O Level Combined Physics Structured

Electromagnetism Test 3.0

Q1

Fig. 10.1 shows a wire **ABCD** positioned between the two poles of a horseshoe magnet which is resting on a top-pan balance.

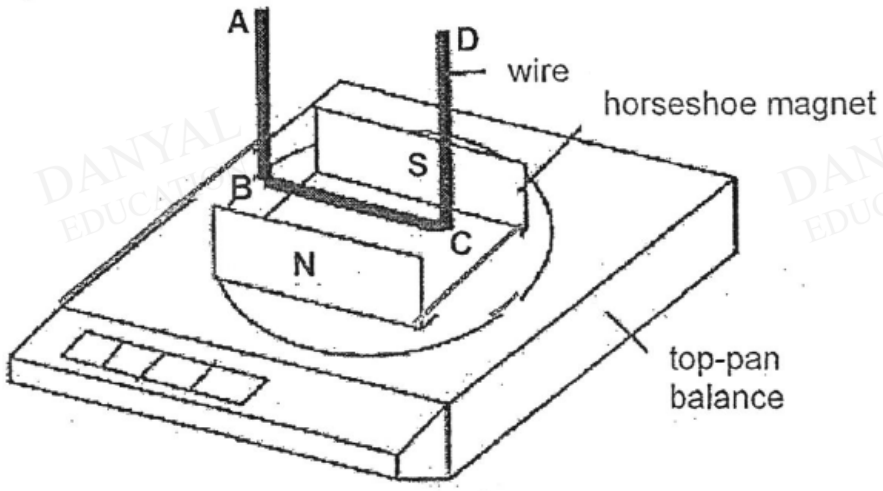

Fig. 10.1

(a) When there is no current flowing through wire **ABCD**, the top-pan balance registers only the mass of the horseshoe magnet.

The reading on the top-pan balance changes when a current flows through wire **ABCD**.

Discuss how the reading on the top-pan balance will change when the current direction in wire **ABCD** changes.

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[3]

(b) (i) A current of 12.0 A flows through wire **ABCD** when the potential difference across points **A** and **D** is 8.00 V. Calculate the resistance of wire **ABCD**.

resistance = ... Ω [1]

(ii) If the potential dfference between points **A** and **D** is fixed at 8.00 V, and wire **ABCD** is replaced by another piece of wire of the same length and material but double the thickness, what will happen to the current flowing through wire **ABCD**? Explain your answer.

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[2]

Q2

Fig. 13.1 shows a coil wound around an iron core and a permanent magnet placed near the iron core with a cardboard cone attached.

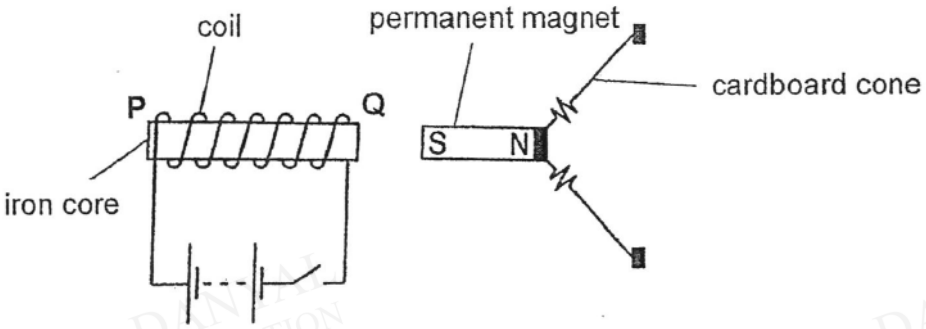

Fig. 13.1

a) Explain what happens to the iron core when the current is switched on.

.....

..... [1]

b) State the polarity at each end of the iron core.

End **P**: ..... End **Q**: ..... [1]

c) Describe what happens to the permanent magnet when the current is switched on.

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..... [1]

d) The battery is changed to an alternating current source which changes the direction of the current 50 times in every second.
Explain how a sound wave is generated by the new set-up.

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..... [4]

e) If the permanent magnet is replaced by an iron rod, explain if a sound wave can be generated using a similar set-up in (d).

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..... [3]

Q3

A current is flowing in a wire as shown in Fig. 9. The wire is placed in between an electromagnet and was observed to move to the right.

