More than one option may be correct.

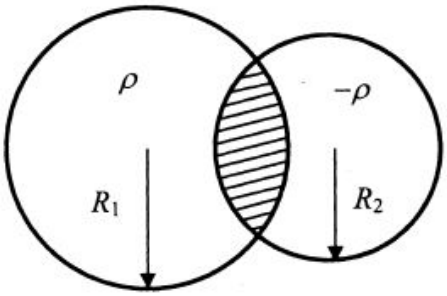
Two non-conducting spheres of radii R_1 and R_2 and carrying uniform volume charge densities $+\rho$ and $-\rho$, respectively, are placed such that they partially overlap, as shown in the figure. At all points in the overlapping region,

(A) the electrostatic field is zero.

(B) the electrostatic potential is constant.

(C) the electrostatic field is constant in magnitude.

(D) the electrostatic field has same direction.



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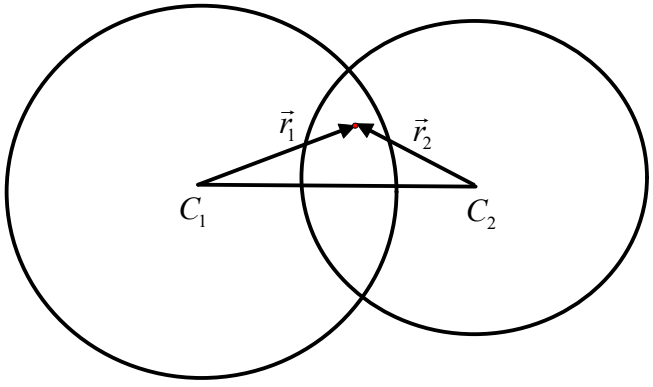
Solution

Electric field due to a uniformly charged sphere at an internal point

$$= \frac{Q}{4\pi\epsilon_0 R^3}\vec{r} = \frac{\frac{4}{3}\pi R^3\rho}{4\pi\epsilon_0 R^3}\vec{r} = \frac{\rho}{3\epsilon_0}\vec{r}$$

Let us consider some arbitrary point in the overlapping region,



$$\vec{E} = \frac{\rho}{3\epsilon_0}\vec{r}_1 + \frac{-\rho}{3\epsilon_0}\vec{r}_2 = \frac{\rho}{3\epsilon_0}(\vec{r}_1 - \vec{r}_2) = \frac{\rho}{3\epsilon_0}\overrightarrow{C_1C_2}$$

Hence, (C) & (D).