

NAME: \_\_\_\_\_

DATE: \_\_\_\_\_

### Ideal Gas Law Problems

$$CO_2 = 12 \times 20 = 240$$

$$12 \times 32 = 384$$

$$240 + 384 = 624$$

$$624 / 16 = 44 \text{ g/mol}$$

1. Determine the volume of occupied by 2.34 grams of carbon dioxide gas at STP.

$$\frac{2.34 \text{ g}}{44 \text{ g/mol}} = 0.0532 \text{ mol} \times \frac{22.4 \text{ L}}{\text{mol}} = \underline{\underline{1.19 \text{ L}}}$$

or  $PV = nRT \Rightarrow V = \frac{nRT}{P} = \frac{0.0821 \times 0.0532 \times 273}{1} = 1.19 \text{ L}$

2. A sample of argon gas at STP occupies 56.2 liters. Determine the number of moles of argon and the mass in the sample.

STP, 22.4 L/mol

$$\frac{56.2 \text{ L}}{22.4 \text{ L/mol}} = \underline{\underline{2.51 \text{ mol}}} \times 39.95 \text{ g/mol} = \underline{\underline{100.27 \text{ g}}}$$

3. At what temperature will 0.654 moles of neon gas occupy 12.30 liters at 1.95 atmospheres?

$T = \frac{PV}{nR}$

$R = 0.0821$   $n = 0.654 \text{ mol}$   $V = 12.30 \text{ L}$   $P = 1.95 \text{ atm}$

$$T = \frac{1.95 \text{ atm} \times 12.30 \text{ L}}{0.654 \text{ mol} \times 0.0821 \frac{\text{L atm}}{\text{mol K}}} = \underline{\underline{447 \text{ K}}}$$

4. A 30.6 g sample of gas occupies 22.4 L at STP. What is the molecular weight of this gas?

$30.6 \text{ g} = 22.4 \text{ L}$  if 1 mole = 22.4 L then this is one mole.

$$1 \text{ mole} = \underline{\underline{30.6 \text{ g}}}$$

5. A 40.0 g gas sample occupies 11.2 L at STP. Find the molecular weight of this gas.

$$\frac{11.2 \text{ L}}{22.4 \text{ L/mol}} = 0.5 \text{ moles} = 40 \text{ g} \rightarrow \frac{0.5 \text{ mol}}{40 \text{ g}} = \frac{1 \text{ mol}}{80 \text{ g}}$$

6. A 12.0 g sample of gas occupies 19.2 L at STP. What is the molecular weight of this gas?

$$M = 12 \text{ g} \quad V = 19.2 \text{ L} \quad \frac{12 \text{ g}}{0.857 \text{ mol}} = 14 \text{ g/mol}$$

$$M = \frac{12 \text{ g}}{\frac{19.2 \text{ L}}{22.4 \text{ L/mol}}} = 0.857 \text{ mol} \quad \frac{12 \text{ g}}{0.857 \text{ mol}} = 14 \text{ g/mol}$$

7. 96.0 g. of a gas occupies 48.0 L at 700.0 mm Hg and 20.0 °C. What is its molecular weight?

$$96 \text{ g} = 48 \text{ L} \quad V = 48 \text{ L} \quad P = 700 \text{ mm Hg} \quad T = 20^\circ\text{C} = 293 \text{ K} \quad PV = nRT \quad n = \frac{PV}{RT} \quad \frac{96 \text{ g}}{1.84 \text{ mol}} = 52.2 \frac{\text{g}}{\text{mol}}$$

$$R = 62.4 \frac{\text{mmHg} \cdot \text{L}}{\text{mol} \cdot \text{K}} \quad n = \frac{700 \times 48}{62.4 \times 293} = 1.84 \text{ mol}$$

8. 20.83 g. of a gas occupies 4.167 L at 79.97 kPa at 30.0 °C. What is its molecular weight?

$$V = 4.167 \text{ L} \quad P = 79.97 \text{ kPa} \quad T = 30^\circ\text{C} = 303 \text{ K} \quad PV = nRT \quad n = \frac{PV}{RT} = \frac{79.97 \text{ kPa} \times 4.167 \text{ L}}{8.314 \text{ L} \cdot \text{kPa} / \text{mol} \cdot \text{K} \times 303 \text{ K}} = 0.132 \text{ mol}$$

$$\frac{20.83 \text{ g}}{0.132 \text{ mol}} = 157.8 \frac{\text{g}}{\text{mol}}$$

9. At STP 3.00 liters of an unknown gas has a mass of 9.50 grams. Calculate its molar mass.

$$\frac{3 \text{ L}}{22.4 \frac{\text{L}}{\text{mol}}} = 0.134 \text{ mol} \quad \frac{9.5 \text{ g}}{0.134 \text{ mol}} = 70.9 \text{ g/mol}$$

10. At STP 0.250 liter of an unknown gas has a mass of 1.00 gram. Calculate its molar mass.

$$V = 0.250 \text{ L} \quad \frac{0.250 \text{ L}}{22.4 \frac{\text{L}}{\text{mol}}} = 0.011 \text{ mol} \quad \frac{1 \text{ g}}{0.011 \text{ mol}} = 90.9 \text{ g/mol}$$