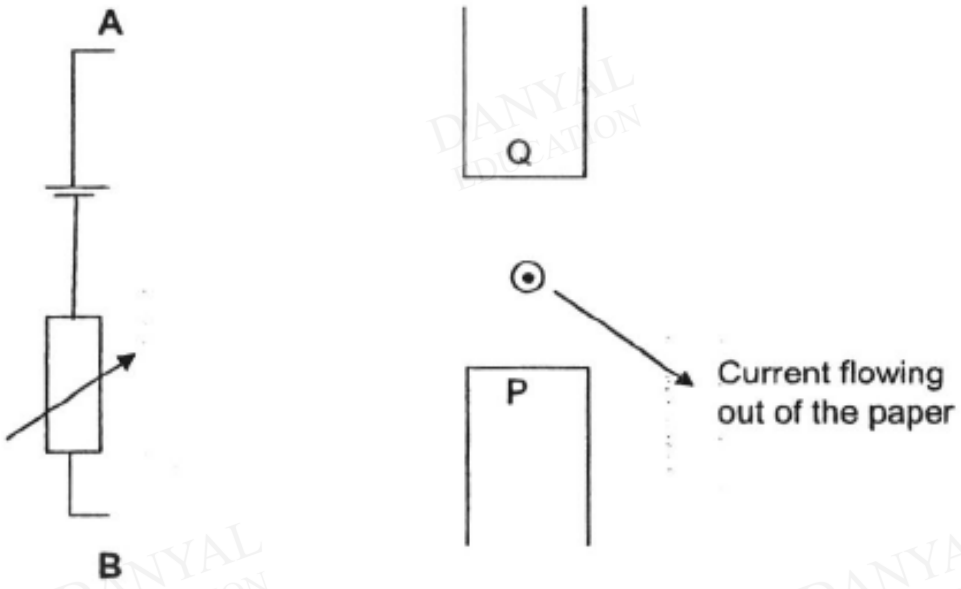

Fig. 9

(a) State the polarity of Q and P that will cause the wire to move to the right. [1]

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(b) In Fig. 9, complete the wiring from A and B on the electromagnet so that the wire will move to the right. [2]

Q4

Fig. 8.1 shows a simple ammeter. It consists of a bent copper wire ABCD that is suspended freely from two metal rings X and Y above the south pole of a magnet.

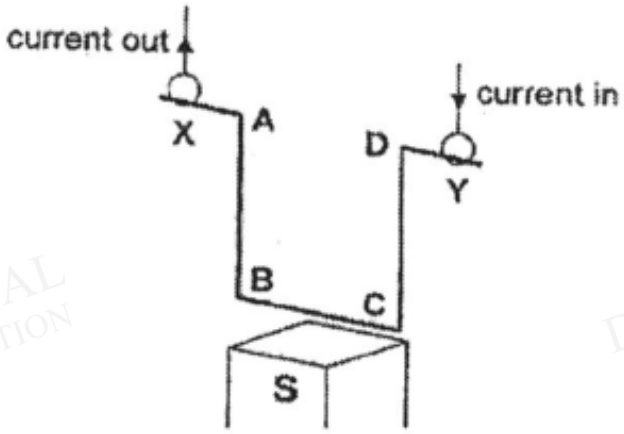

Fig. 8.1

(a) Indicate with an arrow the direction that section BC of the wire in Fig. 8.1 would move when the current flows in the direction shown above. [1]

(b) Briefly explain how the set-up in Fig. 8.1 could be used to measure current.

.....

.....[1]

(c) State and explain a change that could be made so that the set-up would be more sensitive to a small change in current.

.....

.....[2]

Q5

Fig 12.1 shows a current being passed through a long wire A.

