CH30 Rxns Part 2 Key

① a) Synth b) S.R. c) decomp d) D.R. e) Comb f) Synth

② a) $2Na + 2HCl \rightarrow 2NaCl + H_2$

b) $Al_2(SO_4)_3 + 3Ca(OH)_2 \rightarrow 2Al(OH)_3 + 3CaSO_4$

c) $2K + 2H_2O \rightarrow 2KOH + H_2$

d) $6CaO + P_4O_{10} \rightarrow 2Ca_3(PO_4)_2$

e) $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$

③ a) $2(NH_4)_3PO_4 + 3Mg(OH)_2 \rightarrow Mg_3(PO_4)_2 + 6NH_4OH$

b) $C_5H_{12} + 8O_2 \rightarrow 5CO_2 + 6H_2O$

c) $2KI + Pb(NO_3)_2 \rightarrow 2KNO_3 + PbI_2$

d) $3Hg_2S + N_2 \rightarrow 2Hg_3N + 3S$

④ $0.15\ mol\ S \times \frac{32.1\ g}{1\ mol} = \boxed{4.815\ g\ S}$

⑤ $16.1\ g\ NO_2 \times \frac{1\ mol}{46\ g} = \boxed{0.35\ mol\ NO_2}$

⑥ $2.17 \times 10^{23}\ atoms \times \frac{1\ mol}{N_A\ atoms} = \boxed{0.36\ mol\ Mg}$

⑦ $32.1\ g\ Ca \times \frac{1\ mol}{40.1\ g} = \boxed{0.8\ mol\ Ca}$

(8) $2.25\,g \times \frac{1\,mol}{18.02\,g} = \boxed{0.13\,mol\ H_2O}$

(9) $1.5\,mol\ H_3PO_4 \times \frac{98.03\,g}{1\,mol} = \boxed{147.05\,g}$

(10) $2.46\,g\ Ca(NO_3)_2 \times \frac{1\,mol}{164.1\,g} = \boxed{0.015\,mol}$

(11) $7.6\,g\ F_2 \times \frac{1\,mol}{38\,g} = \boxed{0.2\,mol}$

(12) $0.6\,mol\ Na_2SO_4 \times \frac{N_A\ molecules}{1\,mol} = 3.61\times10^{23}\ molecules \times \frac{7\,atoms}{1\,molecule} = \boxed{2.53\times10^{24}\ atoms}$

(13) $58.5\,g\ (NH_4)_2SO_4 \times \frac{1\,mol}{132.8\,g} = \boxed{0.44\,mol}$

(14) $179.1\,g\ Fe(HCO_3)_3 \times \frac{1\,mol}{238.83\,g} = 0.75\,mol \times \frac{6.02\times10^{23}\ molecules}{1\,mol} = \boxed{4.51\times10^{23}\ molecules}$

(15) $1.25\,mol\ He \times \frac{22.4\,L}{1\,mol} = \boxed{28\,L}$

(16) $1\,mol\ H_2 = 2.02\,g$, $1\,mol\ H_2 = 22.4\,L$, $\therefore$ density $= \frac{2.02\,g}{22.4\,L} = \boxed{0.090\,g/L}$

(17) $8.96\,L\ SO_2 \times \frac{1\,mol}{22.4\,L} = 0.4\,mol \times \frac{64.1\,g}{1\,mol} = \boxed{25.64\,g}$

(18) $6.4\,g\ CH_4 \times \frac{1\,mol}{16.04\,g} = 0.4\,mol \times \frac{6.02\times10^{23}\ molecules}{1\,mol} = \boxed{2.4\times10^{23}\ molecules}$

(19) a) $2Al_{(s)} + 6HCl_{(aq)} \rightarrow 2AlCl_{3(s)} + 3H_{2(g)}$

b) $8.25g\ Al \times \frac{1mol}{27g} = \boxed{0.31mol\ Al}$

c) $0.31mol\ Al \times \frac{3mol\ H_2}{2mol\ Al} = 0.465mol\ H_2 \times \frac{2.02g}{1mol} = \boxed{0.94g\ H_2}$

d) $0.31mol\ Al \times \frac{2mol\ AlCl_3}{2mol\ Al} = 0.31mol\ AlCl_3 \times \frac{133.5g}{1mol} = \boxed{41.39g\ AlCl_3}$

e) $\frac{38.15g}{41.39g} \times 100 = \boxed{92\%}$

(20) $2\ MgO \rightarrow 2Mg + O_2$

$0.5mol\ MgO \times \frac{2mol\ Mg}{2mol\ MgO} = \boxed{0.5mol\ Mg}$

$\times \frac{1mol\ O_2}{2mol\ MgO} = \boxed{0.25mol\ O_2}$

(21) $0.75mol\ C_3H_8 \times \frac{6mol\ H_2O}{1mol\ C_3H_8} = \boxed{4.5mol\ H_2O}$

" $\times \frac{3mol\ CO_2}{1mol\ C_3H_8} = 2.25mol\ CO_2 \times \frac{44g}{1mol} = \boxed{99g\ CO_2}$

" $\times \frac{10mol\ H_2}{1mol\ C_3H_8} = 7.5mol\ H_2 \times \frac{2.02g}{1mol} = \boxed{15.15g\ H_2}$

