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

THE following report of the Committee covers the twelve-month period, September 30, 1931, to September 30, 1932.*

Two changes in the table of atomic weights are recommended, from 138·90 to 138·92 in the case of lanthanum and from 126·932 to 126·92 in the case of iodine.

PHYSICO-CHEMICAL METHODS.

CARBON.—Moles and Salazar (*Anales Soc. Espan. Fís. Quím.*, 1932, **30**, 182) have determined the normal density of carbon monoxide prepared by four methods: (1) reaction of sodium formate with phosphorus pentoxide, (2) dehydration of formic acid with phosphorus pentoxide, (3) dehydration of formic acid with concentrated sulphuric acid, (4) reaction of potassium ferrocyanide with concentrated sulphuric acid. In each case the gas was subjected to chemical purification and then was fractionally distilled.

The Density of Carbon Monoxide.

	Preliminary Series.		
Method.	Globe N-2. 608·87 ml.	Globe G. 987·52 ml.	Average.
1	1·25058	1·25006	1·25032
2	1·25076	1·24984	1·25030
	1·25013	1·24986	1·24999
	1·25130	1·25018	1·25074
	1·25105	1·25024	1·25064
	1·25073	1·25027	1·25005
	(1·25124)	(1·25081)	(1·25102)
	1·25095	1·25090	1·25092
	1·25019	1·24945	1·24982
Average	1·25073	1·25011	1·25042

	Final Series.		
Method.	Globe N. 992·04 ml.	Globe G. 987·52 ml.	Average.
2	1·24953	1·24980	1·24966
	1·25000	1·25053	1·25026
	1·24941	1·24992	1·24966
	1·24953	1·25046	1·24999
Average	1·24962	1·25018	1·24989
3	1·24920	1·24959	1·24939
	1·24972	1·25039	1·25005
	1·25179	1·25067	1·25123
	1·25003	1·25109	1·25056
	1·25061	1·24997	1·25029
	1·24930	1·25019	1·24974
	1·25029	1·24973	1·25001
Average	1·25013	1·25023	1·25018
4	1·24966	1·25056	1·25011
	1·24968	1·25105	1·25036
Average	1·24967	1·25081	1·25023
Average of all	1·24990	1·25030	1·25010

This result is in exact agreement with that previously found by Pire and Moles. With the values 22·414 and 1·0050 for R and $1 + \lambda$ respectively the atomic weight of carbon is calculated to be 12·006. Because of the small coefficient of deviation from Boyle's law, carbon monoxide is as well suited for precise molecular weight determination as the permanent gases, so that this result may be accepted as valuable addition to the evidence which has been accumulating recently that the atomic weight of carbon is somewhat higher than 12·00.

NITROGEN.—Batuecas (*J. Chim. phys.*, 1931, **28**, 572; *Anales Soc. Espan. Fís. Quím.*, 1931, **29**, 538) has continued the investigation on nitrous oxide, previously reported, by determination of the density at pressures below one atmosphere. The gas was prepared (1) by the reaction of hydroxylamine hydrochloride and sodium nitrite, (2) by the decomposition of ammonium nitrate. Chemical purification was followed by condensation and fractional distillation. The values given in the following table are referred to one atmosphere without correction for the deviation from Boyle's law.

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* Authors of papers bearing on the subject are requested to send copies to each of the five members of the Committee at the earliest possible moment.

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The Density of Nitrous Oxide.

P = 506·67 mm.

Method.	Globe G. 1007·55 ml.	Globe N-3. 772·58 ml.	Average.
1	1·9749	1·9741	1·9745
1	1·9750	1·9744	1·9747
1	1·9743	1·9746	1·9745
Average	1·9747	1·9744	1·9746
2	1·9744	1·9744	1·9744
2	1·9738	1·9745	1·9741
2	1·9745	1·9758	1·9751
Average	1·9742	1·9749	1·9745

P = 380 mm.

Method.	Globe G. 1007·55 ml.	Globe N-3. 772·58 ml.	Average.
1	1·9723	1·9721	1·9722
1		1·9719	1·9719
1		1·9706	1·9706
1	1·9724	1·9724	1·9724
Average	1·9724	1·9718	1·9718
2	1·9718	1·9719	1·9718
2	1·9726	1·9730	1·9728
2	1·9722	1·9730	1·9726
Average	1·9722	1·9726	1·9724

P = 253·33 mm.

