

Electromagnetic effects

Question Paper 3

Level	IGCSE
Subject	Physics
ExamBoard	CIE
Topic	Electricity and Magnetism
Sub-Topic	Electromagnetic effects
Paper Type	(Extended) Theory Paper
Booklet	Question Paper 3

Time Allowed: 55 minutes

Score: /46

Percentage: /100

- 1 (a) Describe an experiment that shows how a magnet can be used to produce a current in a solenoid by electromagnetic induction. Sketch and label the arrangement of apparatus you would use.

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..... [3]

- (b) Fig. 8.1 represents a transformer with primary coil P and secondary coil S, wound on an iron core.

There is an alternating current in coil P.

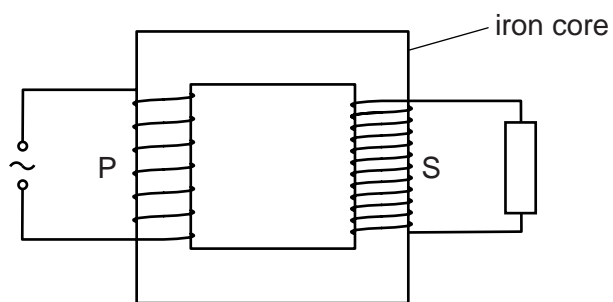


Fig. 8.1

(i) State what happens in the iron core as a result of the alternating current in P.

.....
..... [2]

(ii) Tick the box next to the correct description of the current in S.

- higher frequency a.c.
- same frequency a.c.
- lower frequency a.c.
- rectified d.c.
- constant d.c.

[1]

(iii) Coil P has 50 turns of wire, an applied voltage of 12V, and a current of 0.50 A.
Coil S has 200 turns.

Calculate the current in S. Assume the transformer is 100% efficient.

current = [3]

[Total: 9]

2 The a.c. supply from a power station is connected to the primary coil of a transformer. The secondary coil is connected to long-distance transmission cables.

(a) The output voltage of the transformer is greater than the input voltage.

Explain how a transformer produces this output voltage.

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.....
.....
..... [4]

(b) There are energy losses in the transmission cables.

(i) Explain why the energy losses become greater when the length of the transmission cables is greater.

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.....
..... [2]

(ii) Discuss the advantages and disadvantages of using transmission cables of greater cross-sectional area.

.....
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..... [2]

[Total: 8]

- 3 (a) Fig. 10.1 shows a wire PQ placed between the poles of a magnet. There is a current in wire PQ.

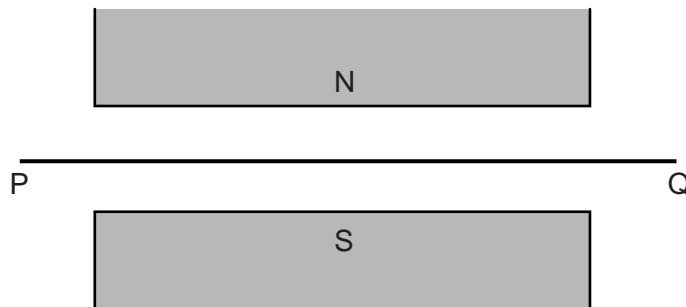


Fig. 10.1

- (i) On Fig. 10.1, sketch lines with arrows to show the direction of the magnetic field between the poles of the magnet. [1]
- (ii) The force on PQ is into the paper.
Draw an arrow on PQ to show the direction of the current. [1]
- (b) The wire PQ in Fig. 10.1 is replaced by a narrow beam of β -particles travelling from left to right.
- (i) Suggest a suitable detector for the β -particles.
..... [1]
- (ii) State the direction of the force on the β -particles.
..... [1]
- (iii) Describe the path of the β -particles in the space between the poles of the magnet.
.....
..... [1]
- (iv) State what happens to the air molecules along the path of the β -particles.
..... [1]

[Total: 6]

- 4 A simple motor is made in a school laboratory. A coil of wire is mounted on an axle between the poles of a horseshoe magnet, as illustrated in Fig. 9.1.

