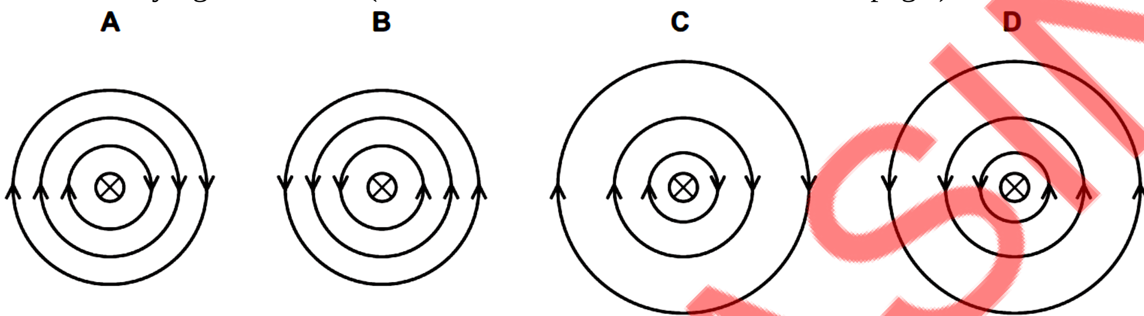
Chapter # 22

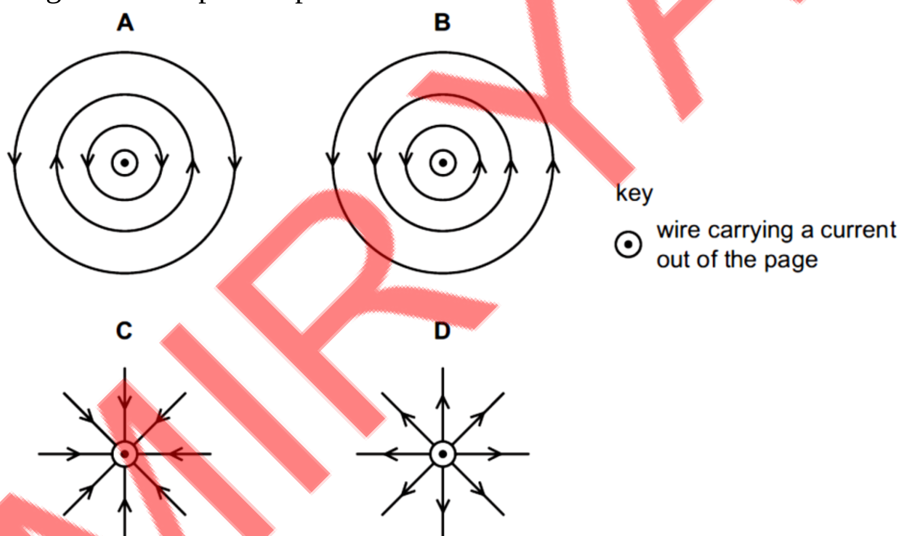
Electromagnetic Effects

Electromagnets/Magnetic Field Pattern

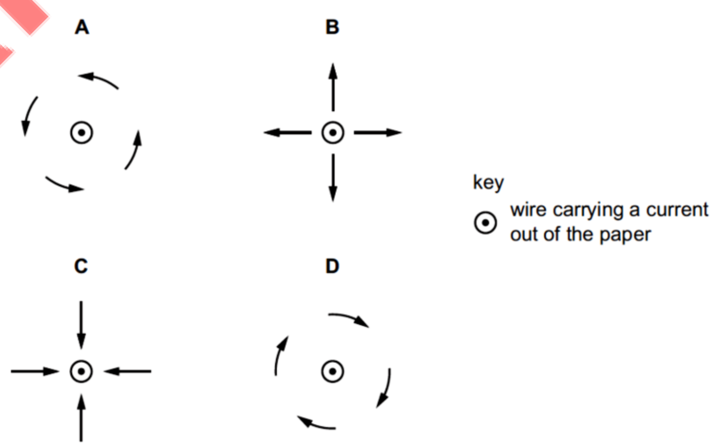
Q-1: Which diagram represents the strength and direction of the magnetic field around a current-carrying conductor? (The direction of the current is into the page.)



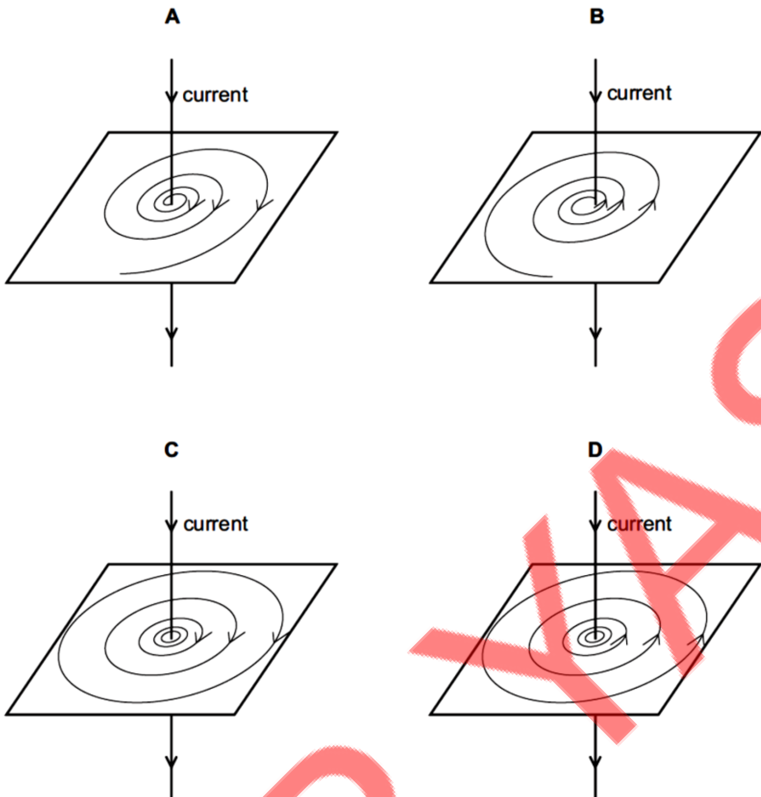
Q-2: There is a current in a wire. The direction of the current is out of the page. Which diagram shows the magnetic field pattern produced?



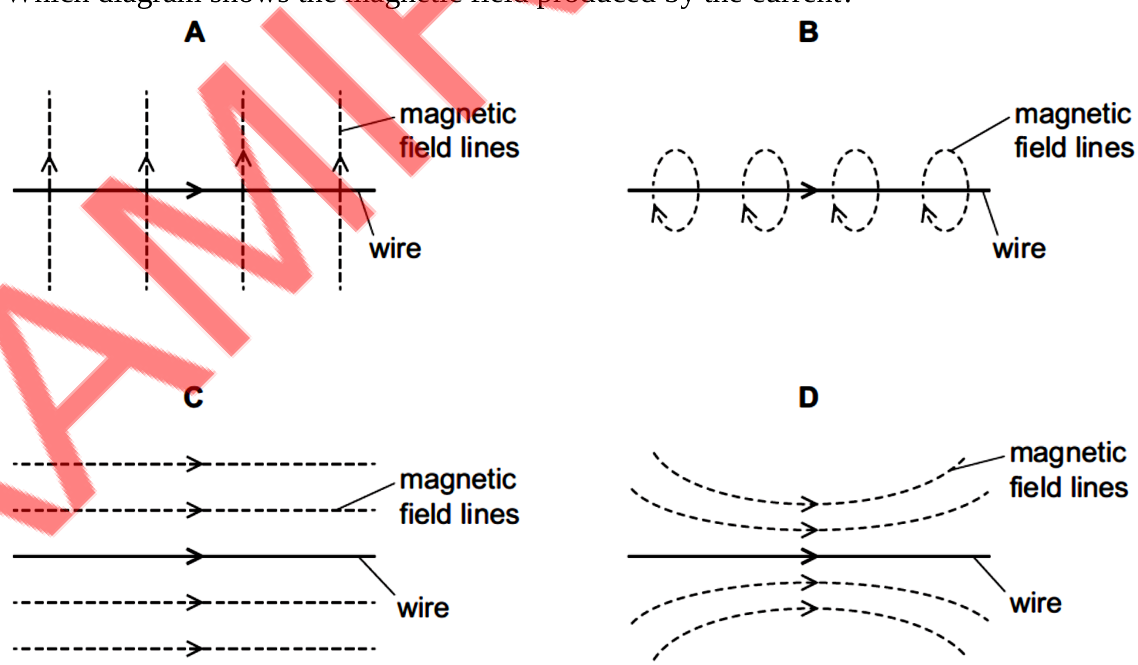
Q-3: The diagram shows a conductor carrying current in a direction out of the plane of the page. Which set of arrows represents the direction of the magnetic field due to this current?



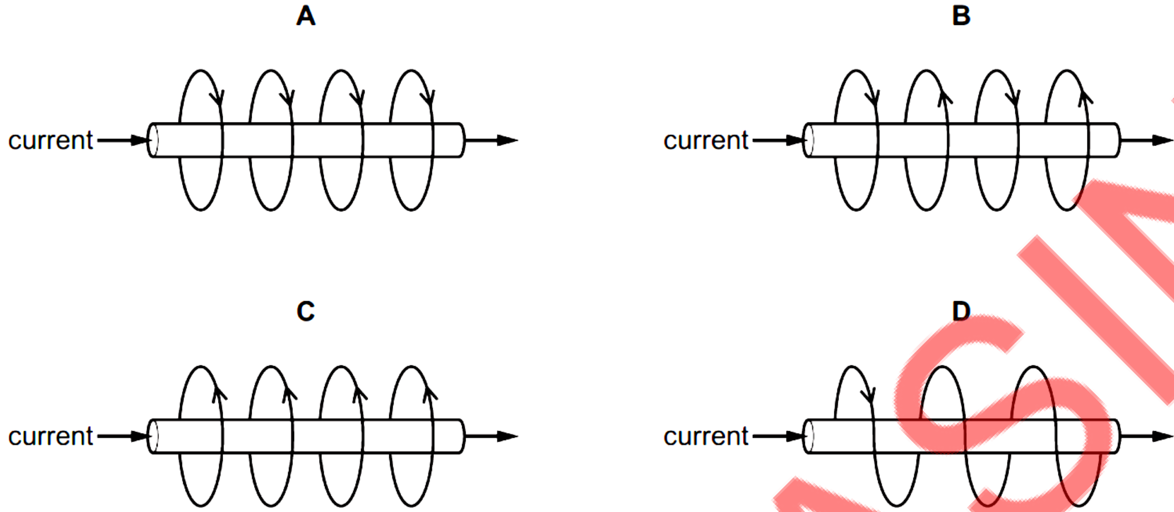
Q-4: Which diagram shows the pattern and direction of the magnetic field due to a current in a straight wire?



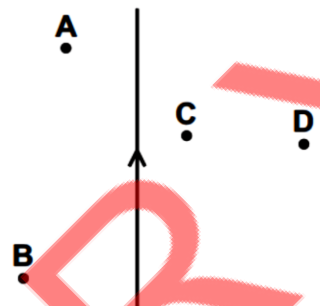
Q-5: The diagrams show a current-carrying wire with an arrow in the direction of the current. Which diagram shows the magnetic field produced by the current?



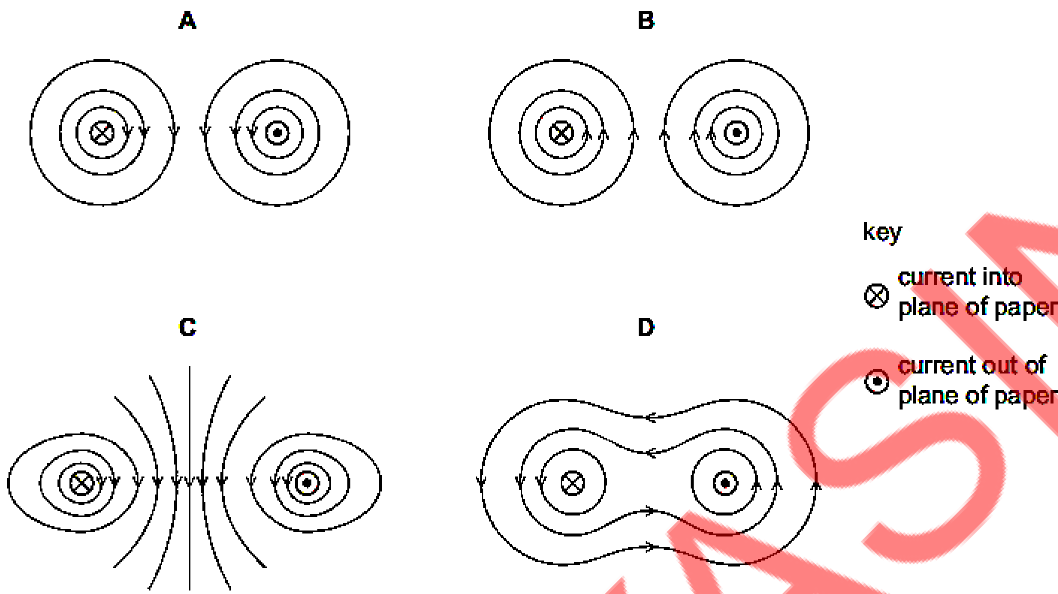
Q-6: Which diagram shows the magnetic field around a straight, current-carrying wire?



Q-7: The diagram shows part of a long current-carrying conductor. At which point is the magnetic field strongest?

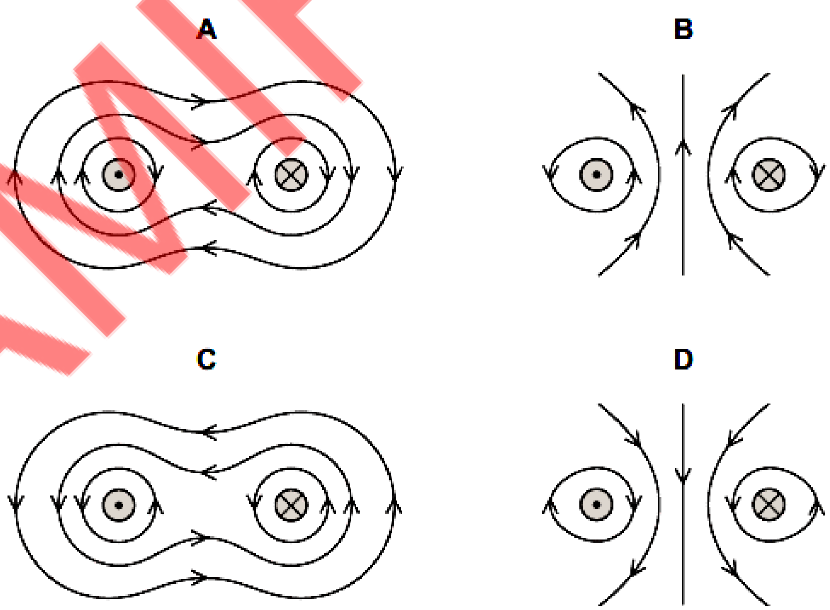


Q-8: Two straight electrical conductors are parallel to one another. Each carries a current, one into the plane of the paper and one out of the plane of the paper. Which diagram shows the magnetic field around the two wires?

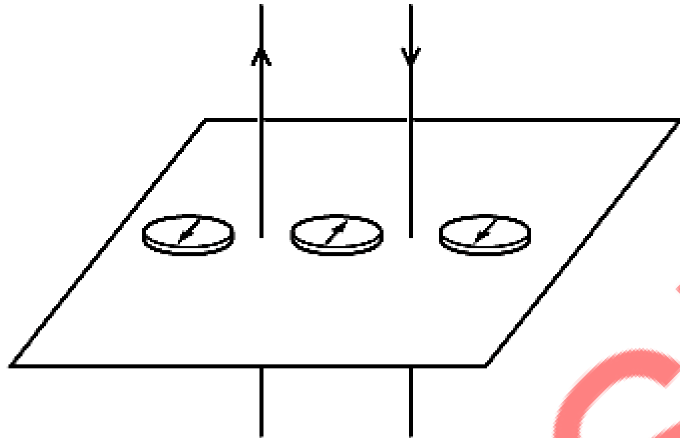


Q-9: Two long, straight wires hang vertically, close to each other. The wires carry currents in opposite directions

Which diagram shows the magnetic field pattern around the wires?



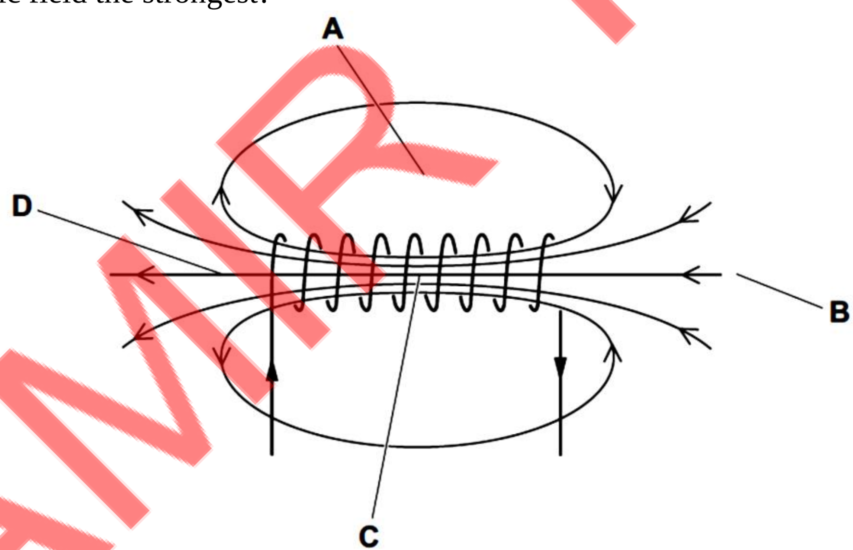
Q-10: Two parallel wires carry currents in opposite directions. Three plotting compasses are placed in the positions shown.



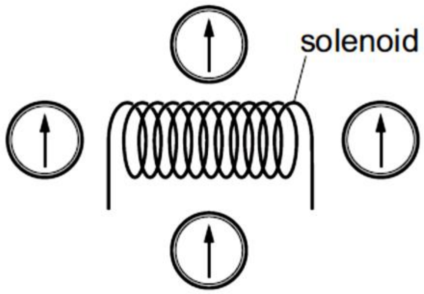
The currents in both wires are reversed. How many compass needles change direction? (Ignore the effect of the Earth's magnetic field.)

A 0 **B** 1 **C** 2 **D** 3

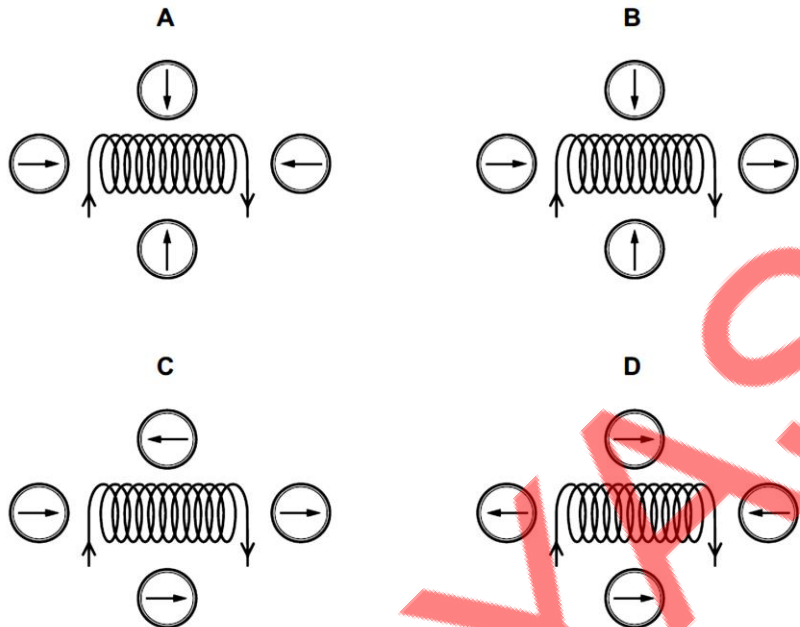
Q-11: The diagram shows the magnetic field due to a current in a solenoid. Where is the magnetic field the strongest?



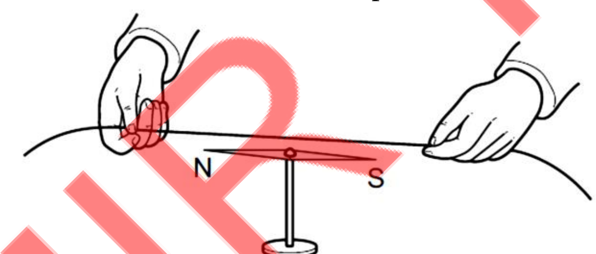
Q-12: Four small compasses are placed around a solenoid



A current is now switched on in the solenoid. Which diagram shows possible new directions of the compass needles?



