Vol. XXIX. MARCH 1907 No. 3.

THE JOURNAL

OF THE

American Chemical Society

FOURTEENTH ANNUAL REPORT OF THE COMMITTEE ON ATOMIC WEIGHTS. DETERMINATIONS PUBLISHED DURING 1906.

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Received January 18, 1907.

During 1906 there was a remarkable activity among the workers upon atomic weights, and many new determinations were published. Brief summaries of the new data are given in the following pages.

Nitrogen.

Three papers on the atomic weight of nitrogen have appeared during 1906, but they are essentially critical and contain no new determinations. First, Guye[1] has summed up all the recent work upon this constant, and shown that it cannot vary much from 14.01. Gray[2] has subjected Stas' determinations to a searching criticism, and has attempted to discover their possible source of error. Various alternatives are suggested, but no definite conclusion is reached. Scott[3] has rediscussed his old analyses[4] of ammonium chloride and bromide, which were discordant, and finds that upon applying the new value for chlorine to them, ($Cl = 35.473$) the disagreement vanishes. On this basis his figures give, from NH_4Br, $N = 14.010$, and from NH_4Cl, $N = 14.013$. These figures are in harmony with the modern physico-chemical determinations.

Silver.

The accepted value for the atomic weight of silver rests upon analyses of chlorates, bromates and iodates, and upon the ratios between the figures thus obtained for the halides, and the ratios of the latter to silver. The chief pair of ratios is that of $KClO_3 : KCl$, and $KCl : Ag$, from which, when $O = 16$, $Ag = 107.927$.

[1] Ber. 39, 1470

[2] J. Chem. Soc., 89, 1173.

[3] Proc. Chem. Soc., 21, 300.

[4] J. Chem. Soc., 79, 147.

The potassium chlorate ratio has now been reinvestigated by Guye and Ter Gazarian,[1] who find that the crystallized salt contains a constant impurity of KCl, amounting to 2.7 parts in 10000. This contamination was overlooked by Stas, and when it is taken into account, the atomic weight of silver is reduced to 107.879.

With this datum, the modern atomic weights for nitrogen and carbon, and Dixon and Edgar's value for chlorine, the authors have recomputed the atomic weight of silver from data already existing. The results of the recalculation are as follows :

Ag : $AgNO_3$,	Ag = 107.882
Ag : Ag $C_2H_3O_2$,	107.886
Ag : Ag $C_7H_6O_2$,	107.888
Ag : NH_4Cl,	107.871
Ag : Cl,	107.895
N_2O_5 : Cs_2O and Ag : CsCl,	107.885
N_2O_5 : K_2O and Ag : KCl,	107.901
$KClO_3$: KCl and Ag : KCl,	107.879
Ag ClO_3 : Ag Cl and Cl : H,	107.908
Ag ClO_3 : AgCl and Ag : Ag Cl,	107.905
	Mean, Ag = 107.890.

The concordance of these values is most striking, and the argument for a lower atomic weight for silver is very strong.

In another paper, discussing some of the same evidence, Guye[2] has pointed out the necessity for a general revision of the atomic weights, upon the basis of modern physico-chemical data. He also calls attention to the remarkable experiments of Landolt and others, on apparent changes of weight during chemical reactions, and shows that in any general discussion of atomic weights, investigations of that order should be taken into account.

Chlorine.

Guye and Ter Gazarian[3] have determined the density of HCl. At 0°, 760 mm., sea level, and lat. 45°, one litre of the gas weighs, in grams.

1.6404
1.6397
1.6389
1.6401

Mean, 1.6398

Reducing this value by means of the critical constants, the authors find Cl = 35.461. This agrees closely with the gravimetric determination of Dixon and Edgar.

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[1] Compt. rend., 143, 411.

[2] J. chim. phys., 4, 174.

[3] Compt. rend., 143, 1233.

Bromine.

The atomic weight of bromine, referred to Ag = 107.93 and Cl = 35.473, has been carefully redetermined by Baxter.[1] First, the ratio Ag: AgBr was measured. The data are given below, with weights reduced to a vacuum.

