

Limiting Reagents / Percentage Yield Worksheet



a) mass of I_2 ?

80.0g I_2O_5 28.0g CO

determine limiting reactant

$$80.0g I_2O_5 \times \frac{1 \text{ mol } I_2O_5}{333.8g} = 0.240 \text{ mol } I_2O_5$$

$$28.0g CO \times \frac{1 \text{ mol } CO}{28.01g} = \frac{0.9996 \text{ mol } CO}{5} = 0.1999$$

CO limiting reactant

$$0.996 \text{ mol } CO \times \frac{1 \text{ mol } I_2}{5 \text{ mol } CO} = 0.1999 \text{ mol } I_2 \times \frac{253.8g I_2}{1 \text{ mol } I_2} = \boxed{50.7g I_2}$$

b) i) $0.160 \text{ mol } I_2 \times \frac{253.8g I_2}{1 \text{ mol } I_2} = \boxed{40.6g I_2}$

ii) $\frac{40.6g I_2}{50.7g} \times 100 = \boxed{80.1\%}$



25.0g Zn 30.0g S

a) $25.0g Zn \times \frac{1 \text{ mol}}{65.39g} = \frac{0.382 \text{ mol } Zn}{1}$

$$30.0g S \times \frac{1 \text{ mol}}{32.07g} = \frac{0.935 \text{ mol } S}{1}$$

Zn is limiting

b) $0.382 \times 1 \text{ mol } ZnS = 0.382 \text{ mol } ZnS \times \frac{97.45g}{\cancel{97.45}} = \boxed{37.2g ZnS}$

c) $0.935 \text{ mol } S - 0.382 \text{ mol} =$
 $0.553 \text{ mol } S \times \frac{32.07g S}{\text{mol } S} = \boxed{17.7g S}$

3. 3.00g Mg 2.20g O₂



$$a) 3.00\text{g Mg} \times \frac{\text{mol Mg}}{24.31\text{g Mg}} = \frac{0.123\text{ mol Mg}}{2} = 0.0615$$

$$2.20\text{g O}_2 \times \frac{1\text{ mol O}_2}{32\text{g O}_2} = 0.06875\text{ mol O}_2$$

Mg is limiting

b) O₂ is excess

$$0.06875\text{ mol O}_2 - 0.0615 = 0.00725\text{ mol O}_2 \times \frac{32\text{g O}_2}{1\text{ mol}} = \boxed{0.23\text{g O}_2 \text{ excess}}$$

$$c) 0.0615 \times 2\text{ mol MgO} = \boxed{0.123\text{ mol MgO}}$$

4. 5.00g Al heated 10.0g S

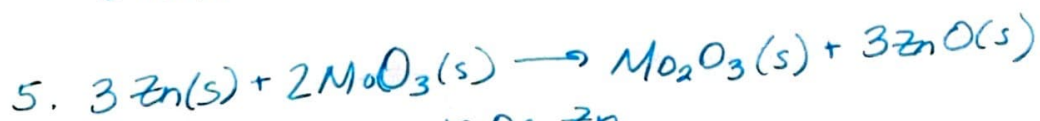


$$5.00\text{g Al} \times \frac{1\text{ mol Al}}{26.98\text{g}} = \frac{0.185\text{ mol Al}}{2} = 0.0925$$

$$10.0\text{g S} \times \frac{1\text{ mol S}}{32.07\text{g S}} = \frac{0.312\text{ mol S}}{3} = 0.104$$

Al limiting

$$0.0925 \times 1\text{ mol Al}_2\text{S}_3 = 0.0925\text{ mol Al}_2\text{S}_3 \times \frac{150.17\text{g Al}_2\text{S}_3}{1\text{ mol Al}_2\text{S}_3} = \boxed{13.9\text{g Al}_2\text{S}_3}$$



20.0g MoO₃ 10.0g Zn

$$20.0\text{g MoO}_3 \times \frac{1\text{ mol}}{143.95\text{g MoO}_3} = \frac{0.139\text{ mol MoO}_3}{2} = 0.0695$$

$$10.0\text{g Zn} \times \frac{\text{mol Zn}}{65.38\text{g}} = \frac{0.153\text{ mol Zn}}{3} = 0.051$$

