

Name : _____ Date : _____

GAS STOICHIOMETRY WORKSHEET

1. Given the equation: $2 \text{NH}_3 (\text{g}) + 3 \text{Cl}_2 (\text{g}) \rightarrow \text{N}_2 (\text{g}) + 6 \text{HCl} (\text{g})$

a. How many milliliters of nitrogen can be made from 13 L of chlorine and 10 L of ammonia gas at STP?

b. How many grams of chlorine must react to produce 16 L of nitrogen gas at 1.2 atm and 23 °C?

c. How many liters of ammonia gas at 244 torr and 35 °C must be used to produce 2.3 kg of HCl gas?

2. How many liters of ammonia, measured at STP, must produce 2.65 grams of calcium hydride?

3. How many mL of 0.0246 M AgNO_3 are required to precipitate as silver chromate if all the chromate ions in a solution contain 2.1 g sodium chromate?

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Answers

1. Given the equation: $2 \text{NH}_3 (\text{g}) + 3 \text{Cl}_2 (\text{g}) \rightarrow \text{N}_2 (\text{g}) + 6 \text{HCl} (\text{g})$

a. How many milliliters of nitrogen can be made from 13 L of chlorine and 10 L of ammonia gas at STP?

$$0 \times 103 \text{ mL NH}_3 \times (1 \text{ mol N}_2 / 2 \text{ mol NH}_3) = 5000 \text{ mL N}_2$$

$$13 \times 103 \text{ mL Cl}_2 \times (1 \text{ mol N}_2 / 3 \text{ mol Cl}_2) = \boxed{4333 \text{ mL N}_2}$$

The lower volume is the amount of N_2 produced.

b. How many grams of chlorine must react to produce 16 L of nitrogen gas at 1.2 atm and 23 °C?

$$\text{Number of moles of nitrogen: } n = PV/RT = (1.2 \text{ atm} \times 16 \text{ L}) / (0.082 \text{ L-atm mol}^{-1} \text{ K}^{-1} \times 296 \text{ K}) = 0.79 \text{ mol N}_2$$

$$0.79 \text{ mol N}_2 \times (3 \text{ mol Cl}_2 / 1 \text{ mol N}_2) \times (71 \text{ g Cl}_2 / 1 \text{ mol Cl}_2) = 168.2 \text{ g Cl}_2$$

c. How many liters of ammonia gas at 244 torr and 35 °C must be used to produce 2.3 kg of HCl gas?

$$2300 \text{ g HCl} \times (1 \text{ mol HCl} / 36.5 \text{ g HCl}) \times (2 \text{ mol NH}_3 / 6 \text{ mol HCl}) = 21 \text{ mol NH}_3$$

$$\text{Converting torr to atm: } 244 \text{ torr} = 0.321 \text{ atm}$$

$$V = nRT/P = (21 \text{ mol} \times 0.082 \text{ L-atm mol}^{-1} \text{ K}^{-1} \times 308 \text{ K}) / 0.321 \text{ atm} = 1700 \text{ L NH}_3$$

2. How many liters of ammonia, measured at STP, must produce 2.65 grams of calcium hydride?



$$2.65 \text{ g CaH}_2 \times (1 \text{ mol CaH}_2 / 42.1 \text{ g CaH}_2) \times (2 \text{ mol NH}_3 / 3 \text{ mol CaH}_2) \times (22.4 \text{ L NH}_3 / 1 \text{ mol NH}_3) = 0.940 \text{ L NH}_3$$

3. How many mL of 0.0246 M AgNO_3 are required to precipitate as silver chromate if all the chromate ions in a solution contain 2.1 g sodium chromate?



$$2.1 \text{ g Na}_2\text{CrO}_4 \times (1 \text{ mol Na}_2\text{CrO}_4 / 161.8 \text{ g Na}_2\text{CrO}_4) \times (2 \text{ mol AgNO}_3 / 1 \text{ mol Na}_2\text{CrO}_4) \times (1000 \text{ mL AgNO}_3 / 0.0246 \text{ mol AgNO}_3) = 1050 \text{ mL}$$