Electromagnetism – 2021/20 GCE Physics A Component 02

1. Nov/2021/Paper_H556_02/No.1

Faraday's law of electromagnetic induction is written below with **two** terms missing.

The .... induced in a circuit is directly proportional to the rate of change of magnetic flux ....

What are the **two** missing terms?

A current, density

B current, linkage

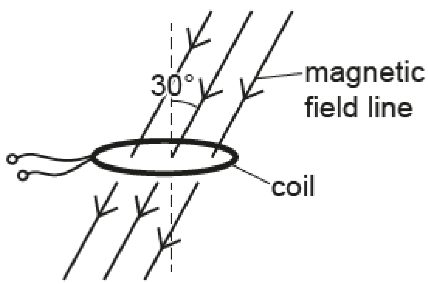
C electromotive force, density

D electromotive force, linkage

Your answer [1]

2. Nov/2021/Paper_H556_02/No.12

A flat coil has 200 turns and a cross-sectional area of $1.20 \times 10^{-4}\,m^2$.



The coil is placed horizontally in a uniform magnetic field. The magnetic flux density is 0.050 T. The magnetic field is at an angle of 30.0° to the vertical.

What is the magnetic flux linkage for this coil?

A 3.00×10^{-6} Wb

B 5.20×10^{-6} Wb

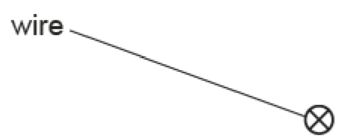
C 6.00×10^{-4} Wb

D 1.04×10^{-3} Wb

Your answer [1]

3. Nov/2021/Paper_H556_02/No.19

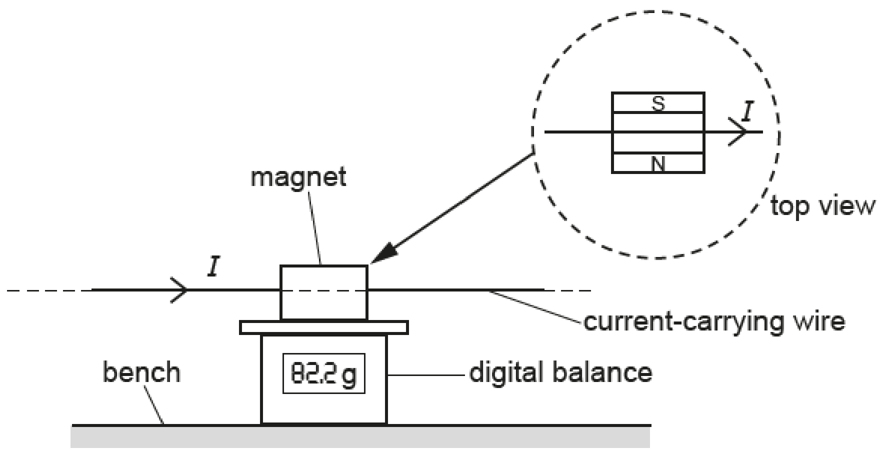
(a) The diagram below shows the top-view of a long current-carrying wire.



The direction of the current in the wire is into the plane of the paper.

Draw at least **three** field lines to indicate the magnetic field pattern around this wire. **[2]**

(b) The arrangement shown in the diagram below is used to determine the magnetic flux density between the poles of a permanent magnet.



The magnet is placed on the digital balance. The current-carrying wire is horizontal and at right angles to the magnetic field between the poles of the magnet. The wire is fixed.

The following results are collected.

- length of the wire in the uniform field of the magnet = 6.0 ± 0.2 cm
- balance reading with no current in wire = 80.0 g
- balance reading with current in wire = 82.2 g
- current in wire = 5.0 ± 0.1 A

Calculate the magnetic flux density B, including the absolute uncertainty.
Ignore the absolute uncertainty in the balance readings.
Write your value for B to **2** significant figures and the absolute uncertainty to **1** significant figure.

B = ... ± .... T **[4]**

4. Nov/2020/Paper_H556_02/No.4

A student is doing an experiment on the magnetic force experienced by a current-carrying wire in a uniform magnetic field. The magnetic flux density B can be varied.

For a particular flux density, the current in the wire is 2.0A. The length of the wire in the field is 0.12 m. The angle between the current and the magnetic field is 30°. The force experienced by the wire is 7.7×10^{-2} N.

The student calculates B and records the results in a table.