Zn limiting

$$0.051 \times 3\text{ mol ZnO} = 0.153\text{ mol ZnO} \times \frac{81.38\text{g}}{\text{mol}} = \boxed{12.5\text{g ZnO}}$$



25.0g AgNO_3 45.0g FeCl_3

b) $25.0\text{g AgNO}_3 \times \frac{\text{mol}}{169.88\text{g}} = \frac{0.1472\text{mol}}{3} = 0.04907$

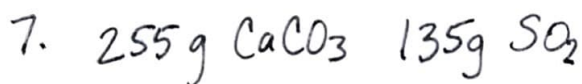
$45.0\text{g FeCl}_3 \times \frac{\text{mol}}{162.195\text{g}} = \frac{0.2774\text{mol}}{1}$

AgNO_3 is limiting $\rightarrow 0.147\text{mol AgCl}$

c) $0.04907 (3\text{mol AgCl}) \times \frac{143.32\text{g}}{1\text{mol AgCl}} = 7.03\text{g AgCl}$

d) 7.03g AgCl

e) FeCl_3 excess
 $0.2774\text{mol} - 0.04907 = 0.2283\text{mol} \times \frac{162.2\text{g}}{1\text{mol FeCl}_3} = 37.0\text{g FeCl}_3$ excess



a) $255\text{g CaCO}_3 \times \frac{\text{mol}}{100.09\text{g}} = 2.548\text{mol CaCO}_3$

$135\text{g SO}_2 \times \frac{\text{mol}}{64.07\text{g}} = 2.11\text{mol SO}_2$

SO_2 limiting reactant

$2.11 \times 1\text{mol CaSO}_3 = 2.11\text{mol CaSO}_3 \times \frac{120.15\text{g}}{1\text{mol}} = 253.52\text{g CaSO}_3$

b) 198g CaSO_3

% yield: $\frac{198\text{g CaSO}_3}{253.52\text{g}} = 78.1\% \text{ yield}$

8. 100g chlorobenzene is a 65% yield

$$\frac{100g}{x} = \frac{65}{100}$$
$$x = 153.85g$$



$$153.85g C_6H_5Cl \times \frac{1 \text{ mol } C_6H_5Cl}{112.56g} \times \frac{1 \text{ mol } C_6H_6}{1 \text{ mol } C_6H_5Cl} \times \frac{78.12g C_6H_6}{1 \text{ mol } C_6H_6} = \boxed{106.78g C_6H_6}$$



68% yield $KC_7H_5O_2$

10.0g $KC_7H_5O_2$ needed

g toluene = ?

$$\frac{10.0}{x} = \frac{68}{100} \Rightarrow x = 14.71g$$

$$14.71g KC_7H_5O_2 \times \frac{1 \text{ mol } KC_7H_5O_2}{163.22g} \times \frac{1 \text{ mol } C_7H_8}{1 \text{ mol } KC_7H_5O_2} \times \frac{92.15g}{1 \text{ mol } C_7H_8} = \boxed{8.30g C_7H_8}$$



i.) 84.1g NaOH 51.0g Al

$$84.1g NaOH \times \frac{1 \text{ mol } NaOH}{40g NaOH} = \frac{2.10 \text{ mol } NaOH}{2} = 1.05$$

$$51.0g Al \times \frac{1 \text{ mol}}{26.98g} = \frac{1.00 \text{ mol } Al}{2} = 0.50 \text{ mol}$$

Al is limiting reactant

ii) NaOH excess

$$2.10 \text{ mol } NaOH - (0.50 \times 2) = 1.10 \text{ mol} \times \frac{40g NaOH}{\text{mol}} = \boxed{44.0g NaOH \text{ Excess}}$$

iii) $0.50(3) = 1.50 \text{ mol } H_2 \times \frac{2.02g H_2}{1 \text{ mol } H_2} = \boxed{3.03g H_2}$



$$ii) \frac{150,000\text{g}}{150\text{kg}} (\text{CH}_3)_2\text{NNH}_2 \times \frac{1\text{mol} (\text{CH}_3)_2\text{NNH}_2}{60.12\text{g}} = 2495.01\text{mol}$$

$$460,000\text{g N}_2\text{O}_4 \times \frac{1\text{mol N}_2\text{O}_4}{92.02\text{g}} = 4998.91\text{mol}$$

