Electromagnetic Effects

Question Paper

Course	CIE IGCSE Physics
Section	4. Electricity & Magnetism
Topic	Electromagnetic Effects
Difficulty	Hard

Time Allowed 80

Score /59

Percentage /100

Question 1a

A teacher demonstrates electromagnetic induction using the apparatus shown in Fig.10.1.

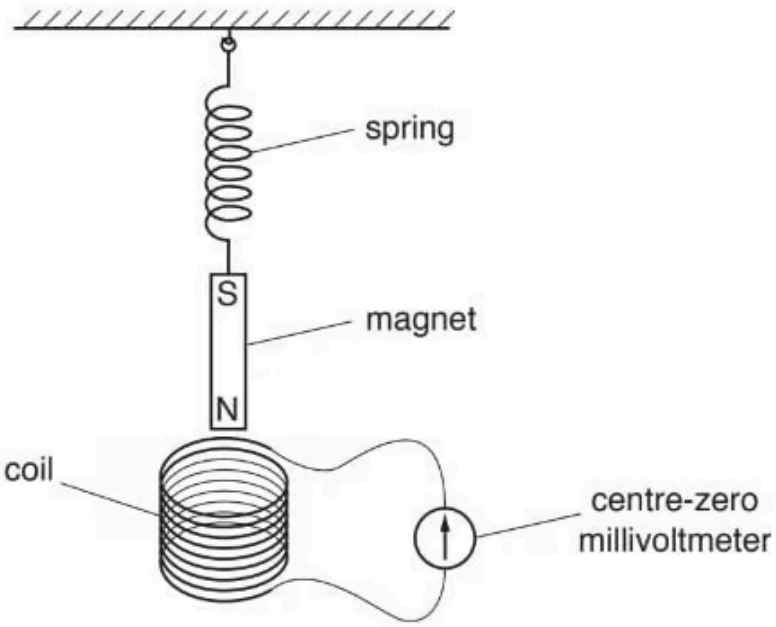

Fig. 10.1

The teacher pulls the magnet down until one end is inside the coil. The teacher then releases the magnet. The magnet moves up and down repeatedly. As it moves, one end of the magnet enters and leaves the coil.

Describe and explain the readings on the centre-zero millivoltmeter as the magnet enters and leaves the coil.

[4 marks]

Question 1b

Fig.10.2 shows a system for transmitting electricity from a power station.

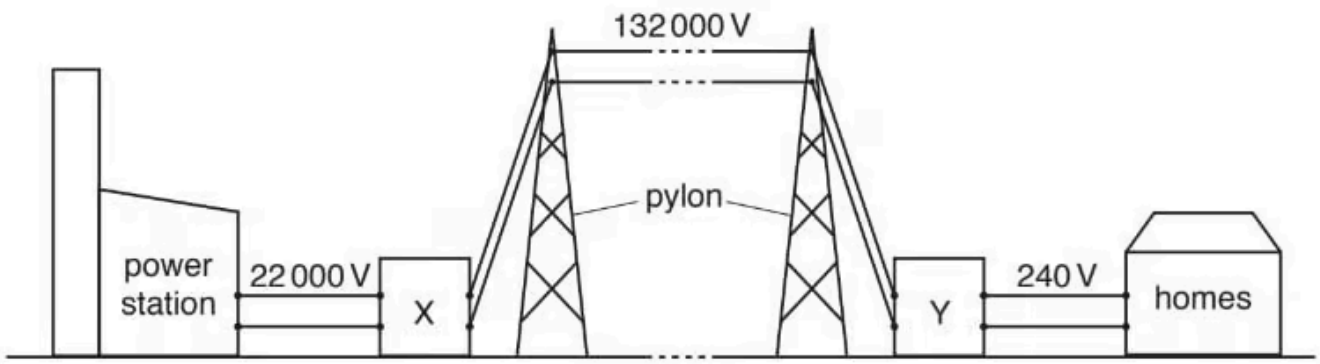

Fig. 10.2

State the name of the device used in X and the name of the device used in Y.

[2 marks]

Question 2a

A student is experimenting with electromagnetic effects.

Describe an experiment, using any standard laboratory equipment, to demonstrate electromagnetic induction. You may draw a diagram.

[3 marks]

Question 2b

Fig. 11.1 shows a transformer connected to an input voltage of 12 V a.c.