Method.	Globe G. 1007·55 ml.	Globe N-3. 772·58 ml.	Average.
1	1·9695	1·9701	1·9698
1	1·9685	1·9700	1·9692
1		1·9677	1·9677
1	1·9691	1·9691	1·9691
Average	1·9690	1·9622	1·9690
2	1·9701	1·9698	1·9700
2	1·9691	1·9701	1·9696
2		1·9700	1·9700
Average	1·9696	1·9700	1·9699

The limiting density is calculated on the assumption that a linear relation holds between pressure and density referred to one atmosphere.

Pressure (atmospheres).	Density.	Limiting density.	$1 + \lambda$.
1	1·9804		
2/3	1·9746	1·9630	1·0086
1/2	1·9722	1·9640	1·00835
1/4	1·9694	1·9639	1·00840
	Average	1·9636	1·00854

The calculation of $1 + \lambda$ by linear extrapolation of values for PV found from the expression $L_1/L_p\frac{P_1}{P}$ gave the following result :

Pressure (atmospheres).	PV.	$1 + \lambda$.
1	1·00000	
2/3	1·00294	1·00882
1/2	1·00416	1·00832
1/3	1·00559	1·00839
	Average	1·00851

With the values 1·9804, 22·414, and 1·0085 for the density at one atmosphere, R and $1 + \lambda$ respectively, the molecular weight of nitrous oxide is found to be 44·014 and the atomic weight of nitrogen 14·007.

In an article devoted chiefly to criticism of the report of this Committee for 1931, Moles (*Anales Soc. Espan. Fis. Quim.*, 1932, **30**, 460) applies corrections to the above results (1) for diminution in volume of the globes when filled at low pressures and (2) for adsorption as found by Crespi in work as yet unpublished.

The corrected figures are as follows :

Pressure (atmospheres).	Density.	Limiting density.	$1 + \lambda$.	N_2O.
1	1·98034			
2/3	1·97459	1·96309	1·00880	44·001
1/2	1·97223	1·96412	1·00829	44·023
1/3	1·96946	1·96402	1·00833	44·022
	Average	1·96364	1·00845	44·016

Whence N = 14·0078.

FLUORINE.—Moles (*J. Chim. phys.*, 1932, **29**, 53; *Nature*, 1931, **128**, 966) discusses critically earlier determinations of the atomic weight of fluorine with the final conclusion that the atomic weight of this element is very close to integral, 19, and suggests that the higher value recently found by Patterson, Whytlaw-Gray, and Cawood, through the density of methyl fluoride, is due to the effect of impurity of methane in the methyl fluoride employed by the latter. Patterson, Whytlaw-Gray, and Cawood (*Nature*, 1932, **129**, 245; *J. Chem. Soc.*, 1932, 2180) have prepared methyl fluoride by their own (Collie's) method (pyrolysis of tetramethylammonium fluoride) and that of Moles and Batuecas (action of potassium methyl sulphate on potassium fluoride) and found that the two samples had identical critical constants within the error of the experiments. A direct determination of the compressibility of methyl fluoride yielded the values 1·0114 at 0° and 1·0087 at 21°. The latter is essentially identical with the value calculated from their experiments with the micro-displacement balance, but the former is much lower than that found by Moles and Batuecas from gas density measurements, 1·018. Batuecas (*J. Chim. phys.*, 1932, **29**, 269) discusses the calculation of Patterson, Whytlaw-Gray, and Cawood's density determinations with the micro-balance, and points out that since the methyl fluoride employed by Moles and Batuecas possessed a vapour pressure obeying the law $\log p = -\frac{A}{T} + B$, it must have been essentially free from impurity. The Committee feel that the preponderance of evidence is in favour of the lower value for fluorine, and see no reason at present to alter the value in current use.

KRYPTON and XENON.—Allen and Moore (*J. Amer. Chem. Soc.*, 1931, **53**, 2512) have separated krypton and xenon from liquid air residues by means of fractional distillation. The average density of the purest krypton fractions, found with a globe of 22 ml. capacity, was 3·733, and that of the purest xenon 5·887. Using values calculated by Watson in 1910 for the compressibilities of these gases, the atomic weights of krypton and xenon are found to be 83·6 and 131·4, with an uncertainty of 0·1 unit in each case. These results, which agree with the recent results of Aston, Watson, and Whytlaw-Gray, Patterson, and Cawood (see report for 1931; *J.*, 1931, 1627), escaped notice by the Committee in preparing the report for 1931.