(22) $4Na + O_2 \rightarrow 2Na_2O + 5.0KJ$

$8.05g\ Na \times \frac{1mol}{23g} = 0.35mol\ Na \times \frac{2mol\ Na_2O}{4mol\ Na} = 0.175mol\ Na_2O \times \frac{62g}{1mol} = \boxed{10.85g}$

$0.35mol\ Na \times \frac{5.0KJ}{4mol\ Na} = \boxed{0.438KJ}$

(23) $4H_2 + Fe_2O_4 \rightarrow 2Fe + 4H_2O + 30KJ$

$50.9g\ Fe_2O_4 \times \frac{1mol}{175.6g} = 0.29mol\ Fe_2O_4 \times \frac{30KJ}{1mol\ Fe_2O_4} = \boxed{8.7\ KJ}$

(24) $3S + 2Fe_2O_3 \rightarrow 3SO_2 + 4Fe$

$19.2g\ Fe_2O_3 \times \frac{1mol}{159.6g} = 0.12\ mol\ Fe_2O_3 \times \frac{3mol\ SO_2}{2mol\ Fe_2O_3} = 0.18mol\ SO_2 \times \frac{22.4L}{1mol} = \boxed{4.03L}$

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

$9.5L\ H_2 \times \frac{1mol}{22.4L} = 0.424mol\ H_2 \times \frac{2mol\ NH_3}{3mol\ H_2} = 0.28mol\ NH_3 \times \frac{22.4L}{1mol} = \boxed{6.3L}$

(26) $2S + 3O_2 \rightarrow 2SO_3$

$160.5g\ S \times \frac{1mol}{32.1g} = \boxed{5mol\ S} \times \frac{3mol\ O_2}{2mol\ S} = 7.5mol\ O_2$ needed

$\boxed{8.4mol\ O_2}$ ← HAVE

$\therefore O_2$ is Excess, S is L.R.

$5mol\ S \times \frac{2mol\ SO_3}{2mol\ S} = 5mol\ SO_3 \times \frac{80.1g}{1mol} = \boxed{400.5g\ SO_3}$

(27) $3AgNO_3 + Na_3PO_4 \rightarrow 3NaNO_3 + Ag_3PO_4$

$200g\ AgNO_3 \times \frac{1mol}{169.9g} = 1.18mol\ AgNO_3 \times \frac{1mol\ Na_3PO_4}{3mol\ AgNO_3} = 0.39mol\ Na_3PO_4$ Needed

$200g\ Na_3PO_4 \times \frac{1mol}{164g} = 1.22mol\ Na_3PO_4$ HAVE

∴ Na_3PO_4 is excess & $AgNO_3$ is L.R.

$1.18mol\ AgNO_3 \times \frac{1mol\ Ag_3PO_4}{3mol\ AgNO_3} = 0.39mol\ Ag_3PO_4 \times \frac{418.7g}{1mol} = 163.3g$

(28) will use 0.39 mol Na_3PO_4, Have 1.22 mol.

∴ 1.22 mol − 0.39 mol = 0.83 mol left over

$0.83mol \times \frac{164g}{1mol} = 136.12g$ left

(29) $Mg + 2HCl \rightarrow MgCl_2 + H_2$

$50g\ Mg \times \frac{1mol}{24.3g} = 2.06mol\ Mg \times \frac{2mol\ HCl}{1mol\ Mg} = 4.12mol\ HCl$ needed

$75g\ HCl \times \frac{1mol}{36.51g} = 2.05mol\ HCl$ Have

∴ HCl is L.R.

$2.05mol\ HCl \times \frac{1mol\ H_2}{2mol\ HCl} = 1.025mol\ H_2 \times \frac{22.4L}{1mol} = 23L\ H_2$

(30) $2.05mol\ HCl \times \frac{1mol\ Mg}{2mol\ HCl} = 1.025mol\ Mg$ used

Have 2.06 mol, so 2.06 mol − 1.025 mol = 1.035 mol left over

$1.035mol \times \frac{24.3g}{1mol} = 25.15g$ left

(31) Assume 100g Sample

$\therefore$ $19.8g\ C \times \frac{1mol}{12g} = 1.65mol\ C \div 0.83 = 2$ $\therefore$ empirical = $C_2H_3NO_5$

$2.5g\ H \times \frac{1mol}{1.01g} = 2.48mol\ H \div 0.83 = 3$

$11.6g\ N \times \frac{1mol}{14g} = 0.83mol\ N \div 0.83 = 1$

$66.1g\ O \times \frac{1mol}{16g} = 4.13mol\ O \div 0.83 = 5$

(32) empirical = $C_2H_3NO_5$ = 121.03g/mol $\frac{242}{121.03} = 2\times$ bigger

molecular = 242g/mol

$\therefore$ molecular = $C_4H_6N_2O_{10}$

(33) Assume 100g Sample.

$\therefore$ $82.66g\ C \times \frac{1mol}{12g} = 6.89mol\ C \div 6.89 = 1 \times 2 = 2$

$17.34g\ H \times \frac{1mol}{1.01g} = 17.17mol\ H \div 6.89 = 2.5 \times 2 = 5$

$\therefore$ empirical = C_2H_5