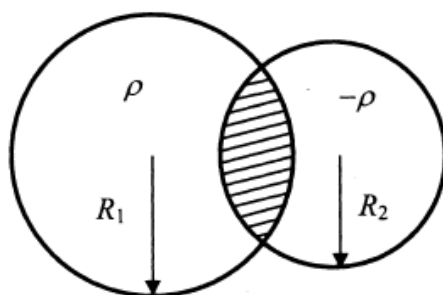


More than one option may be correct.

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.



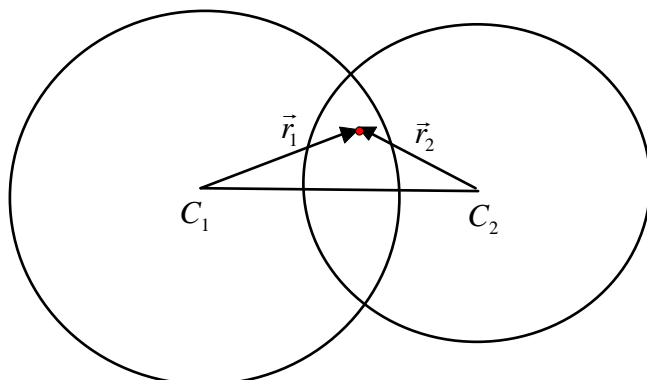
[JEE 2013 Advanced]

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,



$$\vec{E} = \frac{\rho}{3\epsilon_0} \vec{r}_1 + \frac{-\rho}{3\epsilon_0} \vec{r}_2 = \frac{\rho}{3\epsilon_0} (\vec{r}_1 - \vec{r}_2) = \frac{\rho}{3\epsilon_0} \overrightarrow{C_1 C_2}$$

Hence, (C) & (D).