

4.5 Electromagnetic effects

01. 0625_m23_qp_42 Q: 8

Fig. 8.1 shows a horizontal, flat coil in a magnetic field

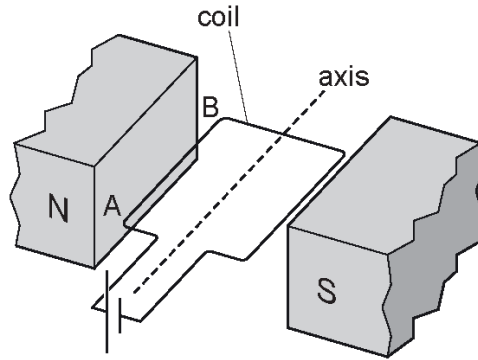


Fig. 8.1

The coil is connected to a cell. The coil rotates.

- (a) Determine the direction of movement of the side AB relative to the plane of the coil.

direction of movement = [1]

- (b) Explain how you determined the direction in (a).

.....
 [2]

- (c) State and explain what happens to the coil as it reaches the vertical position.

.....

 [2]

- (d) To operate as a motor, a split-ring commutator and brushes are added to the parts shown in Fig. 8.1.

Explain the effects of the split-ring commutator and the brushes on the action of the motor.

.....
 [3]

4.5. ELECTROMAGNETIC EFFECTS

02. 0625_s23_qp_41 Q: 8

The electricity supplied to a town is transmitted using a high-voltage cable. A transformer in the town has a soft-iron core.

(a) Explain the principle of operation of a simple iron-cored transformer.

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

(b) The transformer steps the supply voltage down from 220 000 V to 33 000 V.

(i) There are 450 turns on the secondary coil.

Calculate the number of turns on the primary coil.

number of turns = [2]

(ii) The electrical power transferred to the transformer by the high-voltage cable is 77 MW.

Calculate the current in the primary coil.

current = [3]



03. 0625_s23_qp_43 Q: 7

The voltage across the primary coil of a 100% efficient transformer is 220 V and the voltage across the secondary coil is 12 V.

- (a) The current in the secondary coil is 2.5 A.

Calculate the current in the primary coil.

current = [3]

- (b) Calculate the ratio of the number of turns on the primary coil to the number of turns on the secondary coil of the transformer.

ratio = [2]

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4.5. ELECTROMAGNETIC EFFECTS

04. 0625_w23_qp_43 Q: 8

(a) Fig. 8.1 shows the single turn coil of a simple direct current (d.c.) motor.

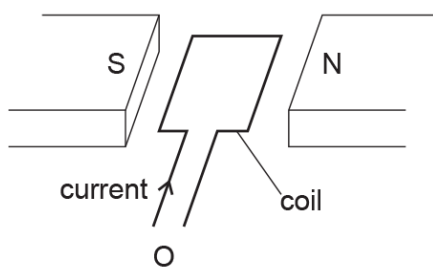


Fig. 8.1

(i) Explain the direction of the turning effect as seen by an observer at O.

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

(ii) The coil is replaced by an otherwise identical new coil with three turns and the same current in the coil.

State how the turning effect compares with the turning effect in (i).

..... [1]

(iii) A third coil is identical to the coil in (i) except that its resistance is three times greater. The potential difference (p.d.) across the coil is the same as the p.d. in (i).

State how the turning effect compares with the turning effect in (i).

..... [1]

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- (b) Fig. 8.2 is a voltage–time graph showing the output of a simple alternating current (a.c.) generator at times t_0 , t_1 , t_2 and t_3 .

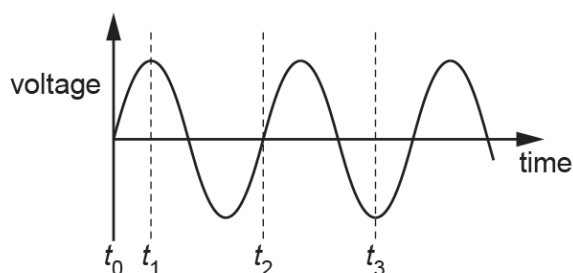


Fig. 8.2

Fig. 8.3 is an end view of the plane of the coil of the generator at time t_0 . The coil is rotating clockwise.

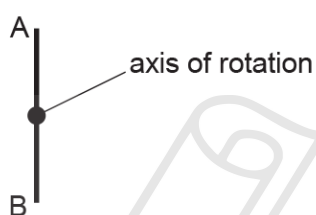


Fig. 8.3

- (i) Draw an end view of the position of the plane of the coil at time t_1 . Include the labels A and B.

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[1]

- (ii) Draw an end view of the position of the plane of the coil at time t_2 . Include the labels A and B.

[1]

4.5. *ELECTROMAGNETIC EFFECTS*

- (iii) Draw an end view of the position of the plane of the coil at time t_3 . Include the labels A and B.

[1]



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05.0625_m22_qp_42 Q: 6

Fig. 6.1 shows two bar magnets.



Fig. 6.1

(a) On Fig. 6.1, sketch the pattern and the direction of the magnetic field lines between the bar magnets. [2]

(b) Fig. 6.2 shows the same bar magnets with a coil of wire between them.

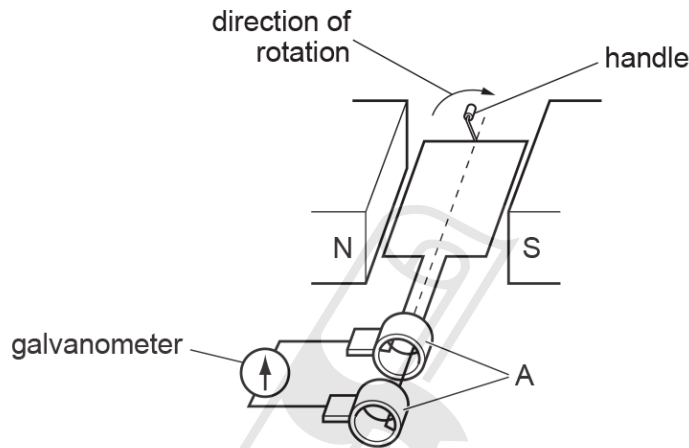


Fig. 6.2

(i) Name the parts labelled A in Fig. 6.2.

..... [1]

(ii) The coil of wire is rotated in the direction shown in Fig. 6.2.

On Fig. 6.2, draw an arrow to show the direction of the current in the coil. Explain your answer.

..... [2]

(iii) Explain how rotating the coil in Fig. 6.2 continuously causes the galvanometer needle to show an alternating current.

..... [4]

4.5. ELECTROMAGNETIC EFFECTS

06. 0625_m22_qp_42 Q: 8

A radio is connected to the mains supply using a step-down transformer.

(a) Draw a labelled diagram of the structure of a basic step-down transformer.

[3]

(b) Explain the operation of a basic transformer.

.....

.....

.....

..... [3]

(c) The voltage of the mains supply is 230 V. The output voltage of the transformer is 6.0 V.

Calculate the value of the turns ratio ($\frac{N_s}{N_p}$). Give your answer to two significant figures.

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value of turns ratio = [2]

07. 0625_s22_qp_41 Q: 8

Fig. 8.1 shows two vertical, cylindrical tubes and a cylindrical magnet all held in a vacuum.

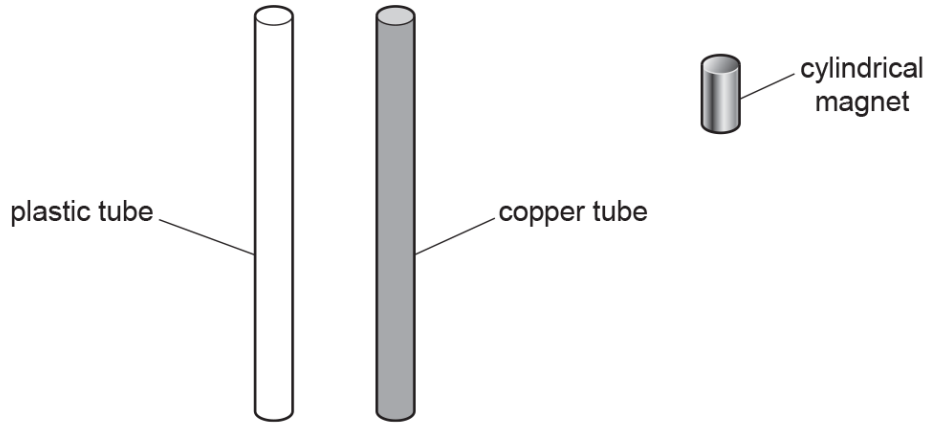


Fig. 8.1 (not to scale)

One tube is made of plastic and the other tube is made of copper. The two cylindrical tubes have identical dimensions.

The magnetic field of the small, cylindrical magnet is extremely strong.

Initially, the magnet is at rest at the top of the plastic tube.

The magnet is released and it falls through the plastic tube without experiencing a resistive force. The magnet takes 0.67 s to fall to the lower end of the plastic tube.

- (a) The mass of the magnet is 0.012 kg.

Calculate the kinetic energy of the magnet when it reaches the lower end of the plastic tube.

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kinetic energy = [4]

- (b) The magnet is then held at the top of the copper tube and released. As it falls through the copper tube, an electric current is generated in the copper.

- (i) Explain why there is a current in the copper.

.....

 [2]

4.5. *ELECTROMAGNETIC EFFECTS*

(ii) The current in the copper produces a magnetic field of its own in the tube.

The magnet falls much more slowly in the copper tube than in the plastic tube.

Explain why the magnet falls more slowly in the copper tube.

.....

.....

..... [2]



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08.0625_s22_qp_42 Q: 7

Fig. 7.1 shows a small plotting compass which is aligned with the magnetic field between magnetic poles A and B of a U-shaped magnet.

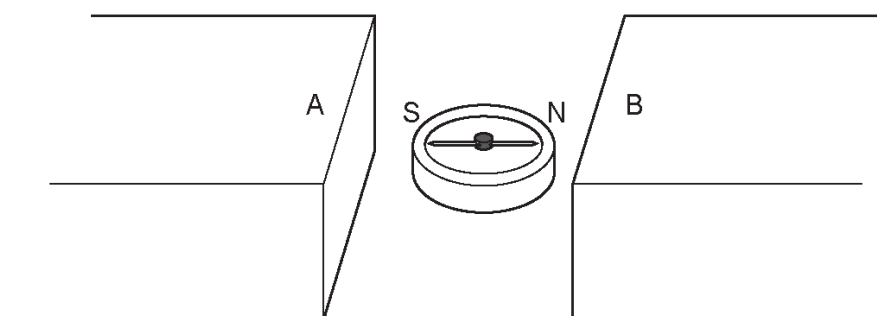


Fig. 7.1

(a) State the polarity of the poles.

pole A

pole B

[1]

(b) Fig. 7.2 shows a wire, placed between two poles, carrying a current in the direction of the arrow.

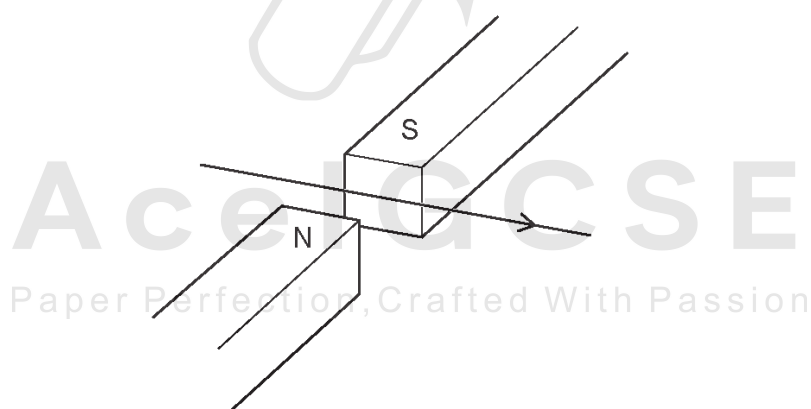


Fig. 7.2

On Fig. 7.2, draw an arrow to show the direction of the force on the wire due to the magnetic field. [2]

4.5. ELECTROMAGNETIC EFFECTS

(c) Fig. 7.3 shows a β -particle moving in the direction of the arrow between the same two poles.

