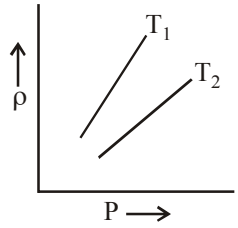
12 Kinetic Theory

Diagram Based Questions :

1. The density (ρ)versus pressuure (P) of a given mass of an ideal gas is shown at two temperatures T_1 and T_2



Then relation between T_1 and T_2 may be

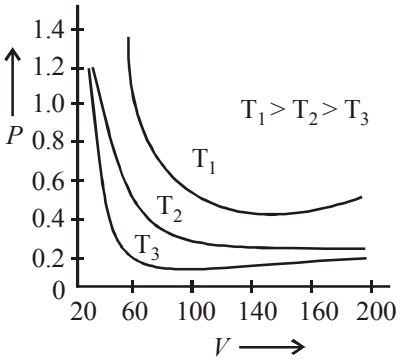
(a) $T_1 > T_2$

(b) $T_2 > T_1$

(c) $T_1 = T_2$

(d) All the three are possible

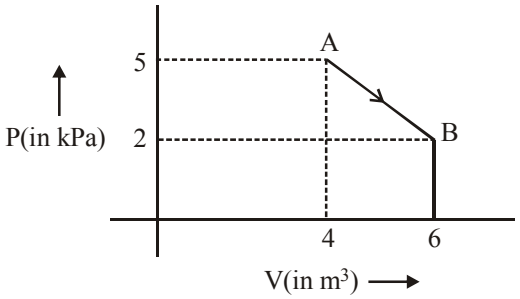
2. The given *P-V* curve is predicted by



(a) Boyle's law (b) Charle's law

(c) Avogadro's law (d) Gaylussac's law

3. One mole of an ideal diatomic gas undergoes a transition from A to B along a path AB as shown in the figure.

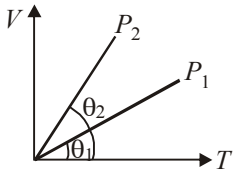


The change in internal energy of the gas during the transition is

(a) – 20 kJ (b) 20 J

(c) –12 kJ (d) 20 kJ

4. The figure shows the volume *V* versus temperature *T* graphs for a certain mass of a perfect gas at two constant pressures of P_1 and P_2. What inference can you draw from the graphs?



(a) $P_1 > P_2$

(b) $P_1 < P_2$

(c) $P_1 = P_2$

(d) No inference can be drawn due to insufficient information.

Solution

1. **(b)** According to ideal gas equation

$PV = nRT$

$$PV = \frac{m}{M}RT, \quad P = \frac{\rho}{M}RT \text{ or } \frac{\rho}{P} = \frac{M}{RT}$$

$$\text{or } \frac{\rho}{P} \propto \frac{1}{T}$$

Here, $\frac{\rho}{P}$ represent the slope of graph

Hence $T_2 > T_1$

2. **(a)**

3. **(a)** Change in internal energy from $A \rightarrow B$

$$\Delta U = \frac{f}{2} nR\Delta T = \frac{f}{2} nR\,(T_f - T_i)$$

$$= \frac{5}{2}\{P_f V_f - P_i V_i\}$$

(As gas is diatomic $\therefore$ f = 5)

$$= \frac{5}{2}\{2 \times 10^3 \times 6 - 5 \times 10^3 \times 4\}$$

$$= \frac{5}{2}\{12 - 20\} \times 10^3\ J = 5 \times (-4) \times 10^3\ J$$

$\Delta U = -20$ KJ

4. **(a)** $\because \theta_1 < \theta_2 \Rightarrow \tan\theta_1 < \tan\theta_2$

$$\Rightarrow \left(\frac{V}{T}\right)_1 < \left(\frac{V}{T}\right)_2$$

From $PV = \mu RT$; $\frac{V}{T} \propto \frac{1}{P}$

Hence $\left(\frac{1}{P}\right)_1 < \left(\frac{1}{P}\right)_2 \Rightarrow P_1 > P_2$.