"Dissolve a suitable quantity of the mineral, or substance containing sulphur in an evaporating dish by means of nitric acid or other oxidising agent free from sulphuric acid; evaporate to a small bulk to expel excess of acid; dilute with water; boil and nearly neutralise with ammonia.

"Run in a dilute solution of barium chloride of known strength until no further precipitation occurs. The exact point is found by filtering off a small portion into a test tube and adding a drop of the standard. If a precipitate forms, add this filtrate to the original solution, well mix, and repeat the filtering a second time. In case the finishing point is overreached, a solution of sodium sulphate of a strength equal to that of the barium chloride is cautiously added to bring it back to the point where no further precipitation occurs, as determined by means of filtering and testing. In such a case the volume of sodium sulphate used is subtracted from the total volume of barium chloride required.

"For standard solution, instead of having a deci-normal solution of 20·8 grammes to the litre, which corresponds to ·32 of sulphur for 100 c.c., that amount of barium chloride, which is equivalent to ·5 gramme of sulphur, may be dissolved in a litre of water, namely 32·5 grammes; then if 1 gramme of ore be dissolved, each c.c. of standard solution will represent ·5 per cent. of sulphur.

"The standard solution of sodium sulphate must then contain 22·19 grains of anhydrous sodium sulphate. This method will not yield perfectly accurate results. In presence of lead, the method is not applicable in consequence of the formation of insoluble lead sulphate."

APPENDIX.

TABLE I.

TABLE OF ELEMENTS WITH THEIR SYMBOLS, ATOMIC WEIGHTS, AND SPECIFIC GRAVITIES.

METALS.

Names.	Symbols.	Atomic Weights.	Specific Gravity.
Aluminium,	Al	27	2·56
Antimony,	Sb	120	6·72
Arsenic,	As	75	5·67
Barium,	Ba	137	3·75
Bismuth,	Bi	207·5	9·8
Cadmium,	Cd	112	8·6
Caesium,	Cs	133	1·88
Calcium,	Ca	40	1·58
Cerium,	Ce	141	6·68
Chromium,	Cr	52·4	6·8
Cobalt,	Co	58·6	8·5
Copper,	Cu	63·2	8·8
Didymium,	Di	145	6·5
Erbium,	E	112·6	—
Glucinum,	Gl	9	2
Gold,	Au	196·8	19·32
Indium,	In	113·4	7·4
Iridium,	Ir	192·5	22·4
Iron,	Fe	56	7·86
Lanthanium,	La	138·5	6·2
Lead,	Pb	206·4	11·37
Lithium,	Li	7	·58
Magnesium,	Mg	24	1·74
Manganese,	Mn	55	8
Mercury,	Hg	200	13·59
Molybdenum,	Mo	96	8·6
Nickel,	Ni	58·6	8·8
Niobium,	Nb	94	6·27
Osmium,	Os	195	22·48
Palladium,	Pd	106·2	11·5
Platinum,	Pt	194·3	21·5
Potassium,	K	39	·87

METALS—*Continued.*

Names.	Symbols.	Atomic Weights.	Specific Gravity.
Rhodium,	Rh	104	12·1
Rubidium,	Rb	85·2	1·52
Ruthenium,	Ru	103·5	12·26
Silver,	Ag	107·6	10·53
Sodium,	Na	23	·97
Strontium,	Sr	87·2	2·54
Tantalum,	Ta	182	10·8
Thallium,	Tl	203·5	11·9
Thorium,	Th	232	11·1
Tin,	Sn	117·4	7·3
Titanium,	Ti	48	—
Tungsten,	W	184	19·1
Uranium,	U	240	18·7
Vanadium,	V	51	5·5
Yttrium,	Y	61·7	—
Zinc,	Zn	65	7·15
Zirconium,	Zr	90·4	4·15

NON-METALS.

Names.	Symbols.	Atomic Weights.	Specific Gravity.
Boron,	B	11	2·68
Bromine,	Br	79·76	2·96
Carbon (Graphite,	—	—	2·2
Carbon (Diamond,	C	12	3·5
Chlorine,	Cl	35·5	—
Fluorine,	F	19	—
Hydrogen,	H	1	—
Iodine,	I	126·54	4·95
Nitrogen,	N	14	—
Oxygen,	O	16	—
Phosphorus,	P	31	1·8–2·1
Selenium,	Se	79·5	4·28–4·8
Silicon,	Si	28·3	2·49
Sulphur,	S	32	1·97–2·07
Tellurium,	Te	126·3	6·25

TABLE II.