Weight Ag.	Weight Ag Br.	At. Wt. Br.
4.71853	8.21363	79.946
5.01725	8.73393	79.952
5.96818	10.38932	79.953
5.62992	9.80039	79.951
8.13612	14.16334	79.954
5.07238	8.82997	79.954
4.80711	8.36827	79.956
4.27279	7.43776	79.947
5.86115	10.20299	79.953
7.91425	13.77736	79.958
6.40765	11.15468	79.959
6.38180	11.10930	79.952
6.23696	10.85722	79.953
9.18778	15.99392	79.953
8.01216	13.94826	79.953
10.48638	18.25452	79.953
8.59260	14.95797	79.954
8.97307	15.62022	79.953
	Mean,	79.953

Secondly, silver bromide was transformed into chloride, by heating in a current of chlorine. The corrected data are as follows:

Weight AgBr.	Weight AgCl.	At. Wt. Br.
8.03979	6.13642	79.953
8.57738	6.54677	79.952
13.15698	10.04221	79.952
12.71403	9.70413	79.952
13.96784	10.66116	79.951
13.08168	9.98469	79.953
12.52604	9.56059	79.953
11.11984	8.48733	79.952
8.82272	6.73402	79.953
11.93192	9.10721	79.951
12.53547	9.56767	79.955
17.15021	13.09009	79.952
10.31852	7.87572	79.952
	Mean,	79.952

The value Br = 79.953 is the one finally adopted.

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[1] This Journal 28, 1322.

Iodine.

The electrochemical equivalent of iodine has been measured by Gallo.[1] Iodine was liberated electrolytically from a solution of potassium iodide, and determined by titration with sodium thiosulphate. In the same circuit silver was deposited in a silver voltameter. The equivalent weights, reduced to a vacuum, and with values for I referred to Ag = 107.93, are given below.

Weight Ag.	Weight I.	At. Wt. I.
0.18054	0.21230	126.92
0.21360	0.251309	126.98
0.23103	0.27181	126.90
0.24005	0.28213	126.85
0.15454	0.18167	126.85
0.2597	0.30515	126.82
0.16229	0.19080	126.89
0.300988	0.35411	126.98
0.26819	0.31528	126.88
0.25877	0.30425	126.90
0.24422	0.28703	126.85
0.20838	0.24516	126.92
0.25047	0.29445	126.88
0.20266	0.23826	126.89
0.18316	0.21533	126.89
0.27278	0.43809	126.84
0.28221	0.33207	126.90
0.2582	0.30356	126.89
0.33963	0.39923	126.88
0.33461	0.39345	126.91
0.3360	0.39502	126.89
0.37025	0.43526	126.88
0.30824	0.36233	126.87
0.36390	0.42789	126.91
	Mean,	126.89

The values found are not very concordant, and the determination can hardly be given much weight when compared with the recent measurements by Baxter.

Potassium.

The ratios connecting potassium chloride with silver and silver chloride have been redetermined by Richards and Staehler[2]. The data are as follows, with vacuum weights:

First, Ag : KCl : : 1 : x

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[1] Gazz. chim. ital., 36, 116.

[2] Ber. 39, 3611.

Weight KCl.	Weight Ag.	Ratio.
2.35178	3.40295	0.681100
1.97348	2.85582	0.691038
3.88074	5.61536	0.691094
7.44388	10.77156	0.691068
5.00681	7.24514	0.691058
5.04833	7.30515	0.691065
8.19225	11.85412	0.691089
4.99795	7.23230	0.691060
5.16262	7.47042	0.691075
		Mean, 0.691072

Hence, if Ag = 107.93 and Cl = 35.473, K = 39.114. The first two experiments are regarded as preliminary.

Second, AgCl : KCl : : 1 : x

Weight KCl.	Weight AgCl.	Ratio.
* 3.88672	7.47271	0.520122
* 3.47292	6.67680	0.520147
* 8.75449	16.83071	0.520150
4.36825	8.39858	0.520118
5.56737	10.70384	0.520128
6.41424	12.33228	0.520120
3.27215	6.29126	0.520110
4.83028	9.28702	0.520111
		Mean of last 5, 0.520118

Hence K = 39.114.

* Preliminary determinations, not included in the mean.

Sodium.

