

Atoms and Molecules

EXAM DRILL

ANSWERS

1. Aurum

2. MSO_4

3(i) BaCl_2

3(ii) A compound made up of two elements is called a binary compound, e.g., water (H_2O).

3(iii) Magnesium bromide

3(iv) CO_3^{2-}

4(i) CaCl_2

4(ii) Valency of Na : 1, Valency of sulphide : 2

4(iii) (b)

4(iv) (a)

5. (c) : Mg has valency of +2. So, it will form MgCl_2 while Al, Na and Si will form chlorides AlCl_3 , NaCl and SiCl_4 respectively.

OR

(d)

6. (c)

7. (c) :	K	L	M	Valency
N (at. no. 7) :	2	5	—	3
Cl (at. no. 17) :	2	8	7	1

Thus, N and Cl will form compound, NCl_3 .

	K	L	M	Valency
Cl (at. no. 17) :	2	8	7	1
S (at. no. 16) :	2	8	6	2

Thus, S and Cl will form compound, SCl_2 .

	K	L	M	Valency
O (at. no. 8) :	2	6	—	2
F (at. no. 9) :	2	7	—	1

Thus, O and F will form compound, OF_2 .

	K	L	M	Valency
Na (at. no. = 11) :	2	8	1	1
F (at. no. = 9) :	2	7	—	1

Thus, Na and F will form compound, NaF .

8. (b) : Valency of sodium = 1

Valency of phosphorus = 3

Symbol	Na	P
Valency	1	3

Formula : Na_3P

OR

(c) : Phosphorus (P) is a tetratomic element (written as P_4). Hence, it should indicated as $\boxed{\text{P}}$.

9. (d)

10. (c)

11. (a) : Symbol of tin is Sn.

12. (a) : $\frac{\text{Atomic mass of O}}{\text{Atomic mass of C}} = \frac{16}{12} = \frac{4}{3}$

OR

(d) : (i) Nitrogen — N_2 (ii) Neon — Ne

(iii) Oxygen — O_2

(iv) Sulphur — S_8

(v) Phosphorus — P_4

(vi) Ozone — O_3

(vii) Fluorine — F_2

(viii) Hydrogen — H_2

(ix) Fullerene — C_{60}

13. (d) : % of carbon in the compound = $\frac{12}{106} \times 100$
= 11.32%

14. (a) : For universally accepted atomic mass unit in 1961, C-12 was selected as standard. However, the new symbol used is 'u' (unified mass) in place of amu.

15. Molecular mass of CaSO_4 = 1 (Ca) + 1 (S) + 4 (O)
= 1 (40) + 1 (32) + 4 (16)
= 40 + 32 + 64 = 136 u

Also mass of sulphur in CaSO_4 = 1 $\times$ (32) = 32 u

$\therefore$ Mass percentage of sulphur in CaSO_4
= $\frac{32}{136} \times 100 = 23.53\%$

OR

Total mass of reactants = 8.4 g + 20 g = 28.4 g

Total mass of reactants = Total mass of products

28.4 = 4.4 + x (mass of residue left)

28.4 - 4.4 = x $\Rightarrow$ x = 24 g

16. (a) K_2SO_4

(b) In MCl valency of M is 1.

17. (a) Calcium phosphate (b) Magnesium hydroxide

Symbol	Ca	PO_4	Symbol	Mg	OH
Charge	2+	3-	Charge	2+	1-
Formula:	$\text{Ca}_3(\text{PO}_4)_2$		Formula:	$\text{Mg}(\text{OH})_2$	

18. Ratio by mass C : O

3 8

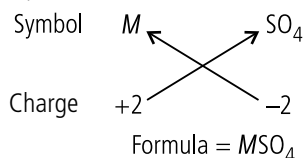
? 40

$$\text{Mass of carbon required} = \frac{3 \times 40}{8} = 15 \text{ g}$$

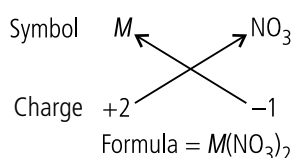
OR

(a) The formula MO shows that the valency (charge) of $M = +2$

$\therefore$ Formula of its sulphate



Formula of its nitrate



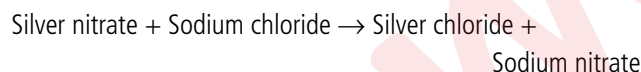
(b) (i) In $MgCO_3$, Mg : C : O = $24 : 12 : 3 \times 16$
 $= 24 : 12 : 48 = 2 : 1 : 4$