Wild (*Phil. Mag.*, 1931, [7], **12**, 41) has compared the values for $1 + \lambda$ as found (1) by extrapolation of high pressure measurements of PV, (2) from low pressure measurements of PV, and (3) from gas density determinations. In computing the high pressure values the expression $PV = A + BP + CP^2 + DP^4$ was employed. In case of the low pressure and density determinations the relation of PV to P is assumed to be linear.

Observer.	H_2.	N_2.	O_2.	He.	Ne.	A.
		High Pressure.				
Onnes	0·99942	1·00041	1·00096	0·99949	0·99959	
Holborn and Otto	0·99938	1·00046	1·00098	0·99947	0·99952	1·00098
Verschoyle	0·99937	1·00049				
Average	0·99939	1·00045	1·00097	0·99948	0·99956	1·00098
		Low Pressure.				
Chappuis	0·99942	1·00043				
Gray and Burt			1·00097			
Geneva Lab.	0·99935	1·00043	1·00086			
Heuse and Otto	0·99942	1·00048	1·00097	0·99948	0·99953	1·00094
Average	0·99940	1·00045	1·00093	0·99948	0·99953	1·00094
		Density.				
Baxter and Starkweather		1·00040	1·00093		0·99941	1·00107
Final Mean	0·99939	1·00044	1·00094	0·99948	0·99951	1·00099

CHEMICAL METHODS.

Johnson (*J. Physical Chem.*, 1931, **35**, 540, 830, 2237, 2581; 1932, **36**, 1942) claims that the equal opalescence method of titrating halogen compounds with silver is insensitive and gives erroneous results, and that the silver halide is probably contaminated with adsorption products. A new method of finding the end-point is proposed, by comparing the test solution with standard solutions of the reactants containing known amounts of silver and halide.

POTASSIUM.—Heller and Wagner (*Z. anorg. Chem.*, 1932, **206**, 152) were unable to detect by analysis of potassium chloride from plant sources any concentration of the higher isotope of potassium. This confirms their previous finding (*ibid.*, 1931, **200**, 105).

LANTHANUM.—Baxter and Behrens (*J. Amer. Chem. Soc.*, 1932, **54**, 591) have determined the atomic weight of lanthanum by analysis of lanthanum bromide. Lanthanum ammonium nitrate which had already been brought to a high state of purity in an earlier investigation was subjected to thirty series of fractional crystallisations. After conversion into bromide this salt was carefully dehydrated in a current of dry nitrogen and hydrogen bromide in such a way that melting of the hydrate was avoided, and the salt was finally fused in an atmosphere of pure hydrogen bromide. After being weighed, the salt was dissolved and compared with silver in the conventional way, and finally the silver bromide was collected and weighed. The following table gives weights corrected to vacuum. The fractions of lanthanum are numbered in the order of increasing solubility of the double nitrate, No. 371 representing the head fraction of the last series of crystallisations.

The Atomic Weight of Lanthanum.

Fract.	Wt. of $LaBr_3$.	Wt. of Ag.	Ratio $LaBr_3$: 3Ag.	At. Wt. of La.	Wt. of AgBr.	Ratio $LaBr_3$: 3AgBr.	At. Wt. of La.
376	4·01090	3·42801	1·170037	138·923	5·96743	0·672132	138·923
379	5·19186	4·43727	1·170057	138·929	7·72475	0·672107	138·909
372	6·57727	5·62133	1·170056	138·929	9·78548	0·672146	138·931
371	6·38414	5·45612	1·170088	138·939	9·49843	0·672126	138·920
372	6·91830	5·91287	1·170061	138·931	10·29285	0·672146	138·931
371	6·19359	5·29339	1·170041	138·924			
		Average	1·170057	138·929		0·672131	138·923

The average value of the two methods, 138·926, is slightly higher than the value previously found by Baxter, Tani, and Chapin, corrected for a new determination of the density of lanthanum chloride, 138·916. The average, 138·92, is probably nearer the truth than that recently given in the International Table. The atomic weight of lanthanum is therefore changed in the table from 138·90 to 138·92.

