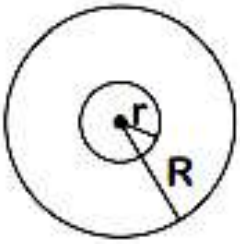
A charge Q is distributed over two concentric conducting thin spherical shells radii r and R (R > r). If the surface charge densities on the two shells are equal, electric potential at the common centre is



(1) $\frac{1}{4\pi\varepsilon_0}\frac{(R+r)}{(R^2+r^2)}Q$

(2) $\frac{1}{4\pi\varepsilon_0}\frac{(R+2r)Q}{2(R^2+r^2)}$

(3) $\frac{1}{4\pi\varepsilon_0}\frac{(R+r)}{2(R^2+r^2)}Q$

(4) $\frac{1}{4\pi\varepsilon_0}\frac{(2R+r)}{(R^2+r^2)}Q$

Answer is (1)

Let charges on shells be q_1 and q_2

$q_1 + q_2 = Q$ ....(i)

$$\frac{q_1}{4\pi r^2} = \frac{q_2}{4\pi R^2} \qquad \ldots.(ii)$$

We get $q_1 = \frac{r^2}{r^2+R^2}Q$, $q_2 = \frac{R^2}{r^2+R^2}Q$

$$V = \frac{1}{4\pi\varepsilon_0}\left(\frac{q_1}{r} + \frac{q_2}{R}\right)$$

$$= \frac{1}{4\pi\varepsilon_0}\frac{(R+r)}{\left(R^2+r^2\right)}Q$$