TABLE OF MELTING AND BOILING POINTS.

	Melting Point.	Boiling Point.
Aluminium,	625° C.	
Antimony,	440°	
Bismuth,	270°	
Bromine,	−7°	59°
Cadmium,	320°	860°
Calcium,	—	1040°
Chlorine,	—	−50°
Cobalt,	1500°	
Copper,	1050°	
Gold,	1045°	
Indium,	176°	
Iodine,	107°	187°
Iron—		
Cast,	1100°–1300°	
Steel,	1300°–1500°	
Wrought,	Above 1600°	
Lead,	325°	1040°
Lithium,	180°	
Magnesium,	750°	
Mercury,	−39°·4	350°
Nickel,	1500°–1600°	
Phosphorus,	44°	
,, Amorphous,	250°	
Potassium,	62°·5	
Platinum,	1775°	
Silver,	945°	
Selenium,	217°	700°
Sodium,	95°	
Sulphur,	115°	440°
Tellurium,	525°	
Thallium,	88°	
Tin,	27°	
Zinc,	415°	1040°

All statements with regard to melting points at very high temperatures must be taken with reserve, as there

is probably no instrument yet invented on which absolute reliance can be placed, so that the temperatures given for iron, nickel, platinum, etc., can only be considered to approximate to the correct degrees.

The following results arrived at by Pouillet may be useful to the student as a general guide :—

Incipient red heat corresponds to		525° C.	977° F.
Dull red	do.	700°	1292°
Incipient cherry red	do.	800°	1472°
Cherry red	do.	900°	1652°
Clear cherry red	do.	1000°	1832°
Deep orange	do.	1100°	2012°
Clear orange	do.	1200°	2192°
White	do.	1300°	2372°
Bright white	do.	1400°	2552°
Dazzling white	do.	1500°–1600°	2732°–2912°

Some metals readily vapourise when melted, such as zinc, cadmium, and antimony, while arsenic, under ordinary conditions, passes into the state of vapour without melting.

TABLE III.

METALS ARRANGED IN THE ORDER OF THEIR MALLEABILITIES, DUCTILITIES, TENACITIES, AND HARDNESS.

Malleability.	Ductility.	Tenacity.	Hardness.
Gold.	Gold.	Steel.	Manganese.
Silver.	Silver.	Iron.	Cobalt.
Copper.	Platinum.	Nickel.	Nickel.
Tin.	Iron.	Copper.	Iron.
Platinum.	Nickel.	Platinum.	Copper.
Lead.	Copper.	Silver.	Platinum.
Zinc.	Aluminium.	Gold.	Zinc.
Iron.	Zinc.	Zinc.	Silver.
Nickel.	Tin.	Tin.	Gold.
	Lead.	Lead.	Aluminium.
			Magnesium.
			Tin.
			Lead.

TABLE IV.

CONDUCTIVITY OF SUBSTANCES FOR ELECTRICITY.

According to Dr. Matthiessen, the order of conductivity is as follows :—

Silver,	100	Tin,	12·4
Copper,	99·9	Thallium,	9·2
Gold,	77·9	Lead,	8·3
Zinc,	29	Arsenic,	4·8
Cadmium,	23·7	Antimony,	4·6
Palladium,	18·4	Mercury,	1·6
Platinum,	18	Bismuth,	1·2
Cobalt,	17·2	Graphite,	·069
Iron,	16·8	Gas Coke,	·038
Nickel,	13·1	Bunsen's Coke,	·025

TABLE V.

RELATIVE VALUES OF THE FRENCH WITH THE BRITISH SYSTEM OF WEIGHTS AND MEASURES.

METRICAL MEASURES OF LENGTH.

