4. Electricity and magnetism

4.5 Electromagnetic effects

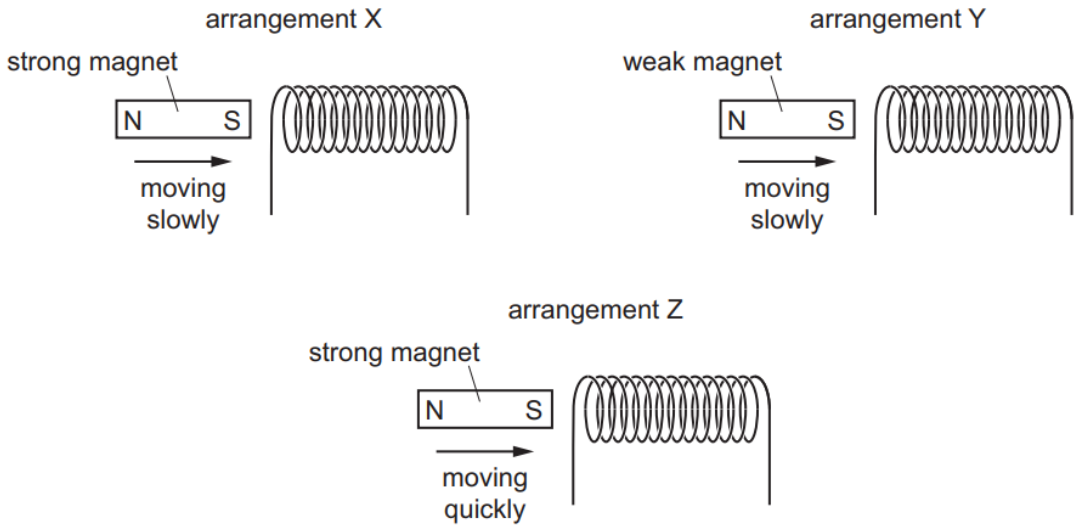
Paper 1 and 2

Question Paper

Paper 1

Questions are applicable for both core and extended candidates

1 The diagrams show a strong magnet and a weak magnet moving into the same coil of wire at different speeds.



Which arrangement induces the largest electromotive force (e.m.f.) and which arrangement induces the smallest e.m.f.?

	largest e.m.f.	smallest e.m.f.
A	X	Y
B	Y	Z
C	Z	X
D	Z	Y

2 What are the best materials to use for the construction of a transformer?

A copper for the core and steel for the coils wound around it

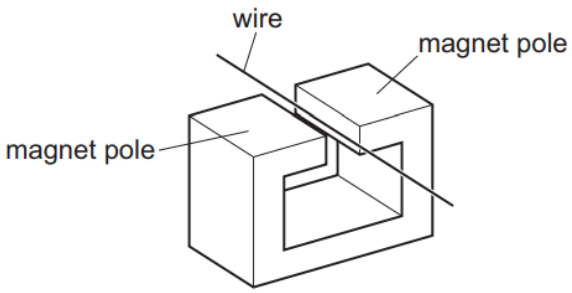
B copper for the core and copper for the coils wound around it

C soft iron for the core and copper for the coils wound around it

D steel for the core and copper for the coils wound around it

3 A straight wire is stationary between the poles of a magnet.

It lies perpendicular to the magnetic field.



Which action does **not** induce an e.m.f. in the wire?

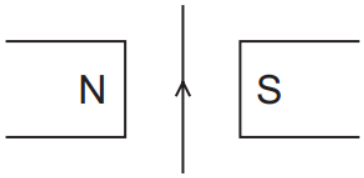
A moving the magnet up towards the top of the page and the wire down towards the bottom of the page

B moving the magnet up towards the top of the page only

C moving the wire and the magnet up towards the top of the page at the same speed

D moving the wire down towards the bottom of the page only

4 The diagram shows a wire hanging vertically between the poles of a magnet.



There is a current in the wire in the direction shown. The wire moves into the plane of the page away from the observer.

In which direction does the wire move when the current is reversed?

A The wire moves into the plane of the page, away from the observer.

B The wire moves to the left.

C The wire moves to the right.

D The wire moves out of the plane of the page, towards the observer.

5 A current-carrying coil in a magnetic field experiences a turning effect.

Students are asked how the turning effect can be increased.

Three suggestions are listed.

1 decreasing the number of turns on the coil

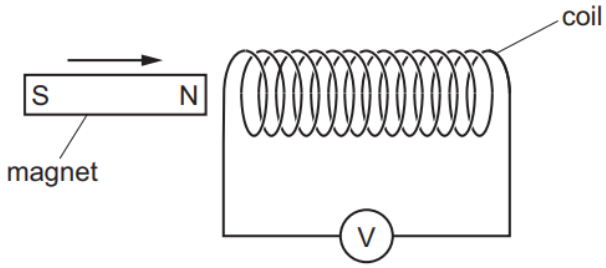
2 increasing the current

3 increasing the strength of the magnetic field

Which suggestions will increase the turning effect?

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

6 A student moves a magnet into a coil, as shown. The voltmeter measures the magnitude of the electromotive force (e.m.f.) induced in the coil.



Which quantity does **not** affect the magnitude of the induced e.m.f.?

A the number of turns per unit length in the coil

B the polarity of the magnet

C the speed of the magnet

D the strength of the magnet

7 A student makes a small d.c. motor. The teacher supplies the following equipment.

- battery
- ammeter
- voltmeter
- coil of wire
- magnets
- resistor

The student is also able to use other equipment if he wishes.

Which equipment **must** be used?

A ammeter, battery and resistor

B ammeter, coil of wire and voltmeter

C battery, coil of wire and magnets

D magnets, resistor and voltmeter

8 A metal bar is placed inside a current-carrying coil, as shown in diagram 1.

There is a small current in the coil. The bar holds a few nails, as shown in diagram 2.

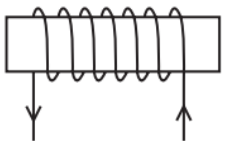


diagram 1

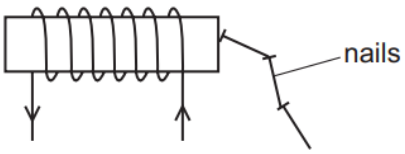


diagram 2

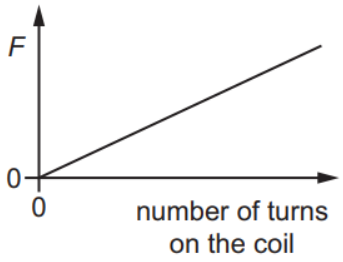
When there is no current in the coil, the nails drop off.

Which row is correct?

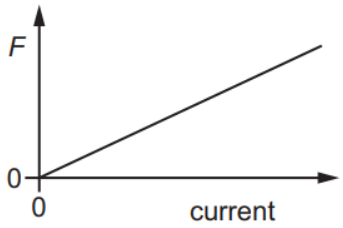
	metal from which the bar is made	effect of a larger current in the coil
A	soft iron	it makes no difference
B	soft iron	the bar holds more nails
C	steel	it makes no difference
D	steel	the bar holds more nails

9 Which graph does **not** show the correct trend for the force *F* causing the turning effect on the coil in a d.c. motor?

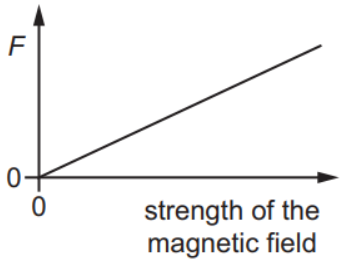
A



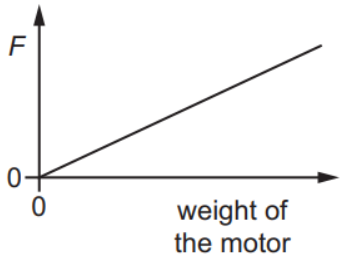
B



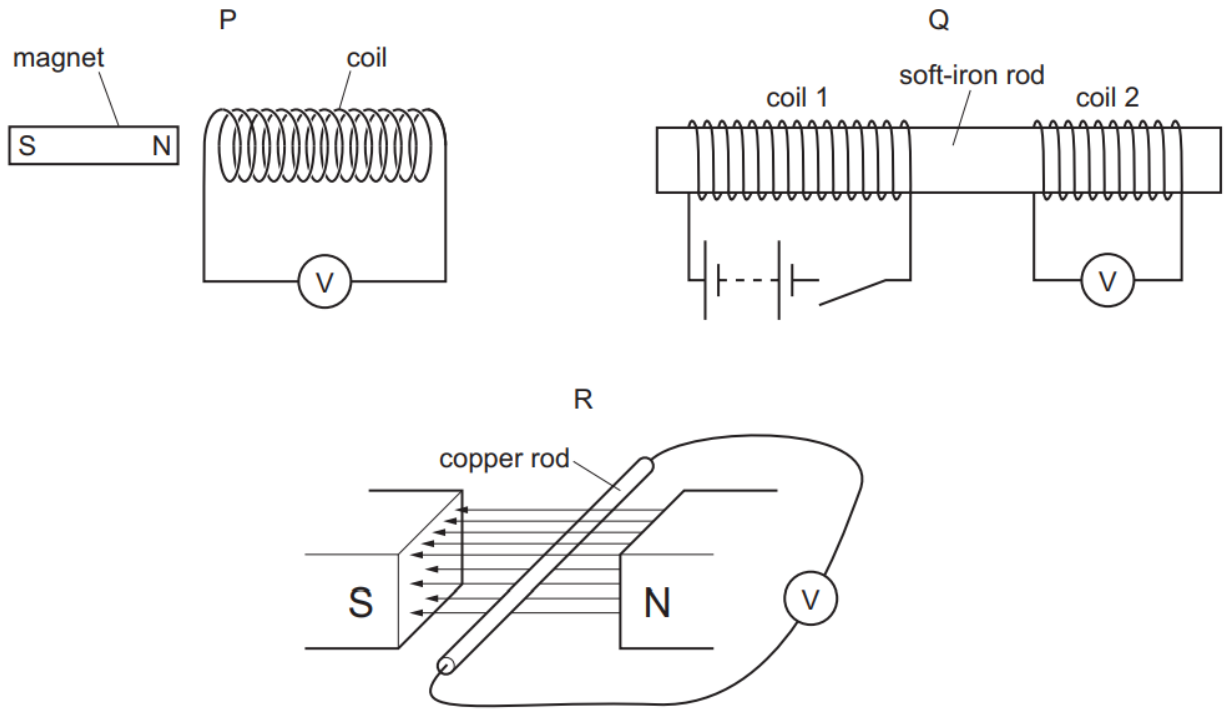
C



D



10 A teacher sets up the equipment for three demonstrations, P, Q and R.



In demonstration P, the magnet is moved to the right.

