PHYSICS UNIT TEST 01

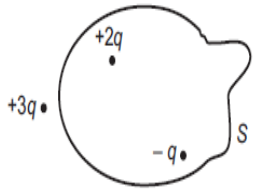
SET A (15)

1. *Using Gauss' law deduce the expression for the electric field due to a uniformly charged spherical conducting shell of radius R at a point (i) outside and (ii) inside the shell. Plot a graph showing variation of electric field as a function of* $r > R$ *and* $r < R$. *(r being the distance from the centre of the shell)* **(5)**

2. *Calculate the amount of work done in rotating a dipole, of dipole moment* 2×10^{-8} **cm,** *from its position of stable equilibrium to the position of unstable equilibrium, in uniform electric field of intensity* 5×10^{4} **N/C.** **(2)**

3. *Obtain the expression for the potential energy of an electric dipole of dipole moment* **p** *placed in an electric field* **E**. **(3)**

4. *Figure shows three point charges, +2q, –q and +3q. Two charges +2q and –q are enclosed within a surface 'S'. What is the electric flux due to this configuration through the surface 'S'*



5. *The sum of two point charges is* **7 m C.** *They repel each other with a force of* **1 N** *when kept* **30 cm** *apart in free space. Calculate the value of each charge.* **(3)**

OR

Find an expression for the electric field strength at a distant point situated along the equatorial line of an electric dipole

SET B (15)

1. **(a)** *Define electric flux. Write its S.I. units.*
(b) *Using Gauss's law, prove that the electric field at a point due to a uniformly charged infinite plane sheet is independent of the distance from it.*
(c) *How is the field directed if* **(i)** *the sheet is positively charged,* **(ii)** *negatively charged?* **(5)**

2. *Calculate the amount of work done in rotating a dipole, of dipole moment* 3×10^{-8} **cm**, *from its position of stable equilibrium to the position of unstable equilibrium, in a uniform electric field of intensity* 10^{4} **N/C.** **(3)**

3. *The sum of two point charges is* **9 μC.** *They repel each other is force of* **2 N** *when kept* **30 cm** *apart in free space. Calculate the value of each charge.* **(2)**

4. *(a) Define* ***electric dipole moment****. Is it scalar or vector?*
(b) Find an expression for the electric field strength at a distant point situated along the ***equatorial line*** *of an electric dipole* **(3)**

5. *Two concentric metallic spherical shells of radii* **R** *and* **3R** *are given charges* Q_1 *and* Q_2 *respectively. The surface charge densities on the outer surfaces of the shells are equal. Determine the ratio* $Q_1 : Q_2$. **(2)**

SET C (15)

1. *State* ***Guass's law*** *in electrostatics. Use this law to derive an expression for the electric field due to an infinitely long straight wire of linear charge density* λ Cm^{-1}. **(5)**

2. *The sum of two point charges is* **7 m C.** *They repel each other with a force of* **1 N** *when kept* **30 cm** *apart in free space. Calculate the value of each charge.* **(2)**

3. *An electric dipole of length* **1 cm,** *which placed with its axis making an angle of* **60°** *with uniform electric field, experiences a torque of* **63 Nm.** *Calculate the potential energy of the dipole if it has charge* **± 2 nC.** **(3)**

4. *Calculate the amount of* ***work done*** *in rotating a dipole, of dipole moment* 2×10^{-8} **cm,** *from its position of stable equilibrium to the position of unstable equilibrium, in uniform electric field of intensity* **5** $\times 10^{4}$ **N/C.** **(2)**

5. *Find an expression for the electric field strength at a distant point situated on the* ***axis of an electric dipole*** **(3)**