# Examples Worksheet of Chapter "1"

Use *the universal gas constant R = 0.0821 L*atm to solve the following problems: K*mol If pressure is needed in kPa then convert by multiplying by 101.3kPa / 1atm to get R =8.31 kPa*L / (K*mole)*

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**1. a 4 moles of a gas at a pressure of 5.6 atm and a volume of 12 liters, what is the temperature?**

*Pv=nRT*

$$T=\frac{PV}{nR}=\frac{(5.6\ atm)(12\ L)}{4\ mol\ (0.0821 L.\frac{atm}{K*mol})}=204.63K$$

**2. 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?**

*Pv=nRT*

$$n=\frac{PV}{TR}=\frac{(1.2\ atm)(31\ L)}{(87+273)K*\ (0.0821 L.\frac{atm}{K*mol})}= 1.26\ mol$$

**3. A 7.7 moles of gas at a pressure of 0.09 atm and at a temperature of 56 $^{0}$C, what is the volume of the container that the gas is in?**

*Pv=nRT*

$$V=\frac{nRT}{P}=\frac{(7.7\ mol)(56+273)K*\ (0.0821 L.\frac{atm}{K*mol})}{0.09}= 2310.9\ L$$

**4. A 17 moles of gas at a temperature of 67 C, and a volume of 88.89 liters, what is the pressure of the gas?**

*Pv=nRT*

$$P=\frac{nRT}{V}=\frac{(17\ mol)(67+273)K*\ (0.0821 L.\frac{atm}{K*mol})}{88.9}= 5.34\ atm = 540.61\ kPa$$

**5. Carbon dioxide gas (1.00 mole) at 373 K occupies 536 mL at 50.0 atmosphere pressure. What is the calculated value of the pressure using:**

**(i) Ideal gas equation**

**(ii) Van der Waals equation?**

**[Data - Van der Waals constants for carbon dioxide:**

**a = 3.61 L2 atm mol-2; b = 0.0428 L mol-1]**

*i) Using the Ideal Gas Equation*

*V = 0.536 L*

*n = 1.00 mol*

*T = 373 K*

*PV = nRT*

$P=\frac{nRT}{V}=\frac{(1mol)(373)K*(0.0821L.\frac{atm}{K*mol})}{0.536L}$ = 57.1 atm

*ii) the Van der Waals equation for real gas behavior:*

*(P + an2/V2) (V – n b) = nRT.*

*P + 3.61 x (1.00/0.536)2) (0.536 - 1.00 x 0.0428) = 1.00 x 0.0821 x 373)*

*(P + 12.57) (0.493) = 30.62*

*P + 12.57 = 62.12*

*P = 49.6 atm*

**6. Using Van der Waals equation, calculate the temperature of 20.0 mole of helium in a 10.0-liter cylinder at 120 atmosphere pressure.**

**[Data - Van der Waals constants for helium: a = 0.0341 L2 at mol-2; b = 0.0237 L mol-1]**

P = 120 atm

n = 20.0 mol, V = 10.0 L

(120 + 0.0341 x (20.0/10.0)2) (10.0 - 20.0 x 0.0237) = 20.0 x 0.0821 x T

[Note the value of R = 0.0821 because P is in atm and V in L]

(120 + 0.1364) (10.0 - 0.5) = 1.64 x T

T = 696 K

$F = \frac{9}{5}C + 32 = \frac{9}{5}(37) + 32 = 98.6$

$37 + 273.15 = 310.15$

**1. Convert 37˚C to both Fahrenheit degrees and Kelvin.**

$F = \frac{9}{5}C + 32 = \frac{9}{5}(37) + 32 = 66.6 + 32 = 98.6^\circ$ F ← That's human body temp.

K → C → F

**2. Convert 80K to both Celsius and Fahrenheit degrees.**

First convert to Celsius by subtracting 273.15 K:

$T = 80 - 273.15 = -193.15^\circ C$

Then to Fahrenheit: $F = \frac{9}{5}C + 32 = \frac{9}{5}(-193.15) + 32 = -347.7^\circ$ F

$C = 80 - 273.15 = -193.15\ C^\circ$

$F = \frac{9}{5}C + 32 = \frac{9}{5}(-193.15) + 32 = -347.7F$

**3. Calculate the difference between 97˚F and 40˚F in both Celsius degrees and Kelvin.**

In Celsius degrees, these temperatures are

$T1 = \frac{9}{5}(F - 32) = \frac{9}{5}(97 - 32) = 37.22^\circ C$

$T2 = \frac{9}{5}(F - 32) = \frac{9}{5}(40 - 32) = 4.44^\circ C$

The difference is $37.22 - 4.44 = 32.78^\circ$ C or 32.78 K

$T_1(C) = \frac{5}{9}(F - 32)$

$T_1(C) = \frac{5}{9}(97 - 32) = 36.1$

$T_2(C) = \frac{5}{9}(40 - 32) = 4.44$

$\Delta T = 36.1 - 4.44 = 31.66\ C^\circ$

$\Delta T = 31.66\ K^\circ$

فروق درجات الحرارة بوحدة K هي نفس وحدة C°