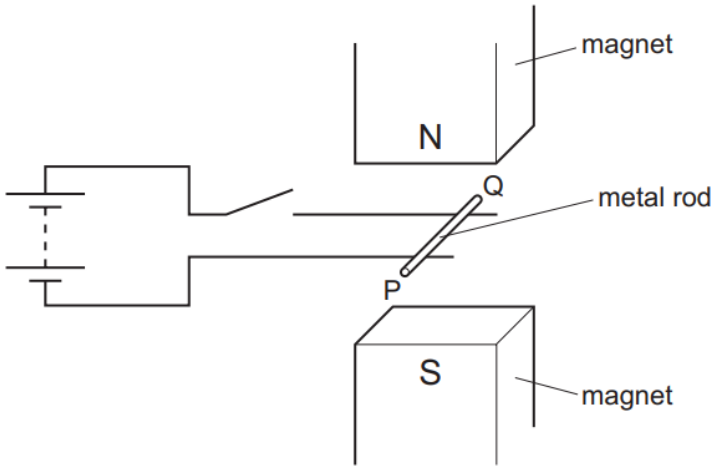
In demonstration Q, the switch is closed.

In demonstration R, the copper rod is moved vertically upwards.

Which demonstrations can be used to demonstrate electromagnetic induction?

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

11 A metal rod PQ rests on two horizontal metal wires that are attached to a battery. The rod lies between the poles of a magnet.



When the switch is closed, the rod moves to the right.

What could be changed so that the rod moves to the left?

A Open the switch.

B Reverse the battery terminals and exchange the poles of the magnet.

C Reverse the battery terminals but without exchanging the poles of the magnet.

D Turn the metal rod around (P and Q exchanged).

12 A transformer in a computer is used to transform the mains voltage of 240 V to 12 V.

The number of turns on the secondary coil is 2000.

Which statement about the transformer is correct?

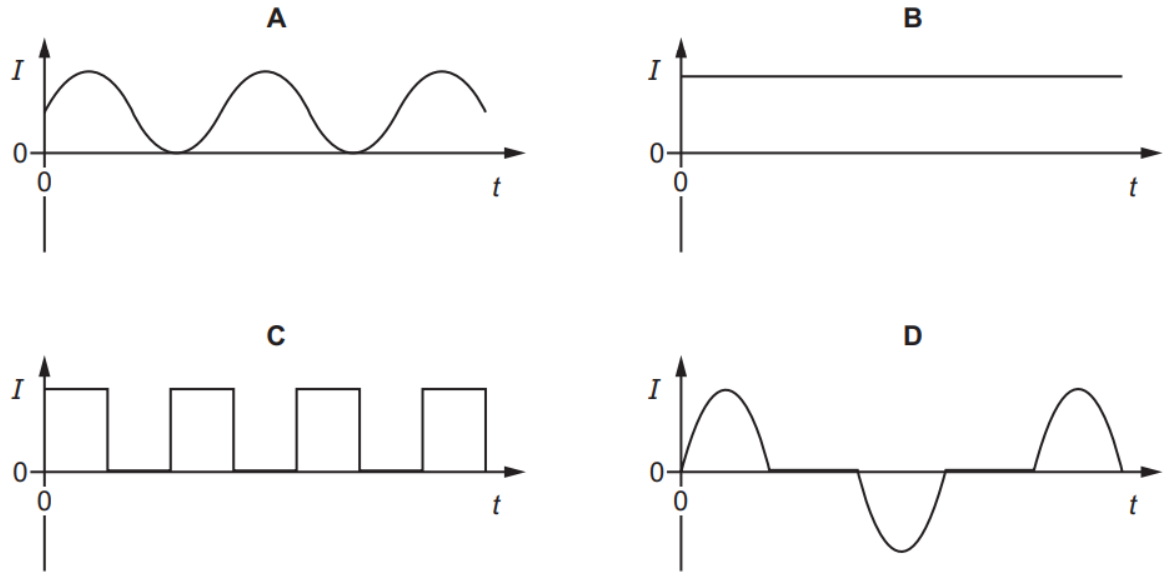
A It is a step-down transformer and has 100 turns on its primary coil.

B It is a step-down transformer and has 40 000 turns on its primary coil.

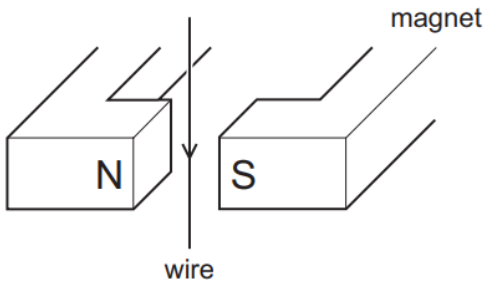
C It is a step-up transformer and has 100 turns on its primary coil.

D It is a step-up transformer and has 40 000 turns on its primary coil.

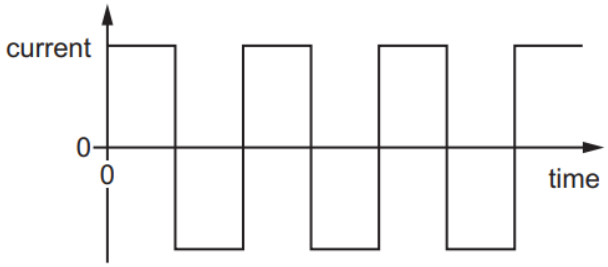
13 Which graph of current I against time t represents an alternating current (a.c.)?



14 The diagram shows a wire in the magnetic field between two poles of a magnet.



The current in the wire repeatedly changes between a constant value in one direction and a constant value in the opposite direction, as shown in the graph.



What is the effect on the wire?

A The force on the wire alternates between one direction and the opposite direction.

B The force on the wire is constant in size and direction.

C There is no force acting on the wire at any time.

D There is only a force on the wire when the current reverses.

15 A transformer has N_p turns on its primary coil and N_s turns on its secondary coil. The voltage across the primary coil is V_p and the voltage across the secondary coil is V_s.

What is the relationship between these four quantities?

A $V_p \times V_s = N_p \times N_s$

B $\frac{V_p}{V_s} = \frac{N_p}{N_s}$

C $\frac{V_p}{V_s} = \frac{N_s}{N_p}$

D $\frac{V_p}{V_s} = N_p \times N_s$

16 A simple electric generator induces an electromotive force (e.m.f.).

Which modification would increase the induced e.m.f.?

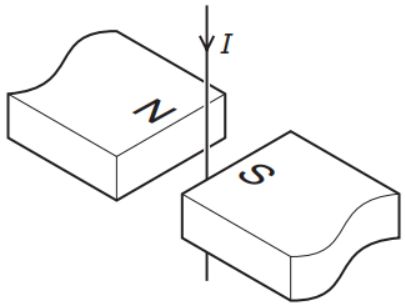
A Increase the number of turns in the coil of the generator.

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.

17 The diagram shows a vertical wire carrying a current I placed between the poles of a magnet.



What is the direction of the force on the wire exerted by the magnetic field?

A from N to S

B from S to N

C horizontal and at right angles to the direction from N to S

D parallel to the wire

18 What is an advantage of transmitting electricity at a high voltage?

A It is faster.

B It is safer.

C Less energy is wasted.

D Less equipment is needed.

19 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.

20 In which device is the magnetic effect of a current **not** used?

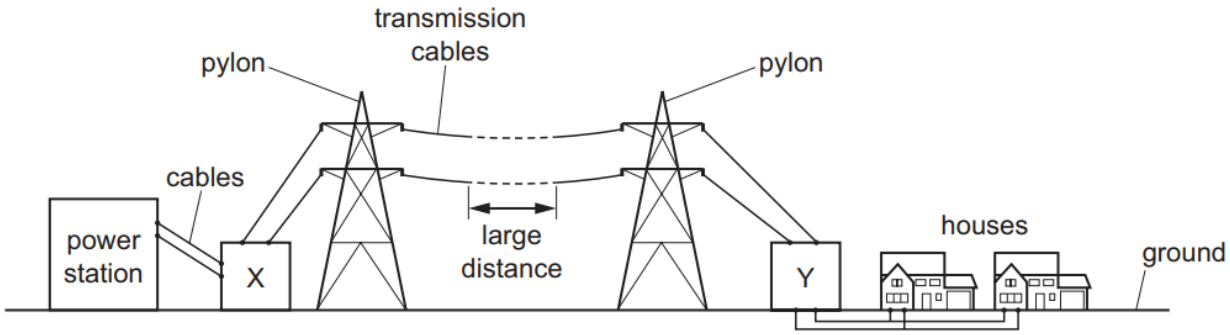
A electromagnet

B loudspeaker

C potential divider

D relay

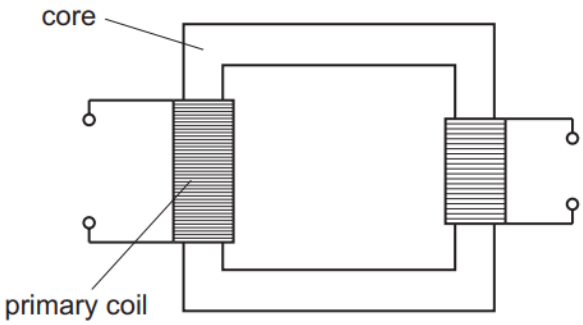
21 The diagram represents the transmission of electricity from a power station to homes that are many kilometres away. Two transformers are labelled X and Y.



