Name _____ Hour _____

Dalton's Law of Partial Pressures

Honors Chemistry

1. A container holds 3 gases. The partial pressures are 2.0-atm oxygen, 3.0-atm carbon dioxide, and 4.0-atm helium. What is the total pressure *(in kPa and atm)* inside the container?

$P_{O_2} = 2.0\text{atm}$
$P_{CO_2} = 3.0\text{atm}$
$P_{He} = 4.0\text{atm}$
$P_{total} = ?$

$P_{total} = P_{O_2} + P_{CO_2} + P_{He} = 2.0\text{atm} + 3.0\text{atm} + 4.0\text{ atm} = \boxed{9.0\text{ atm}}$

$\frac{9.0\text{atm}}{1} \times \frac{101.3\text{ kPa}}{1.0\text{atm}} = \boxed{911.7\text{ kPa}}$

2. A container with two gases, helium and argon, is 30.0% helium by volume. Calculate the partial pressures of helium and argon *(in atm)* if the total pressure in the container is 4.0-atm.

$P_{He} = 0.3 \times 4.0\text{ atm} = \boxed{1.2\text{ atm}}$
$P_{Ar} = ?$
$P_{total} = 4.0\text{atm}$

$P_{Ar} = P_{total} - P_{He}$
$P_{Ar} = 4.0\text{atm} - 1.2\text{atm} = \boxed{2.8\text{atm}}$

3. A breathing mixture used by deep-sea-divers contains helium, oxygen, and carbon dioxide with a total pressure of 253.3-kPa. What is the P_{Osygen} in kilopascals if the P_{Helium}= 210.0-kPa and the $P_{Carbon\ dioxide}$ = 0.2- kPa?

$P_{He} = 210.0\text{ kPa}$
$P_{O_2} = ?$
$P_{CO_2} = 0.2\text{ kPa}$
$P_{total} = 253.3\text{ kPa}$

$P_{O_2} = P_{total} - (P_{He} + P_{CO_2})$
$P_{O_2} = 253.3\text{ kPa} - (210.0\text{kPa} + 0.2\text{kPa}) = \boxed{43.1\text{ kPa}}$

4. A mixture of gases at a total pressure of 2.86-atm contains N_2, CO_2, and O_2. The $P_{nitrogen}$ is 0.563-atm and the partial pressure of CO_2 is 1.50-atm. What is the partial pressure of O_2 in atm?

$P_{N_2} = 0.563\text{atm}$
$P_{CO_2} = 1.50\text{ atm}$
$P_{O_2} = ?$
$P_{total} = 2.86\text{atm}$

$P_{O_2} = P_{total} - (P_{N_2} + P_{CO_2})$
$P_{O_2} = 2.86\text{ atm} - (.563\text{ atm} + 1.50\text{ atm}) = \boxed{0.797\text{atm}}$

5. A gaseous mixture consisting of nitrogen, argon, and oxygen is in a 3.5-L vessel at 25°C with a total pressure of 0.972-atm. The partial pressure of nitrogen is 0.217-atm and the partial pressure of argon is 0.494-atm. Determine the partial pressure of oxygen and use it to find the moles of oxygen present in the vessel.

$P_{N_2} = 0.217\text{ atm}$
$P_{Ar} = 0.494\text{atm}$
$P_{O_2} = ?$
$P_{total} = 0.972\text{atm}$

$n = \frac{PV}{RT} = \frac{(0.261\text{ atm})(3.5\text{L})}{(.0821\ \frac{\text{L·atm}}{\text{mol·K}})(298\text{K})} = \boxed{.037\ \text{mol}\ O_2}$

$P = 0.261\text{atm}$
$V = 3.5\text{L}$
$n = ?$
$T = 298\text{K}$

$P_{O_2} = P_{total} - (P_{N_2} + P_{Ar})$
$P_{O_2} = 0.972\text{ atm} - (.217\text{atm} + .494\text{ atm}) = \boxed{0.261\text{ atm}}$

More of the Ideal Gas Law

Honors Chemistry

1. What is the pressure, in atm, exerted by a 0.50 mole sample of nitrogen gas in a 10.0 L container at 25.0°C?

$P = ?$ $n = .50\ mol$ $V = 10.0\ L$ $T = 298\ K$ $P = \frac{nRT}{V} = \frac{(.50\ mol)(.0821\ \frac{L \cdot atm}{mol\ K})(298\ K)}{10.0\ L} = \boxed{1.22\ atm}$

2. What is the volume, in liters, of 0.250 mole of oxygen gas at 20.0°C and 0.974 atm of pressure?

$P = .974\ atm$ $n = .250\ mol$ $V = ?$ $T = 293\ K$ $V = \frac{nRT}{P} = \frac{(.250\ mol)(.0821\ \frac{L \cdot atm}{mol\ K})(293\ K)}{.974\ atm} = \boxed{6.17\ L}$

