Electric Field

1. <u>Electric force between point charges</u>

   ○ Coulomb's Law states that the magnitude of the electrostatic force between two point electric charges is directly proportional to the product of the magnitude of each charge and inversely proportional to the square of the distance between the charges (i.e. $F_E \propto \frac{Qq}{r^2}$).

   ○ Electric force between two point charges, $F_E = \frac{1}{4\pi\varepsilon_0}\frac{Qq}{r^2}$.

   ○ Like charges repel, unlike charges attract.

2. <u>Electric field</u>

   ○ An electric field is a region of space where an electric force acts on a stationary charge placed at any point within the region.
   ○ The electric field strength (E) at a point in an electric field is defined as the electric force exerted per unit positive charge placed at that point. $E = \frac{F_E}{q}$.

   ○ In a uniform electric field between two parallel plates, $E = \frac{U}{r}$.

   ○ Electric field strength is a vector quantity. The direction of electric field strength at a point is the same to the direction of the electric force exerted on a positive test charge placed at that point.

3. <u>Electric potential energy</u>

   ○ The electric potential energy (U) of a point charge at a point is the work done in bringing the charge from infinity to that point. $U = \frac{Qq}{4\pi\varepsilon_0 r}$.

   ○ The electric potential energy is positive if the electric force between the two charges are repulsive, vice versa.
   ○ The electric potential (V) at a point is the work done per unit positive charge in bringing a small test charge from infinity to that point. $V = \frac{U}{q} = \frac{Q}{4\pi\varepsilon_0 r}$.