Mole Concept

DPP-2 Solutions

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1. 10 mol NH_3.

Sol. 1 mol Cu $(NH_3)_4$ SO_4 is produced from
= 4 mol NH_3
2.5 mol Cu $(NH_3)_4$ SO_4 is produced from
= 4/1 × 2.5
= 10 mol NH_3

2. 0.2

Sol. $Ba(OH)_2 + 2HClO_3 \rightarrow Ba(ClO_3)_2 + 2H_2O$
0.1 0.25
1 mole of $Ba(OH)_2$ reacts with 2 moles of $HClO_3$
0.1 mole of $Ba(OH)_2$ reacts with 0.2 moles of $HClO_3$
$\therefore$ $Ba(OH)_2$ is the limiting reagent & $HClO_3$ is the excess reagent.
$\therefore$ Moles of H_2O formed = 0.2

3. 823.53g

Sol. $2C_8H_{18} + 17O_2 \rightarrow 16CO + 18H_2O$
wt. of C_8H_{18} = 1000g $\Rightarrow$ moles of C_8H_{18} = 8.77
wt. of O_2 = 1000g $\Rightarrow$ moles of O_2 = 31.25
2 moles of octane reacts with = 17 moles of O_2
8.77 moles of octane reacts with
= 74.545 moles of O_2
$\therefore$ O_2 is the Limiting reagent.
17 moles of O_2 forms = 16 moles of CO
31.25 moles of O_2 forms = 29.41 moles of CO
Wt. of CO produced = 29.41 × 28
= 823.52g

4. 264g

Sol. $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$
wt. of ethane = 90g

$\therefore$ moles of ethane = $\frac{90}{30} = 3$

$\therefore$ moles of CO_2 produced = $3 \times \frac{4}{2} = 6$moles.

$\therefore$ wt. of CO_2 produced = 6×44g
= 264g

5. 5.55g

Sol. $CaCl_2 + 2AgNO_3 \rightarrow Ca(NO_3)_2 + 2AgCl.$
wt. of AgCl = 14.3g.

$\therefore$ Moles of AgCl = $\frac{14.3}{143.5} \approx 0.1.$

Moles of $CaCl_2$ = $\frac{0.1}{2} = 0.05$ moles

2 moles of AgCl is produced from = 1 mol of $CaCl_2$
0.1 mole of AgCl is produced from = 0.05 moles
$\therefore$ wt. of $CaCl_2$ required = 0.05×111
= 5.55g

6. 6.38g

Sol. $2KClO_3 \xrightarrow{\Delta} 2KCl + 3O_2$
wt. of O_2 produced = 2.5g.

$\therefore$ Moles of O_2 produced = $\frac{2.5}{32}$

$\therefore$ Moles of $KClO_3$ required = $\frac{2}{3} \times \frac{2.5}{32}$

$\therefore$ wt. of $KClO_3$ required = $\frac{2}{3} \times \frac{2.5}{32} \times 122.5$
= 6.38 g

7. 132.8g

Sol. $8KI + 5H_2SO_4 \rightarrow 4K_2SO_4 + 4I_2 + H_2S + 4H_2O$

Moles of K_2SO_4 = $\frac{69.6}{174} = 0.4$ Moles

4 Moles of K_2SO_4 is produced from = 8 Moles KI
0.4 Moles of K_2SO_4 is produced from
= 0.8 moles KI
Mass of KI = 0.8 × 166
= 132.8 g

8. 59.2g

Sol. $2Al + 3MnO \rightarrow Al_2O_3 + 3Mn$
Weight of Al taken = 110g
$\Rightarrow$ Moles of Al taken = 110/27 = 4.074 moles
Weight of MnO taken = 200g
$\Rightarrow$ Moles of MnO taken = 2.817 moles
3 Moles of MnO reacts with = 2 moles of Al
So, 2.817 moles of MnO reacts with
= $\frac{2}{3} \times 2.817$ moles of Al
= 1.878 moles of Al
Therefore,
MnO is the limiting reagent and Al is the excess reagent.
Amount of Al in excess = 4.074 – 1.878
= 2.196 moles = 2.196 × 27g
= 59.2g

9. (i) 44g, (ii) 22g, (iii) 22g

Sol. (i) $C + O_2 \rightarrow CO_2$
1 mol carbon produces = 44g CO_2
(ii) 12g carbon requires = 32g O_2
L.R. = O_2
32g O_2 produces = 44g CO_2
16g O_2 produces = 22g CO_2
(iii) 12g carbon requires = 32g O_2