THALLIUM.—Briscoe, Kikuchi, and Peel (*Proc. Roy. Soc.*, 1931, *A*, **133**, 440) have redetermined the atomic weight of thallium by comparison of the chloride with silver. The processes of purification consisted in repeated crystallisation of thallous sulphate and chloride, prepared from (A) English thallium of unknown origin and (B) German thallium obtained from Westphalian pyrites. The novel feature of the investigation lies in the method of titrating the chloride with silver. A few milligrams (2—3) excess of silver were added in every case to the thallous chloride solution and, after standing and settling, the supernatant solution (6—7 litres) was decanted, evaporated to small bulk, and the silver content estimated by titration with *N*/1000-thiocyanate. Vacuum weights are given in the following table.

The Atomic Weight of Thallium.

Wt. of TlCl.	Wt. of Ag.	TlCl : Ag.	At. Wt. of Tl.	Wt. of TlCl.	Wt. of Ag.	TlCl : Ag.	At. Wt. of Tl.
English (preliminary series).				English A.			
2·41969	1·08861	2·22273	204·33	10·04965	4·52210	2·22234	204·29
4·97940	2·24057	2·22234	204·29	11·55090	5·19723	2·22251	204·31
4·90541	2·20686	2·22280	204·34	10·60756	4·77211	2·22282	204·34
4·90351	2·20608	2·22272	204·33	9·91726	4·46146	2·22288	204·35
4·90391	2·20615	2·22283	204·34	9·53722	4·29023	2·22300	204·36
6·27962	2·82533	2·22261	204·32	11·88154	5·34523	2·22283	204·34
		Average	204·33			Average	204·33

Wt. of TlCl.	Wt. of Ag.	TlCl : Ag.	At. Wt. of Tl.	Wt. of TlCl.	Wt. of Ag.	TlCl : Ag.	At. Wt. of Tl.
German.				English B.			
5·05837	2·27554	2·22293	204·35	9·49327	4·27091	2·22277	204·34
5·25891	2·86607	2·22264	204·32	9·91925	4·46205	2·22302	204·36
9·53621	4·28987	2·22296	204·35	10·43230	4·69329	2·22281	204·34
10·01985	4·50788	2·22274	204·33	10·06308	4·52668	2·22305	204·36
7·25159	3·26254	2·22268	204·33	9·07037	4·08074	2·22272	204·33
		Average	204·34			Average	204·35
						Average of all	204·34

Exception may be taken to the analytical method, which was adopted because of alleged uncertainty in the conventional nephelometric method of comparison. The large bulk of supernatant liquid and washings must have contained many milligrams of dissolved silver chloride, since the excess of silver used was very small. The ultimate fate of this silver chloride is difficult to guess, but it is hard to believe that the titration of the excess of silver was not seriously affected by it, especially in view of the well-known disturbance of the thiocyanate titration of silver in the presence of silver chloride. In fact, it is hard to understand why the excess of silver in the individual experiments was so small as actually found. The effect of this difficulty would be, however, to raise rather than lower the atomic weight of thallium, so that it is surprising that the atomic weight found is lower rather than higher than that recently found by Hönigschmid, 204·39.

One experiment in which the nephelometric method was used showed erratic behaviour, the final result for the atomic weight of thallium being 204·43.

The ratio of thallium to thallous nitrate was also determined. Buttons of fused electrolytic thallium were polished with chamois, fused in hydrogen, and bottled in nitrogen for weighing. Solution in nitric acid, followed by repeated evaporation with oxalic acid and fusion of the residue, failed to give a product of constant weight, so that the authors consider the method (Crookes) unreliable. The results of two experiments are given in which the final weight of thallous nitrate is employed.

Tl.	$TlNO_3$.	At. Wt. of Tl.
12·08412	15·74910	204·42
12·33736	16·07846	204·46

The results of both methods seem of doubtful value.

SELENIUM AND TELLURIUM.—Hönigschmid (*Naturwiss.*, 1932, **20**, 659) publishes, in a preliminary communication, his new results relative to the atomic weights of selenium and tellurium.

