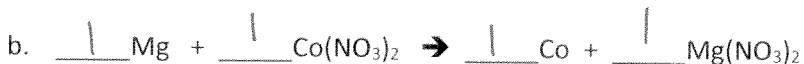


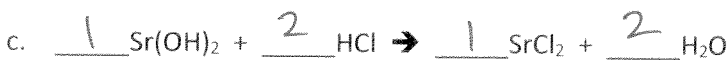
1. Balance and determine the reaction type:



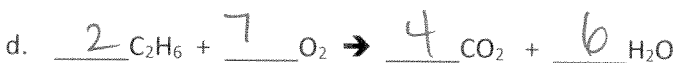
Rxn Type: SYN



Rxn Type: SR



Rxn Type: DR/Neutralization



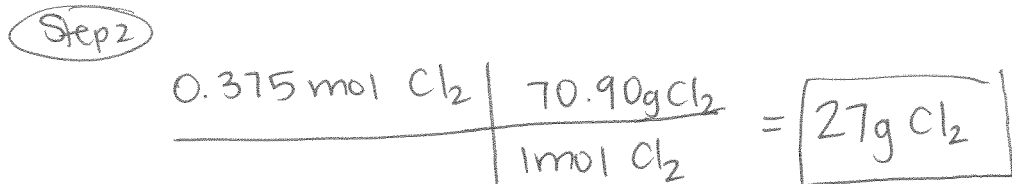
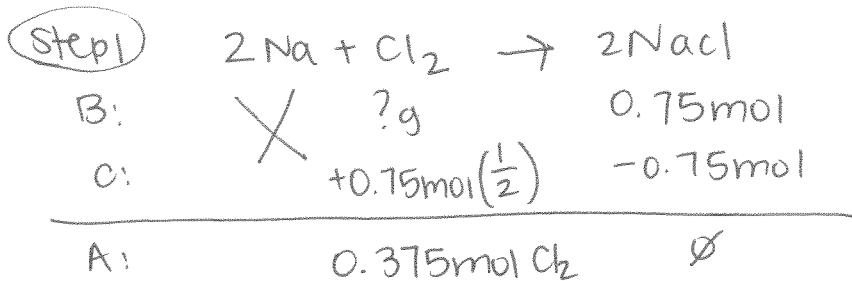
Rxn Type: Combustion



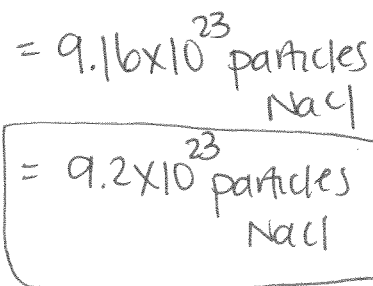
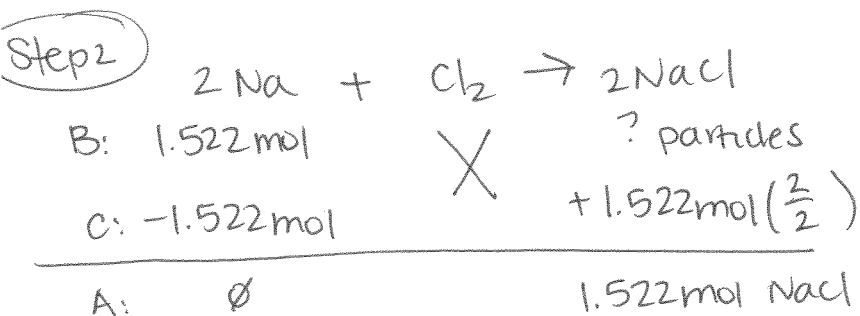
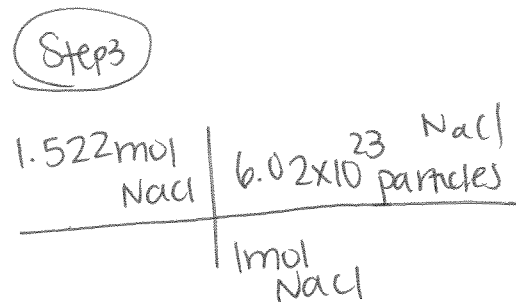
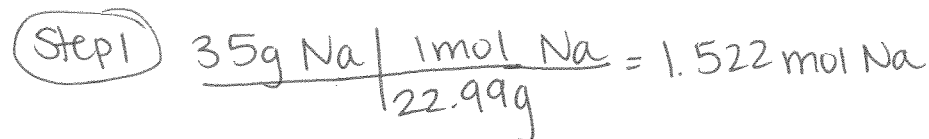
a. Is the reaction endothermic or exothermic?

