SHEHNAZ
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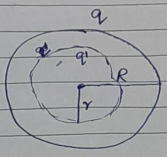
Date: __/__/____

Q Find $\vec{E}$ inside and outside a sphere of radius 'R' which carries uniform charge density $\rho$




Sol Electric field due to q' charges enclosed by Gaussian Surface

$$\vec{E} = \frac{1}{4\pi\varepsilon_0}\frac{q'}{r^2} \quad \text{(i)}$$

Electric field due to q charge

$$\vec{E} = \frac{1}{4\pi\varepsilon_0}\frac{q}{R^2} \quad \text{(ii)}$$

Charges are uniformly distributed over the sphere so we can say charge per unit Volume remain same

$$\frac{q'}{q} = \frac{\frac{4}{3}\pi r^3}{\frac{4}{3}\pi R^3}$$

$$\frac{q'}{q} = \frac{r^3}{R^3}$$

$$\boxed{q' = \frac{q r^3}{R^3}}$$

Put value of q' in eq (i)

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$$\vec{E} = \frac{1}{4\pi\varepsilon_0} \frac{q r^3}{R^3 \cdot r^2}$$

$$\boxed{\vec{E} = \frac{q r}{4\pi\varepsilon_0 R^3} \hat{r}}$$ electric field inside the sphere

$r \leq R$ → point inside the sphere

When $r \geq R$ point outside the sphere

$$\vec{E} = \frac{q r}{4\pi\varepsilon_0 r^3} \hat{r}$$

$$\boxed{\vec{E} = \frac{q}{4\pi\varepsilon_0 r^2} \hat{r}}$$ - electric field outside the sphere.

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