MIXED GAS LAWS WORKSHEET - SOLUTIONS

1) How many moles of gas occupy 98 L at a pressure of 2.8 atmospheres and a temperature of 292 K?

$n = \frac{PV}{RT} = \frac{(2.8\ atm)(98\ L)}{(0.0821\ L.atm/mol.K)(292\ K)} = 11$ moles of gas

2) If 5.0 moles of O_2 and 3.0 moles of N_2 are placed in a 30.0 L tank at a temperature of 25° C, what will the pressure of the resulting mixture of gases be? **25° C = 298 K**

O_2: $P = \frac{nRT}{V} = \frac{(5.0\ mol)(0.0821\ L.atm/mol.K)(298\ K)}{(30.0\ L)} = 4.1$ atm

N_2: $P = \frac{nRT}{V} = \frac{(3.0\ mol)(0.0821\ L.atm/mol.K)(298\ K)}{(30.0\ L)} = 2.4$ atm

$P_{Tot} = P_{O2} + P_{N2} = 4.1\ atm + 2.4\ atm = 6.5\ atm$

Alternately you can substitute total moles of gas (8.0) as the total pressure depends on the total moles of gas – what type of gas is irrelevant

3) A balloon is filled with 35.0 L of helium in the morning when the temperature is 20.0° C. By noon the temperature has risen to 45.0°C. What is the new volume of the balloon?

$T_1 = 20.0°\ C = 293\ K$, $V_1 = 35.0\ L$, $T_2 = 45.0°\ C = 318\ K$, $V_2 = ?$

$V_2 = \frac{V_1 T_2}{T_1} = \frac{(35.0\ L)(318\ K)}{(293\ K)} = 38.0\ L$

4) A 35 L tank of oxygen is at 315 K with an internal pressure of 190 atmospheres. How many moles of gas does the tank contain?

$n = \frac{PV}{RT} = \frac{(190\ atm)(35\ L)}{(0.0821\ L.atm/mol.K)(315\ K)} = 260$ moles of gas

5) A balloon that can hold 85 L of air is inflated with 3.5 moles of gas at a pressure of 1.0 atmosphere. What is the temperature in °C of the balloon?

$T = \frac{PV}{nR} = \frac{(1\ atm)(85\ L)}{(3.5\ mol)(0.0821\ L.atm/mol.K)} = 296\ K = 23°C$

6) $CaCO_3$ decomposes at 1200°C to form CO_2 gas and CaO. If 25 L of CO_2 are collected at 1200°C, what will the volume of this gas be after it cools to 25°C?

$T_1 = 1200°C = 1473\ K$, $V_1 = 25\ L$, $T_2 = 25°C = 298\ K$, $V_2 = ?$

$V_2 = \frac{V_1 T_2}{T_1} = \frac{(25\ L)(298\ K)}{(1473\ K)} = 5.1\ L$

7) A helium balloon with an internal pressure of 1.00 atm and a volume of 4.50 L at 20.0°C is released. What volume will the balloon occupy at an altitude where the pressure is 0.600 atm and the temperature is –20.0°C?

$P_1 = 1.00\ atm$, $V_1 = 4.50\ L$, $T_1 = 20.0°C = 293\ K$, $P_2 = 0.600\ atm$, $V_2 = ?$, $T_2 = -20.0°C = 253\ K$

$V_2 = \frac{P_1 V_1 T_2}{T_1 P_2} = \frac{(1.00\ atm)(4.50\ L)(253\ K)}{(293\ K)(0.600\ atm)} = 6.48\ L$