OCR B Physics A Level

6.1.4 - Electric Fields

Flashcards

What is an electric field?

What is an electric field?

An electric field is a region in which a charged particle will experience a non-contact force.

Compare the forces produced by a gravitational and electric field.

Compare the forces produced by a gravitational and electric field.

- Gravitational forces are always attractive whereas electric forces can be both attractive and repulsive.
- Gravitational forces act on mass while electric forces act on charged particles.
- Both follow an inverse-square law.
- Both have equipotential surfaces.

Describe the force between two like charges.

Describe the force between two like charges.

A repulsive, non-contact force.

Describe the force between two opposite charges.

Describe the force between two opposite charges.

An attractive, non-contact force.

What law determines the strength of the force between two charges?

What law determines the strength of the force between two charges?

Coulomb's Law

What does Coulomb's law state?

What does Coulomb's law state?

The magnitude of the force between two charges is directly proportional to the product of their charges and inversely proportional to the square of the separation of their centres.

State the defining equation of Coulomb's law.

State the defining equation of Coulomb's law.

$$F = \frac{kQq}{r^2}$$

Where $k = \frac{1}{4\pi\varepsilon_0}$

What is electric field strength?

What is electric field strength?

Electric field strength is the force per unit charge experienced by a charged particle in the field.

State **two** equations for electric field strength.

State **two** equations for electric field strength.

$$E = \frac{F}{q} \qquad E = \frac{kQ}{r^2}$$

Where $k = \frac{1}{4\pi\varepsilon_0}$

What is the unit for electric field strength?

What is the unit for electric field strength?

NC^{-1}

State the equation for electric potential.

State the equation for electric potential.

$$V = \frac{kQ}{r}$$

Where $k = \frac{1}{4\pi\varepsilon_0}$

What was the purpose of Millikan's oil drop experiment?

What was the purpose of Millikan's oil drop experiment?

To identify the charge of an electron.

What did the results of Millikan's experiment suggest about charge?

What did the results of Millikan's experiment suggest about charge?

All charges calculated were a multiple of 1.6×10^{-19} C, which suggested that charge is quantised and the smallest possible charge is e, the charge of an electron (1.6×10^{-19} C).

What happens when a charged particle moves in a magnetic field?

What happens when a charged particle moves in a magnetic field?

The charged particle will experience a force.

What three factors determine the magnitude of the force experienced by a moving charge in a magnetic field?

What three factors determine the magnitude of the force experienced by a moving charge in a magnetic field?

1. Magnetic flux density of the field.
2. Magnitude of the charge.
3. Velocity of the charge.

State the equation for the force experienced by a moving charge in a magnetic field.

State the equation for the force experienced by a moving charge in an magnetic field.

Force = Magnetic Flux Density x Charge x Velocity

$$F = Bqv$$

Describe the direction of the force that acts on a moving charge in a magnetic field.

Describe the direction of the force that acts on a moving charge in an electric field.

The force will always act perpendicular to the motion of the charged particle.

Describe the path that a charged particle will take as a result of this magnetic force.

Describe the path that a charged particle will take as a result of this magnetic force.

Since the force experienced by the particle always acts perpendicular to its motion, it acts like a centripetal force. This means that the charged particle will travel in a circular path.

What is the equation for the radius of the circular path of a charged particle in a magnetic field?

What is the equation for the radius of the circular path of a charged particle in a magnetic field?

$$r = \frac{mv}{Bq}$$

Where r is the radius of the path, m is the mass of the particle, v is its velocity, q is its charge and B is the magnetic flux density of the field.