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

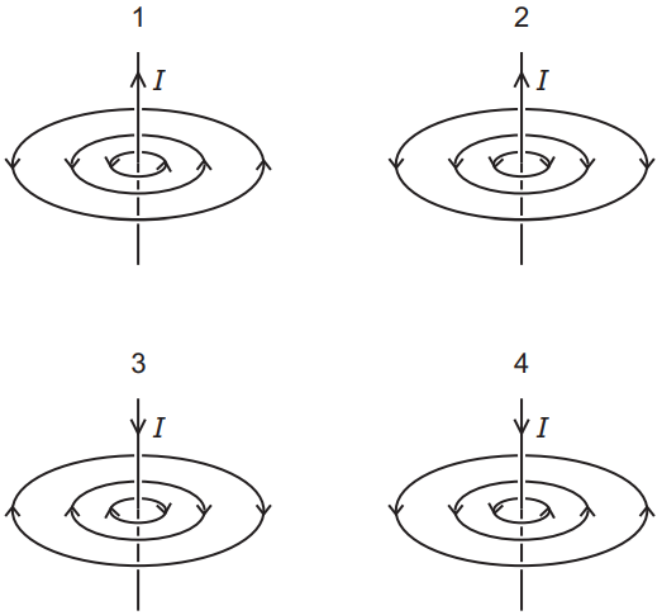
22 The diagram represents a transformer.



Which row shows materials suitable for making the core and the primary coil?

	core	primary coil
A	iron	copper
B	iron	plastic
C	steel	copper
D	steel	plastic

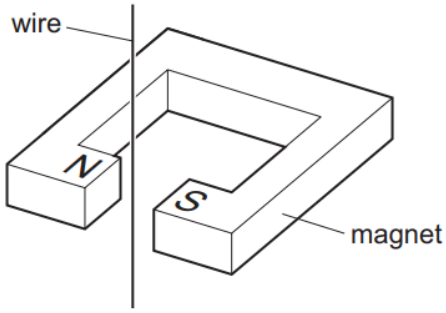
23 The diagrams show the magnetic field lines around a wire carrying a current, I.



Which diagrams are correct?

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

24 A wire is placed between the poles of a magnet.



Which statements are correct?

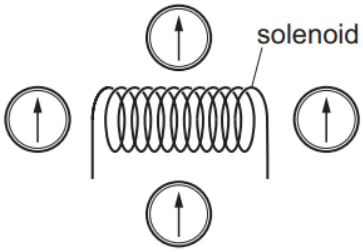
1 An a.c. current in the wire causes a changing force on it.

2 A downward d.c. current in the wire causes a constant force on it.

3 An upward d.c. current in the wire causes a constant force on it.

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

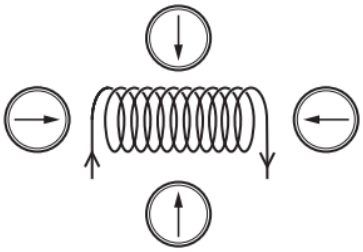
25 Four small compasses are placed around a solenoid.



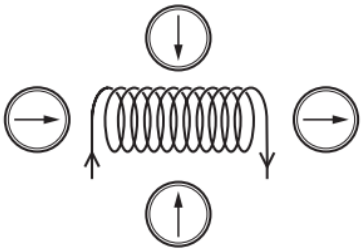
A current is now switched on in the solenoid.

Which diagram shows possible new directions of the compass needles?

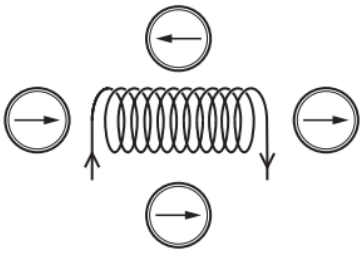
A



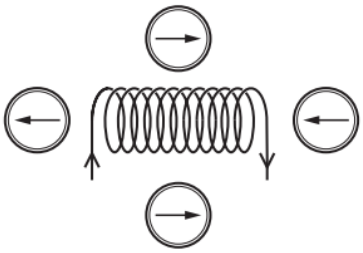
B



C



D

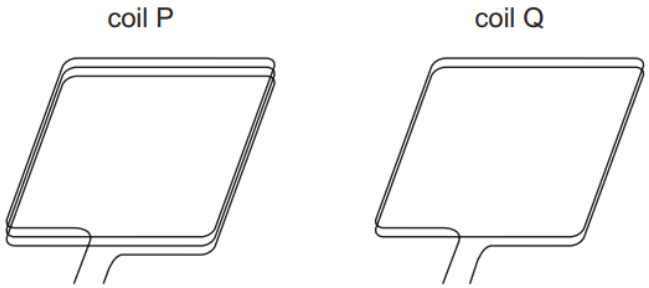


26 Transformers are used in the transmission of electrical power to houses.

Which type of transformer is used at the power station prior to connection to the power lines and which type is used prior to delivery to the houses?

	power station	before houses
A	step-down	step-down
B	step-down	step-up
C	step-up	step-down
D	step-up	step-up

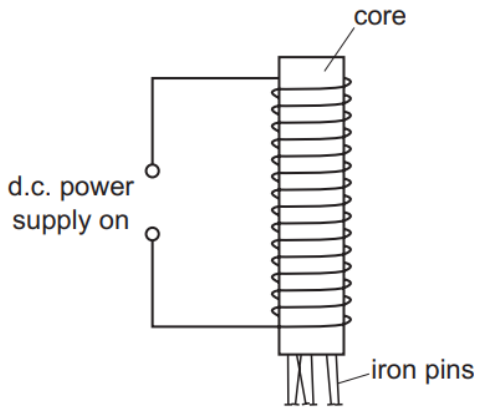
27 The diagrams show the coils of two simple direct current (d.c.) motors. Coil P has three turns of wire and coil Q has two turns. Coil P has the same dimensions as coil Q. The coils are in identical magnet fields.

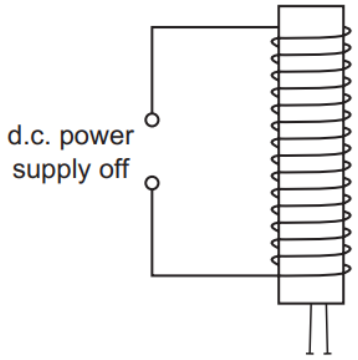


What produces the greatest turning effect?

	coil	current / A
A	P	2
B	P	4
C	Q	2
D	Q	4

28 A student counts how many iron pins an electromagnet picks up when its power supply is switched on. Then, she counts how many pins are picked up when the power supply is switched off.





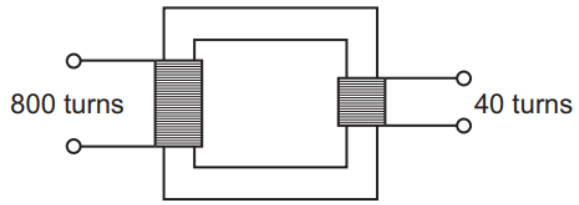
She repeats the experiment using cores made of different materials. The results are shown.

Which core is made out of soft iron?

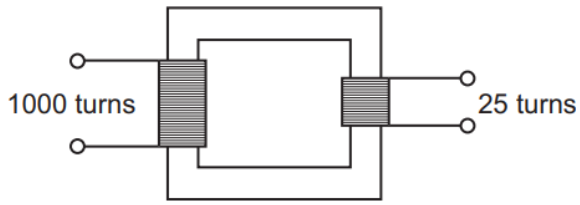
	pins picked up with the power supply on	pins picked up with the power supply off
A	0	0
B	2	7
C	8	5
D	12	0

29 Which transformer can change a 240 V a.c. input into a 15 V a.c. output?

A



B



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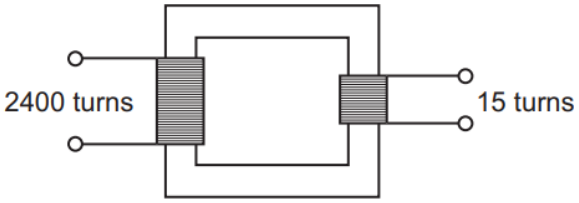
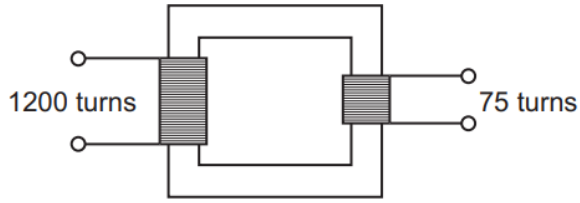


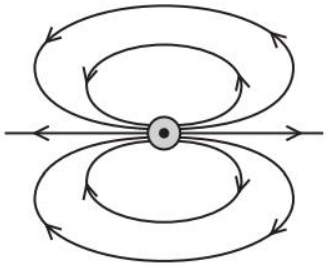
D



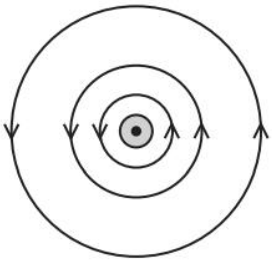
30 The diagrams show patterns around a straight wire carrying a current perpendicularly out of the page.

