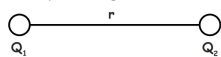


ELECTROSTATIC POTENTIAL ENERGY

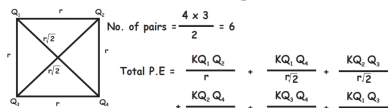
2 point charges



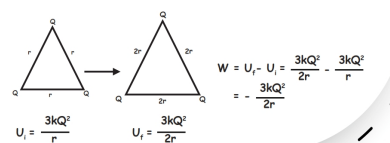
$\Delta U = \frac{1}{4\pi\epsilon_0} \frac{Q_1 Q_2}{r}$
 like charges - positive (repulsive energy)
 Unlike charges - negative (attractive energy)

System of charges

$$\Delta U_{\text{system}} = \sum \Delta U_{\text{pair}} \quad \text{No. of pairs} = \frac{n(n-1)}{2}$$



WORK DONE IN REARRANGEMENT OF THE SYSTEM



ELECTROSTATIC POTENTIAL

$$V_p = \frac{1}{4\pi\epsilon_0} \frac{Q}{r}$$

$$V_{AB} = V_B - V_A = \frac{Q}{4\pi\epsilon_0} \left[\frac{1}{r_b} - \frac{1}{r_a} \right]$$

WORK DONE

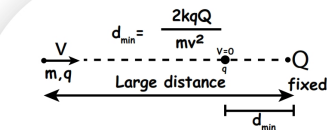
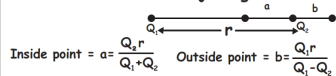
$$W = q[V_B - V_A]$$

$$W = 1 \times (-500 - 500) = -1000J$$

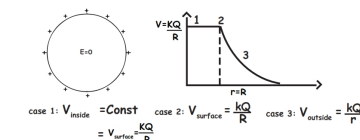
Superposition of potential - Algebraic sum of all potentials

ZERO POTENTIAL

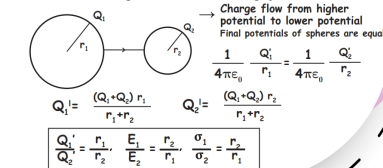
- a) Like charge - no zero potential point
- b) Unlike charge - 2 points of zero potential on line joining



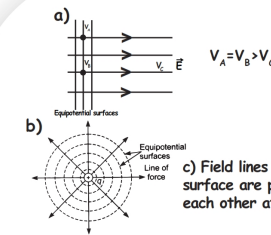
POTENTIAL OF CHARGED CONDUCTING SPHERE



Redistribution of Charge when two Conducting sphere are connected



EQUIPOTENTIAL SURFACE



d) work done in moving a charge on equipotential surface is 0

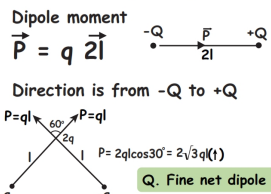
ELECTRIC FIELD & POTENTIAL

$$E = -\frac{dV}{dr} \quad E_x = -\frac{\partial V}{\partial x} \quad E_y = -\frac{\partial V}{\partial y} \quad E_z = -\frac{\partial V}{\partial z}$$

$$\Delta V = -\int \vec{E} \cdot d\vec{r}$$

ELECTROSTATICS

DIPOLE



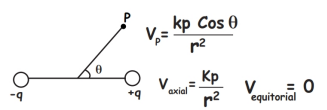
ELECTRIC FIELD

$$E_p = \frac{Kp}{r^3} \sqrt{3\cos^2\theta + 1}$$

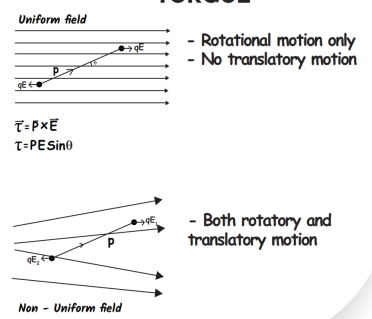
$$E_{\text{axial}} = \frac{Kp}{r^3} \sqrt{3+1} = \frac{2Kp}{r^3}$$

$$E_{\text{equatorial}} = \frac{Kp}{r^3} \sqrt{0+1} = \frac{Kp}{r^3}$$

ELECTRIC POTENTIAL



TORQUE



$$\tau_{\text{max}} = pE \sin\theta = pE, (\theta = 90^\circ)$$

$$\tau_{\text{min}} = pE \sin\theta = 0, (\theta = 0^\circ)$$

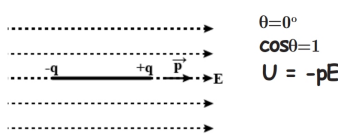
WORK DONE

$$W = pE (\cos\theta_1 - \cos\theta_2)$$

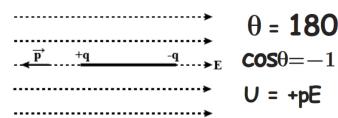
POTENTIAL ENERGY

$$U = -pE \cos\theta$$

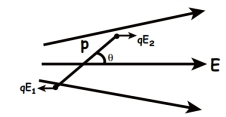
- 1) U_{minimum} (stable equilibrium)



- 2) U_{maximum} (Unstable equilibrium)



Force in Non-Uniform field



$$F_x = p \frac{dE}{dx} \cos\theta$$

where, dE = small change in field at the two locations of the charges