

# Electromagnetic effects

## Question Paper 2

Level	IGCSE
Subject	Physics
ExamBoard	CIE
Topic	Electricity and Magnetism
Sub-Topic	Electromagnetic effects
Paper Type	(Extended) Theory Paper
Booklet	Question Paper 2

**Time Allowed:** 63 minutes

**Score:** /52

**Percentage:** /100

- 1 Fig. 9.1 shows a simple electric motor with a single rectangular coil between magnetic poles X and Y.

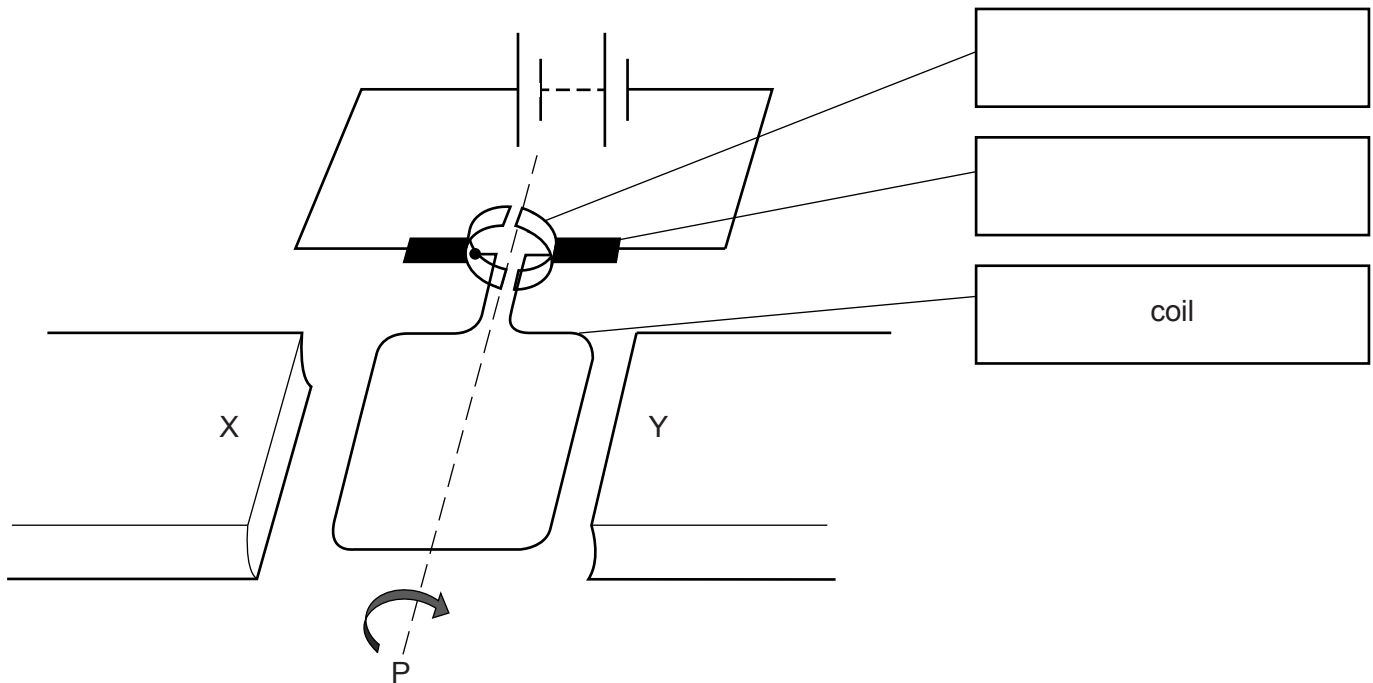


Fig. 9.1

- (a) (i) Add labels to the empty boxes to the right of Fig. 9.1, to identify the parts indicated. [2]

- (ii) The coil rotates in a clockwise direction when viewed from point P.