A quantitative synthesis of silver selenide, Ag_2Se, obtained by heating pure silver in the vapour of selenium and brought to constant weight in vacuum, has given, as an average of eleven determinations, Se = 78·962 ± 0·002, a value which agrees perfectly with that calculated by Aston from mass spectra.

As the analogous synthesis of silver telluride offers difficulties as a consequence of the low stability of this compound when heated, Hönigschmid has carried out the analysis of tellurium tetrabromide and has obtained as an average Te = 127·587 ± 0·019. In fact, this value agrees badly with that calculated by Aston (128·03; see last year's report), but very well with the value 127·58, calculated recently by Bainbridge from the consideration of the new isotopes described by him (see the present report, page 360).

On this subject Hönigschmid points out that Aston himself approves the result of Bainbridge, and considers that the mass spectrum which he himself has studied is incomplete.

IODINE.—Hönigschmid and Striebel (*Z. anorg. Chem.*, 1932, **208**, 53) have continued their experiments on the conversion of silver iodide into silver chloride, with precipitated silver iodide, instead of material synthesised from the elements previously used.

Iodine was three times distilled from iodide solutions prepared from similar iodine and was sublimed in an oxygen current over red-hot platinum. From this iodine hydriodic acid was prepared by direct synthesis with hydrogen, and after solution in water this acid was distilled.

Sample A of silver iodide was precipitated by adding an excess of 0·04*N*-hydriodic acid solution to an acid solution (0·04*N*) of the purest silver. Sample B was precipitated in ammoniacal solution, and then an excess of nitric acid was added. Sample C was prepared by adding 0·03*N*-ammoniacal silver nitrate to an excess of 0·03*N*-ammoniacal ammonium iodide. Sample D resulted from adding an excess of 0·16*N*-silver nitrate to 0·16*N*-hydriodic acid.

After washing and drying, the silver iodide was fused in an air current containing free iodine and then in pure air in a weighed quartz tube, and weighed. Then the silver iodide was converted into silver chloride by heating in a chlorine current at gradually increasing temperatures up to fusion. Proof was secured that the iodide did not retain iodine and that the conversion was complete. Vacuum weights are given.

The Atomic Weight of Iodine.

Sample.	Wt. of AgI.	Wt. of AgCl.	Ratio AgI : AgCl.	At. Wt. of I.
A	14·41889	8·80228	1·638085	126·918
A	10·61180	6·47828	1·638058	126·914
A	13·61047	8·30885	1·638070	126·916
B	17·91554	10·93678	1·638100	126·920
A	14·11519	8·61962	1·638078	126·917
A	14·03900	8·57050	1·638061	126·915
A	13·39032	8·17448	1·638064	126·915
B	11·47497	7·00511	1·638085	126·918
B	13·49506	8·23839	1·638070	126·916
B	14·36421	8·76879	1·638106	126·921
C	10·72744	6·54879	1·638080	126·917
C	8·42456	5·14298	1·638069	126·916
D	14·91865	9·10741	1·638078	126·917
D	12·57197	7·67526	1·638080	126·918
D	8·28549	5·05809	1·638067	126·916
C	13·95958	8·52190	1·638083	126·918
C	9·21692	5·62671	1·638066	126·916
		Average	1·638076	126·917

In view of the concordance of this result and the earlier one of Hönigschmid and Striebel (see report for 1931), the atomic weight of iodine is changed in the table from 126·932 to 126·92.

ATOMIC WEIGHTS FROM ISOTOPES.

A comprehensive report of the German Chemical Society by Hahn (*Ber.*, 1932, **65**, *A*, 1) covers the year 1931.

The question of the conversion factor from the physical to the chemical scale still seems to be unsettled. Birge and Menzel (*Physical Rev.*, 1931, **37**, 1669) prefer the Mecke and Childs value 1·00022 to that of Babcock and Naudé, 1·00012. Aston (*Nature*, 1932, **130**, 21) has been successful in photographing the lines of $O^{16}O^{17}$ and $O^{16}O^{18}$ of sufficient intensity for comparison with O_2^{16}. From the relative intensities 1 : 4 : 1072 the relative abundance of O^{17}, O^{18}, and O^{16} is 0·24 : 1 : 536, a result which seems to support the ratio of O^{18} to O^{16} found by Mecke and Childs, 1 : 630. Since the accuracy of the mass spectrograph is admittedly no greater than 1/10000, and the uncertainty of the conversion factor obviously is as large, whilst the measurement of isotopic ratios has inherent uncertainties, the degree of precision of the determination of atomic weights from mass spectrographic data still seems to be inferior to that of the best chemical methods, although the striking concordance of the two methods in most cases is reassuring.

