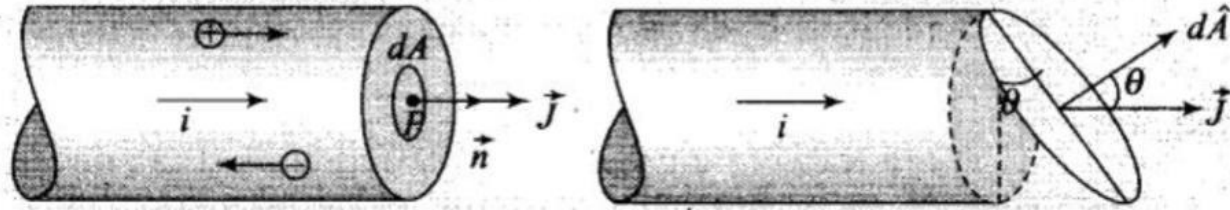


Question 1. Consider a current carrying wire (current  $I$ ) in the shape of a circle. Note that as the current progresses along the wire, the direction of  $\vec{j}$  (current density) changes in an exact manner, while the current  $I$  remain unaffected. The agent that is essentially responsible for is

- (a) source of emf
- (b) electric field produced by charges accumulated on the surface of wire
- (c) the charges just behind a given segment of wire which push them just the right way by repulsion
- (d) the charges ahead

Solution: (b)

**Key concept:** Current per unit area (taken normal to the current),  $I/A$ , is called current density and is denoted by  $\vec{J}$ .



The SI unit of the current density are  $A/m^2$ . The current density is also directed along  $E$  and which is also a vector quantity and the relationship is given by

$$\vec{J} = \sigma \vec{E} = \frac{\vec{E}}{\rho}$$

where  $\sigma$  = conductivity and  $\rho$  = resistivity or specific resistance of the substance.

The  $\vec{J}$  changes due to the electric field produced by charges accumulated on the surface of wire.