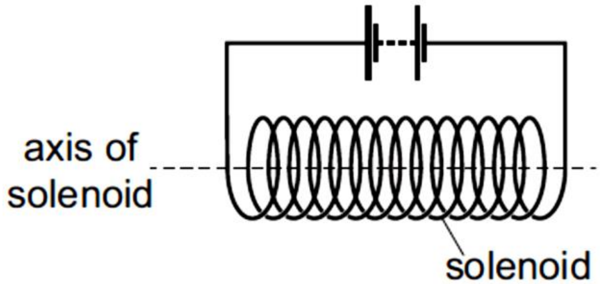
Q-13: In an experiment, a wire is held above a compass needle as shown.



An electric current is switched on in the wire and the compass needle is deflected. Which row explains why this happens and then describes what happens when the current is reversed?

	why this happens	what happens when the current is reversed
A	there is a magnetic field inside the wire	the compass needle deflects in the opposite direction
B	there is a magnetic field inside the wire	there is no effect on the compass needle
C	there is a magnetic field around the wire	the compass needle deflects in the opposite direction
D	there is a magnetic field around the wire	there is no effect on the compass needle

Q-14: A solenoid is connected to a battery.



Which statement about the magnetic field at the centre of the solenoid is correct?

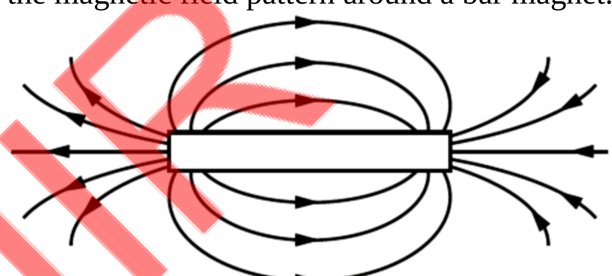
A The magnetic field along the axis is zero.

B The direction of the magnetic field is at an angle of 45° to the axis.

C The direction of the magnetic field is parallel to the axis.

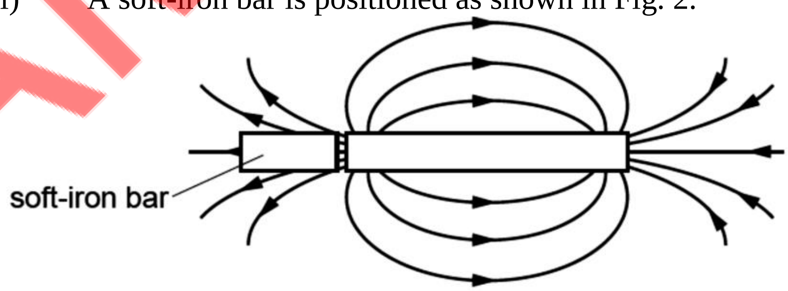
D The direction of the magnetic field is perpendicular to the axis.

Q-15: a) Fig. 1 shows the magnetic field pattern around a bar magnet.



i) On Fig. 1, label the north and south poles of the magnet, using the letters N and S.

ii) A soft-iron bar is positioned as shown in Fig. 2.

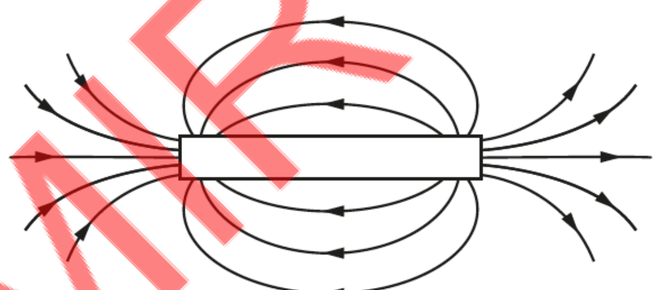


State and explain what happens to the soft-iron bar.

b) **i)** A plastic rod is rubbed with a cloth. The plastic rod becomes positively charged. Explain how the friction between the cloth and the rod causes the rod to become positively charged. Use your ideas about the movement of charge.

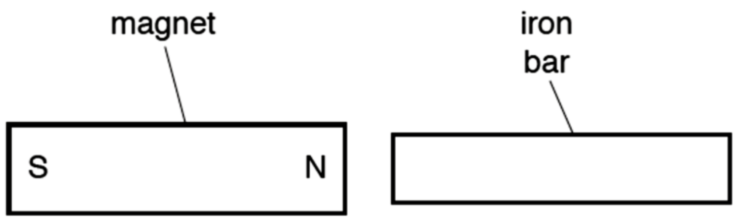
ii) Plastic is an electrical insulator. Iron is an electrical conductor. State **two** other materials that are electrical conductors.

Q-16: a) Fig. 1 shows the magnetic field pattern around a bar magnet.



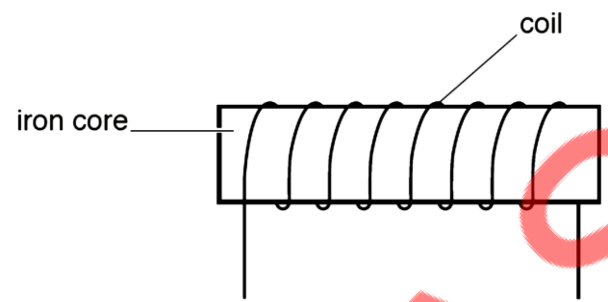
i) On Fig. 1, mark the North and South poles of the magnet. Use the letter N for the North pole and S for the South pole.

ii) A small bar of unmagnetised iron is placed next to a bar magnet, as shown in Fig. 2.



The iron bar moves towards the magnet. Explain why the iron bar moves.

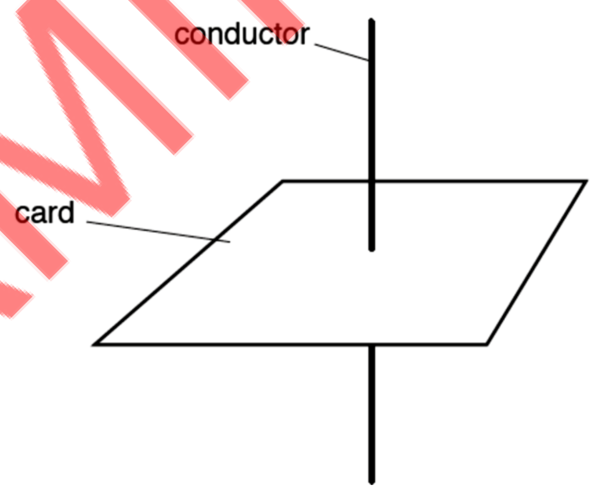
b) Fig. 8.3 shows a coil of wire wrapped around an iron core. A student uses these to make an electromagnet.



i) Complete the diagram in Fig. 3 to show how it could be used to make an electromagnet.

ii) State **one** advantage of an electromagnet compared to a permanent magnet.

Q-17: Fig. 1 shows a vertical conductor passing through a horizontal piece of card.



a) **i)** On Fig. 1, draw a cell and a switch in series with the conductor to form a complete circuit. Use the correct circuit symbols.

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.

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

b) 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.

Q-18: a) A long straight wire passes through a piece of card. There is a current in the wire, as shown in Fig. 1.

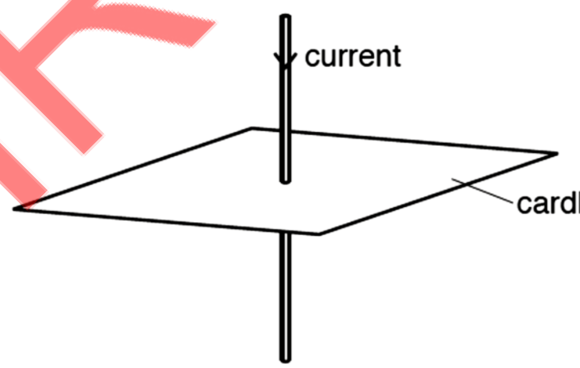
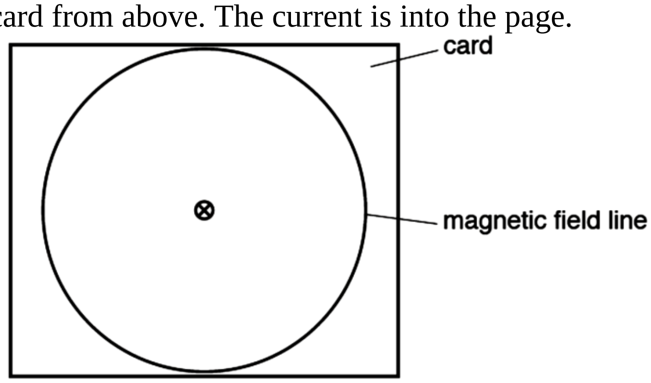
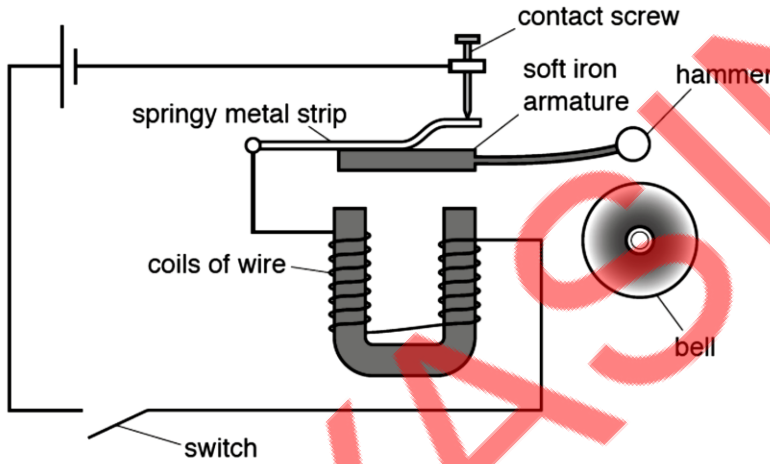


Fig. 2 shows the view of the card from above. The current is into the page.



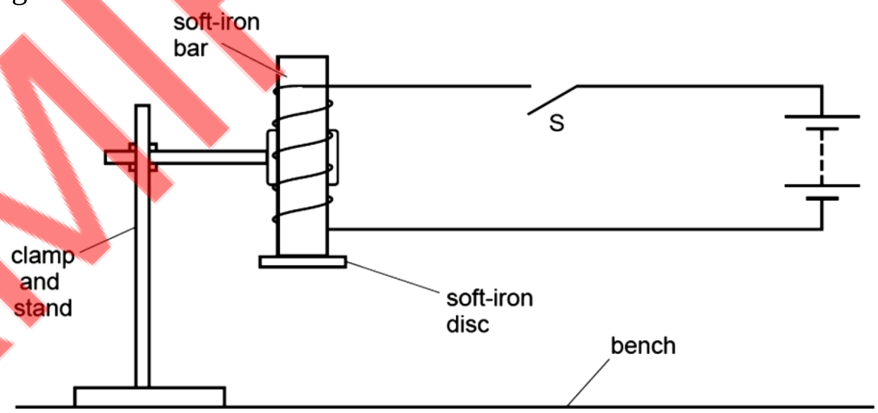
The current in the wire produces a magnetic field around the wire. One magnetic field line is drawn. On Fig. 2, draw **two** more magnetic field lines around the wire. Show the direction of the magnetic field by drawing an arrow on each field line.

b) Fig. 3 shows the circuit for an electric bell.



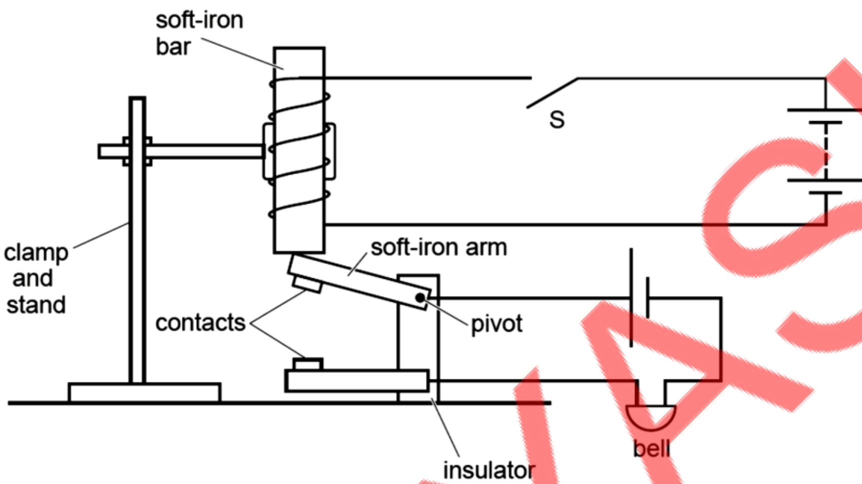
Explain how the circuit causes the hammer to hit the bell repeatedly when the switch is closed. Use your ideas about circuits and electromagnets.

Q-19: a) A clamp and stand hold a soft-iron bar above a bench. A coil of wire is wrapped round the soft-iron bar. The coil of wire is part of an electric circuit. Fig. 1 shows the arrangement.



Switch S is closed. A student holds a soft-iron disc close to the bar and releases the disc. The disc becomes attached to the bar as shown in Fig. 1. Explain why the soft-iron disc is attracted to the soft-iron bar.

b) The circuit in Fig. 1 is used to operate a bell in a different circuit, as shown in Fig. 2.

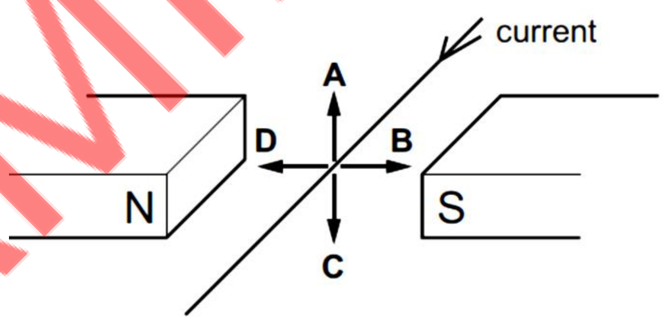


i) Switch S is closed. The soft-iron arm is attracted to the soft-iron bar. Explain why the bell operates when the switch S is opened.

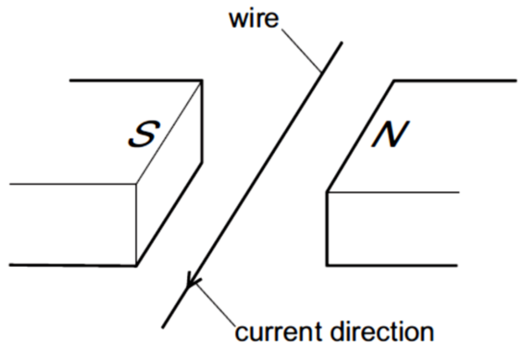
ii) The switch S is closed. The soft-iron arm is attracted to the soft-iron bar. The battery in the circuit containing the soft-iron bar becomes fully discharged. State and explain whether the bell operates.

Force on a current-carrying conductor placed in magnetic field

Q-20: A conductor carrying a current is placed in a magnetic field. In which direction does the force on the conductor act?



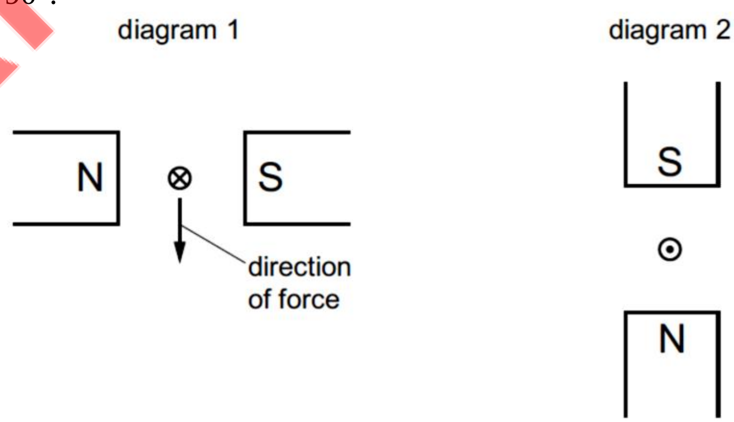
Q-21: The diagram shows a current-carrying wire placed between two magnetic poles. The current is in the direction shown.



What is the direction of the force on the wire?

A towards the bottom of the page
B towards the top of the page
C towards the left-hand side of the page
D towards the right-hand side of the page

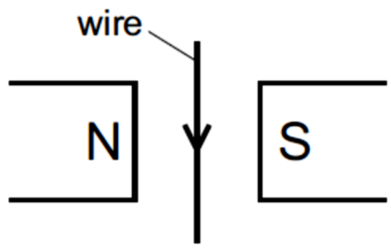
Q-22: Diagram 1 shows a wire carrying an electric current into the page. The wire is between the poles of a magnet. A force is produced on the wire acting down towards the bottom of the page. Diagram 2 shows the situation after the current is reversed and the magnet is turned through 90°.



In which direction does the force act after these changes?

A towards the top of the page
B towards the bottom of the page
C towards the left-hand side of the page
D towards the right-hand side of the page

Q-23: A conducting wire is placed between the poles of a magnet. When an electric current in the wire is in the direction shown, then the force on the wire acts out of the page.

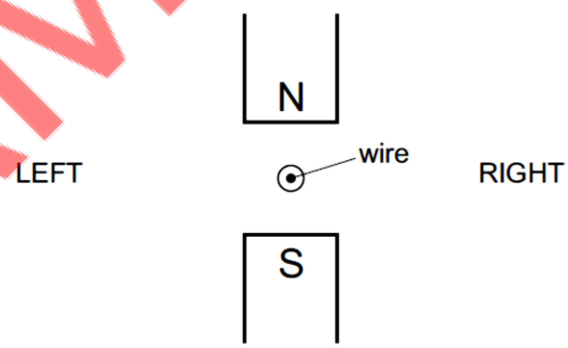


Three statements of different conditions and how the wire is affected are given.

1 The current is towards the top of the page and the direction of the magnetic field is unchanged then the force produced acts into the page.
2 The current is towards the bottom of the page and the magnetic field is reversed then the force produced acts into the page.
3 The current in the wire is alternating and the wire vibrates into and out of the page. Which statements are correct?

A 1 and 2 only **B** 1 and 3 only **C** 2 and 3 only **D** 1, 2 and 3

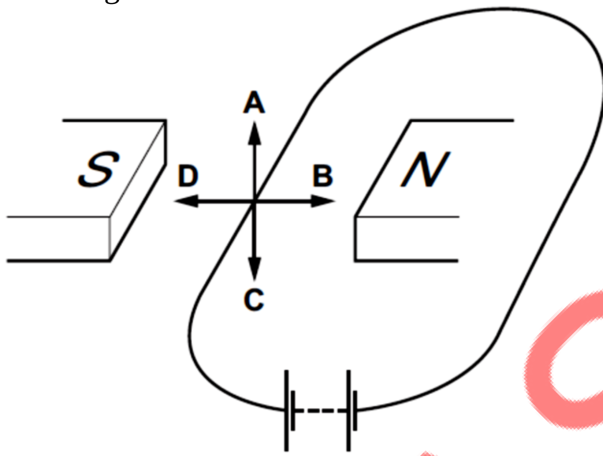
Q-24: The diagram shows a wire between the poles of a magnet. The wire is perpendicular to the page.



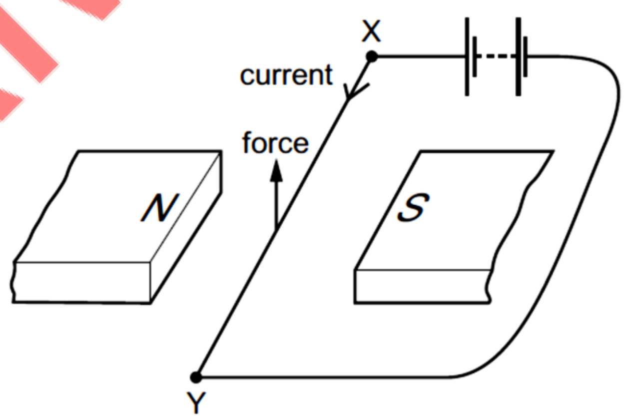
The wire is moved and a current is induced upwards, out of the paper. In which direction is the wire moved?

A left to right **B** right to left **C** up the page **D** down the page

Q-25: The diagram shows a current-carrying conductor in a magnetic field. Which arrow shows the direction of the force acting on the conductor?



Q-26: A wire XY lies between the poles of a magnet. The diagram shows the upward force on the wire XY caused when there is an electric current in the direction XY as shown.



Three tests are made using this apparatus.

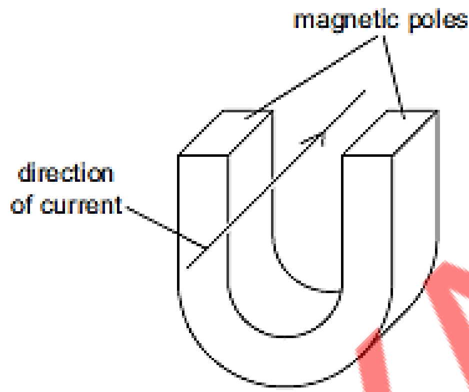
1 The current direction is reversed.