	In English Inches.	In English Feet.	In English Yards.
Millimetre,	·03937	·003281	·0010936
Centimetre,	·39371	·032809	·0109363
Decimetre,	3·93708	·328090	·1093633
Metre,	39·37079	3·280899	1·0936331
Decametre,	393·70790	32·808992	10·9363306
Hectametre,	3937·07900	328·089917	109·3633056
Kilometre,	39370·79000	3280·899167	1093·6330556

1 inch = 2·539954 centimetres. | 1 yard = 0·9143835 metre.
1 foot = 3·0479449 decimetres. | 1 mile = 1·6093149 kilometre.

Metrical Measures of Surface.

	In English Square Feet.	In English Square Yards.	In English Acres.
Centiare, - - - - or sq. metre,	10·764299	1·196033	·0002471
Are, - - - - - or 100 sq. metres,	1076·429934	119·603326	·0247114
Hectare, - - - - or 10,000 sq. metres,	107642·993419	11960·332602	2·4711431

1 square inch = 6·5413669 square centimetres.
1 square foot = 9·2899683 square decimetres.
1 square yard = 0·83609715 square metre.
1 acre = 0·40467102 hectare.
1 square mile = 258·989451 hectares.

Metrical Measures of Weight.

	In Grains.	In Avoirdupois Ounces = 437·5 Grains.	In Avoirdupois Lbs. = 7000. Grains.
Milligramme, -	·015432	·000035	·0000022
Centigramme, -	·154323	·000353	·0000220
Decigramme, -	1·543235	·003527	·0002205
Gramme, - -	15·432349	·035274	·0022046
Decagramme, -	154·323488	·352739	·0220462
Hectagramme, -	1543·234880	3·527394	·2204621
Kilogramme, -	15432·348800	35·273940	2·2046213

1 grain = ·064799 gramme.
1 troy ounce = 31·103496 grammes.
1 lb. avoir. = ·453593 kilogramme.
1 cwt. = 50·802377 kilogrammes.

Metrical Measures of Capacity.

	In Cubic Inches.	In Cubic Feet.	In Pints.
Millilitre, or cubic centimetre,	·06103	·000035	·001761
Litre, or cubic decimetre, - -	61·02705	·035317	1·760770

1 cubic inch = 16·386176 cubic centimetres.
1 cubic foot = 28·315312 cubic decimetres.
1 gallon = 4·543458 litres.

TABLE VI.

METRICAL SYSTEM OF WEIGHTS AND MEASURES.

Length.

1 millimetre = ·001 metre.
1 centimetre = ·01 ,,
1 decimetre = ·1 ,,
1 metre = the ten millionth part of a quarter of the earth's meridian.

Capacity.

1 millilitre = 1 cubic centimetre, or the measure of 1 gramme of water
1 centilitre = 10 cubic centimetres.
1 decilitre = 100 ,, ,,
1 litre = 1000 ,, ,,

Weight.

1 milligramme = ·001 gramme.
1 centigramme = ·01 ,,
1 decigramme = ·1 ,,
1 gramme = the weight on 1 cubic centimetre of pure water at 4° C.
1 decagramme = 10 grammes.
1 hectagramme = 100 ,,
1 kilogramme = 1000 ,,

TABLE VII.

TABLE OF CORRESPONDING TEMPERATURES ON THE SCALES OF CENTIGRADE AND FAHRENHEIT THERMOMETERS.

Deg. Cent.	Deg. Fahr.	Deg. Cent.	Deg. Fahr.	Deg. Cent.	Deg. Fahr.
0	32	34	93·2	68	154·4
1	33·8	35	95	69	156·2
2	35·6	36	96·8	70	158
3	37·4	37	98·6	71	159·8
4	39·2	38	100·4	72	161·6
5	41	39	102·2	73	163·4
6	42·8	40	104	74	165·2
7	44·6	41	105·8	75	167
8	46·4	42	107·6	76	168·8
9	48·2	43	109·4	77	170·6
10	50	44	111·2	78	172·4
11	51·8	45	113	79	174·2
12	53·6	46	114·8	80	176
13	55·4	47	116·6	81	177·8
14	57·2	48	118·4	82	179·6
15	59	49	120·2	83	181·4
16	60·8	50	122	84	183·2
17	62·6	51	123·8	85	185
18	64·4	52	125·6	86	186·8
19	66·2	53	127·4	87	188·6
20	68	54	129·2	88	190·4
21	69·8	55	131	89	192·2
22	71·6	56	132·8	90	194
23	73·4	57	134·6	91	195·8
24	75·2	58	136·4	92	197·6
25	77	59	138·2	93	199·4
26	78·8	60	140	94	201·2
27	80·6	61	141·8	95	203
28	82·4	62	143·6	96	204·8
29	84·2	63	145·4	97	206·6
30	86	64	147·2	98	208·4
31	87·8	65	149	99	210·2
32	89·6	66	150·8	100	212
33	91·4	67	152·6		

