WJEC England A-Level Physics

3.9 Magnetic Fields

Flashcards

Why do charged particles move in a circular orbit in a magnetic field?

Why do charged particles move in a circular orbit in a magnetic field?

The magnetic force is always perpendicular to the velocity of the particle, so they end up being forced in a circular orbit. The particles undergo centripetal acceleration, with the centripetal force being the magnetic force.

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?

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

Thumb - **T**hrust/Force

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

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

What is magnetic flux density (B)?

What is magnetic flux density (B)?

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

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

Does a charged particle moving through a field feel 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?

$$F = BQv \sin\theta$$

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

Is the force applied to the particles applied perpendicular to the particle's 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.

Define magnetic field.

Define magnetic field.

A region of space in which moving charged particles are subject to a magnetic force.

This force is caused by the interaction of two magnetic fields (there is a field around the moving charged particles which interacts with the existing magnetic field they are passing through).

What is a magnetic field line?

What is a magnetic field line?

The path which a north pole would take when placed in a magnetic field.

Field lines go from north to south.

How can you map field lines around a magnet?

How can you map field lines around a magnet?

You can place iron filings on a piece of paper and then put the magnet on the paper and the filings will align to the field.

You can also use a plotting compass and place it in various positions around the magnet, before marking the direction of the needle at each point and connecting them.

How do you represent the strength of a magnetic field on a diagram?

How do you represent the strength of a magnetic field on a diagram?

It is represented by how close together the field lines are – the closer they are, the stronger the field. (It is the **density** of the field lines, which is why **magnetic flux density** and **Magnetic Field strength** are interchangable).

Define magnetic flux density.

Define magnetic flux density.

The force per unit current per unit length on a current-carrying conductor placed in a magnetic field perpendicular to the field lines. (Magnetic flux per unit area)

What is the unit of magnetic flux density?

What is the unit of magnetic flux density?

Tesla (T)

$1\ T = 1\ N\ m^{-1}\ A^{-1}$

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

Give the formula relating magnetic force, flux density, current, length and angle between the field and the conductor.

Give the formula relating magnetic force, flux density, current, length and angle between the field and the conductor.

$$F = BIL\sin\theta$$

F = Magnetic force (N)

B = Magnetic flux density (T)

I = Current in the conductor (A)

L = Length of conductor in the field (m)

θ = Angle between the field lines and the conductor (º or rad)

What is the Hall voltage?

What is the Hall voltage?

When a magnetic field, B, is applied to a conductor carrying a current I, perpendicular to the field direction, a Hall voltage appears perpendicular to the B and I directions.

What is the the field strength of a long straight wire and a long solenoid?

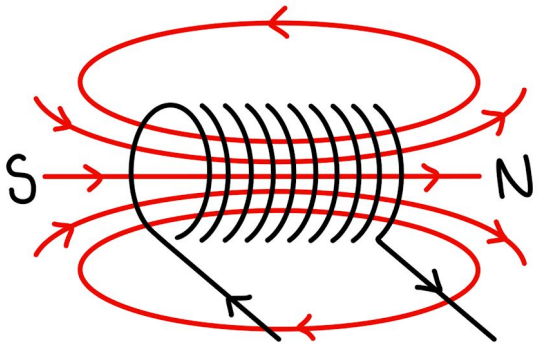
What is the the field strength of a long straight wire and a long solenoid?

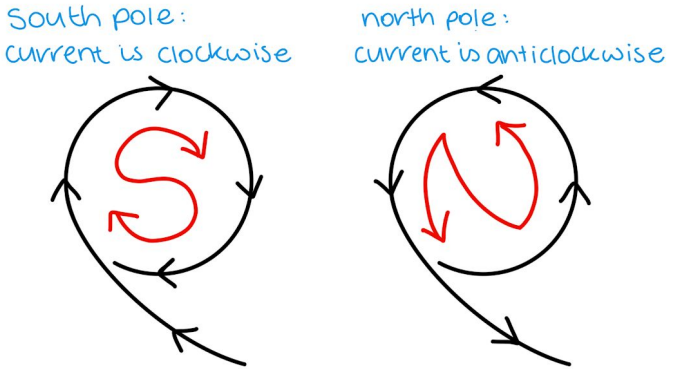
$$B = \frac{\mu_0 I}{2\pi a} \qquad B = \mu_0 n I$$

How do you work out the shape of the field around a solenoid?

How do you work out the shape of the field around a solenoid?

Where the current is going **anticlockwise** around the coil is the north pole. At the south pole, the current goes clockwise. The shape of the field is then similar to a bar magnet. A good way to remember it is by the shapes of the letters:





What increases the field strength in a solenoid?

What increases the field strength in a solenoid?

Adding an iron core.