STP ↳ 1 atm = 760 mm Hg = 101.3 kPa $PV = nRT$ $R = 0.0821 \frac{atm \cdot L}{K \cdot mol}$ $^{\circ}C + 273 = \_K$

Ideal Gas Law Problems

Use the ideal gas law to solve the following problems:

1) If I have 4 moles of a gas at a pressure of 5.6 atm and a volume of 12 liters, what is the temperature?

P = 5.6 atm
V = 12 L
n = 4 mol
R = 0.0821
T = ?

$PV = nRT$

$T = \frac{PV}{nR} = \frac{(5.6\,atm)(12\,L)}{(4\,mol)(0.0821)} = 204.6\,K$

2) If I have an unknown quantity of gas at a pressure of 1.2 atm, a volume of 31 liters, and a temperature of 87 °C, how many moles of gas do I have?

P = 1.2 atm
V = 31 L
n = ?
R = 0.0821
T = 360 K

$n = \frac{(1.2\,atm)(31\,L)}{(0.0821)(360\,K)} = 1.26\,mol$

3) If I contain 3 moles of gas in a container with a volume of 60 liters and at a temperature of 400 K, what is the pressure inside the container?

P = ?
V = 60 L
n = 3 mol
R = 0.0821
T = 400 K

$P = \frac{nRT}{V} = \frac{(3\,mol)(0.0821)(400\,K)}{60\,L} = 1.64\,atm$

4) If I have 7.7 moles of gas at a pressure of 0.09 atm and at a temperature of 56 °C, what is the volume of the container that the gas is in?

P = 0.09 atm
V = ?
n = 7.7 mol
R = 0.0821
T = 56 °C + 273 = 329 K

$V = \frac{nRT}{P} = \frac{(7.7\,mol)(0.0821)(329\,K)}{0.09} = 2310.9\,L$

5) If I have 17 moles of gas at a temperature of 67 °C, and a volume of 88.89 liters, what is the pressure of the gas?

P = ?
V = 88.89 L
n = 17 mol
R = 0.0821
T = 67 + 273 = 340

$P = \frac{nRT}{V} = \frac{(17\,mol)(0.0821)(340\,K)}{88.89\,L} = 5.34\,atm$

6) If I have an unknown quantity of gas at a pressure of 0.5 atm, a volume of 25 liters, and a temperature of 300 K, how many moles of gas do I have?

P = 0.5 atm
V = 25 L
n = ?
R = 0.0821
T = 300 K

$\frac{PV}{RT} = n = \frac{(0.5\,atm)(25\,L)}{(0.0821)(300\,K)} = 0.508\,atm = 0.5\,mol$

7) If I have 21 moles of gas held at a pressure of 78 atm and a temperature of 900 K, what is the volume of the gas?

P = 78 atm
V = ?
n = 21 mol
R = 0.0821
T = 900 K

$V = \frac{nRT}{P} = \frac{(21\,mol)(0.0821)(900\,K)}{78\,atm} = 19.9\,L$

8) If I have 1.9 moles of gas held at a pressure of 5 atm and in a container with a volume of 50 liters, what is the temperature of the gas?

P = 5 atm
V = 50 L
n = 1.9 mol
R = 0.0821
T = ?

$T = \frac{PV}{nR} = \frac{(5\,atm)(50\,L)}{(1.9\,mol)(0.0821)} = 602.7\,K$

9) If I have 2.4 moles of gas held at a temperature of 97 °C and in a container with a volume of 45 liters, what is the pressure of the gas?

P = ?
V = 45 L
n = 2.4 mol
R = 0.0821
T = 97 + 273 = 370 K

$P = \frac{nRT}{V} = \frac{(2.4\,mol)(0.0821)(370\,K)}{45\,L} = 1.62\,atm$

10) If I have an unknown quantity of gas held at a temperature of 1195 K in a container with a volume of 25 liters and a pressure of 560 atm, how many moles of gas do I have?

P = 560 atm
V = 25 L
n = ?
R = 0.0821
T = 1195 K

$n = \frac{PV}{RT} = \frac{(560\,atm)(25\,L)}{(0.0821)(1195\,K)} = 142.7\,mol \approx 140$

11) If I have 0.275 moles of gas at a temperature of 75 K and a pressure of 1.75 atmospheres, what is the volume of the gas?

P = 1.75 atm
V = ?
n = 0.275 mol
R = 0.0821
T = 75 K

$V = \frac{nRT}{P} = \frac{(0.275\,mol)(0.0821)(75\,K)}{1.75\,atm} = 0.97\,L$

12) If I have 72 liters of gas held at a pressure of 3.4 atm and a temperature of 225 K, how many moles of gas do I have?

P = 3.4 atm
V = 72 L
n = ?
R = 0.0821
T = 225 K

$n = \frac{PV}{RT} = \frac{(3.4\,atm)(72\,L)}{(0.0821)(225\,K)} = 13.25$

13 mol