State which of the magnetic poles, X or Y, is the N-pole. .... [1]

- (b) (i) Suggest two changes that cause the motor to spin faster.

1. ....

2. .... [2]

- (ii) State the effect on the motor of reversing the connections to the battery.

..... [1]

- (c) The battery in Fig. 9.1 is replaced with a resistor. The coil is made to rotate by an external mechanism.

Explain why there is a current in the resistor.

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

[Total: 8]

- 2 Fig. 10.1 shows a coil of wire rotating steadily in the magnetic field between the poles of a permanent magnet. The current generated in the coil is to pass through resistor R.

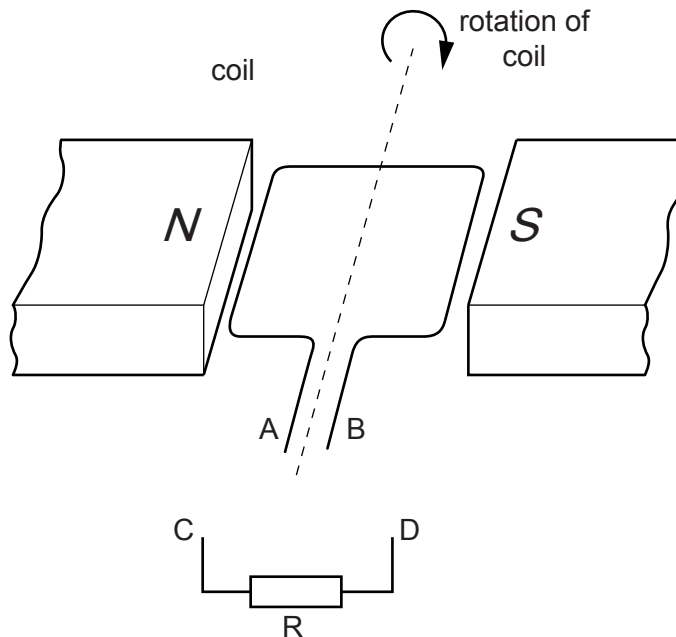


Fig. 10.1

- (a) The apparatus in Fig. 10.1 is part of an a.c. generator. What is connected between the ends A and B of the coil and the connections C and D?

..... [1]

- (b) (i) On Fig. 10.2, sketch a graph to show the variation with time of the current through R. [1]

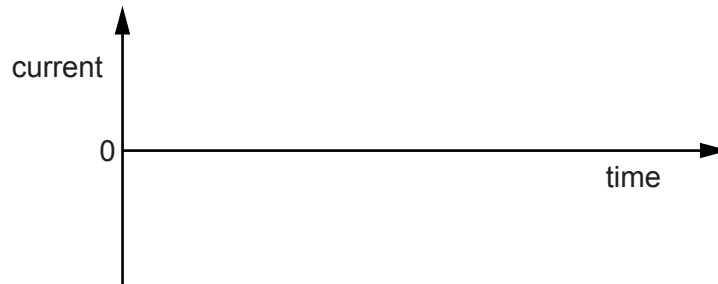


Fig. 10.2

- (ii) On Fig. 10.2, show the time  $T$  corresponding to one complete rotation of the coil. [1]
- (iii) State **two** ways in which the graph would be different if the coil spins at a faster rate.
1. ....
2. .... [2]
- (c) Suggest what could be connected between C and R so that the current in R is always in the same direction.
- ..... [1]

[Total: 6]

3 A battery charger includes a transformer and a rectifier.

Fig. 11.1 represents the transformer, consisting of an iron core with two coils P and Q wound on to the core.

