Answer on Question #42900 – Physics – Other

43. In Millikan's experiment, an oil drop of radius 1.64 um and density 0.85 gm/cm^3 is suspended when a downward electric field of 1.9*10^5 N/C is applied. What is the charge on the drop in terms of e?

Solution.

Electrical force compensates gravitational:

$$mg = Eq$$

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

Then charge in terms of e:

$$q = \frac{\frac{4}{3}\rho g \pi r^3}{Ee}$$

Numerically:

$$q \approx -5e$$

Answer: (c) -5e

44. A uniformly charged conducting sphere of diameter 1.2 m has a surface charge density of 8.1 uC/m^2. Find the total energy flux leaving the surface of the sphere:

Solution.

Electric flux due to Gauss's law:

$$\Phi = \int E * dS = E * S = \frac{Q}{\epsilon_0}$$

$$Q = \sigma * S = \sigma * \pi d^2$$

Thus

$$\Phi = \frac{\sigma \pi d^2}{\epsilon_0}$$

Numerically:

$$\Phi \approx 4.1 * 10^6 \frac{N * m^2}{C}$$

Answer: (a)

45. A thin non-conductive rod of length 50 cm has a positive charge of uniform linear density 10^{-12} C/m. Find the electrical potential due to the rod at a point which is at a perpendicular distance of 1.0 cm from one-end of the rod.

Solution.

$$\varphi = \int dE * x$$

$$\varphi = \int_{\Delta x}^{L+\Delta x} \frac{1}{4\pi\epsilon_0} * \frac{\rho dx * x}{x^2}$$

$$\varphi = \frac{\rho}{4\pi\epsilon_0} \ln \frac{L+\Delta x}{\Delta x}$$

$Numerically$

$$\varphi \approx 0.04V$$

Answer: (b) 0.04V