65·377	4·28307	0·475439	65·382
Average		0·631681	65·378	—	0·475426	65·378

The average of all the experiments, 65·377, confirms the present value in the International Table, 65·38, but is 0·05 unit higher than that calculated from mass spectroscopic data, 65·33.

Molybdenum.—In the tenth report of the Committee the mean mass number as computed by Aston, 96·03, was stated to be in error. This statement is incorrect, and was due to an oversight of the fact that the summation of the percentages of the isotopes as given by Aston is 99·9 instead of 100. With the packing fraction $- 6{\cdot}0 \times 10^{-4}$ and the conversion factor 1·000275 the atomic weight of molybdenum obtained from Aston's mean mass number is 95·95. A more recent determination of the abundance ratios by Valley (*Physical Rev.*, 1940, **57**, 945) yields 96·00 and 95·92 as the mean mass number and atomic weight respectively, while Hönigschmid and Wittner by analysis of the pentachloride found 95·95.

Samarium.—Hönigschmid and Hirschbold-Wittner (*Z. physikal. Chem.*, 1941, **189**, *A*, 38) have analysed anhydrous samarium trichloride. The samarium material had been purified by Feit and shown by Noddack by *X*-ray analysis to be of atomic weight purity. Further purification consisted of double precipitation of the oxalate followed by ignition to oxide in each case and crystallisation of the chloride from solution saturated with hydrogen chloride at ice temperature. The chloride was dehydrated by heating in a current of dry hydrogen chloride at gradually increasing temperatures, finally at 450°. Fusion was avoided since it was found experimentally that dissociation occurs at temperatures above the melting point. After being weighed, the chloride was dissolved and compared with a nearly equivalent weight of pure silver by the usual nephelometric method and the silver chloride was collected and weighed. Weights are corrected to vacuum.

The Atomic Weight of Samarium.

Wt. of $SmCl_3$, g.	Wt. of Ag, g.	$SmCl_3$: 3Ag.	At. wt. of Sm.	Wt. of AgCl, g.	$SmCl_3$: 3AgCl.	At. wt. of Sm.
			$SmCl_3$ fused in HCl.			
3·27893	4·13279	0·79339	150·403	5·49102	0·59715	150·408
			$SmCl_3$ dried at 450° in HCl.			
3·08886	—	—	—	5·17381	0·59702	150·354
2·96740	3·74054	0·79331	150·375	4·96975	0·59709	150·385
3·87834	4·88888	0·79330	150·372	6·49574	0·59706	150·371
3·37089	4·24914	0·79331	150·376	5·64562	0·59708	150·380
4·40134	5·54798	0·79332	150·380	7·37129	0·59709	150·385
Average	....	0·79331	150·376	—	0·59708	150·375

The average of all determinations, 150·38, is 0·05 unit lower than the present international value, 150·43, which depends on analyses of *fused* chloride by Stewart and James (*J. Amer. Chem. Soc.*, 1917, **39**, 2605) and Owens, Balke and Kremers (*ibid.*, 1920, **42**, 515). Although no change in the table is made at the present time, the new higher value seems to be a more reliable one.

Gadolinium.—Wahl (*Soc. Sci. Fennica, Commentationes Phys.-Math.*, 1941, II, **3**, 1) finds the isotopic constitution of gadolinium to be as follows :

Mass	152	154	155	156	157	158	160
Per cent.	0·2	2·86	15·61	20·59	16·42	23·45	20·87

These figures lead to the atomic weight 157·18 if the packing fraction $- 1{\cdot}5 \times 10^{-4}$ is employed.

Ytterbium.—Hönigschmid and Hirschbold-Wittner (*Z. anorg. Chem.*, 1941, **248**, 72) have compared anhydrous ytterbium trichloride with silver. The starting material had been prepared by v. Bruckl by repeated electrolytic reduction and when subjected to *X*-ray analysis by Noddack was found to contain no other rare earths except lutecium, and this element only to the extent of 0·04%. The effect of this impurity would be to raise the atomic weight by only 0·001 unit. After repeated precipitation as hydroxide and oxalate, with intermediate ignition to oxide, the chloride was prepared and crystallised from a solution saturated with hydrogen chloride at 0°. Dehydration in preparation for weighing was effected by heating in a current of dry hydrogen chloride at gradually increasing temperatures up to 450°. Fusion was avoided since Hönigschmid had already found dissociation of the salt to occur above the melting point. Comparison with silver was effected in the usual way with the help of a nephelometer and the resulting silver chloride was collected and weighed. Weights are corrected to vacuum.

The Atomic Weight of Ytterbium.

Wt. of $YbCl_3$, g.	Wt. of Ag., g.	$YbCl_3$: 3Ag.	At. wt. of Yb.	Wt. of AgCl, g.	$YbCl_3$: 3AgCl.	At. wt. of Yb.
3·87107	—	—	—	5·94071	0·649934	173·108
3·82762	—	—	—	5·88965	0·649889	173·089
4·12899	4·78127	0·863576	173·117	6·35269	0·649959	173·119
2·58325	2·99157	0·863510	173·095	3·97473	0·649918	173·101
2·66672	3·08799	0·863578	173·117	4·10299	0·649946	173·113
2·58988	2·99916	0·863535	173·104	3·98478	0·649943	173·112
2·06819	2·39519	0·863476	173·085	—	—	—
2·42097	2·80349	0·863556	173·100	3·72495	0·649934	173·108
2·08411	2·41356	0·863500	173·092	3·20680	0·649904	173·095
1·72464	1·99732	0·863477	173·085	2·65378	0·649881	173·085
3·12912	3·62361	0·863537	173·089	4·81490	0·649883	173·086
3·92599	4·54636	0·863546	173·107	6·04062	0·649932	173·107
4·98554	5·77369	0·863493	173·090	7·67151	0·649877	173·083
Average		0·863526	173·098	—	0·649916	173·100

The average, 173·10, is 0·06 unit higher than that found by Hönigschmid and Striebel (*Z. anorg. Chem.*, 1933, **212**, 385) with less pure material isolated by Prandtl. The new, higher value is evidently to be preferred although Wahl (*Naturwiss.*, 1941, **29**, 536) by determination of isotopic abundances obtains the lower figure.

Mass	168	170	171	172	173	173	174	176
Per cent.	0·06	4·21	14·26	21·49	17·02	17·02	29·58	13·38