

The Language Of Chemistry

Exercise

Question.1 (1985)

XCl_2 is the chloride of a metal X. State the formula of the sulphate and the hydroxide of the metal X.

Answer:

Chloride of metal X is $\text{X}_1^2 \text{Cl}_2^1$

By inter changing subscript and writing as superscript

Valency of metal X is 2

Valency of sulphate SO_4 is 2- and of hydroxide OH is 1-

\therefore Formula of $\text{X}^{2+} \text{SO}_4^{2-}$

Sulphate of X = $\text{X}_1^2 \text{SO}_4^1 \Rightarrow \text{XSO}_4$

Formula of hydroxide of metal

$\text{X}^{2+} \text{OH}^{1-} \Rightarrow \text{X}_1^2 \text{OH}^1 \Rightarrow \text{X}_1 (\text{OH})_2$

dropping 1 $\Rightarrow \text{X}[\text{OH}]_2$

Question.1 (1987)

An element X is trivalent. Write the balanced equation for the combustion of X in oxygen.

Answer:

Combustion of X^{3+} in oxygen means oxide of X

$\text{X}^{3+} + \text{O}^{2-}$

$\text{X}_2^3 \text{O}_3^2 \Rightarrow \text{X}_2\text{O}_3$ oxide of X

Question.1 (1991)

The formula of the nitride of a metal X is XN , state the formula of :

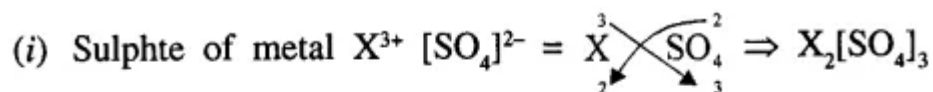
1. its sulphate
2. its hydroxide.

Answer:

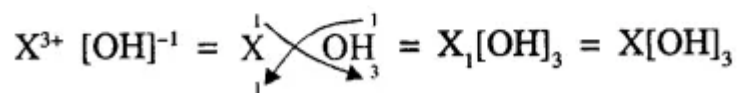
Formula of nitride of metal X is XN

Since valency of nitrogen is 3-

∴ Valency of X is 3+



(ii) Hydroxide of metal X



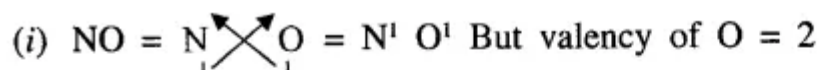
Question.1 (1992)

What is the valency of nitrogen in :

1. NO
2. N_2O
3. NO_2

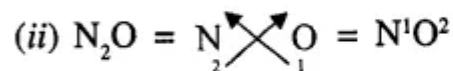
Answer:

Valency of nitrogen in

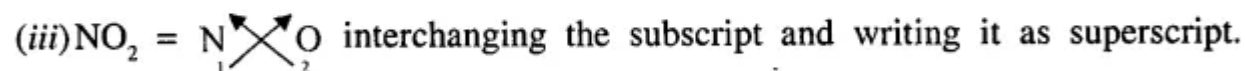


Multiplying by 2 ∴ $N^{1 \times 2} O^{2 \times 2} = N^2 O^4$

∴ Valency of nitrogen is 2



∴ Valency of nitrogen is 1



$N^2 O^1$ but valency of O is 2

∴ Multiplying by 2

$N^{2 \times 2} O^{1 \times 2} = N^4 O^2$

∴ Valency of nitrogen is 4

Additional Questions

Question 1.

What is meant by the term 'symbol'. Give the qualitative and quantitative meaning of the term 'symbol'.

Answer:

Symbol : "Is the short form that stands for the atom of a specific element."

Qualitative meaning : C is the symbol of atom of element carbon

S is the symbol of atom of element sulphur.

This means symbol stand for a specific element.

No two elements can have the same symbol.

Quantitative meaning : A symbol also represents quantity of the element i.e. atomic mass of element. Symbol C represents 12 g of carbon. In other words how many times that element is heavier than $1/12$ th C^{12}

Question 2.

Name three metals whose symbols are derived from :

(a) the first letter of the name of the element

(b) from their Latin names.

Answer:

Ni — nickel

Zn — zinc

Ca — calcium

Mg — magnesium

are symbols of metals derived from first letter of name of element.

K — kalium (potassium)

Fe — Ferrum (iron)

Na — Natrium (sodium)

are symbols of metals derived the names from their latin names.

Question 3.

Explain the meaning of the term 'valency'.

State why the valency of the metal potassium is +1 and of the non-metal chlorine is -1.

Answer:

Valency : "Is the combining capacity of atom or of a radical." **OR**

"Valency is the number of electrons, which an atom can lose/gain/share during a chemical reaction."

Metal potassium (K) has 1 electron in outer most shell which it loses and becomes K^+ has valency [+1] whereas

Non-metal chlorine [Cl] has 7 electrons in valence shell and gains 1 electron and becomes $[Cl^-]$ has valency [-1]

Question 4.

What is meant by the term 'variable valency'. Give a reason why silver exhibits a valency of +1 and +2.

Answer:

Variable valency : "Certain elements exhibit more than one valency and show variable valency."

Reason : Why silver exhibits valency +1 and +2 Ag 47 [2, 8, 18, 18, 1] has 1 electron in the outermost shell when loses this electron shows [+1] valency but when penultimate shell has not attained stability and one more electron jumps to the outermost shell there by increasing valency

electron and new configuration [2, 8, 18, 17, 2] loses two electrons and has valency [+2]

∴ Silver exhibits Ag^{1+} [ous] and Ag^{2+} [ic]

Question 5.

Give examples of eight metals which shows variable valency. State the valency of sulphur in :

(a) SO_2

(b) SO_3

Answer:

Eight metals which show variable valency are

(i) Copper

Cu^{1+} Cu^{2+} [Cupric]

(ii) Silver

Ag^{1+} Ag^{2+} [Argentive]

(iii) Mercury

Hg^{1+} [mercurous] Hg^{2+} [mercuric]

(iv) Iron

Fe^{2+} [Ferrous] Fe^{3+} [Ferric]

(v) Lead

Pb^{2+} [Plumbous] Pb^{4+} [Plumbic]

(vi) Tin

Sn^{2+} [stannous] Sn^{4+} [Stannic]

(vii) Gold

Au^{1+} [Aurous] Au^{3+} [Auric]

(viii) Manganese

Mn^{2+} [Mangnous] Mn^{4+} [Manganic]

As valency of oxygen is 2

Valency of sulphur in [a] $\text{SO}_2 = \overset{2}{\underset{1}{\text{S}}} \overset{1}{\underset{2}{\text{O}}}$ inter changing the subscript and writing

it as superscript.

$$= \text{S}^2\text{O}^1 = \text{S}^{2 \times 2} \text{O}^{1 \times 2} = \text{S}^4\text{O}^2$$

∴ Valency of sulphur is 4

$$(b) \text{SO}_3 = \overset{3}{\underset{1}{\text{S}}} \overset{1}{\underset{3}{\text{O}}} = \text{S}^{3 \times 2} \text{O}^{1 \times 2} = \text{S}^6\text{O}^2$$

Question 6.

State the valency in each case and name the following elements or radicals given below

1. K	2. Cr_2O_7	3. Cl	4. Ni
5. ClO_3	6. CO_3	7. Ba	8. HCO_3
9. NO_2	10. Na	11. Br	12. Zn
13. Mg	14. O	15. Co	16. CrO_4
17. ClO	18. MnO_4	19. Li	20. I
21. OH	22. O_2	23. ZnO_2	24. SiO_3
25. NO_3	26. SO_3	27. SO_4	28. PO_4
29. N	30. C	31. PO_3	32. Al
33. Ca	34. H	35. PbO_2	36. HSO_3
37. AlO_2	38. Cr	39. HSO_4	40. NH_4

Answer:

1. K	K^{1+}	Potassium
2. Cr_2O_7	$\text{Cr}_2\text{O}_7^{2-}$	Dichromate
3. Cl	Cl^{1-}	Chloride
4. Ni	Ni^{2+}	Nickel
5. ClO_3	ClO_3^{1-}	Chlorate
6. CO_3	CO_3^{2-}	Carbonate
7. Ba	Ba^{2+}	Barium
8. HCO_3	HCO_3^{1-}	Hydrogen [Bi] carbonate
9. NO_2	NO_2^{1-}	Nitrite

10. Na	Na^{1+}	Sodium
11. Br	Br^{1-}	Bromide
12. Zn	Zn^{2+}	Zinc
13. Mg	Mg^{2+}	Magnesium
14. O	O^{2-}	Oxide
15. Co	Co^{2+}	Cobalt
16. CrO_4	CrO_4^{2-}	Chromate
17. ClO	ClO^{1-}	Hypochlorite
18. MnO_4	MnO_4^{1-}	Permanganate
19. Li	Li^{1+}	Lithium
20. I	I^{1-}	Iodide
21. OH	OH^{1-}	Hydroxide
22. O_2	O_2^{2-}	Peroxide
23. ZnO_2	ZnO_2^{2-}	Zincate
24. SiO_3	SiO_3^{2-}	Silicate
25. NO_3	NO_3^{1-}	Nitrate
26. SO_3	SO_3^{2-}	Sulphite
27. SO_4	SO_4^{2-}	Sulphate
28. PO_4	PO_4^{3-}	Phosphate
29. N	N^{3-}	Nitride
30. C	C^{4-}	Carbide
31. PO_3	PO_3^{3-}	Phosphite
32. Al	Al^{3+}	Aluminium
33. Ca	Ca^{2+}	Calcium
34. H	H^+	Hydrogen
35. PbO_2	PbO_2^{2-}	Plumbate
36. HSO_3	HSO_3^-	Hydrogen sulphite
37. AlO_3 & AlO_2	AlO_3^{3-} & AlO_2^{1-}	Aluminate
38. Cr	Cr^{3+}	Chromium
39. HSO_4	HSO_4^{1-}	Bisulphate
40. NH_4	NH_4^+	Ammonium

Question 7.

