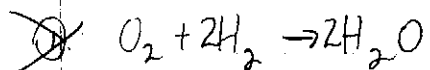
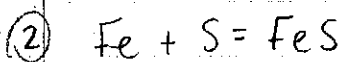


12.3 Practice Problems (from handout) evens only

$$\frac{1.22\text{g O}_2}{1} \cdot \frac{1\text{mole O}_2}{32.00\text{g O}_2} \cdot \frac{2\text{moles H}_2\text{O}}{1\text{mole O}_2} \cdot \frac{18.02\text{g H}_2\text{O}}{1\text{mole H}_2\text{O}} = 1.37\text{g H}_2\text{O}$$

$\therefore \text{O}_2$  limiting reactant

$$\frac{1.05\text{g H}_2}{1} \cdot \frac{1\text{mole H}_2}{2.02\text{g H}_2} \cdot \frac{2\text{moles H}_2\text{O}}{2\text{mole H}_2} \cdot \frac{18.02\text{g H}_2\text{O}}{1\text{mole H}_2\text{O}} = 9.37\text{g H}_2\text{O}$$

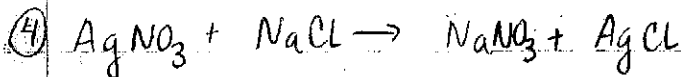


$$M_{\text{FeS}} = 55.85 + 32.07 = 87.92 \text{ g/mol}$$

$$\frac{4.68\text{g Fe}}{1} \cdot \frac{1\text{mole Fe}}{55.85\text{g Fe}} \cdot \frac{1\text{mole FeS}}{1\text{mole Fe}} \cdot \frac{87.92\text{g FeS}}{1\text{mole FeS}} = 7.37\text{g FeS}$$

$\therefore \text{Fe}$  limiting reactant

$$\frac{2.88\text{g S}}{1} \cdot \frac{1\text{mole S}}{32.07\text{g S}} \cdot \frac{1\text{mole FeS}}{1\text{mole S}} \cdot \frac{87.92\text{g FeS}}{1\text{mole FeS}} = 7.90\text{g FeS}$$



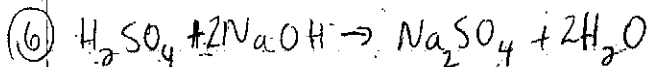
$$M_{\text{AgCl}} = 107.87 + 35.45 = 143.32$$

$$M_{\text{AgNO}_3} = 107.87 + 14.01 + 3(16.00) = 169.88$$

$$\frac{6.25\text{g AgNO}_3}{1} \cdot \frac{1\text{mole AgNO}_3}{169.88\text{g AgNO}_3} \cdot \frac{1\text{mole AgCl}}{1\text{mole AgNO}_3} \cdot \frac{143.32\text{g AgCl}}{1\text{mole AgCl}} = 5.27\text{g AgCl}$$

$\therefore \text{AgNO}_3$  limiting reactant

$$\frac{4.12\text{g NaCl}}{1} \cdot \frac{1\text{mole NaCl}}{58.44\text{g NaCl}} \cdot \frac{1\text{mole AgCl}}{1\text{mole NaCl}} \cdot \frac{143.32\text{g AgCl}}{1\text{mole AgCl}} = 10.10\text{g AgCl}$$



$$M_{\text{H}_2\text{SO}_4} = 2.02 + 32.07 + 4(16.00) = 98.09 \text{ g/mol}$$

$$M_{\text{NaOH}} = 22.99 + 16.00 + 1.01 = 40.00 \text{ g/mol}$$

$$\frac{6.33\text{g H}_2\text{SO}_4}{1} \cdot \frac{1\text{mole H}_2\text{SO}_4}{98.09\text{g H}_2\text{SO}_4} \cdot \frac{2\text{mole H}_2\text{O}}{1\text{mole H}_2\text{SO}_4} \cdot \frac{18.02\text{g H}_2\text{O}}{1\text{mole H}_2\text{O}} = 2.33\text{g H}_2\text{O}$$

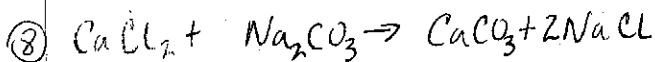
$\therefore \text{H}_2\text{SO}_4$  limiting reactant

$$\frac{5.92\text{g NaOH}}{1} \cdot \frac{1\text{mole NaOH}}{40.00\text{g NaOH}} \cdot \frac{2\text{mole H}_2\text{O}}{2\text{mole NaOH}} \cdot \frac{18.02\text{g H}_2\text{O}}{1\text{mole H}_2\text{O}} = 2.67\text{g H}_2\text{O}$$

$$M_{Na_2CO_3} = 2(22.99) + 12.01 + 3(16.00) = 105.99$$

$$M_{NaCl} = 22.99 + 35.45 = 58.44 \text{ g/mol}$$

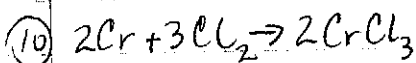
$$M_{CaCl_2} = 40.08 \text{ g/mol} + 2(35.45 \text{ g/mol}) = 110.98 \text{ g/mol}$$



$$\frac{65.14 \text{ g } CaCl_2}{1} \cdot \frac{1 \text{ mol } CaCl_2}{110.98 \text{ g } CaCl_2} \cdot \frac{2 \text{ mol } NaCl}{1 \text{ mol } CaCl_2} \cdot \frac{58.44 \text{ g } NaCl}{1 \text{ mol } NaCl} = 68.60 \text{ g } NaCl$$

