SECTION–A

1. A point charge situated at a distance 'r' from a short electric dipole on its axis, experiences a force $\vec{F}$. If the distance of the charge is '$2r$', the force on the charge will be: **1**

(*a*) $\frac{\vec{F}}{16}$ (*b*) $\frac{\vec{F}}{8}$ (*c*) $\frac{\vec{F}}{4}$ (*d*) $\frac{\vec{F}}{2}$

1. Sol. (b) $\cdot \frac{\vec{F}}{8}$

Explanation :- Electric field on a dipole at an axial point is given by

$$E = \frac{1}{4\pi\varepsilon_0}\frac{2P}{r^3}$$

where, P is the dipole moment.
q is the charge which is placed at a distance r from the dipole.

Force on charge q is

$$F = qE = \frac{1}{4\pi\varepsilon_0}\frac{2Pq}{r^3}$$

when the distance is doubled

$$r' = 2r$$

$$F' = \frac{1}{4\pi\varepsilon_0}\frac{2Pq}{(2r)^3}$$

$$F' = \frac{1}{4\pi\varepsilon_0}\frac{2Pq}{8r^3}$$

$$F' = \frac{1}{8}\left[\frac{1}{4\pi\varepsilon_0}\frac{2Pq}{r^3}\right]$$

$$F' = \frac{F}{8}$$