Consider an ideal gas confined in an isolated closed chamber. As the gas undergoes an adiabatic expansion, the average time of collision between molecules increases as V^q, where V is the volume of the gas. The value of q is : $\left(\gamma = \frac{C_p}{C_v}\right)$

(1) $\frac{3\gamma - 5}{6}$

(2) $\frac{\gamma + 1}{2}$

(3) $\frac{\gamma - 1}{2}$

(4) $\frac{3\gamma + 5}{6}$

$\bar{v} = \frac{\bar{l}}{t_{av}} \propto \frac{\bar{l}}{V^q}$ ($\bar{l} =$ mean free path)

But, $\bar{l} \propto \frac{1}{n}$ (n = no. of molecules per unit volume)

$\therefore \bar{l} \propto \frac{V}{N}$ Or $\bar{l} \propto V$

($\because N =$ no. of molecules = constant)

$\therefore \bar{v} \propto \frac{V}{V^q}$ Or $\bar{v} \propto V^{1-q}$

Also, $\bar{v} \propto \sqrt{T}$

$\therefore V^{1-q} \propto \sqrt{T}$

$\therefore V^{q-1} \propto \frac{1}{\sqrt{T}}$

$\therefore T^{1/2} V^{q-1} =$ constant

$\therefore TV^{2q-2} =$ constant

Comparing the above with adiabatic equation, $TV^{\gamma-1} =$ constant

$2q - 2 = \gamma - 1$

$\therefore q = \frac{\gamma + 1}{2}$

Hence, Option (2).