

CHM 151 Quiz #5 25 Pts Spring 2007 Name: Key

$PV = nRT$ $P_1V_1/T_1 = P_2V_2/T_2$ $E = mc^2$ $R = 0.0821 \text{ L}\cdot\text{atm}/\text{mol}\cdot\text{K} = 62.4 \text{ L}\cdot\text{torr}/\text{mol}\cdot\text{K}$

SHOW WORK TO RECEIVE CREDIT

1. (5 Pts) A student collected 40 mL of H₂ gas when the temperature was 20 °C and the pressure was 720 mmHg. The next day the temperature was 20 °C, but the volume was only 38.4 mL of gas. Determine the new pressure of the gas?

$P_1V_1/T_1 = P_2V_2/T_2$
 $720 \text{ mmHg} \cdot 40 \text{ mL} / 20^\circ\text{C} = P_2 \cdot 38.4 \text{ mL} / 20^\circ\text{C}$
 $P_2 = \frac{720 \cdot 40}{38.4} = 750 \text{ mmHg}$

2. (5 Pts) 500 mL of a gaseous compound has a mass of 0.9825 g at 0 °C and 760 mmHg. What is the molar mass of the compound?

$PV = nRT$
 $n = \frac{PV}{RT} = \frac{(760 \text{ mmHg}) (0.500 \text{ L})}{(62.4 \text{ L}\cdot\text{torr}/\text{mol}\cdot\text{K}) (273 \text{ K})}$
 $n = 0.0227 \text{ mol}$
 $M = \frac{m}{n} = \frac{0.9825 \text{ g}}{0.0227 \text{ mol}} = 44.0 \text{ g/mol}$

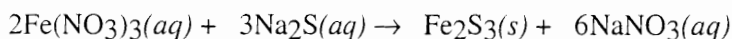
3. (5 Pts) A gas sample occupies a volume of 18.4 L at 37 °C and 0.500 atm. How many moles of gas are present?

$PV = nRT$
 $n = \frac{PV}{RT} = \frac{(0.500 \text{ atm}) (18.4 \text{ L})}{(0.0821 \text{ L}\cdot\text{atm}/\text{mol}\cdot\text{K}) (310 \text{ K})}$
 $n = 0.361 \text{ mol}$

4. (5 Pts) Calculate the mass, in grams, of 2.74 L of CO gas measured at 33°C and 945 mmHg. (C 12.01 g/mol; O 16.00 g/mol)

$PV = nRT$
 $n = \frac{PV}{RT} = \frac{(945 \text{ mmHg}) (2.74 \text{ L})}{(62.4 \text{ L}\cdot\text{torr}/\text{mol}\cdot\text{K}) (306 \text{ K})} = 0.136 \text{ mol}$
 $m = n \cdot M = 0.136 \text{ mol} \cdot 28.01 \text{ g/mol} = 3.71 \text{ g}$

5. (5 Pts) What mass of iron(III) sulfide is produced from the reaction of 14.6 g of iron(III) nitrate with excess sodium sulfide? (Fe 55.3847 g/mol; N 14.01 g/mol; S 32.06 g/mol; O 16.00 g/mol; Na 23.00 g/mol)



$\frac{14.6 \text{ g Fe}(\text{NO}_3)_3}{259.09 \text{ g/mol}} \cdot \frac{1 \text{ mol Fe}_2\text{S}_3}{2 \text{ mol Fe}(\text{NO}_3)_3} \cdot 207.57 \text{ g/mol} = 0.31 \text{ g Fe}_2\text{S}_3$

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PV = nRT $P_1V_1T_2 = P_2V_2T_1$ $E = mc^2$ $R = 0.0821 \text{ L}\cdot\text{atm}/\text{mol}\cdot\text{K} = 62.4 \text{ L}\cdot\text{torr}/\text{mol}\cdot\text{K}$

SHOW WORK TO RECEIVE CREDIT

1. (5 Pts) A student collected 40 mL of H₂ gas when the temperature was 20 °C and the pressure was 720 mmHg. The next day the temperature was 20 °C, but the volume was only 38.4 mL of gas. Determine the new pressure of the gas?

$P_1 = 720 \text{ torr}$ $P_2 = ?$
 $V_1 = 40 \text{ mL}$ $V_2 = 38.4 \text{ mL}$
 $T_1 = 20 + 273$ $T_2 = 20 + 273$
 Constant
 $P_1V_1T_2 = P_2V_2T_1$
 $P_2 = \frac{P_1V_1}{V_2} = \frac{(720 \text{ torr})(40 \text{ mL})}{38.4 \text{ mL}}$
 $P_2 = 750 \text{ torr}$

2. (5 Pts) 500 mL of a gaseous compound has a mass of 0.9825 g at 0 °C and 760 mmHg. What is the molar mass of the compound?

molar mass = $g \div \text{mol}$
 $P = 760 \text{ mmHg}$
 $V = 0.500 \text{ L}$
 $n = ?$
 $R = 62.4 \text{ L}\cdot\text{torr}/\text{mol}\cdot\text{K}$
 $T = 0 + 273 \text{ K}$
 $PV = nRT$
 $n = \frac{PV}{RT} = \frac{(760 \text{ torr})(0.500 \text{ L})}{62.4 \text{ L}\cdot\text{torr}/\text{mol}\cdot\text{K} \cdot 273 \text{ K}}$
 $n = 0.0223 \text{ mol}$
 molar mass = $\frac{0.9825 \text{ g}}{0.0223 \text{ mol}} = 44.0 \text{ g/mol}$

3. (5 Pts) A gas sample occupies a volume of 18.4 L at 37 °C and 0.500 atm. How many moles of gas are present?

$P = 0.500 \text{ atm}$
 $V = 18.4 \text{ L}$
 $n = ?$
 $R = 0.0821 \text{ L}\cdot\text{atm}/\text{mol}\cdot\text{K}$
 $T = 37 + 273 \text{ K}$
 $PV = nRT$
 $n = \frac{PV}{RT} = \frac{(0.500 \text{ atm})(18.4 \text{ L})}{0.0821 \text{ L}\cdot\text{atm}/\text{mol}\cdot\text{K} \cdot 310 \text{ K}}$
 $n = 0.361 \text{ mol}$

4. (5 Pts) Calculate the mass, in grams, of 2.74 L of CO gas measured at 33°C and 945 mmHg. (C 12.01 g/mol; O 16.00 g/mol)

Find moles then convert to grams
 $P = 945 \text{ mmHg}$
 $V = 2.74 \text{ L}$
 $n = ?$
 $R = 62.4 \text{ L}\cdot\text{torr}/\text{mol}\cdot\text{K}$
 $T = 33 + 273 \text{ K}$
 $PV = nRT$
 $n = \frac{PV}{RT} = \frac{945 \text{ torr} \cdot 2.74 \text{ L}}{62.4 \text{ L}\cdot\text{torr}/\text{mol}\cdot\text{K} \cdot 306 \text{ K}} = 0.136 \text{ mol}$
 $0.136 \text{ mol} \cdot \frac{28.01 \text{ g}}{\text{mol}} = 3.798 \text{ g}$

5. (5 Pts) What mass of iron(III) sulfide is produced from the reaction of 14.6 g of iron(III) nitrate with excess sodium sulfide? (Fe 55.847 g/mol; N 14.01 g/mol; S 32.06 g/mol; O 16.00 g/mol; Na 23.00 g/mol)