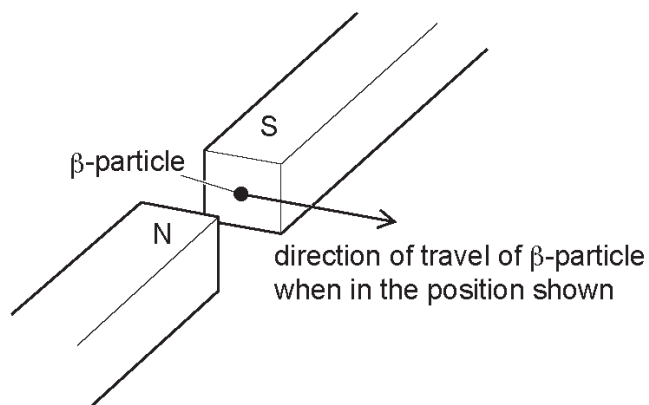


Fig. 7.3

On Fig. 7.3, draw an arrow to show the direction of the force on the β -particle due to the magnetic field. [2]



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09.0625_s22_qp_42 Q: 8

Fig. 8.1 shows how the electromotive force (e.m.f.) of a 60Hz alternating current (a.c.) power supply varies with time.

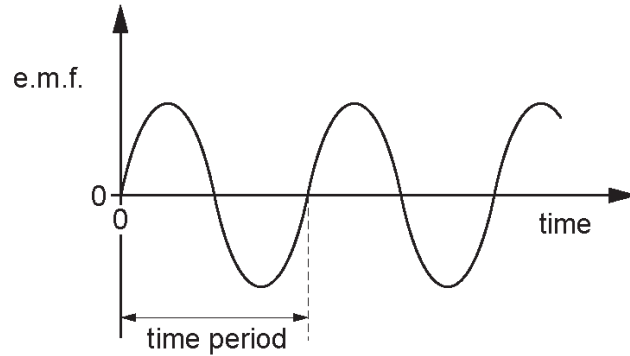


Fig. 8.1

(a) Calculate the time period of the a.c.

time period = [1]

(b) Fig. 8.2 shows this power supply connected in a circuit.

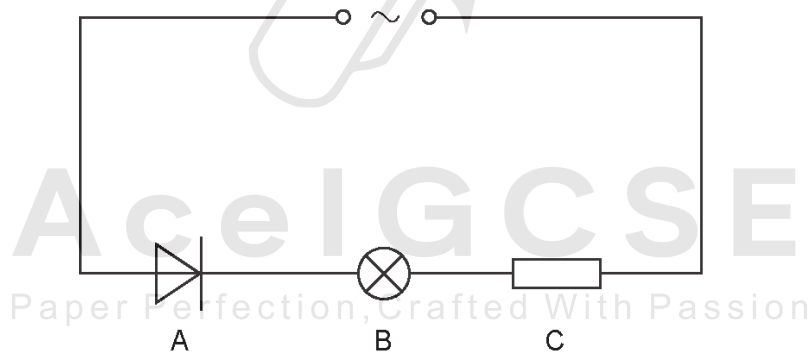


Fig. 8.2

(i) State the name of component A.

..... [1]

(ii) In each time period of the a.c., 1.5×10^{17} electrons pass through component A. The charge on an electron is $1.6 \times 10^{-19} \text{C}$.

Calculate the average current in the circuit during one time period.

current = [3]

4.5. ELECTROMAGNETIC EFFECTS

(c) On Fig. 8.3:

1. mark, with an arrow labelled E, the direction of the electron flow through component B
2. mark, with an arrow labelled I, the direction of the conventional current in component C.

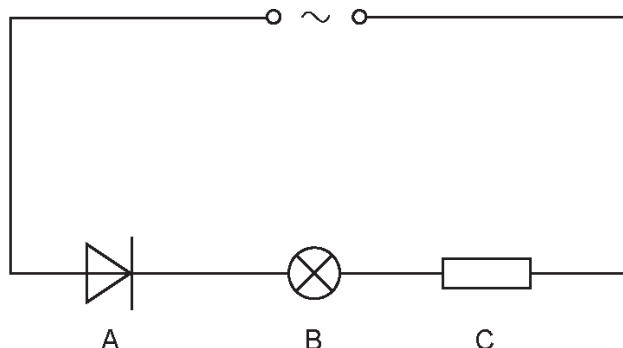


Fig. 8.3

[2]

(d) Fig. 8.4 shows a circuit with components B and C connected to a direct current (d.c.) power supply of e.m.f. 12V.

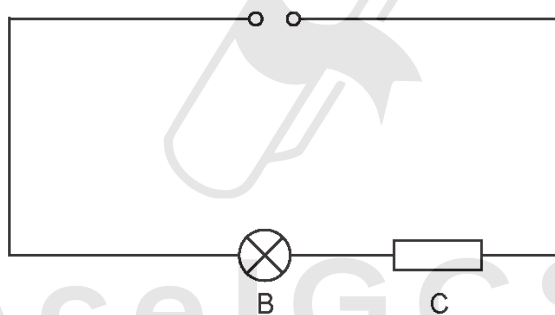


Fig. 8.4

The current in the circuit is 0.35A.

Calculate the power delivered by the power supply to the circuit.

power = [2]

10. 0625_s22_qp_43 Q: 9

- (a) Fig. 9.1 shows a magnet on the end of a spring and a coil of wire connected to a sensitive centre-zero galvanometer. The magnet can move freely through the coil.

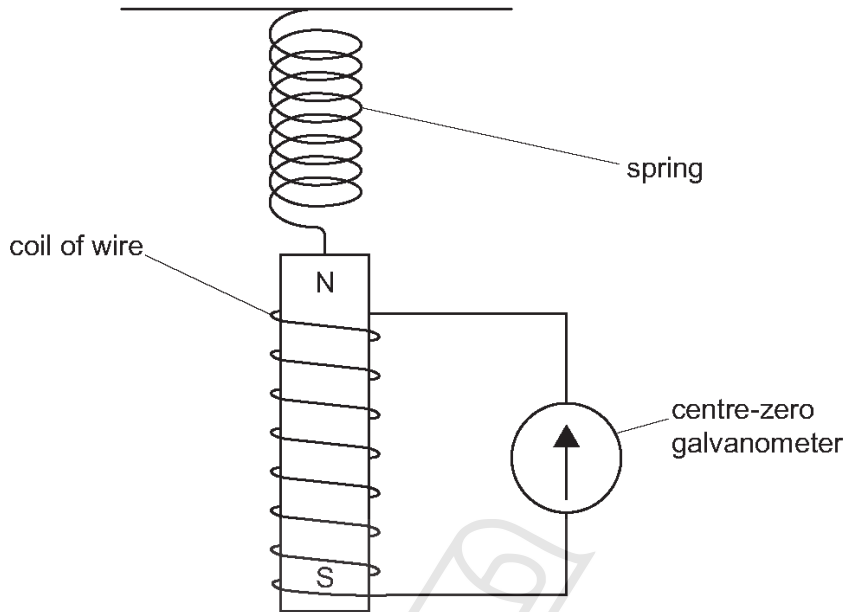


Fig. 9.1

- (i) The magnet is pulled down and released.

Describe and explain what happens to the needle of the sensitive galvanometer.

.....

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- (ii) The magnet is replaced with a stronger magnet.

State the effect of using a stronger magnet on what happens to the needle of the galvanometer.

..... [1]

4.5. *ELECTROMAGNETIC EFFECTS*

- (b) A step-up transformer is used to step up the output voltage of a power station from 25000V to 400000V for transmission along power lines.

The number of turns on the secondary coil is 36000.

Calculate the number of turns on the primary coil.

number of turns = [2]



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11. 0625_w22_qp_41 Q: 7

The electric starter motor in a car is switched on and off using a relay.

The relay consists of a plastic case and two flexible springy strips, X and Y, which are made of soft iron. These iron strips act as the switch when a circuit is connected between the terminals W and Z.

Fig. 7.1 shows X, Y and the plastic case.

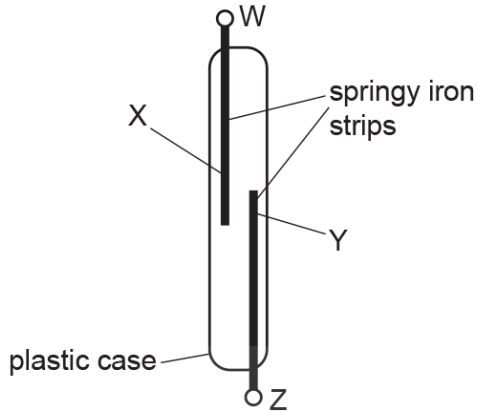


Fig. 7.1

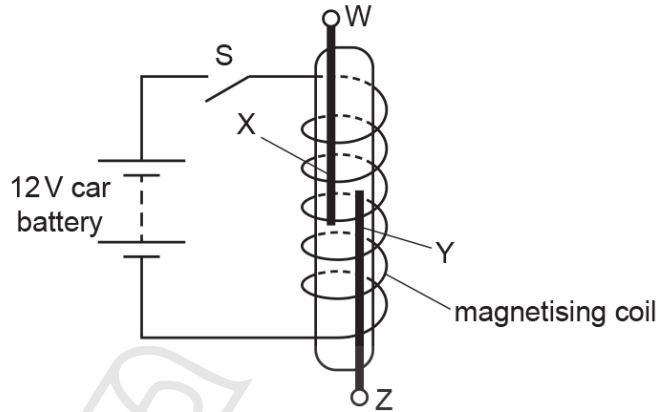


Fig. 7.2

Fig. 7.2 shows the equipment from Fig. 7.1 inside a magnetising coil. The magnetising coil is in series with the 12V car battery and switch S, which is open.

(a) Switch S is now closed.

Explain what happens to the springy iron strips X and Y.

.....

 [3]

(b) The power of the starter motor is 1.8kW and it is also operated by the car battery.

(i) Calculate the current in the starter motor when it is used.

current = [2]

4.5. ELECTROMAGNETIC EFFECTS

(ii) The starter motor circuit is connected between terminals W and Z.

Explain why copper wires with a large cross-sectional area are used for this circuit.

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

(c) Fig. 7.3 shows the relay and the symbols for the car battery and the starter motor.

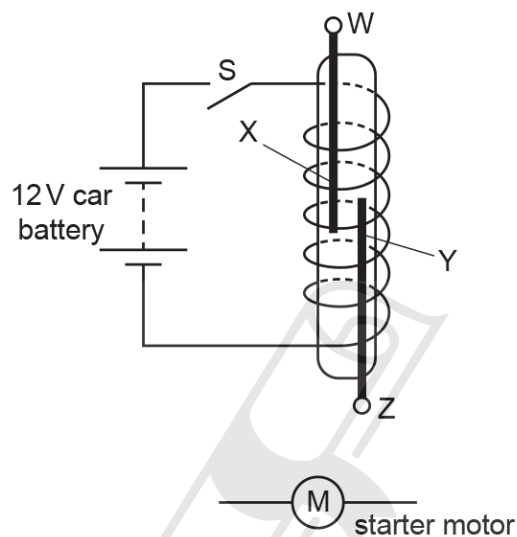


Fig. 7.3

The springy iron strips X and Y act as the switch for the starter motor circuit.

Complete the circuit diagram for the motor circuit.

[2]

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12. 0625_w22_qp_43 Q: 9

Fig. 9.1 shows a circuit with an alternating current (a.c.) supply, a resistor and a diode.

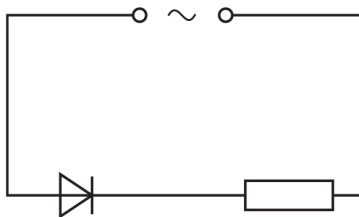


Fig. 9.1

The frequency of the power supply is 50 Hz.