Recent results obtained by Aston (*Proc. Roy. Soc.*, 1932, *A*, **134**, 571; *Nature*, 1931, **128**, 221, 725; 1932, **129**, 649) with the mass spectroscope are given in the following table. The factor used for conversion from the physical to the chemical basis is 1·000125.

Isotopic Weights and Percentages.

									“ Packing fraction.”	At. Wt.
Lithium	6	7							$\{20 \times 10^{-4}$	6·928
	8·3	91·7							17×10^{-4}	
Scandium	45								$- 7 \times 10^{-4}$	44·96
	100								assumed	
Rubidium	85	87							$- 8{\cdot}2 \times 10^{-4}$	85·43
	75	25							assumed	
Strontium	86	87	88						$- 8 \times 10^{-4}$	87·64
	10	6·6	83·3						assumed	
Cæsium	133								$- 5 \times 10^{-4}$	132·91
	100									
Barium	135	136	137	138					$- 6{\cdot}1 \times 10^{-4}$	137·43
	5·9	8·9	11·1	74·2						
Thallium	203	205							$1{\cdot}8 \times 10^{-4}$	204·41
	70·6	29·4								
Lead (common)	203	204	205	206	207	208	209	210	$0 - 1 \times 10^{-4}$	207·19
	(0·04)	(1·50)	(0·03)	27·75	20·20	49·55	(0·85)	(0·08)		
Lead (Katanga)				206	207	208			$0 - 1 \times 10^{-4}$	206·067
				93·3	6·7	(0·02)				
Lead (Wilberforce, Canada)				206	207	208			$0 - 1 \times 10^{-4}$	206·20
				85·9	8·3	5·8				
Lead (Norwegian thorite)				206	207	208			$0 - 1 \times 10^{-4}$	207·895
				4·6	1·3	94·1				
Uranium	238									
	100									

HYDROGEN.—Urey, Brickwedde, and Murphy (*Physical Rev.*, 1932, [2], **39**, 164) by spectroscopic examination of the least volatile fractions remaining from the evaporation of large quantities of liquid H_2, have detected the lines corresponding to the principal series of H^2. Examination of the spectrum of ordinary hydrogen indicated the proportion to be approximately 1 in 4000. Bainbridge (*Physical Rev.*, 1932, **41**, 115) finds the mass of H^2 to be 2·01353, assuming He = 4·00216 and H^1 = 1·00778. The atomic weight of hydrogen is therefore slightly higher than the value for H^1 found by Aston.

BORON.—Elliott (*Z. Physik*, 1931, **67**, 75) by a study of the band spectrum of boron monoxide finds the isotopic relationship 3·63 and the atomic weight 10·794.

LITHIUM, SODIUM, POTASSIUM, CÆSIUM.—Bainbridge (*J. Franklin Inst.*, 1931, **212**, 317), using a Dempster mass-spectrograph, finds the ratio of the abundance of the lithium isotopes to be independent of the temperature of the source of the ions. The abundance ratio was determined in three experiments to be 10·75, 11·28, and 11·51, average 11·18, whilst Aston finds the ratio 11.

Van Wijk and van Koeveringe (*Proc. Roy. Soc.*, 1931, *A*, **132**, 98) and Nakamura (*Nature*, 1931, **128**, 759) from a study of band spectra find a low value for the isotopic ratio of Li^7 to Li^6, and the corresponding atomic weight 6·89.

Sodium was found to contain less than 1/3000 of Na^{21} or Na^{25} and less than 1/800 of Na^{22}, if any, whilst potassium was found to be free from more than 1/1500 of K^{43}, 1/600 of K^{42}, and 1/300 of K^{40} referred to K^{39}.

Bainbridge (*Physical Rev.*, 1930, **36**, 1668) supports Aston's conclusion that the cæsium mass spectrum is simple. The discrepancy between the atomic weights determined by chemical and physical methods is far larger than the apparent error of either.

