STUDY PACK : 1.1

Pearson Edexcel

1. Principles of Chemistry

Chemical Formulae

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Chemical Formulae

1. What is meant by the term Valency?

Valency of an element is equal to the number of positive or negative charge acquired by the atom by losing or gaining electrons

2. Write down the Rules of writing a Chemical formula?

a) Write down the symbols of the elements/ radicals given in the chemical name of the compound.
b) Write down the valencies of each element or radical under the corresponding symbol.
c) Cross them over as shown below

d) The valencies show the simplest combining ratio & may be cancelled down in order to simplify

e) If an element has more than one valency, the name of the compound will indicate the valency in capital roman numerals.

Eg: Copper (I) Oxide
Lead (IV) chloride

5. Explain why the valency of noble gasses is zero hence forming no compounds

Noble gases possess a completely filled outermost shell of electrons. Therefore, it will not lose or gain electrons, hence the valency is zero forming no bonds.

6. Assign the valency for the following Elements & Radicals:

ELEMENTS			RADICALS		
	Symbol	**Valency**		**Symbol**	**Valency**
Hydrogen	**H**		Hydroxide	**OH**	
Carbon	**C**		Nitr**ite**	**NO_2**	
Nitrogen	**N**		Nitr**ate**	**NO_3**	
Oxygen	**O**		Sulf**ite**	**SO_3**	
Sodium	**Na**		Sulf**ate**	**SO_4**	
Magnesium	**Mg**		Ammonium	**NH_4**	
Aluminium	**Al**		Carbonate	**CO_3**	
Silicon	**Si**		Hydrogen-carbonate (bicarbonate)	**HCO_3**	
Phosphorus	**P**		Hydrogen- Sulfite (bisulfite)	**HSO_3**	
Sulfur	**S**		Hydrogen- Sulfate (bisulfate)	**HSO_4**	
Chlorine	**Cl**		Phosphate	**PO_4**	
Potassium	**K**		Manganate (VII)	**MnO_4**	
Manganese	**Mn**		Chlorate (I)	**ClO**	
Iron	**Fe**		Chlorate (V)	**ClO_3**	
Cobalt	**Co**		Vanadate (V)	**VO_3**	
Copper	**Cu**		Chromate (VI)	**CrO_4**	
Zinc	**Zn**		Dichromate (VI)	**Cr_2O_7**	
Bromine	**Br**		Oxalate	**C_2O_4**	
Barium	**Ba**		Thiosulfate	**S_2O_3**	
Iodine	**I**		Tetrathionate	**S_4O_6**	
Lead	**Pb**		Peroxi di sufate (per sulfate)	**S_2O_8**	
Mercury	**Hg**				
Silver	**Ag**				

7. Write the formulae of the following, by showing the valencies of each element & Crossing them over:

Aluminium Oxide

Iron (II) Sulfate

Copper (I) Oxide

Lead (II) Nitrate

Ammonium Carbonate

Calcium Hydrogen Carbonate

Lead (IV) Oxide

Tin (II) Chloride

Iron (III) hydroxide

Ammonium Phosphate

Magnesium Chromate (VI)

Potassium Chlorate (V)

Aluminium Vanadate (V)

Sodium dichromate (VI)

Calcium Oxalate

Zinc nitrate

Sodium thiosulfate

Sodium Chlorate (I)