State the variable valencies of the following elements and give their names.

(a) Cu, (b) Ag, (c) Hg, (d) Fe, (e) Pb, (f) Sn, (g) Mn, (h) Pt, (i) Au

Answer:

- (a) Cu Cu^{1+} – Copper [I] *i.e.* cuprous ; Cu^{2+} – Copper [II] *i.e.* cupric]
 (b) Ag Ag^{1+} – Silver [I] Argentous Ag^{2+} – Silver [II] Argentic
 (c) Hg Hg^{1+} – Mercury [I] Mercurous Hg^{2+} – Mercury [II] Mercuric

 (d) Fe Fe^{2+} – [II] Ferrous Fe^{3+} – Iron [III] Ferric
 (e) Pb Pb^{2+} – Lead [II] Plumbous Pb^{4+} – Lead [IV] Plumbic
 (f) Sn Sn^{2+} – Tin [II] Stannous Sn^{4+} – Tin [IV] Stannic
 (g) Mn Mn^{2+} – Manganese [II] Manganous Mn^{4+} – Manganese [IV] Manganic
 (h) Pt Pt^{2+} – Platinum [II] Platinous Pt^{4+} – Platinum [IV] Platinic
 (i) Au Au^{1+} – Gold [I] Aurous Au^{3+} – Gold [III] Auric

Question 8.

State which of the following elements or radicals are divalent –

(a) Lithium, (b) Nickel, (c) Ammonium, (d) Bromide, (e) Sulphite, (f) Nitride, (g) Carbide, (h) Chromium, (i) Bisulphite, (j) Dichromate, (k) Permanganate.

Answer:

- (b) Nickel
 (e) Sulphite
 (j) Dichromate are divalent

Question 9.

Explain the meaning of the term 'compound' with a suitable example. State the main characteristics of a compound with special reference to the compound iron [II] sulphide.

Answer:

Compound : "Is a pure substance made up of two or more elements combined chemically by in a fixed proportion."

Example : CO_2 carbon dioxide is made up of two elements carbon and oxygen C,

12 parts by weight and oxygen

$2 \times 16 = 32$ parts by weight

i.e. in ratio C : O = 12 : 16 = 3 : 4

CHARACTERISTICS OF COMPOUND :

1. Components in definite proportion e.g. compound iron [II] sulphide FeS element Iron and sulphur are in definite ratio.
2. Compound is Homogeneous.
3. Particles in a compound are of J kind composition of iron (II) sulphide is uniform and components cannot be seen separately.
4. Compound has definite set of properties.

5. Component in FeS do not retain their original properties, i.e. iron cannot be attracted by a magnet, sulphur is insoluble in CS₂ and Fe does not give H₂ with dil. acid. This means compound formed has new properties.

Question 10.

Name the elements in the compound and give the formula – of the following compounds :

(a) Nitric acid, (b) Carbonic acid, (c) Phosphoric acid, (d) Acetic acid, (e) Blue vitriol, (f) Green vitriol, (g) Glauber's salt, (h) Ethane, (i) Ethanol

Answer:

	Element in compound	Formula
(a) Nitric acid	H, N, O Hydrogen, nitrogen, oxygen	HNO ₃
(b) Carbonic acid	H, C, O Hydrogen, carbon, oxygen	H ₂ CO ₃
(c) Phosphoric acid	H, P, O Hydrogen, phosphorous, oxygen	H ₃ PO ₄
(d) Acetic acid	C, H, O Carbon, hydrogen, oxygen	CH ₃ COOH
(e) Blue vitriol	Copper, sulphur, oxygen, hydrogen	CuSO ₄ .5H ₂ O
(f) Green vitriol	Iron, sulphur, oxygen, hydrogen	FeSO ₄ .7H ₂ O
(g) Glauber's salt	Sodium, sulphur, oxygen, hydrogen,	Na ₂ SO ₄ .10H ₂ O
(h) Ethane	Carbon, hydrogen	C ₂ H ₆
(i) Ethanol	Carbon, hydrogen, oxygen	C ₂ H ₅ OH

Question 11.

Explain the term 'chemical formula'. State why the molecular formula of zinc carbonate is ZnCO₃

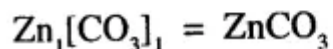
Answer:

Chemical Formula : "A molecule of a substance element or compound could be represented by symbols. Representation known as chemical formula i.e. molecular formula of oxygen gas is O₂ water H₂O, hydrochloric acid HCl etc.

Molecular formula of zinc carbonate : Zinc and carbonate both have valency



Divide by H.C.F. 2 exchange of valency



Question 12.

Write the formula of the following compounds :

- | | | | |
|-----------------------|------------------|-----------------|----------------|
| 1. Potassium – | (a) chloride | (b) nitrate | (c) carbonate |
| | (d) bisulphate | (e) sulphite | (f) dichromate |
| | (g) permanganate | (h) zincate | (i) plumbite |
| | (j) sulphate | (k) bicarbonate | (l) aluminate |
| | (m) hydroxide | (n) iodide | (o) nitrite |
| | (p) bisulphite | | |
| 2. Sodium – | (a) chloride | (b) nitrate | (c) carbonate |
| | (d) bisulphate | (e) sulphite | (f) dichromate |
| | (g) permanganate | (h) zincate | (i) plumbite |
| | (j) sulphate | (k) bicarbonate | (l) aluminate |
| | (m) hydroxide | (n) iodide | (o) nitrite |
| | | | |

- (p) bisulphite
3. Calcium – (a) chloride (b) nitrate (c) carbonate
(d) bisulphite (e) sulphite (f) sulphate
(g) bicarbonate (h) hydroxide
4. Magnesium – (a) chloride (b) nitrate (c) carbonate
(d) sulphate (e) bicarbonate (f) hydroxide
(g) oxide
5. Zinc – (a) chloride (b) nitrate (c) carbonate
(d) sulphate (e) hydroxide (f) oxide
6. Aluminium – (a) chloride (b) nitrate (c) carbonate
(d) sulphate (e) hydroxide (f) oxide
7. Copper – Copper [I] chloride; Copper [II] chloride
Copper [I] oxide; Copper [II] oxide
Copper [I] sulphide; Copper [II] sulphide
Copper [II] nitrate; Copper [II] sulphate
Tetra amine copper [II] sulphate
8. Iron – Iron [II] chloride; Iron [III] chloride
Iron [II] oxide; Iron [III] oxide
Iron [II] sulphate; Iron [III] sulphate
Iron [II] sulphide; Iron [III] sulphide
Iron [II] hydroxide; Iron [III] hydroxide
9. Lead – Lead [II] chloride; Lead [II] oxide;
Lead [II] hydroxide; lead [II] nitrate
Lead [II] sulphate
10. Silver – Silver [I] chloride; Silver [II] chloride;
Diamine silver chloride

Answer:

1. Formula of

(a) Potassium chloride	KCl	$K^{1+}Cl^{1-}$
(b) Potassium nitrate	KNO_3	$K^{1+}NO_3^{1-}$
(c) Potassium carbonate	K_2CO_3	$K^{1+}CO_3^{2-}$
(d) Potassium bisulphate	$KHSO_4$	$K^{1+}[HSO_4]^{1-}$
(e) Potassium sulphite	K_2SO_3	$K^{1+}[SO_3]^{2-}$
(f) Potassium dichromate	$K_2Cr_2O_7$	$K^{1+}[Cr_2O_7]^{2-}$
(g) Potassium permanganate	$KMnO_4$	$[MnO_4]^{1-}$
(h) Potassium zincate	K_2ZnO_2	ZnO_2^{2-}

(i) Potassium plumbite	K_2PbO_2	PbO_2^{2-}
(j) Potassium sulphate	K_2SO_4	$[SO_4]^{2-}$
(k) Potassium bicarbonate	$KHCO_3$	HCO_3^{1-}
(l) Potassium aluminate	$KAlO_2$	AlO_2^{1-}
(m) Potassium hydroxide	KOH	OH^{1-}
(n) Potassium iodide	KI	I^{1-}
(o) Potassium nitrite	KNO_2	NO_2^{1-}
(p) Potassium bisulphite	$KHSO_3$	HSO_3^{1-}

