11-2 Ideal Gas Constant

Moles can be included in the Combined Gas Law

$$\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2} = \text{Constant}$$

1 mole of a gas at STP conditions can be substituted in:

$$\frac{PV}{nT} = \frac{(1\text{ atm})(22.4\text{ L})}{(1\text{ mol})(273\text{ K})} = 0.0821\ \frac{\text{L}\cdot\text{atm}}{\text{mol}\cdot\text{K}}$$

This gives us the ideal gas constant "R"

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

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11-2 Ideal Gas Law

Ideal gas Law

$\frac{PV}{nT}$ = R can be have both sides multiplied by nT to give:

Pressure, Volume, Temperature (K)

$$PV = nRT$$

Moles, Ideal Gas Constant

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

This can find the pressure, volume, temperature or moles of a gas

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11-2 Ideal Gas Law

What is the pressure in atmospheres exerted by a 0.500 mol sample of nitrogen gas in a 10.0 L container at 298 K?

$$PV = nRT \rightarrow P = \frac{nRT}{V}$$

$$P = \frac{(0.500\ \cancel{\text{mol}})(\ 0.0821\ \frac{\cancel{\text{L}}\cdot\text{atm}}{\cancel{\text{mol}}\cdot\cancel{\text{K}}}\ )(298\ \cancel{\text{K}})}{(10.0\ \cancel{\text{L}})}$$

$$P = 1.22\text{ atm}$$

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11-2 Ideal Gas Law

What mass of chlorine gas, Cl_2, in grams, is contained in a 10.0 L tank at 27°C and 3.50 atm of pressure?

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

$$27°C + 273 = 300K$$

$$n = \frac{(3.5\ \text{atm})(10.0\ \cancel{\text{L}})}{(0.0821\ \frac{\cancel{\text{L}}\cdot\text{atm}}{\text{mol}\cdot\cancel{\text{K}}}\ )(300\ \cancel{\text{K}})} = 1.42\text{ mol } Cl_2$$

$$1.42\ \cancel{\text{mol}}\ Cl_2 \left[\frac{71.0\text{ g}}{\cancel{\text{mol}}}\right] = 101\text{ g } Cl_2$$

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