TABLE VIII.

TABLE OF TANGENTS.

Deg.	Tangent.	Deg.	Tangent.	Deg.	Tangent.
1	·0174	31	·6009	61	1·8040
2	·0349	32	·6249	62	1·8807
3	·0524	33	·6494	63	1·9626
4	·0699	34	·6745	64	2·0503
5	·0875	35	·7002	65	2·1445
6	·1051	36	·7265	66	2·2460
7	·1228	37	·7535	67	2·3558
8	·1405	38	·7813	68	2·4751
9	·1584	39	·8098	69	2·6050
10	·1763	40	·8391	70	2·7475
11	·1944	41	·8693	71	2·9042
12	·2125	42	·9004	72	3·0777
13	·2309	43	·9325	73	3·2708
14	·2493	44	·9657	74	3·4874
15	·2679	45	1·0000	75	3·7320
16	·2867	46	1·0355	76	4·0108
17	·3057	47	1·0724	77	4·3315
18	·3249	48	1·1106	78	4·7046
19	·3443	49	1·1504	79	5·1445
20	·3640	50	1·1917	80	5·6713
21	·3839	51	1·2349	81	6·3137
22	·4040	52	1·2799	82	7·1154
23	·4245	53	1·3270	83	8·1443
24	·4452	54	1·3764	84	9·5144
25	·4663	55	1·4281	85	11·4300
26	·4897	56	1·4826	86	14·3007
27	·5095	57	1·5399	87	19·0811
28	·5317	58	1·6003	88	28·6362
29	·5543	59	1·6643	89	57·2899
30	·5773	60	1·7320	90	X.

TABLE IX.

TABLE OF COEFFICIENTS GIVING THE AMOUNT OF THE BODY SOUGHT BY SIMPLE MULTIPLICATION.