2. Formula of

(a) Sodium chloride	$NaCl$	$Na^{1+}Cl^{1-}$
(b) Sodium nitrate	$NaNO_3$	NO_3^{1-}
(c) Sodium carbonate	Na_2CO_3	$Na^{1+}[CO_3]^{2-}$
(d) Sodium bisulphate	$NaHSO_4$	$[HSO_4]^{1-}$
(e) Sodium sulphite	Na_2SO_3	$Na^{1+}[SO_3]^{2-}$
(f) Sodium dichromate	$Na_2Cr_2O_7$	$Na^{1+}[Cr_2O_7]^{2-}$
(g) Sodium permanganate	$NaMnO_4$	$Na^{1+}[MnO_4]^{1-}$
(h) Sodium zincate	Na_2ZnO_2	$Na^{1+}[ZnO_2]^{2-}$
(i) Sodium plumbite	Na_2PbO_2	$Na^{1+}[PbO_2]^{2-}$
(j) Sodium sulphate	Na_2SO_4	$Na^{1+}SO_4^{2-}$
(k) Sodium bicarbonate	$NaHCO_3$	HCO_3^{1-}
(l) Sodium aluminate	$NaAlO_2$	AlO_2^{1-}
(m) Sodium hydroxide	$NaOH$	$[OH]^{1-}$
(n) Sodium iodide	NaI	I^{1-}
(o) Sodium nitrite	$NaNO_2$	$[NO_2]^{1-}$
(p) Sodium bisulphite	$NaHSO_3$	$[HSO_3]^{1-}$

3. Formula of

(a) Calcium chloride	CaCl_2	$\text{Ca}^{2+}\text{Cl}^{1-}$
(b) Calcium nitrate	$\text{Ca}[\text{NO}_3]_2$	NO_3^{1-}
(c) Calcium carbonate	CaCO_3	CO_3^{2-}
(d) Calcium bisulphite	$\text{Ca}[\text{HSO}_3]_2$	$\text{Ca}^{2+}[\text{HSO}_3]^{1-}$
(e) Calcium sulphite	CaSO_3	$[\text{SO}_3]^{2-}$
(f) Calcium sulphate	CaSO_4	SO_4^{2-}
(g) Calcium bicarbonate	$\text{Ca}[\text{HCO}_3]_2$	$\text{Ca}^{2+}[\text{HCO}_3]^{1-}$
(h) Calcium hydroxide	$\text{Ca}[\text{OH}]_2$	$\text{Ca}^{2+}[\text{OH}]^{1-}$

4. Formula of

(a) Magnesium chloride	MgCl_2	$\text{Mg}^{2+}\text{Cl}^{1-}$
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(b) Magnesium nitrate	$\text{Mg}[\text{NO}_3]_2$	$\text{Mg}^{2+}\text{NO}_3^{1-}$
(c) Magnesium carbonate	MgCO_3	$\text{Mg}^{2+}\text{CO}_3^{2-}$
(d) Magnesium sulphate	MgSO_4	SO_4^{2-}
(e) Magnesium bicarbonate	$\text{Mg}[\text{HCO}_3]_2$	HCO_3^{1-}
(f) Magnesium hydroxide	$\text{Mg}[\text{OH}]_2$	OH^{1-}
(g) Magnesium oxide	MgO	$\text{Mg}^{2+}\text{O}^{2-}$

5. Formula of

(a) Zinc chloride	ZnCl_2	$\text{Zn}^{2+}\text{Cl}^{1-}$
(b) Zinc nitrate	$\text{Zn}[\text{NO}_3]_2$	$\text{Zn}^{2+}[\text{NO}_3]^{1-}$
(c) Zinc carbonate	ZnCO_3	$\text{Zn}^{2+}\text{CO}_3^{2-}$
(d) Zinc sulphate	ZnSO_4	$\text{Zn}^{2+}\text{SO}_4^{2-}$
(e) Zinc hydroxide	$\text{Zn}[\text{OH}]_2$	$\text{Zn}^{2+}[\text{OH}]^{1-}$
(f) Zinc oxide	ZnO	$\text{Zn}^{2+}\text{O}^{2-}$

6. Formula of

(a) Aluminium chloride	AlCl_3	$\text{Al}^{3+}\text{Cl}^{1-}$
(b) Aluminium nitrate	$\text{Al}[\text{NO}_3]_3$	$\text{Al}^{3+}\text{NO}_3^{1-}$
(c) Aluminium carbonate	$\text{Al}_2[\text{CO}_3]_3$	$\text{Al}^{3+}\text{CO}_3^{2-}$
(d) Aluminium sulphate	$\text{Al}_2[\text{SO}_4]_3$	$\text{Al}^{3+}[\text{SO}_4]^{2-}$
(e) Aluminium hydroxide	$\text{Al}[\text{OH}]_3$	$\text{Al}^{3+}[\text{OH}]^{1-}$
(f) Aluminium oxide	Al_2O_3	$\text{Al}^{3+}\text{O}^{2-}$

7. Formula of

Copper [I] chloride	CuCl	$\text{Cu}^{1+}\text{Cl}^{1-}$
Copper [II] chloride	CuCl_2	$\text{Cu}^{2+}\text{Cl}^{1-}$
Copper [I] oxide	Cu_2O	$\text{Cu}^{1+}\text{O}^{2-}$
Copper [II] oxide	CuO	$\text{Cu}^{2+}\text{O}^{2-}$
Copper [I] sulphide	Cu_2S	$\text{Cu}^{1+}\text{S}^{2-}$
Copper [II] sulphide	CuS	$\text{Cu}^{2+}\text{S}^{2-}$

Copper [II] nitrate	$\text{Cu}[\text{NO}_3]_2$	$\text{Cu}^{2+}\text{NO}_3^{1-}$
Copper [II] sulphate	CuSO_4	$[\text{SO}_4]^{2-}$
Tetra amine copper [II] sulphate	$[\text{Cu}(\text{NH}_3)_4]\text{SO}_4$	
8. Formula of		
Iron [II] chloride	FeCl_2	$\text{Fe}^{2+}\text{Cl}^{1-}$
Iron [III] chloride	FeCl_3	$\text{Fe}^{3+}\text{Cl}^{1-}$
Iron [II] oxide	FeO	$\text{Fe}^{2+}\text{O}^{2-}$
Iron [III] oxide	Fe_2O_3	$\text{Fe}^{3+}\text{O}^{2-}$
Iron [II] sulphate	FeSO_4	$\text{Fe}^{2+}\text{SO}_4^{2-}$
Iron [III] sulphate	$\text{Fe}_2[\text{SO}_4]_3$	$\text{Fe}^{3+}\text{SO}_4^{2-}$
Iron [II] sulphide	FeS	$\text{Fe}^{2+}\text{S}^{2-}$
Iron [III] sulphide	Fe_2S_3	$\text{Fe}^{3+}\text{S}^{2-}$
Iron [II] hydroxide	$\text{Fe}[\text{OH}]_2$	$\text{Fe}^{2+}\text{OH}^{1-}$
Iron [III] hydroxide	$\text{Fe}[\text{OH}]_3$	$\text{Fe}^{3+}\text{OH}^{1-}$
9. Formula of		
Lead [II] chloride	PbCl_2	$\text{Pb}^{2+}\text{Cl}^{1-}$
Lead [II] oxide	PbO	O^{2-}
Lead [II] hydroxide	$\text{Pb}[\text{OH}]_2$	OH^{1-}
lead [II] nitrate	$\text{Pb}[\text{NO}_3]_2$	NO_3^{1-}
Lead [II] sulphate	PbSO_4	SO_4^{2-}
10. Formula of		
Silver [I] chloride	AgCl	
Silver [II] chloride	AgCl_2	
Diamine silver chloride	$[\text{Ag}(\text{NH}_3)_2]\text{Cl}$	

Question 13.

Write the names of the following compounds :

(a) KClO	(b) HClO	(c) NaClO_3	(d) AlN
(e) $\text{K}_2\text{Cr}_2\text{O}_7$	(f) KMnO_4	(g) Ca_3N_2	(h) $\text{Ca}_3(\text{PO}_4)_2$
(i) H_2SO_3	(j) HCl	(k) HNO_3	(l) H_2SO_4
(m) NH_4OH	(n) NaOH	(o) H_2CO_3	(p) HNO_2
(q) $\text{Mg}(\text{HCO}_3)_2$	(r) NaAlO_2	(s) K_2PbO_2	(t) $\text{Cr}_2(\text{SO}_4)_3$
(u) Na_2O			

Answer:

(a) KClO	Potassium hypochlorite
(b) HClO	Hypochloric acid
(c) NaClO_3	Sodium chlorate
(d) AlN	Aluminium nitride
(e) $\text{K}_2\text{Cr}_2\text{O}_7$	Potassium dichromate
(f) KMnO_4	Potassium permanganate
(g) Ca_3N_2	Calcium nitride
(h) $\text{Ca}_3(\text{PO}_4)_2$	Calcium phosphate
(i) H_2SO_3	Sulphurous acid
(j) HCl	Hydrochloric acid
(k) HNO_3	Nitric acid
(l) H_2SO_4	Sulphuric acid
(m) NH_4OH	Ammonium hydroxide
(n) NaOH	Sodium hydroxide
(o) H_2CO_3	Carbonic acid
(p) HNO_2	Nitrous acid
(q) $\text{Mg}(\text{HCO}_3)_2$	Magnesium bicarbonate
(r) NaAlO_2	Sodium aluminate
(s) K_2PbO_2	Potassium plumbite
(t) $\text{Cr}_2(\text{SO}_4)_3$	Chromium sulphate
(u) Na_2O	Sodium peroxide

Question 14.

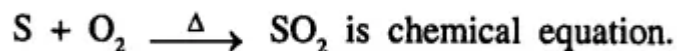
Explain the term 'chemical equation'. What is meant by 'reactants' and 'products' in a chemical

equation.

Answer:

Chemical equation : "Is the symbolic representation of a chemical reaction using symbols and the formulae of the substances involved in the reaction."

