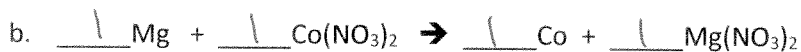


1. Balance and determine the reaction type:



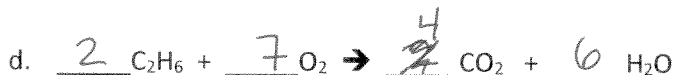
Rxn Type: SYN



Rxn Type: SR



Rxn Type: DR/Neutralizati



Rxn Type: combust.



a. Is the reaction endothermic or exothermic?

exothermic

b. How many grams of chlorine gas is needed to produce 0.75 moles of sodium chloride?

$$\frac{0.75 \text{ mol NaCl} \mid 1 \text{ mol Cl}_2 \mid 70.90 \text{ g Cl}_2}{2 \text{ mol NaCl} \mid 1 \text{ mol Cl}_2} = 26.5875$$

27 g Cl<sub>2</sub> 2 S.F.

c. How many particles of NaCl will be produced when 35 grams of Na reacts with excess chlorine?

$$\frac{35 \text{ g Na} \mid 1 \text{ mol Na} \mid 2 \text{ mol NaCl} \mid 6.02 \times 10^{23} \text{ particles NaCl}}{22.99 \text{ g Na} \mid 2 \text{ mol Na} \mid 1 \text{ mol NaCl}}$$

$9.1649 \Rightarrow$   $9.2 \times 10^{23}$  particles



a. Is the reaction endothermic or exothermic?

endothermic

b. How many liters of carbon dioxide are produced at STP when 25.0 g of calcium carbonate decompose?

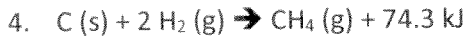
$$\frac{25.0 \text{ g CaCO}_3 \mid 1 \text{ mol CaCO}_3 \mid 1 \text{ mol CO}_2 \mid 22.4 \text{ L CO}_2}{100.09 \text{ g CaCO}_3 \mid 1 \text{ mol CaCO}_3 \mid 1 \text{ mol CO}_2}$$

5.59 L CO<sub>2</sub>

c. How many grams of CaCO<sub>3</sub> are required to produce 4.11 grams of CaO?

$$\frac{4.11 \text{ g CaO} \mid 1 \text{ mol CaO} \mid 1 \text{ mol CaCO}_3 \mid 100.09 \text{ g CaCO}_3}{56.08 \text{ g CaO} \mid 1 \text{ mol CaO} \mid 1 \text{ mol CaCO}_3}$$

7.34 g CaCO<sub>3</sub>



a. Is the reaction endothermic or exothermic?

exothermic

b. How many liters of  $CH_4$  will be produced when 31 grams of carbon react with excess hydrogen at STP?

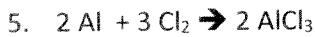
$$\frac{31 \text{ g C}}{12.01 \text{ g C}} \times \frac{1 \text{ mol C}}{1 \text{ mol C}} \times \frac{1 \text{ mol } CH_4}{2 \text{ mol } H_2} \times \frac{22.4 \text{ L } CH_4}{1 \text{ mol } CH_4} = 58 \text{ L } CH_4$$

c. How many grams of carbon are required to react with  $4.22 \times 10^{24}$  molecules of  $H_2$ ?

$$\frac{4.22 \times 10^{24} \text{ molecules } H_2}{6.02 \times 10^{23} \text{ molecules } H_2} \times \frac{1 \text{ mol } H_2}{2 \text{ mol } H_2} \times \frac{1 \text{ mol C}}{1 \text{ mol C}} \times 12.01 \text{ g C} = 42.1 \text{ g C}$$

d. 55 liters of  $H_2$  at STP react with excess carbon. How many moles of  $CH_4$  will be produced?

$$\frac{55 \text{ L } H_2}{22.4 \text{ L } H_2} \times \frac{1 \text{ mol } H_2}{2 \text{ mol } H_2} \times \frac{1 \text{ mol } CH_4}{1 \text{ mol } H_2} = 1.2 \text{ mol } CH_4$$



Aluminum reacts with chlorine to produce aluminum chloride according to the equation above.  $4.25 \times 10^{22}$  atoms of aluminum are mixed with 18.23 grams of chlorine gas and allowed to react.

- What is the limiting reactant? Aluminum
- What is the excess reactant? chlorine
- How many grams of the excess reactant remain after the reaction?
- What is the maximum mass (theoretical yield) of aluminum chloride that will be made?
- What is the percent yield if 7.48 g of aluminum chloride is produced in lab?

Step 1  $\frac{4.25 \times 10^{22} \text{ atom Al}}{6.02 \times 10^{23} \text{ atom Al}} \times \frac{1 \text{ mol Al}}{1 \text{ mol Al}} = 0.0706 \text{ mol Al}$

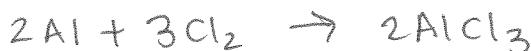
$$\frac{18.23 \text{ g } Cl_2}{70.90 \text{ g } Cl_2} \times \frac{1 \text{ mol } Cl_2}{1 \text{ mol } Cl_2} = 0.257 \text{ mol } Cl_2$$

(B)  $0.257 \text{ mol } Cl_2 - 0.1059 \text{ mol } Cl_2 = 0.1511 \text{ mol } Cl_2 \text{ excess}$

$$\frac{0.1511 \text{ mol } Cl_2}{1 \text{ mol } Cl_2} \times 70.90 \text{ g} = 10.7 \text{ g } Cl_2 \text{ excess}$$

(C)  $\frac{0.0706 \text{ mol Al}}{1 \text{ mol Al}} \times 133.33 \text{ g } AlCl_3 = 9.41 \text{ g } AlCl_3$

(d) % yield:  $\frac{7.48 \text{ g}}{9.41 \text{ g}} \times 100 = 79.5\%$



B: 0.0706 mol	0.257 mol	0
$\therefore -0.0706 \text{ mol}$	$0.0706 \left(\frac{3}{2}\right)$	$0.0706 \left(\frac{2}{2}\right)$
0	0.1059 mol	0.0706 mol