2 The N and S poles are swapped around.
3 The current is switched off.

Which will result in **no change** in the size of the force on the wire?

A 1 and 2 only **B** 1 only **C** 2 only **D** 3 only

Q-27: The diagram shows a current-carrying conductor between the poles of a magnet. The force on the wire acts downwards.



Four changes are possible.

1 The current is increased.
2 A stronger magnet is used.
3 The current is reversed.
4 The poles exchange positions.

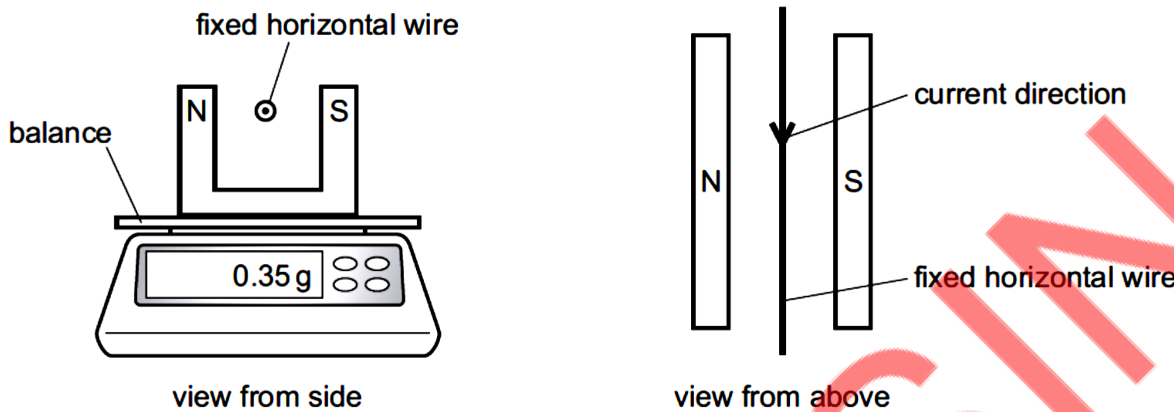
Which two changes made together keep the force acting downwards?

A 1 and 3 **B** 2 and 3 **C** 2 and 4 **D** 3 and 4

Q-28: There is an electric current in a wire. The wire is placed in a magnetic field. A force acts on the wire due to the current. Which statement is correct?

A The magnetic field must be produced by a permanent magnet and not by an electromagnet.
B The wire must be made from a magnetic material.
C When both the current and the magnetic field are reversed, the direction of the force is unchanged.
D When the current is reversed, but not the magnetic field, there will be no force on the wire.

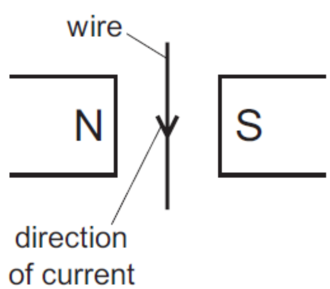
Q-29: The diagrams show a horizontal wire in a magnetic field. The horizontal wire is firmly held at each end (not shown) and cannot move. The magnets and holder are on a balance. When there is no current in the wire, the reading on the balance is 0.35 g.



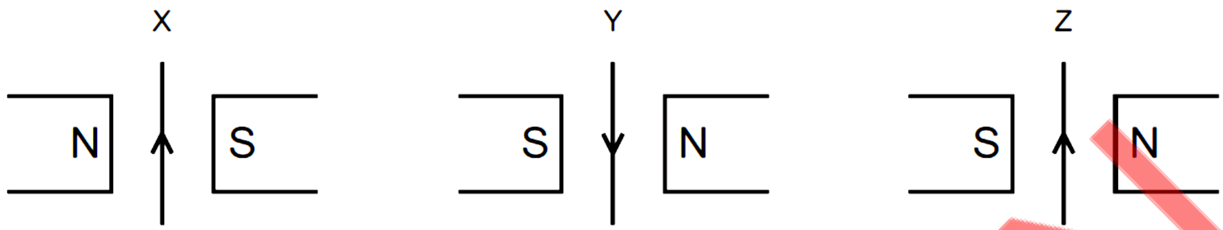
There is a d.c. current in the wire, as shown. What happens to the reading on the balance?

A smaller than 0.35 g
B no change
C changing from smaller to larger than 0.35 g repeatedly
D larger than 0.35 g

Q-30: The diagram shows a wire carrying a current in the direction shown. The wire is between the poles of a magnet. A force is produced on the wire out of the page.



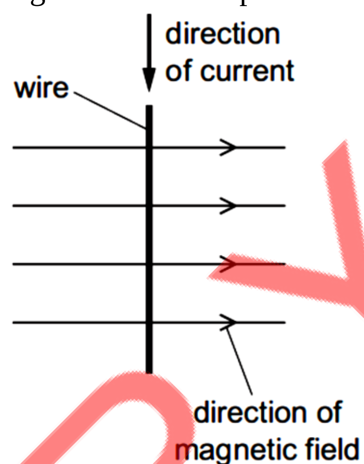
The wire and magnet are now put into different arrangements X, Y and Z. The arrow shows the direction of the current in each case.



In which arrangements is the force on the wire out of the page?

A X only **B** X and Y **C** X and Z **D** Z only

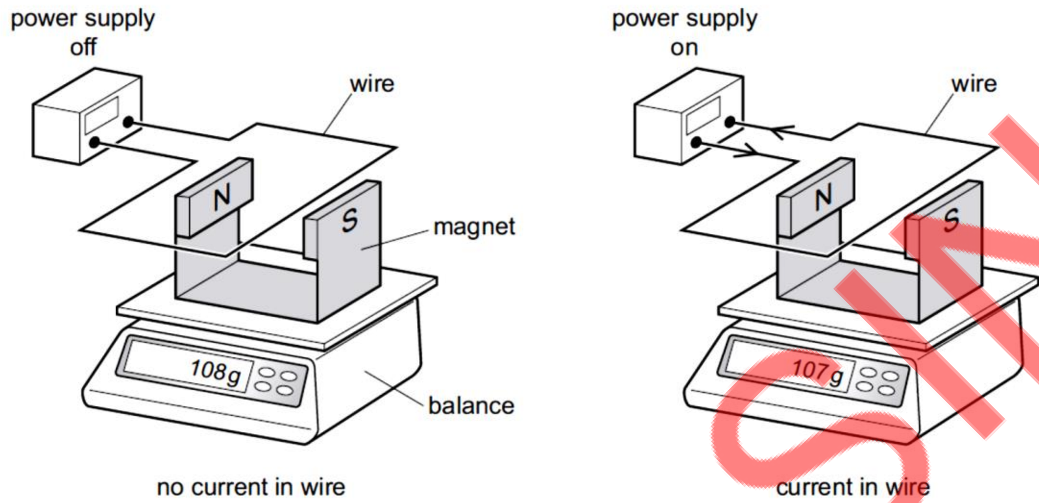
Q-31: The diagram shows a wire carrying a current in the direction shown. There is a magnetic field acting from left to right. The wire experiences a force acting out of the page.



The current is now reversed. In which direction does the force on the wire now act?

A into the page **B** out of the page **C** to the left **D** to the right

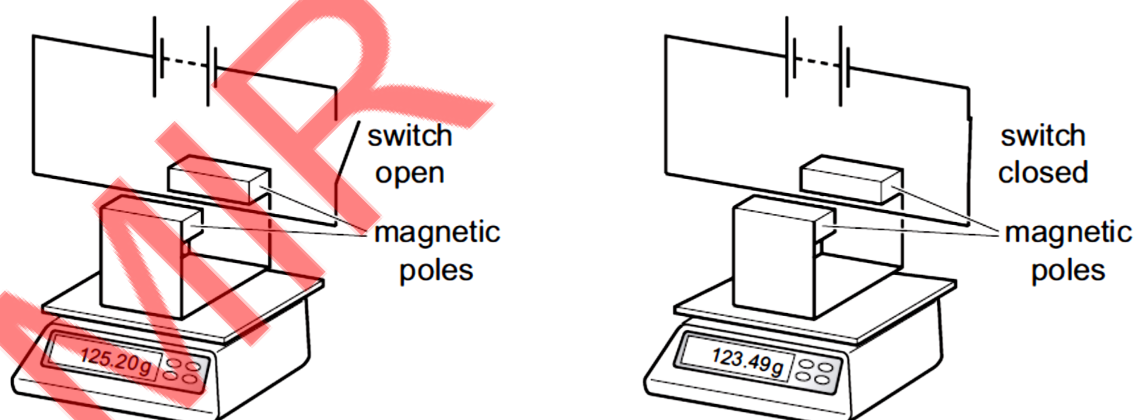
Q-32: A student uses a balance, a magnet and a power supply to determine the force on a wire in a magnetic field. The wire is held between the poles of the magnet. The student switches on the power supply. The diagrams show the readings with and without a current in the wire.



The student reverses the current in the wire. The magnitude of the current does not change. What is the new reading on the balance?

A 106 g **B** 107 g **C** 108 g **D** 109 g

Q-33: The diagram shows a horizontal wire between the two magnetic poles of a U-shaped magnet. The U-shaped magnet is on a balance. When the switch closed, the reading on the balance decreases.



The experiment is carried out three more times with the following changes made.

1 Only the current is reversed.

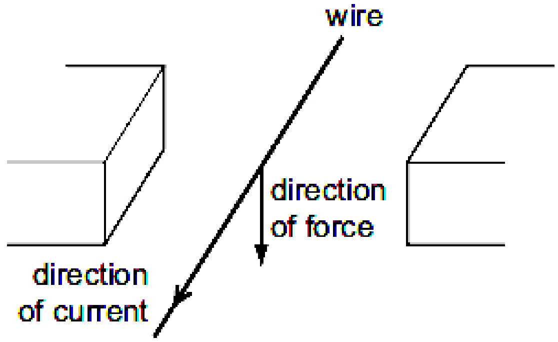
2 Only the magnetic field is reversed.

3 Both the current and the magnetic field are reversed at the same time.

Which changes cause an increase in the reading on the balance?

A 1 only **B** 2 only **C** 3 only **D** 1 and 2 only

Q-34: The diagram shows a wire placed between two magnetic poles of equal strength. A current passes through the wire in the direction shown. The current causes a downward force on the wire.



What is the arrangement of the magnetic poles?

A

B

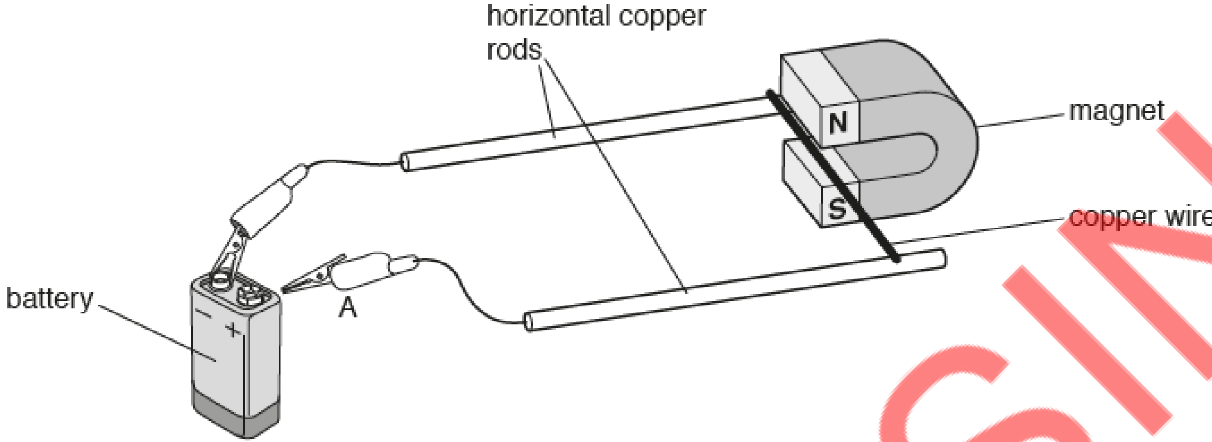
C

D

Q-35: a) Describe an experiment to show that a force acts on a current-carrying conductor placed in a magnetic field. You may draw a diagram to help your answer.

b) A current in a wire can cause the wire to get hot and melt the wire. Describe how to reduce the heating effect of a current.

Q-36: Fig. 1 shows a copper wire placed on two copper rods in the magnetic field between the poles of a magnet



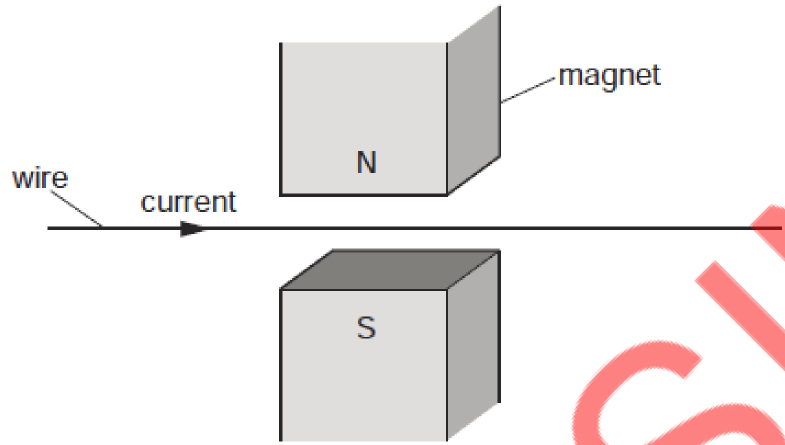
The crocodile clip A touches the positive terminal of the battery. This causes the copper wire to move.

a) On Fig. 1, mark with an arrow the direction of the current in the copper wire.

b) Explain why the copper wire moves along the copper rods.

c) Name **two** different devices that use this effect

Q-37: A teacher demonstrates the force on a wire carrying a current in a magnetic field. Fig. 1 shows some of the apparatus used.



a) The current is to be varied and measured.

i) On Fig. 1, draw the circuit diagram of the circuit used to provide the current. Include a method to vary and measure the current.

ii) Describe how to increase the current in the wire.

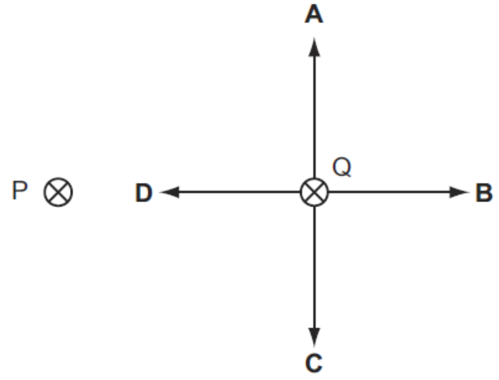
iii) Describe how to reverse the direction of the current in the wire.

iv) Describe how to reverse the direction of the magnetic field.

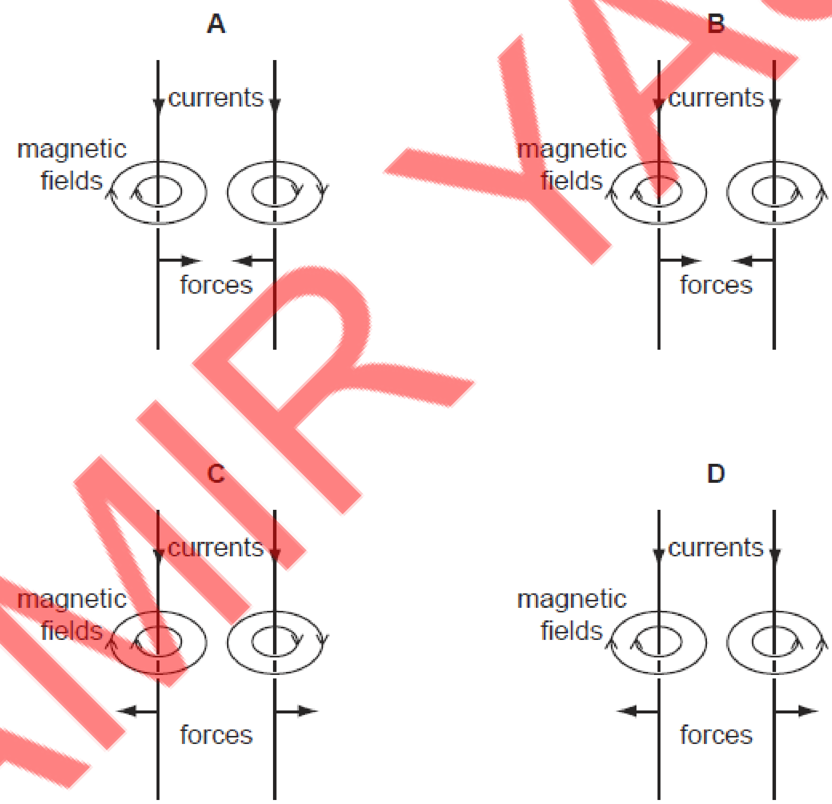
b) The current is increased to a very large value. Suggest one problem this may cause.

Force on two current carrying conductors placed near one another

Q-38: P and Q represent two, parallel, straight wires carrying currents into the plane of the paper. P and Q exert a force on each other. Which arrow shows the force on Q?



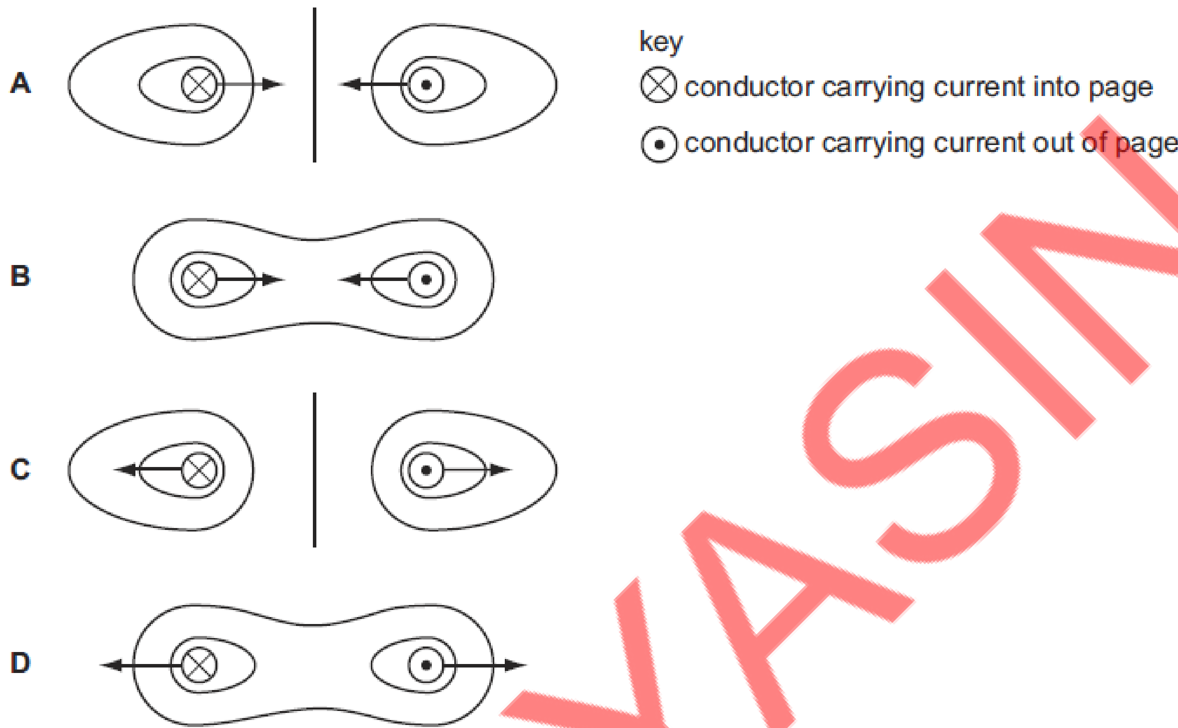
Q-39: Two parallel wires carry currents in the same direction. Which diagram shows the magnetic field around each wire and the direction of the force on each wire?