Sulphur burns in oxygen is a chemical reaction and sulphur dioxide is formed. This can be represented as sulphur + oxygen $\xrightarrow{\text{heating}}$ sulphur dioxide is word equation.



Reactants : Substances taking part in a reaction separated by (+) sign on the left hand side of arrow are called reactants.

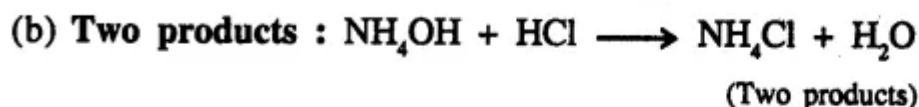
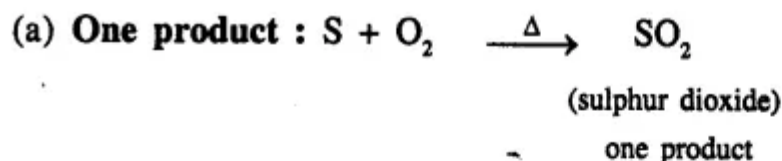
Products : Substances formed in the reaction are called products.

Question 15.

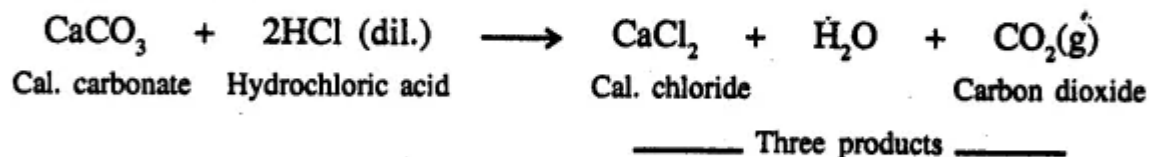
Give an example of a chemical equation in which two reactants form –

- (a) one product
- (b) two products
- (c) three products
- (d) four products

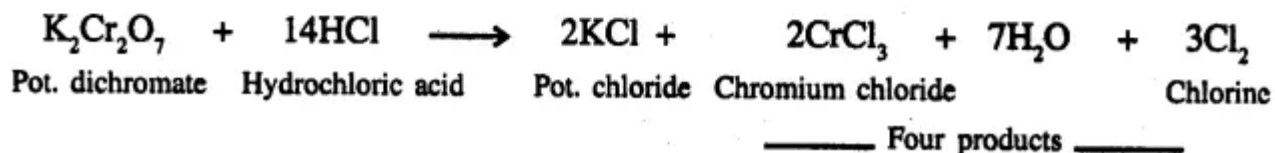
Answer:



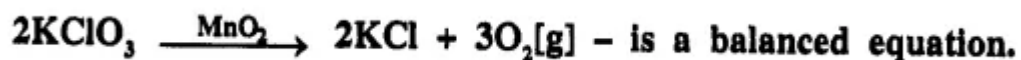
(c) **Three products :**



(d) **Four products :**



Question 16.



- (a) State what is a 'balanced equation'.
(b) Give a reason why the above equation is balanced.
(c) State why the compound MnO_2 is written above the arrow.

Answer:

- (a) **Balanced equation** : "Equation in which the total number of atoms of each element in the reactants, on the left side of the equation is equal to the number of atoms of each element in the products formed, on the right side of the equation."
(b) As the total number of [K, Cl, O] atoms on the L.H.S. is equal to the number of the given atoms on the R.H.S., the given equation is balanced.
(c) MnO_2 is a catalyst in the reaction which does not under go any change and simply increases the rate of reaction is written above the arrow.

Question 17.

What do the symbols —

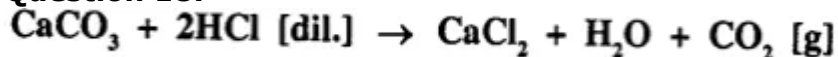


present in a chemical equation, mean.

Answer:

- (i) \rightarrow Arrow separates reactants from the products.
(ii) \rightleftharpoons Stands for reversible reaction. (iii)(s) Stands for solid state.
(iv)(l) or (l) Stands for liquid state. (v) (g) Stands for gas.
(vi)(aq.) Represents for solution in water (aqua).

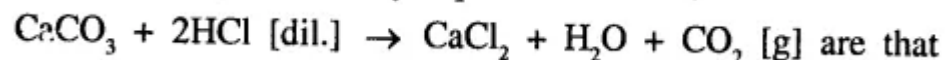
Question 18.



- (a) State the information provided by the above chemical equation.
(b) State the information not conveyed by the above chemical equation.

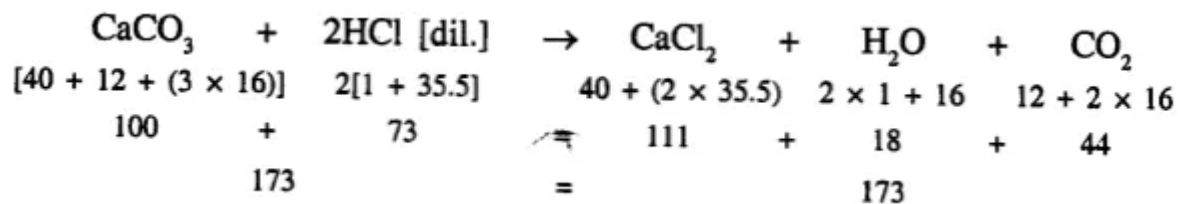
Answer:

(a) Information provided by equation



1. Calcium carbonate reacts with [dil.] hydrochloric acid to produce calcium chloride, water and Carbondioxide.

2. One molecule of calcium carbonate reacts with two molecules of acid to produce one molecule of calcium chloride, one molecule of water and one molecule of carbondioxide.
3. About the chemical composition of respective, molecules like one molecule of calcium chloride contains one atom of calcium, one atom of carbon and three atoms of oxygen.
4. Molecular masses



that 100 parts by weight of calcium carbonate reacts with 73 parts by weight of hydrochloric acid to produce 111 parts by weight of calcium chloride 18 parts by weight of water and 44 parts by weight of carbon dioxide.

5. That reaction is irreversible.
6. That about the state of substances present i.e. solid, liquid or gas.

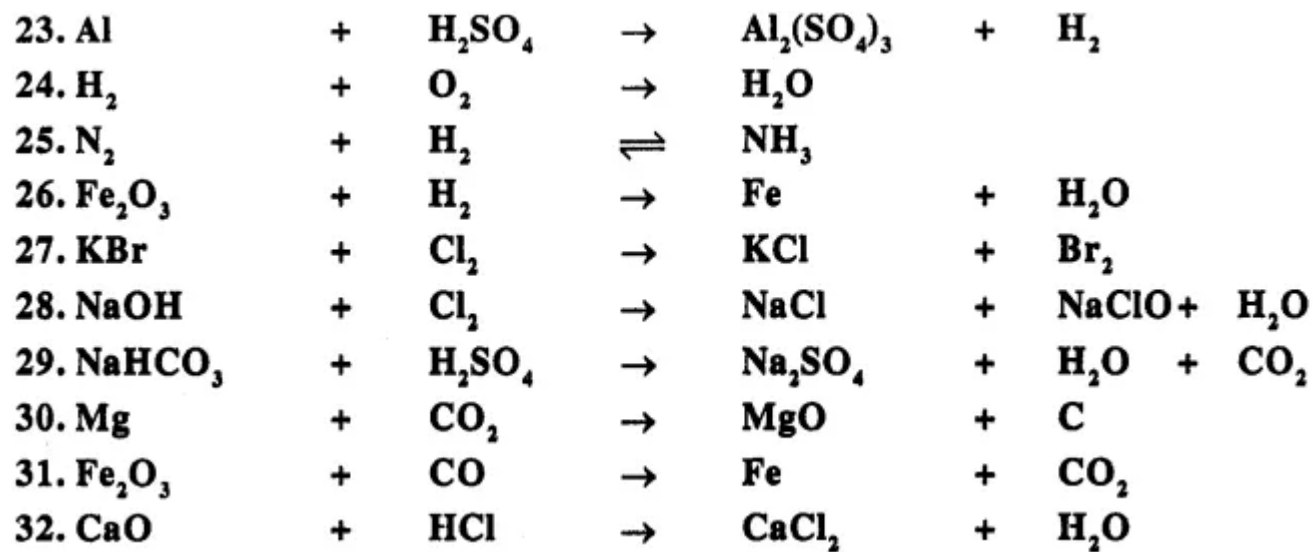
(b) Information not conveyed are :

1. Time, reaction takes to complete.
2. About the concentrations of reactants and products.
3. Speed of reaction.
4. Changes in colour occuring – during the reaction.
5. Whether heat is given out or absorbed during the reaction.
6. The physical state of reactants and products.