Which pattern represents the magnetic field due to the current in the wire?

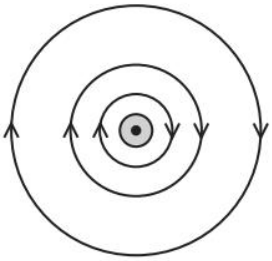
A



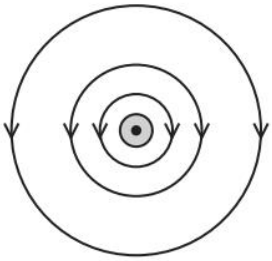
B



C



D



31 A current-carrying coil in a magnetic field experiences a turning effect.

Three suggestions for increasing the turning effect are given.

1 Increase the number of turns on the coil.

2 Increase the current in the coil.

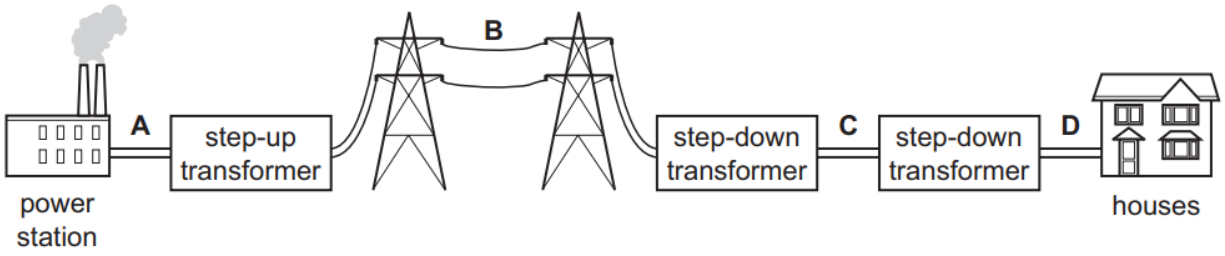
3 Increase the strength of the magnetic field.

Which suggestions are correct?

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

32 Electrical power is transmitted from power stations to homes using the National Grid.

In which part of the National Grid is the voltage highest?



33 The coils in two electric motors are identical in size, but motor 1 is observed to spin more quickly than motor 2.

Three suggestions are made to explain this observation.

1 The current in the coil of motor 1 is greater than the current in the coil of motor 2.

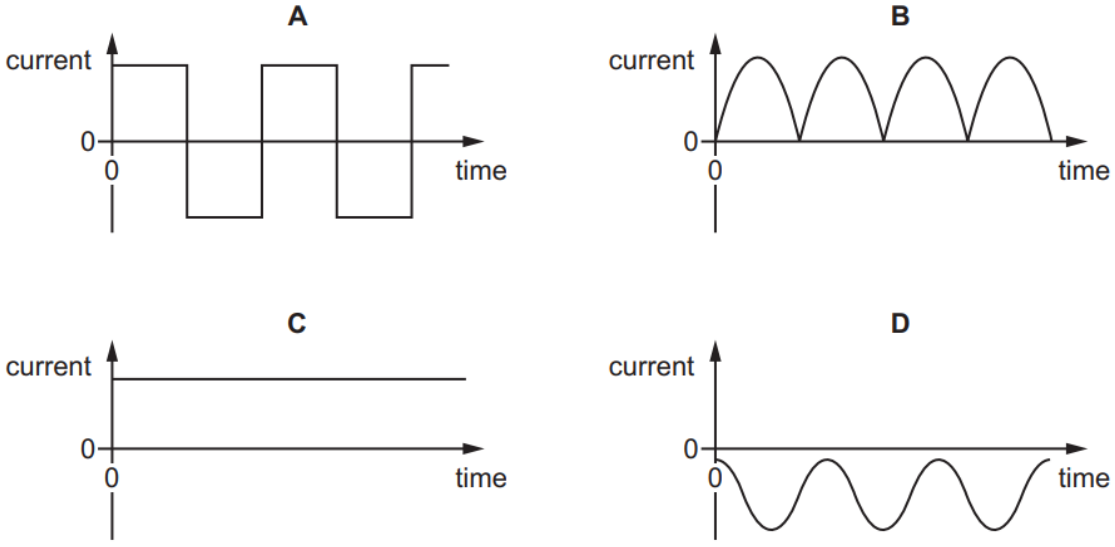
2 The number of turns on the coil of motor 1 is greater than on the coil of motor 2.

3 The magnets in motor 1 are stronger than the magnets in motor 2.

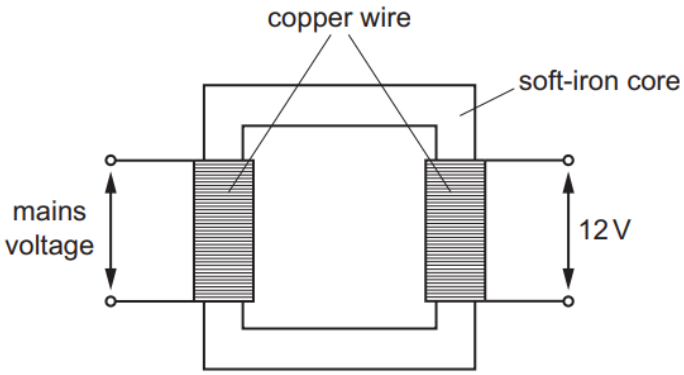
Which suggestions give a possible explanation for this observation?

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

34 Which graph represents an alternating current (a.c.)?



35 The step-down transformer shown reduces mains voltage to 12 V.



When the transformer is used, some energy is transferred to the surroundings.

Which type of energy is transferred to the surroundings?

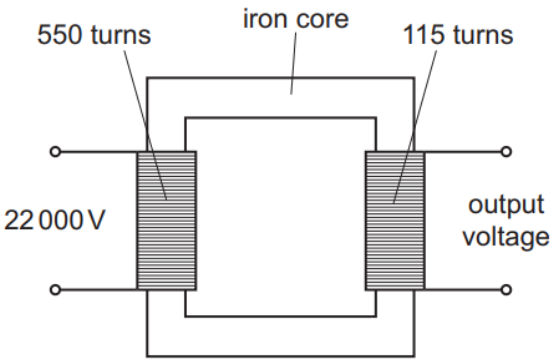
A chemical energy

B light energy

C thermal energy

D elastic energy

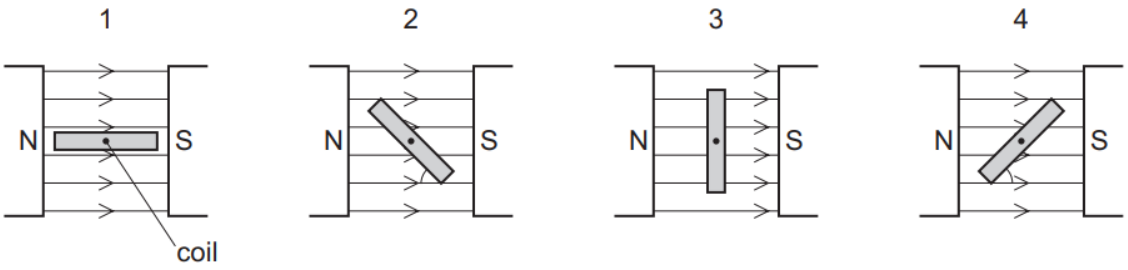
36 The diagram shows a transformer.



What is the output voltage?

A 0.35 V **B** 2.9 V **C** 4600 V **D** 105 000 V

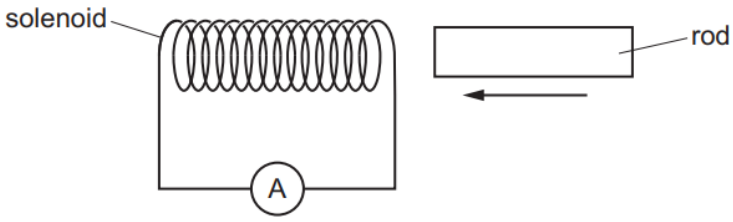
37 Four positions of a current-carrying coil in a magnetic field, as in a d.c. motor, are shown. In diagrams 2 and 4, the coil is at an angle of 45° to the field lines.



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

38 A solenoid is connected to a very sensitive ammeter. A rod is inserted into one end of the solenoid. The ammeter shows that there is a small electric current in the solenoid while the rod is moving.



Which rod is being inserted?

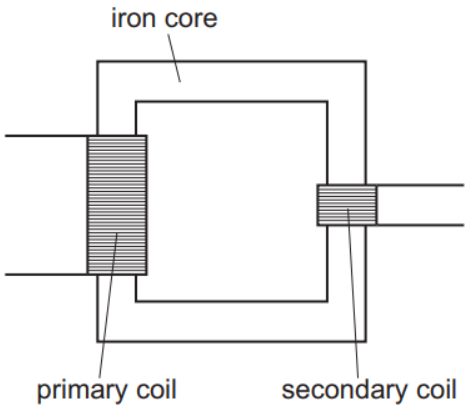
A a heated copper rod

B a magnetised steel rod

C an uncharged nylon rod

D a radioactive uranium rod

39 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

40 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.