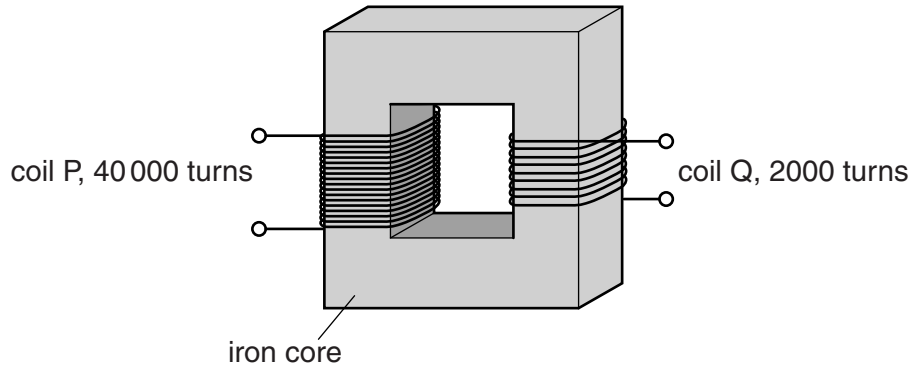


Fig. 11.1

P consists of 40 000 turns and Q consists of 2000 turns.

When P is connected to a 230V a.c. supply, there is an e.m.f. across the terminals of Q.

(a) (i) Calculate the size of this e.m.f.

e.m.f. = ..... [2]

(ii) Explain how this e.m.f. is generated.

.....  
.....  
.....  
.....  
..... [3]

**(b)** The output of Q is connected to the rectifier circuit.

State

**(i)** the name of the circuit component that is used in a rectifier circuit to rectify the a.c. (alternating current),

..... [1]

**(ii)** the property of this component that is used to rectify the current.

..... [1]

[Total: 7]

- 4 (a) Name the process that causes a potential difference across a solenoid due to the movement of a nearby magnet.

.....[1]

- (b) Fig. 11.1 shows a solenoid connected to a centre-zero voltmeter, M.

A bar magnet is held with its N-pole close to one end of the solenoid.

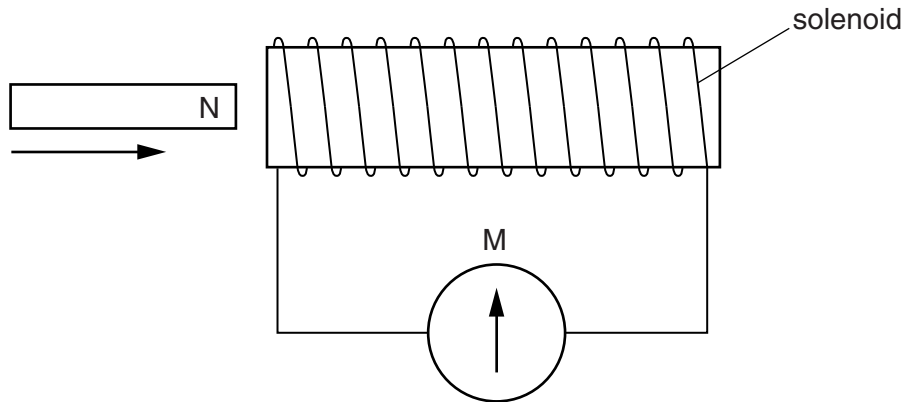


Fig. 11.1

- (i) The magnet is pushed into the solenoid, and then brought to rest with its N-pole just inside the solenoid.

Describe the movement of the pointer of the meter M.

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

- (ii) The magnet is now pulled to the left out of the solenoid, at a higher speed than in (i).

Compare the movement of the pointer of the meter with that seen in (i).

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

[Total: 5]

5 A transformer is used to reduce the voltage of a supply from 120V a.c. to 12V a.c.

(a) Explain how a transformer works. Your answer should include an explanation of why a transformer would not work with a d.c. supply voltage.

.....  
.....  
.....  
.....  
.....  
.....  
..... [3]

(b) The output current is 1.2 A.

(i) Calculate the input current.

input current = ..... [2]

(ii) State an assumption you made in your calculation for (b)(i).