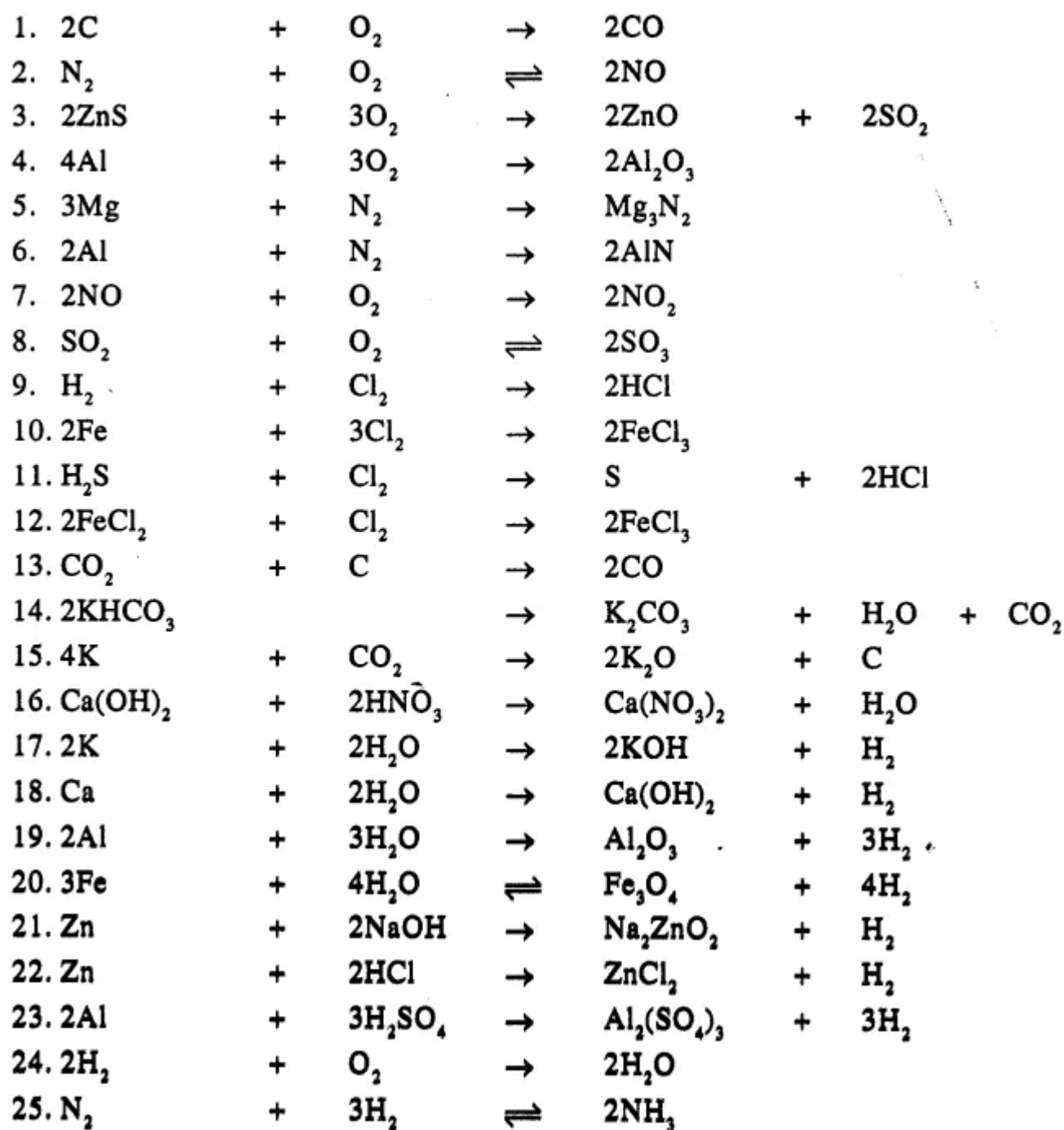
Question 19.

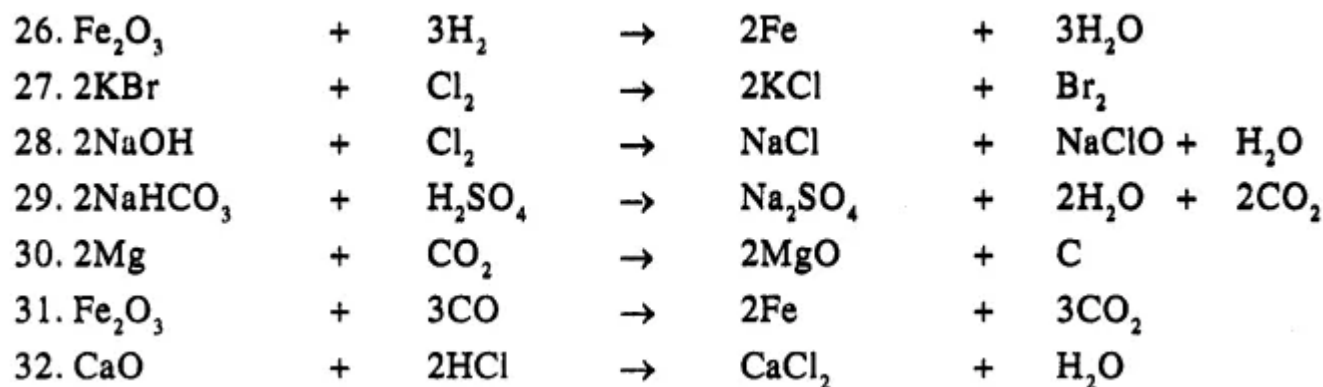
Balance the following simple equation :

1. C	+	O ₂	→	CO				
2. N ₂	+	O ₂	⇌	NO				
3. ZnS	+	O ₂	→	ZnO	+	SO ₂		
4. Al	+	O ₂	→	Al ₂ O ₃				
5. Mg	+	N ₂	→	Mg ₃ N ₂				
6. Al	+	N ₂	→	AlN				
7. NO	+	O ₂	→	NO ₂				
8. SO ₂	+	O ₂	⇌	SO ₃				
9. H ₂	+	Cl ₂	→	HCl				
10. Fe	+	Cl ₂	→	FeCl ₃				
11. H ₂ S	+	Cl ₂	→	S	+	HCl		
12. FeCl ₂	+	Cl ₂	→	FeCl ₃				
13. CO ₂	+	C	→	CO				
14. KHCO ₃			→	K ₂ CO ₃	+	H ₂ O	+	CO ₂
15. K	+	CO ₂	→	K ₂ O	+	C		
16. Ca(OH) ₂	+	HNO ₃	→	Ca(NO ₃) ₂	+	H ₂ O		
17. K	+	H ₂ O	→	KOH	+	H ₂		
18. Ca	+	H ₂ O	→	Ca(OH) ₂	+	H ₂		
19. Al	+	H ₂ O	→	Al ₂ O ₃	+	H ₂		
20. Fe	+	H ₂ O	⇌	Fe ₃ O ₄	+	H ₂		
21. Zn	+	NaOH	→	Na ₂ ZnO ₂	+	H ₂		
22. Zn	+	HCl	→	ZnCl ₂	+	H ₂		



Answer:





Question 20.

Write balanced equations for the following word equations :

- Potassium nitrate \rightarrow Potassium nitrite + Oxygen
- Calcium + Water \rightarrow Calcium hydroxide + Hydrogen
- Iron + Hydrochloric acid \rightarrow Iron [II] chloride + Hydrogen
- Nitrogen dioxide + Water + Oxygen \rightarrow Nitric acid
- Lead dioxide [lead (IV) oxide] \rightarrow Lead monoxide + Oxygen
- Aluminium + Oxygen \rightarrow Aluminium oxide
- Iron + Chlorine \rightarrow Iron [III] chloride
- Potassium bromide + Chlorine \rightarrow Potassium chloride + Bromine
- Potassium bicarbonate \rightarrow Potassium carbonate + Water + Carbon dioxide
- Calcium hydroxide + Ammonium chloride \rightarrow Calcium chloride + Water + Ammonia

Answer:

