Limiting Reactants

① (a) $\frac{3.45}{1} N_2 = \frac{x}{3} H_2$ $\quad x = 10.35 \text{ mol } H_2$

$\therefore H_2$ is the limiting reactant

(b) $\frac{4.85}{3} H_2 = \frac{x}{2} NH_3$ $\quad$ 3.23 mol NH_3

② (a) $\frac{20}{2} C_2H_2 = \frac{x}{5} O_2$ $\quad x = 50 \text{ mol } O_2$

$\therefore O_2$ is the limiting reactant

(b) $\frac{10}{5} O_2 = \frac{x}{4} CO_2$ $\quad$ 8 mol CO_2

③ $\frac{2.36}{1} CH_3CO_2H = \frac{x}{1} NaOH$ $\quad x = 2.36 \text{ mol } NaOH$

so CH_3CO_2H is limiting reactant

$\frac{2.36}{1} CH_3CO_2H = \frac{x}{1} H_2O$ $\quad$ 2.36 mol H_2O

④ $\frac{.3}{3} Br = \frac{x}{1} Cl$ $\quad x = .1 \text{ mol } Cl$

So Br is the limiting reactant

$\frac{.3}{3} Br = \frac{x}{2} Br_3Cl$ $\quad$ 0.2 mol Br_3Cl

(5) Na_2SO_4: $\frac{100\,g}{142.1\,g/mol} = 0.704\,mol$

$Ba(NO_3)_2$: $\frac{50\,g}{261.3\,g/mol} = 0.191\,mol$

$\frac{.704}{1} Na_2SO_4 = \frac{x}{1} Ba(NO_3)_2$ $\quad x = 0.704\,mol$

∴ $Ba(NO_3)_2$ is the limiting reactant.

$\frac{.191}{1} Ba(NO_3)_2 = \frac{x}{1} BaSO_4$ $\quad 0.191\,mol\ BaSO_4$

$BaSO_4 = 233.4\,g/mol$

1 mol	233.4 g	
0.191 mol	x	44.58 g

(6) H_2: $\frac{15.5\,g}{2.02\,g/mol} = 7.67\,mol$

O_2: $\frac{30\,g}{32\,g/mol} = 0.94\,mol.$

$\frac{7.67}{2} H_2 = \frac{x}{1} O_2$ $\quad x = 3.84\,mol$

∴ O_2 is the limiting reactant

$\frac{.95}{1} O_2 = \frac{x}{2} H_2O$ $\quad 1.9\,mol\ H_2O$

H_2O: $18.02\,g/mol$

1 mol	18.02 g	
1.9	x	34.2 g

(7) (a) CH_3CO_2H : $\frac{10.0\,g}{60.04\,g/mol} = 0.1666\ mol$

$Pb(OH)_2$: $\frac{10.0\,g}{241.22\,g/mol} = 0.0415\ mol$

$\frac{0.1666}{2}\ CH_3CO_2H = \frac{x}{1}\ Pb(OH)_2$ $\quad x = 0.0833\ mol.$

∴ $Pb(OH)_2$ is the limiting reactant

So CH_3CO_2H is in excess.

(b) $\frac{0.0415}{1}\ Pb(OH)_2 = \frac{x}{2}\ CH_3CO_2H$ $\quad x = 0.083\ mol$

Start with 0.2212 mol
− use 0.083 mol
remain 0.1382 mol

$0.1382\ mol\ (45.21\ g/mol) = 6.25\,g\ CH_3CO_2H$

$\frac{.0415}{1}\ Pb(OH)_2 = \frac{x}{1}\ Pb(CH_3CO_2)_2$ $\quad x = 0.0415\ mol$

$Pb(CH_3CO_2)_2 = 325.26\ g/mol$

$0.0415\ mol\ (325.26\ g/mol) = 13.5\,g$

(8) (a) $Mg: \frac{25.3\,g}{24.3\,g/mol} = 1.04\ mol$

$Cu(NO_3)_2: \frac{44.3\,g}{187.5} = 0.24\ mol$

$\frac{1.04}{1} Mg = \frac{x}{1} Cu(NO_3)_2 \qquad x = 1.04\ mol$

$\therefore Cu(NO_3)_2$ is the limiting reactant

$\frac{0.24}{1} Cu(NO_3)_2 = \frac{x}{1} Cu \qquad x = 0.24\ mol$

$1\ mol\ Cu = 63.5\,g$
$0.24 \quad - \quad x$

$\underline{15.24\,g\ Cu}$

(b) $\frac{0.24}{1} Cu(NO_3)_2 = \frac{x}{1} Mg \qquad x = 0.24\ mol$

$1\ mol\ Mg = 24.3\,g$
$0.24 \quad = \quad x \qquad x = 5.83\,g\ react$

$\therefore 25.3\,g - 5.83\,g = \underline{19.47\,g\ remain}$