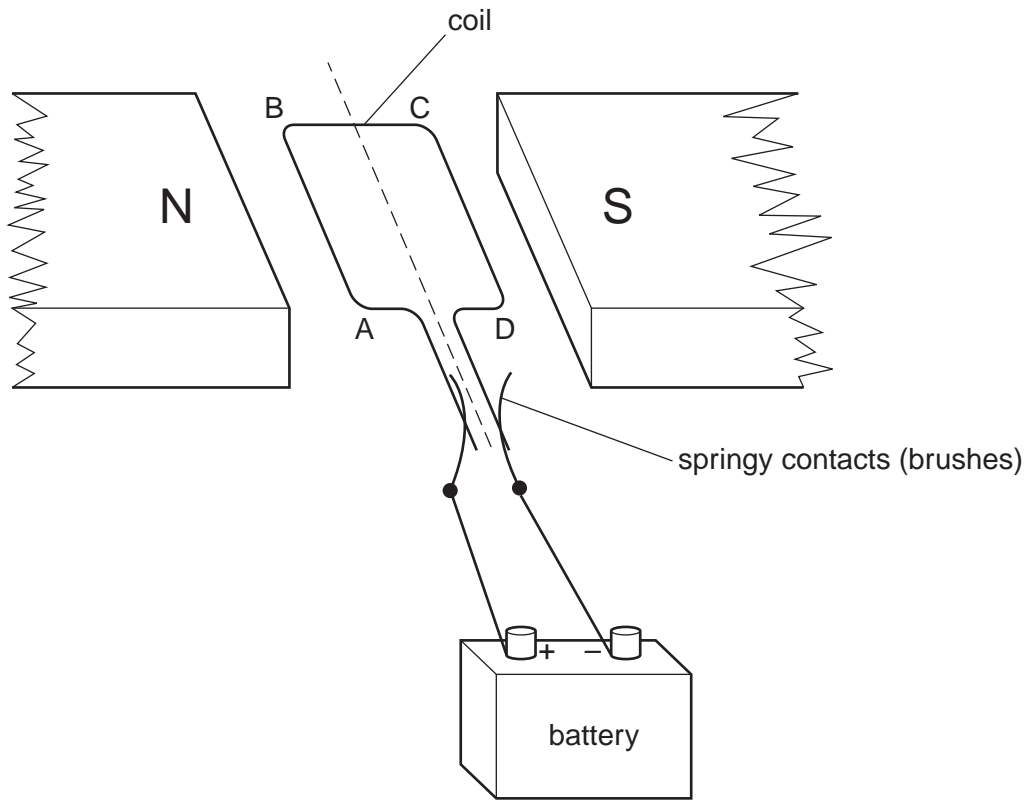


Fig. 9.1

- (a) At the instant illustrated in Fig. 9.1, the coil ABCD is horizontal and the battery is connected as shown.

- (i) For this position, state the direction of the force on AB and the direction of the motion of AB.

force on AB

direction of motion of AB[1]

- (ii) Explain why BC does not contribute to the turning force on the coil.

.....

.....[1]

- (b) At the instant when the coil is vertical, the springy contacts do not, in fact, make contact with the ends of the coil.

Describe and explain what happens to the coil.

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.....
.....
.....[2]

- (c) The motor in Fig. 9.1 does not rotate very quickly. The designer of a commercial motor is required to produce a faster-rotating motor.

Suggest **one** change that could be made to increase the speed of the motor.

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.....[1]

[Total: 5]

- 5 (a) Fig. 9.1 shows a wire, held between the poles of a magnet, carrying a current in the direction of the arrow.

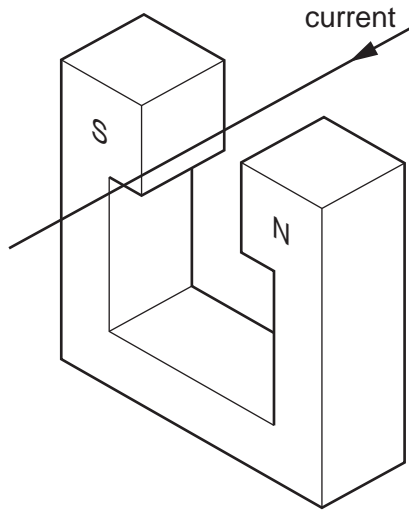


Fig. 9.1

- (i) On Fig. 9.1, draw an arrow, labelled F , to show the direction of the force acting on the wire. [1]

- (ii) Explain why the force F acts on the wire.

.....
.....[1]

- (iii) The directions of the current and the magnetic field are both reversed. State the effect on the force F .

..... [1]

- (b) Fig. 9.2 shows a negatively charged particle travelling, in a vacuum, into a region where a magnetic field acts. The magnetic field, shown by the crosses, is acting **into** the paper.

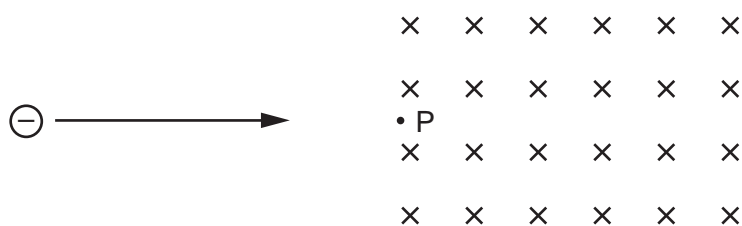


Fig. 9.2

- (i) Draw an arrow, labelled F , to show the direction of the force on the particle at point P where it enters the field.
- (ii) Describe the path of the particle as it continues to move through the magnetic field.