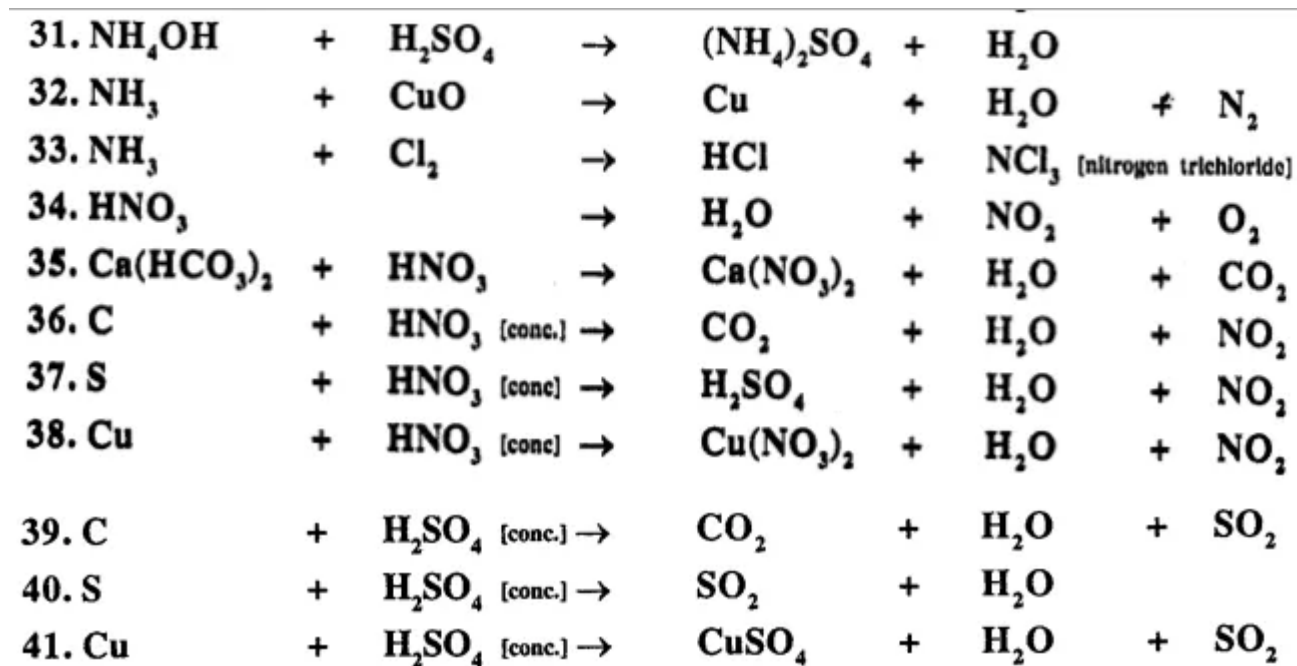
- $2\text{KNO}_3 \xrightarrow{\Delta} 2\text{KNO}_2 + \text{O}_2$
- $\text{Ca} + 2\text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2 + \text{H}_2$
- $\text{Fe} + 2\text{HCl} \rightarrow \text{FeCl}_2 + \text{H}_2$
- $4\text{NO}_2 + 2\text{H}_2\text{O} + \text{O}_2 \rightarrow 4\text{HNO}_3$
- $2\text{PbO}_2 \rightarrow 2\text{PbO} + \text{O}_2$
- $4\text{Al} + 3\text{O}_2 \rightarrow 2\text{Al}_2\text{O}_3$
- $2\text{Fe} + 3\text{Cl}_2 \rightarrow 2\text{FeCl}_3$
- $2\text{KBr} + \text{Cl}_2 \rightarrow 2\text{KCl} + \text{Br}_2$
- $2\text{KHCO}_3 \xrightarrow{\text{heat}} \text{K}_2\text{CO}_3 + \text{H}_2\text{O} + \text{CO}_2$
- $\text{Ca(OH)}_2 + 2\text{NH}_4\text{Cl} \rightarrow \text{CaCl}_2 + 2\text{H}_2\text{O} + 2\text{NH}_3$

Question 21.

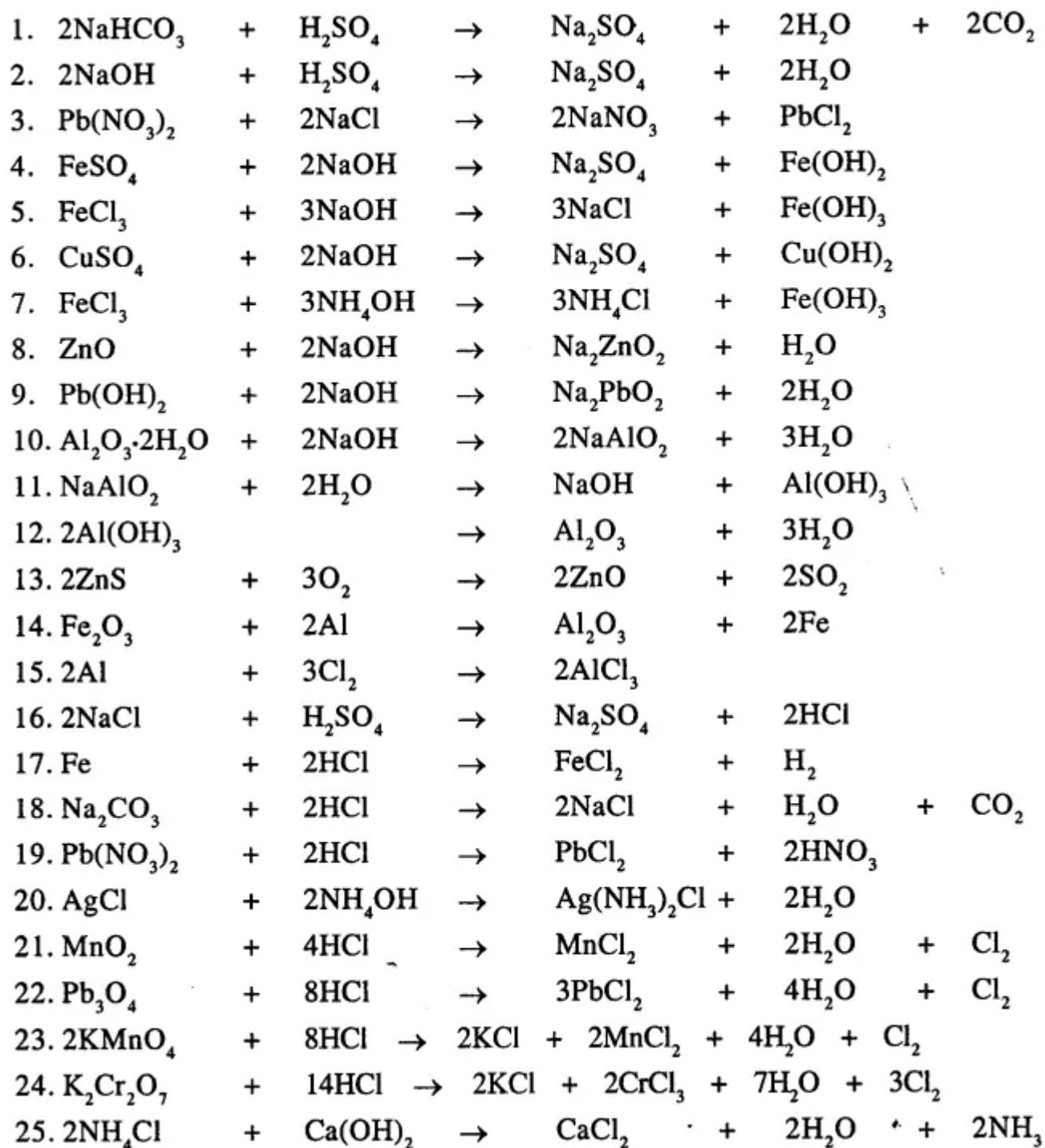
Balance the following important equations :