3. What mass of chlorine gas, Cl_2, in grams, is contained in a 10.0-L tank at 27.0°C and 3.50 atm of pressure? {*Hint: Find moles and then convert to grams!*]

$P = 3.50\ atm$ $n = ?$ $V = 10.0\ L$ $T = 300\ K$ $n = \frac{PV}{RT} = \frac{(3.50\ atm)(10.0\ L)}{(.0821\ \frac{L \cdot atm}{mol\ K})(300\ K)} = 1.42\ mol$ $\frac{1.42\ mol}{1} \times \frac{71\ g}{1\ mol} = \boxed{101\ g\ Cl_2}$

4. An engineer pumps 5.00 moles of carbon monoxide gas into a cylinder that has a capacity of 20.0 L. What is the pressure, in atm, of CO inside the cylinder at 25.0°C?

$P = ?$ $n = 5.00\ mol$ $V = 20.0\ L$ $T = 298\ K$ $P = \frac{nRT}{V} = \frac{(5.00\ mol)(.0821\ \frac{L\ atm}{mol\ K})(298\ K)}{20.0\ L} = \boxed{6.12\ atm}$

5. A student collects 425-mL of oxygen at a temperature of 24.0°C and a pressure of 0.899 atm. How many moles of oxygen did the student collect?

$P = .899\ atm$ $n = ?$ $V = .425\ L$ $T = 297\ K$ $n = \frac{PV}{RT} = \frac{(.899\ atm)(.425\ L)}{(.0821\ \frac{L\ atm}{mol\ K})(297\ K)} =$ $\boxed{.0157\ mol\ O_2}$

6. Determine the mass of CO_2 gas that has a volume of 7.10-L at a pressure of 1.11 atm and a temperature of 31.0°C.

$P = 1.11\ atm$ $n = ?$ $V = 7.10\ L$ $T = 304\ K$ $n = \frac{PV}{RT}$ $n = \frac{(1.11\ atm)(7.10\ L)}{(.0821\ \frac{L\ atm}{mol\ K})(304\ K)} = .316\ mol$ $\frac{.316\ mol}{1} \times \frac{44\ g}{1\ mol} = \boxed{13.9\ g\ CO_2}$

7. What pressure, in atmospheres, will 1.36 kg of N_2O gas exert when it is compressed in a 25.0 L cylinder and it's stored in an outdoor shed where the temperature reaches 59.0°C during the summer?

$P = ?$ $n = 30.9\ mol$ $V = 25.0\ L$ $T = 332\ K$ $P = \frac{nRT}{V} = \frac{(30.9\ mol)(.0821\ \frac{L\ atm}{mol\ K})(332\ K)}{25.0\ L} = \boxed{33.7\ atm}$

8. A large balloon contains 11.7 g of helium. What volume will the helium occupy at an altitude of 1.00×10^4 meters, where the atmospheric pressure is 0.262 atm and the temperature is –50.0°C?

$P = .262\ atm$ $n = 2.925\ mol$ $V = ?$ $T = 223\ K$ $\frac{11.7\ g\ He}{1} \times \frac{1\ mol}{4\ g} = 2.925\ mol$ $V = \frac{nRT}{P} = \frac{(2.925\ mol)(.0821\ \frac{L\ atm}{mol\ K})(223\ K)}{.262\ atm} = \boxed{204\ L}$

9. A sample of an unknown gas has a mass of 0.116-g. It occupies a volume of 25.0-mL at a temperature of 127°C and has a pressure of 1.53-atm. Calculate the molar mass of the gas.

$P = 1.53\ atm$ $n = ?$ $V = .025\ L$ $T = 400\ K$ $n = \frac{PV}{RT} = \frac{(1.53\ atm)(.025\ L)}{(.0821\ \frac{L\ atm}{mol\ K})(400\ K)} = .00116\ mol$ $\text{molar mass} = \frac{.116\ g}{.00116\ mol} = \boxed{99.69\ g/mol}$

10. Determine the molar mass of an unknown gas that has a volume of 72.5 ml at a temperature of 68.0°C, and a pressure of 0.980 atm, and a mass of 0.207 g.

$P = .980\ atm$ $n = ?$ $V = .0725\ L$ $T = 341\ K$ $n = \frac{PV}{RT} = \frac{(.980\ atm)(.0725\ L)}{(.0821\ \frac{L\ atm}{mol\ K})(341\ K)} = .0025\ mol$

$\text{molar mass} = \frac{0.207\ g}{.0025\ mol} = \boxed{81.69\ g/mol}$