Visit QB365-SLMS - https://www.qb365.in/slms/ Complete Questions and Answers

Answers Key:

IV. Answer any 3

1. $2Al + Fe_2O_3 \longrightarrow Al_2O_3 + 2Fe$

	Reactants		Products	
	Al	Fe_2O_3	Al_2O_3	Fe
Amount of reactant allowed to react	324 g	1.12 kg	-	-
Number of moles allowed to react	$\frac{324}{27} = 12mol$	$\frac{1.12\times10^3}{160} = 7mol$	-	-
Stoichiometric Co-efficient	2	1	1	2
Number of moles consumed during reaction	12 mol	6 mol	-	-
Number of moles of reactant unreacted and number of moles of product formed	-	1 mol	6 mol	12 mol

Molar mass of Al_2O_3 format = 6 mol x 102 g mol^{-1} = 612 g
[Al_2O_3 : (2 x 27) + 3(16) = 54 + 48 = 102] = 612 g
Excess reagent = Fe_2O_3
Amount of excess reagent left at the end of the reaction = 1 mol x 160 g mol^{-1}
= 160g [Fe_2O_3 : (2 x 56) + (3 x 16) = 112 + 48 = 160] = 160 g

2. Half reactions are:
$\overset{+7}{MnO_4^-} \longrightarrow Mn^{2+}$
and $Sn^{2+} \longrightarrow Sn^{4+}$
(1) $\Rightarrow MnO_4^- + 8H^- + 5e^- \longrightarrow Mn^{2+} + 4H_2O$
(2) $\Rightarrow Sn^{2+} \longrightarrow Sn^{4+} + 2e^-$

$(1)\times2 \Rightarrow \quad 2MnO_4^- + 16H^- + 10e^- \longrightarrow 2Mn^{2+} + 8H_2O$
$(2)\times5 \Rightarrow \quad 5Sn^{2+} \longrightarrow 5Sn^{4+} + 10e^-$
$\Rightarrow 2MnO_4^- + 5Sn^{2+} + 16H^+ \longrightarrow 2Mn^{2+} + 5Sn^{4+} + 8H_2O$

ii)
$C_2O_4^{2-} + Cr_2O_7^{2-} \longrightarrow Cr^{3+} + CO_2$ (in acid medium)

$C_2^{+3}O_4^{2-} \longrightarrow C^{+4}O_2$ .....(1)
$Cr_2^{+6}O_7^{2-} \longrightarrow Cr^{3+}$ .....(2)
$C_2O_4^{2-} \longrightarrow 2\,CO_2 + 2\,e^-$ .....(3)
$Cr_2O_7^{2-} + 14\,H^+ \longrightarrow 2\,Cr^{3+} + 7\,H_2O$ .....(4)
$3\,C_2O_4^{2-} \longrightarrow 6\,CO_2 + 6\,e^-$ .....(5) [Eq. (3) × 3]
$Cr_2O_7^{2-} + 14\,H^+ + 6\,e^- \longrightarrow 2\,Cr^{3+} + 7\,H_2O$ .....(4)
$Cr_2O_7^{2-} + 3\,C_2O_4^{2-} + 14\,H^+ \longrightarrow 2\,Cr^{3+} + 6\,CO_2 + 7\,H_2O$

iii)
$Na_2S_2O_3 + I_2 \longrightarrow Na_2S_4O_6 + NaI$

$S_2O_3^{2-} \longrightarrow S_4O_6^{2-}$ .....(1)
half reaction $I_2 \longrightarrow I^-$ .....(2)
$2\,S_2O_3^{2-} \longrightarrow S_4O_6^{2-} + 2\,e^-$ .....(3)
$I_2 + 2\,e^- \longrightarrow 2\,I^-$ .....(4)
Add Equation (3) + (4) we get,
$2\,S_2O_3^{2-} + I_2 \longrightarrow S_4O_6^{2-} + 2\,I^-$

iv)
$Zn + NO_3^- \longrightarrow Zn^{2+} + NO$ (in acid medium)

Half reactions are

$Z^0n \longrightarrow Zn^{2+}$ .....(1)

$N^{+5}O_3^- \longrightarrow N^{2+}O$ .....(2)

$Zn \longrightarrow Zn^{2+} + 2e^-$ .....(3)

$NO_3^- + 3e^- + 4H^+ \longrightarrow NO + 2H_2O$ .....(4)

$3Zn \longrightarrow 3Zn^{2+} + 6e^-$ .....(5) [Eq. (3) × 3]

$2NO_3^- + 6e^- + 8H^+ \longrightarrow 2NO + 4H_2O$ .....(6) [Eq. (4) × 2]

$3Zn + 2NO_3^- + 8H^+ \longrightarrow 3Zn^{2+} + 2NO + 4H_2O$

3.

Element	Percentage Composition	$\frac{Relative No. of atoms Percentage}{Atomic mass}$	$\frac{Atomic Mass Percentage}{Relative No. of atoms}$	Simple Ratio
X	32%	2	16	$\frac{2}{0.5} = 4$
Y	24%	1	24	$\frac{1}{0.5} = 2$
Z	44%	0.5	88	$\frac{0.5}{0.5} = 1$
Empirical formula ($X_4 y_2 Z$)				

Empirical formula mass = (16 x 4) + (24 x 2) + 88 = 64 + 48 + 88 = 200

n = $\frac{Molar \quad mass}{calculated\ emphirical\ formula\ mass}$

n = $\frac{400}{200}$

= 2

Molecular formula $(X_4 y_2 Z)_2 = X_8 Y_4 Z_2$

4. Step - 1 : To find atoms undergoing change in O.N.

$\overset{+3}{N}H_3 + \overset{0}{F_2} \rightarrow \overset{-1}{H}\overset{}{F} + \overset{0}{N_2}$.