(a) Calculate the time period (time for one complete cycle) of the a.c. supply.

time = [2]

(b) The peak potential difference (p.d.) across the resistor is 340 V.



Fig. 9.2

On Fig. 9.2:

- (i) sketch a graph to show how the p.d. across the resistor varies with time for two cycles [2]
- (ii) label the p.d. axis with the value of p.d. at the peak [1]
- (iii) label the time axis with two values of time. [2]

4.5. ELECTROMAGNETIC EFFECTS

13. 0625_w22_qp_43 Q: 11

(a) Fig. 11.1 shows a solenoid connected to a battery.

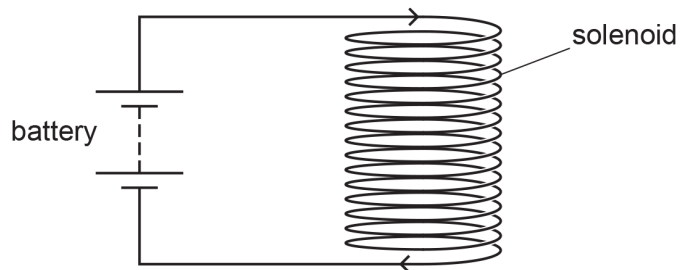


Fig. 11.1

On Fig. 11.1, draw the pattern of the magnetic field inside and around the solenoid. Indicate the direction of the magnetic field with an arrow. [3]

(b) Electrical power is transmitted at a voltage of 400 kV. A transformer reduces the voltage to 33 kV for use by heavy industry in large factories. The number of turns on the primary coil of the transformer is 11 000.

Calculate the number of turns on the secondary coil of the transformer.

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number of turns = [2]

14. 0625_m21_qp_42 Q: 7

Fig. 7.1 shows a horizontal conducting wire XY between two opposite magnetic poles. Wire XY forms a circuit with an ammeter.

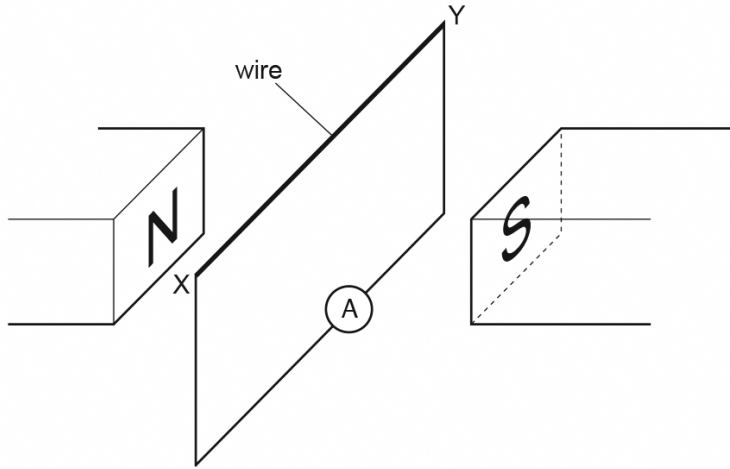


Fig. 7.1

(a) Explain why the reading on the ammeter is zero when the wire XY is not moving.

.....
 [1]

(b) The wire XY is moved and there is a deflection on the ammeter that indicates there is a current in the wire from X to Y.

On Table 7.1, tick **one** box to indicate the direction of the movement of the wire XY and explain your answer.

Table 7.1

into page	out of page	to the left	to the right	to the bottom of the page	to the top of the page

explanation

 [3]

(c) State what is observed on the ammeter when the wire XY is moved

- (i) in the opposite direction to part (b) [1]
- (ii) in the same direction as part (b) but at a greater speed [1]

[Total: 6]

4.5. ELECTROMAGNETIC EFFECTS

15. 0625_s21_qp_41 Q: 7

Fig. 7.1 represents an alternating current (a.c.) generator.

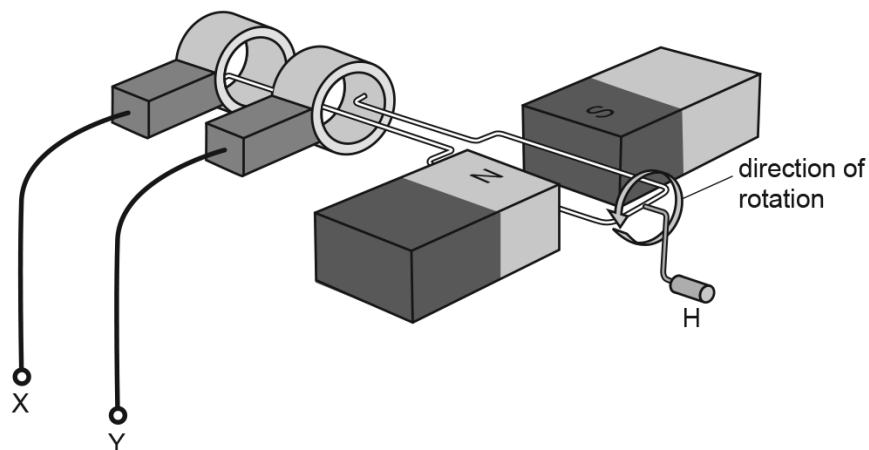


Fig. 7.1

(a) A student rotates the handle H, as shown in Fig. 7.1.

(i) On Fig. 7.2, sketch a graph to show how the electromotive force (e.m.f.) between terminals X and Y varies with time during **two** complete revolutions of the coil.



Fig. 7.2

[3]

(ii) On Fig. 7.2, mark and label a point P, for the e.m.f. when the coil is horizontal, as shown in Fig. 7.1. [1]

(iii) The student turns the handle more quickly.

State **two** ways in which the e.m.f. between terminals X and Y changes.

1.
2.

[2]

- (b) Terminals X and Y are connected to the primary coil of a transformer.

State and explain what happens in the transformer as the student turns the handle of the a.c. generator.

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

- (c) Explain why the power losses in transmission cables are lower when electrical energy is transmitted at higher voltages.

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

[Total: 11]



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4.5. ELECTROMAGNETIC EFFECTS

16. 0625_s21_qp_42 Q: 7

- (a) Fig. 7.1 shows two magnets and the gap between the N pole of one magnet and the S pole of the other magnet.

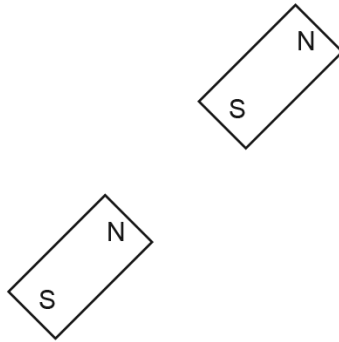


Fig. 7.1

On Fig. 7.1, draw **three** lines to show the pattern and direction of the magnetic field in the gap. [2]

- (b) (i) Fig. 7.2 is a repeat of Fig. 7.1 showing the two magnets.

On Fig. 7.2, draw the position of a plotting compass needle when it comes to rest in the gap between the N pole and the S pole.

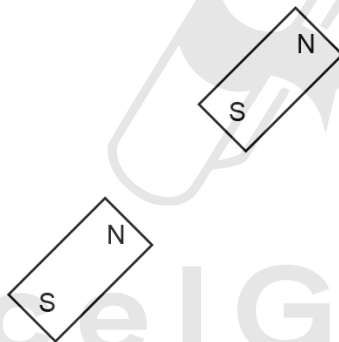


Fig. 7.2

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[1]

- (ii) Explain why the needle comes to rest in this position.

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

- (c) Describe a method of demagnetising a bar magnet.

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

[Total: 7]

17. 0625_s21_qp_42 Q: 8

(a) Two identical radioactive sources emit α -particles and γ -rays into two vacuum tubes.

(i) Fig. 8.1 shows two electrically charged plates on either side of one of the vacuum tubes.

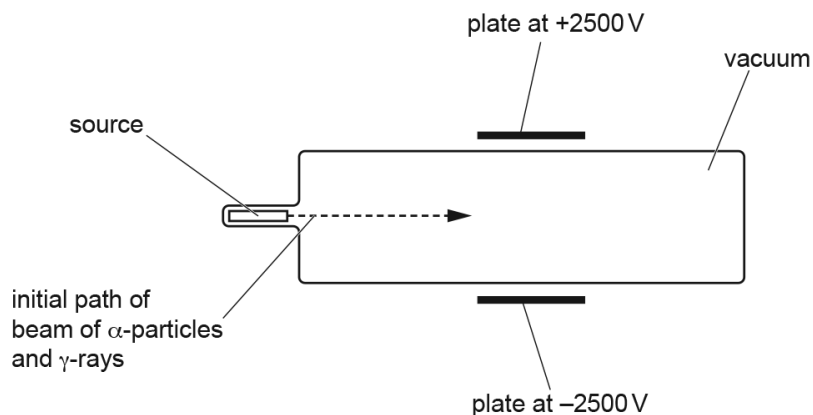


Fig. 8.1

Write the symbol α **once** in Table 8.1 to indicate any deflection of the α -particles.

Write the symbol γ **once** in Table 8.1 to indicate any deflection of the γ -rays.

Table 8.1

into page	out of page	no deflection	towards bottom of page	towards top of page

[2]

4.5. ELECTROMAGNETIC EFFECTS

- (ii) Fig. 8.2 shows the poles of a very strong magnet on either side of the other vacuum tube.

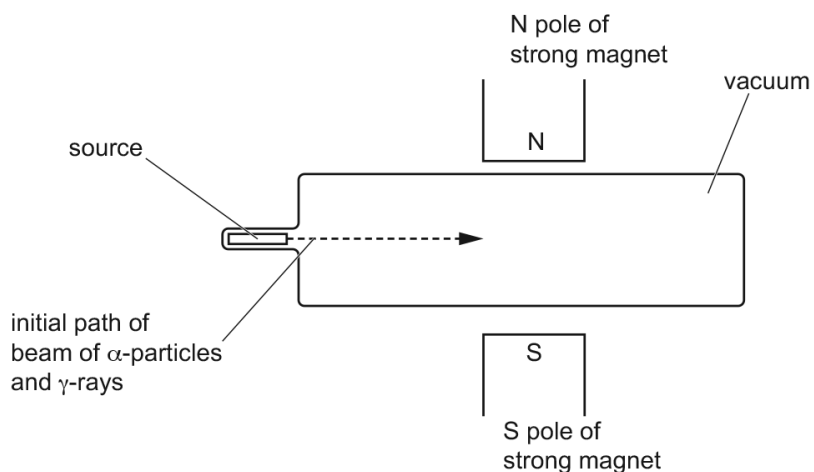


Fig. 8.2

Write the symbol α **once** in Table 8.2 to indicate any deflection of the α -particles.

Write the symbol γ **once** in Table 8.2 to indicate any deflection of the γ -rays.

Table 8.2

into page	out of page	no deflection	towards bottom of page	towards top of page

[2]

(b) Fig. 8.3 shows a simple direct current (d.c.) electric motor with a split-ring commutator.