∴  $CaCl_2$  limiting reactant

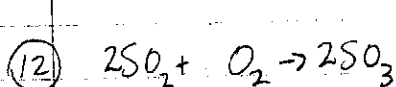
$$\frac{74.68 \text{ g } Na_2CO_3}{1} \cdot \frac{1 \text{ mol } Na_2CO_3}{105.99 \text{ g } Na_2CO_3} \cdot \frac{2 \text{ mol } NaCl}{1 \text{ mol } Na_2CO_3} \cdot \frac{58.44 \text{ g } NaCl}{1 \text{ mol } NaCl} = 83.35 \text{ g } NaCl$$



$$\frac{4.1 \text{ g } Cr}{1} \cdot \frac{1 \text{ mol } Cr}{52.00 \text{ g } Cr} \cdot \frac{2 \text{ mol } CrCl_3}{2 \text{ mol } Cr} \cdot \frac{158.35 \text{ g } CrCl_3}{1 \text{ mol } CrCl_3} = 12 \text{ g } CrCl_3$$

∴ Chromium limiting reactant

$$\frac{9.3 \text{ g } Cl_2}{1} \cdot \frac{1 \text{ mol } Cl_2}{70.9 \text{ g } Cl_2} \cdot \frac{2 \text{ mol } CrCl_3}{3 \text{ mol } Cl_2} \cdot \frac{158.35 \text{ g } CrCl_3}{1 \text{ mol } CrCl_3} = 13.8 \text{ g } CrCl_3$$

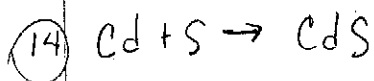


$$M_{SO_2} = 32.07 + 2(16.00) = 64.07 \text{ g/mol} \quad M_{SO_3} = 80.07 \text{ g/mol}$$

$$\frac{12.4 \text{ g } SO_2}{1} \cdot \frac{1 \text{ mol } SO_2}{64.07 \text{ g } SO_2} \cdot \frac{2 \text{ mol } SO_3}{2 \text{ mol } SO_2} \cdot \frac{80.07 \text{ g } SO_3}{1 \text{ mol } SO_3} = 15.5 \text{ g } SO_3$$

∴  $SO_2$  limiting reactant

$$\frac{3.45 \text{ g } O_2}{1} \cdot \frac{1 \text{ mol } O_2}{32.00 \text{ g } O_2} \cdot \frac{2 \text{ mol } SO_3}{1 \text{ mol } O_2} \cdot \frac{80.07 \text{ g } SO_3}{1 \text{ mol } SO_3} = 17.27 \text{ g } SO_3$$



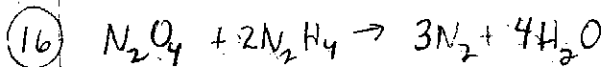
$$M_{CdS} = 112.41 \text{ g/mol} + 32.07 \text{ g/mol} = 144.48 \text{ g/mol}$$

$$\frac{8.47 \text{ g } Cd}{1} \cdot \frac{1 \text{ mol } Cd}{112.41 \text{ g } Cd} \cdot \frac{1 \text{ mol } CdS}{1 \text{ mol } Cd} \cdot \frac{144.48 \text{ g } CdS}{1 \text{ mol } CdS} = 10.89 \text{ g } CdS \rightarrow 10.9 \text{ g } CdS$$

$$\frac{2.51 \text{ g } S}{1} \cdot \frac{1 \text{ mol } S}{32.07 \text{ g } S} \cdot \frac{1 \text{ mol } CdS}{1 \text{ mol } S} \cdot \frac{144.48 \text{ g } CdS}{1 \text{ mol } CdS} = 11.31 \text{ g } CdS$$

$$M_{N_2O_4} = 2(14.01) + 4(16.00) = 92.02 \text{ g/mol}$$

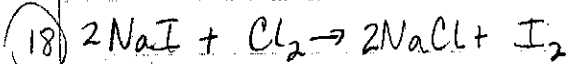
$$M_{N_2H_4} = 2(14.01) + 4(1.01) = 32.06 \text{ g/mol}$$



$$\frac{41.6 \text{ g } N_2O_4}{1} \cdot \frac{1 \text{ mol } N_2O_4}{92.02 \text{ g } N_2O_4} \cdot \frac{4 \text{ mol } H_2O}{1 \text{ mol } N_2O_4} \cdot \frac{18.02 \text{ g } H_2O}{1 \text{ mol } H_2O} = 32.6 \text{ g } H_2O$$