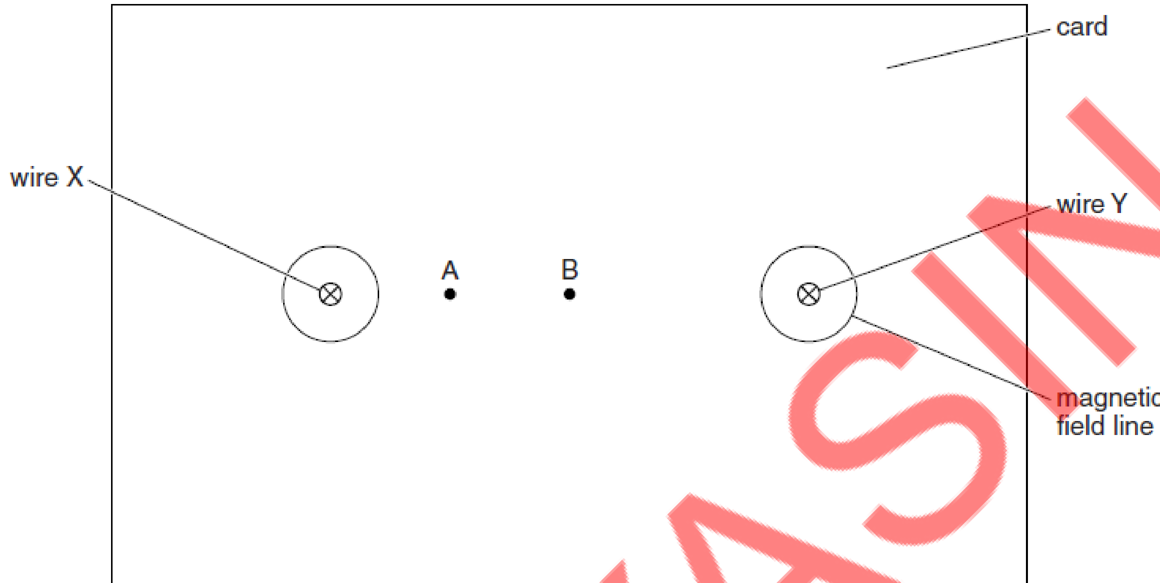
Q-40: Two long, parallel conductors carrying current lie in a horizontal plane.
The two conductors attract one another. The two currents must

A be in the same direction.
B be in opposite directions.
C be parallel to the Earth's magnetic field.
D be at 90° to the Earth's magnetic field.

Q-41: Each of the diagrams shows a cross-section through two parallel, current-carrying conductors. Which diagram shows the shape of the magnetic field pattern and the directions of the forces on the two conductors?



Q-42: Fig. 1 shows a view, from above, of two wires X and Y. These wires carry equal currents vertically downwards through a piece of card.



One complete magnetic field line is drawn around each wire. In this question, ignore the effects of the Earth's magnetic field.

a) On Fig. 1, draw the complete magnetic field line due to the current in wire X that passes through point A. Mark the direction of this field line.

b) Point B is midway between the two wires. Explain why the magnetic field at B is zero.

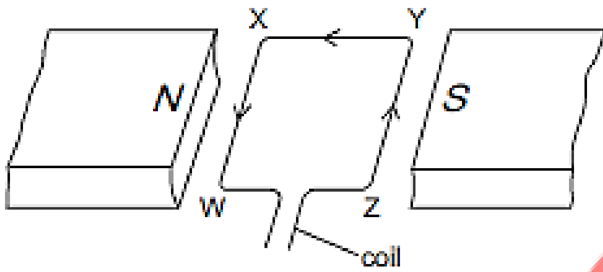
c) There is a force on wire Y due to the current in wire X.

i) State the direction of the force on wire Y.

ii) Explain why there is a force on wire Y.

Direct-Current motor (D.C motor)

Q-43: The diagram shows a horizontal rectangular wire coil WXYZ between the poles of a magnet.



There is a current in the coil in the direction shown.
Which statement is correct?

A The side WX experiences an upward force.
B The side XY experiences an outward force.
C The side YZ experiences an inward force.
D The side ZW experiences a downward force.

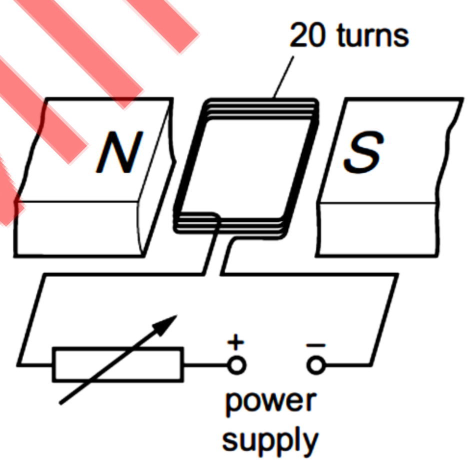
Q-44: A class is designing a d.c. motor. To achieve a greater turning effect, three suggestions are made.

1 Have a larger current in the coil of the motor.
2 Have a stronger magnet in the motor.
3 Put a larger number of turns on the coil.

Which suggestions will help to increase the turning effect?

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

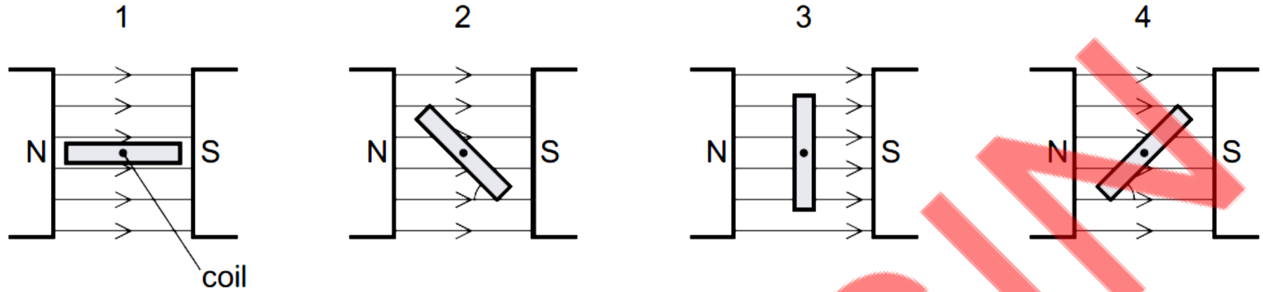
Q-45: The diagram shows a coil of wire between the poles of a magnet.



The coil consists of 20 turns of insulated wire. The coil is connected to a variable resistor and a power supply. How can the turning effect on the coil be increased?

A by moving the poles of the magnet closer to the coil
B by reducing the number of turns on the coil while keeping the current constant
C by increasing the resistance of the variable resistor
D by reversing the terminals of the power supply

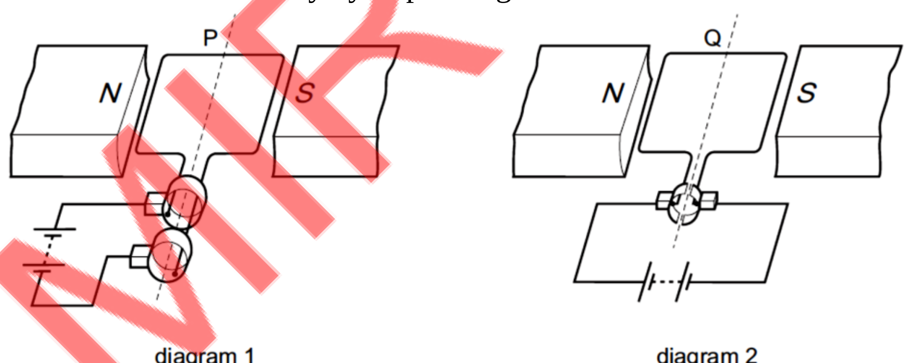
Q-46: Four positions of a current-carrying coil in a magnetic field, as in a d.c. motor, are shown. In diagrams 2 and 4, the coil is at an angle of 45° to the field lines.



Which row is correct?

	turning effect of the forces in positions 1 and 3	turning effect of the forces in positions 2 and 4
A	different	different
B	different	same
C	same	different
D	same	same

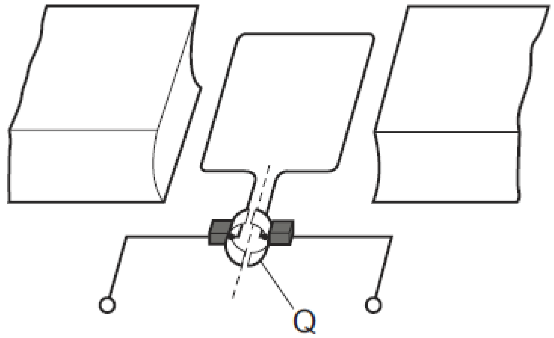
Q-47: Diagram 1 shows a coil of wire P between the poles of a magnet. The ends of coil P are connected to a battery by slip rings.
Diagram 2 shows a coil of wire Q between the poles of a different magnet. The ends of coil Q are connected to a battery by a split-ring commutator.



What happens to coils P and Q?

	coil P	coil Q
A	continuously turns anticlockwise	makes one quarter turn anticlockwise then stops
B	continuously turns clockwise	makes one quarter turn clockwise then stops
C	makes one quarter turn anticlockwise then stops	continuously turns anticlockwise
D	makes one quarter turn clockwise then stops	continuously turns clockwise

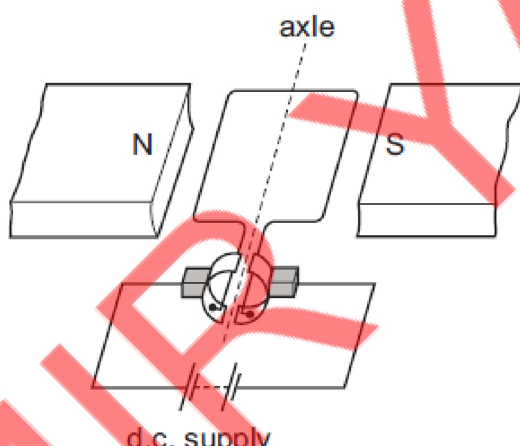
Q-48: The diagram shows a simple d.c. motor.



What is the part labelled Q?

A a coil **B** a commutator **C** a magnet **D** a slip ring

Q-49: The diagram shows a d.c. motor with its coil horizontal



Why is a split-ring commutator used?

A to change the current direction in the coil as the coil passes the horizontal position
B to change the current direction in the coil as the coil passes the vertical position
C to change the current direction in the d.c. supply as the coil passes the horizontal position
D to change the current direction in the d.c. supply as the coil passes the vertical position

Q-50: One component of a simple d.c. motor is a split-ring commutator. Which metal is used to make the commutator, and why is this metal chosen?

	metal	reason
A	copper	it is a good conductor of electricity
B	copper	it is a good conductor of heat
C	iron	it increases the magnetic field strength
D	iron	it is attracted to the brushes

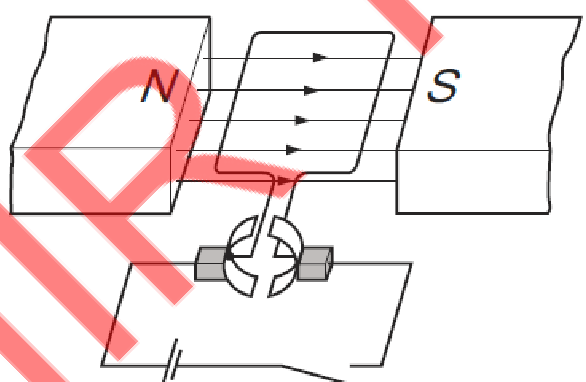
Q-51: What does not alter the size of the turning effect on the coil of an electric motor?

A the direction of the current in the coil
B the number of turns in the coil
C the size of the current in the coil
D the strength of the magnetic field

Q-52: A split-ring commutator is used in a simple d.c. motor. It reverses the current in the coil. How often does it reverse the current?

A every quarter turn **B** every half turn
C every full turn **D** every two turns

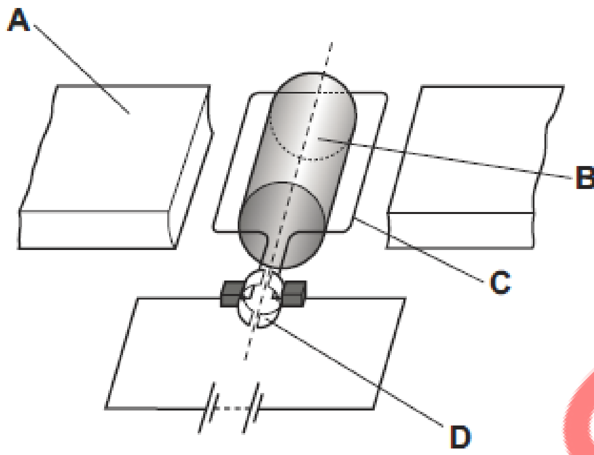
Q-53: The diagram shows a simple d.c. motor.



The switch is closed and the coil rotates. Which change makes the coil rotate in the opposite direction and at a faster rate?

A increase the current in the coil and increase the number of turns in the coil
B reverse both the magnetic field and the current in the coil
C reverse the magnetic field and decrease the current in the coil
D reverse the magnetic field and increase the current in the coil

Q-54: The diagram shows a simple d.c. motor. Which labelled part is the commutator?



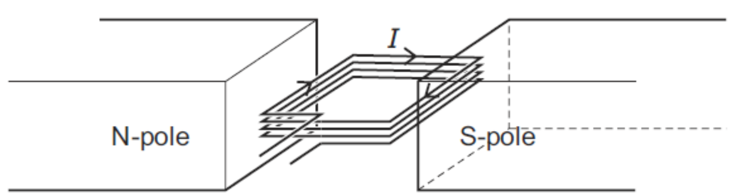
Q-55: A simple d.c. motor consists of a coil that rotates between the poles of a permanent magnet. The turning effect is increased by winding the coil on a metal cylinder. Which metals are used to make the magnet and the cylinder?

	magnet	cylinder
A	iron	copper
B	iron	steel
C	steel	copper
D	steel	iron

Q-56: The coil in an electric motor is wound onto a cylinder.
Why is the cylinder made of soft iron?

A to deflect the magnetic field away from the coil
B to increase the current through the coil
C to increase the strength of the magnetic field through the coil
D to support the coil and prevent it from collapsing

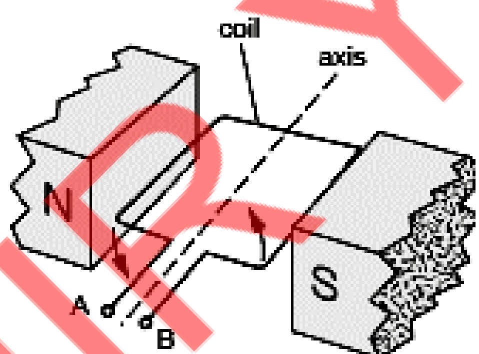
Q-57: A coil P of N turns is made from a length L of wire. The coil carries a current I when between two magnetic poles.



A similar coil Q of 2N turns is made from a length 2L of identical wire. It also carries a current I when between the two magnetic poles. Which coil has the greater resistance and which coil experiences the greater turning effect?

	greater resistance	greater turning effect
A	P	P
B	P	Q
C	Q	P
D	Q	Q

Q-58: Fig. shows part of a simple d.c. electric motor.



The motor is connected to a battery with the positive terminal of the battery connected to terminal A.

a) Explain why the coil turns in the direction shown.

b) The turning effect is increased when the coil is wound around a soft-iron cylinder.

i) Explain why this happens.

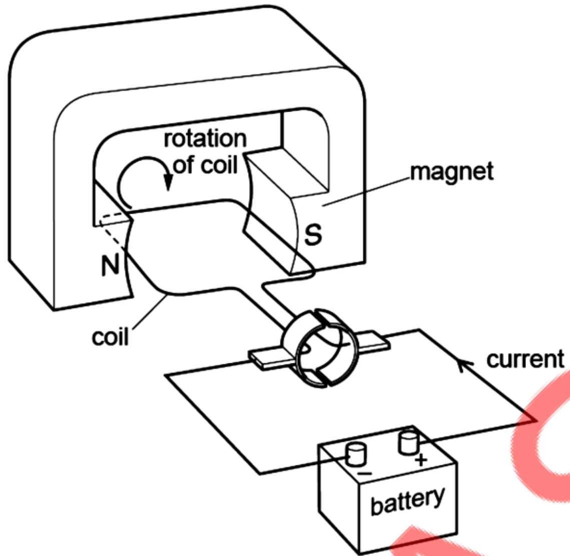
ii) Suggest **one** other way to increase the turning effect of the motor.

Q-59: a) A student plans to demonstrate the induction of an electromotive force (e.m.f.) in a wire. He has a length of wire, a sensitive centre-reading galvanometer and a permanent magnet.

i) Describe how the student uses the equipment.

ii) State **two** ways in which the student can increase the size of the induced e.m.f.

b) Fig. shows a d.c. motor.

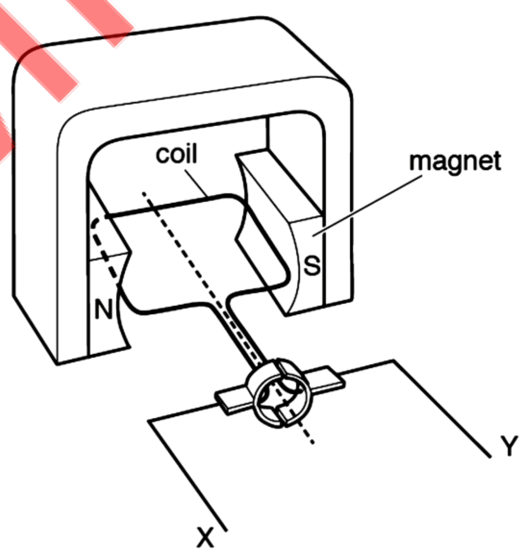


i) On Fig. 10.1, draw an arrow between the poles of the magnet to show the direction of the magnetic field.

ii) State **two** ways of making the coil spin faster.

iii) State **one** way of making the coil spin in the opposite direction.

Q-60: Fig. shows a diagram of an electrical device. The diagram is **not** complete. The coil rotates ina magnetic field when connected to a d.c. power supply.



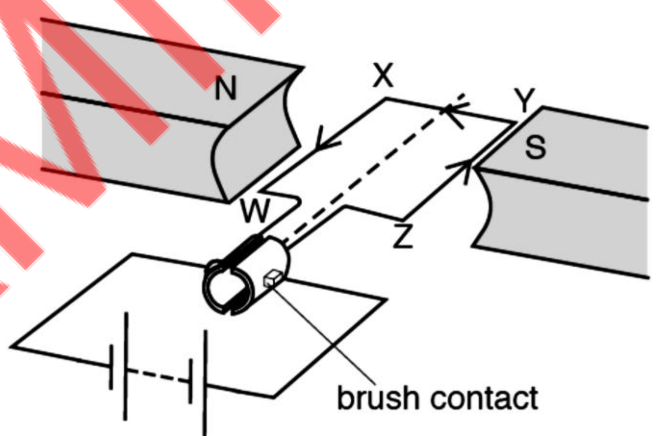
a) **i)** Explain the meaning of the term *d.c.*

ii) Complete the diagram in Fig. 1 by drawing the symbols for two cells in series **and** a switch to make a circuit.

b) **i)** State the name of the electrical device shown in Fig. 1.

ii) State **two** changes to the electrical device that will make the coil in the device rotate faster.

Q-61: **a)** Fig. 1 shows a simple electric motor.

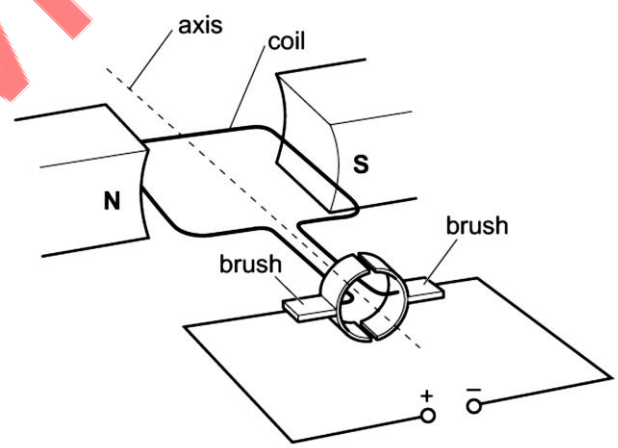


i) There is a current in the coil WXYZ. The direction of this current is shown by the arrows. On Fig. 1, draw an arrow to show the direction of the force acting on side WX and an arrow to show the direction of the force acting on side YZ.

ii) State three ways of increasing the turning effect of the motor.

b) In a home, a step-down transformer reduces the mains voltage of 225 V to 4.5 V. The transformer has 4000 turns on the primary coil. Calculate the number of turns on the secondary coil.

Q-62: Fig. 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.



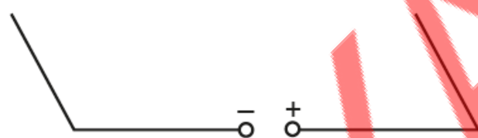
a) **i)** On Fig. 1, draw a pair of arrows to show which way the coil rotates. Explain the direction you have chosen.

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

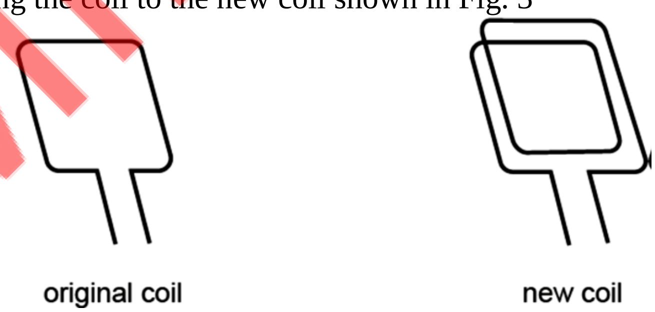
iii) Explain why the electrons flow in the direction you have shown in **(a)(ii)**.

b) State any difference each of the following changes makes to the rotation of the coil in Fig. 1:

i) changing the polarity of the power supply to that shown in Fig. 2



ii) changing the coil to the new coil shown in Fig. 3



iii) using a stronger magnetic field.