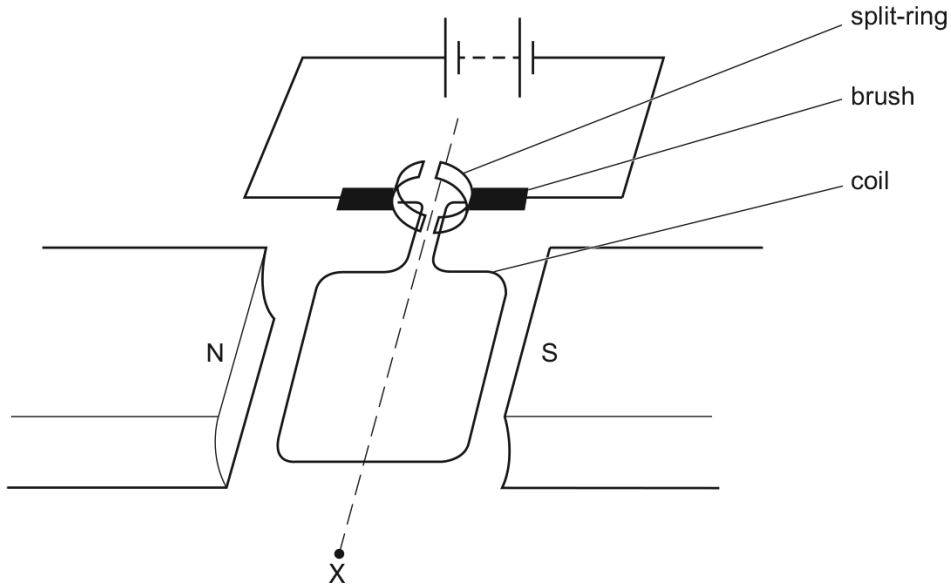


Fig. 8.3

- (i) State and explain the direction of rotation of the coil as seen from point X.
 statement
 explanation [3]
- (ii) The coil rotates through 90° from the position shown.
 State what happens to the moment in this position.
 [1]
- (iii) The coil is rotated through 180° from the position shown. By considering the forces on the coil, explain how the split-ring commutator enables the motor to turn continuously.

 [2]

[Total: 10]

4.5. ELECTROMAGNETIC EFFECTS

18. 0625_s21_qp_43 Q: 9

- (a) An X-ray machine requires a supply of 110kV. The mains electricity supply is 230V. A transformer is used to supply the correct voltage to the X-ray machine. There are 50 turns on the primary coil of the transformer.

Calculate the number of turns on the secondary coil.

number of turns = [2]

- (b) Draw a labelled diagram of a step-down transformer. On the labels, state a suitable material for each of the components.

[3]

- (c) Explain how a transformer operates.

.....
.....
.....
.....

[3]

[Total: 8]

19. 0625_w21_qp_43 Q: 10

(a) A transformer has 500 turns on the primary coil and 25 turns on the secondary coil. The input voltage is 120 V.

(i) Calculate the output voltage.

output voltage = [2]

(ii) The current in the primary coil is 125 mA. The transformer is 100% efficient.

Calculate the output current.

output current = [2]

(b) Fig. 10.1 shows a loose wire connected in a circuit with a d.c. (direct current) power supply and a switch. The length of the wire between the two supports is in the magnetic field of a horseshoe magnet.

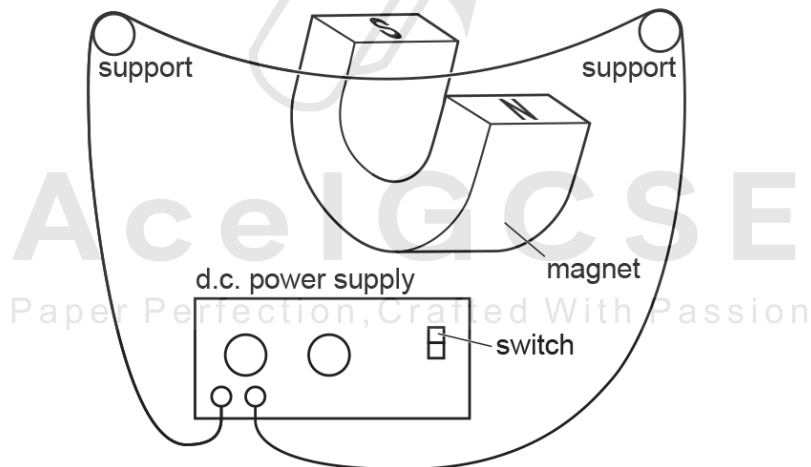


Fig. 10.1

The power supply is switched on and the wire moves down.

(i) On Fig. 10.1, draw an arrow on the wire to show the direction of the current. [1]

(ii) The power supply is switched off and the wire returns to its original position. The power supply is then switched on so that the current is in the opposite direction.

State and explain what happens to the wire.

.....
 [2]

4.5. *ELECTROMAGNETIC EFFECTS*

(c) A split-ring commutator is an important feature of a d.c. motor.

Suggest **one** reason why the d.c. motor cannot operate without a split-ring commutator.

..... [1]



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20. 0625_m20_qp_42 Q: 10

(a) Fig. 10.1 is a simplified top view of a flat coil. There is an alternating current (a.c.) in the coil.



Fig. 10.1

Describe the magnetic effect of this alternating current.

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

(b) Fig. 10.2 shows a pan placed above the coil. The base of the pan is made of steel.

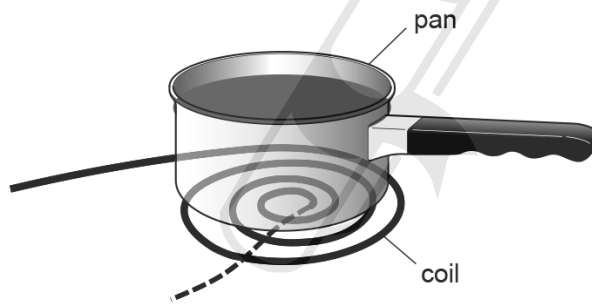


Fig. 10.2

State what quantity is induced in the base of the pan.

..... Paper Perfection Crafted With Passion..... [1]

(c) The pan contains water.

State and explain the effect of the quantity induced in part (b) on the temperature of the water in the pan.

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

[Total: 6]

4.5. ELECTROMAGNETIC EFFECTS

21. 0625_s20_qp_41 Q: 7

An electromagnet consists of a solenoid X that is made of copper wire. The solenoid contains an iron core.

(a) Explain why:

- (i) the structure of copper makes it a suitable material for the wire

.....

 [2]

- (ii) iron is a suitable material for the core of an electromagnet.

.....

 [2]

(b) Fig. 7.1 shows the electromagnet inside a second solenoid Y.

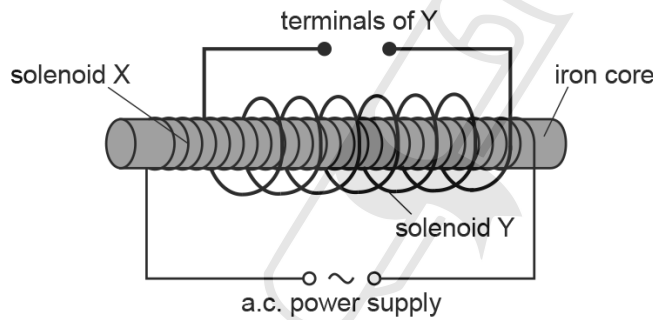


Fig. 7.1

- (i) Describe and explain what happens in solenoid Y when solenoid X is connected to an alternating current (a.c.) power supply.

.....

 [3]

- (ii) A switch and a lamp are connected in series with the terminals of solenoid Y. When the switch is closed, the lamp lights up at normal brightness.

Describe and explain what happens to the current in solenoid X when the switch is closed.

.....

 [2]

[Total: 9]

22. 0625_s20_qp_42 Q: 7

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

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

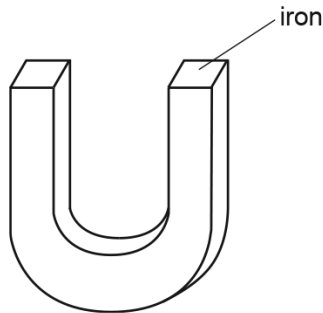


Fig. 7.1

- (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.

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current = [2]

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

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

.....
 [2]

[Total: 9]

4.5. ELECTROMAGNETIC EFFECTS

23. 0625_s20_qp_43 Q: 9

Fig. 9.1 shows a simple direct current (d.c.) electric motor. The coil rotates about the axis when there is a current in the coil. The coil is connected to the rest of the circuit by the brushes.

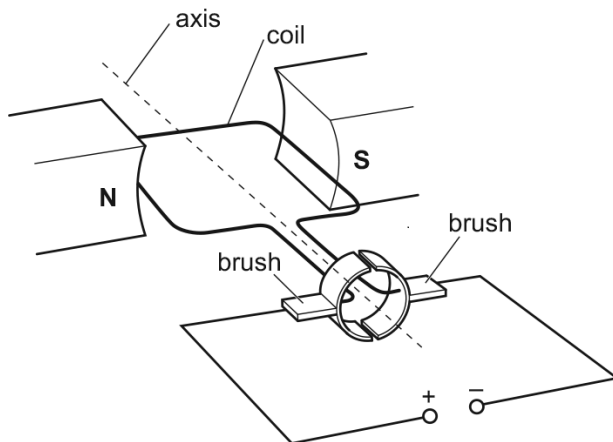


Fig. 9.1

- (a) (i) On Fig. 9.1, draw a pair of arrows to show which way the coil rotates. Explain the direction you have chosen.

.....

 [3]

- (ii) On Fig. 9.1, draw an arrow to show the direction in which electrons flow through the coil. [1]

- (iii) Explain why the electrons flow in the direction you have shown in (a)(ii).

.....
 [1]

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(b) State any difference each of the following changes makes to the rotation of the coil in Fig. 9.1:

(i) changing the polarity of the power supply to that shown in Fig. 9.2

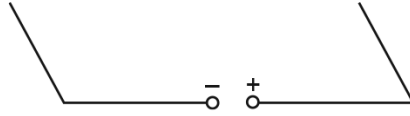


Fig. 9.2

..... [1]

(ii) changing the coil to the new coil shown in Fig. 9.3



Fig. 9.3

..... [1]

(iii) using a stronger magnetic field.

..... [1]

[Total: 8]

4.5. ELECTROMAGNETIC EFFECTS

24. 0625_w20_qp_41 Q:7

(a) A permanent magnet is made from only one material.

Underline the material from which it is possible to make a permanent magnet. [1]

aluminium copper soft iron mercury plastic steel uranium

(b) An electron source produces a narrow beam of electrons that all travel at the same speed.

The electron source is placed in a vacuum and the beam of electrons travels vertically downwards. Fig. 7.1 shows the beam of electrons before it passes between the N-pole and the S-pole of a magnet.

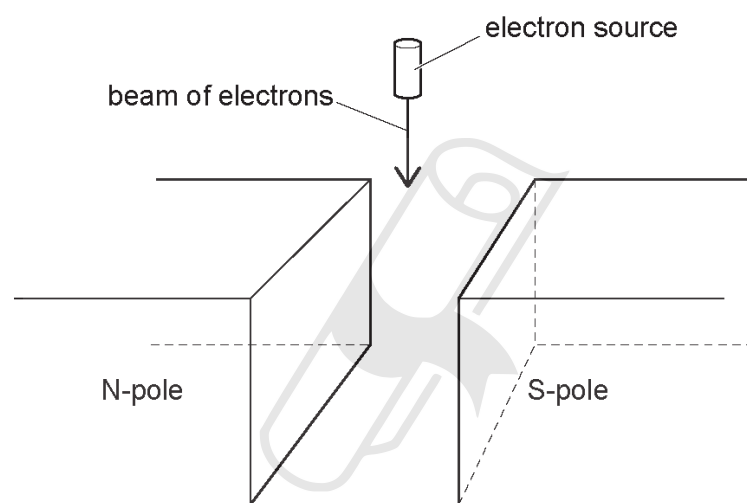


Fig. 7.1

(i) Describe what is meant by the direction of a magnetic field. State the direction of the magnetic field between the two poles in Fig. 7.1.

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

- (ii) Describe and explain what happens to the beam of electrons in the magnetic field between the poles of the magnet in Fig. 7.1.

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

- (c) A beam consists of α -particles, β -particles and γ -rays.

Explain how a uniform magnetic field may be used to separate the α -particles, the β -particles and the γ -rays.

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



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4.5. ELECTROMAGNETIC EFFECTS

25. 0625_w20_qp_42 Q: 9

(a) Fig. 9.1 shows a bar magnet and four plotting compasses A, B, C and D.