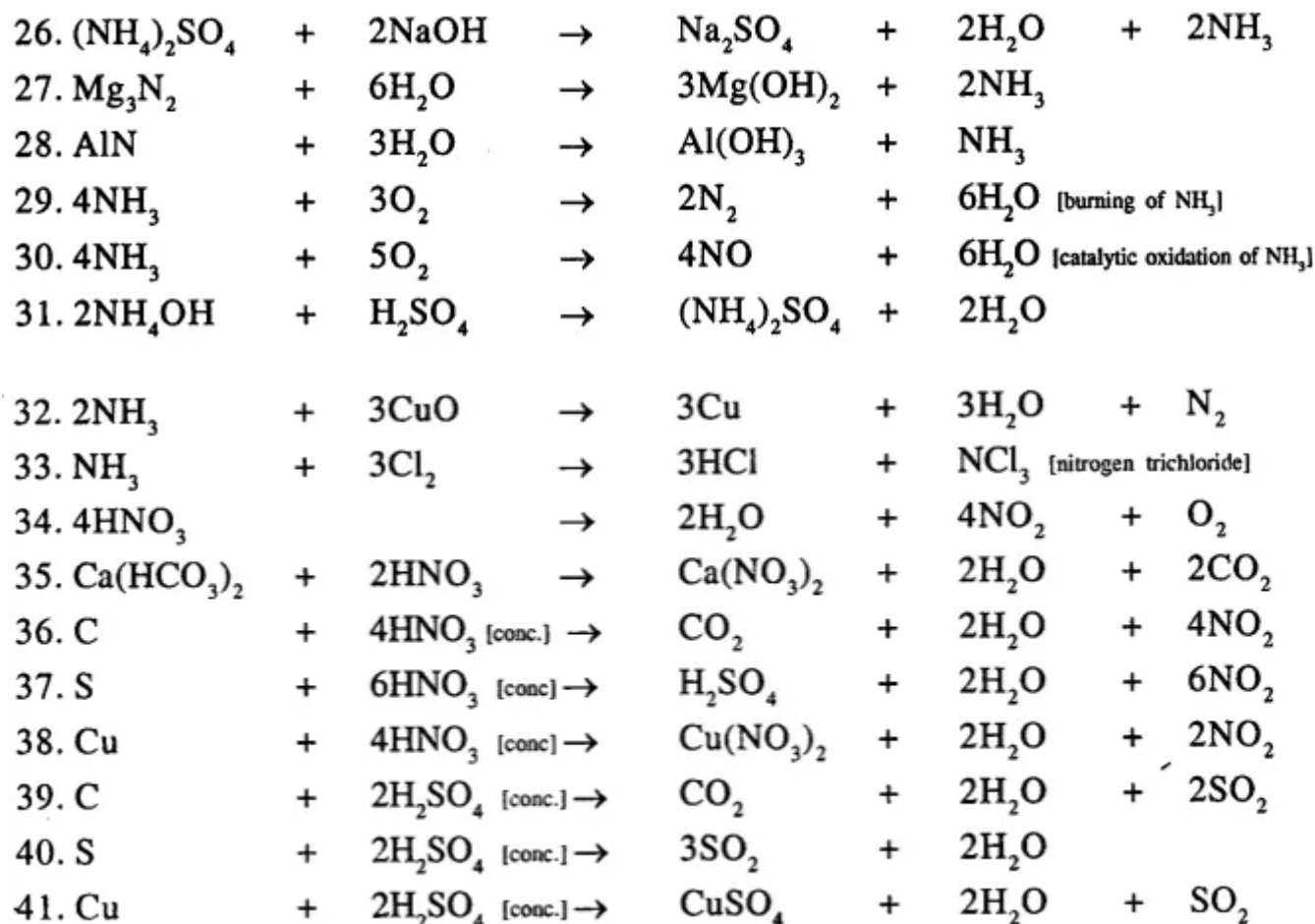


5. FeCl_3	+	NaOH	\rightarrow	NaCl	+	Fe(OH)_3				
6. CuSO_4	+	NaOH	\rightarrow	Na_2SO_4	+	Cu(OH)_2				
7. FeCl_3	+	NH_4OH	\rightarrow	NH_4Cl	+	Fe(OH)_3				
8. ZnO	+	NaOH	\rightarrow	Na_2ZnO_2	+	H_2O				
9. Pb(OH)_2	+	NaOH	\rightarrow	Na_2PbO_2	+	H_2O				
10. $\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$	+	NaOH	\rightarrow	NaAlO_2	+	H_2O				
11. NaAlO_2	+	H_2O	\rightarrow	NaOH	+	Al(OH)_3				
12. Al(OH)_3			\rightarrow	Al_2O_3	+	H_2O				
13. ZnS	+	O_2	\rightarrow	ZnO	+	SO_2				
14. Fe_2O_3	+	Al	\rightarrow	Al_2O_3	+	Fe				
15. Al	+	Cl_2	\rightarrow	AlCl_3						
16. NaCl	+	H_2SO_4	\rightarrow	Na_2SO_4	+	HCl				
17. Fe	+	HCl	\rightarrow	FeCl_2	+	H_2				
18. Na_2CO_3	+	HCl	\rightarrow	NaCl	+	H_2O	+	CO_2		
19. $\text{Pb(NO}_3)_2$	+	HCl	\rightarrow	PbCl_2	+	HNO_3				
20. AgCl	+	NH_4OH	\rightarrow	$\text{Ag(NH}_3)_2\text{Cl}$	+	H_2O				
21. MnO_2	+	HCl	\rightarrow	MnCl_2	+	H_2O	+	Cl_2		
22. Pb_3O_4	+	HCl	\rightarrow	PbCl_2	+	H_2O	+	Cl_2		
23. KMnO_4	+	HCl	\rightarrow	KCl	+	MnCl_2	+	H_2O	+	Cl_2
24. $\text{K}_2\text{Cr}_2\text{O}_7$	+	HCl	\rightarrow	KCl	+	CrCl_3	+	H_2O	+	Cl_2
25. NH_4Cl	+	Ca(OH)_2	\rightarrow	CaCl_2	+	H_2O	+	NH_3		
26. $(\text{NH}_4)_2\text{SO}_4$	+	NaOH	\rightarrow	Na_2SO_4	+	H_2O	+	NH_3		
27. Mg_3N_2	+	H_2O	\rightarrow	Mg(OH)_2	+	NH_3				
28. AlN	+	H_2O	\rightarrow	Al(OH)_3	+	NH_3				
29. NH_3	+	O_2	\rightarrow	N_2	+	H_2O	[burning of NH_3]			
30. NH_3	+	O_2	\rightarrow	NO	+	H_2O	[catalytic oxidation of NH_3]			



Answer:





Question 22.

Give balanced equations for (1) & (2) by partial equation method, [steps are given below]

(1) Reaction of excess ammonia with chlorine – Ammonia as a reducing agent

(a) Ammonia first reacts with chlorine to give hydrogen chloride and nitrogen.

(b) Hydrogen chloride then further reacts with excess ammonia to give ammonium chloride.

(2) Oxidation of Lead [II] Sulphide by Ozone

(a) Ozone first decomposes to give molecular oxygen & nascent oxygen.

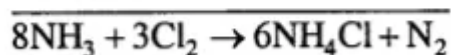
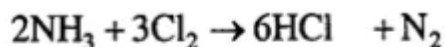
(b) Nascent oxygen then oxidises lead [II] sulphide to lead [II] sulphate.

Answer:

(1)

(a) Ammonia reacts with chlorine to give hydrogen chloride and nitrogen.

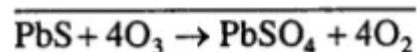
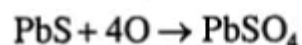
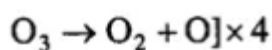
(b) Hydrogen chloride reacts with excess ammonia to give ammonium chloride.



(2)

(a) ozone decomposes to O_2 (molecular) and nascent oxygen.

(b) Nascent oxygen oxidises Pb [II] sulphide to Lead [II] sulphate and needs 4 atoms of oxygen to form sulphate. Hence 1st equation must be multiplied by 4. Cancelling 4 atom of oxygen from both sides and adding.



Question 23.

Define the terms – (a) Relative atomic mass (b) Relative molecular mass. State why indirect methods are utilised to determine the absolute mass of an atom. Explain in brief the indirect method used.

Answer:

(a) Relative atomic mass [RAM] of an element :

"is the number of times one atom of an element is heavier than $1/12$ the mass of an atom of carbon [C^{12}]"

or

"Mass of an atom of an element as compared with $1/12$ mass of an atom of carbon [C^{12}]"

(b) Relative molecular mass [RMM] of an element/compound : "Is the number of times one molecule of the substance is heavier than $1/12$ the mass of an atom of carbon [C^{12}]."

$$\text{RAM} = \frac{\text{Mass of one atom of the element}}{\text{Mass of one atom of carbon } [\text{C}^{12}]}$$

or

"Mass of one molecule as compared with the $1/12$ mass of an atom of carbon [C^{12}]"

$$\text{RMM} = \frac{\text{Mass of one molecule of the substance}}{(\frac{1}{12}) \text{Mass of one atom of carbon } [\text{C}^{12}]}$$

To determine the absolute mass of an atom indirect methods are utilised as Atom are extremely small and very light.

An isotope of carbon C^{12} [carbon -12 atom] has been assigned atomic mass of exactly 12 atomic mass unit] is used.

Question 24.

1. Calculate relative molecular mass of

(a) ZnCO_3

(b) CaSO_4 [Zn = 65, S=32, O = 16, Ca = 40, C = 12]

2. Calculate the percentage composition of

(a) calcium chloride

(b) calcium nitrate [Ca = 40 , Cl = 35.5 , N = 14 , O = 16]

Answer:

1. (a) Relative molecular mass of ZnCO_3

$$= \text{Zn} + \text{C} + 3[\text{O}]$$

$$= 65 + 12 + 3[16]$$

$$= 77 + 48 = 125$$

(b) Relative molecular mass of CaSO_4

$$\text{At wt. of Ca} + \text{At. wt. of S} + 4 [\text{at. wt. of O}]$$

$$= 40 + 32 + 4(16) = 72 + 64$$

$$= 136$$

2. (a) Percentage composition of (a) calcium chlorine [CaCl_2]

$$\text{Molecular mass of } \text{CaCl}_2 = \text{Ca} + 2[\text{Cl}]$$

$$= 40 + 2[35.5]$$

$$= 40 + 70 = 110$$

$$\% \text{ of Ca} = \frac{\text{Mass of calcium}}{\text{Molecular mass}} \times 100$$

$$= \frac{40}{110} \times 100 = \frac{400}{11} = 36.36\%$$

$$\% \text{ age of chlorine} = \frac{\text{Mass of } \text{Cl}_2}{\text{Molecular mass of } \text{CaCl}_2}$$

$$= \frac{70}{110} \times 100 = \frac{700}{11} = 63.64\%$$

$$\text{Or } \% \text{ of } \text{Cl}_2 = 100 - 36.36 = 63.64\%$$

(b) Calcium nitrate $\text{Ca}[\text{NO}_3]_2$

$$\text{Molecular mass of } \text{Ca}[\text{NO}_3]_2 = \text{Ca} + 2[\text{N}^2 + 3(\text{O})]$$

$$= 40 + 2 [14 + 3 \times 16]$$

$$= 40 + 2[14 + 48]$$

$$= 40 + 124 = 164$$

$$\% \text{ of Ca} = \frac{40}{164} \times 100 = 24.39$$

$$\% \text{ of N} = \frac{28}{164} \times 100 = 17.07$$

$$\% \text{ of O} = \frac{96}{164} \times 100 = 58.54$$

Q.1. Match the names of ions and radicals from 1 to 10 with their correct answer from A to Q.

A : Hg^{2+}	B : MnO_4^{1-}	C : Sn^{4+}	D : Pb^{2+}
E : Sn^{2+}	F : Pb^{4+}	G : SO_3^{2-}	H : N^{3-}
I : NO_2^{1-}	J : MnO_4^{2-}	K : Hg^{1+}	L : SO_4^{2-}
M : ClO^{1-}	N : ZnO_2^{2-}	O : $\text{Cr}_2\text{O}_7^{2-}$	P : CrO_4^{2-}
Q : ClO_3^{1-}			

1. Hypochlorite

2. Permanganate

3. Plumbous

4. Zincate

5. Nitride

6. Mercuric

7. Stannic

8. Nitrite

9. Sulphite

10. Dichromate

Answer:

1. Hypochlorite — M : ClO^{1-}

2. Permanganate — J : MnO_4^{2-}

3. Plumbous — D : Pb^{2+}

4. Zincate — N : ZnO_2^{2-}

5. Nitride — H : N^{3-}

6. Mercuric — A : Hg^{2+}

7. Stannic — C : Sn^{4+}

8. Nitrite — I : NO_2^{1-}

9. Sulphite — G : SO_3^{2-}

10. Dichromate — O : $\text{Cr}_2\text{O}_7^{2-}$

Q.2. State which of the following formulas of compounds A to J are incorrect. incorrect write the correct formula.