Incidentally to a paper upon the transition temperature of sodium bromide, Richard and Wells[1] give two determinations of the ratio Ag Br : Na Br : : 1 : X. The data with vacuum weights, are—

Weight NaBr.	Weight AgBr.	Ratio.
5.49797	10.03253	0.54814
3.64559	6.65248	0.54805

If Ag = 107.93 and Br = 79.955, Na = 23.008 ; a value in agreement with that previously found from analyses of sodium chloride.

Manganese.

Baxter and Hines[2] have revised the atomic weight of manganese, through analyses of the chloride and bromide. The data with reference to the chloride are as follows ;

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[1] Pr. Am. Acad., 41, 443.

[2] This Journal, 28, 1560.

Weight $MnCl_2$.	Weight AgCl.	Weight Ag.	At. Wt. Mn.	
			AgCl ratio.	Ag. ratio.
4.62970	10.54641	7.93740	54.957	54.960
3.52899	8.03868	6.05041	54.962	54.958
3.30881	7.53731	5.67279	54.959	54.960
3.56843	8.12932	6.11818	54.950	54.955
3.45083	7.86129	5.91637	54.952	54.958
4.47948	10.20372	7.67995	54.963	54.959
3.92089	8.93140	6.72227	54.962	54.958
		Mean,	54.958	54.958

All weights are reduced to a vacuum, and computations were based upon Ag = 107.93 and Cl = 35.473. The bromide series gave the following results, when Br = 79.953.

Weight $MnBr_2$.	Weight AgBr.	Weight Ag.	At. Wt. Mn.	
			AgBr ratio.	Ag ratio.
5.58416	9.76561	....	54.964	......
5.63432	9.85345	....	54.961	......
6.53738	11.43300	6.56755	54.957	54.962
4.81005	8.41206	4.83238	54.959	54.957
4.88097	8.53642	4.90354	54.950	54.960
5.63219	9.85008	5.65813	54.954	54.964
6.52626	11.41293	....	54.968	......
5.79924	10.14206	5.82600	54.957	54.963
3.59809	6.29271	3.61478	54.952	54.957
5.16334	9.02959	5.18711	54.966	54.965
3.92226	6.85968	3.94042	54.951	54.959
4.49158	7.85571	4.51250	54.942	54.953
3.60071	6.29740	3.61736	54.949	54.960
4.77392	8.34915	4.79620	54.951	54.951
3.57660	6.25569	3.59319	*54.933	54.957
5.69972	9.96840	5.72641	54.947	54.948
6.58983	....	6.62041	......	54.957
4.19911	....	4.21839	......	54.967
	Mean, rejecting the starred value,		54.955	54.959

Mean of both series, 54.957.

Cobalt.

The determinations by Baxter and Coffin[1] of the atomic weight of cobalt are based upon analyses of the chloride. The data are subjoined, with corrected weights, and reduced with Ag = 107.93 and Cl = 35.473.

Weight $CoCl_2$.	Weight AgCl.	Weight Ag.	At. Wt. Co.	
			Ag Cl ratio.	Ag ratio.
1.09959	2.42676	1.82671	59.009	58.991
1.47733	3.26095	2.45398	58.988	59.005
3.84133	8.47735	6.38081	59.014	59.005
2.96315	6.54019	4.92244	58.997	58.995
3.48418	7.69084	5.78815	58.986	58.991
3.29523	7.27284	5.47410	59.002	58.995
1.57655	3.48012	2.61905	58.982	58.992
3.64342	....	6.05232	......	58.999
		Mean,	58.997	58.997

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[1] This Journal, 28, 1560.

Hence Co. varies from the round number 59, only within the limits of experimental uncertainty.

Copper.

In order to determine the atomic weight of Copper, Murmann[1] made a series of experiments upon the oxidation of the metal, by prolonged heating in a stream of air, followed by a series of reductions in hydrogen of the oxide so formed. His results range from Cu = 63.513 to Cu = 64.397, and are therefore too discordant to have much significance. The best determinations ran from 63.513 to 63.560, the value 63.53 being regarded by Murmann as the most probable. The individual data are given so confusedly that it is not desirable to attempt their reproduction here.

Cadmium.