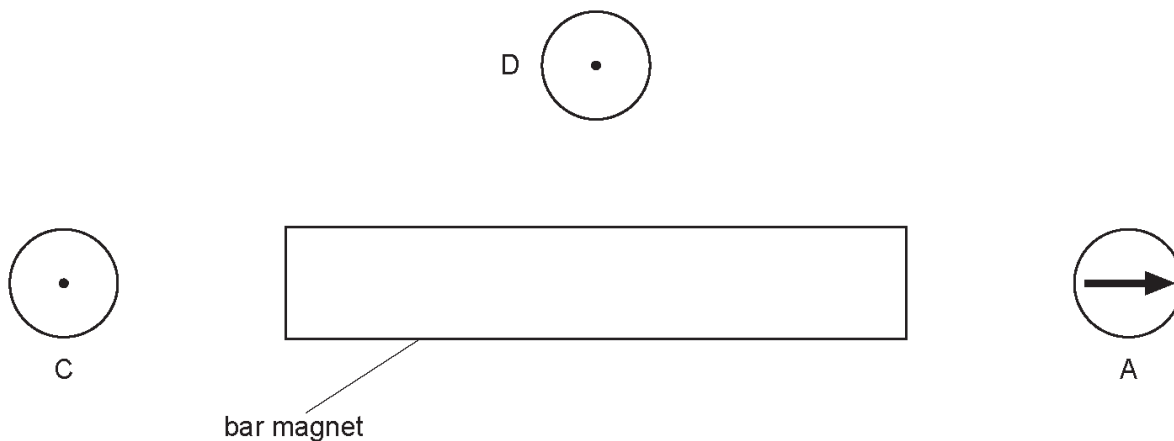


Fig. 9.1

On Fig. 9.1:

- (i) draw an arrow on each of the three plotting compasses B, C and D to show the direction of the magnetic field [2]
- (ii) label the magnetic poles of the bar magnet N and S. [1]

(b) Describe **one** method for demagnetising a bar magnet.

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..... [2]

- (c) Fig. 9.2 represents a current in a wire. The current is into the plane of the paper.
- (i) Draw the pattern of the magnetic field produced around the wire. Show clearly the direction of the magnetic field.



Fig. 9.2

[2]

- (ii) The direction of the current in the wire is reversed. The magnitude of the current is unchanged.

State the effect that reversing the current has on the magnetic field produced.

.....

..... [1]

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4.5. ELECTROMAGNETIC EFFECTS

26. 0625_w20_qp_43 Q: 9

- (a) Electrical power is produced in a power station by an alternating current (a.c.) generator. The output of the generator has a voltage of 22 000 V. The electrical power is transmitted at a voltage of 400 000 V.

Explain why electrical power is transmitted at a voltage of 400 000 V and not 22 000 V.

.....

.....

.....

.....

.....

.....

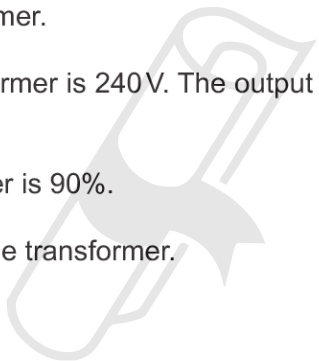
..... [3]

- (b) A computer contains a transformer.

The input voltage to the transformer is 240 V. The output voltage from the transformer is 20 V and the output current is 2.3 A.

The efficiency of the transformer is 90%.

Calculate the input current to the transformer.



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current = [5]

27. 0625_w20_qp_43 Q: 10

Fig. 10.1 shows a relay.

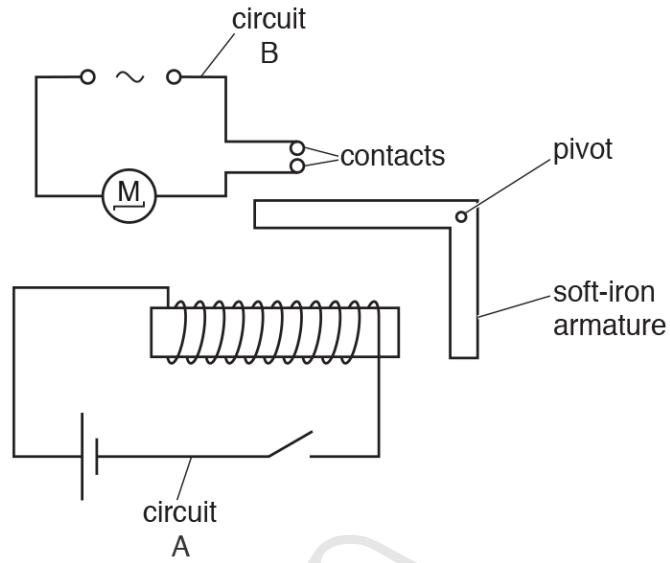


Fig. 10.1

- (a) The switch in circuit A is closed. Describe how this operates the motor in circuit B.

.....

.....

.....

..... [3]

- (b) The switch in circuit A is opened. The soft-iron armature is replaced with a steel armature. The switch in circuit A is closed.

Explain what happens when the switch in circuit A is then opened.

.....

.....

..... [2]

4.5. ELECTROMAGNETIC EFFECTS

28. 0625_m19_qp_42 Q: 10

- (a) The electrical energy produced by a power station is transmitted over long distances at a very high voltage.

Explain why a very high voltage is used.

.....

.....

.....

.....

.....

.....

..... [3]

- (b) Fig. 10.1 represents a transformer.

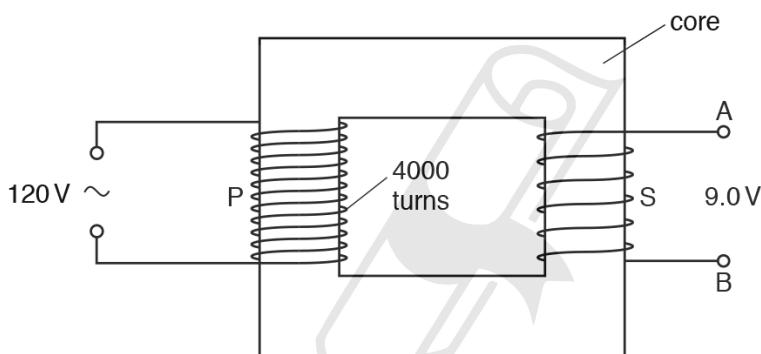


Fig. 10.1

- (i) The primary coil P has 4000 turns and an input of 120V. The secondary coil S has an output of 9.0V.

Calculate the number of turns in the secondary coil.

number = [2]

- (ii) State a suitable material for the core of the transformer.

..... [1]

[Total: 6]

29. 0625_s19_qp_41 Q: 8

A student turns the handle of an alternating current (a.c.) generator and the coil rotates.

Fig. 8.1 represents the structure of the a.c. generator.

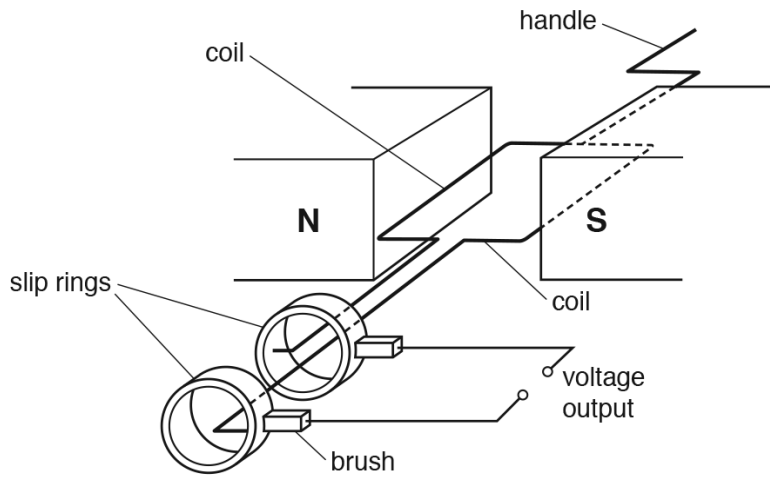


Fig. 8.1

(a) There is an alternating voltage output between the two terminals.

(i) Explain why rotating the coil produces an output voltage.

.....

 [3]

(ii) State the position of the rotating coil when the alternating output voltage is at a maximum value and explain why the maximum output occurs at this position.

.....

 [2]

4.5. *ELECTROMAGNETIC EFFECTS*

- (b) A lamp and an open switch are connected in series to the output terminals of the a.c. generator.

The switch is closed and the lamp lights up. The student has to apply a greater force on the handle.

Explain why a greater force is needed to keep the lamp lit.

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

[Total: 8]



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30. 0625_s19_qp_42 Q: 9

(a) Describe how to demagnetise a bar magnet using alternating current (a.c.) in a coil.

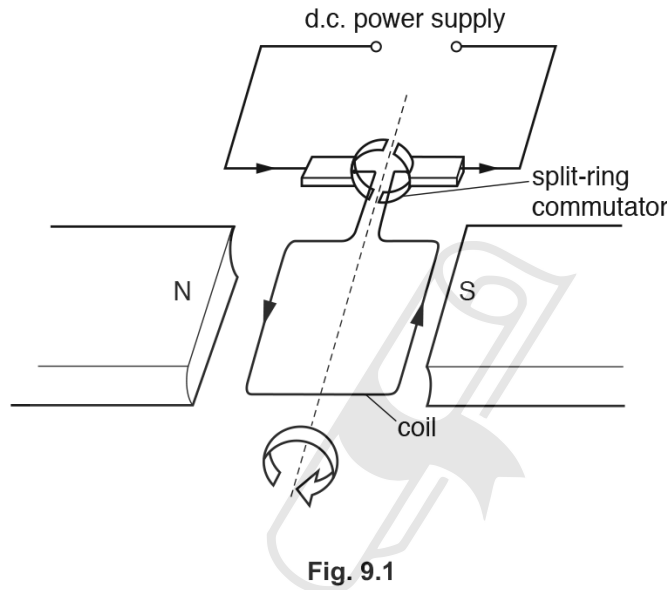
.....

.....

.....

..... [3]

(b) Fig. 9.1 shows a simple direct current (d.c.) motor.



(i) Explain the purpose of the split-ring commutator.

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.....

.....

..... [3]

(ii) The voltage of the power supply is increased.

State the effect this has on the motor.

..... [1]

[Total: 7]

4.5. ELECTROMAGNETIC EFFECTS

31. 0625_s19_qp_43 Q: 10

Fig. 10.1 shows a simple alternating current generator.

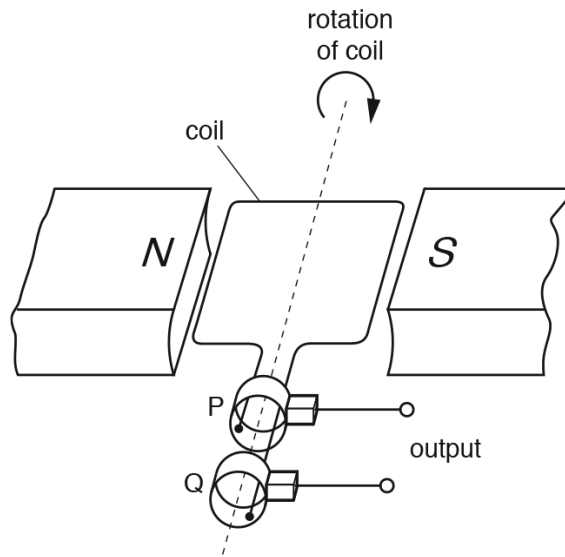


Fig. 10.1

- (a) On Fig. 10.2, sketch a graph to show how the electromotive force (e.m.f.) induced varies with time for one revolution of the coil. Assume that the coil starts in the horizontal position, as shown in Fig. 10.1. Label the points on the time axis where the coil has completed 1/4 revolution and 3/4 revolution. [3]



Fig. 10.2

- (b) Explain why an e.m.f. is induced only when the coil is turning.

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

(c) State the name of the components labelled P and Q and state their purpose.

Name:

Purpose:

..... [2]

(d) State **two** possible changes that cause a larger e.m.f. to be induced.

1.

2.