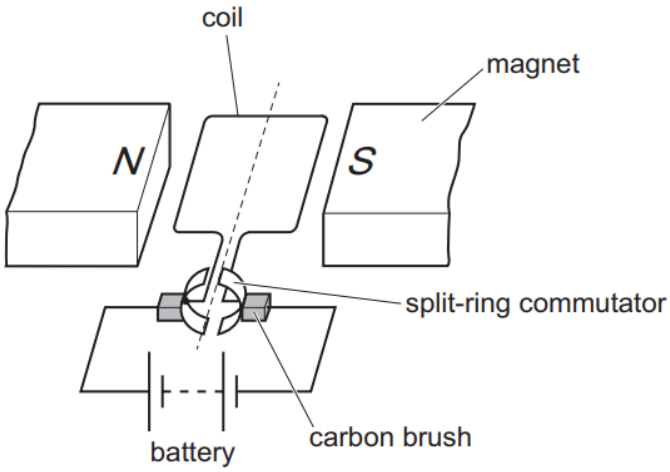
2 Have a stronger magnet in the motor.

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

41 The diagram shows a d.c. motor.



Which two changes together will always make the coil spin more slowly?

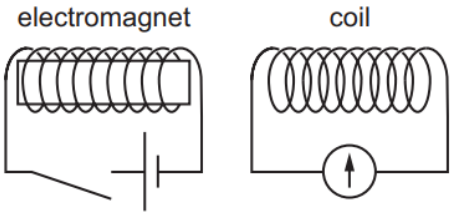
A Decrease the current in the coil and use a magnet of less strength.

B Decrease the current in the coil and increase the number of turns on the coil.

C Increase the current in the coil and use a magnet of less strength.

D Increase the current in the coil and decrease the number of turns on the coil.

42 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.

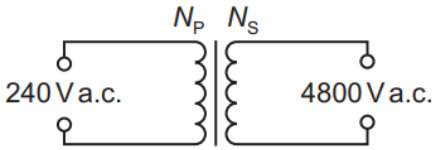
2 The pointer records a steady non-zero value while the electromagnet remains switched on.

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

43 A transformer is needed to convert a supply of 240 V a.c. into 4800 V a.c..



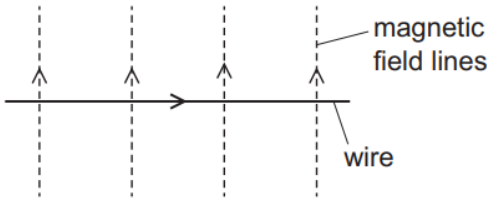
Which pair of coils would be suitable for this transformer?

	number of turns on primary coil N_P	number of turns on secondary coil N_S
A	50	1 000
B	240	48 000
C	480	24
D	2000	100

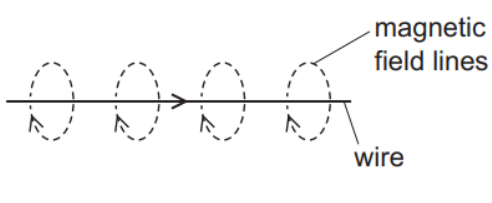
44 The diagrams show a current-carrying wire with an arrow in the direction of the current.

Which diagram shows the magnetic field produced by the current?

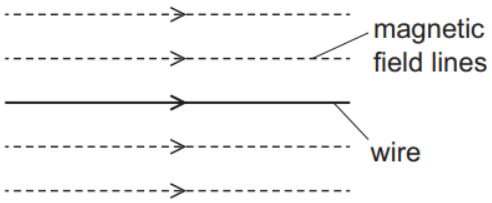
A



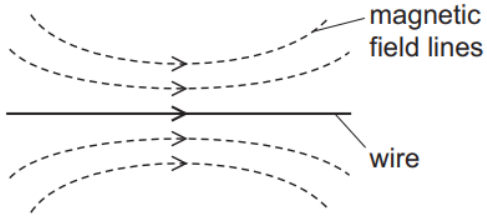
B



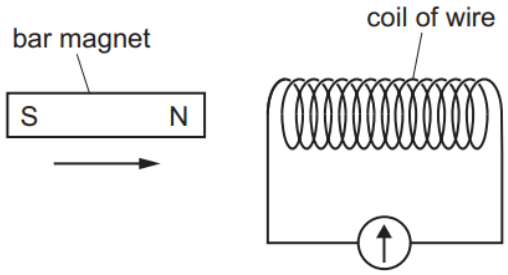
C



D



45 A student investigates electromagnetic induction. She moves the N pole of a magnet quickly towards a coil of wire. There is a reading on the galvanometer.



What can she do to get a greater reading on the galvanometer?

A Hold the bar magnet stationary inside the coil.

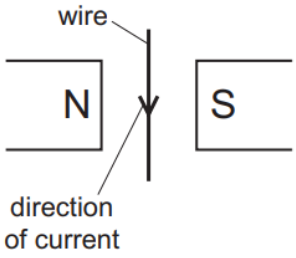
B Move the bar magnet slowly away from the coil.

C Use a coil of wire with fewer turns on it.

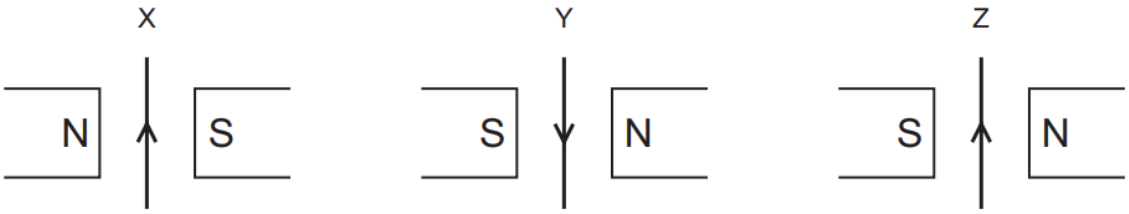
D Use a stronger bar magnet.

46 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

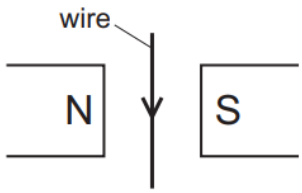
47 A transformer has 200 turns on its primary coil and is connected to a 240 V a.c. supply.

The output voltage of the transformer is 60 V a.c..

How many turns are on the secondary coil of the transformer?

A 20 **B** 50 **C** 72 **D** 800

48 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.

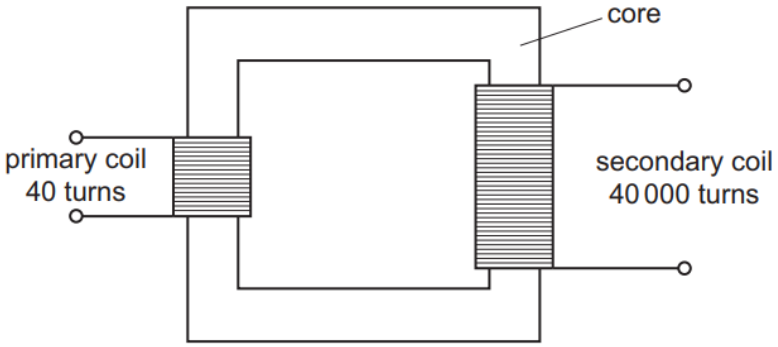
2 The current is towards the bottom of the page and the magnetic field is reversed then the force produced acts into the page.

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

49 The diagram shows a transformer.



Which statement about this transformer is correct?

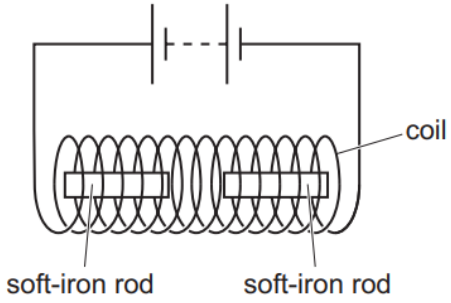
A It can operate from a 12 V battery.

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.

50 Two soft-iron rods are placed end-to-end inside a coil. The coil is connected to a battery.



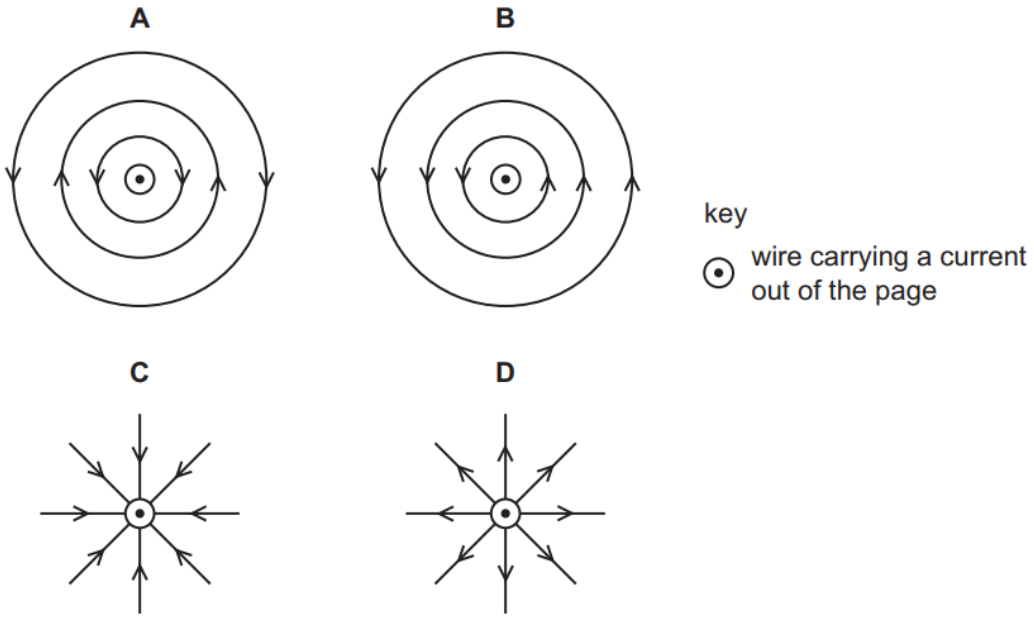
The connections from the battery to the coil are now reversed.