.....[2]

[Total: 5]

- 6 (a) In Fig. 8.1, a magnet is moving towards one end of a solenoid connected to a sensitive centre-zero meter. During this movement a current is induced in the solenoid.

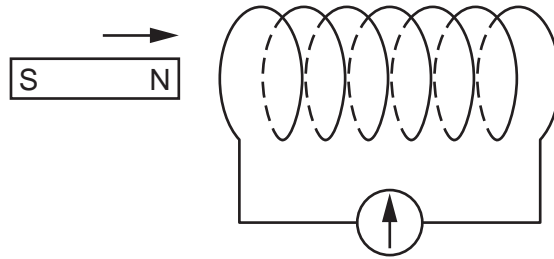


Fig. 8.1

Suggest **three** possible changes to the system in Fig. 8.1 that would increase the induced current.

1.
2.
3.[3]

- (b) Fig. 8.2 shows a transformer. P is the primary coil. S is the secondary coil. The coils are wound on an iron core.

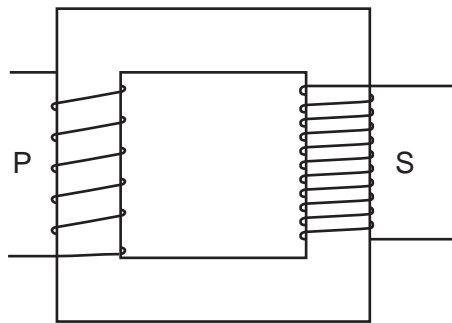


Fig. 8.2

P has 200 turns and S has 800 turns. The e.m.f. induced across S is 24V. The current in S is 0.50A. The transformer operates with 100% efficiency.

Calculate

(i) the voltage of the supply to P,

voltage =[2]

(ii) the current in P.

current =[2]

[Total: 7]

- 7 Fig. 8.1 shows a simple motor with a rectangular coil that is free to rotate about an axis A_1A_2 . The coil is connected to a battery by brushes B_1 and B_2 .

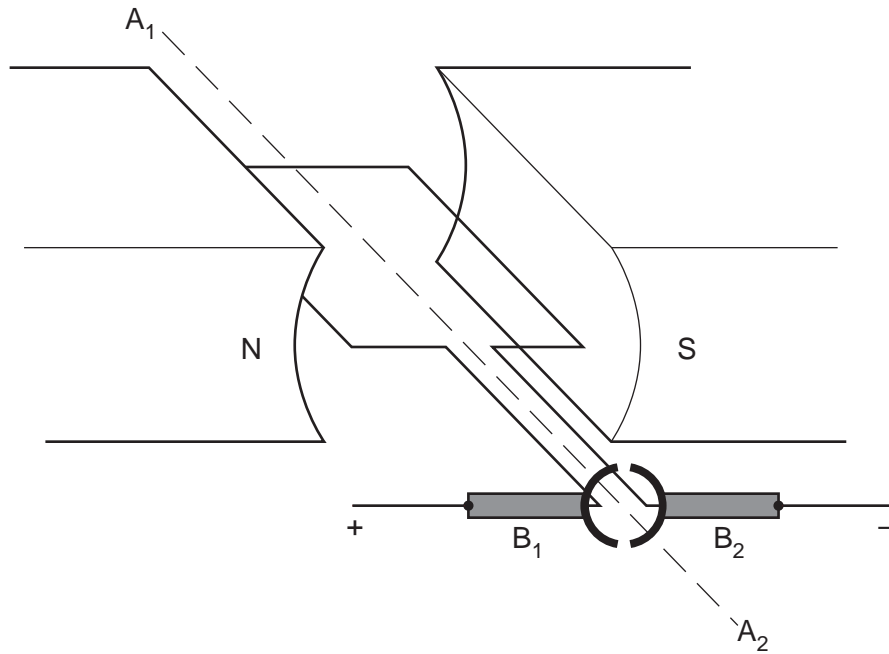


Fig. 8.1

- (a) Brush B_1 is connected to the positive terminal of the battery and brush B_2 is connected to the negative terminal of the battery.

(i) On Fig. 8.1, use an arrow to show the direction of the conventional current in the coil. [1]

(ii) State the direction in which the coil rotates, when viewed from the end closest to the brushes.

.....[1]

(b) State what difference, if any, each of the following changes makes to the rotation of the coil:

(i) using a battery with a larger potential difference,

.....

(ii) using a coil with several turns of wire carrying the same current as in **(a)**,

.....

(iii) using a stronger magnetic field.

.....

[3]

(c) The structure of the motor is very similar to that of an a.c. generator. Use ideas about induction to suggest why the current from the battery falls as the motor speeds up.

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.....[1]

[Total: 6]