exothermic

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



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





a. Is the reaction endothermic or exothermic?

endothermic

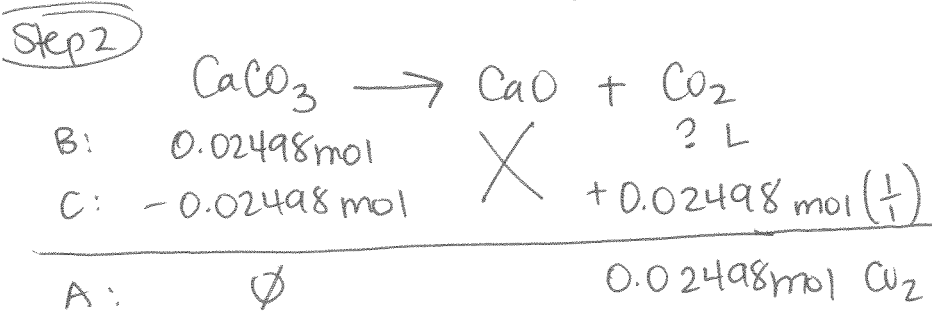
b. How many liters of carbon dioxide are produced at STP when 25.0 g of calcium carbonate decompose? 3SF

Step 1

$$\frac{25.0 \text{ g CaCO}_3}{100.09 \text{ g CaCO}_3} \times \frac{1 \text{ mol CaCO}_3}{1 \text{ mol CaCO}_3} = 0.2498 \text{ mol CaCO}_3$$

Step 3

$$\frac{0.2498 \text{ mol CO}_2}{1 \text{ mol CO}_2} \times 22.4 \text{ L CO}_2 = 5.60 \text{ L CO}_2$$



5.60 L CO<sub>2</sub>

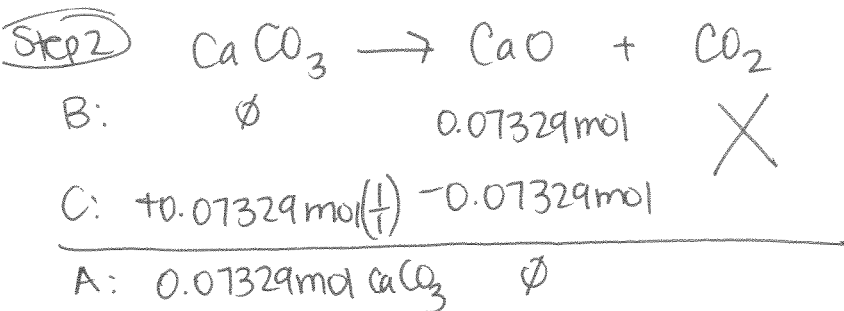
c. How many grams of CaCO<sub>3</sub> are required to produce 4.11 grams of CaO? 3SF

Step 1

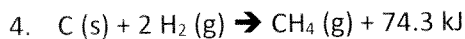
$$\frac{4.11 \text{ g CaO}}{56.08 \text{ g CaO}} \times \frac{1 \text{ mol CaO}}{1 \text{ mol CaO}} = 0.07329 \text{ mol CaO}$$

Step 3

$$\frac{0.07329 \text{ mol CaCO}_3}{1 \text{ mol CaCO}_3} \times 100.09 \text{ g CaCO}_3 = 7.34 \text{ g CaCO}_3$$



= 7.34 g CaCO<sub>3</sub>



a. Is the reaction endothermic or exothermic?

