

INVESTIGATION OF MAGNETIC FLUX DENSITY USING A HALL PROBE

Specification reference: A2 Unit 4.4 - Magnetic fields

Theory:

A Hall probe is a slice of doped semiconductor with a connecting wire at each end to provide a steady current. Another two wires are connected across the edges of the slice to allow the Hall potential difference, V_H to be measured. Note that the slice must be placed so that it is at right angles to the magnetic field lines. When a constant current flows the Hall pd is proportional to the magnetic field strength, and so can be calibrated using a known magnetic field.

Apparatus:

Hall probe
Solenoid
Voltmeter
Ammeter
d.c. supply
Magnet of known magnetic field strength

Experimental Method:

Place the Hall probe into a known magnetic field, B_1 and note the Hall potential difference, V_1 . Then place the Hall probe in the centre of a solenoid. Ensure, in both cases, the probe is at 90° to the magnetic field. Again measure the Hall potential difference, V_2 when the probe is in the solenoid. The unknown magnetic field of the solenoid, B_2 , can be found using:

$$B_2 = \frac{B_1}{V_1} V_2$$

Extension:

A graph of field strength against distance along the solenoid could be drawn to show the difference in magnetic field at the ends. It is also possible to investigate the variation of magnetic field strength with the solenoid diameter.

Practical Techniques:

- Correctly construct circuits from circuit diagrams using D.C. power supplies, cells, and a range of circuit components, including those where polarity is important.
- Use signal generator and oscilloscope, including volts/division and time-base.
- Use ICT such as computer modelling, or data logger with a variety of sensors to collect data, or use of software to process data.