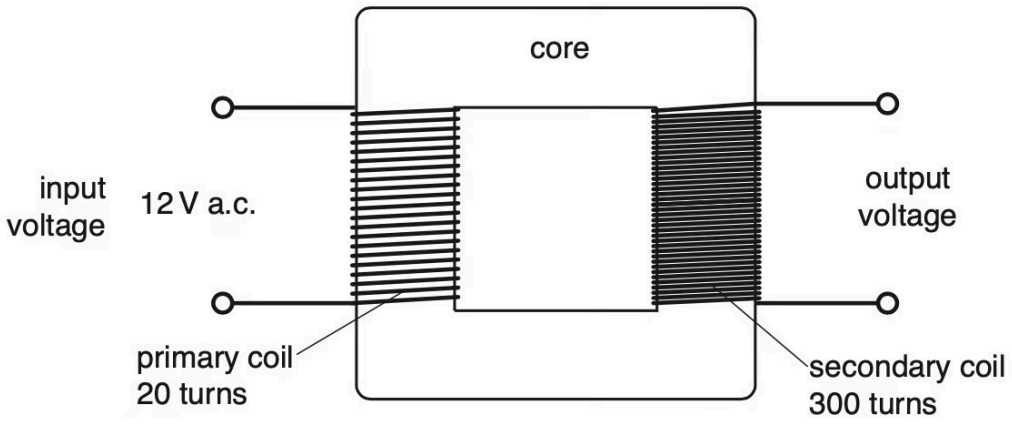

Fig. 11.1

(i) State the name of a suitable material for the core of the transformer.

[1]

(ii) Explain how the diagram in Fig. 11.1 shows a step-up transformer.

[1]

(iii) Using the information in Fig. 11.1, calculate the output voltage of the transformer.

output voltage = ... V [3]

[5 marks]

Question 3a

Fig. 10.1 shows a straight wire AB placed in the magnetic field between the poles of a magnet.

The ends of AB are connected to a galvanometer.

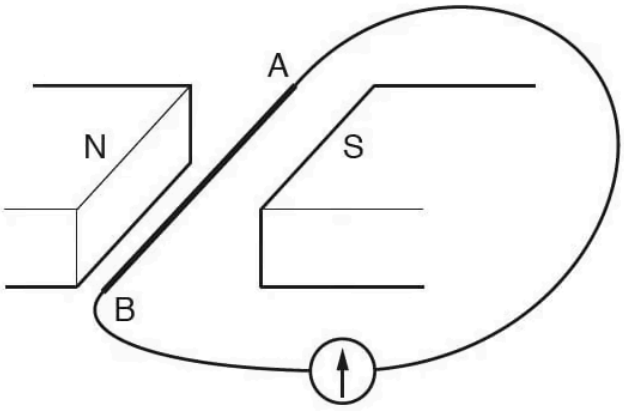

Fig. 10.1

When AB is moved vertically, the needle of the galvanometer shows a deflection.

State three factors that affect the size of the deflection.

[3 marks]

Question 3b

Fig. 10.2 shows a transformer.

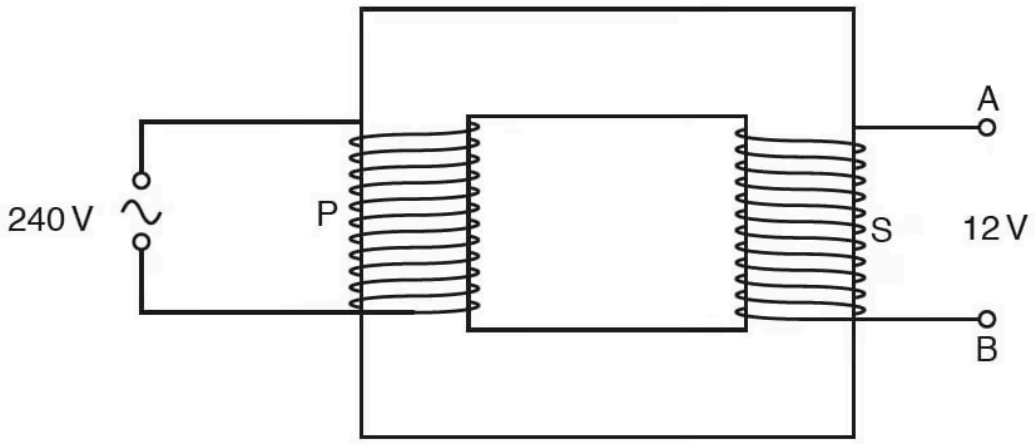

Fig. 10.2

(i) The primary coil P has 8000 turns and an input of 240 V. The secondary coil S has an output of 12 V.

Calculate the number of turns in the secondary coil.

number = ... [2]

(ii) A circuit containing a resistor is connected to the terminals A and B.

A direct current (d.c.) is required in this resistor.

On Fig. 10.1, draw this circuit.

[1]

[3 marks]

Question 4a

Extended tier only

A student makes a transformer that uses an alternating current (a.c.) supply with an electromotive force (e.m.f.) of 12.0 V to induce an output potential difference (p.d.) of 2.0 V.

The student is provided with two lengths of insulated wire and the U-shaped piece of iron shown in Fig. 7.1.

