AQA A-Level Physics

7.5 Magnetic Fields

Flashcards

When a magnetic field is perpendicular to a current-carrying wire, does the wire feel a force ?

When a magnetic field is perpendicular to a current-carrying wire, does the wire feel a force ?

Yes, the magnitude of the force is = BIl

l = length of the wire

B = Magnetic flux density

I = Current in the wire

Fleming's left hand rule for motors represents what properties on what fingers?

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Thumb - **T**hrust/Force

First finger - **F**ield (Magnetic)

Se**c**ond finger - **C**urrent

What is magnetic flux density (B)?

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Flux density measured in Tesla (T) or Webers/meters² (Wb/m²), is the flux per metre².

A charged particle moving through a field feels a force when it is traveling along the field lines or perpendicular to them?

A charged particle moving through a field feels a force when it is traveling along the field lines or perpendicular to them?

Perpendicular to the field.

What is the equation for the Force felt by a moving charge in a magnetic field ?

What is the equation for the Force felt by a moving charge in a magnetic field ?

$$F = BQv$$

Is the force applied to the particles applied perpendicular to the particles motion or in one direction?

Is the force applied to the particles applied perpendicular to the particles motion or in one direction?

Perpendicular to its motion, causing it to move in a circular motion.

Which fields do cyclotrons use?

A. Electric field
B. Magnetic field
C. Gravitational field
D. Both Electric and Magnetic

Which fields do cyclotrons use?

D. An electric field and a magnetic field.

How does a Cyclotron work and what's the electric and magnetic fields purpose in a cyclotron?

How does a Cyclotron work and what's the electric and magnetic fields purpose in a cyclotron?

A cyclotron is made up of 2 semicircular electrodes called "Dees" with a magnetic field applied perpendicular to the Dees and an alternating pd applied between the Dees.

Each Dee is a metal electrodes with opposite charges, this creates an electric field in the gap between the two Dees. This is what accelerates the particles.

The magnetic field causes the particles to move in a circular motion, which allows it to gain speed whilst minimising space. As they speed up the radius of their motion increases, until it breaks free tangential to one of the Dees.

What is magnetic flux? (Quantitative)

What is magnetic flux? (Quantitative)

$$\phi = BA$$

Flux = Flux Density x Area

Where B is normal to A.

What is flux linkage?

What is flux linkage?

$N\Phi$ = The number of turns cutting the flux at one time.

What is the flux linkage of a rectangular coil rotating through a magnetic field?

What is the flux linkage of a rectangular coil rotating through a magnetic field?

$N\Phi = BANcos\Theta$

What is Faraday's Law?

What is Faraday's Law?

The induced e.m.f. is directly proportional to the rate of change of magnetic flux linkage.

What is Lenz's Law?

What is Lenz's Law?

The direction of the induced e.m.f. is such as to oppose the change that induces it.

$$\varepsilon = -N\frac{\Delta\phi}{\Delta t}$$

What happens when you move a straight conductor through a magnetic field?

What happens when you move a straight conductor through a magnetic field?

The electrons experience a force pushing them to one end of the conductor creating an emf across the conductor. The rod obey Faraday's law, it is changing flux as it moves through the field hence an EMF is induced.

What would be the EMF produced when rotating a coil at a constant rate in a magnetic field?

What would be the EMF produced when rotating a coil at a constant rate in a magnetic field?

$\varepsilon = BAN\omega\sin(\omega t)$

Where ω is the angular velocity of the rotating coil.

Describe how one would use an oscilloscope

Describe how one would use an oscilloscope

Oscilloscopes are used to displace AC waves, the x axis is called the time base and shows how long it takes the wave to move 1 division and the y axis shows how much PD is needed to move the wave up 1 division. Using this we find the peak voltage, time period and frequency.

How does a transformer work?

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A primary coil wrapped around an iron core with an alternating p.d. creates an alternating magnetic field, this magnetic field induces an EMF in a secondary coil also wrapped around the core. This creates a current in the secondary coil.

What kind of current is produced by a transformer and why?

What kind of current is produced by a transformer and why?

An alternating current.

An EMF is induced by a changing magnetic field, hence the EMF induced is alternating producing an alternating current.

Why are transformers used?

Why are transformers used?

By changing the number of coils, the transformers can be used to increase the voltage and reduce current when transporting power, with minimal energy loses. The voltage is then dropped again locally to ensure safe usage in households.

What equation links the number of coils in a transformer with their voltages?

What equation links the number of coils in a transformer with their voltages?

$$Ns / Np = Vs / Vp$$

What is transformer efficiency?

What is transformer efficiency?

The ratio of output power in the transformer to input power.

$$= IsVs / IpVp$$

In a step-up transformer, does the secondary coil or primary coil have more coils?

In a step-up transformer, does the secondary coil or primary coil have more coils?

The secondary coil.

Step-up transformers increase the voltage, hence more coils need to be in the secondary coil for a larger p.d.

What is an eddy current?

What is an eddy current?

As the primary coils magnetic field induces emf in the secondary coil, it also induces emf and hence mini currents within the iron core.These are known as eddy currents.

Why are eddy currents a problem?

Why are eddy currents a problem?

By Lenz's law the emf created and its field opposes that of the primary coil. This causes energy loss via resistive heating of the iron core by the eddy currents, which reduces efficiency.

How can you reduce eddy current losses?

How can you reduce eddy current losses?

Use a laminated iron core.

Thin sheets of iron with an electrical insulator in between, which reduces the eddy currents circuit.