24g (2 mol) carbon requires = 64g O_2

L.R. = O_2

16g O_2 will produce = 22g CO_2

10. $\mathbf{A + B_2 \rightarrow AB_2}$

Sol. (i) 1 atom of A reacts with = 1 molecule of B_2

300 atoms of A reacts with

= 300 molecules of B_2

L.R. = B_2

(ii) 1 mol of A reacts with = 1 mol of B_2

2 mol A reacts with = 2 mol of B_2

$\therefore$ L.R. = A

(iii) 1 atom of A reacts with = 2 atoms of B

100 atoms of A reacts with = 200 atoms of B

LR. = B_2

(iv) 1 mol A reacts with = 1 mol of B_2

5 mol A reacts with = 5 mol of B_2

L.R. = B_2

(v) 1 mol of A reacts with = 1 mol of B_2

2.5 mol of A reacts with

= 2.5 mol of B_2

L.R. = A

11. $\mathbf{N_2\ (g) + 3H_2(g) \rightarrow 2\ NH_3}$

Sol. **(i)** 28g N_2 reacts with = 6g H_2

2000g N_2 reacts with = 428.56g H_2

L.R. = N_2

$\therefore$ 28g N_2 forms = 34g NH_3

2000g N_2 forms = 2428.57g NH_3

(ii) Yes, H_2

(iii) H_2 left = 1000 – 428.56 = 571.43g

12. **8.4g**

Sol. 4HCl (aq) + MnO_2(s) $\rightarrow$ 2 H_2O (l) + $MnCl_2$ (aq) + Cl_2 (g)

M.M. of MnO_2 = 87g/mol

87g MnO_2 reacts with = 146g HCl

5g MnO_2 reacts with = 8.40g HCl

13. **(a)**

Sol. No solution

14. **(c)**

Sol. **(a)** 28g $N_2 \equiv N_A$ molecules

7g $N_2 = N_A/4$ molecules

(b) 32g $O_2 \equiv N_A$ molecules

16g $O_2 \equiv N_A/2$ molecules

(c) 2g $H_2 \equiv N_A$ molecules

(d) 46g $NO_2 \equiv N_A$ molecules

16g $NO_2 \equiv 0.34\ N_A$ molecules.

15. **(b)**

Sol. 24 g Mg $\equiv N_A$ atoms

$\Rightarrow$ 12 g Mg $\equiv N_A/2$ atoms

Also, 28g $N_2 \equiv 2N_A$ atoms

7g $N_2 \equiv N_A/2$ atoms

16. **(a)**

Sol. **(a)** 18g $H_2O \equiv N_A$ molecules

36g $H_2O \equiv 2N_A$ molecules

(b) 44g $CO_2 \equiv N_A$ molecules

28g $CO_2 \equiv 0.64\ N_A$ molecules

(c) 42g $CH_3OH \equiv N_A$ molecules

46g $CH_3OH \equiv 1.4375\ N_A$ molecules

(d) 108g $N_2O_5 = N_A$ molecules

58g $N_2O_5 \equiv 0.54\ N_A$ molecules

17. **(b)**

Sol. $2Al + 3/2\ O_2 \rightarrow Al_2O_3$

3/2 moles of O_2 combine with Al = 2 mol

mass of Al = 2 × 27 = 54g

18. **(c)**

Sol. No solution

19. **(d)**

Sol. 3 $BaCl_2$ + $2Na_3PO_4 \rightarrow Ba_3(PO_4)_2$ + 6 NaCl

0.5 mol 0.2 mol

3 mol $BaCl_2 \equiv$ 2 mol Na_3PO_4

0.5 mol $BaCl_2 \equiv \frac{2}{3} \times 0.5 = 0.33$ mol Na_3PO_4

$\Rightarrow$ Na_3PO_4 = L.R.

2 mol $Na_3PO_4 \equiv$ 1 mol $Ba_3(PO_4)_2$

0.2 mol $Na_3PO_4 \equiv$ 0.1 mol $Ba_3(PO_4)_2$

20. **(b)**

Sol. (a) mass of Fe = 50g

(b) mass of N_2 = 5 × 28 = 140 g

(c) mass of Ag = 0.1 × 108 = 10.8 g

(d) mass of carbon = 6g.

21. **(b)**

Sol. $CaCO_3 \longrightarrow CaO + CO_2$

100g $CaCO_3$ produces = 56g CaO

25g $CaCO_3$ produces = 14g CaO.