Electromagnetic Induction

Q-63: Which statement about electromagnetic induction is correct?

A A strong magnet that is held stationary near a stationary conductor causes a greater effect than a weak magnet.

B The effect occurs when a magnet and a conductor are both moved with the same speed and in the same direction.

C The effect occurs when a magnet is moved away from a nearby conductor.

D The effect only occurs when a magnet is moved towards a conductor.

Q-64: A simple electric generator induces an electromotive force (e.m.f.). Which modification would increase the induced e.m.f.?

A Increase the number of turns in the coil of the generator.

B Increase the distance between the magnetic poles.

C Reduce the strength of the magnetic field around the coil.

D Reverse the direction of the magnetic field.

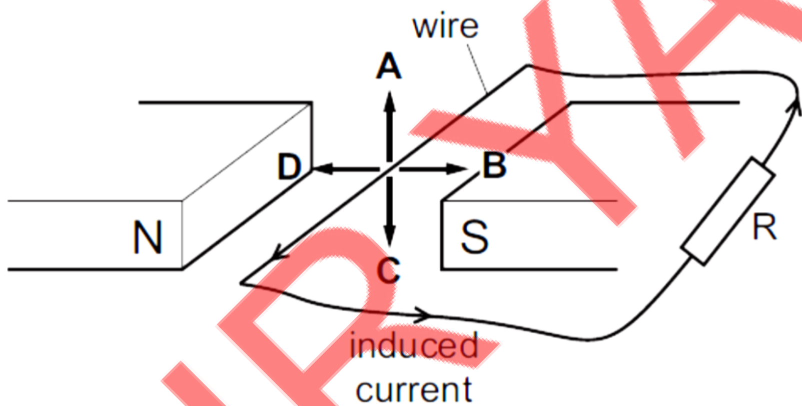
Q-65: When a metal wire moves up, cutting a magnetic field, an electromotive force (e.m.f.) is induced across the wire. Which change affects the magnitude of the induced e.m.f.?

A moving the wire down at the same speed
B moving the wire up at a faster speed
C using a thicker wire
D using a wire made from a different metal

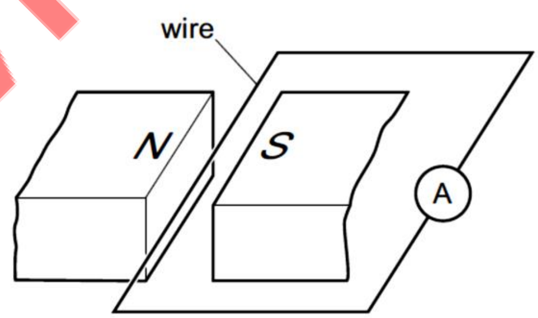
Q-66: A student investigates the output voltage induced across a coil of wire by a bar magnet. When will the induced voltage have the greatest value?

A The student slowly moves the bar magnet into the coil of wire.
B The student leaves the bar magnet stationary in the coil of wire.
C The student quickly removes the bar magnet from the coil of wire.
D The student places the bar magnet at rest outside the coil of wire.

Q-67: A wire connected to a resistor is moved in a magnetic field. A current is induced in the direction shown. In which direction is the wire moved?



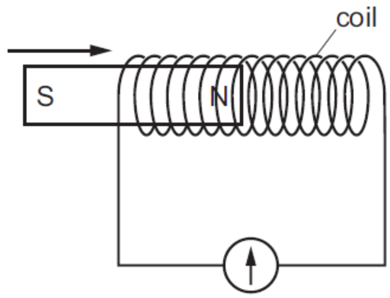
Q-68: The diagram shows a wire between two magnetic poles. The wire is connected in a circuit with an ammeter.



The wire is moved downwards, towards the bottom of the page. A current is induced in the wire. In which direction is the force on the wire caused by this current?

A towards the bottom of the page **B** towards the left of the page
C towards the right of the page **D** towards the top of the page

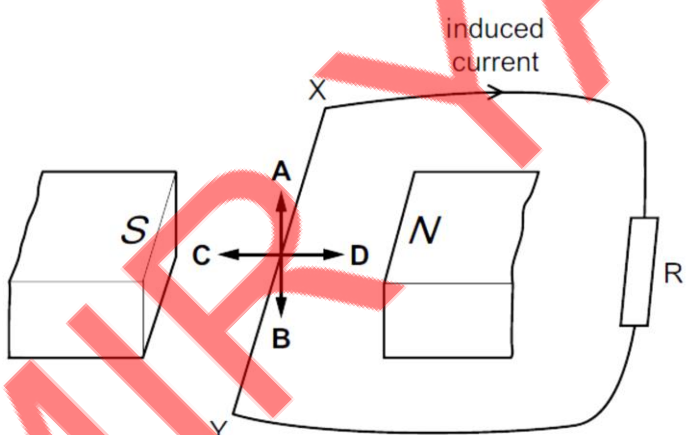
Q-69: The N-pole of a magnet is moved into a coil of wire connected to a galvanometer.



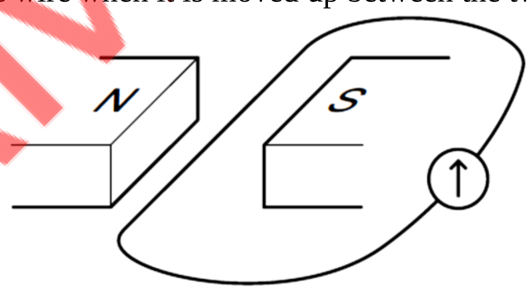
The needle of the galvanometer moves. Which situation **must** give a smaller galvanometer reading?

A Use a coil with fewer turns and a stronger magnet.
B Use a coil with fewer turns and a weaker magnet.
C Use a coil with more turns and a stronger magnet.
D Use a coil with more turns and a weaker magnet.

Q-70: A wire XY is connected to a resistor R. The wire is moved in the magnetic field between two magnetic poles. In which direction must the wire be moved so that the induced current is in the direction shown?



Q-71: The diagram shows a wire between two magnets. An electromotive force (e.m.f.) is induced in the wire when it is moved up between the two magnets.



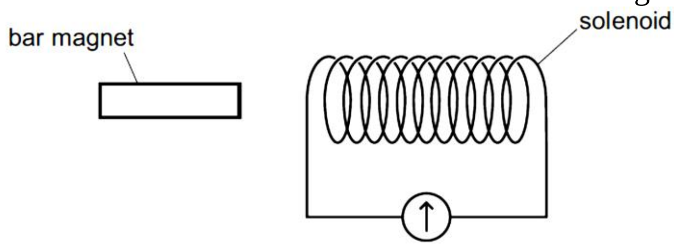
Four tests are done.

1 The direction of movement of the wire is reversed.
2 The direction of the magnetic field is reversed.
3 The wire is moved more quickly.
4 The magnetic field strength is decreased.

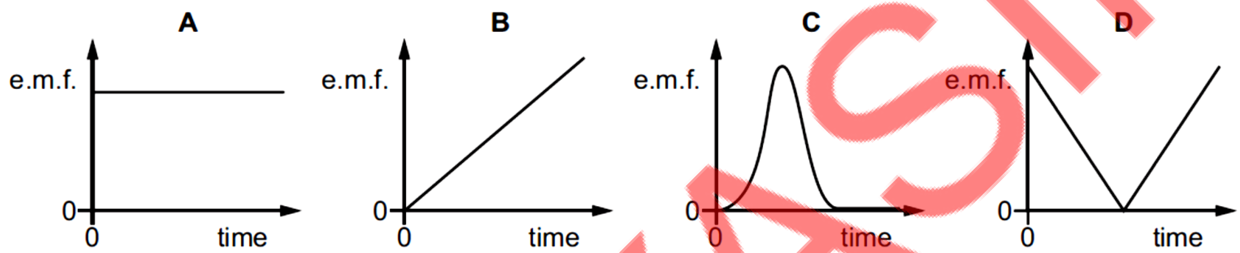
Which tests will induce a smaller e.m.f. in the wire?

A 1 and 2 **B** 1 and 3 **C** 3 and 4 **D** 4 only

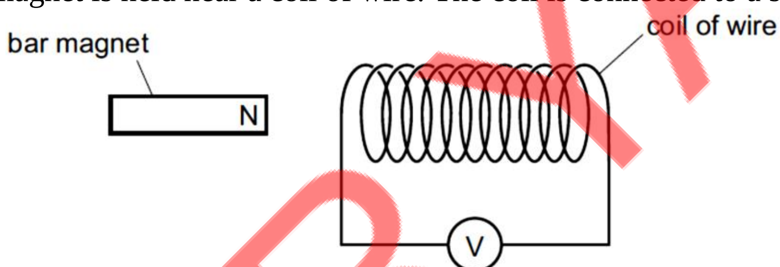
Q-72: A bar magnet is held near a solenoid. The coil is connected to a galvanometer.



The magnet is moved into the coil of wire and then held stationary inside the coil.
Which graph shows how the induced electromotive force (e.m.f.) varies with time?



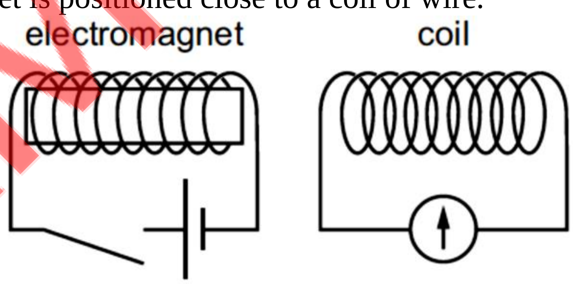
Q-73: A bar magnet is held near a coil of wire. The coil is connected to a sensitive voltmeter.



The N-pole of the magnet is moved quickly towards the coil. The voltmeter shows a reading of +10 mV. The N-pole of the magnet is then moved slowly away from the same end of the coil. The reading on the voltmeter is observed. Which voltmeter reading is possible?

A –15 mV **B** –5 mV **C** 0 mV **D** +5 mV

Q-74: An electromagnet is positioned close to a coil of wire.



The electromagnet is switched on, remains on for a short time, and is then switched off.
Three statements about the pointer on the galvanometer during this sequence are given.

1 The pointer kicks to one side as the electromagnet is switched on.

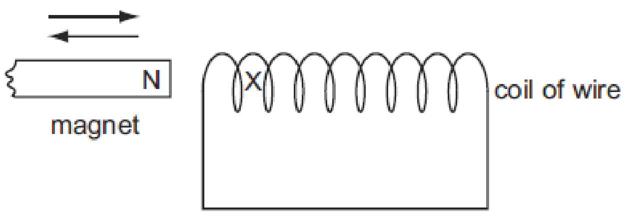
2 The pointer records a steady non-zero value while the electromagnet remains switched on.

3 The pointer kicks to the other side as the electromagnet is switched off.

Which statements are correct?

A 1 and 2 only **B** 1 and 3 only **C** 2 and 3 only **D** 1, 2 and 3

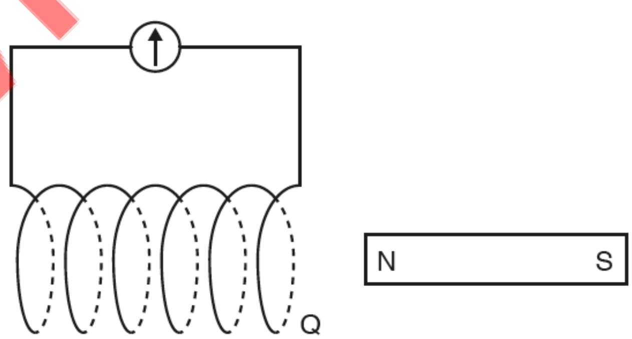
Q-75: The diagram shows the N-pole of a magnet moving into, and out of, a coil of wire



This movement produces a current in the coil of wire. The current produces a magnetic pole at X. Which pole is produced at X when the magnet is moved in and when it is moved out?

	magnet moved in	magnet moved out
A	N	N
B	N	S
C	S	N
D	S	S

Q-76: Fig. 1 shows a permanent bar magnet next to a circuit that contains a coil and a galvanometer.



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

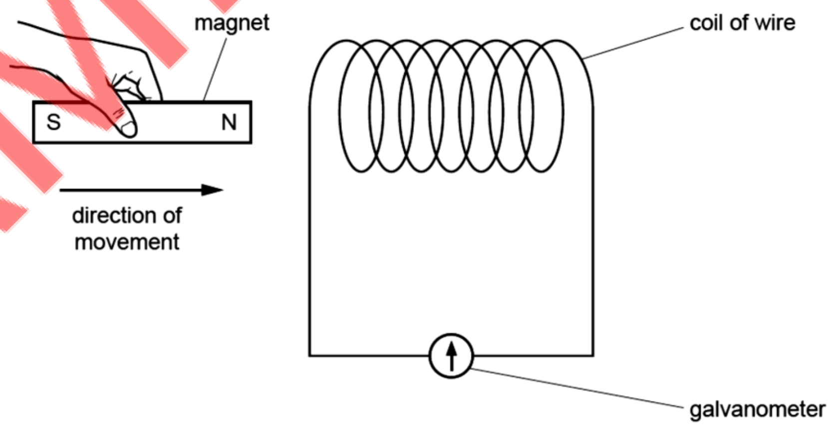
b) The magnet is moved to the left and inserted a small distance into the coil. The galvanometer deflects briefly and shows that there is a current in the coil.

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

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.

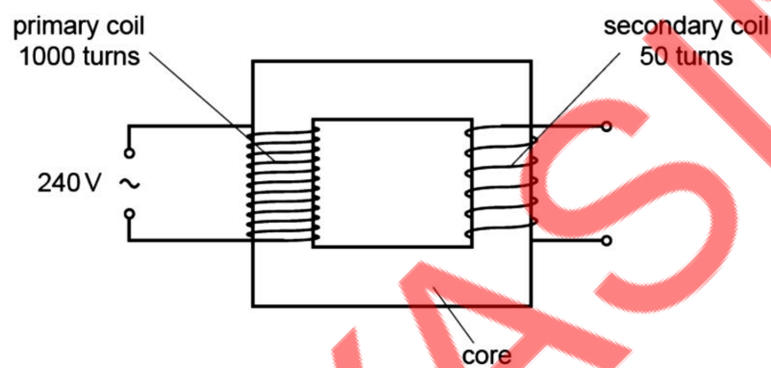
c) Suggest **two** ways in which the deflection of the galvanometer can be reversed.

Q-77: a) Fig. 1 shows a magnet and a coil of wire connected to a galvanometer.



A student slowly moves the magnet into the coil. The pointer on the galvanometer moves to the left. This deflection shows that an electromotive force (e.m.f.) is induced in the coil. State **three** ways of increasing the size of the e.m.f. in the coil.

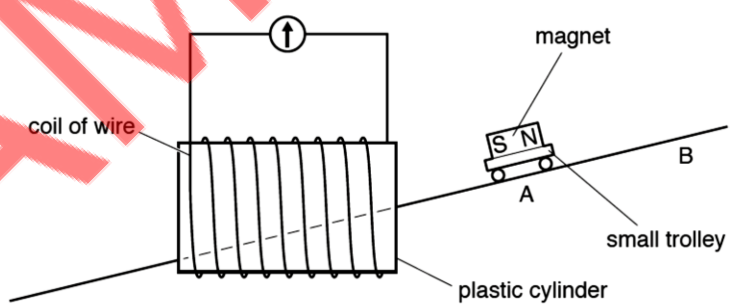
b) Fig. 2 shows a transformer.



i) Name **one** material that is suitable for the core of the transformer.

ii) The primary coil has 1000 turns and its input is 240 V a.c.
The secondary coil has 50 turns. Calculate the output voltage across the secondary coil.

Q-78: a) Fig. 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.

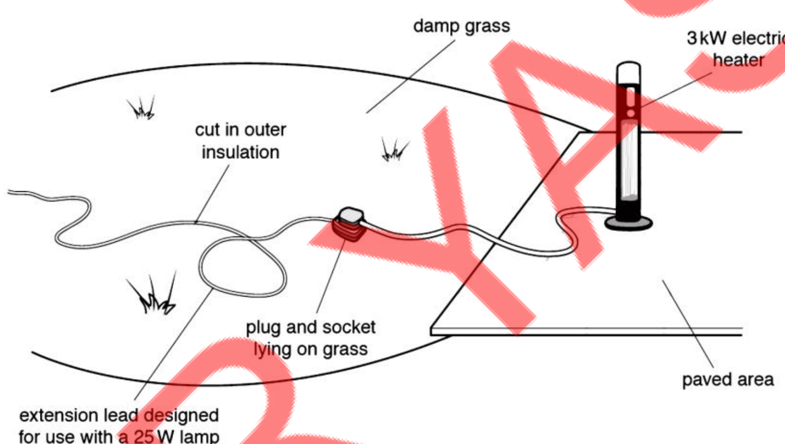


A magnet is fixed to a small trolley that runs without friction on a track through the cylinder and coil.

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.

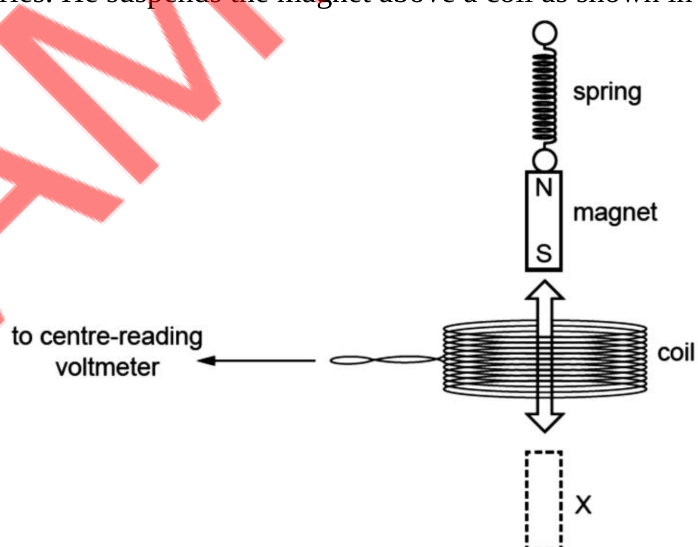
ii) The trolley is now released from point B so it runs through the coil from right to left again. State what is observed on the galvanometer and explain why it is different to your answer in **(a)(i)**.

b) Fig. 2 shows an extension lead used to supply power to a 3 kW electric heater on a cool evening.



State and explain three dangers with this arrangement.

Q-79: A student uses a coil and a magnet on a spring to generate an electromotive force (e.m.f.) that varies. He suspends the magnet above a coil as shown in Fig. 1.



a) The student pulls the magnet through the coil to X and then releases it. The magnet moves up and down through the coil. State the type of voltage induced in the coil. Tick (3) **one** box.

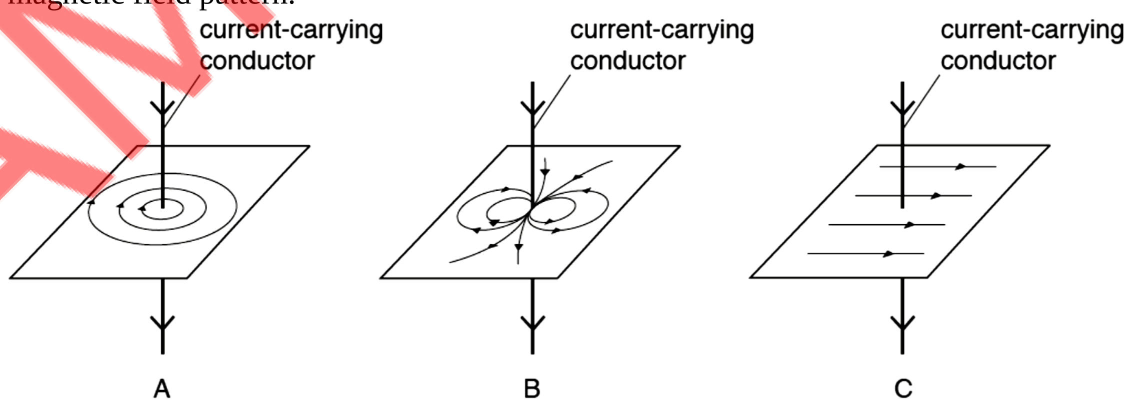
alternating ☐

digital ☐

direct ☐

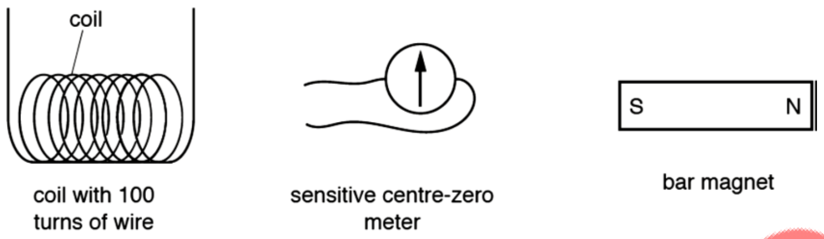
b) State **two** ways of increasing the voltage induced in the coil.