[2]

[Total: 8]



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4.5. ELECTROMAGNETIC EFFECTS

32. 0625_w19_qp_42 Q:7

(a) Fig. 7.1 shows a coil of wire wound on a thin plastic cylinder. The plastic has no effect on any magnetic field. The galvanometer is extremely sensitive.

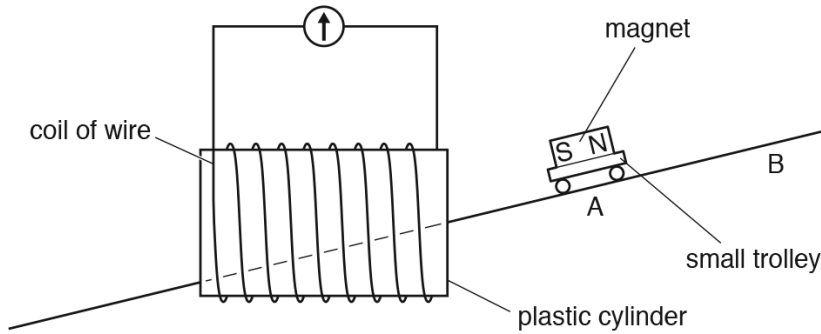


Fig. 7.1

A magnet is fixed to a small trolley that runs without friction on a track through the cylinder and coil.

(i) The trolley is released from point A so it runs through the coil from right to left.

State and explain what is observed on the galvanometer.

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

(ii) The trolley is now released from point B so it runs through the coil from right to left again.

State what is observed on the galvanometer and explain why it is different to your answer in (a)(i).

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

(b) Fig. 7.2 shows an extension lead used to supply power to a 3 kW electric heater on a cool evening.

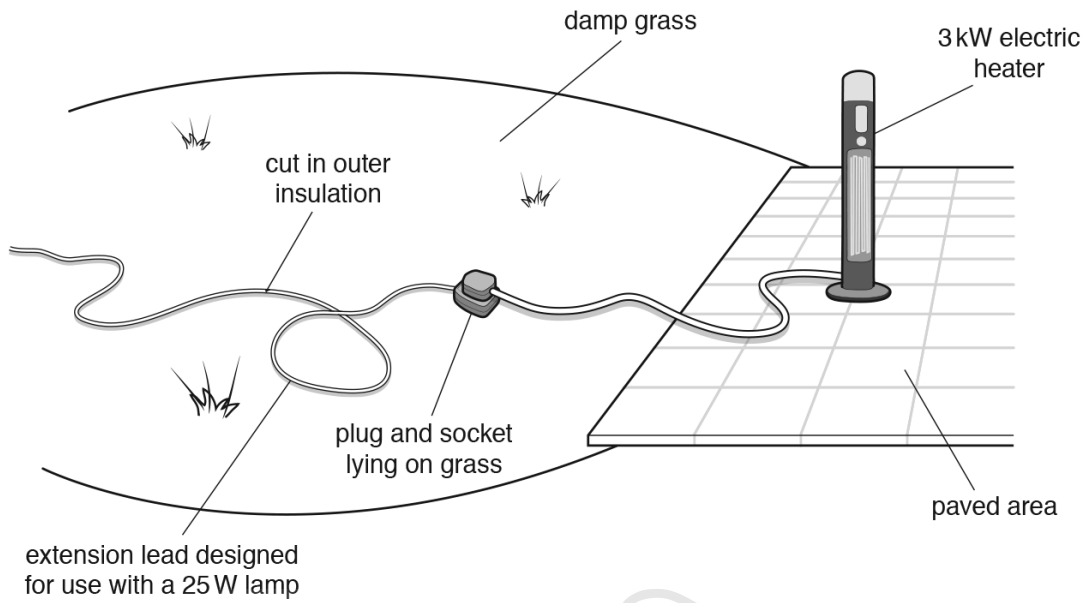


Fig. 7.2

State and explain three dangers with this arrangement.

- danger 1
-
-
- danger 2
-
-
- danger 3
-
-

[4]

[Total: 8]

4.5. ELECTROMAGNETIC EFFECTS

33. 0625_w19_qp_43 Q:10

- (a) A magnet and a coil are attached separately to a door and a door frame as shown in Fig. 10.1.

The purpose of the arrangement is to activate a circuit connected to an LED indicator when the door is opening or closing. This will provide a visual indication that the door is being used.

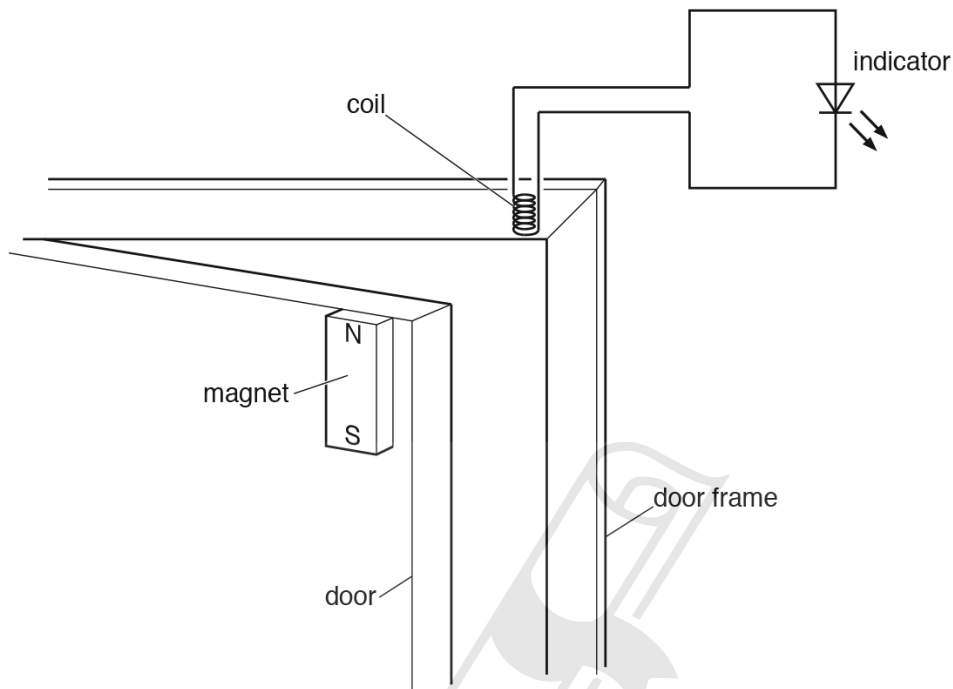


Fig. 10.1

Initially, the door is closed and then it is opened.

- (i) Explain why the indicator comes on and then goes off when the door is opened.

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

- (ii) The door shuts. The indicator comes on more brightly but for a shorter time than it did in (i). Suggest and explain why this happens.

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

(b) A circuit breaker is recommended for use with an electric lawnmower.

State **two** reasons for this recommendation.

reason 1.....

.....

reason 2.....

.....

[2]

[Total: 6]



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4.5. ELECTROMAGNETIC EFFECTS

34. 0625_m18_qp_42 Q:10

- (a) 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.

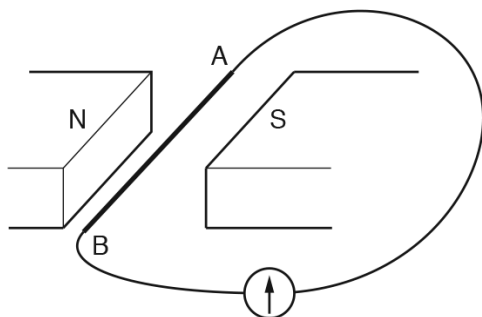


Fig. 10.1

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

State **three** factors that affect the size of the deflection.

- 1
 - 2
 - 3
- [3]

- (b) Fig. 10.2 shows a transformer.

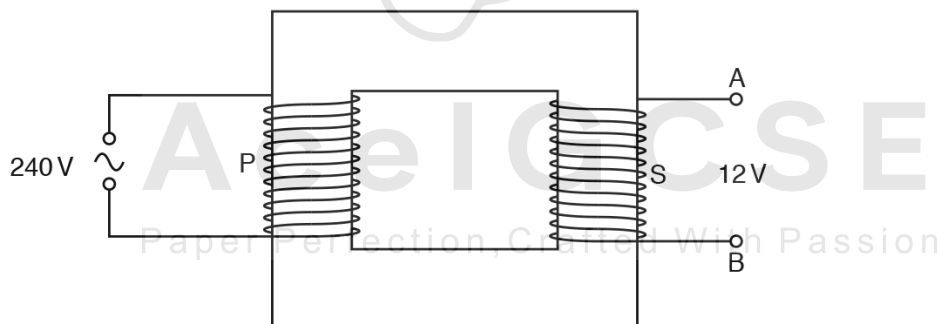


Fig. 10.2

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

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. 10.2, draw this circuit.

[1]

[Total: 6]



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4.5. ELECTROMAGNETIC EFFECTS

35. 0625_s18_qp_41 Q: 9

(a) A student wants to demagnetise a permanent bar magnet. She suggests these steps:

1. Place the magnet in a long coil.
2. Switch on a large alternating current in the coil.
3. Switch off the current.
4. Remove the bar from the coil.

State and explain whether the steps will always be able to demagnetise the magnet.

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

(b) (i) Fig. 9.1 shows a coil supplied with current using a split-ring commutator.

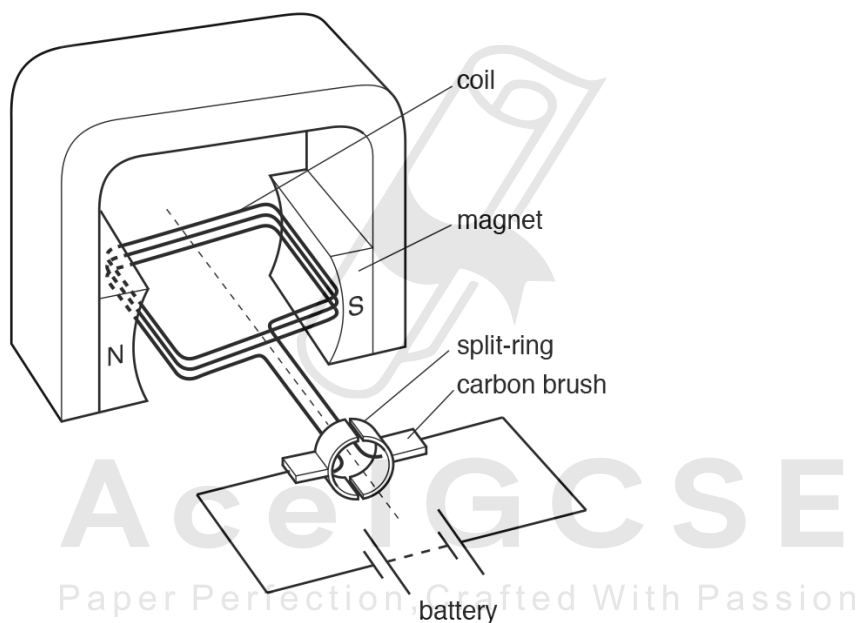


Fig. 9.1

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 2.0A 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]

[Total: 9]

4.5. ELECTROMAGNETIC EFFECTS

36. 0625_s18_qp_41 Q: 10

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

.....

.....

.....

.....[2]

(b) Fig. 10.1 shows a transformer.