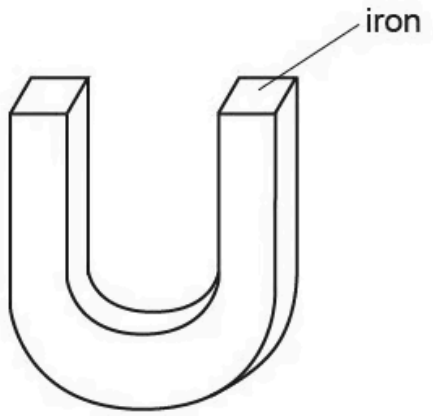

Fig. 7.1

(i) Complete and label Fig. 7.1 to show the transformer connected to the supply and the output from the transformer.

[3]

(ii) Explain the function of the piece of iron in the transformer.

[2]

(iii) The output of the transformer is connected to a lamp. The current in the lamp is 100 mA.

The transformer is 100% efficient.

Calculate the input current to the transformer.

current = ... [2]

[7 marks]

Question 4b

Another transformer is used in a school laboratory to step down a mains supply with a p.d. of 110 V to 12 V. This transformer is mounted in a metal case.

State and explain an essential safety feature required for this arrangement.

[2 marks]

Question 5a

Fig. 11.1 shows a vertical conductor passing through a horizontal piece of card.

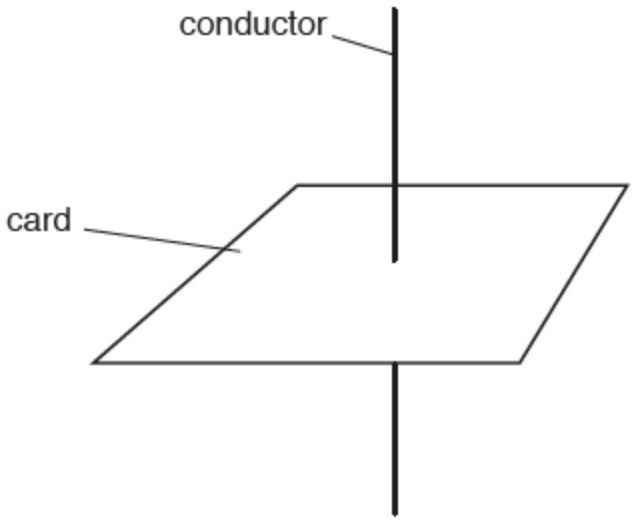

Fig. 11.1

(i) On Fig. 11.1, draw a cell and a switch in series with the conductor to form a complete circuit.

Use the correct circuit symbols.

[2]

(ii) A student sprinkles iron filings onto the card and closes the switch. There is a current in the conductor. Describe the pattern of the magnetic field seen.

[2]

(iii) The student reverses the direction of the current in the conductor. State the effect, if any, on the pattern he sees.

[1]

[5 marks]

Question 5b

Describe an experiment to show that a force acts on a current-carrying conductor in a magnetic field. Show how to arrange the equipment. Include a diagram in your answer.

[4 marks]

Question 6

Extended tier only

Fig. 9.1 shows a coil supplied with current using a split-ring commutator.

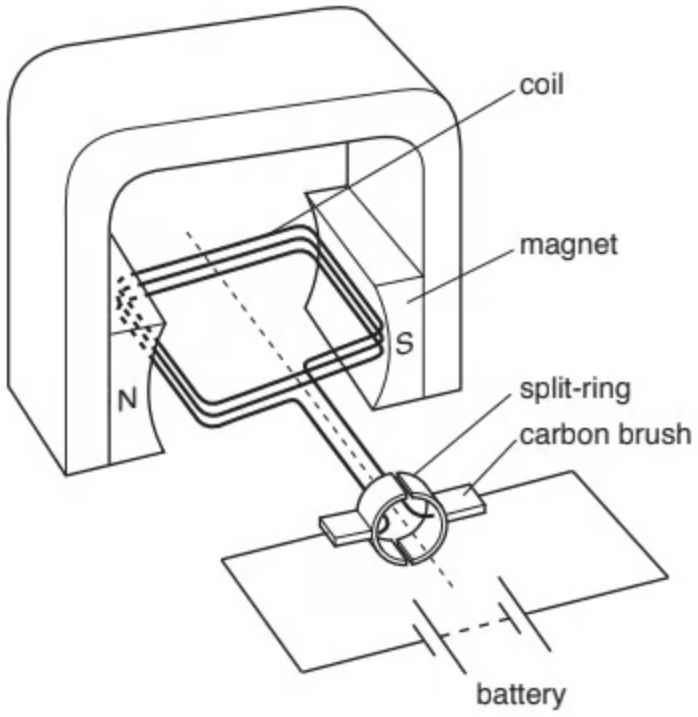

Fig. 9.1

(i) State and explain any motion of the coil.