ZINC.—The mass spectrum of zinc (Bainbridge, *Physical Rev.*, 1932, **39**, 847) obtained with a new form of discharge tube which avoids the presence of zinc hydrides gave no evidence of the isotopes Zn^{65} and Zn^{69} reported by Aston. The atomic weight recalculated from Aston's ratios, assuming the relation of the metallic line to the corresponding hydride to be that of the lines 64 and 65 in Aston's spectra, is found to be 65·33, with the conversion factor 1·00022.

TELLURIUM.—Additional isotopes of tellurium (Bainbridge, *Physical Rev.*, 1932, **39**, 1021) of mass numbers 122, 123, 124 (and 127?) were discovered, the mass numbers and percentages of the complete spectrum being as follows :

122	123	124	125	126	127	128	130
2·9	1·6	4·5	6	19·0	?	32·8	33·1

With Aston's packing fraction, -5×10^{-4}, and the conversion factor 1·00022 the atomic weight of tellurium is calculated to be 127·58, a value in much closer agreement with the chemical value than Aston's, 128·03.

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ATOMIC WEIGHTS, 1933.

	Symbol.	At. No.	At. wt.		Symbol.	At. No.	At. wt.
Aluminium	Al	13	26·97	Neodymium	Nd	60	144·27
Antimony	Sb	51	121·76	Neon	Ne	10	20·183
Argon	A	18	39·944	Nickel	Ni	28	58·69
Arsenic	As	33	74·93	Niobium	Nb		
Barium	Ba	56	137·36	(Columbium)	(Cb)	41	93·3
Beryllium	Be	4	9·02	Nitrogen	N	7	14·008
Bismuth	Bi	83	209·00	Osmium	Os	76	190·8
Boron	B	5	10·82	Oxygen	O	8	16·0000
Bromine	Br	35	79·916	Palladium	Pd	46	106·7
Cadmium	Cd	48	112·41	Phosphorus	P	15	31·02
Cæsium	Cs	55	132·81	Platinum	Pt	78	195·23
Calcium	Ca	20	40·08	Potassium	K	19	39·10
Carbon	C	6	12·00	Praseodymium	Pr	59	140·92
Cerium	Ce	58	140·13	Radium	Ra	88	225·97
Chlorine	Cl	17	35·457	Radon	Rn	86	222·00
Chromium	Cr	24	52·01	Rhenium	Re	75	186·31
Cobalt	Co	27	58·94	Rhodium	Rh	45	102·91
Copper	Cu	29	63·57	Rubidium	Rb	37	85·44
Dysprosium	Dy	66	162·46	Ruthenium	Ru	44	101·7
Erbium	Er	68	167·64	Samarium	Sm	62	150·43
Europium	Eu	63	152·0	Scandium	Sc	21	45·10
Fluorine	F	9	19·00	Selenium	Se	34	79·2
Gadolinium	Gd	64	157·3	Silicon	Si	14	28·06
Gallium	Ga	31	69·72	Silver	Ag	47	107·880
Germanium	Ge	32	72·60	Sodium	Na	11	22·997
Gold	Au	79	197·2	Strontium	Sr	38	87·63
Hafnium	Hf	72	178·6	Sulphur	S	16	32·06
Helium	He	2	4·002	Tantalum	Ta	73	181·4
Holmium	Ho	67	163·5	Tellurium	Te	52	127·5
Hydrogen	H	1	1·0078	Terbium	Tb	65	159·2
Indium	In	49	114·8	Thallium	Tl	81	204·39
Iodine	I	53	126·92	Thorium	Th	90	232·12
Iridium	Ir	77	193·1	Thulium	Tm	69	169·4
Iron	Fe	26	55·84	Tin	Sn	50	118·70
Krypton	Kr	36	83·7	Titanium	Ti	22	47·90
Lanthanum	La	57	138·92	Tungsten	W	74	184·0
Lead	Pb	82	207·22	Uranium	U	92	238·14
Lithium	Li	3	6·940	Vanadium	V	23	50·95
Lutecium	Lu	71	175·0	Xenon	Xe	54	131·3
Magnesium	Mg	12	24·32	Ytterbium	Yb	70	173·5
Manganese	Mn	25	54·93	Yttrium	Y	39	88·92
Mercury	Hg	80	200·61	Zinc	Zn	30	65·38
Molybdenum	Mo	42	96·0	Zirconium	Zr	40	91·22