Element.	Found.	Form.	Sought.	Form.	Coefficient
Aluminium,	Alumina,	Al_2O_3	Aluminium,	Al_2	·53398
Ammonium,	Ammonic chloride,	NH_4Cl	Ammonia,	NH_3	·31804
	Ammonio-platinic chloride	$2NH_4Cl,PtCl_4$	,,	$2NH_3$	·07614
Antimony,	Antimonious oxide,	Sb_2O_3	Antimony,	Sb_2	·83562
	,, sulphide,	Sb_2S_3	,,	,,	·71765
	,, ,,	,,	Antimonious oxide,	Sb_2O_3	·85882
	Diantimonic tetroxide,	Sb_2O_4	,, ,,	Sb_2O_3	·94805
Arsenic,	Arsenious anhydride,	As_2O_3	Arsenic,	As_2	·75758
	Arsenic ,,	As_2O_5	,,	,,	·65217
	,, ,,	,,	Arsenious anhydride,	As_2O_3	·86087
	Arsenious sulphide,	As_2S_3	,, ,,	,,	·80488
	,, ,,	,,	Arsenic anhydride,	As_2O_5	·93496
	Ammonic-magnesic arseniate,	$(MgNH_4AsO_4)_2OH_2$	,, ,,	,,	·60526
	,, ,, ,,	,,	Arsenious anhydride,	As^2O_3	·52105
Barium,	Baryta,	BaO	Barium,	Ba	·89542
	Baric sulphate,	$BaSO_4$	Baryta,	BaO	·65665
	,, carbonate,	$BaCO_3$	,,	,,	·77665
	,, silico-fluoride,	BaF_2,SiF_4	,,	,,	·54839
Bismuth,	Bismuthous oxide,	Bi_2O_3	Bismuth,	Bi_2	·89655
Boron,	Boric Anhydride,	B_2O_3	Boron,	B_2	·31429
Bromine,	Silver bromide,	AgBr	Bromine,	Br	·42560
Cadmium,	Cadmic oxide,	CdO	Cadmium,	Cd	·8750
Calcium,	Lime,	CaO	Calcium,	Ca	·71429
	Calcic sulphate,	$CaSO_4$	Lime,	CaO	·41176
	,, carbonate,	$CaCO_3$	,,	,,	·5600
Carbon,	Carbon dioxide,	CO_2	Carbon,	C	·27273
	Calcic carbonate,	$CaCO_3$	Carbon dioxide,	CO_2	·440
Chlorine,	Silver chloride,	AgCl	Chlorine,	Cl	·24724
	,, ,,	,,	Hydrochloric acid,	HCl	·25421
Chromium,	Chromic oxide,	Cr_2O_3	Chromium,	Cr_2	·68619
	,, ,,	,,	Chromic acid,	$2CrO_3$	1·31381
	Lead chromate,	$PbCrO_4$	,, ,,	,,	·31062
Cobalt,	Cobalt sulphate,	$CoSO_4$	Cobalt,	Co	·37984
	,, tetroxide,	Co_3O_4	,,	Co_3	·73444
Copper,	Cupric oxide,	CuO	Copper,	Cu	·79849
	Cuprous sulphide,	Cu_2S	,,	Cu_2	·79849
Fluorine,	Calcic fluoride,	CaF_2	Fluorine,	F_2	·48718
	Silicic ,,	SiF_4	,,	F_4	·73077
Hydrogen,	Water,	H_2O	Hydrogen,	H_2	·11111
Iodine,	Silver iodide,	AgI	Iodine,	I	·54049
	Palladium iodide,	PdI_2	,,	I_2	·70556
Iron,	Ferric oxide,	Fe_2O_3	Iron,	Fe_2	·700
	,, ,,	,,	Ferrous oxide,	2FeO	·900
	Ferrous sulphide,	FeS	Iron,	Fe	·63636
Lead,	Lead oxide,	PbO	Lead,	Pb	·92825
	,, sulphate,	$PbSO_4$	,, oxide,	PbO	·73597
	,, ,,	,,	,,	Pb	·68317
	,, chloride,	$PbCl_2$	,,	,,	·74482
	,, sulphide,	PbS	,,	,,	·86864
Lithium,	Lithium carbonate,	Li_2CO_3	Lithium oxide,	Li_2O	·40541
	,, sulphate,	Li_2SO_4	,, ,,	,,	·27273
	,, phosphate,	Li_3PO_4	,, ,,	,,	·38793

TABLE IX.—*Continued.*

Element.	Found.	Form.	Sought.	Form.	Coefficient
Magnesium,	Magnesium oxide,	MgO	Magnesium,	Mg	·600
	,, sulphate,	$MgSO_4$	,, oxide,	MgO	·33350
	,, pyrophosphate,	$Mg_2P_2O_7$	,, ,,	$2MgO$	·36036
Manganese,	Manganese tetroxide,	Mn_3O_4	Manganese,	Mn_3	·72052
	,, sulphide,	MnS	,,	Mn	·63218
Mercury,	Mercury,	$2Hg$	Mercurous oxide,	Hg_2O	1·0400
	,,	Hg	Mercuric ,,	HgO	1·0800
	Mercurous chloride,	Hg_2Cl_2	Mercury,	Hg_2	·84940
	Mercuric sulphide,	HgS	,,	Hg	·86207
Nickel,	Nickel oxide,	NiO	Nickel,	Ni	·78667
Nitrogen,	Ammonio-platinum chloride,	$2NH_4Cl,PtCl_4$	Nitrogen,	N_2	·06271
	Platinum,	Pt	,,	,,	·14155
	Baric sulphate,	$BaSO_4$	Nitric pentoxide,	N_2O_5	·46352
	Silver cyanide,	$AgCN$	Cyanogen,	CN	·19410
	,, ,,	,,	Hydrocyanic acid,	HCN	·20156
Oxygen,	Alumina,	Al_2O_3	Oxygen,	O_3	·46602
	Antimony oxide,	Sb_2O_3	,,	O_3	·16438
	Arsenious acid,	As_2O_3	,,	O_3	·24242
	Arsenic ,,	As_2O_5	,,	O_5	·34783
	Barium oxide,	BaO	,,	O	·10458
	Bismuth ,,	Bi_2O_3	,,	O_3	·10345
	Cadmium ,,	CdO	,,	O	·12500
	Chromium ,,	Cr_2O_3	,,	O_3	·31381
	Cobalt ,,	CoO	,,	O	·21333
	Copper ,,	CuO	,,	O	·20151
	Ferrous ,,	FeO	,,	O	·22222

