Answer on Question #42905, Physics, Other

43. Conditions: In Millikan's experiment, an oil drop or radius $r = 1.64 \cdot 10^{-6} m$ and density $\rho = 0.85 gm/cm^3$ is suspended when a downward electric field of $E = 1.9 \cdot 10^5 N/C$ is applied. What is the charge q on the drop in terms of e?

Solution:

$Eq = mg;$

$m = V\rho = \frac{4}{3}\pi r^3 \rho;$

$q = N \cdot (-e); \quad N = q/e;$

$q = mg/E = \frac{4}{3}\pi r^3 \rho / E;$

$N = \frac{4}{3}\pi r^3 \rho / (-eE) \simeq 5;$

Answer:c) $q = -5e$.

44. Conditions: A uniformly charged conducting sphere of diameter $d = 1.2\ m$ has a surface charge density $\sigma = 8.1 \mu C/m^2$. Find the total electric flux Φ leaving the surface of the sphere.

Solution:

$S = \pi d^2;$

$q = \sigma S;$

$E = kq/R^2 = k\sigma S/R^2;$

$\Phi = ES = k\sigma S^2/R^2 = (2\pi d)^2 k\sigma = 4 \cdot 10^6\ Nm^2/C;$

Answer: a) $\Phi = 4 \cdot 10^6\ Nm^2/C$ **.**

45. Conditions: A thin nonconducting rod of length $a = 0.5m;$ has a positive charge of uniform linear density $\sigma = 10^{-12} C/m$. Find the electric potential φ due to the rod at a point, which is at perpendicular distance of $l = 0.01m$ from one end of the rod.

Solution:

$$\varphi = \int dq/4\pi r = \int_0^{0.5} \sigma dx/4\pi r = \int_0^{0.5} \sigma dx/4\pi\sqrt{l^2 + x^2} = (\sigma/4\pi) \cdot \int_0^{0.5} d(x/l)/\sqrt{1 + (x/l)^2} =$$

$$= (\sigma/4\pi) \cdot ln(x/l + \sqrt{1 + (x/l)^2}) = 0.04V$$

Answer: b) $\varphi = 0.04V$.