Naming of Compounds

$CaSO_4$

$BaCl_2$

$AlCl_3$

$Al(NO_3)_3$

$Al_2(SO_4)_3$

$FeSO_4$

$FeCl_2$

$FeCl_3$

$Fe_2(SO_4)_3$

PbO

PbO_2

$Pb(NO_3)_2$

$PbCl_2$

$PbSO_4$

$Cu(NO_3)_2$

$CuCl$

$CuCl_2$

$CuSO_4$

$ZnCl_2$

$AgNO_3$

NH_4Cl

$(NH_4)_2SO_4$

K_2CrO_4

$(NH_4)_2CO_3$

$KHCO_3$

$Co(NO_3)_2$

$NaNO_2$

Balancing Equations

1	_ H_2	+	O_2	→	_ H_2O				
2	$BaCl_2$	+	_ NaOH	→	$Ba(OH)_2$	+	_ NaCl		
3	H_2SO_4	+	_ KOH	→	_ K_2SO_4	+	H_2O		
4	K_2CO_3	+	_ HCl	→	_KCl	+	H_2O	+	CO_2
5	$CaCO_3$	+	_HNO_3	→	$Ca(NO_3)_2$	+	H_2O	+	CO_2
6	Ca	+	_H_2O	→	$Ca(OH)_2$	+	H_2		
7	$Pb(NO_3)_2$	+	NaI	→	PbI_2	+	$NaNO_3$		
8	$Al_2(SO_4)_3$	+	NaOH	→	$Al(OH)_3$	+	Na_2SO_4		
9	$Al(OH)_3$	+	NaOH	→	$NaAlO_2$	+	H_2O		
10	$Pb(NO_3)_2$	→	PbO	+	NO_2	+	O_2		

11	$FeSO_4$	→	Fe_2O_3	+	SO_2	+	SO_3	
12	NH_4NO_3	→	N_2O	+	H_2O			
13	$NaNO_3$	→	$NaNO_2$	+	O_2			
14	CH_4	+	O_2	→	CO_2	+	H_2O	
15	C_4H_{10}	+	O_2	→	CO_2	+	H_2O	
16	PCl_3	+	H_2O	→	H_3PO_3	+	HCl	
17	$8HNO_3$	+	$3Cu$	→	$Cu(NO_3)_2$	+	NO	+ H_2O
18	$4HNO_3$	+	Cu	→	$Cu(NO_3)_2$	+	NO_2	+ H_2O
19	H_3PO_4	+	NaOH	→	NaH_2PO_4	+	H_2O	
20	H_3PO_4	+	NaOH	→	Na_3PO_4	+	H_2O	
21	H_3PO_4	+	NaOH	→	Na_2HPO_4	+	H_2O	
22	$6NaOH$	+	Cl_2	→	$NaClO_3$	+	NaCl	+ H_2O

Ionic equations

In questions 1–5 you are required to balance the equations, in questions 6–10 you are required to complete the equation and then balance it. For questions 1–17 you are required to write the full, balanced ionic equation. Questions 18–20 involve more complex ions again you are just asked to balance the equation.

1	$Pb^{2+}(aq)$	+	$OH^-(aq)$	→	$Pb(OH)_2(s)$					
2	$Al^{3+}(aq)$	+	$OH^-(aq)$	→	$Al(OH)_3(s)$					
3	$Al(OH)_3(s)$	+	$OH^-(aq)$	→	$AlO_2^{2-}(aq)$	+	$H_2O(l)$			
4	$Cl_2(g)$	+	$OH^-(aq)$	→	$ClO_3^{3-}(aq)$	+	$Cl^-(aq)$	+	$H_2O(l)$	
5	$S_2O_3^{2-}(aq)$	+	$I_2(s)$	→	$S_4O_6^{2-}(aq)$	+	$2I^-(aq)$			
6	$Cu^{2+}(aq)$	+	$OH^-(aq)$	→						
7	$CO_3^{2-}(s)$	+	$H^+(aq)$	→						
8	$Zn(s)$	+	$H^+(aq)$	→						
9	$Zn(s)$	+	$Pb^{2+}(aq)$	→						
10	$H^+(aq)$	+	$OH^-(aq)$	→						

11	Write an ionic equation for the reaction of magnesium with sulphuric acid.
12	Write an ionic equation for the reaction of sodium carbonate solution with nitric acid.
13	Write an ionic equation for the reaction of copper oxide with hydrochloric acid.
14	Write an ionic equation for the reaction of barium chloride solution with sodium sulphate solution.
15	Write an ionic equation for the reaction of silver nitrate solution with potassium chloride solution.
16	Write an ionic equation for the reaction of zinc with silver nitrate solution.
17	Write ionic equations for the reactions of sodium hydroxide and potassium hydroxide with hydrochloric acid.
18	Write ionic equations for the reactions of sodium hydroxide and potassium hydroxide with nitric acid.
19	Write ionic equations for the reactions of sodium hydroxide and potassium hydroxide with sulphuric acid.
20	What do you notice about the answers to questions 17, 18 and 19?

Steps for writing ionic equations.

Step 1 : Write the correct formulae of the reactants & the products.

Step II : Balance the equation.

Step III : Write the state symbols, aqueous (aq), liquid (l), gaseous (g), solid (s), vapour (v)

Step IV : Seperate ONLY the (aq) molecules in to their respective ions.