A : $(\text{NH}_4)_3\text{SO}_4$

B : NaZnO_2

C : KCr_2O_7

D : NaCO_3

E : $\text{Ca}_2(\text{PO}_4)_3$

F : $\text{Mg}(\text{SO}_4)_2$

G : KNO_3

H : NaClO

I : NaO

J : BaCl_2

Answer:

A : $(\text{NH}_4)_3\text{SO}_4$	Correct is -	$(\text{NH}_4)_2\text{SO}_4$
B : NaZnO_2	Correct is	Na_2ZnO_2
C : KCr_2O_7	Correct is	$\text{K}_2\text{Cr}_2\text{O}_7$
D : NaCO_3	Correct is	Na_2CO_3
E : $\text{Ca}_2(\text{PO}_4)_3$	Correct is	$\text{Ca}_3(\text{PO}_4)_2$
F : $\text{Mg}(\text{SO}_4)_2$	Correct is	MgSO_4
I : NaO	Correct is	Na_2O
G, H, J are correct		

Q.3. Fill in the blanks with the correct word from the words in brackets :

Question 1.

A symbol represents a short form of a / an ____ [atom / element / molecule]

Answer:

A symbol represents a short form of a / an **element**.

Question 2.

Compounds are always ____ (heterogeneous/homogeneous) in nature.

Answer:

Compounds are always **homogeneous** in nature.

Question 3.

Variable valency is exhibited, since electrons are lost from an element from the ____ [valence / penultimate] shell.

Answer:

Variable valency is exhibited, since electrons are lost from an element from the **penultimate** shell.

Question 4.

A chemical equation is a shorthand form for a ____ [physical / chemical] change.

Answer:

A chemical equation is a shorthand form for a **chemical** change.

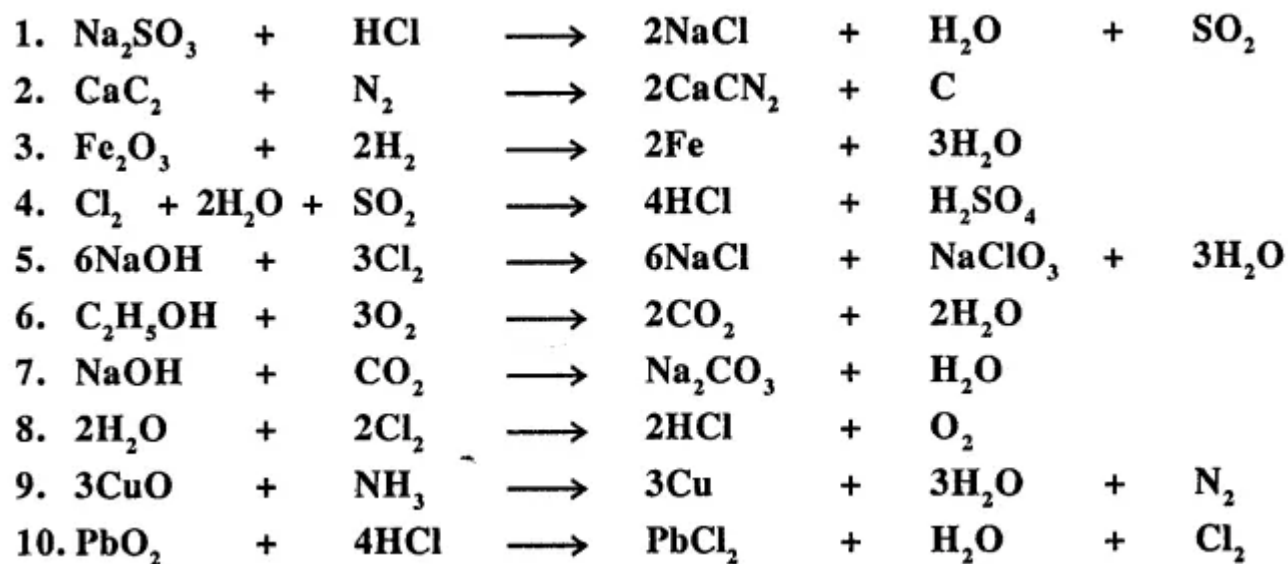
Question 5.

Relative molecular mass of an element/compound is the number of times one ____ of the substance is heavier than $\frac{1}{12}$ th the mass of an atom of carbon [C_{12}]. (atom/ion/molecule)

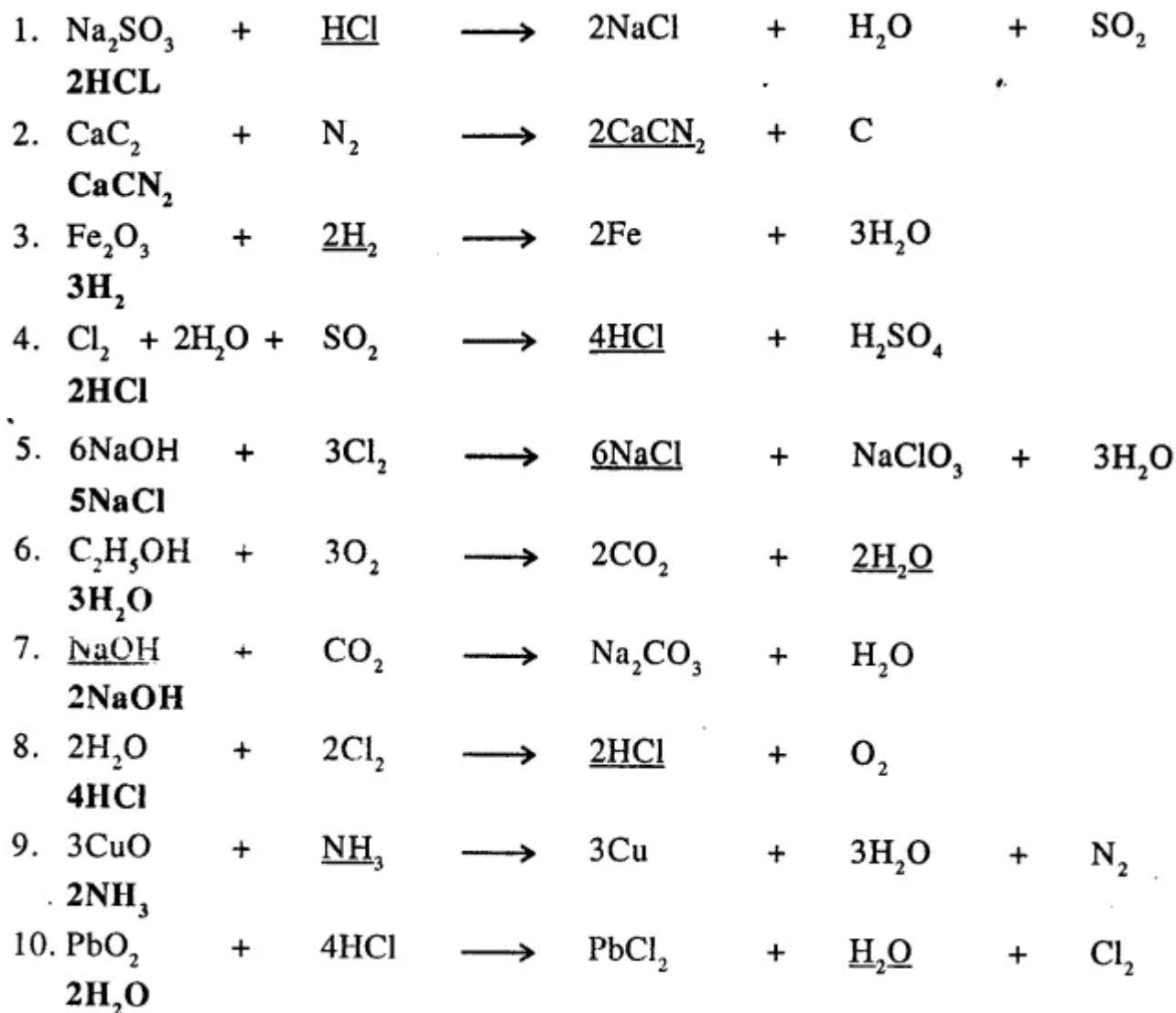
Answer:

Relative molecular mass of an element/compound is the number of times one **molecule** of the substance is heavier than $\frac{1}{12}$ th the mass of an atom of carbon [C_{12}].

Q.4. Underline the compound in each equation given below, which is incorrectly balanced and write the correct balancing for the same.



Answer:



Q.5. With reference to a chemical equation state which of the statements 1 to 5 pertain to A or B.

A : Information provided by a chemical equation. .

B : Limitations of a chemical equation

1. The nature of the individual elements.
2. The speed of the reaction.
3. The state of matter in which the substance is present.
4. The completion of the reaction.
5. The direction of the reaction.

Answer:

A : Information provided by a chemical equation.

1. The nature of the individual elements.
3. The state of matter in which the substance is present.

5. The direction of the reaction.

B : Limitations of a chemical equation

2. The speed of the reaction.

4. The completion of the reaction.