What happens to the soft-iron rods in each case?

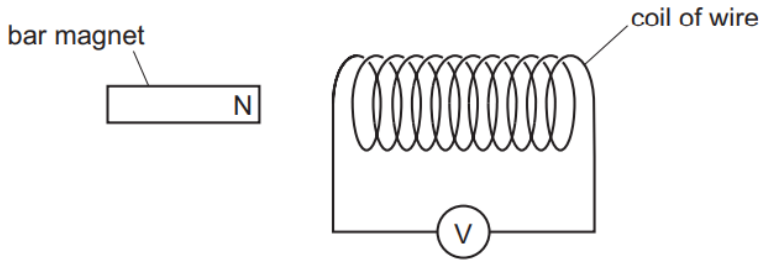
	battery connections as shown	battery connections reversed
A	rods attract	rods attract
B	rods attract	rods repel
C	rods repel	rods attract
D	rods repel	rods repel

51 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?



52 A bar magnet is held near a coil of wire. The coil is connected to a sensitive voltmeter.



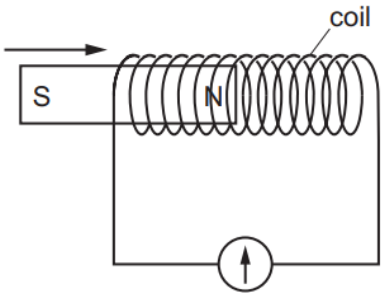
The N-pole of the magnet is moved quickly towards the coil. The voltmeter shows a reading of +10 mV.

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

53 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.

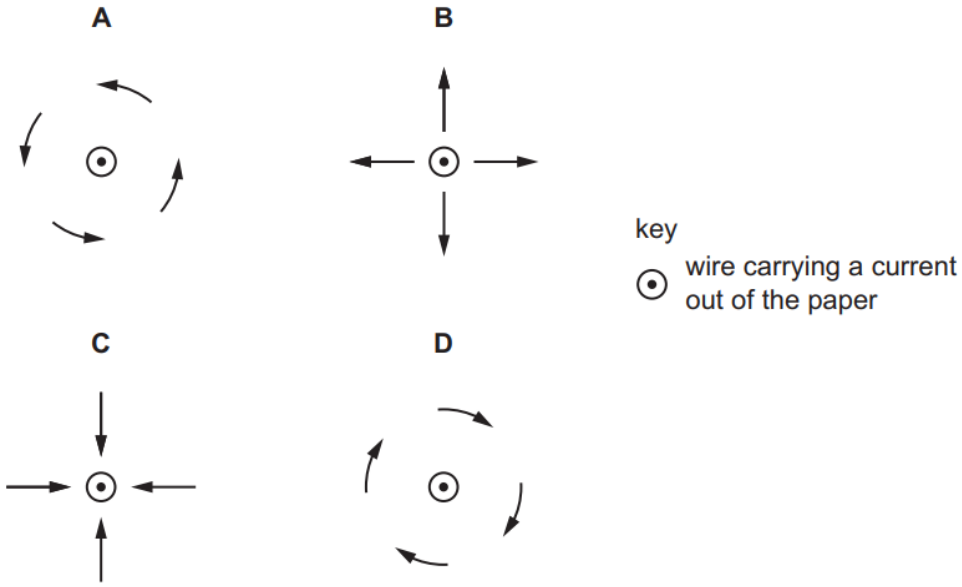
B Use a coil with fewer turns and a weaker magnet.

C Use a coil with more turns and a stronger magnet.

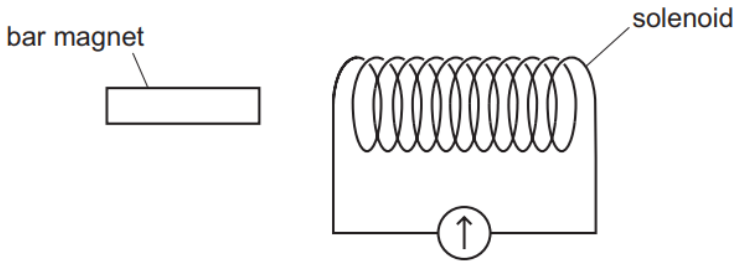
D Use a coil with more turns and a weaker magnet.

54 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?

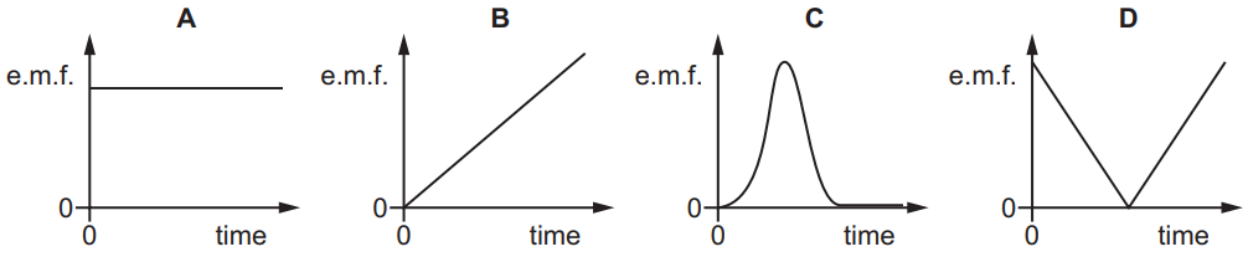


55 A bar magnet is held near a solenoid. The coil is connected to a galvanometer.



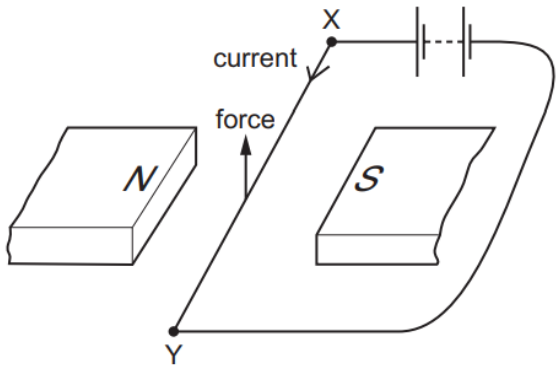
The magnet is moved into the coil of wire and then held stationary inside the coil.

Which graph shows how the induced electromotive force (e.m.f.) varies with time?



56 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

57 Which electrical device uses the turning effect produced by a current-carrying coil in a magnetic field?

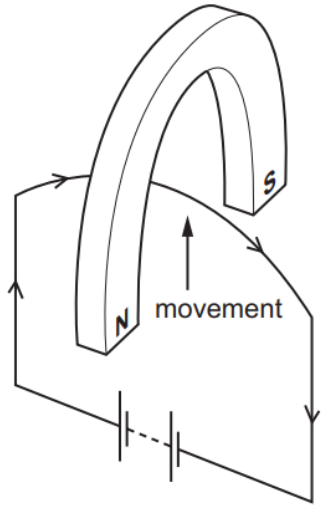
A a.c. generator

B d.c. motor

C relay

D transformer

58 A wire is placed in a strong magnetic field. When a current is passed through the wire it moves upwards, as shown.



The current is reversed.

In which direction does the wire move?

A downwards

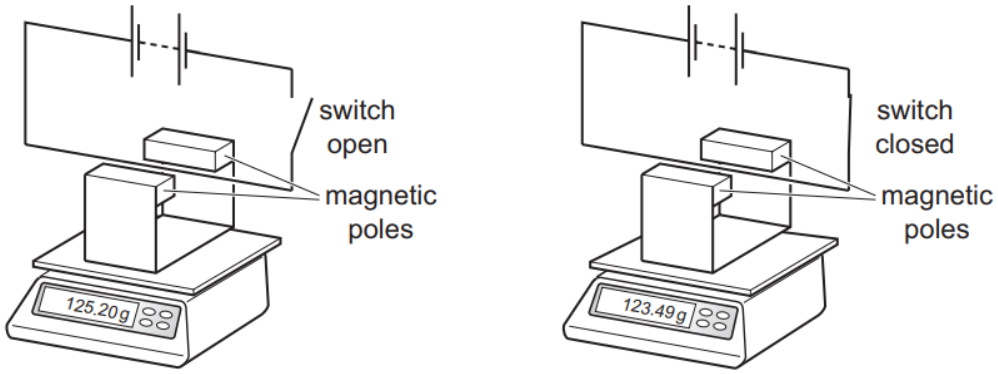
B towards the north pole

C towards the south pole

D upwards

59 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.

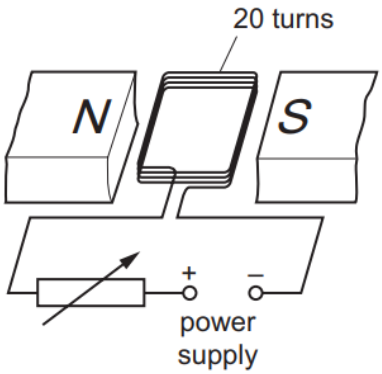
2 Only the magnetic field is reversed.