The paper on cadmium by Baxter, Hines and Frevert[2] is a continuation of a research which was published last year. Analyses of the bromide gave the following results, when Ag = 107.93 and Br = 79.955.

Weight $CdBr_2$.	Weight AgBr.	Weight Ag.	At. Wt. Cd. Ag Br ratio.	At. Wt. Cd. Ag ratio.
11.46216	15.81319	9.08379	112.466	112.468
6.82282	9.41267	5.40724	112.469	112.461
6.75420	9.31830	5.35277	112.460	112.465
7.08588	9.77649	5.61597	*112.444	*112.449
5.13859	7.08933	4.07226	112.461	112.473
5.84324	8.06130	4.63072	112.467	112.471
5.99704	8.27360	4.75259	112.463	112.472
5.90796	8.15070	4.68200	112.463	112.472
	Mean, rejecting the starred values,		112.464	112.467

New analyses of the chloride gave data as follows, when Cl = 35.473.

Weight $CdCl_2$.	Weight AgCl.	Weight Ag.	At. Wt. Cd. AgCl ratio.	At. Wt. Cd. Ag ratio.
5.62500	....	6.61193	....	112.472
6.81031	10.64918	8.01496	112.471	112.470
5.50089	8.60174	6.47393	112.469	112.470
6.11750	9.56590	....	112.470	....
		Mean,	112.470	112.471

The final conclusion is that Cd = 112.47. All weights were reduced to a vacuum.

Tellurium.

The investigation by Norris[3] was primarily to determine the definiteness of tellurium as an element, by fractional processes which would prove the presence or absence of any other substance, such as the hy-

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[1] Monatsh., **27**, 351.

[2] This Journal, **28**, 770.

[3] This Journal, **28**, 1675.

pothetical "dvitellurium" of Mendeleef. The integrity of the element having been established, the atomic weight determinations followed. The basic nitrate, $2TeO_2.HNO_3$, dried at 140° in a current of dry air, was decomposed by heating gradually, at last to 400°–450°. The weights thus obtained, are given below. The atomic weight, reduced to a vacuum standard, was computed with H = 1.0076, and N = 14.01.

Weight nitrate.	Weight TeO_2.	At. Wt. Te.
2.28215	1.90578	127.47
2.35429	1.96615	127.53
1.86853	1.56042	127.49
1.77348	1.48110	127.49
2.31048	1.92938	127.44
2.14267	1.78936	127.50
2.35523	1.96676	127.45
2.18860	1.82780	127.54
3.29158	2.74881	127.50
2.27516	1.89993	127.46
2.53164	2.11410	127.46
2.01327	1.68121	127.45
	Mean,	127.48

Without reduction to vacuum and with N = 14.04, Te = 127.64. Köthner, under these conditions, found Te = 127.63, and his data, reduced, became Te = 127.47. The two series of determinations are therefore in good accord; but differ materially from recent measurements by other methods, which agree in making Te = 127.60. The cause of this difference is unexplained.

Bismuth.

In the report for 1905, a dissertation by Birckenbach was noticed, which contained determinations of atomic weight made under the direction of Gutbier at Erlangen. Two more dissertations from the same laboratory have since appeared, giving additional determinations by other methods.

Mehler[1] determined the ratio between bismuth bromide and silver bromide. The results obtained, with vacuum weights, are subjoined. The computation was based upon Br = 79.96, Ag = 107.934.

Weight $BiBr_3$.	Weight Ag Br.	At. Wt. Bi.
3.77071	4.74323	208.24
4.37676	5.50932	207.92
8.64088	4.58160	208.05
4.57894	5.76183	208.08
4.53204	5.70410	207.89
2.85054	3.58682	208.10
4.58310	5.76618	208.14
6.47910	8.15465	207.99
	Mean,	208.05

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[1] Doctoral Dissertation, Erlangen, 1905.

In the other investigation, by Janssen,[1] the synthesis of bismuth sulphate from the metal was effected. The metal was first dissolved in nitric acid, and then treated with sulphuric acid, with various precautions which cannot be discussed here. The final data are as follows, reduced with S = 32.06.