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

[Total: 6]



- 6 A circuit contains a battery, a variable resistor and a solenoid. Fig. 9.1 shows the magnetic field pattern produced by the current in the solenoid.

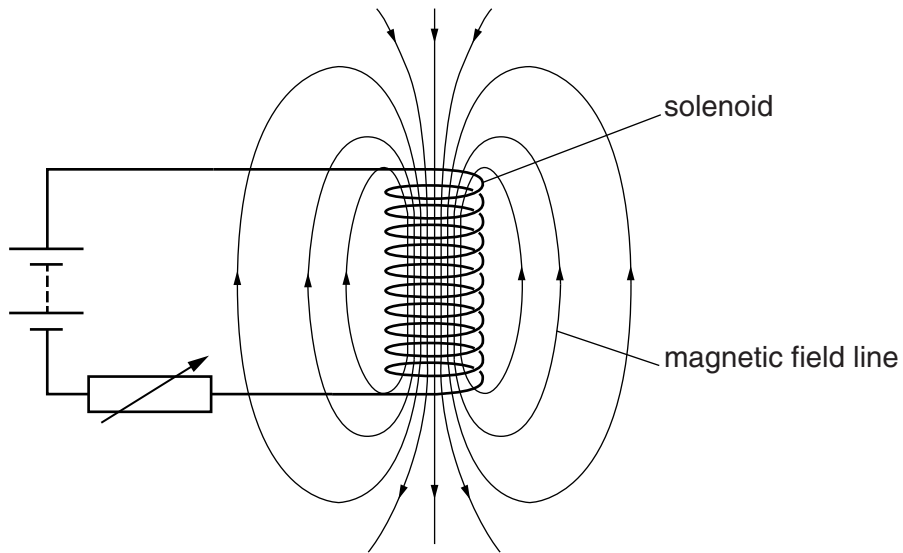


Fig. 9.1

- (a) (i) State how the magnetic field pattern indicates regions where the magnetic field is stronger.

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

- (ii) State what happens to the magnetic field when the current in the circuit is reversed.

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

- (b) A second solenoid is placed next to the first solenoid.

Fig. 9.2 shows the second solenoid connected to a very sensitive ammeter.

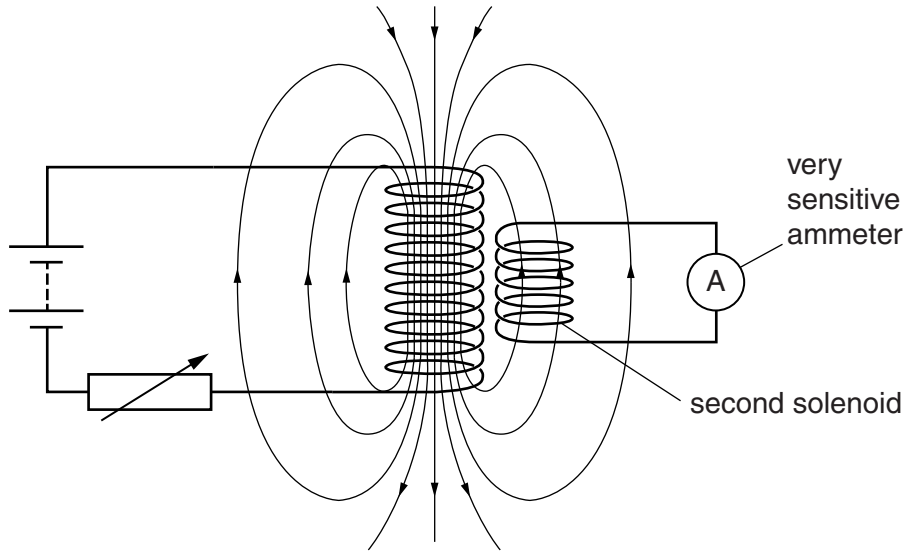


Fig. 9.2

- (i) The variable resistor is adjusted so that its resistance changes quickly.  
State and explain what is seen to happen in the circuit of the second solenoid.

