Topic 17 Electric fields

Summary

- Like charges repel; unlike charges attract each other.
- The force between two point charges is proportional to the product of the charges and inversely proportional to the square of the distance between them. This is Coulomb's law: $F = Q_1Q_2/4\pi\varepsilon_0 r^2$
- ε_0 is the permittivity of free space; its value is 8.85×10^{-12} C^2 N^{-1} m^{-2} ($F\ m^{-1}$).
- An electric field is a region of space where a stationary charge experiences a force.
- Electric field strength is the force per unit positive charge $E = F/Q$
- The electric field strength at a point in the field of an isolated point charge is given by $E = Q/4\pi\varepsilon_0 r^2$
- The electric potential at a point in an electric field is the work done per unit positive charge in bringing a small test charge from infinity to the point.
- The potential at a point in the field of an isolated point charge is given by $V = Q/4\pi\varepsilon_0 r$

Definitions and formulae

- Force between point charges in free space $F = \dfrac{Q_1Q_2}{4\pi\varepsilon_0 r^2}$
- Electric field due to an isolated point charge Q is $E = \dfrac{Q}{4\pi\varepsilon_0 r^2}$
- Potential at a point in an electric field is the work done per unit positive charge brought from infinity to that point
- The electric field strength is equal to the negative of the potential gradient at that point
- Potential V due to a point charge Q is given by $V = Q/4\pi\varepsilon_o r$