Weight Bi.	Weight sulphate.	At. Wt. Bi.
2.4045	4.0706	207.951
2.41900	4.09445	208.040
2.20280	3.72745	208.178
2.57206	4.35444	207.928
5.79241	9.79987	208.266
3.65233	6.18143	208.082
		Mean, 208.074.

Although the data given by Mehler and Janssen are by no means sharply concordant, they corroborate the results obtained by Birckenbach, and agree with the earlier determinatious of Löwe, Schneider and Marignac. For practical purposes the even value Bi = 208 may be employed.

Palladium.

In order to determine the atomic weight of palladium, Krell[2] reduced weighed quantities of palladosamine chloride, $PdN_2H_6Cl_2$, by heating in hydrogen. The reduced palladium was afterwards heated in a stream of carbon dioxide, in order to free it from occluded hydrogen. The data given are as follows, with vacuum weights.

Weight chloride.	Weight Pd.	Percent. Pd.	At. Wt. Pd.
1.83034	0.92197	50.372	106.59
1.73474	0.87433	50.401	106.72
1.92532	0.96524	50.396	106.72
2.63544	1.32868	50.416	106.78
3.23840	1.63175	50.387	106.66
		Mean,	106.694

If the first experiment is rejected, this becomes 106.72. The atomic weights used were those of the International Committee for 1906.

Tantalum.

Hinrichsen and Sahlbom[3] have determined the atomic weight of tantalum, by oxidizing the metal to pentoxide. The metal was obtained from Siemens and Halske, and contained no appreciable impurity. The oxidation was effected by direct heating in oxygen. The results obtained, with vacuum weights, and with O = 16, were as follows:

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[1] Doctoral Dissertation, Erlangen, 1906.

[2] Doctoral Dissertation, Erlangen, 1906.

[3] Ber. 39, 2600.

Weight Ta.	Weight Ta_2O_5.	At. Wt. Ta.
0.37200	0.45437	180.65
0.41278	0.50364	181.77
0.33558	0.40975	180.98
0.35883	0.43807	181.14
0.47554	0.58087	180.59
	Mean,	181.03

From the sum of the weights the authors deduce Ta = 180.98, or 181 in round numbers. Potassium tantalifluoride was investigated, and found to be unsuitable for good atomic weight determinations.

The Rare Earths.

During 1906 an unusual number of determinations have been published, relative to the atomic weights of the rare earth metals. First, Urbain[1] has made a good determination of the atomic weight of terbium, by estimating the amount of water in the octohydrated sulphate. The amount of oxide was not determined, because the product obtained on igniting the sulphate varied in composition. The data are subjoined :

Weight octohydrate.	Anhydrous sulphate.	At. Wt. Tb.
2.0407	1.6489	159.20
1.9626	1.5859	159.30
2.2580	1.8245	159.19
2.2385	1.8087	159.17
2.0037	1.6190	159.19
	Mean,	159.22

Calculated with H = 1.007 and S = 32.06. Hinrichs[2], rediscussing these data, argues in favor of Tb = 159.

Two series of determinations, by Urbain and Demenitroux[3], relate to dysprosium. They represent different fractions of the material studied, and were obtained by the ignition of the octohydrated sulphate.

First Series.

Weight sulphate.	Weight Dy_2O_3.	At. Wt. Dy.
1.1966	0.8359	162.61
2.0926	1.0301	162.29
1.8415	0.9069	162.45
1.5519	0.7649	162.75
2.4955	1.2296	162.64
1.8130	0.8927	162.39
	Mean,	162.52

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[1] Compt. rend., **142**, 957.

[2] Compt. rend., **143**, 1196.

[3] Compt. rend., **143**, 598. Preliminary in C. R. **142**, 727.

Second Series.

Weight sulphate.	Weight Dy_2O_3.	At. Wt. Dy.
1.8817	0.9271	162.61
1.1164	0.5500	162.59
1.7308	0.8528	162.63
2.6038	1.2820	162.36
1.6942	0.8346	162.56
2.1776	1.0726	162.52
	Mean,	162.54

This paper was followed by a communication from Hinrichs[1], who attempts to show that Dy = 162.5 exactly.