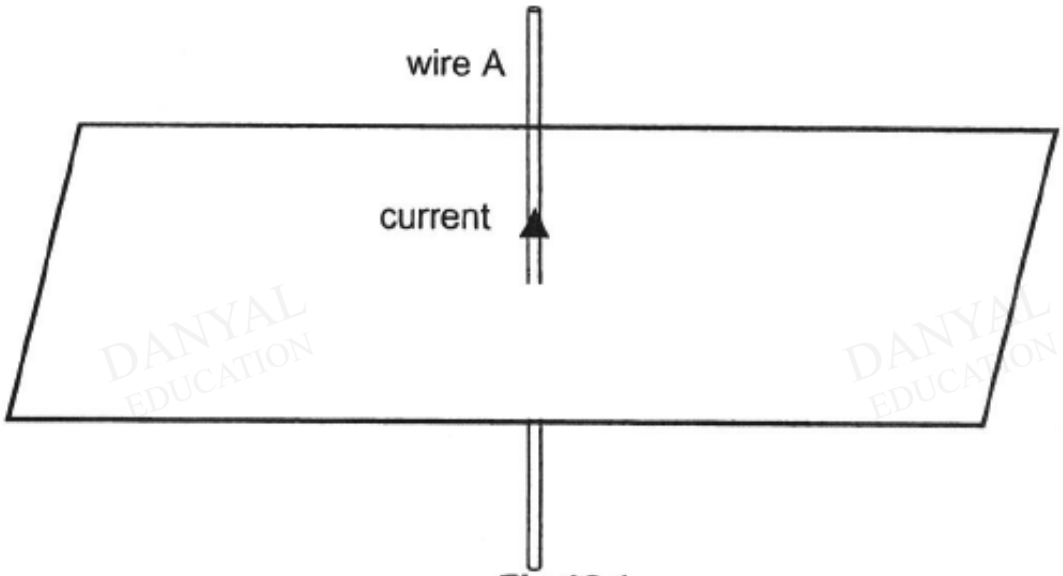

Fig 12.1

(a) Explain how the magnetic field caused by the current in wire A can be plotted using a plotting compass. [2]

(b) On Fig. 12.1, sketch the magnetic field pattern caused by the current in wire A on the sheet. [3]

(c) Suggest how the diagram showing the magnetic field will change when the current in wire A increases in magnitude. Explain your answer. [2]

(d) Fig 12.2 shows a long wire B, with the current flowing in the same direction as wire A.

(X) is the magnetic field produced by wire A.

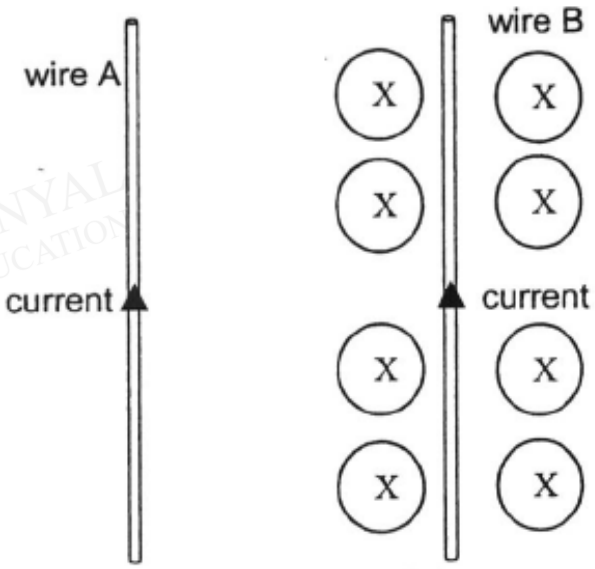

Fig 12.2

i. Determine the direction of force acting on Wire B due to the magnetic field. [1]

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ii. Describe and explain what happens to the direction of force acting on wire B when:

1. the direction of current in wire B is reversed. [1]

_____

_____

2. the current in wire A is increased. [1]

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_____

Answers

Electromagnetism Test 3.0

Q1

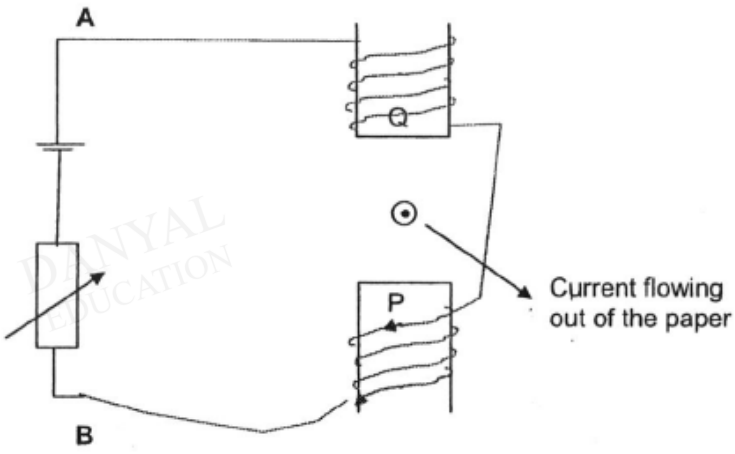
)a	When current flows in the direction from B to C, an upwards force is exerted on the wire creating a repulsion between the wire and the magnet. Therefore, the reading on the scale will increase. When the current is flowing in the reversed direction, a downwards force is exerted on the wire creating an attraction between the wire and the magnet. This will cause the reading on the scale to reduce.	[1] [1] [1]
)bi	V = I x R R = V / I = 8.00 V / 12.0 A = 0.667 Ω	[1]
bii	Since R = ρ L / A, resistance between B and C will reduce by half (accept reduce). And as V=IR, when resistance is reduced by half (accept reduced) with the same potential difference applied, current will increase. (no need to specify that current is doubled).	[1] [1]