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

60 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

61 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.

62 An electrical device changes the voltage of an electrical supply from 240 V a.c. to 20 V a.c.

What is this device?

A a generator

B a relay

C a transformer

D a voltmeter

63 A transformer has N_p turns in the primary coil and N_s turns in the secondary coil.

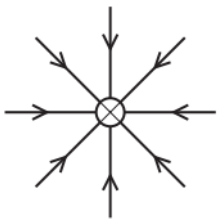
Which row gives the values of N_p and N_s for a transformer that steps up a voltage of 1200 V to 36 000 V?

	N_p	N_s
A	2000	60 000
B	2000	600 000
C	60 000	2000
D	600 000	2000

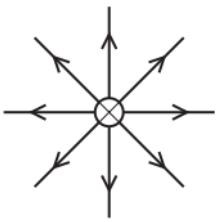
64 A straight wire is perpendicular to the paper. It carries a current into the paper.

What is the magnetic field pattern and its direction near the wire?

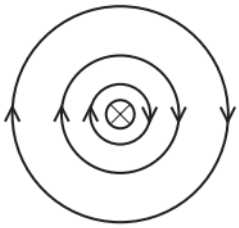
A



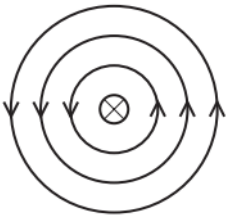
B



C



D



key

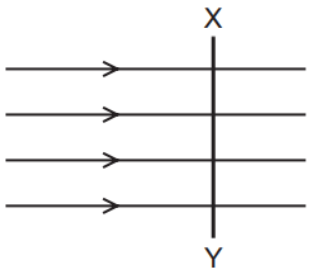
⊗ wire with current into the page

Paper 2

Questions are applicable for both core and extended candidates unless indicated in the question

65 A metal rod, XY, is placed in a magnetic field so that it is perpendicular to the field, as shown.

(extended only)



In which direction is the rod moved so that there is an induced current from Y to X?

A left to right

B right to left

C into the paper, away from the observer

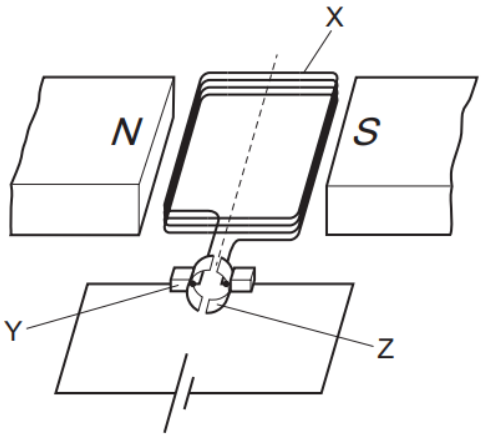
D out of the paper, towards the observer

66 Which types of electric current are in the primary coil and the secondary coil of a step-up transformer?

(extended only)

	primary coil	secondary coil
A	a.c.	a.c.
B	a.c.	d.c.
C	d.c.	a.c.
D	d.c.	d.c.

67 The diagram shows a basic electric motor. **(extended only)**



What are the names of the features?

	X	Y	Z
A	axle	battery	brushes
B	coil	brushes	commutator
C	generator	wires	transformer
D	solenoid	connectors	switch

68 Two transformers, P and Q, each have 2000 turns on their primary coils and 1000 turns on their secondary coils. Both transformers are 100% efficient. **(extended only)**

The secondary of transformer P is connected to the primary of transformer Q.

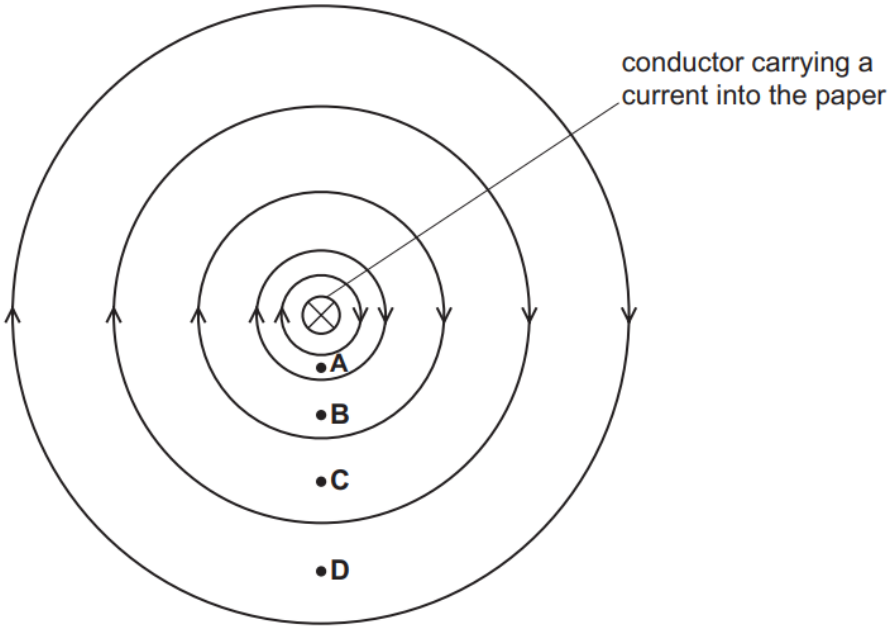
Q provides a motor with a current of 0.2 A.

What is the current being supplied to the primary of transformer P?

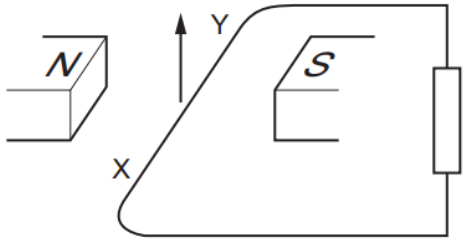
A 0.8 A **B** 0.4 A **C** 0.1 A **D** 0.05 A

69 The diagram shows the magnetic field around a conductor which is carrying a current.

Where is the strength of the field greatest? **(extended only)**



70 The diagram shows a wire XY moving upwards in a magnetic field. **(extended only)**



A current is induced in the wire.

The current-carrying wire XY experiences a force because of its interaction with the magnetic field.

Which row gives the direction of the induced current and the direction of the force experienced by the wire XY?

	direction of induced current	direction of the force
A	from X to Y	downwards
B	from X to Y	upwards
C	from Y to X	downwards
D	from Y to X	upwards

71 Diagram 1 shows a magnet being pushed into a coil that is connected to a centre-zero sensitive voltmeter.

(extended only)

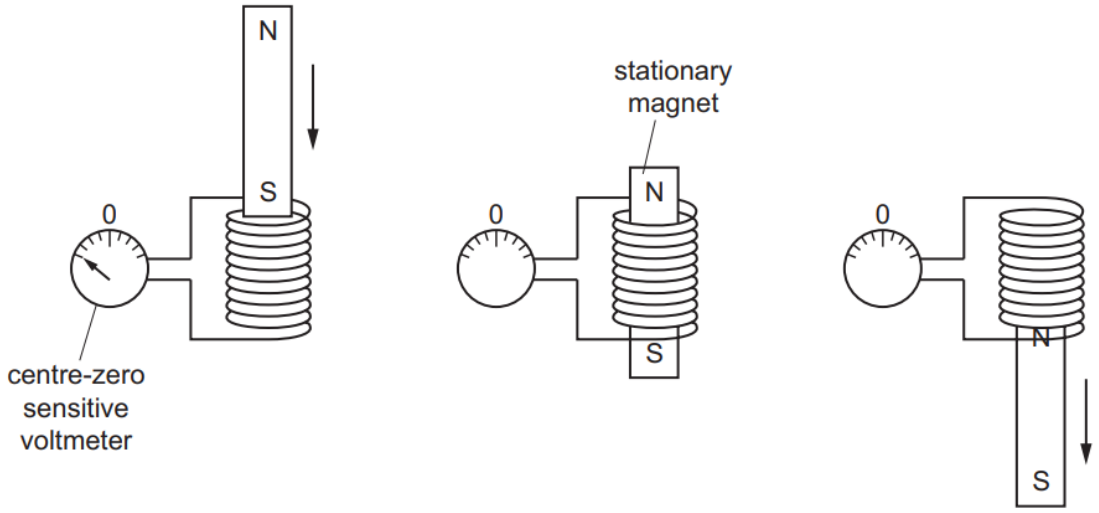


diagram 1 diagram 2 diagram 3

Which row shows the directions of the pointer on the voltmeter when the magnet is as shown in diagrams 2 and 3?

	diagram 2	diagram 3
A		
B		
C		
D		

72 What is the purpose of the brushes and the split-ring commutator in a d.c. motor? **(extended only)**

A to change the size of the current

B to keep the coil turning in the same direction

C to keep the speed of rotation constant

D to make the output an alternating voltage

73 When a conductor in a complete circuit cuts across a magnetic field, a current is induced in the conductor.

(extended only)

Which statement about the induced current is correct?

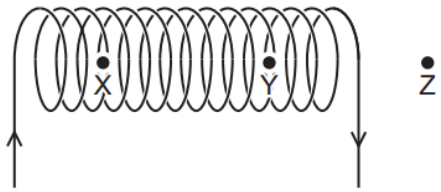
A The induced current is in the same direction as the motion of the conductor.

B The induced current is in the opposite direction to the motion of the conductor.