exothermic

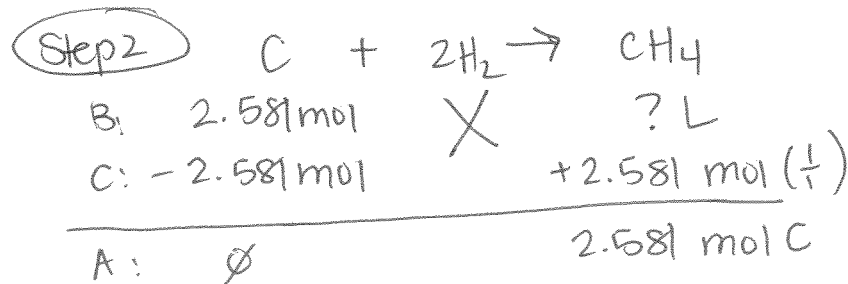
b. How many liters of CH<sub>4</sub> will be produced when 31 grams of carbon react with excess hydrogen at STP? 2SF

Step 1

$$\frac{31 \text{ g C}}{12.01 \text{ g C}} \times \frac{1 \text{ mol C}}{1 \text{ mol C}} = 2.581 \text{ mol C}$$

Step 3

$$\frac{2.581 \text{ mol C}}{1 \text{ mol C}} \times 22.4 \text{ L} = 58 \text{ L CH}_4$$



58 L CH<sub>4</sub>



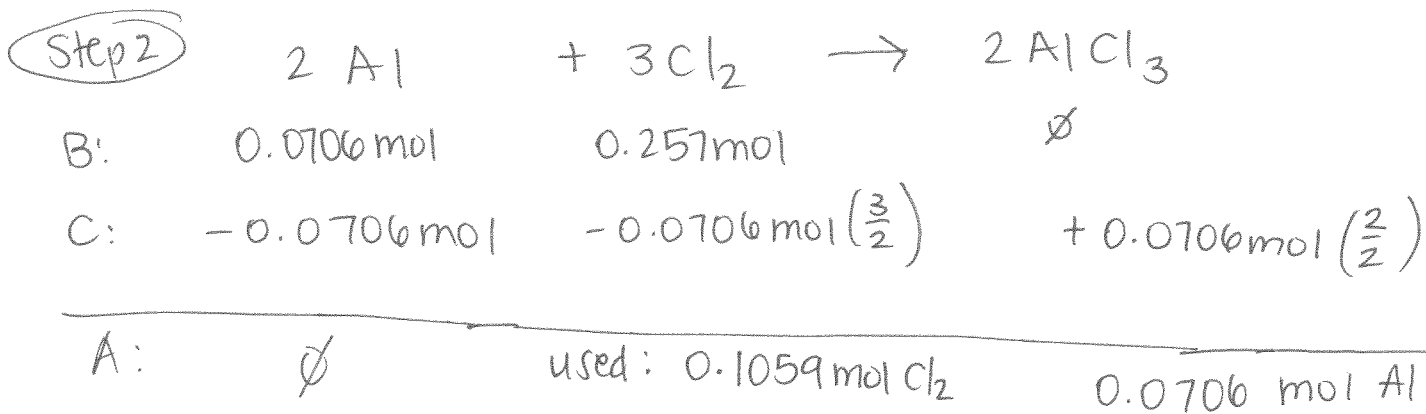
Aluminum reacts with chlorine to produce aluminum chloride according to the equation above.  $4.25 \times 10^{22}$  atoms of aluminum are mixed with 18.23 grams of chlorine gas and allowed to react.