Q2

)a	The iron core will be magnetised	A1
)b	P: North, Q: South	A1
)c	The magnet will be repelled/ move away from the iron core	A1
d	As the current changes direction, the polarities of the iron core also change. It will attract and repel the permanent magnet continuously. The cardboard will vibrate left and right continuously. This generates a series of compression and rarefaction to produce sound.	A1 A1 A1 A1
e	The iron rod will be induced to have an opposite pole from the iron core. It will always be attracted to the iron core. No vibration of the cardboard to produce sound.	A1 A1 A1

Q3

A current is flowing in a wire as shown in Fig. 9. The wire is placed in between an electromagnet and was observed to move to the right.



[1] correct wiring at P **[1] correct wiring at Q**

Fig. 9

(a) State the polarity of Q and P that will cause the wire to move to the right. [1]

P (S) and Q (N) **[1]**

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(b) In Fig. 9, complete the wiring from A and B on the electromagnet so that the wire will move to the right. [2]

Q4

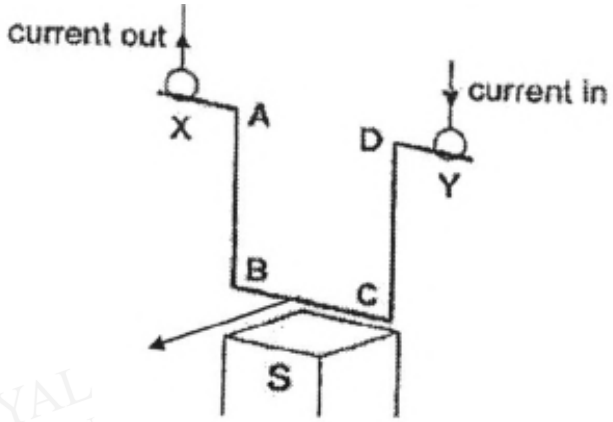

Fig. 8.1

(a) Indicate with an arrow the direction that section BC of the wire in Fig. 8.1 would move when the current flows in the direction shown above. [1]

(b) Briefly explain how the set-up in Fig. 8.1 could be used to measure current.

Size of force is related to size of current, force is greater when current is higher.

..... [1]

(c) State and explain a change that could be made so that the set-up would be more sensitive to a small change in current.

Use stronger magnet / use more coils; Greater force produced

.....

Q5

(a) Explain how the magnetic field caused by the current in wire A can be plotted using a plotting compass. [2]

Place compass on the sheet.

Mark the positions of the S and N ends of the compass needle

Move the compass so that the S end of the need is at the previous N

Repeat until a circle is formed. [1] Repeat for different distances from wire. [1]

(b) On Fig. 12.1, sketch the magnetic field pattern caused by the current in wire A. [3]
(1 for direction) (1 for circle) (1 for near circles closer together)

(c) Suggest how the diagram showing the magnetic field will change when the current in wire A increases in magnitude. Explain your answer. [2]

Circles become closer together. [1] As the current in wire A increases

in magnitude, the magnetic field becomes stronger. [1]

i. Using Fleming's Left Hand Rule and your answer in b(ii), determine the direction of force acting on Wire B due to the magnetic field. [1]

the force points towards wire A/ to the left

ii. Describe and explain what happens to the direction of force acting on wire B when:

1. the direction of current in wire B is reversed. [1]

The force changes direction and points away from A by FLHR.

2. the current in wire A is increased. [1]
Force does NOT change direction, still points towards wire A. [1]
Force increases as the strength of magnetic field by A increases.