Q-80: a) Fig. 1 shows in each of the diagrams a current-carrying conductor and a magnetic field pattern.



State the diagram which correctly shows the magnetic field around a current-carrying conductor.

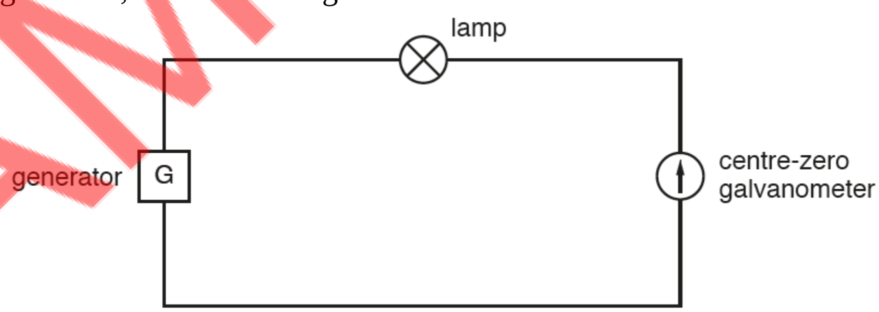
b) Fig. 2 shows three pieces of equipment.



i) Describe how to generate and detect an electromotive force (e.m.f.) using the equipment in Fig. 2. You may draw a diagram.

ii) Describe **two** changes that will generate a larger e.m.f. using similar equipment to that in Fig. 2.

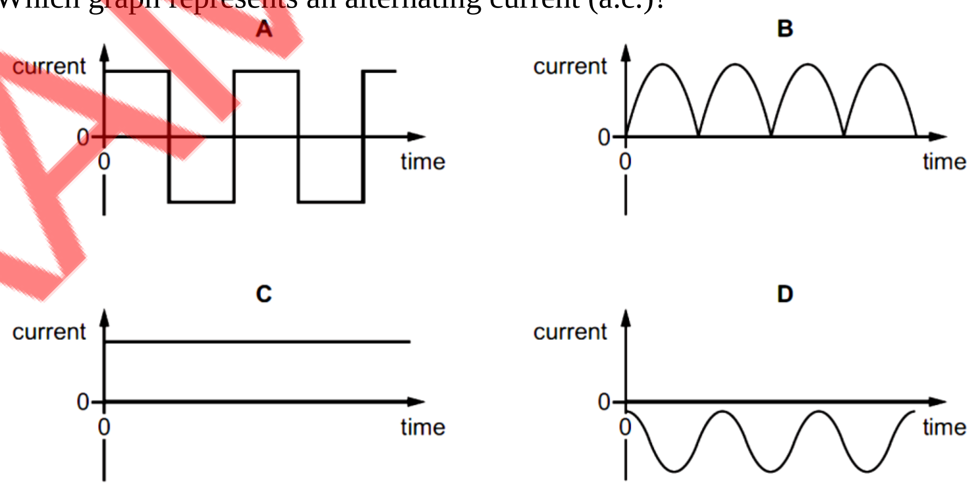
c) A student connects a lamp and centre-zero galvanometer in series with a generator, as shown in Fig. 3.



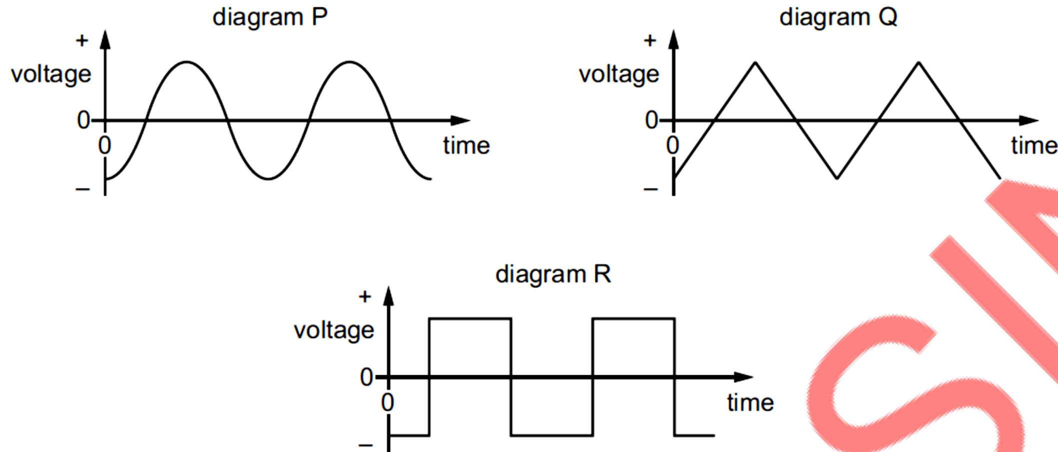
The student observes the galvanometer needle moving from side-to-side repeatedly. Explain why the needle moves in this way.

Alternating Current/Direct Current

Q-81: Which graph represents an alternating current (a.c.)?



Q-82: The diagrams P, Q and R show three voltage–time graphs.



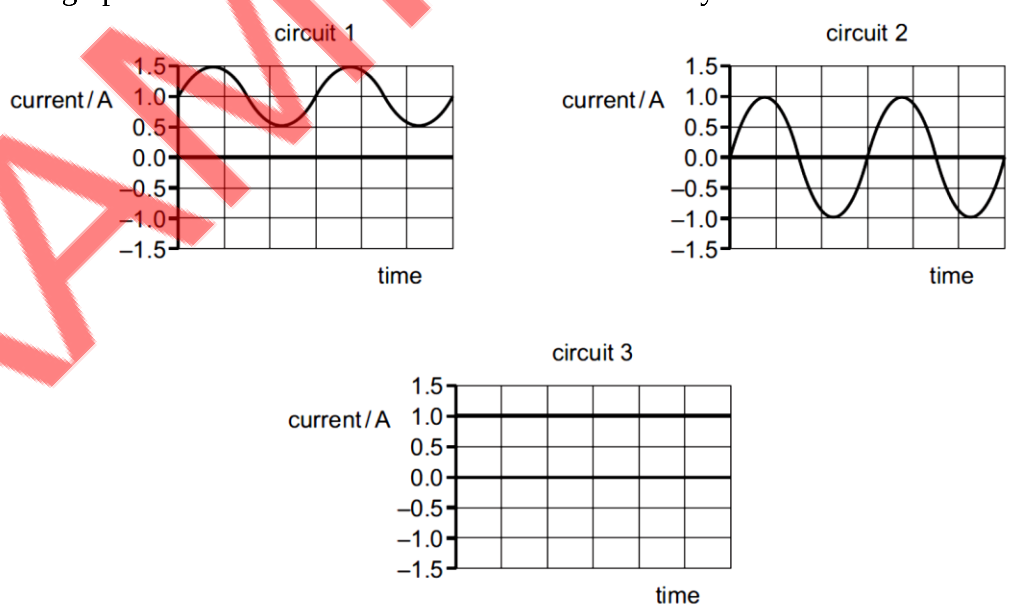
Which graphs show an alternating voltage?

A P and Q only **B** P and R only **C** Q and R only **D** P, Q and R

Q-83: An a.c. generator contains a coil that rotates at a rate of 4500 revolutions per minute.
What is the frequency of the alternating current?

A 1.25 Hz **B** 75 Hz **C** 150 Hz **D** 4500 Hz

Q-84: The graphs show how the currents in three circuits vary with time.

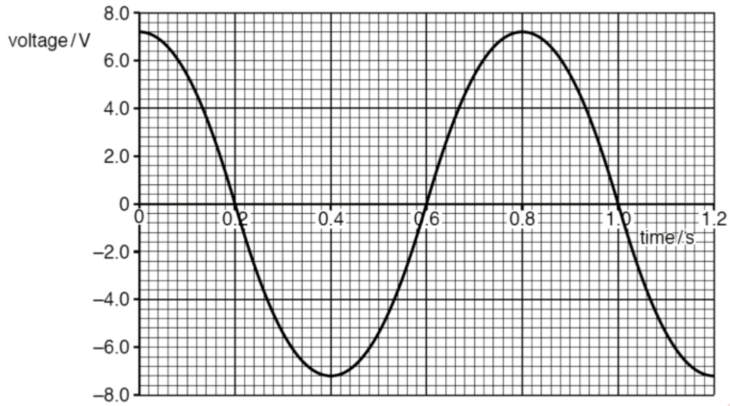


In which circuits is there a direct current?

A 1 and 2 **B** 1 and 3 **C** 2 only **D** 3 only

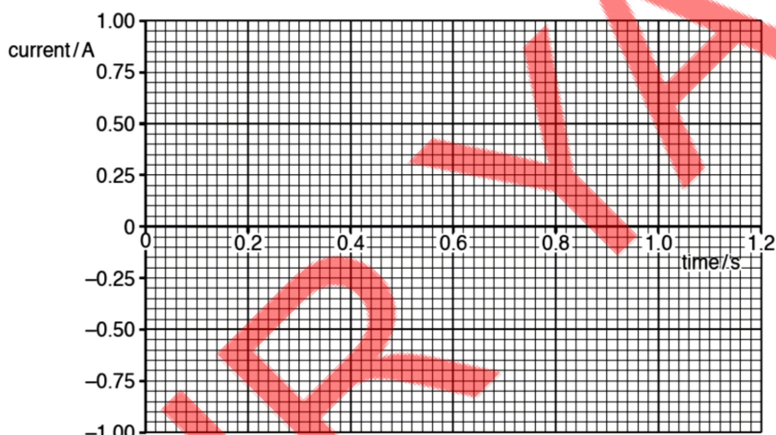
Q-85: a) Describe how a direct current (d.c.) differs from an alternating current (a.c.).

b) Fig. 1 shows how the voltage output of an a.c. generator varies with time.



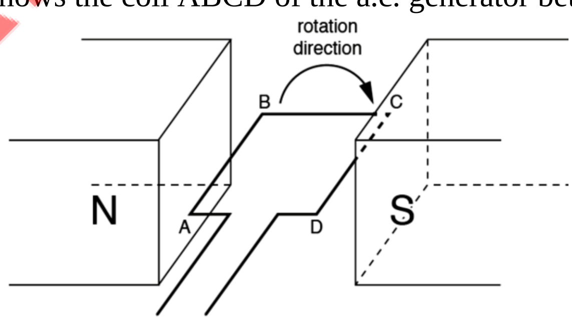
A heater is connected directly to the a.c. generator and the maximum current in the heater is 0.75 A.

i) On Fig. 2, sketch a graph to indicate how the current in the heater varies with time.



ii) Calculate the power produced by the heater when the current is 0.75 A.

c) Fig. 3 shows the coil ABCD of the a.c. generator between two magnetic poles.



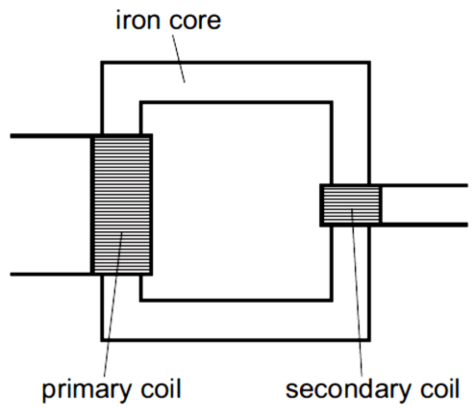
i) On Fig. 3, draw a straight arrow to indicate the direction in which side AB of the coil is moving. Label this arrow M.

ii) Deduce the direction of the current induced in side AB of the coil and explain your reasoning.

iii) The rate at which the coil of the a.c. generator rotates increases. State **two** ways in which the alternating voltage changes.

Transformer

Q-86: The diagram shows a transformer. There are 460 turns on the primary coil and 24 turns on the secondary coil. The primary voltage is 230 V.



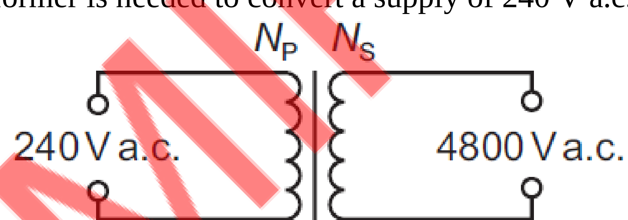
What is the secondary voltage?

A 2.0 V **B** 12 V **C** 48 V **D** 4400 V

Q-87: A transformer has *N*p turns in the primary coil and *N*s turns in the secondary coil. Which row gives the values of *N*p and *N*s for a transformer that steps up a voltage of 1200 V to 36 000 V?

	N_p	N_s
A	2000	60000
B	2000	600000
C	60000	2000
D	600000	2000

Q-88: A transformer is needed to convert a supply of 240 V a.c. into 4800 V a.c..



Which pair of coils would be suitable for this transformer?

	number of turns on primary coil N_P	number of turns on secondary coil N_S
A	50	1000
B	240	48000
C	480	24
D	2000	100

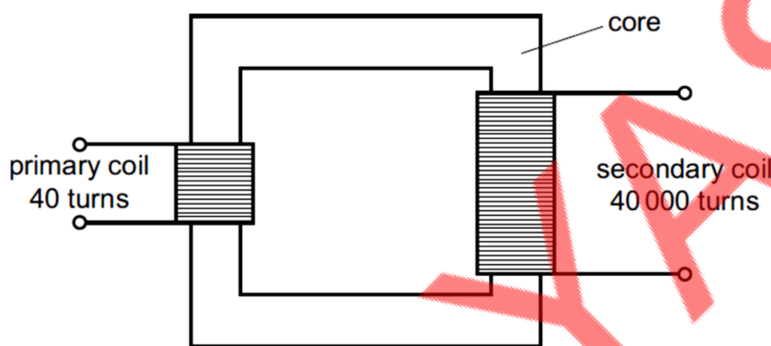
Q-89: A step-up transformer produces a 60 V a.c. output from a 12 V a.c. input. There are 50 turns on the secondary coil. How many turns are there on the primary coil?

A 5 **B** 10 **C** 50 **D** 250

Q-90: A 100% efficient step-down transformer has primary voltage *V*p and primary current *I*p. Which row compares the secondary voltage with *V*p and the secondary current with *I*p?

	secondary voltage	secondary current
A	greater than V_p	greater than I_p
B	greater than V_p	less than I_p
C	less than V_p	greater than I_p
D	less than V_p	less than I_p

Q-91: The diagram shows a transformer.



Which statement about this transformer is correct?

A It can operate from a 12 V battery.
B It has a core which is made of steel.
C It steps the input voltage up by a factor of 1000.
D It steps the input voltage down by a factor of 1000.

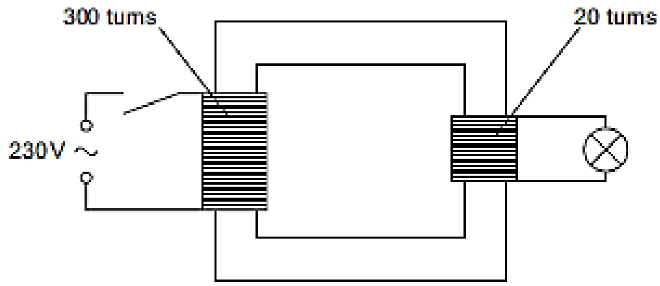
Q-92: A transformer has 4800 turns on its primary coil and 480 turns on its secondary coil. The primary coil is connected to a 240 V a.c. supply. The secondary coil is connected to a lamp. How does the output current in the lamp compare with the input current?

A higher frequency a.c.
B lower frequency a.c.
C current in one direction only
D the same frequency a.c.

Q-93: The input voltage to a transformer is 24 V a.c. and the output voltage is 6.0 V. The input coil has 720 turns. How many turns are on the output coil?

A 5 **B** 180 **C** 2900 **D** 100 000

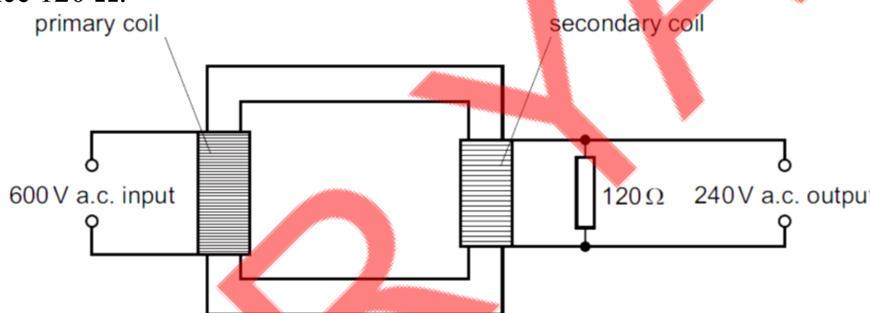
Q-94: A student uses a transformer to light a filament lamp using a 230 V a.c. supply. The lamp has a maximum voltage rating of 6.0 V.



What happens when the circuit is switched on?

A The lamp does not light at all.
B The lamp lights at normal brightness.
C The lamp lights dimly.
D The lamp lights up brightly and then goes out.

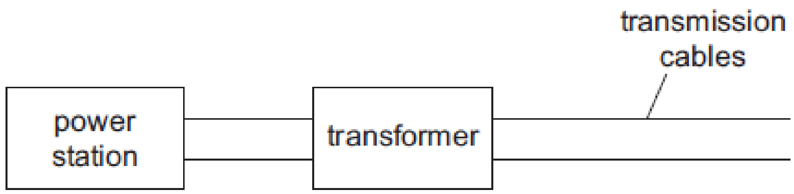
Q-95: A transformer with an efficiency of 100% has a primary voltage input of 600 V and a Secondary voltage output of 240 V. The secondary coil is attached to a resistor of resistance 120 Ω.



What is the power dissipated in the resistor and what is the current in the primary coil?

	power / W	current / A
A	120	0.20
B	120	5.0
C	480	0.80
D	480	1.3

Q-96: Transformers are used to transmit electrical energy between power stations and transmission cables, as shown.



What is the purpose of the transformer in the diagram?

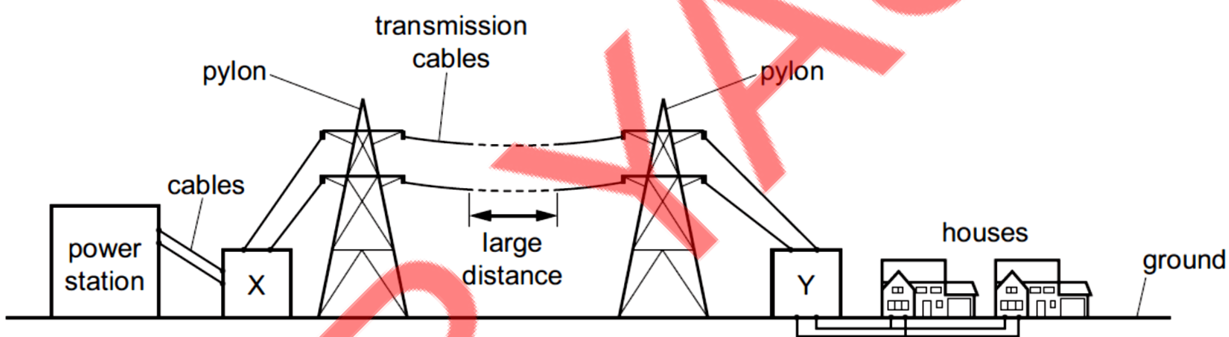
A to decrease the current and the potential difference from the power station

B to decrease the current and increase the potential difference from the power station

C to increase the current and the potential difference from the power station

D to increase the current and decrease the potential difference from the power station

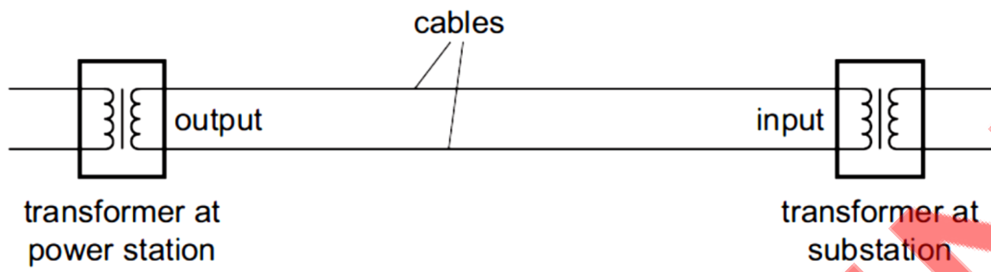
Q-97: The diagram represents the transmission of electricity from a power station to homes that are many kilometres away. Two transformers are labelled X and Y.



