Problem Based on Boyle's Law

VERY SHORT ANSWER TYPE QUESTIONS :

VSA.1 What type of graph will you get when PV is plotted against P at constant temperature.

Sol. A straight line parallel to pressure axis.

VSA.2 Define Boyle's law equation.

Sol. $P \propto \frac{1}{V}$ (At constant temperature)

$P_1 V_1 = P_2 V_2$.

VSA.3 What is isotherm.

Sol. A P – V curve at a constant temperature is called an isotherm.

SHORT ANSWER TYPE QUESTIONS :

SA.1 Define Boyle's law. How is it represented mathematically ?

Sol. Boyle's Law : Temperature remaining constant, the volume of a given mass of a gas is inversely proportional to its pressure.

Mathematically

$V \propto \frac{1}{P}$ for a given mass of a gas at constant temperature.

$V = K \cdot \frac{1}{P}$

$PV = K$

PV = constant at constant temperature.

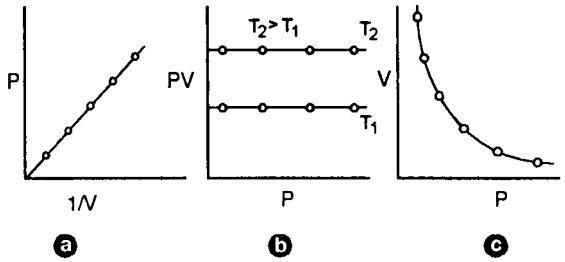
SA.2 What type of curves are obtained when at constant temperature, we plot.

(i) P vs $\frac{1}{V}$ (ii) PV vs P (iii) V vs P

Sol. (i) P vs $\frac{1}{V}$ when a straight line passing through the origin is obtained, or

(ii) PV vs P when a straight line parallel to the X-axis is obtained or

(iii) V vs P when branch of hyperbola in the first quadrant is obtained.



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SA.3 On the basis of Boyle's law explain why mountaineers carry oxygen cylinders with them.

Ans. Boyle's law proves a very important fact that the gases are more compressible. The more it is compressed, the denser it becomes. Hence it can be concluded that at constant temperature the gas density is directly proportional to pressure.

At altitudes, as the atmospheric pressure is low, the air is less dense. As a result, less oxygen is available for breathing. That is why the mountaineers have to carry oxygen cylinders with them.

SA.4 A bulb 'X' of unknown volume containing a gas at one atmospheric pressure is connected to an evaluated bulb of 0.5 litre capacity through a stopcock. On opening the stop cock the pressure in the whole system after some time was found to have a constant volume by 570 mm at the same temperature. What is the volume of the bulb X ?

Sol. $P_1\ V_1 = P_2V_2$

$$1 \times V = \frac{570}{760} \times (0.5 + V)$$

$$760V = 285 + 570V$$

$$190V = 285$$

$$V = \frac{285}{190} = 1.5\ L.$$