Oxygen,	Ferric oxide,	Fe_2O_3	Oxygen,	O_3	·30000
	Lead ,,	PbO	,,	O	·07175
	Calcic ,,	CaO	,,	O	·28571
	Magnesium oxide,	MgO	,,	,,	·39970
	Manganous ,,	MnO	,,	O	·22535
	Manganese tetroxide,	Mn_3O_4	,,	O_4	·27947
	,, trioxide,	Mn_2O_3	,,	O_3	·30380
	Mercurous oxide,	Hg_2O	,,	O	·03846
	Mercuric ,,	HgO	,,	O	·07407
	Nickel ,,	NiO	,,	O	·21333
	Potassium ,,	K_2O	,,	O	·16982
	Silica,	SiO_2	,,	O_2	·53333
	Silver oxide,	Ag_2O	,,	O	·06898
	Strontium oxide.	SrO	,,	O	·15459
	Tin	SnO_2	,,	O_2	·21333
	Water,	H_2O	,,	O	·88889
	Zinc oxide,	ZnO	,,	O	·19740
Phosphorus,	Phosphorous pentoxide,	P_2O_5	Phosphorus,	P_2	·43662
	Magnesium pyrophosphate,	$Mg_2P_2O_7$	Phosphorous pentoxide	P_2O_5	·63964
	,, ,,	,,	Phosphorus,	P_2	·27928
	Ferric phosphate,	$Fe_2P_2O_8$	Phosphorous pentoxide	P_2O_5	·47020
	,, ,,	,,	Phosphorus,	P_2	·30463
Potassium,	Potassium sulphate,	K_2SO_4	Potassium oxide,	K_2O	·54080
	Potassic-platinic chloride,	$PtCl_4,2KCl$	,, ,,	,,	·19272
	,, ,, ,,	,,	,, chloride,	$2KCl$	·30507
	,, ,, ,,	,,	,,	K_2	·16028
Silicon,	Silica,	SiO_2	Silicon,	Si	·46667
Silver,	Silver chloride,	$AgCl$	Silver,	Ag	·75276
Sodium,	Sodium sulphate,	Na_2SO_4	Sodium oxide,	Na_2O	·43658
	,, chloride,	$NaCl$	,, ,,	$\frac{Na_2O}{2}$	·53022

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TABLE IX.—*Continued.*

Element.	Found.	Form.	Sought.	Form.	Coefficient
Sodium,	Sodium chloride,	NaCl	Sodium,	Na	·39337
	,, carbonate,	Na_2CO_3	,, oxide,	Na_2O	·58487
Strontium,	Strontium sulphate,	$SrSO_4$	Strontium,	Sr	·47598
	,, carbonate,	$SrCO_3$	,, oxide,	SrO	·70169
Sulphur,	Barium sulphate,	$BaSO_4$	Sulphur,	S	·13734
	Arsenious sulphide,	As_2S_3	,,	S_3	·39021
	Barium sulphate,	$BaSO_4$	,, trioxide,	SO_3	·34335
	Sulphur trioxide,	SO_3	,, ,,	SO_4	1·2000
Tin,	Stannic oxide,	SnO_2	Tin,	Sn	·78667
	,,	,,	Stannous oxide,	SnO	·89333
Zinc,	Zinc oxide,	ZnO	Zinc,	Zn	·80260
	,, sulphide,	ZnS	,,	,,	·67031
	,, ,,	ZnS	,, oxide,	ZnO	·83515

Table VIII. is taken from Bayley's Chemist's Pocket Book, pp. 10–16.

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