Step V : Cancel the common ions. (spectator ions)

Rules for solubility of salts

1. All nitrate salts are soluble.
2. All salts of Na^+, K^+ & NH_4^+ are soluble.
3. Most Chloride salts are soluble. Exceptions : AgCl, $PbCl_2$
4. Most sulfate salts are soluble. Exceptions : $BaSO_4$, $PbSO_4$,$CaSO_4$
5. Most of hydroxide salts are slightly soluble. Important soluble hydroxides are : NaOH, KOH, & $Ca(OH)_2$
6. Most carbonate salts are insoluble. Except for Na^+, K^+ & NH_4^+

Answers

The Periodic Table of Elements

1	2											3	4	5	6	7	0 (8) (18)
							1.0 H hydrogen 1										4.0 He helium 2
(1)	(2)		Key									(13)	(14)	(15)	(16)	(17)	
6.9 Li lithium 3	9.0 Be beryllium 4		relative atomic mass atomic symbol name atomic (proton) number									10.8 B boron 5	12.0 C carbon 6	14.0 N nitrogen 7	16.0 O oxygen 8	19.0 F fluorine 9	20.2 Ne neon 10
23.0 Na sodium 11	24.3 Mg magnesium 12	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	27.0 Al aluminium 13	28.1 Si silicon 14	31.0 P phosphorus 15	32.1 S sulfur 16	35.5 Cl chlorine 17	39.9 Ar argon 18
39.1 K potassium 19	40.1 Ca calcium 20	45.0 Sc scandium 21	47.9 Ti titanium 22	50.9 V vanadium 23	52.0 Cr chromium 24	54.9 Mn manganese 25	55.8 Fe iron 26	58.9 Co cobalt 27	58.7 Ni nickel 28	63.5 Cu copper 29	65.4 Zn zinc 30	69.7 Ga gallium 31	72.6 Ge germanium 32	74.9 As arsenic 33	79.0 Se selenium 34	79.9 Br bromine 35	83.8 Kr krypton 36
85.5 Rb rubidium 37	87.6 Sr strontium 38	88.9 Y yttrium 39	91.2 Zr zirconium 40	92.9 Nb niobium 41	95.9 Mo molybdenum 42	[98] Tc technetium 43	101.1 Ru ruthenium 44	102.9 Rh rhodium 45	106.4 Pd palladium 46	107.9 Ag silver 47	112.4 Cd cadmium 48	114.8 In indium 49	118.7 Sn tin 50	121.8 Sb antimony 51	127.6 Te tellurium 52	126.9 I iodine 53	131.3 Xe xenon 54
132.9 Cs caesium 55	137.3 Ba barium 56	138.9 La* lanthanum 57	178.5 Hf hafnium 72	180.9 Ta tantalum 73	183.8 W tungsten 74	186.2 Re rhenium 75	190.2 Os osmium 76	192.2 Ir iridium 77	195.1 Pt platinum 78	197.0 Au gold 79	200.6 Hg mercury 80	204.4 Tl thallium 81	207.2 Pb lead 82	209.0 Bi bismuth 83	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86
[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[261] Rf rutherfordium 104	[262] Db dubnium 105	[266] Sg seaborgium 106	[264] Bh bohrium 107	[277] Hs hassium 108	[268] Mt meitnerium 109	[271] Ds darmstadtium 110	[272] Rg roentgenium 111							

Elements with atomic numbers 112-116 have been reported but not fully authenticated

* Lanthanide series

* Actinide series

140 Ce cerium 58	141 Pr praseodymium 59	144 Nd neodymium 60	[147] Pm promethium 61	150 Sm samarium 62	152 Eu europium 63	157 Gd gadolinium 64	159 Tb terbium 65	163 Dy dysprosium 66	165 Ho holmium 67	167 Er erbium 68	169 Tm thulium 69	173 Yb ytterbium 70	175 Lu lutetium 71
232 Th thorium 90	[231] Pa protactinium 91	238 U uranium 92	[237] Np neptunium 93	[242] Pu plutonium 94	[243] Am americium 95	[247] Cm curium 96	[245] Bk berkelium 97	[251] Cf californium 98	[254] Es einsteinium 99	[253] Fm fermium 100	[256] Md mendelevium 101	[254] No nobelium 102	[257] Lr lawrencium 103