Step - 2 : To find the total increase and decrease in O.N.

$NH_3 \longrightarrow N_2$ (decrease of 3 units per atom)

$F_2 \longrightarrow HF$ (increase in 1 unit per atom)

Total decrease = 6 units (3 x 2)

Total increase =6 units (2 x 3)

Step-3: To balance the increase and decrease in O.N, multiply NH_3 by 2 and F_2 by 3.

$2NH_3 + 3F_2 \longrightarrow HF + N_2$

Step-4: To balance all atoms other than oxygen

$2NH_3 + 3F_2 \longrightarrow 6HF + N_2$

Hydrogen atom balanced by themselves.

Hence, the balanced equation is $2N_3 + 3F_2 \longrightarrow 6HF + N_2$.

QB TM 365 Study Material
QUESTION BANK 365

5.

Elements	Percentage	Atomic Mass	Relative No. of moles = percentage/Atomic mass	Simple ratio of
C	54.55%	12	$\frac{54.55}{12} = 4.55$	$\frac{4.54}{2.27} = 2$
H	9.09%	1	$\frac{9.09}{1} = 9.09$	$\frac{9.09}{2.27} = 4$
O	36.36%	16	$\frac{36.06}{16} = 2.27$	$\frac{2.27}{2.27} = 1$
Empirical Formulla = C_2H_4O				

III. Answer any 4

6. Molar mass = density x Molar volume

= 1.965 x 2.24 x 10^{-2}

= 4.4016 x 10^{-2} kg/mol

= 4.4016 x 10^{-2} x 10^3 g/mol

= 44.016 g/mol

7. 1) The unit of molecular mass is atomic mass unit [amu]. The unit of molar mass is gram per mole.

2) Molecular mass is the mass of one molecule while molar mass is the mass of one mole of molecules (6.022 x 10^{23})

(i) Molecular mass of CO_2 = 1(C) + 2(0) = 12 + 32 = 44 amu

or 7.304 x 10^{-23} g

(ii) Molar mass of CO_2 = 44 g mol^{-1}.

8. Mass of the metal = 0.456 g

Mass of the metal chloride = 0.606 g

0.456 g of the metal combines with 0.15 g of chlorine.

Mass of the metal that combines with 35.5 g of chlorine is $\frac{0.456}{0.15}$ x 35.5

= 107.92 g eq^{-1}.

9. The balanced stoichiometric equation for the formation of ammonia is

$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

As per the stoichiometric equation,

To produce 2 moles of ammonia, 3 moles of hydrogen are required.

∴ to produce 10 moles of ammonia,

$\frac{3 \text{ moles of } H_2}{2 \text{ moles of } NH_3} \times 10 \text{ moles of } NH_3$

= 15 moles of hydrogen are required.

10.

Element	Percentage	Molar mass	Relative no. of moles	Simplest ratio	Simplest ratio (in whole no)
C	32	12	$\frac{32}{12} = 2.66$	$\frac{2.66}{2.66} = 1$	2
H	4	1	$\frac{4}{1} = 4$	$\frac{4}{2.66} = 1.5$	3
O	64	16	$\frac{64}{16} = 4$	$\frac{4}{2.66} = 1.5$	3

The empirical formula is $C_2H_3O_3$

II. Answer any 4

11. One mole is the amount of substance of a system, which contains as many elementary particles as there are atoms in 12 g of carbon -12 isotope.
12. Gram equivalent mass of an element, compound or ion is the mass that combines or displaces 1.008 g hydrogen or 8 g oxygen or 35.5 g chlorine.
13. It is defined as the imaginary charge left on the atom when all other atoms of the compound have been removed in their usual oxidation states that are assigned according to set of rules.
14. i) urea $[CO(NH_2)_2]$
Mol.mass = 1 (C) + 2(N) + 4(H) + 1(0)
= 1(12) + 2(14) + 4(1) + 1(16)
= 12 + 28 + 4 + 16 = 60
ii) Acetone $[CH_3\,COCH_3]$
Mol.mass = 3(C) + 6(H) + 1(0)
= 3(12) + 6(1) + 1(16)
= 36 + 6 + 16 = 58
iii) Boric Acid $[H_3\,BO_3]$
Mol.mass = 3(H) + 1(B) + 3(0)
= 3(1) + 1(11) + 3(16)
= 3 + 11 + 48 = 62
iv) Sulphuric Acid $[H_2\,SO_4]$
Mol.mass = 2(H) + 1(S) + 4(0)
= 2(1) + 1(32) + 4(16)
= 2 + 32 + 64 = 98
15. (i) Element - Copper wire, Silver plate
(ii) Compound - Sugar, distilled water, carbon dioxide, Table salt, Naphthalene balls
(iii) Mixture - Sea water

QB 365 TM Study Material
QUESTION BANK 365

I. Choose the correct answer

16. (a) 40 ml CO_2 gas
17. (b) Oxygen
18. (c) 6.022×10^{20}
19. (c) 16%
20. (c) $S_2O_4^{2-} < SO_3^{2-} < S_2O_6^{2-} < SO_4^{2-}$