(ii) In HNO_3 , H : N : O = $1 : 14 : 3 \times 16 = 1 : 14 : 48$

(iii) In C_2H_5OH or C_2H_6O , C : H : O
 $= 2 \times 12 : 1 \times 6 : 16 = 24 : 6 : 16 = 12 : 3 : 8$

19. (a) Molecular mass of HNO_3
 $= (1 \times 1) + (14 \times 1) + (16 \times 3) = 1 + 14 + 48 = 63 \text{ u}$

(b) The reaction is



If law of conservation of mass is true,

Total mass of reactants = Total mass of products

i.e., Mass of $AgNO_3$ + Mass of $NaCl$ = Mass of $AgCl$ + Mass of $NaNO_3$

We have : Mass of $NaCl$ = 5.85 g, Mass of $AgCl$ = 14.35 g,

Mass of $NaNO_3$ = 8.5 g

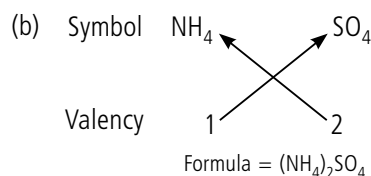
Substituting these values in the above equation, we get

Mass of $AgNO_3$ + 5.85 g = 14.35 g + 8.5 g

Mass of $AgNO_3$ = $(14.35 + 8.5) - 5.85 \text{ g}$
 $= 22.85 - 5.85 = 17.0 \text{ g}$

20. (a) (i) Atoms cannot exist independently whereas molecules can exist independently.

(ii) Molecular mass is the sum of masses of the atoms in the molecule whereas formula mass is the sum of atomic masses of all the atoms in a formula unit of an ionic compound.



21. (a) Let the element be represented by the symbol E .

Formula of oxide in which valency of $E = 4$ are E_2O_4 or EO_2

Formula of oxide in which valency of $E = 6$ are E_2O_6 or EO_3

(b) Formula of oxide of the element = A_2O_5

(i) The valency of the element A in the oxide = 5

(ii) The formula of the chloride of the element $A = ACl_5$

22. (a) Ionic compounds are made up of ions. An ionic compound contains a cation which is a positive ion and an anion which is a negative ion e.g., sodium chloride is an ionic compound made up of Na^+ and Cl^- ions.

A molecular compound is made up of molecules e.g. ammonia (NH_3), carbon dioxide (CO_2).

(b)

	Metal	Non-metal
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(i) Fe_2O_3

Fe(3)

O(2)

(ii) $BaCl_2$

Ba(2)

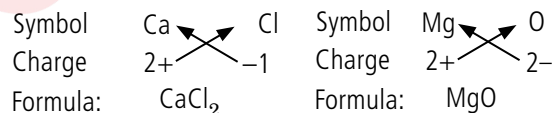
Cl(1)

OR

(i) % composition of B = $\frac{0.096 \times 100}{0.24} = 40\%$

% composition of O = $\frac{0.144}{0.24} \times 100 = 60\%$

(ii) (a) Calcium phosphate (b) Magnesium hydroxide



23.

	Atom		Molecule
(i)	It is the smallest particle of an element that takes part in a chemical reaction.	(i)	It is the smallest particle of an element or a compound that is capable of an independent existence.
(ii)	It is usually not stable by itself.	(ii)	It is usually stable by itself.

	Cation		Anion
(i)	It is positively charged.	(i)	It is negatively charged.
(ii)	It is formed from metal atoms.	(ii)	It is formed from non-metal atoms.

	Molecular mass		Formula unit mass
(i)	It is calculated by adding atomic masses of all the atoms present in one molecule of the substance.	(i)	Formula unit mass of a substance is the sum of the atomic masses of all the atoms present in one formula unit of the compound.
(ii)	It is for molecules.	(ii)	It is for ionic compounds.

24. (a) Cation : Mg^{2+} , Anion : CH_3COO^-

(b) K_2SO_4 , $BaSO_4$, $Al_2(SO_4)_3$

25. (a) (i) Elements : Co, Cu
 (ii) Compounds : AlF_3 , CoO , NaBrO_3 , Na_2S , V_2O_5 , CaSO_4

(b) Compounds	Elements
AlF_3	(Al, F) Aluminium, Fluorine
CoO	(Co, O) Cobalt, Oxygen
NaBrO_3	(Na, Br, O) Sodium, Bromine, Oxygen
Na_2S	(Na, S) Sodium, Sulphur
V_2O_5	(V, O) Vanadium, Oxygen
CaSO_4	(Ca, S, O) Calcium, Sulphur, Oxygen

(c) NaBrO_3 : Sodium bromate

CaSO_4 : Calcium sulphate

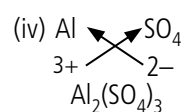
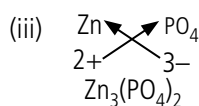
OR

