Physics assignment 02
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Section = CSE/C

Chapter 24 examples:-

Q) 24.1:-
consider .... as shown in.

Solution:-

$$\Phi_E = \int_1 \vec{E} \cdot d\vec{A} + \int_2 \vec{E} \cdot d\vec{A}$$

$$\int_1 \vec{E} \cdot d\vec{A} = \int_1 E(\cos 180^\circ)\, dA = -E\int_1 dA = -EA = -EL^2$$

$$\int_2 \vec{E} \cdot d\vec{A} = \int_2 E(\cos 0^\circ)\, dA = E\int_2 dA = +EA = EL^2$$

$$\Phi_E = -EL^2 + EL^2 + 0 + 0 + 0 + 0 \boxed{= 0}$$

Q) 24.2:-
A spherical .... surface.

Solution:-

Ans:-A) The flux through the surface is tripled because flux is proportional to the amount of charge inside the surface.

Ans:-B) The flux doesn't change because all electric field lines from the charge pass through the sphere, regardless of it's radius

Ans:-C) The flux doesn't change when the shape of the gaussian surface changes because all electric field lines from the charge pass through the surface, regardless of it's safe.

Ans:-D) The flux doesn't change when charge is moved to another location inside that surface because gauss's law refers to the total charge enclosed, regardless of where the charge is located inside.

example 24.3:-

An ...... charge Q.

Solution:- (A)

$$\Phi_E = \oint \vec{E}\cdot d\vec{A} = \oint E\,dA = \frac{Q}{\epsilon_0}$$

$$\oint E\,dA = E\oint dA = E(4\pi r^2) = \frac{Q}{\epsilon_0}$$

$$(1)\ E = \frac{Q}{4\pi\epsilon_0 r^2} \boxed{= k_e\frac{Q}{r^2}} \text{ (for } r>a)$$

(B) $q_m = \rho V = \rho(4/3\,\pi r^3)$

$$\oint E\cdot dA = E\oint dA = E(4\pi r^2) = \frac{q_m}{\epsilon_0}$$

$$E = \frac{q_m}{4\pi\epsilon_0 r^2} = \frac{\rho(4/3\,\pi r^3)}{4\pi\epsilon_0 r^2} = \frac{\rho}{3\epsilon_0} r$$

$$(2)\ E = \frac{(Q/\,4/3\,\pi a^3)}{3(1/4\pi k_e)} r = \boxed{k_e\frac{Q}{a^3} r} \text{ (for } r<a)$$

example 24.4:-

Find .... unit length A.

Solution:-

$$\Phi_E = \oint \vec{E}\cdot d\vec{A} = E\oint dA = EA = \frac{q_m}{\epsilon_0} = \frac{\lambda l}{\epsilon_0}$$

$$E(2\pi r l) = \frac{\lambda l}{\epsilon_0}$$

$$E = \frac{\lambda}{2\pi\epsilon_0 r} = \boxed{2k_e\frac{\lambda}{r}}$$

example 24.5:-

Find .....density σ.

Solution:-

$$\Phi_E = 2EA = \frac{q_{in}}{\epsilon_0} = \frac{\sigma A}{\epsilon_0}$$

$$\boxed{E = \frac{\sigma}{2\epsilon_0}}$$

example 24.6:-

Explain ....each corner.

Solution:-

The charge distribution of all these configuration don't have sufficient symmetry to make the use of Gauss's law practical. We cann't find a closed surface surrounding any of these distributions that satisfies one or more of conditions (1) through ~~(4) listed at~~.

example 24.7:-

A solid .....equilibrium.

$$E_2 = k_e\frac{Q}{r^2} \quad (\text{for } a<r<b)$$

$$E_1 = k_e\frac{Q}{a^3}r \quad (\text{for } r<a)$$

$$E_4 = -k_e\frac{Q}{r^2} \quad (\text{for } r>c)$$

$$E_3 = 0 \quad (\text{for } b<r<c)$$

$$q_{in} = q_{sphere} + q_{inner}$$

$$q_{inner} = q_{in} - q_{sphere} = 0 - Q = -Q$$