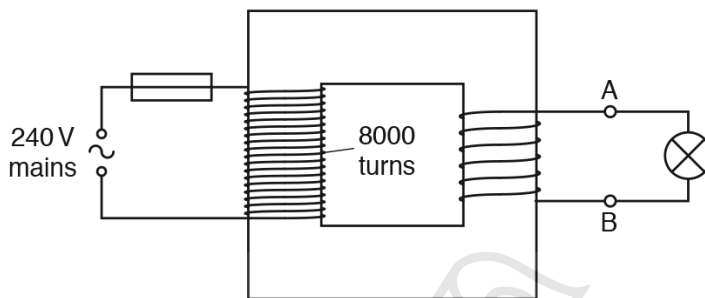


Fig. 10.1

There are 8000 turns in the primary coil of the transformer. The primary coil is connected to a 240V mains supply. A 6.0V 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 2A 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]

[Total: 7]

37. 0625_s18_qp_42 Q: 9

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

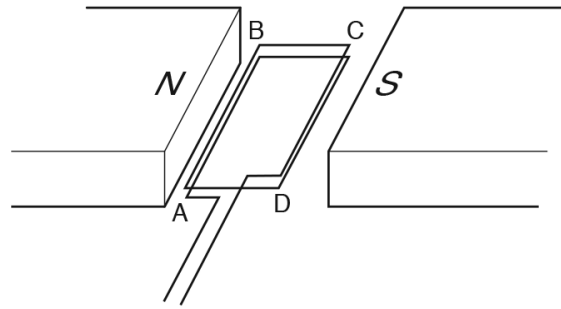


Fig. 9.1

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 3A. 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]

4.5. ELECTROMAGNETIC EFFECTS

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

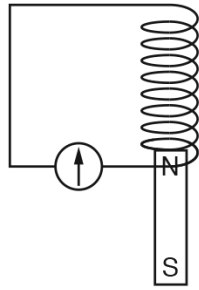


Fig. 9.2

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]

[Total: 8]

38. 0625_s18_qp_43 Q: 10

(a) A bar magnet is held with its N-pole just inside one end of a coil.

Fig. 10.1 shows the coil connected to a galvanometer that has the zero mark in the centre of the scale.

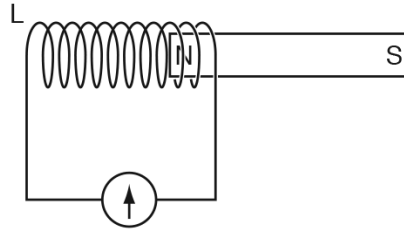


Fig. 10.1

The magnet is pulled horizontally to the right at a constant speed through a large distance.

(i) State what happens to the galvanometer reading as time passes.

.....

[2]

(ii) As the magnet moves, an N-pole is produced at the left-hand end L of the coil.

Explain why the pole at L is an N-pole.

.....

[2]

(b) A transformer has N_p turns on the primary coil and N_s turns on the secondary coil. The transformer is used in a school laboratory as a 12V alternating current (a.c.) supply. The transformer is powered from the 240V a.c. mains supply.

(i) Determine the turns ratio N_p/N_s of the transformer.

$N_p/N_s = \dots\dots\dots$ [2]

(ii) The laboratory 12V a.c. supply is rectified to produce a direct current (d.c.) supply.

Underline the component that the rectification circuit must include.

- AND gate diode NOT gate potentiometer thermistor

[1]

[Total: 7]

4.5. ELECTROMAGNETIC EFFECTS

39. 0625_w18_qp_41 Q: 10

A transformer consists of two coils of wire wound on a metal core. Fig. 10.1 represents the transformer.

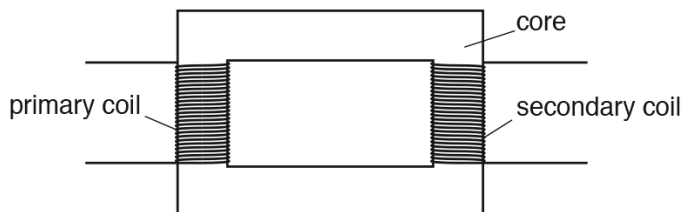


Fig. 10.1

(a) State the name of the metal from which the core is made.

.....[1]

(b) The primary coil of the transformer is connected to the output voltage of an a.c. generator which supplies an alternating current.

(i) Explain why there is a voltage between the two terminals of the secondary coil.

.....

[3]

(ii) There are 560 turns on the primary coil and 910 turns on the secondary coil of the transformer. The voltage between the two terminals of the secondary coil is 78 V.

Calculate the voltage supplied by the a.c. generator.



generator voltage =[2]

(c) Transformers are used to increase the voltage when electrical energy is transmitted in cables across long distances.

Explain why power losses in the cables are lower when the voltage is high.

.....

[2]

[Total: 8]

40. 0625_w18_qp_42 Q: 9

Fig. 9.1 shows a permanent bar magnet next to a circuit that contains a coil and a galvanometer.

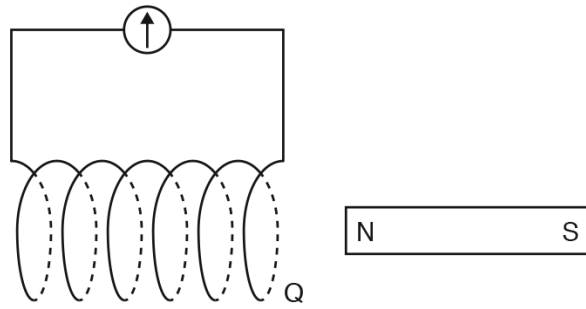


Fig. 9.1

(a) Suggest a metal from which the magnet is made.

.....[1]

(b) The magnet is moved to the left and inserted a small distance into the coil. The galvanometer deflects briefly and shows that there is a current in the coil.

(i) Explain why there is a current in the coil.

.....

[2]

(ii) As the magnet is moving near to the coil, end Q of the coil behaves as a magnetic pole. State the polarity of end Q and explain why it has this polarity.

.....
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[2]

(c) Suggest **two** ways in which the deflection of the galvanometer can be reversed.

1.

 2.

[2]

[Total: 7]

4.5. ELECTROMAGNETIC EFFECTS

41. 0625_w18_qp_43 Q:9

(a) Describe how a direct current (d.c.) differs from an alternating current (a.c.).

.....
[1]

(b) Fig. 9.1 shows how the voltage output of an a.c. generator varies with time.

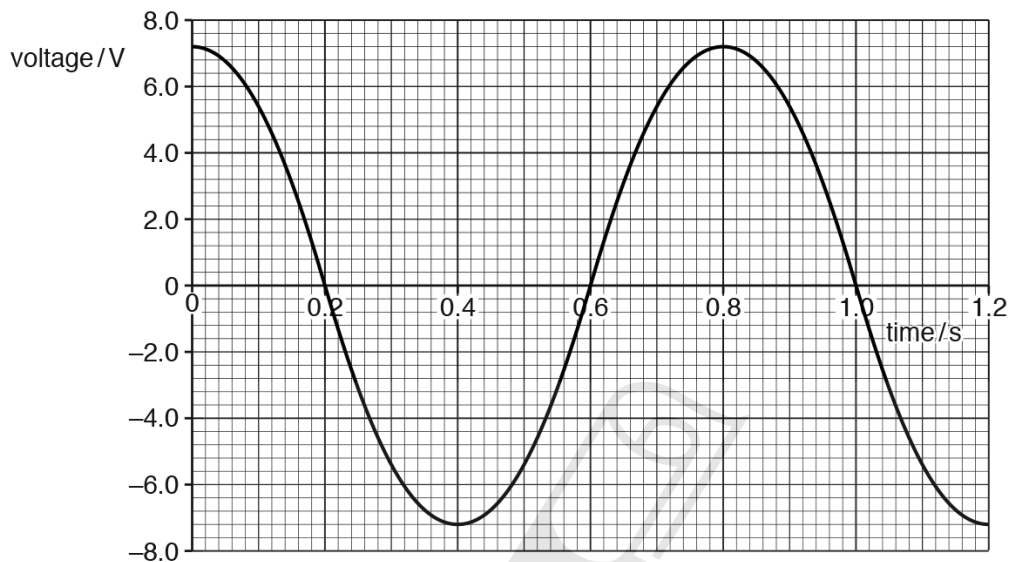


Fig. 9.1

A heater is connected directly to the a.c. generator and the maximum current in the heater is 0.75A.

(i) On Fig. 9.2, sketch a graph to indicate how the current in the heater varies with time.

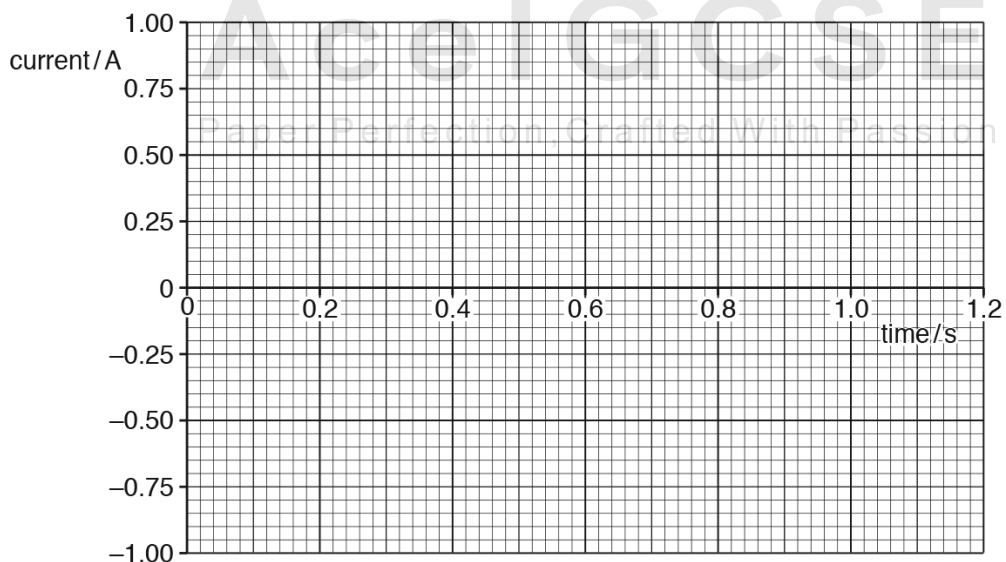


Fig. 9.2

[1]

4.5. ELECTROMAGNETIC EFFECTS

42. 0625_m17_qp_42 Q: 8

- (a) A transformer consists of two coils of wire wound on a core.
- (i) Suggest the material from which the two coils are made. State the reason for using this material.
- material
- reason [2]
- (ii) Suggest the material from which the core is made. State the reason for using this material.
- material
- reason [2]

(b) Fig. 8.1 represents the system of transmission of electrical energy from a power station to a home that is a long distance away.

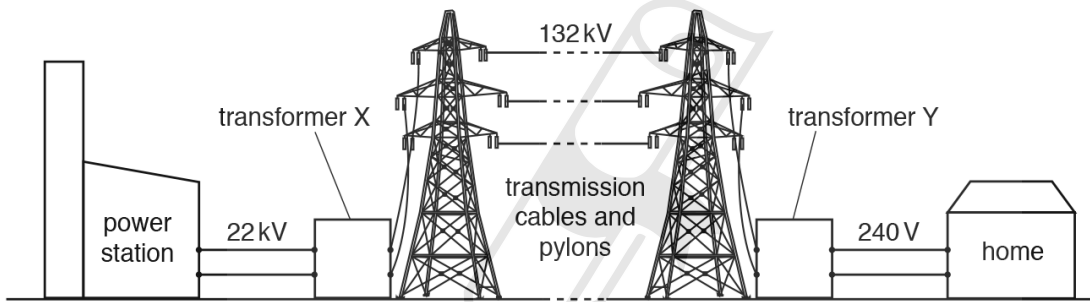


Fig. 8.1

- (i) State the difference between transformer X and transformer Y.
- [1]
- (ii) Explain why a very high voltage is used for transmission over large distances.
-
-
- [3]
- (iii) Suggest why the voltage for use by a home consumer is 240V, and not a much higher value.
-
- [1]

[Total: 9]

43. 0625_s17_qp_41 Q: 8

A bar magnet is made of metal.

(a) Suggest a metal from which the bar magnet is made.

.....[1]

(b) Fig. 8.1 shows the bar magnet being inserted into a coil of wire. The N-pole and the S-pole of the bar magnet are marked.

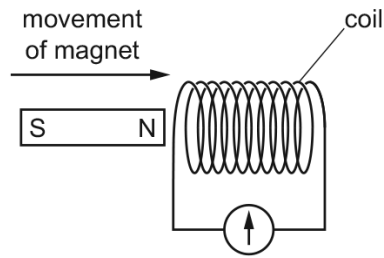


Fig. 8.1

The coil is connected to a galvanometer.

