TP
↳ 1atm = 760mmHg = 101.3KPa

PV = nRT

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

°C + 273 = K

8

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

$PV = nRT$

$T = \frac{PV}{nR} = \frac{(5.6atm)(12L)}{(4mol)(0.0821)} = 204.16K$

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

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

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 = 60L
n = 3mol
R = 0.0821
T = 400K

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

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?

n = 7.7mol R = .0821
P = 0.09atm V = ?
T = 329K

$V = \frac{nRT}{P} = \frac{(7.7)(.0821)(329)}{.09} = 2311L$

V = ~~2311~~ 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 = 88.89L
n = 17mol
R = 0.0821
T = 67 + 273 = 340

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

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?

n = ?
P = .5atm
V = 25L
T = 300K
R = .0821

$n = \frac{PV}{RT} = \frac{(.5)(25)}{(.0821)(300)}$

n = .5098 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 = 78atm
V = ?
n = 21mol
R = 0.0821
T = 900K

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

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?

n = 1.9mol R = .0821
P = 5atm
V = 50L

$T = \frac{PV}{nR} = \frac{(5)(50)}{(1.9)(.0821)} = 1603K$

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

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

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?

T = 1195K R = .0821
V = 25L
P = 560atm n = ?

$n = \frac{PV}{RT} = \frac{(560)(25)}{(.0821)(1195)}$

n = 143 mol

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

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

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?

V = 72L
P = 3.4atm
T = 225K
R = .0821

$n = \frac{PV}{RT} = \frac{(3.4)(72)}{(.0821)(225)}$

n = 13.25 mol