AQA Physics A-level

RP10 - Magnetic Force on a Wire

Practical Flashcards

State the safety precautions that should be taken when working with wires carrying high currents.

State the safety precautions that should be taken when working with wires carrying high currents.

Wires carrying high currents will get very hot, so you must avoid touching the wire throughout the experiment. The power supply should be turned off when not required, in order to reduce the heating effect.

What rule can be used to determine the force on a current-carrying wire in a magnetic field?

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Fleming's Left-Hand Rule

Explain how to apply Fleming's Left-Hand Rule.

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- First Finger: Direction of magnetic field
- Second Finger: Direction of conventional current flow
- Thumb: Direction of the force on the wire

What direction do magnetic field lines point in?

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Magnetic field lines point from North pole of the magnet to the South pole.

In what direction does conventional current flow?

In what direction does conventional current flow?

Conventional current flow is from the positive terminal of the source to the negative terminal.

In this experiment, in what direction is the force on the wire due to the magnetic field?

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The force on the wire is upwards, but since the wire is clamped in place, a downwards force will be exerted onto the mass balance.

What device can be added to the circuit to allow the current to be varied?

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A rheostat (variable resistor used to control current) can be added in series into the circuit.

How is the reading from the mass balance converted into a force value?

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Force = Mass (kg) x Gravitational Field Strength (N/kg)

F = mg

State the equation used to calculate the force on a current-carrying wire in a magnetic field.

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Force = Magnetic Flux Density x Current x Length of Wire in Field

$$F = BIL$$

Describe the graph that should be drawn when plotting the mean mass reading against current.

Describe the graph that should be formed when plotting the mean mass reading against current.

The graph should be a straight line passing through the origin, since the mass and current should be directly proportional to each other.

How can the magnetic flux density be obtained from a graph of mean mass against current?

How can the magnetic flux density be obtained from a graph of mean mass against current?

The gradient of the graph is m/I and so

$$B = \text{gradient} \times (g/L)$$

where the mass is in kg

What length measurement should be used for calculations?

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The length of the magnets (in metres) should be used since this will equal the length of wire that experiences the magnetic field.

What is ignored when considering the length of wire that is experiencing the magnetic field?

What is ignored when considering the length of wire that is experiencing the magnetic field?

The edge effects of the magnets are ignored since in these regions, field strength is low as well as being non-uniform. Since it is non-uniform, it would be very difficult to quantify.

What unit is used for magnetic flux density?

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Tesla (T)

What type of power source must be used in this experiment?

What type of power source must be used in this experiment?

A direct-current source must be used so that the current, and therefore the force exerted, is constant and in one direction.