.....  
.....  
.....  
.....  
.....[3]

- (ii) The variable resistor is adjusted much more slowly than in (i).  
State and explain the difference in what is seen to happen in the circuit of the second solenoid.

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

[Total: 7]

- 7 (a) Fig. 10.1 shows the cross-section of a wire carrying a current into the plane of the paper.



Fig. 10.1

On Fig. 10.1, sketch the magnetic field due to the current in the wire. The detail of your sketch should suggest the variation in the strength of the field. Show the direction of the field with arrows. [3]

- (b) Fig. 10.2 shows part of a model of a d.c. motor.

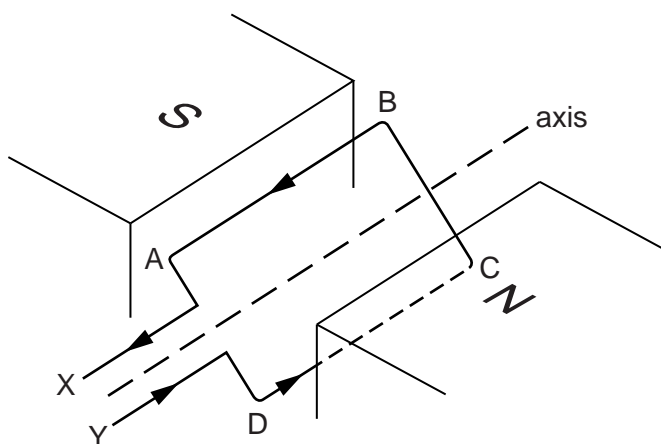


Fig. 10.2

A loop of wire ABCD is placed between the poles of a magnet. The loop is free to rotate about the axis shown. There is a current in the loop in the direction indicated by the arrows.

- (i) On Fig. 10.2, draw arrows to show the directions of the forces acting on side AB and on side CD of the loop. [1]

- (ii) With the loop in the position shown in Fig. 10.2, explain why the forces on AB and CD cause the loop to rotate about the axis.

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

- (iii) The ends X and Y of the loop are connected to a battery using brushes and a split-ring commutator.

State why a split-ring commutator is used.

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

[Total: 7]

8 There is an alternating current in the primary coil of the transformer shown in Fig. 9.1.

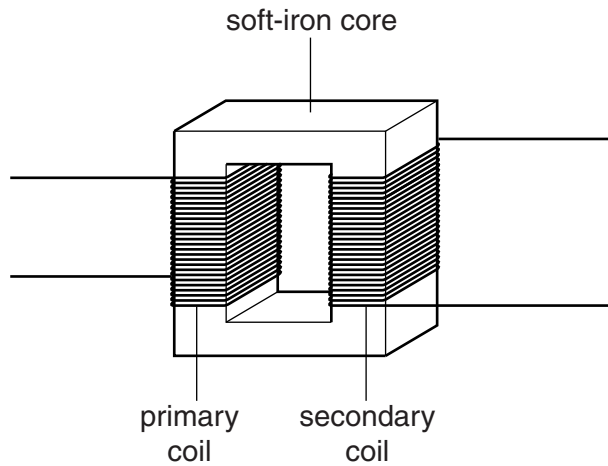


Fig. 9.1

(a) Tick **one** box in each line of the table that best describes the magnetic field in the core and the magnetic field in the secondary coil.

	magnetic field			
	continually increasing and decreasing	continually increasing	continually decreasing	zero
soft-iron core				
secondary coil				

[2]

(b) State and explain the effect on the output from the secondary coil of

(i) increasing the voltage across the primary coil,

output .....

explanation .....

.....

.....

.....

[2]

(ii) replacing the alternating current in the primary coil with direct current from a battery.

output .....

explanation .....

.....

.....

.....

[2]

[Total: 6]