Ideal Gas Law Problems

1. What volume does 0.0200 moles of hydrogen gas at 0.821 atm pressure and 300. K occupy?

P = 0.821 atm **PV = nRT** $V = \frac{nRT}{P}$

V = ?

n = 0.0200 mol

R = 0.0821 L· atm / mol· K

$V = \frac{(0.0200\ \text{mol})(0.0821\ \text{L·atm})(300\ \text{K})}{(\text{mol·K})(0.821\ \text{atm})}$

T = 300. K

V = 0.600 L

2. What pressure does 0.1200 moles of oxygen exert having a volume of 1.20 L at 36.0 °C?

P = ? atm **PV = nRT** $P = \frac{nRT}{V}$

V = 1.20 L

n = 0.1200 mol

R = 0.0821 L· atm / mol· K

$P = \frac{(0.1200\ \text{mol})(0.0821\ \text{L·atm})(309\ \text{K})}{(\text{mol·K})(1.20\ \text{L})}$

T = 36 °C + 273 = 309 K

P = 2.54 atm

3. 750 mL of oxygen is measured at 25.0 °C and 720 mm pressure. How many moles of oxygen is this?

$P = 720\ \text{mm Hg} \times \frac{1\ \text{atm}}{760\ \text{mm Hg}} = 0.947\ \text{atm}$

V = 750 mL = 0.750 L **PV = nRT** $n = \frac{RT}{PV}$

n = ?

R = 0.0821 L· atm / mol· K

$n = \frac{(0.0821\ \text{L·atm})(298\ \text{K})}{(\text{mol·K})(0.947\ \text{atm})(0.750\ \text{L})}$

T = 25 °C + 273 = 298 K

n= 34.4 mol O_2

4. 2.4 L of carbon dioxide is measured at –27 °C and 710 mm pressure. How many grams of carbon dioxide is this?

$P = 710\ \text{mm Hg} \times \frac{1\ \text{atm}}{760\ \text{mm Hg}} = 0.934\ \text{atm}$

$V = 2.4\ \text{L}$

$n = ?$

$R = 0.0821\ \frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}}$

$T = -27\ ^\circ\text{C} + 273 = 271\ \text{K}$

$PV = nRT \qquad n = \frac{RT}{PV}$

$n = \frac{(0.0821\ \frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}})(271\ \text{K})}{(0.934\ \text{atm})(2.4\ \text{L})}$

$n = 9.9\ \text{mol CO}_2$

$9.9\ \text{mol CO}_2 \times \frac{44\ \text{g CO}_2}{1\ \text{mol CO}_2} = 440\ \text{g CO}_2$