[3]

(ii) The coil in Fig. 9.1 consists of three turns of wire. The magnetic field strength of the magnet is M. With a current of 2.0 A in the coil, the coil experiences a turning effect, T.

The first row of Table 9.1 shows this data.

Table 9.1

number of turns	current in the coil / A	magnetic field strength	turning effect
3	2.0	M	T
3	8.0	M	
6	2.0	M	
3	2.0	$\frac{M}{2}$	

Complete Table 9.1 to give the turning effect for the changes made to the arrangement shown in Fig. 9.1.

Choose your answers from the box.

$\frac{T}{8}$	$\frac{T}{4}$	$\frac{T}{2}$	T	$2T$	$4T$	$8T$

[3]

[6 marks]

Question 7a

Extended tier only

Explain why the voltage of the supply to the primary coil of a transformer must be alternating.

[2 marks]

Question 7b

Extended tier only

Fig. 10.1 shows a transformer.

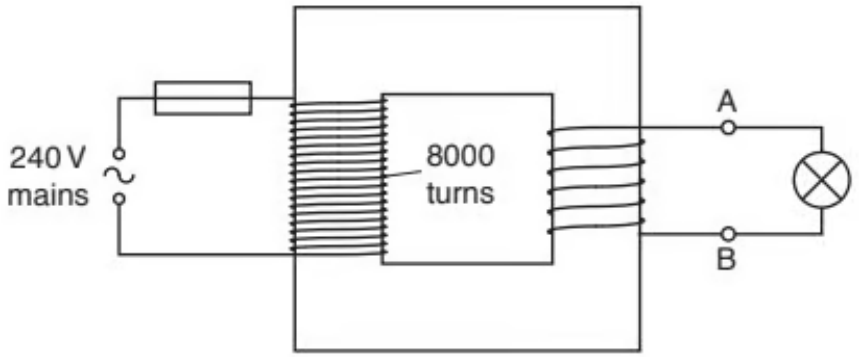

Fig. 10.1

There are 8000 turns in the primary coil of the transformer. The primary coil is connected to a 240 V mains supply. A 6.0 V lamp connected to the secondary coil operates at full brightness.

(i) Calculate the number of turns in the secondary coil

number of turns = ...[2]

(ii) The current in the lamp is 2.0A. The transformer operates with 100% efficiency.

Calculate the current in the primary circuit.

current = ...[2]

(iii) The primary circuit contains a 6.0 A fuse.

Calculate the maximum number of lamps, identical to the lamp in **(ii)**, that can be connected in parallel in the secondary circuit without blowing the fuse.

number of lamps = ...[1]

[5 marks]

Question 8a

Extended tier only

Fig. 9.1 shows a coil ABCD with two turns. The coil is in a magnetic field.

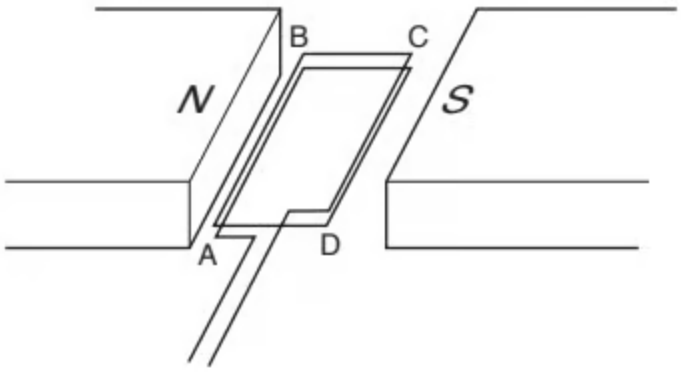

Fig. 9.1

When there is a current in the coil, the coil experiences a turning effect.

(i) Explain why there is a turning effect.

[1]

(ii) The value of the current is 3 A.

Place one tick in each column of the table to indicate how the turning effect changes with the change described.

turning effect	number of turns on coil increased to six	current increased to 9A	strength of magnetic field decreased by a factor of 2
decreased by factor of 4			
decreased by factor of 3			
decreased by factor of 2			
no change			
increased by factor of 2			
increased by factor of 3			
increased by factor of 4			

[3]

[4 marks]

Question 8b

Extended tier only

Fig. 9.2 shows a magnet held just below a vertical coil connected to a galvanometer.

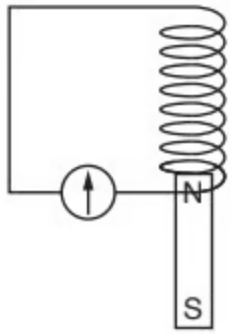

Fig. 9.2

The magnet is released.

(i) State any effect on the galvanometer.

[2]

(ii) State any effect on the magnetic field produced by the coil.

[2]

[4 marks]