$(\text{CH}_3)_2\text{NNH}_2$ limiting

$$2495.01 \times 2\text{mol N}_2 = 4990.02\text{mol N}_2 \times \frac{28.02\text{g}}{1\text{mol N}_2} = 139820.36\text{g} = 139.8 \sim \boxed{140\text{kg N}_2}$$

$$iii) \frac{30\text{g}}{x} = \frac{68}{100}$$

$$x = 44.12\text{g}$$

$$44,120\text{g N}_2 \times \frac{1\text{mol N}_2\text{O}_4}{2\text{mol N}_2} \times \frac{1\text{mol N}_2\text{O}_4}{28.02\text{g N}_2} \times \frac{92.02\text{g}}{1\text{mol N}_2\text{O}_4} = 72.45\text{kg N}_2\text{O}_4$$



$$5.00\text{g Mg} \quad 5.00\text{g O}_2$$

g MgO?

g excess?

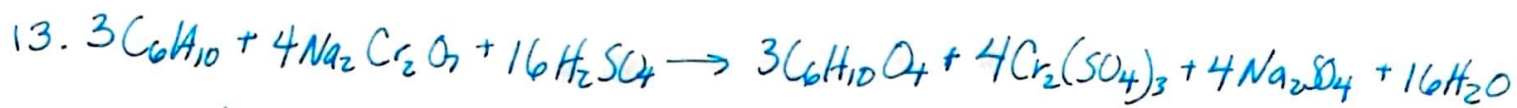
$$5.00\text{g Mg} \times \frac{1\text{mol Mg}}{24.31\text{g Mg}} = \frac{0.206\text{mol Mg}}{2} = 0.103$$

$$5.00\text{g O}_2 \times \frac{1\text{mol O}_2}{32\text{g O}_2} = \frac{0.156\text{mol O}_2}{1} = 0.156$$

Mg is limiting

$$0.103 \times 2\text{mol MgO} = 0.206\text{mol MgO} \times \frac{40.31\text{g MgO}}{1\text{mol MgO}} = \boxed{8.30\text{g MgO}}$$

$$0.156 - 0.103\text{mol O}_2 = 0.053 \times \frac{32\text{g O}_2}{1\text{mol O}_2} = \boxed{1.70\text{g O}_2 \text{ excess}}$$



68.6% yield $\text{C}_6\text{H}_{10}\text{O}_4$

a) 12.5g $\text{C}_6\text{H}_{10}\text{O}_4$

g C_6H_{10} ?

$$\frac{12.5\text{g}}{x} = \frac{68.6}{100} \quad x = 18.22\text{g}$$

$$18.22\text{g C}_6\text{H}_{10}\text{O}_4 \times \frac{1\text{mol C}_6\text{H}_{10}\text{O}_4}{146.16\text{g}} \times \frac{3\text{mol C}_6\text{H}_{10}}{3\text{mol C}_6\text{H}_{10}\text{O}_4} \times \frac{82.16\text{g}}{1\text{mol C}_6\text{H}_{10}} = \boxed{3.41\text{g C}_6\text{H}_{10}}$$

$$\begin{aligned} \text{b) } 18.22\text{g C}_6\text{H}_{10}\text{O}_4 &\times \frac{1\text{mol C}_6\text{H}_{10}\text{O}_4}{146.16\text{g}} \times \frac{4\text{mol Na}_2\text{Cr}_2\text{O}_7 \cdot 2\text{H}_2\text{O}}{3\text{mol C}_6\text{H}_{10}\text{O}_4} \times \frac{298.02\text{g}}{1\text{mol Na}_2\text{Cr}_2\text{O}_7 \cdot 2\text{H}_2\text{O}} \\ &= \boxed{49.53\text{g Na}_2\text{Cr}_2\text{O}_7 \cdot 2\text{H}_2\text{O}} \end{aligned}$$