# CIE A-Level Physics

## 22 - Magnetic Fields

### Flashcards

# Define magnetic field.

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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).

# Define magnetic field lines.

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

Field lines point from north to south.

# How can you map field lines around a magnet?

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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. Mark the direction of the needle at each point and connect 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.

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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?

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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.

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$$F = BIL\sin\theta$$

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 (° or rad)

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

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**T**humb - **T**hrust/Force

**F**irst 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.

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

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Perpendicular to the field.

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

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$$F = BQv$$

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

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Perpendicular to their motion, causing them 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

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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?

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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 electrode 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.