In a dilute gas at pressure P and temperature T, the mean time between successive collisions of a molecule varies with T as :

(A) $\sqrt{T}$

(B) T

(C) $\frac{1}{T}$

(D) $\frac{1}{\sqrt{T}}$

Mean free path between
successive collisons of a molecule
$$(\lambda) = \frac{1}{\sqrt{2}\pi N_v d^2}$$

$$= \frac{RT}{\sqrt{2}\pi N_A P d^2}$$

$$V_{RMS} = \sqrt{\frac{3RT}{M}}$$

$\therefore$ Mean time between
successive collison of a
molecule

$$(\tau) = \frac{\lambda}{V_{RMS}}$$

$$= \frac{RT}{\sqrt{2}\pi N_A P d^2}\sqrt{\frac{M}{3RT}}$$

$$\Rightarrow \boxed{\tau \propto \sqrt{T}} \longrightarrow \text{option (a)}$$