Q. 02 Which of the following characteristics of electrons determines the current in a conductor?

(a) Drift velocity alone

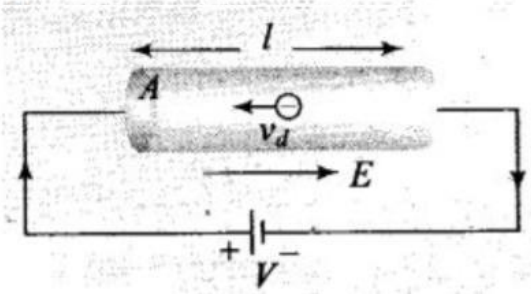
(b) Thermal velocity alone

(c) Both drift velocity and thermal velocity

(d) Neither drift nor thermal velocity

Solution: (a)

Key concept: Drift velocity is the average uniform velocity acquired by free electrons inside a metal by the application of an electric field which is responsible for the current through it.



The direction of drift velocity for electron in a metal is opposite to that of applied electric field (i.e. current density $\vec{J}$).

$v_d \propto E$, i.e. greater the electric field, larger will be the drift velocity.

The relationship between current and drift speed is given by

$$I = ne\,Av_d$$

Here, I is the current and v_d is the drift velocity.

So, $I \propto v_d$

Thus, only drift velocity determines the current in a conductor.

Important point: Remember direction of drift velocity and current is opposite, so we are taking the magnitude of drift velocity or drift speed of free electrons.