O. Holmberg[2], in a doctoral dissertation, has given a series of determinations of the atomic weight of neodymium. The data, representing syntheses of the sulphate from the oxide, are subjoined:

Weight Nd_2O_3.	Weight $Nd_2(SO_4)_3$.	At. Wt. Nd.
0.9692	1.6618	144.05
0.6584	1.1287	144.12
1.0292	1.7643	144.13
1.0118	1.7346	144.10
0.5518	0.9462	144.01
0.5345	0.9164	144.07
	Mean,	144.08

Feit and Przibylla[3], by a special volumetric method, have redetermined the atomic weights of several rare-earth metals. The oxides were dissolved in definite, weighed quantities of half-normal sulphuric acid, and the slight excess of the latter was determined by titration with a decinormal solution of sodium carbonate. From the amount of acid required to form neutral salts, the authors compute the amount of oxygen in the oxides, and thence deduce the atomic weight of the elements. The data, somewhat condensed from the original, are as follows.

Lanthanum	Weight La_2O_3.	Oxygen.	At. Wt. La.
	0.5125	0.07544	139.05
	0.5256	0.07731	139.11
	0.4835	0.07116	139.08
	0.5235	0.07706	139.04
	0.4815	0.07088	139.03
	0.5156	0.07585	139.15
	0.5348	0.07867	139.15
		Mean,	139.09

Reduced to a vacuum standard, La = 139.17.

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[1] Compt. rend., **143**, 1143.

[2] Akademisk Afhandling, Upsala, 1906.

[3] Z. anorg. Chem. **50**, 249.

Praseodymium

Weight Pr_2O_3.	Oxygen.	At. Wt. Pr.
0.54010	0.07879	140.51
0.53240	0.07789	140.60
0.50054	0.07302	140.51

Mean, 140.54

With vacuum weights 140.62

Neodymium

Weight Nd_2O_3.	Oxygen.	At. Wt. Nd.
0.5380	0.07661	144.54
0.5388	0.07675	144.48
0.5358	0.07632	144.49
0.5265	0.07497	144.56

Mean, 144.52

With vacuum weights, 144.60

Samarium

Weight Sa_2O_3.	Oxygen.	At. Wt. Sa.
0.5576	0.07668	150.53
0.5576	0.07670	150.47
0.5583	0.07684	150.38
0.5633	0.07747	150.51

Mean, 150.47

With vacuum weights, 150.56

Europium

Weight Eu_2O_3.	Oxygen.	At. Wt. Eu.
0.3961	0.05835	152.54
0.4096	0.05566	152.62
0.4115	0.05594	152.56

Mean, 152.57

With vacuum weights, 152.66

Gadolinium

Weight Gd_2O_3.	Oxygen.	At. Wt. Gd.
0.3852	0.05097	157.37
0.3956	0.05234	157.40

Mean, 157.38

With vacuum weights, 157.47

Ytterbium

Weight Yb_2O_3.	Oxygen.	At. Wt. Yb.
0.6424	0.07808	173.46
0.6408	0.07783	173.60
0.6403	0.07779	173.55
0.6466	0.07858	173.48

Mean, 173.52

With vacuum weights, 173.52

Yttrium Two sets of determinations were made on two different preparations. They are here treated as one.

Weight Yt_2O_3.	Oxygen.	At. Wt. Yt.
0.3677	0.07781	89.42
0.4928	0.10438	89.31
0.3660	0.07749	89.36
0.3660	0.07751	89.33
0.3704	0.07840	89.39
0.3635	0.07701	89.29

Mean, 89.35

With vacuum weights, 89.40

In Abegg's "Handbuch der anorganischen Chemie," a series of excellent summaries of atomic weight determinations, written by Brauner, has appeared. In the sections relative to the rare earth metals Brauner[1] gives some previously unpublished data of his own, which can be briefly summarized as follows :

Praseodymium. Atomic weight determined by four methods.

First, reduction of the octohydrated sulphate to oxide.

Weight Sulphate.	Weight Oxide.	At. Wt. Pr.
1.29269	0.59747	141.13
1.27990	0.59137	141.04
	Mean,	141.09

Second, analysis of the anhydrous sulphate.

