QUES 04:-
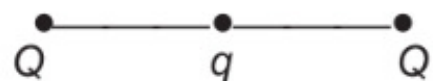
A charge q is placed at the centre of the line joining two equal charges Q. The system of the three charges will be in equilibrium if q is equal to   (1987, 2M)

(a) $-\dfrac{Q}{2}$ (b) $-\dfrac{Q}{4}$ (c) $+\dfrac{Q}{4}$ (d) $+\dfrac{Q}{2}$

Ans - b)

Since, q is at the centre of two charges Q and Q, net force on it is zero, whatever the magnitude and sign of charge

on it. For the equilibrium of Q, q should be negative because other charge Q will repel it, so q should attract it. Simultaneously these attractions and repulsions should be equal.

$$\frac{1}{4\pi\varepsilon_0}\frac{QQ}{r^2} = \frac{1}{4\pi\varepsilon_0}\frac{Qq}{(r/2)^2}$$

or
$$q = \frac{Q}{4}$$

or with sign
$$q = -\frac{Q}{4}$$