- (i) (a) Two atoms of oxygen - 2 O
 (b) Diatomic oxygen - O_2 molecule
 (c) Triatomic oxygen - O_3 molecule
 (d) Two atoms of hydrogen and one atom of oxygen forming one molecule of water (H_2O).
 (ii) (a) K_2CO_3 - Potassium carbonate
 (b) CaCl_2 - Calcium chloride
 (iii) $\text{Al}_2(\text{SO}_4)_3 = 2 \times 27 + 3(32 + 4 \times 16)$
 $= 54 \text{ u} + 3(96)$
 $= 54 + 288 = 342 \text{ u}$
 $\therefore$ Formula unit mass = 342 u

26. (a) $\text{Ca}(\text{OH})_2 = 40 + 2 \times 16 + 2 \times 1 = 64 \text{ u}$
 (b) $(\text{NH}_4)_3\text{PO}_4 = 3 \times (14 + 4) + 31 + 4 \times 16 = 149 \text{ u}$
 (c) $\text{C}_2\text{H}_5\text{COOCH}_3 = 4 \times 12 + 8 \times 1 + 2 \times 16 = 88 \text{ u}$
 (d) $\text{Mg}(\text{NO}_3)_2 = 24 + 2 \times (14 + 16 \times 3) = 148 \text{ u}$
 (e) $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O} = 2 \times 23 + 12 + 3 \times 16 + 10 \times 18 = 286 \text{ u}$

27. (i) Atomicity - Number of atoms constituting a molecule,
 (ii) Polyatomic element - sulphur (S_8)
 Polyatomic ion - NH_4^+ , SO_4^{2-}
 (iii) Law of conservation of mass states that mass can neither be created nor destroyed in a chemical reaction.
 (iv) (a) Na_2CO_3 - Sodium carbonate
 (b) NH_4Cl - Ammonium chloride
 (c) ZnO - Zinc oxide
 (d) $\text{Al}(\text{OH})_3$ - Aluminium hydroxide

28. (i) Symbol Cr SO_4
 Charge 3 2
 Formula = $\text{Cr}_2(\text{SO}_4)_3$
 (ii) Symbol Pb NO_3
 Charge 2 1
 $\text{Pb}(\text{NO}_3)_2$



OR

	Metal	Non-metal
(i)		
(a)	CrBr_3 Cr(3)	Br(1)
(b)	Na_2S Na(1)	S(2)
(c)	Fe_2O_3 Fe(3)	O(2)
(d)	BaCl_2 Ba(2)	Cl(1)
(ii)	(a) NH_4^+ , (b) SO_4^{2-}	

29. (a) A group of atoms carrying a charge is known as polyatomic ion.

e.g., PO_4^{3-} , SO_4^{2-} , NH_4^+

- (b) Cu^{2+} , Na^+ , Fe^{3+} cations
 Cl^- , SO_4^{2-} , PO_4^{3-} anions
 CuCl_2 , CuSO_4 , $\text{Cu}_3(\text{PO}_4)_2$;
 NaCl , Na_2SO_4 , Na_3PO_4 ;
 FeCl_3 , $\text{Fe}_2(\text{SO}_4)_3$, FePO_4
 (c) Number of atoms present in
 (i) $\text{CO}_3^{2-} = 1\text{C} + 3(\text{O}) = 4$
 (ii) $\text{PO}_4^{3-} = 1\text{P} + 4(\text{O}) = 5$
 (iii) $\text{P}_2\text{O}_5 = 2\text{P} + 5(\text{O}) = 7$
 (iv) $\text{CO} = 1\text{C} + 1(\text{O}) = 2$

30.

	Chemical formula	Ratio by mass
(a)	Ammonia (NH_3)	N(1) : H(3) 14 : 3
(b)	Carbon monoxide (CO)	C(1) : O(1) 12 : 16 or 3 : 4
(c)	Hydrogen chloride (HCl)	H(1) : Cl(1) 1 : 35.5 or 2 : 71
(d)	Aluminium fluoride (AlF_3)	Al(1) : F(3) 27 : 19×3 or 9 : 19
(e)	Magnesium sulphide (MgS)	Mg(1) : S(1) 24 : 32 or 3 : 4

OR

- (a) Calcium fluoride - CaF_2
 (b) Hydrogen sulphide - H_2S
 (c) Ammonia - NH_3
 (d) Carbon tetrachloride - CCl_4
 (e) Sodium oxide - Na_2O
 (f) Carbon monoxide - CO
 Carbon dioxide - CO_2