Weight Sulphate.	Weight Oxide.	At. Wt. Pr.
1.03242	0.59747	140.96
1.02193	0.59137	140.94
	Mean,	140.95

Third, synthesis of the sulphate from the oxide.

Weight Oxide.	Weight Sulphate.	At. Wt. Pr.
0.73359	1.26782	140.91
0.64871	0.12059	141.09
0.74103	1.28051	140.96
0.72894	1.25792	140.92
0.36559	0.63350	140.94
0.82769	1.43024	140.96
	Mean,	140.96

Fourth, analysis of the oxalate. The Pr_2O_3 in each sample of the oxalate was determined, and also, volumetrically, by titration with potassium permanganate, the amount of C_2O_3. The *mean* results are given below, for four different samples of oxalate

Percent. Pr_2O_3.	Percent. C_2O_3.	At. Wt. Pr.
45.183	29.581	140.96
45.090	25.517	140.98
45.0775	29.493	141.07
45.136	29.5635	140.89
	Mean,	140.98

Brauner regards Pr = 140.96 as the best value for Pr, which may be rounded off to 141.0.

Neodymium. Three syntheses of the sulphate are given, from different samples of the oxide. The last one, which Brauner regards as trustworthy, is as follows: 0.93788 grm. Nd_2O_3 gave 1.60873 $Nd_2(SO_4)_3$. Hence Nd = 143.89.

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[1] Band 3, Abth. 1, pp. 263, 276, 284, 304, 318, 335.

Samarium. Analysis of the sulphate.

1.36567 grm. $Sa_2(SO_4)_3.8H_2O$, gave 1.09770 $Sa_2(SO_4)_3$. $Sa = 150.76$.
1.09770 $Sa_2(SO_4)_3$ gave 0.65046 Sa_2O_3. $Sa = 150.66$.
Mean, 150.71. As the material was not entirely free from europium this value is too high.

Gadolinium. 0.88884 Gd_2O_3 gave 1.48257 $Gd_2(SO_4)_3$ and 1.83903 $Gd_2(SO_4)_3.8H_2O$. Hence $Gd = 155.78$, which is somewhat too low.

Erbium. 1.09395 Er_2O_3 gave 2.53997 $Er_2(SO_4)_3$. $Er = 167.14$..

Ytterbium. 1.067279 Yb_2O_3 gave 2.69209 $Yb_2(SO_4)_3$. $Yb = 173.08$.

Baxter and Griffin[1] have shown that the oxalates of the rare earths, under certain conditions, carry down ammonium oxalate. This possibility should be borne in mind in any determination of atomic weights by the oxalate method.

Wyrouboff and Verneuil[2] in a long paper upon cerium, reproduce their determinations of 1897, and defend them against criticisms. No new determinations are given.

Some additional information upon thorium, berzelium and carolinium has been published by Baskerville[3]. The report is one of progress, without final results.

Miscellaneous Notes.

Bradbury[4] has pointed out certain relations between the atomic weights of several elements, but his results do not seem to have any great importance. There is also a memoir by Hinrichs[5] in which he reiterates his well known views in favor of whole-number atomic weights, and criticizes the modern determinations.

[CONTRIBUTION FROM THE COMMITTEE ON UNIFORMITY IN
TECHNICAL ANALYSIS III].

REPORT OF THE SUB-COMMITTEE ON ZINC ORE ANALYSIS.[6]

BY GEO. C. STONE AND W. GEO. WARING.

Received January 6, 1907.

In 1903 your Committee prepared three samples of zinc ore: A, a pure blende from Joplin. B, a mixture of franklinite, willemite, calcite, etc., from Franklin, N. J., and C, an impure blende from Colorado containing a good deal of iron, copper and lead. These were analyzed by forty-two chemists, and the results reported to the New York Section in 1904

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[1] This Journal, **28**, 1684.

[2] Ann. chim. phys., (8) **9**, 349.

[3] 4th Ann. Rep. Carnegie Institution, p. 136; and 5th Rep. p. 144.

[4] Chem. News, **94**, 157 and 245.

[5] Chem. Cent., 1906, I. 197. Abstract from the Moniteur Scientifique, which I have not seen.

[6] Read at the New York Meeting of the American Chemical Society.