



Ideal Gas Law Applications Name KEY p. _____

1) A large cylinder of He gas, such as that used to inflate balloons, has a volume of 25.0 L at 22 C and 5.6 atm. **How many moles of helium** are in such a cylinder?

$$n = \frac{PV}{RT} = \frac{(5.6 \text{ atm})(25.0 \text{ L})}{(0.0821 \frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}})(295 \text{ K})} = \boxed{5.8 \text{ mol}}$$

2) **What is the mass (grams)** of the amount of helium calculated in #1?

$$5.8 \text{ mol} \left(\frac{4.00 \text{ g}}{1 \text{ mol}} \right) = \boxed{23 \text{ g He}}$$

3) Gas X has a density of 2.60 g/L at STP. **Determine the molar mass (g/mol)** of this gas.

$$\frac{2.60 \text{ g}}{\text{L}} = \frac{x \text{ g}}{22.4 \text{ L}} \quad x = 58.2 \text{ g} \quad \text{or} \quad \boxed{58.2 \text{ g/mol}}$$

↖ (STP)

4) Gas Y has a density of 2.60 g/L at 77 C and 0.80 atm. **Determine the molar mass (g/mol)** of gas Y.

$$M = \frac{DRT}{P} = \frac{(2.60 \frac{\text{g}}{\text{L}})(0.0821 \frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}})(350 \text{ K})}{0.80 \text{ atm}} = \boxed{93 \text{ g/mol}}$$

5) **Find the pressure**, in atmospheres, of 4.0 grams of CH₄ gas when its temperature is 27 C and its volume is 3000. mL.

$$4.0 \text{ g CH}_4 \left(\frac{1 \text{ mol}}{16.05 \text{ g}} \right) = 0.25 \text{ mol}$$

$$P = \frac{nRT}{V} = \frac{(0.25 \text{ mol})(0.0821 \frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}})(300 \text{ K})}{3.000 \text{ L}} = \boxed{2.1 \text{ atm}}$$

6) **Determine the density** of hydrogen bromide gas (HBr) at 3.10 atm and -5°C.

$$D = \frac{PM}{RT} = \frac{(3.10 \text{ atm})(80.91 \frac{\text{g}}{\text{mol}})}{(0.0821 \frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}})(268 \text{ K})} = \boxed{11 \text{ g/L}}$$

7) **Determine the molar mass** of an unknown gas that has a volume of 72.5 mL at a temperature of 68°C, a pressure of 0.980 atm, and a mass of 0.207 g.

$$M = \frac{mRT}{PV} = \frac{(0.207 \text{ g})(0.0821 \frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}})(341 \text{ K})}{(0.980 \text{ atm})(0.0725 \text{ L})} =$$

$$\boxed{81.6 \text{ g/mol}}$$