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SPECA

GCSE Combined Science (AQA Trilogy) · Physics

Magnetism and Electromagnetism · Mark Scheme

For use with the Tiered Worksheet. Marking points are indicative, not exhaustive: award equivalent correct answers.

Section A: Foundation (Q1 to 12)

1) The region around a magnet (or a current-carrying wire) where it exerts a (non-contact) force on another magnet or on a magnetic material (1) [1]

2) Like poles repel (1); unlike poles attract (1) [2]

3) Non-contact force (1); because the magnets do not need to be touching to exert a force on each other (1) [2]

4) A permanent magnet produces its own magnetic field at all times (1); an induced magnet only becomes magnetic while it is inside another magnetic field (1) [2]

5) It loses most or all of its magnetism (1) [1]

6) Place the compass at various points around the magnet, and mark the direction its needle points at each point (1); join the marks together to build up the overall field pattern (1) [2]

7) Field lines point from the magnet's north pole to its south pole, outside the magnet (1); the field is strongest closest to the poles (1) [2]

8) A compass contains a small bar magnet that turns to align with a magnetic field (1); it aligns with the Earth's magnetic field, which suggests the Earth's core is magnetic (1) [2]

9) Any two of: the size of the current; the distance from the wire (1 mark each, max 2) [2]

10) Shaping the wire into a solenoid strengthens and evens out the field (1); the field becomes strong and uniform inside the solenoid, with a shape similar to a bar magnet's field outside it (1) [2]

11) Adding an iron core further strengthens the magnetic field (1); the resulting device is called an electromagnet (1) [2]

12) Indicative content, mark holistically to a maximum of 2: place a compass (or iron filings) near a current-carrying wire and observe the compass needle deflect (or the filings arrange in circles around the wire); compare this with no deflection/pattern when no current flows, showing the field is produced by the current. [2]

Section B: Higher (Q13 to 18)

13) A force is exerted on a current-carrying conductor placed in a magnetic field (1); the conductor also exerts an equal and opposite force back on the magnet producing that field (1) [2]

14) $F = B \times I \times l$ (1); B = magnetic flux density in tesla (T), I = current in amperes (A), l = length in metres (m), F = force in newtons (N) (1) [2]

15) $F = B \times I \times l = 0.5 \times 3 \times 0.4$ (1 method) = 0.6 N (1 answer); correct unit shown (1) [3]

16) Thumb = force/motion (1); first finger = magnetic field (1); second finger = current (1) [3]

17) Any two of: the strength of the magnetic field (magnetic flux density); the length of conductor within the field (1 mark each, max 2) [2]

18) The current-carrying coil experiences a force on each side, acting in opposite directions because the current flows in opposite directions on each side of the coil (1); these opposite forces create a turning effect that rotates the coil (1); this continual rotation is the basic mechanism of an electric motor (1) [3]

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Total: 22 marks (Section A) + 15 marks (Section B) = 37 marks

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