III. Long Answer Type Questions

Question 1. State and explain Boyle's law. Represent the law graphically.
Answer: It states that, the pressure of a fixed mass of a gas is inversely proportional to its ' volume if temperature is kept constant.

$$P \propto \frac{1}{V}$$
$$PV = \text{constant } (n \text{ and } T \text{ are constant})$$
$$P_1V_1 = P_2V_2.$$

Graphical representation:

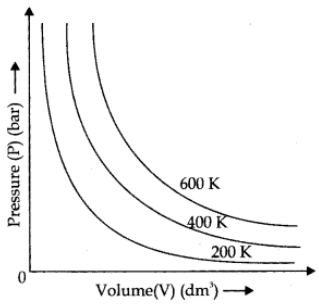

Fig. *Graph of pressure, P vs. Volume, V of a gas at different temperatures.*

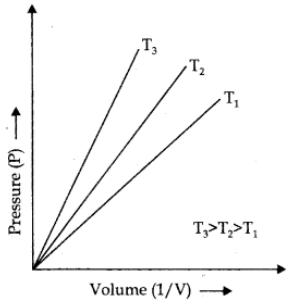

Fig. *Graph of pressure of a gas, P vs. 1/V*

Question 2. Give an expression for the van der Wools equation. Give the significance of the constants used in the equation. What are their units?
Answer:

$$\left(p + \frac{n^2a}{V^2}\right)(V - nb) = nRT$$

When n is the no. of moles present and 'a' and 'V are known as van der Waals constants.
Significance of van der Waals constants
van der Waals constant 'a' : 'a' is related to the magnitude of the attractive forces among the molecules of a particular gas. Greater the value of V, more will be the attractive forces.
Unit of 'a' = L^2 mol^{-2}
van der Waals Constant 'b': 'b' determines the volume occupied by the gas molecules which depends upon size of molecule.
Unit of 'b' = L mol^{-1}.

Question 3. What are ideal and real gases? Out of CO_2 and NH_3 gases, which is expected to show more deviation from the ideal gas behaviour?
Answer: Ideal Gas: A gas that follows Boyle's law, Charles' law and Avogadro law strictly, is called an ideal gas. It is assumed that intermolecular forces are not present between the molecules of an ideal gas.
Real Gases: Gases which deviate from ideal gas behaviour are known as real gases. NH_3 is expected to show more deviation. Since NH_3 is polar in nature and it can be liquified easily.

Question 4. State and explain Dalton's law of partial pressures. Can

we apply Dalton's law of partial pressures to a mixture of carbon monoxide and oxygen?

Answer: Dalton's law of partial pressure: When two or more non-reacting gases are enclosed in a vessel, the total pressure of the gaseous mixture is equal to the sum of the partial pressures that each gas will exert when enclosed separately in the same vessel at constant temperature.

$P = P_1 + P_2 + P_3$

Where, P is the total pressure of the three gases A, B, and C enclosed in a container. P_1 , P_2 and P_3 are the partial pressures of the three gases when enclosed separately in the same vessel at a given temperature one by one.

No, the law cannot be applied. Carbon monoxide and oxygen readily combine to form carbon dioxide. The law can be applied only to the non-reacting gases.

********** END **********