♡ Magical Physics Workbook ♡

IGCSE Classified Model Exams

Chapters 10.1 & 10.2: Magnets and Electromagnets

⋆ Quick Concept Review ⋆

- **Permanent Magnets:** Iron, nickel, cobalt. Field lines go **North to South**. Like poles repel, unlike attract.
- **The Earth:** Acts like a magnet due to swirling liquid iron and nickel in its outer core.
- **Electromagnets:** A coil of wire with a current flowing through it creates a magnetic field.
- **The Magic Superpower:** Electromagnets can be turned **ON and OFF**!
- **Boosting Strength:** Increase the number of coils, increase the current, or add an **iron core**.
- **Applications:** Maglev trains (repulsion for zero friction), MRI scanners, Electric Bells, Industrial Scrapyard Cranes.

♡ Model Exam 1: Core Concepts ♡

Question 1

A student is studying the differences between permanent magnets and electromagnets.

(a) State the **two** main differences between an electromagnet and a permanent bar magnet. [2]

(b) Name **three** ways the student can increase the strength of an electromagnet. [3]

(c) A student wants to make an electromagnet. They have a choice of materials for the core: plastic, copper, or iron. Which material should they choose, and why? [2]

♡ Model Exam 2: Real-World Applications ♡

Question 1

Maglev (Magnetic Levitation) trains are incredibly fast trains used in Japan and China. They use powerful electromagnets on the track and on the bottom of the train.

(a) The electromagnets on the track and the train face each other. Explain how the magnetic poles must be arranged to make the train float. [1]

(b) Explain why floating above the track allows the Maglev train to travel much faster and quieter than a normal train. [2]

Question 2

A large scrapyard uses an industrial crane equipped with a giant electromagnet to move old cars.

(a) Explain why a scrapyard crane uses an electromagnet instead of a permanent magnet. [2]

(b) The car bodies must contain a specific type of metal to be picked up by the crane. Name one magnetic metal commonly found in car bodies. [1]

♡ Model Exam 3: Experimental Physics ♡

Question 1

A student investigates how the number of coils affects the strength of an electromagnet. They measure the strength by counting how many paperclips the electromagnet can pick up. Their results are shown in Table 1.

Number of Coils	Number of Paperclips Picked Up
0	0
10	4
20	8
30	3
40	16

Table 1

(a) Identify the **independent variable** (the one the student changes) in this experiment. [1]

(b) Identify the **dependent variable** (the one the student measures) in this experiment. [1]

(c) State **two** control variables the student must keep the same to ensure this is a fair test. [2]

(d) Look closely at the data in Table 1. Identify the anomalous (odd) result and explain why you think it is anomalous. [2]

(e) What conclusion can the student draw from this experiment (ignoring the anomaly)? [1]

Teacher's Secret Mark Scheme ♡

Model Exam 1 Answers

Question 1

(a) - An electromagnet can be turned on and off (a permanent magnet cannot). (1 mark)
- The strength of an electromagnet can be changed/controlled. (1 mark)

(b) - Increase the number of turns/coils of wire. (1 mark)
- Increase the electrical current. (1 mark)
- Use an iron core (or magnetic core). (1 mark)

(c) - Iron. (1 mark)
- Because it is a magnetic material and will boost the strength of the magnetic field (plastic and copper are non-magnetic). (1 mark)

Model Exam 2 Answers

Question 1

(a) They must be **like poles** (e.g., North facing North, or South facing South) so they repel each other. (1 mark)

(b) - Floating removes contact between the train and the track. (1 mark)
- This eliminates friction (and reduces noise), allowing much higher speeds. (1 mark)

Question 2

(a) - The electromagnet can be turned ON to pick up the car. (1 mark)
- It can be turned OFF to easily drop the car where it needs to go. (A permanent magnet would never let go!). (1 mark)

(b) Iron OR Steel. (1 mark)

Model Exam 3 Answers

Question 1

(a) The number of coils. (1 mark)

(b) The number of paperclips picked up. (1 mark)

(c) Any two from: - The electrical current / voltage of the power supply. (1 mark) - The material of the core (e.g., same iron nail). (1 mark) - The type/size of paperclips used. (1 mark)

(d) - The result for 30 coils (3 paperclips) is anomalous. (1 mark)
- Because the pattern shows the number of paperclips should be increasing (it drops from 8 down to 3 unexpectedly). (1 mark)

(e) As the number of coils increases, the strength of the electromagnet increases. (1 mark)

You're glowing with knowledge! Keep up the amazing work! ⋆