★ P = atm; V = L; T = K; n = mols

crucial

Formula:

$PV = nRT$

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

Ideal Gas Law Practice WS #1

1. How many moles of gas does it take to occupy 120 L at a pressure of 2.3 atmospheres and a temperature of 340 K?

Ex $n = \frac{PV}{RT} = \frac{(2.3\,atm)(120\,L)}{(0.0821 \frac{L\,atm}{mol\,K})(340\,K)} = 9.89\,mols$

$V = 120\,L$
$P = 2.3\,atm$
$T = 340\,K$
$n = ?$

2. If I have a 50 L container that holds 45 moles of gas at a temperature of 200°C. What is the pressure inside the container in atmospheres?

$P = \frac{nRT}{V} = \frac{(45\,mols)(0.0821 \frac{L\,atm}{mol\,K})(473\,K)}{50\,L} = 34.95\,atm$

$V = 50\,L$
$n = 45\,mols$
$T = 200°C = 473\,K$
$P = ?$

3. It is not safe to put aerosol canisters in a campfire, because the pressure inside the canisters gets very high, and they can explode. If I accidentally throw a 1.0 L canister that holds 2 moles of gas into fire that is 1400°C, what is the pressure inside the canister in atmospheres?

$P = \frac{nRT}{V} = \frac{(2\,mols)(0.0821 \frac{L\,atm}{mol\,K})(1673\,K)}{1.0\,L} = 274.71\,atm$

$V = 1.0\,L$
$n = 2\,mols$
$T = 1400°C = 1673\,K$
$P = ?$

4. How many moles of gas are in a 30 L scuba canister if the temperature of the canister is 300 K and the pressure is 200 atmospheres?

$n = \frac{PV}{RT} = \frac{(200\,atm)(30\,L)}{(0.0821 \frac{L\,atm}{mol\,K})(300\,K)} = 243.6\,mols$

$V = 30\,L$
$T = 300\,K$
$P = 200\,atm$
$n = ?$

5. I have a balloon that can hold 100 L of air. If I blow up this balloon with 3 moles of oxygen gas at a pressure of 1 atmosphere, what is the temperature of the balloon in degrees Celsius?

$T = \frac{PV}{nR} = \frac{(1\,atm)(100\,L)}{(3\,mol)(0.0821 \frac{L\,atm}{mol\,K})} = 406.0\,K = 133.0°C$

$V = 100\,L$
$n = 3.0\,mol$
$P = 1\,atm$
$T = ?\,°C$

Ideal Gas Law WS #2

6. If 3.7 moles of propane are at a temperature of 28°C and are under 1.52 atm of pressure, what volume does the sample occupy?

$V = \frac{nRT}{P} = \frac{(3.7\text{ mols})(0.0821\frac{\text{L atm}}{\text{mol K}})(301\text{ K})}{1.52\text{ atm}} = 60.15\text{ L}$

$n = 3.7$ mols
$T = 28°C = 301$ K
$P = 1.52$ atm
$V = ?$

★ 7. A sample of carbon monoxide at 57°C and under 0.67 atm of pressure takes up 85.3 L of space. What mass of carbon monoxide is present in the sample? (Hint- solve for mol, convert to g)

MM CO_2 = 28 g/mol

$n = \frac{PV}{RT} = \frac{(0.67\text{ atm})(85.3\text{ L})}{(0.0821\frac{\text{L atm}}{\text{mol K}})(330\text{ K})} = 2.11\text{ mols } CO_2 \left|\frac{28\text{ g } CO_2}{1\text{ mol } CO_2}\right.$

$= 59.08\text{ g } CO_2$

$T = 57°C = 330$ K
$P = 0.67$ atm
$V = 85.3$ L
$n = ?$
mass = ?

8. At –45°C, 71 g of fluorine (F_2) gas take up 6843 mL of space. What is the pressure of the gas? (Hint- convert g→ mol, then use ideal gas law)

$71\text{ g } F_2 \left|\frac{1\text{ mol } F_2}{38\text{ g } F_2}\right. = 1.87\text{ mols } F_2$

$P = \frac{nRT}{V} = \frac{(1.87\text{ mols})(0.0821\frac{\text{L atm}}{\text{mol K}})(228\text{ K})}{6.843\text{ L}} = 5.11\text{ atm}$

$T = -45°C = 228$ K
$g = 71$ g F_2
$V = 6.843$ L
$P = ?$
$n = ?$

9. At 1.28 atm, 145 g of carbon dioxide (CO_2) have a volume of 34.13 L. What is the temperature of the sample? (Hint- convert g → mole, then use ideal gas law)

$145\text{ g } CO_2 \left|\frac{1\text{ mol } CO_2}{44\text{ g } CO_2}\right. = 3.30\text{ mol } CO_2$

$T = \frac{PV}{nR} = \frac{(1.28\text{ atm})(34.13\text{ L})}{(3.30\text{ mols})(0.0821\frac{\text{L atm}}{\text{mol K}})} = 161.24\text{ K} = -111.75°C$

$P = 1.28$ atm
$g = 145$ g CO_2
$V = 34.13$ L
$T = ?$
$n = ?$

10. CHALLENGE!! At 137°C and under a pressure of 3.11 atm, a 276 g sample of an unknown noble gas occupies 13.46 L of space. What is the gas? (Hint: remember the units for molar mass are g/mol)

$n = \frac{PV}{RT} = \frac{(3.11\text{ atm})(13.46\text{ L})}{(0.0821\frac{\text{L atm}}{\text{mol K}})(410\text{ K})} = 1.24\text{ mols}$

$MM = \frac{g}{\text{mol}} = \frac{276\text{ g}}{1.24\text{ mols}} = 222.58\text{ g/mol} = \text{Radon} \rightarrow \text{Rn}$

$T = 137°C = 410$ K
$P = 3.11$ atm
$g = 276$ g
$V = 13.46$ L
$n = ?$