(i) Explain why the galvanometer deflects as the bar magnet is being inserted into the coil.

.....

[3]

(ii) Explain what determines the direction of the reading on the galvanometer.

.....

[2]

(c) Describe a method for demagnetising a bar magnet.

.....

[2]

[Total: 8]

4.5. ELECTROMAGNETIC EFFECTS

44. 0625_s17_qp_42 Q: 9

Fig. 9.1 shows a horizontal wire PQ placed in the gap between the N pole and the S pole of a magnet.

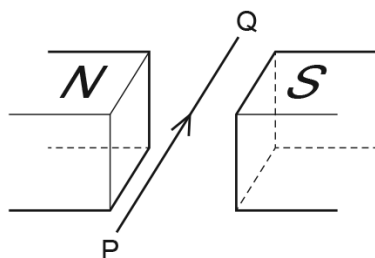


Fig. 9.1

There is a current in the wire in the direction P to Q.
A force acts on the current-carrying wire in the magnetic field.

- (a) On Fig. 9.1, draw
- (i) an arrow, labelled M to show the direction of the magnetic field in the gap between the poles of the magnet, [1]
 - (ii) an arrow, labelled F to show the direction of the force on the current-carrying wire due to the magnetic field of the magnet. [1]
- (b) State the effect of reversing the direction of the current in wire PQ.
.....[1]
- (c) The magnet is removed and the horizontal, current-carrying wire is left on its own, as shown in Fig. 9.2.



Fig. 9.2

- (i) On Fig. 9.2, sketch the pattern of the magnetic field due to the current in the wire. Indicate the field direction. [3]
- (ii) The current in PQ is **increased**.
State the effect of this change in current on the magnetic field.
.....[1]

- (d) A small magnet is placed at a point where the magnetic field is vertically upwards. State the direction of the force on the S pole of the small magnet.

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

[Total: 8]



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4.5. ELECTROMAGNETIC EFFECTS

45. 0625_s17_qp_43 Q: 10

Fig. 10.1 shows a transformer that consists of two coils P and Q, and an iron core.

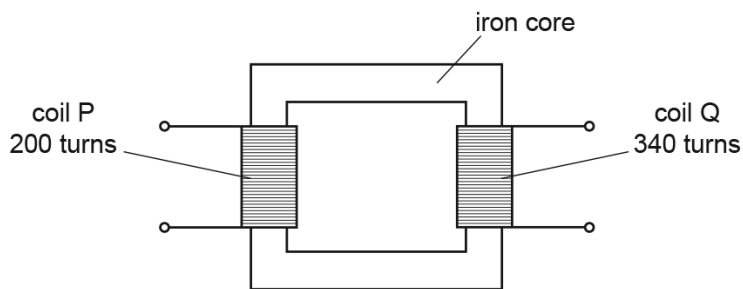


Fig. 10.1

There are 200 turns on coil P and 340 turns on coil Q.

A 4.0V a.c. power supply is connected to coil P.

(a) (i) Explain why there is a voltage between the two terminals of coil Q.

.....

 [3]

(ii) Explain why the core of the transformer is made of soft iron.

.....
 [1]

(b) (i) Calculate the voltage between the two terminals of coil Q.

voltage = [2]

- (ii) A heater is connected to coil Q. The current in the heater is 3.5A. The transformer is 100% efficient.

Calculate the current in coil P.

current =[2]

- (c) A transformer is used to step up the voltage before electrical energy is transmitted over long distances.

State and explain **one** economic effect of transmitting electrical energy at a high voltage.

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

[Total: 10]



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4.5. ELECTROMAGNETIC EFFECTS

46. 0625_w17_qp_41 Q: 10

(a) (i) Draw the circuit symbol for a diode.

[1]

(ii) State the function of a diode.

.....[1]

(b) Fig. 10.1 shows the proposed system for charging the battery of an electric toothbrush.

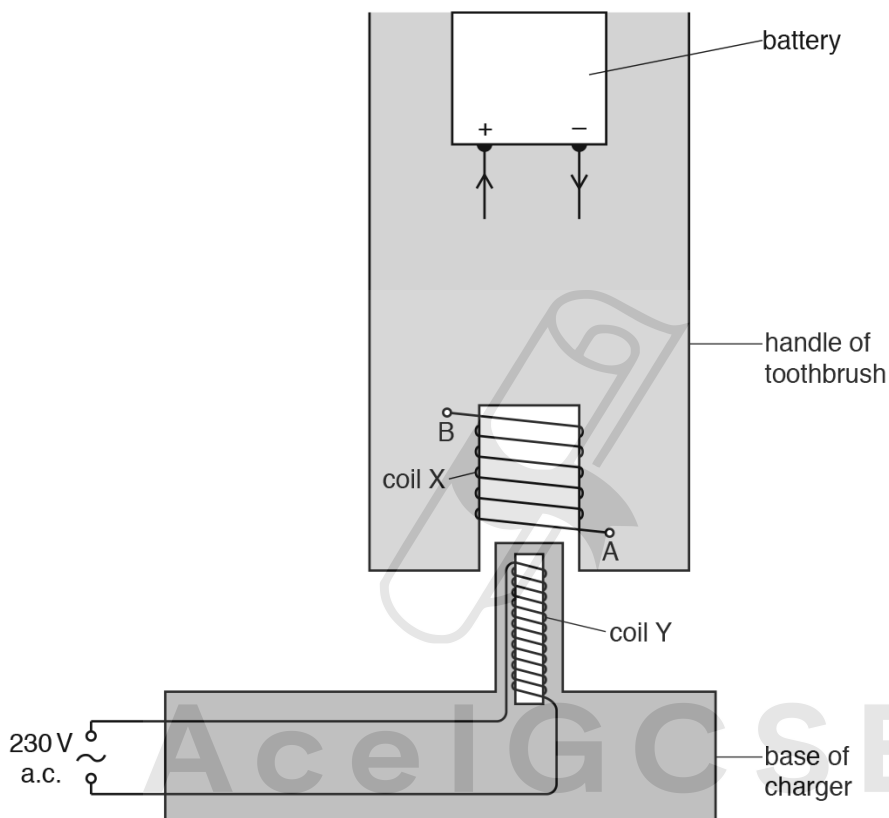


Fig. 10.1

The handle of the brush contains the battery and a coil X. The circuit from coil X to the battery is not shown.

The base of the charger contains a coil Y, wound on an iron core, connected to the a.c. mains supply.

To charge the battery, the handle is lowered so that coil Y is inside coil X.

Fig. 10.1 shows the direction needed for the charging current at the battery.

4.5. ELECTROMAGNETIC EFFECTS

(b) Fig. 10.2 shows an electric door lock.

The slot in the door contains an unmagnetised iron bolt attached to a spring. The slot in the door frame is empty. This slot is surrounded by the coils of a solenoid.

In Fig. 10.2 the door is unlocked. The spring is not stretched.

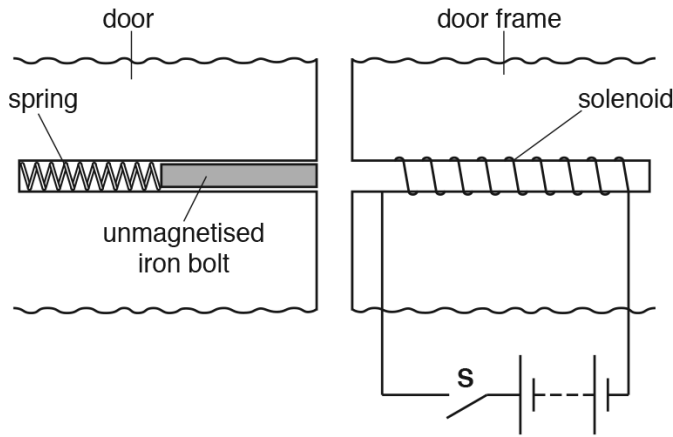


Fig. 10.2

In Fig. 10.3 the door is locked. The spring is now stretched.

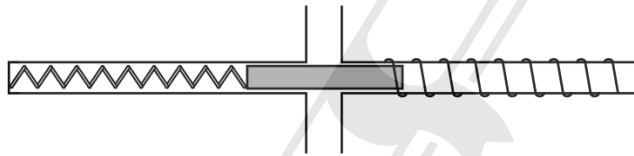


Fig. 10.3

The bolt is initially in the position shown in Fig. 10.2.

Describe and explain what happens when

(i) the switch **S** is closed,

.....
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 [4]

(ii) the switch **S** is reopened.

.....

 [2]

[Total: 8]

48. 0625_w17_qp_43 Q: 9

(a) Fig. 9.1 shows the structure of an alternating current (a.c.) generator.

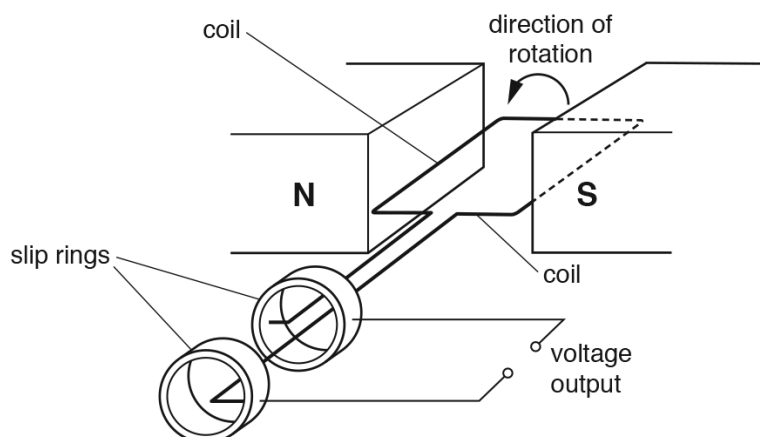


Fig. 9.1

The coil completes one rotation every 0.020 s.

- (i) Using the axes in Fig. 9.2, sketch a graph to show how the voltage output of the generator varies with time during a period of 0.040 s. [2]



Fig. 9.2

- (ii) On your graph in Fig. 9.2, mark a point labelled A to indicate a time when the coil is vertical. [1]

4.5. ELECTROMAGNETIC EFFECTS

- (b) There is an alternating current (a.c.) in a horizontal wire that is buried in a wall. A builder must miss this wire when drilling a hole in the wall.

The builder places an instrument against the wall that registers a reading when it is close to the wire. The instrument includes a long coil (solenoid) S that has an iron core and a sensitive voltmeter. Fig. 9.3 shows the circuit of the instrument close to the wire.

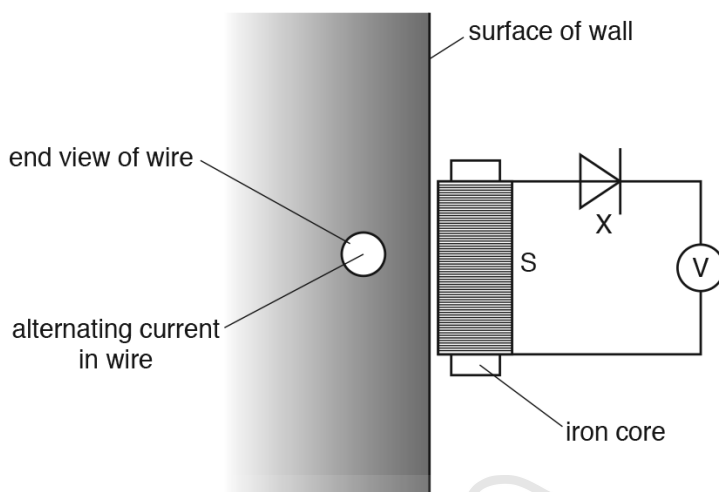


Fig. 9.3

- (i) Explain why there is a reading on the voltmeter.

.....

 [3]

- (ii) State the name and the effect of the component labelled X in Fig. 9.3.

.....

 [2]

[Total: 8]



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