What type of transformers are X and Y?

	X	Y
A	step-down transformer	step-down transformer
B	step-down transformer	step-up transformer
C	step-up transformer	step-down transformer
D	step-up transformer	step-up transformer

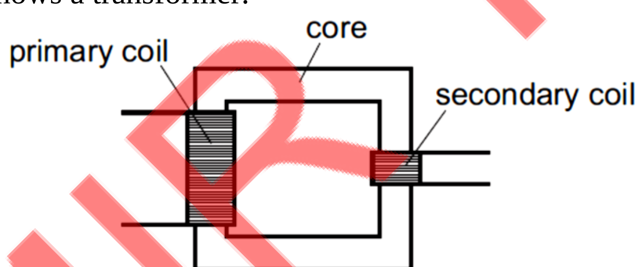
Q-98: Cables transmit electrical power from the output of the transformer at a power station to the input of the transformer at a substation.



The power at the output of the transformer at the power station is 400 MW.
Which situation delivers the most power to the input of the transformer at the substation?

	potential difference at power station transformer output / kV	diameter of cables
A	200	large
B	200	small
C	400	large
D	400	small

Q-99: The diagram shows a transformer.



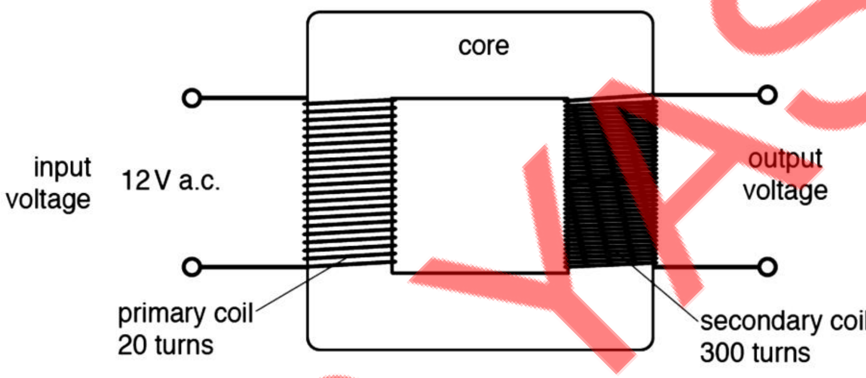
Which materials are the most suitable for the core and for the coils?

	core material	coil material
A	copper	copper
B	copper	iron
C	iron	copper
D	iron	iron

Q-100: A student is experimenting with electromagnetic effects.

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

b) Fig. 1 shows a transformer connected to an input voltage of 12 V a.c.

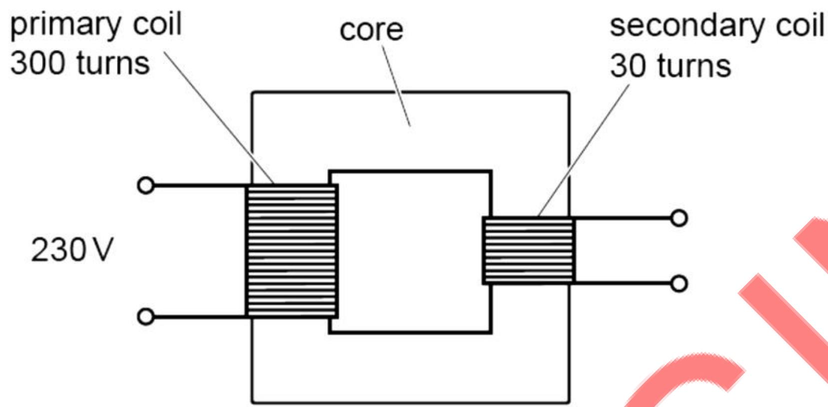


i) State the name of a suitable material for the core of the transformer.

ii) Explain how the diagram in Fig. 1 shows a step-up transformer.

iii) Using the information in Fig. 1, calculate the output voltage of the transformer.

Q-101: Fig. 1 represents a transformer. The primary coil has 300 turns and the secondary coil has 30 turns. The input voltage is 230 V a.c.

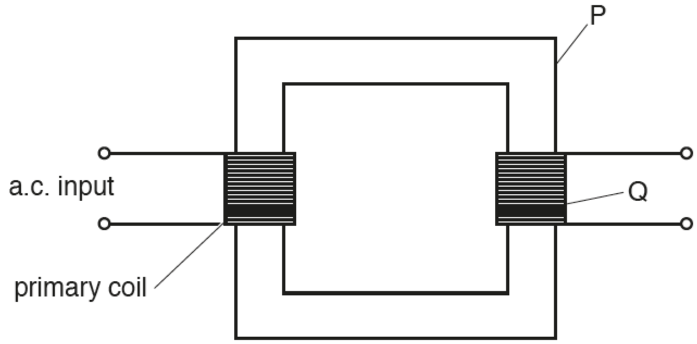


a) Calculate the voltage across the secondary coil.

b) State a suitable material for the core of the transformer.

c) Some transformers produce high electrical voltage for the transmission of electrical energy. Describe **two** advantages of high-voltage transmission.

Q-102: Fig. 1 represents a transformer.



a) **i)** State the name of the part of the transformer labelled Q in Fig. 1.

ii) In Fig. 1, part P is made from a metal.
1. State the metal used to make part P

2. State the term given to part P.

iii) There is an alternating current (a.c.) in the primary coil.
Describe what this current produces in part P.

iv) Complete the sentence using terms from the box

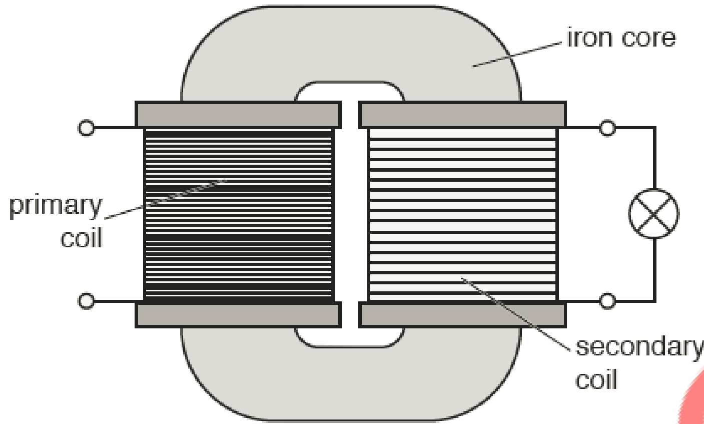
more	fewer	step-up	step-down

When there are .... turns in the primary coil than in Q, the

device is called a........................ transformer.

b) The high-voltage transmission of electricity uses transformers.
Describe **two** advantages of transmitting electricity at high voltages rather than at low voltages.

Q-103: Fig. 1 shows the structure of a transformer.



A lamp is connected to the secondary coil.

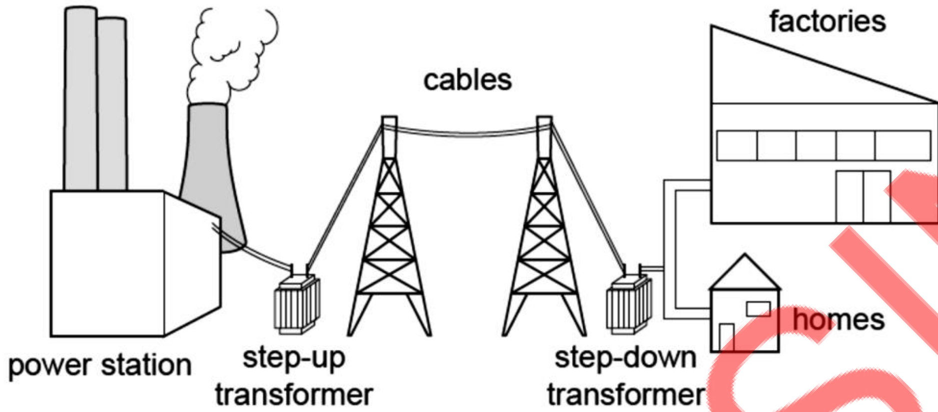
a) Explain why the core of the transformer is made from iron.

b) When there is an alternating current (a.c.) in the primary coil, the lamp is lit. When there is a direct current (d.c.) in the primary coil, the lamp is **not** lit.

i) State two ways in which an alternating current differs from a direct current.

ii) Explain why the lamp is **not** lit when there is a direct current in the primary coil.

Q-104: a) Fig. 1 shows the arrangement for transferring electrical energy from a power station to homes and factories.

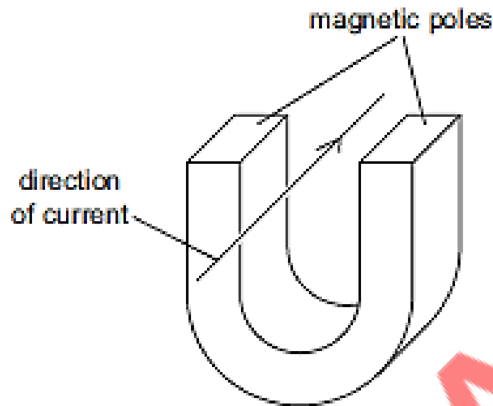


Explain why the arrangement includes a step-up transformer and a step-down transformer.

b) A transformer has 2000 turns on the primary coil and 500 turns on the secondary coil. The potential difference (p.d.) across the primary coil is 240 V a.c. Calculate the p.d. across the secondary coil.

Motion of charge particle in magnetic field

Q-105: The diagram shows a current-carrying conductor between the poles of a magnet. The force on the wire acts downwards.



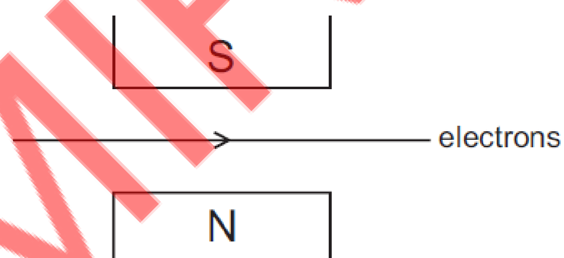
Four changes are possible.

1 The current is increased.
2 A stronger magnet is used.
3 The current is reversed.
4 The poles exchange positions.

Which two changes made together keep the force acting downwards?

A 1 and 3 **B** 2 and 3 **C** 2 and 4 **D** 3 and 4

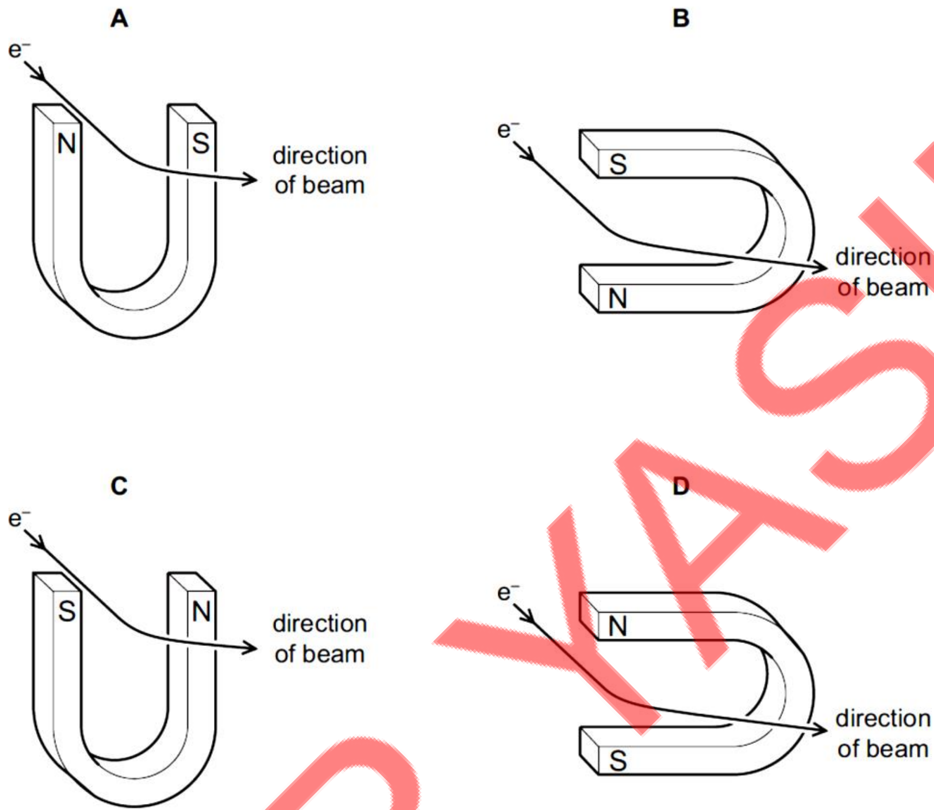
Q-106: A beam of electrons travels through a vacuum. The beam passes between the poles of a magnet as shown.



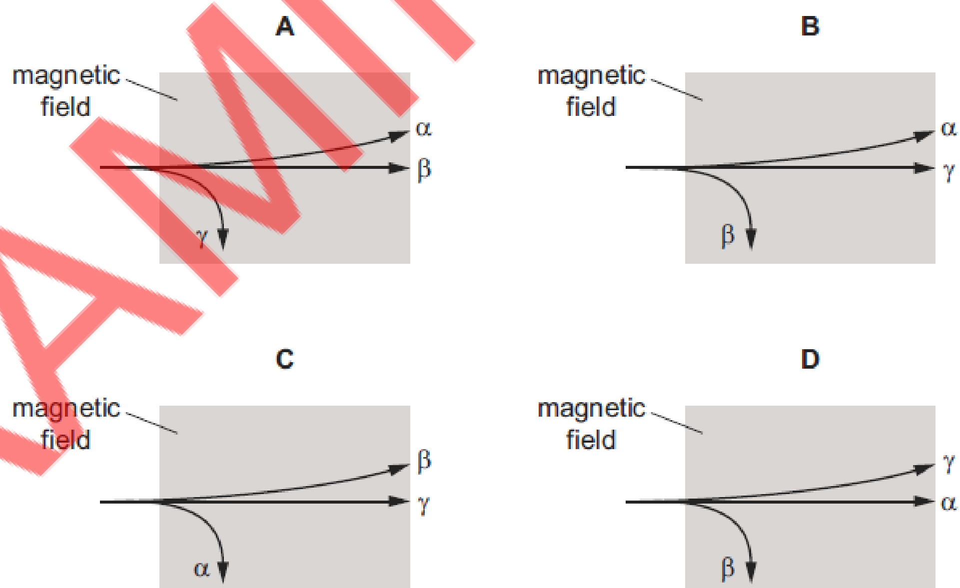
What is the direction of the conventional current and what is the direction of the magnetic field?

	direction of the conventional current	direction of the magnetic field
A	→	↓
B	→	↑
C	←	↓
D	←	↑

Q-107: A beam of electrons is passed through the magnetic field of a magnet.
How must the magnet be positioned to deflect the beam in the direction shown?

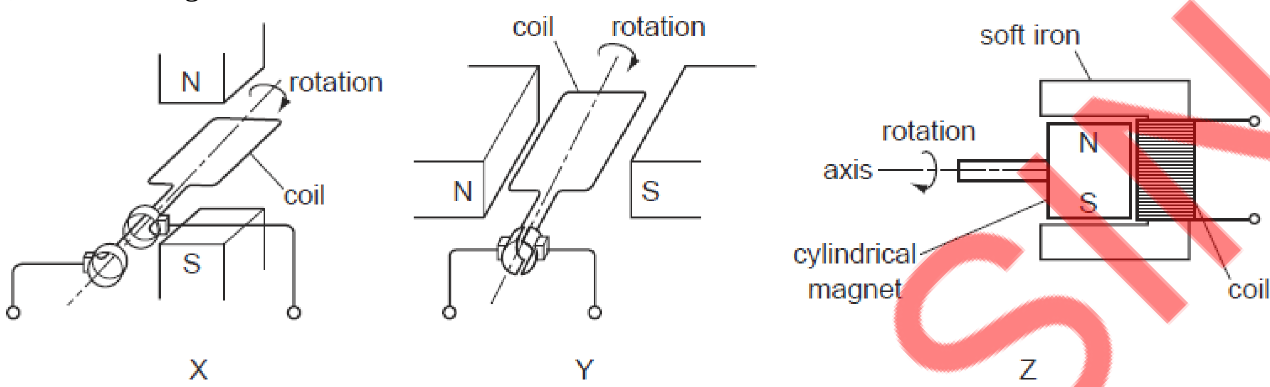


Q-108: A beam, consisting of alpha-particles (α), beta-particles (β), and gamma rays (γ), passes into a magnetic field. Which diagram shows their paths in the magnetic field?



Alternating Current Generator

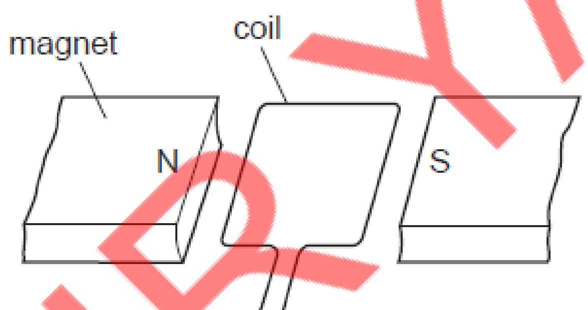
Q-109: The diagrams show three electrical devices, X, Y and Z.



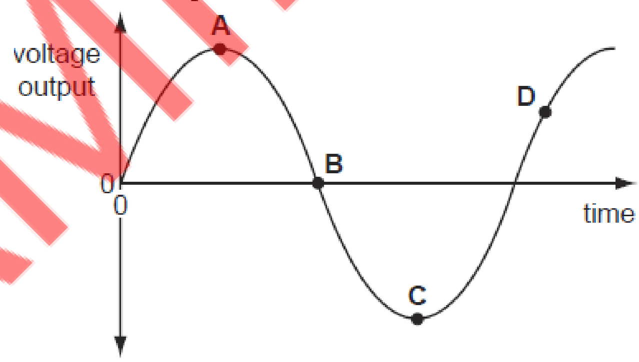
Which devices provide an alternating current (a.c.) output?

A X only **B** Y only **C** X and Y **D** X and Z

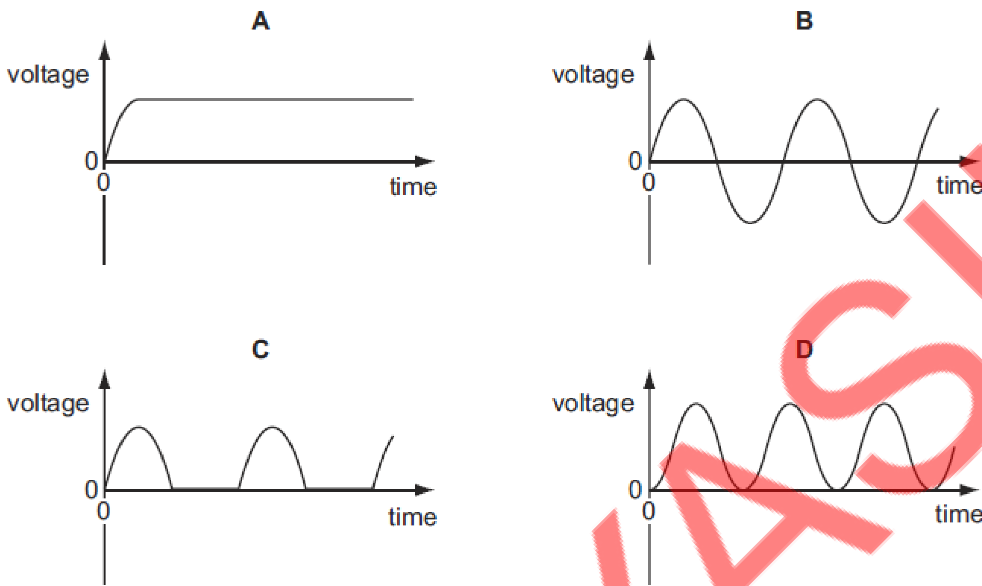
Q-110: The diagram shows part of an a.c. generator when its coil is in a horizontal position



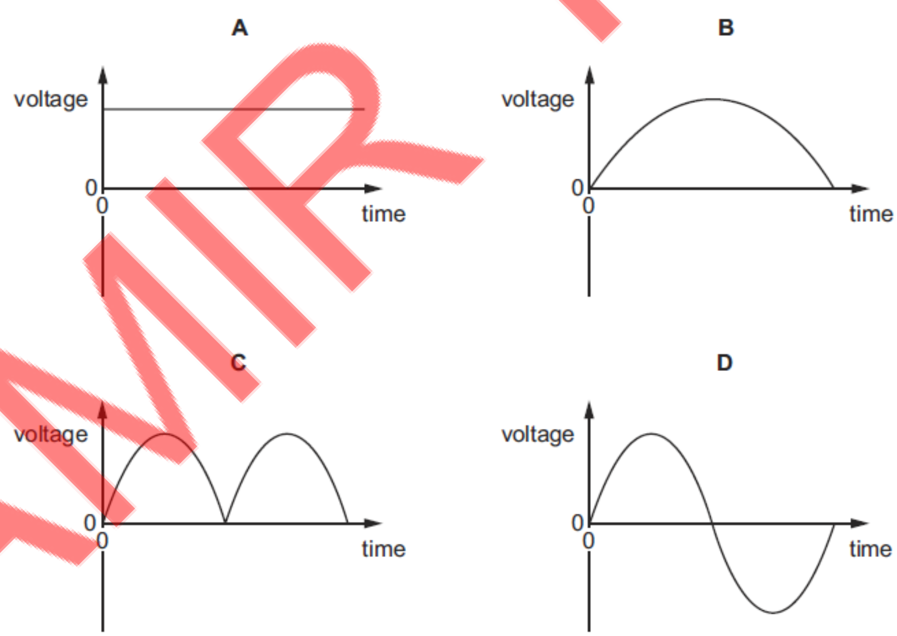
The graph shows the voltage output plotted against time. Which point on the graph shows when the coil is in a vertical position?