- 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

$$\frac{4.22 \times 10^{22} \text{ atom Al}}{6.02 \times 10^{23} \text{ atom Al}} \times \frac{1 \text{ mol Al}}{1 \text{ mol Al}} = 0.0706 \text{ mol Al}$$

$$\frac{18.23 \text{ g Cl}_2}{70.90 \text{ g Cl}_2} \times \frac{1 \text{ mol Cl}_2}{1 \text{ mol Cl}_2} = 0.257 \text{ mol Cl}_2$$



B

$$0.257 \text{ mol Cl}_2 (\text{start}) - 0.1059 \text{ mol Cl}_2 (\text{used}) = 0.1511 \text{ mol Cl}_2 \text{ extra}$$

$$\frac{0.1511 \text{ mol Cl}_2}{1 \text{ mol Cl}_2} \times 70.90 \text{ g Cl}_2 = \boxed{10.7 \text{ g excess Cl}_2}$$

D

$$\frac{0.0706 \text{ mol AlCl}_3}{1 \text{ mol AlCl}_3} \times 133.33 \text{ g AlCl}_3 = \boxed{9.41 \text{ g AlCl}_3}$$

E

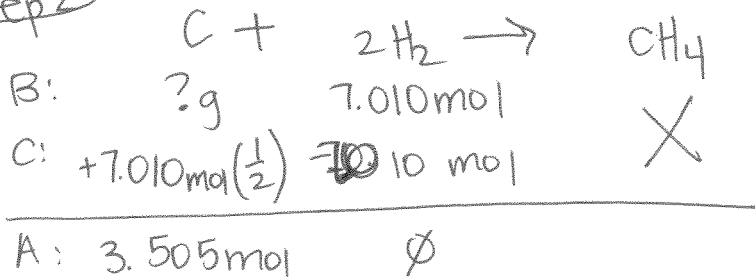
$$\% \text{ yield} = \left(\frac{A}{T}\right) \times 100 = \left(\frac{7.48 \text{ g}}{9.41 \text{ g}}\right) \times 100 = \boxed{79.5\%}$$

4 c. How many grams of carbon are required to react with  $4.22 \times 10^{24}$  molecules of  $H_2$ ? 3SF

Step 1

$$\frac{4.22 \times 10^{24} \text{ molecules } H_2}{6.02 \times 10^{23} \text{ particles } H_2} \times \frac{1 \text{ mol } H_2}{1} = 7.010 \text{ mol } H_2$$

Step 2



Step 3

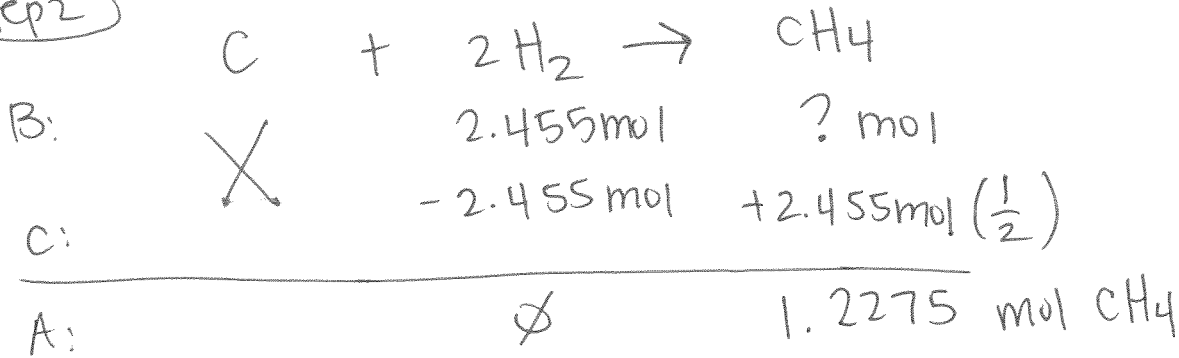
$$\frac{3.505 \text{ mol } C}{1 \text{ mol } C} \times \frac{12.01 \text{ g } C}{1} = \boxed{42.1 \text{ g } C}$$

4 d. 55 liters of  $H_2$  at STP react with excess carbon. How many moles of  $CH_4$  will be produced? 2SF

Step 1

$$\frac{55 \text{ L } H_2}{22.4 \text{ L } H_2} \times \frac{1 \text{ mol } H_2}{1} = 2.455 \text{ mol } H_2$$

Step 2



$$\boxed{1.2 \text{ mol } CH_4}$$