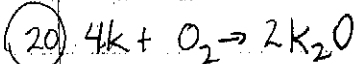
$$\frac{20.8 \text{ g } N_2H_4}{1} \cdot \frac{1 \text{ mol } N_2H_4}{32.06 \text{ g } N_2H_4} \cdot \frac{4 \text{ mol } H_2O}{2 \text{ mol } N_2H_4} \cdot \frac{18.02 \text{ g } H_2O}{1 \text{ mol } H_2O} = \boxed{23.4 \text{ g } H_2O}$$

$$M_{NaI} = 22.99 + 126.90 = 149.89$$



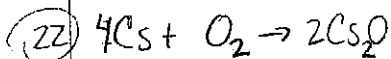
$$\frac{58.7 \text{ g } NaI}{1} \cdot \frac{1 \text{ mol } NaI}{149.89 \text{ g } NaI} \cdot \frac{2 \text{ mol } NaCl}{2 \text{ mol } NaI} \cdot \frac{58.44 \text{ g } NaCl}{1 \text{ mol } NaCl} = \boxed{22.9 \text{ g } NaCl}$$

$$\frac{29.4 \text{ g } Cl_2}{1} \cdot \frac{1 \text{ mol } Cl_2}{70.9 \text{ g } Cl_2} \cdot \frac{2 \text{ mol } NaCl}{1 \text{ mol } Cl_2} \cdot \frac{58.44 \text{ g } NaCl}{1 \text{ mol } NaCl} = 48.5 \text{ g } NaCl$$



$$\frac{6.92 \text{ g } K}{1} \cdot \frac{1 \text{ mol } K}{39.10 \text{ g } K} \cdot \frac{2 \text{ mol } K_2O}{4 \text{ mol } K} \cdot \frac{94.2 \text{ g } K_2O}{1 \text{ mol } K_2O} = 8.34 \text{ g } K_2O$$

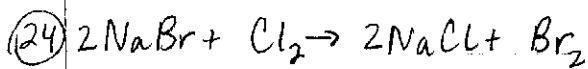
$$\text{Percent Yield} = \frac{7.36}{8.34} \times 100\% = \boxed{88.2\%}$$



$$\frac{46.1 \text{ g } Cs}{1} \cdot \frac{1 \text{ mol } Cs}{132.91 \text{ g } Cs} \cdot \frac{2 \text{ mol } Cs_2O}{4 \text{ mol } Cs} \cdot \frac{281.82 \text{ g } Cs_2O}{1 \text{ mol } Cs_2O} = 48.9 \text{ g } Cs_2O$$

$$\therefore \frac{28.39}{48.9} \times 100\% = \boxed{57.9\%}$$

$$\frac{13.4 \text{ g } O_2}{1} \cdot \frac{1 \text{ mol } O_2}{32.00 \text{ g } O_2} \cdot \frac{2 \text{ mol } Cs_2O}{1 \text{ mol } O_2} \cdot \frac{281.82 \text{ g } Cs_2O}{1 \text{ mol } Cs_2O} = 236 \text{ g } Cs_2O$$

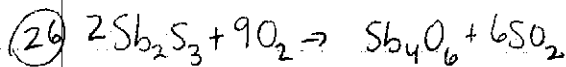


$$M_{\text{NaCl}} = 22.99 + 35.45 = 58.44 \text{ g/mol}$$

$$M_{\text{NaBr}} = 22.99 + 79.90 = 102.89 \text{ g/mol}$$

$$\frac{45.9 \text{ g NaBr}}{1} \cdot \frac{1 \text{ mol NaBr}}{102.89 \text{ g NaBr}} \cdot \frac{2 \text{ mol NaCl}}{2 \text{ mol NaBr}} \cdot \frac{58.44 \text{ g NaCl}}{1 \text{ mol NaCl}} = 26.1 \text{ g NaCl}$$

$$\text{Percent Yield} = \frac{12.8 \text{ g NaCl}}{26.1 \text{ g NaCl}} \times 100\% = \boxed{49.0\%}$$



$$M_{\text{Sb}_2\text{S}_3} = 2(121.76) + 3(32.07) = 339.73 \text{ g/mol}$$

$$M_{\text{Sb}_4\text{O}_6} = 4(121.76) + 6(16.00) = 583.04 \text{ g/mol}$$

$$\frac{98.7 \text{ g Sb}_2\text{S}_3}{1} \cdot \frac{1 \text{ mol Sb}_2\text{S}_3}{339.73 \text{ g Sb}_2\text{S}_3} \cdot \frac{1 \text{ mol Sb}_4\text{O}_6}{2 \text{ mol Sb}_2\text{S}_3} \cdot \frac{583.04 \text{ g Sb}_4\text{O}_6}{1 \text{ mol Sb}_4\text{O}_6} = 84.7 \text{ g Sb}_4\text{O}_6$$

$$\text{Percent Yield} = \frac{72.4 \text{ g Sb}_4\text{O}_6}{84.7 \text{ g Sb}_4\text{O}_6} \times 100\% = \boxed{85.5\%}$$