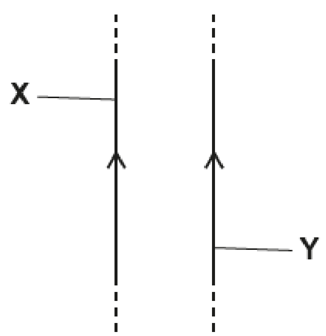
Which row shows the correct table heading for B and the correct value for B?

	Table heading for *B*	**Value for *B***
A	B / T	0.37
B	B / T	0.64
C	B / Wb	0.37
D	B / Wb	0.64

Your answer [ ] **[1]**

5. Nov/2020/Paper_H556_02/No.22

(a) The diagram below shows two long vertical current-carrying wires **X** and **Y**.



The direction of the current in each wire is the same.

Explain why wire **Y** experiences a force and deduce the direction of this force.

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.... **[3]**

(b) (i) State **Faraday's law of electromagnetic induction**.

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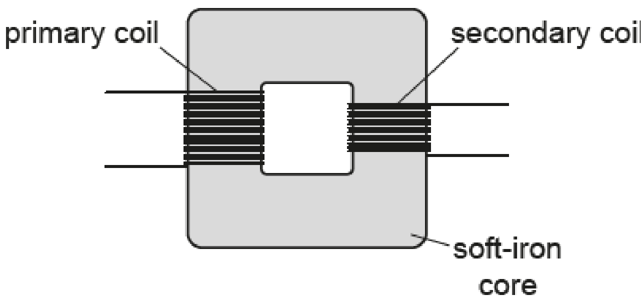
.... **[1]**

(ii) The diagram below shows a simple transformer constructed by a student.



Describe how the student can do an experiment in the laboratory to show that the maximum electromotive force (e.m.f.) E induced in the secondary coil is directly proportional to the number of turns N on the secondary coil.

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.... **[3]**

6. Nov/2021/Paper_H556_03/No.4(b)

(b) The electromagnetic induction hob is shown in **Fig. 4.1**.

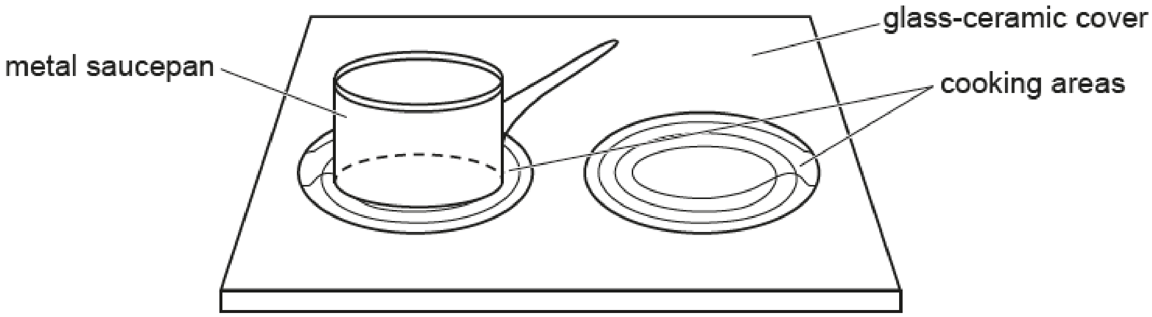

Fig. 4.1

Each cooking area has a coil below the glass-ceramic cover. When switched on, the coils carry a high-frequency **alternating** current.

A metal saucepan is placed above one of the coils. A large alternating current is induced in the saucepan base, and this causes the saucepan to heat up.

(i) **Fig. 4.2** shows one of the coils at a time when the current is in the direction indicated by the arrows.

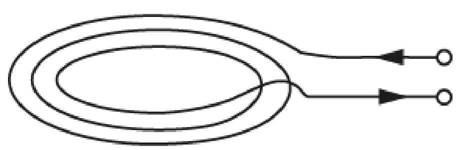

Fig. 4.2

On **Fig. 4.2**, sketch the magnetic field pattern for the current-carrying coil. **[2]**

(ii) **Fig. 4.3** shows the path of the large alternating current induced in the metal base of the saucepan.

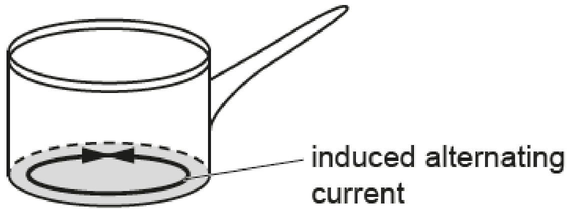

Fig. 4.3

Explain the origin of this large current.

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.... **[2]**

(iii) Explain why it would be safe for a person to place a hand on the cooking area before the saucepan is put onto it.

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.... **[2]**