GET BETTER AT PHYSICS · MARK SCHEME

Force on a Current-Carrying Wire: tiered multiple choice

AQA A-level Physics · 7408 · Specification 3.7.5.1 · 7 questions · 7 marks

1 mark per correct letter | Worked reasoning for every question | **How students did** = from AQA examiner reports, where available

Answer key

Q1	Q2	Q3	Q4	Q5	Q6	Q7
C	B	B	C	A	B	D

Easy

Questions 1–3

1 **C**

Current that just supports a wire · AQA June 2019 · A-level Paper 2 · Q24

The magnetic force balances the weight: $BIl = W$, so $I = W / (Bl) = 1.0 \div (1.5 \times 0.50) = 1.3$ A.

How students did: In June 2019 this was answered much better than most of Section B.

2 **B**

Flux density from a change in force · AQA June 2023 · A-level Paper 2 · Q20

$F = BIl$, so $\Delta F = B\Delta I\, l$. $B = \Delta F / (\Delta I\, l) = 3.6 \times 10^{-3} \div (4.0 \times 0.150) = 6.0 \times 10^{-3}$ T.

Watch out: Convert 150 mm to 0.150 m.

How students did: At least 70% of students got this right in June 2023.

3 **B**

Which sides of a coil feel a force? · AQA June 2019 · A-level Paper 2 · Q23

PQ and RS run parallel to the field lines, so there is no force on them. SP and QR are at right angles to the field and carry current in opposite directions, so they feel equal and opposite forces (into and out of the page), which make the coil turn.

Watch out: $F = BIl$ only applies to the part of the current at right angles to the field.

Medium

Questions 4–6

4 **C**

Forces on a coil in a perpendicular field · AQA June 2018 · A-level Paper 2 · Q27

Use Fleming's left-hand rule on each part of the coil. With the field into the page and a clockwise current, the force on every part of the coil points outwards, away from the centre. The forces all lie in the plane of the coil, so they stretch it: its diameter increases.

Watch out: The coil is perpendicular to the field, so there is no turning effect (A, B).

How students did: 41.9% of students got this right in June 2018.

5 **A**

Rod on rails in a horizontal field · AQA November 2021 · A-level Paper 2 · Q21

The current in R runs across the rails, at right angles to the horizontal field, so the force is at right angles to both: vertical. Fleming's left-hand rule, with the current direction set by the cell, gives an upward force, so R tends to lift off the rails.

Watch out: The force can't be along the rails (B, C): it must be at right angles to the field as well as to the current.

6 **B**

Flux density that supports a wire · AQA June 2022 · A-level Paper 2 · Q22

$BIl = mg$, so $B = mg / (Il) = 3.0 \times 10^{-3} \times 9.81 \div (3.0 \times 0.25) = 3.9 \times 10^{-2}$ T.

Watch out: Use the weight mg, not the mass. Forgetting g gives 4.0×10^{-3} T (D).

Hard

Question 7

7 **D**

Current to support a shorter, thicker wire · AQA June 2025 · A-level Paper 2 · Q20

$BIL = mg = \rho \times L \times (\pi d^2/4) \times g$. The length L cancels, so $I \propto d^2$. Doubling the diameter needs four times the current: 4I.

Watch out: Halving the length halves both the weight and the force, so it has no effect on the current needed.

End of mark scheme. Answers from AQA's published keys; explanations written for this pack. AQA material is © AQA. More free packs and 1-to-1 tuition: **www.getbetteratphysics.co.uk**

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