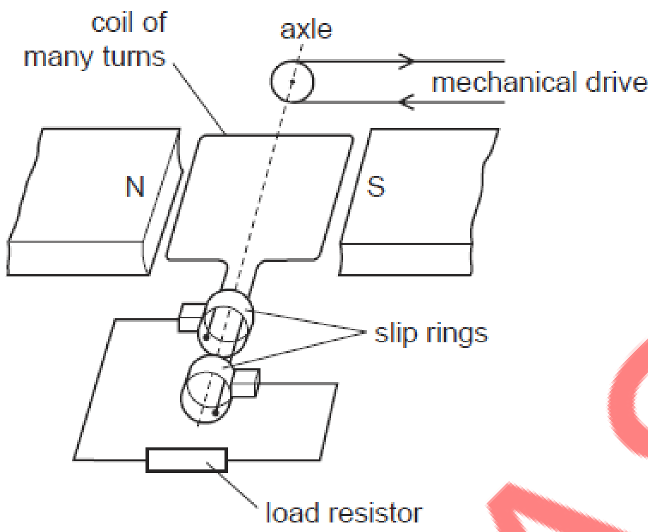
Q-111: Which graph represents the voltage output of a simple a.c. generator?



Q-112: Which graph shows the voltage output of an a.c. generator when the coil makes one complete revolution?



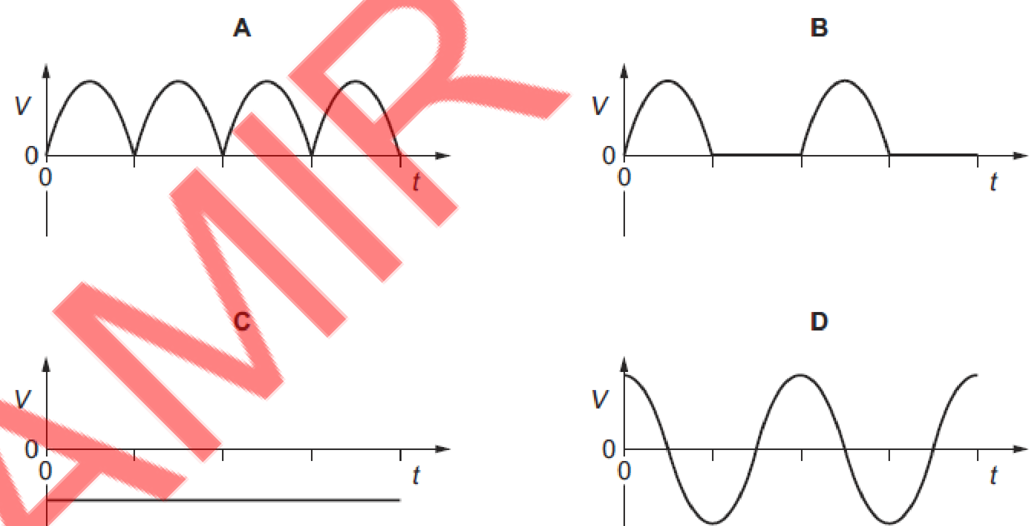
Q-113: The diagram shows an a.c. generator connected to an electrical circuit (load resistor).



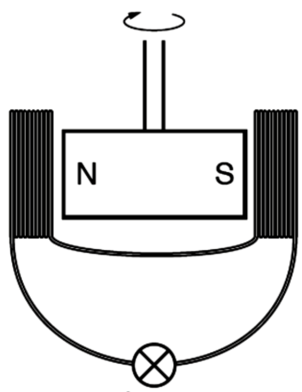
Which statement is correct?

A The direction of the potential difference across the load resistor is always the same.
B The size of the induced e.m.f. depends on the number of turns in the coil.
C The size of the induced e.m.f. does not change as the coil turns.
D Winding the coil on a soft-iron cylinder makes no difference to the induced e.m.f.

Q-114: Which graph shows the voltage output V against time t for an a.c. generator?



Q-115: A student fits an electrical generator to a bicycle. When the front wheel turns, a magnet rotates between two coils of wire. A lamp is connected to the coils of wire. When the magnet is rotating, the lamp is lit. Fig. 1 shows the magnet, the coils of wire and the lamp.



a) Describe and explain how rotating the magnet causes the lamp to light.

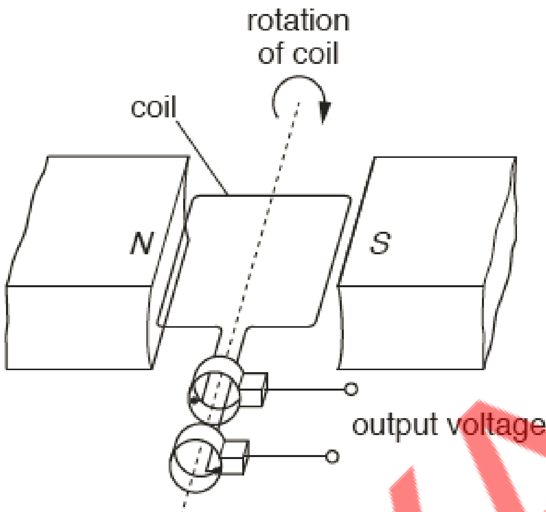
b) State three ways of increasing the brightness of the bicycle lamp.

c) The generator provides an a.c. supply for the lamp.

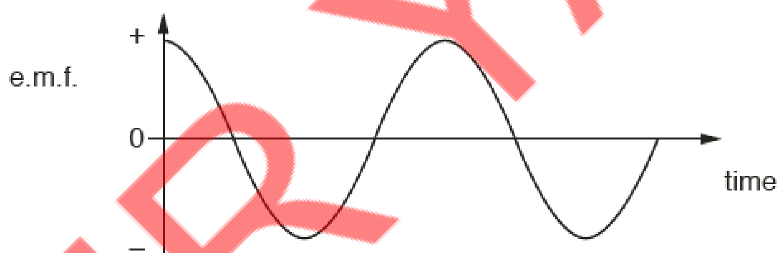
i) State the meaning of the term *a.c.*

ii) Describe how a.c. differs from d.c.

Q-116: Fig. 1 shows a simple a.c. generator.



a) The coil rotates and an alternating electromotive force (e.m.f.) is induced in the coil. Fig. 2 shows how the alternating e.m.f. varies with time as the coil rotates



Explain

i) why an e.m.f. is induced,

ii) why the e.m.f. is sometimes positive and sometimes negative.

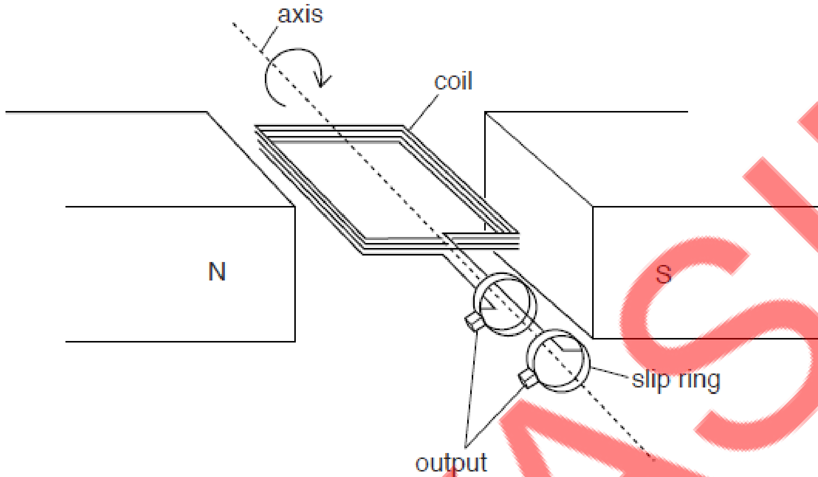
b) Changes are made to the a.c. generator, one at a time:

- stronger magnets are used
- more turns are wound on the coil
- the coil is turned faster.

Complete the table in Fig. 3 to show what happens to the maximum value of the e.m.f. and to the frequency of the alternating e.m.f.

changes made	what happens to the maximum value of the e.m.f.	what happens to the frequency of the e.m.f.
stronger magnets		
more turns on the coil		
the coil is turned faster		

Q-118: Fig. shows a simple a.c. generator. The coil is turning and an e.m.f. is induced in the coil



a) The generator contains a permanent magnet. State the name of a metal used in a permanent magnet.

b) At the instant shown in Fig. 1, the induced e.m.f. is a maximum.

i) Explain why the induced e.m.f. is a maximum.

ii) State the position of the coil where there is no induced e.m.f.

Answers

Q-1: C Q-2: B Q-3: A Q-4: C Q-5: B Q-6: A Q-7: C

Q-8: C Q-9: B Q-10: D Q-11: C Q-12: D Q-13: C Q-14:C

Q-15: a) i) N marked on left AND S on the right of magnet
ii) (soft-iron / bar / it) is attracted to the (N pole of the) magnet
(soft-iron / bar / it) becomes induced magnet
with opposite pole nearest to magnet
b) i) electrons move
from the rod OR to the cloth
ii) TWO electrical conductors named
Q-16: a) i) poles correctly labelled
ii) Any two from
iron bar becomes induced magnet
with S pole nearest to (N pole of) magnet
opposite poles attract
b) i) ends of coil connected to power supply OR battery OR cell
ii) can be switched on/off OR magnetised/demagnetised (easily)
Q-18: a) two roughly circular lines drawn
arrow showing clockwise direction
b) any 5 from:
current in circuit / coil(s)
coil becomes electromagnet owtte
(coil / electromagnet) attracts (soft iron) armature
(so) hammer hits gong
circuit is broken (at A / contact screw)
electromagnet loses magnetic field / stops working
armature springs back
cycle repeats
Q-19: a) current (in coil / circuit)
magnetic (effect of current)
coil OR soft iron rod / bar (becomes a electro)magnet
b) i) any four from:
residual magnetism
circuit broken OR no current in electromagnet / circuit
electromagnet switched off / no longer attracts the (pivoted) arm
(pivoted) arm falls
current in bell OR alarm / bell circuit complete
ii) bell rings
(because) electromagnet switched off / no longer attracts the (pivoted) arm / (pivoted) arm falls
Q-20: A Q-21: A Q-22: C Q-23: D Q-24: A Q-25: A Q-26: A

Q-27: D Q-28: C Q-29: D Q-30: D Q-31: A Q-32: D Q-33: D

Q-34: A

Q-35: a) wire or rod positioned between magnetic poles
diagram or description of working circuit
current in circuit OR switch circuit on
wire / rod moves owtte

b) use resistor in series / only allow current to flow for a short time / use a smaller current / use a smaller p.d. / reduce the pd of the power supply

Q-36: a) current direction in copper wire correct on any part of diagram

b) current and magnetic field create a force
or current (in wire) creates a magnetic field
left-hand rule mentioned or used
or interaction of magnetic fields of magnet and current (catapult effect)

c) (electric) motor or any device that contains a motor
(loud)speaker or any device that contains a loudspeaker

Q-37: a) i) circuit with power supply and given wire with ammeter in series
variable resistor / variable power supply

ii) decrease variable resistor/resistance (of variable resistor) / increase supply voltage / increase number of cells

iii) reverse connections to battery/cell / change polarity of battery (accept reverse wire in the field)

iv) turn magnet other way up / S-pole on top and N-pole under wire / change
polarity of magnets

b) wire becomes hot / melts / fuses / burns / trips power supply / damages/fuses ammeter

Q-38: D Q-39: A Q-40: A Q-41: C

Q-42: a) oval/circle through or near A centered on or near X
clockwise arrow on line(s) around X and none wrong

b) fields (due to X and Y) cancel or X and Y fields equal and opposite

c) i) to the left
or towards X/A/B

ii) current (in wire Y) and (magnetic) field (caused by other wire)
or two (magnetic) fields interact

Q-43: A Q-44: A Q-45: A Q-46: B Q-47: C Q-48: B Q-49: B

Q-50: A Q-51: A Q-52: B Q-53: D Q-54: D Q-55: D Q-56: C

Q-57: D

Q-58: a) current (in coil) is (any one from)
• away from A or towards B
• from positive to negative

• at right angles to magnetic field
• makes the coil an (electro)magnet
left-hand rule stated, mentioned or used
or force at right angle to field and current
or top face of coil is a S-pole / bottom face a N-pole
forces in opposite directions (on opposite sides causing rotation)
or unlike poles attract / like poles repel (only if coil is electromagnet)

b) i) stronger magnetic field
or (soft) iron becomes (temporary) magnet / magnetises easily
stronger / larger force

ii) larger current / larger voltage / more turns on coil / wider coil / larger coil / thicker wire / stronger magnet

Q-59: a) i) connect (both ends of) wire to galvanometer
move wire relative to magnet owtte

ii) any two from:
increase strength of magnet(ic field) OR strong(er) magnet
turn wire into a coil owtte
increase the speed (of relative motion)

b) i) arrow drawn from N to S on Fig.

ii) any two from:
increase (battery) voltage OR larger current in coil
increase strength of magnet(ic) field OR strong(er) magnet
increase number of turns in coil

iii) reverse polarity of battery owtte
OR
reverse magnet(ic field) owtte

Q-60: a) i) current is in one direction

ii) symbols for two cells connected in series
symbol for a switch

b) i) motor

ii) any two from:
increasing number of turns on coil
increasing the current (in the coil)
increasing the strength of the magnetic field

Q-60: a) i) arrow up from side WX of coil AND an arrow down from side YZ of coil

ii) any three from:
stronger / more powerful magnets
smaller gap between coil and magnet(s)
larger current in coil
more coils / turns

b) Vp / Vs = Np / Ns OR ratio used
4000 ÷ (225 ÷ 4.5) OR (4000 x4.5) ÷ 225 OR 4000 ÷ 50
80

Q-61: a) i) anti-clockwise (seen from brushes)
I correctly described
F down on left / up on right
ii) arrow labelled correct direction on coil B1
iii) electrons –ve OR repelled from –ve connection of supply
b) i) rotates in opposite direction
ii) turns faster OR greater moment / turning effect
iii) turns faster OR greater moment / turning effect

Q-63: C Q-64: A Q-65: B Q-66: C Q-67: C Q-68: B Q-69: B

Q-70: B Q-71: D Q-72: C Q-73: B Q-74: A Q-75: B

Q-76: a) steel, nickel, cobalt
b) i) magnetic field (lines) cut OR changing magnetic field / flux linkage (in coil)
e.m.f. / voltage induced
ii) (end Q) is an N-pole repels / opposes (approaching) N-pole / magnet
c) any two from:
withdraw N-pole (from end Q) OR move magnet to the right
insert S-pole (into end Q)
insert N-pole into other end
withdraw S-pole from other end or carry on past mid-point
Q-77: a) strong(er) magnet
move (magnet) more quickly / faster movement
more turns / coils (per unit length)
b) i) (soft) iron
ii) Vp / Vs = Np / Ns in any form
(Vs =) 240 x 50 / 1000
12 (V)
Q-78: a) i) deflection
(then) reverse deflection / current / voltage OR greater deflection
OR deflection for shorter time
OR change of (magnetic) field / flux
ii) larger deflection OR deflection for shorter time M1
higher speed OR
larger (rate of) change of magnetic field / flux
b) {current / power too high OR trip hazard} AND cut (in insulation)
AND plug / socket on damp / wet (grass)
overheating / fire in extension lead OR trip hazard B1
short circuit / shock / electrocution through cut (in insulation) B1
short circuit / shock / electrocution through plug on damp / wet (grass)

Q-79: a) top box ticked (alternating)
b) any two from:
increase strength of magnet/magnetic field
increase speed of magnet
increase number of turns (of wire in coil)

Q-80: a) (diagram) A
b) i) connect coil to (centre zero) meter
move magnet in OR / AND out of coil
(observe) deflection on meter
ii) any two from:
use stronger magnet
move magnet faster
more turns on coil OR use more than 100 turns
c) (generator produces) alternating current OR direction of current keeps changing

Q-81: A **Q-82: D** **Q-83: B** **Q-84: B**

Q-85: a) (a d.c. has) constant value / magnitude or direction does not change or has Only one direction
b) i) sinusoidal curve in phase with voltage and maximum value of 0.75 A and same frequency
ii) (P =) VI or 7.2 x 0.75
5.4 W
c) i) vertical, upward arrow labelled M on side AB
ii) A to B and (Fleming's) right-hand rule (in some way)
rule explained (i.e. fingers explained or labelled 3D diagram)
iii) greater (maximum) voltage
greater frequency or smaller time period or changes direction more often or alternates faster

Q-86: B **Q-87: A** **Q-88: A** **Q-89: B** **Q-90: C** **Q-91: C** **Q-92: D**

Q-93: B **Q-94: D** **Q-95: C** **Q-96: B** **Q-97: C** **Q-98: C** **Q-99: C**

Q-100: a) relative movement (between conductor and magnetic field)
And any two from:
connect conductor/coil to (sensitive) meter
use of magnet/magnetic field
deflection on meter (indicates emf) OR voltage generated OR current in conductor
b) i) (soft-) iron
ii) more turns on output coil (than input coil) ora

iii) Vs / Vp = Ns / Np in any form
Vs / 12 = 300 / 20 OR Vs = (300 / 20) x12 OR Vs = 15 x12
OR 12 / 20 = ? / 300
180 (V)

Q-101: a) *Vp* ÷ *Vs* = *Np* ÷ *Ns*
230 ÷ *Vs* = 300 ÷ 30
23 (V)
b) (soft) iron
c) Any two from:
less energy or power wasted OR
less heating(of wires) OR more efficient
lower current (in transmission wires)
can use thinner (transmission) wires / cables
fewer power stations needed
(so) lower cost for cable and supporting pylons
transmit (energy over) longer distances (without drop in power)

Q-102: a) i) (Q is the) secondary/output (coil)
ii) 1. (soft–) iron
2. core
iii) magnetic field OR e.m.f. OR magnet
changing OR alternating
iv) EITHER
more AND step-down
OR
fewer AND step-up
b) any two from:
smaller current (in wires)
smaller drop in p.d./voltage (across cables)
smaller heating effect
less energy wasted/more efficient
thinner cables can be used
fewer pylons neededl
(electricity) can be transmitted over long(er) distances

Q-103: a) magnetic (material)
temporary / soft magnetic (material)
b) i) it / a.c. changes direction or changes polarity / from positive to negative (continually)
it / a.c. has varying size or is sinusoidal / like a sine wave
ii) magnetic field (in core / secondary coil) is not changing / remains constant no (electromagnetic) induction

Q-104: a) any four from:
step up: increase voltage / high voltage in power lines

lower current
reduce power / energy losses
step down: lower voltage / low voltage in homes
safety/match for appliances / machines
thinner cables (can be used)

b) Vp / Vs = Np / Ns in any form
Vs = (500 / 2000) x 240
60 (V)

Q-105: D Q-106: D Q-107: B Q-108: B Q-109: D Q-110: B Q-111: B

Q-112: D Q-113: B Q-114: D

Q-115: a) magnetic field (of magnet)
changes / cuts coil / linked to coil
induces / causes / produces / generates an emf / voltage / current OR electromagnetic induction

b) stronger magnet
more turns on coil(s)
turn magnet at higher speed

c) i) alternating (current)
ii) a.c. changes direction OR d.c one direction only

Q-116: a) i) mention of (magnetic) field / flux (of N and S-poles)
(coil/wire) cuts magnetic field / flux / lines
or magnetic flux in coil changes

ii) (one side of) coil cuts one way and then the other
or (side) moves one way and then the other / returns
or flux increases and then decreases

b) increase in emf for both stronger magnets and more turns
no change / same frequency for both stronger magnets and more turns
increase and increase for turn the coil faster

Q-117: a) steel / magnadur / alnico / magnetite

b) i) mention of cutting (lines of) magnetic field / change in (magnetic) flux great(est) rate of change
or fast(est) cutting
or other explanation involving time

ii) vertical/upright
or turned through 90°
or normal to (magnetic) field