C The direction of the induced current is in the same direction as the magnetic field.

D The direction of the induced current opposes the change causing it.

74 The diagram shows a solenoid carrying an electric current. **(extended only)**



Which row compares the strength of the magnetic field due to the solenoid at points Y and Z with the strength of the magnetic field at point X?

	magnetic field strength at Y	magnetic field strength at Z
A	equal to X	less than X
B	equal to X	greater than X
C	greater than X	less than X
D	greater than X	greater than X

75 A current in a solenoid produces a uniform magnetic field inside the solenoid. The magnetic field direction is due east.

(extended only)

Which changes will produce a stronger magnetic field with a direction due west?

A Use a smaller current and turn the solenoid through 180°.

B Use a smaller current and reverse the current.

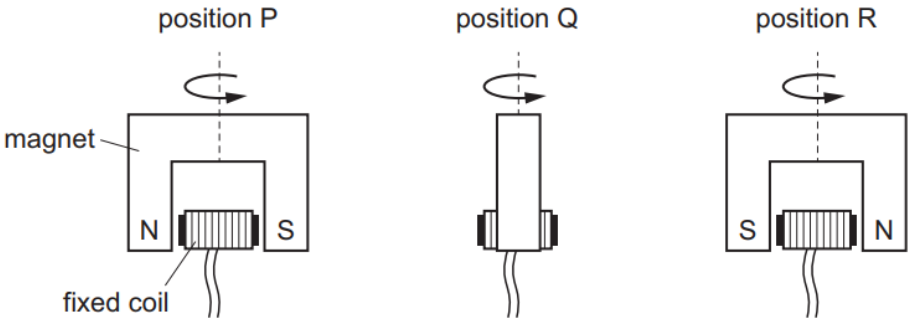
C Use a larger current and turn the solenoid through 90°.

D Use a larger current and reverse the current.

76 The diagram shows a simple a.c. generator. The magnet rotates around a fixed coil wound round a fixed iron core. The electromotive force (e.m.f.) output is a sine wave, a series of crests, zeros and troughs.

(extended only)

The magnet is shown in three positions, P, Q and R, during its rotation. The magnetic field in the coil is zero at Q but changing most rapidly.



Which statement about the induced e.m.f. in the coil is correct?

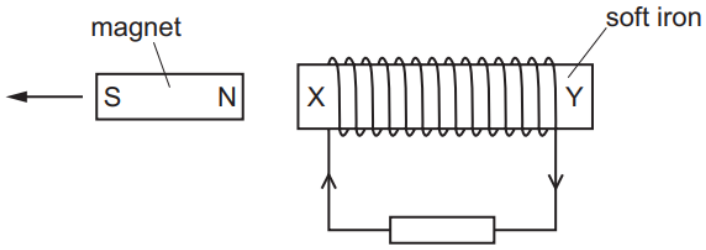
A The magnitude of the e.m.f. at position Q is larger than that at position P.

B The magnitude of the e.m.f. at position Q is zero.

C The magnitude of the e.m.f. at position Q is smaller than at position R, but not zero.

D The magnitude of the e.m.f. at position R is larger than at position P.

77 A piece of soft iron XY has a coil of wire wound round it. **(extended only)**



The N pole of a bar magnet is pulled away from end X which causes an induced current in the coil.

The magnet is now turned round so that the N pole is on the left. It is taken to the other end of the soft iron and the N pole is pushed towards end Y. A new current is induced in the coil.

Which statement is correct?

A The new induced current is in the opposite direction and causes the soft iron to attract the N pole.

B The new induced current is in the opposite direction and causes the soft iron to repel the N pole.

C The new induced current is in the same direction and causes the soft iron to attract the N pole.

D The new induced current is in the same direction and causes the soft iron to repel the N pole.

78 Which statement about electromagnetic induction is correct? **(extended only)**

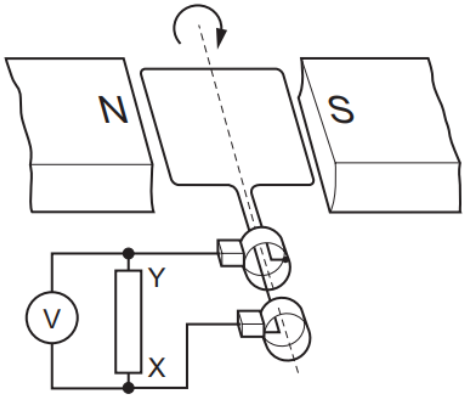
A A conductor moving parallel to magnetic field lines induces an electromotive force (e.m.f.) in the conductor.

B The direction of the induced electromotive force (e.m.f.) opposes the change which produces it.

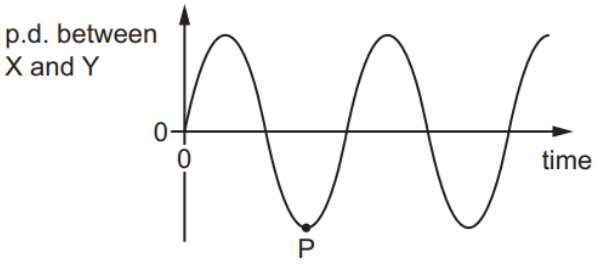
C The induced current is in a direction parallel to the direction of motion producing it.

D The induced electromotive force (e.m.f.) decreases when the speed of the conductor moving across the field lines increases.

79 The diagram shows an a.c. generator. **(extended only)**

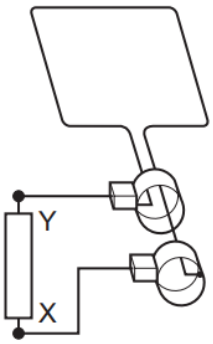


The graph shows the potential difference (p.d.) between points X and Y plotted against time. A positive value of p.d. indicates that X is more positive than Y.

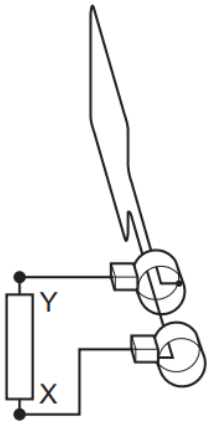


Which diagram shows the position of the coil at point P on the graph?

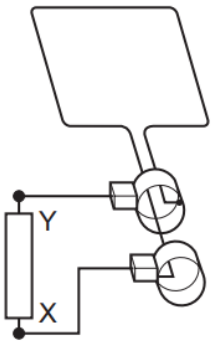
A



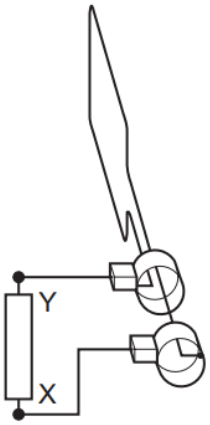
B



C



D



80 An electron moves into a uniform magnetic field. **(extended only)**

The arrow shows the initial direction of motion of the electron.

The direction of the magnetic field is into the plane of the page.

In which direction does a force act on the electron when it enters the magnetic field?

A into the page

B out of the page

C towards the bottom of the page

D towards the top of the page

81 Which statement about a transformer is correct? **(extended only)**

A There is an alternating current in the iron core from the primary coil to the secondary coil.

B An alternating current in the iron core induces an alternating current in the secondary coil.

C An alternating current in the primary coil induces a direct current in the secondary coil.

D An alternating current in the primary coil induces an alternating voltage across the secondary coil.

82 A step-down transformer is 100% efficient. It has an input voltage of 240 V a.c. and an output voltage of 60 V a.c.

(extended only)

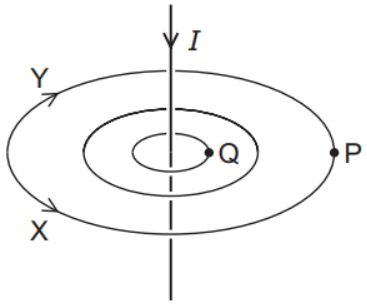
The current in the primary coil is 0.50 A.

What is the current in the secondary coil?

A 0.13 A **B** 0.50 A **C** 2.0 A **D** 8.0 A

83 The diagram shows the pattern of the magnetic field due to the current I in a straight wire.

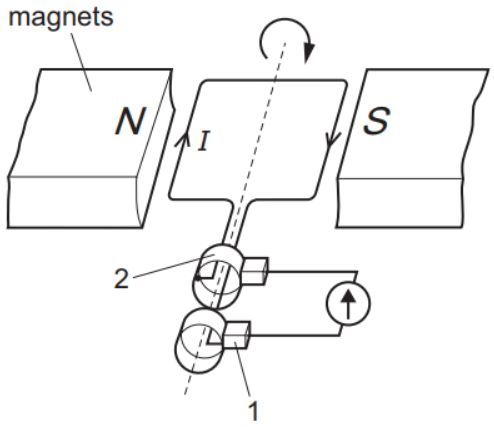
(extended only)



Which row is correct?

	direction of field	relative strength of field
A	X	greater at P than Q
B	Y	greater at P than Q
C	X	greater at Q than P
D	Y	greater at Q than P

84 The diagram shows an a.c. generator rotating in a clockwise direction. **(extended only)**



What are the names of parts 1 and 2?

	1	2
A	brush	slip-ring
B	brush	split-ring commutator
C	slip-ring	brush
D	slip-ring	split-ring commutator

85 What is the purpose of the split-ring commutator in an electric motor? **(extended only)**

A to ensure that the magnetic field in the motor changes direction every half rotation

B to ensure that the magnetic field in the motor stays in the same direction at all times

C to ensure that the turning effect on the motor changes direction every half rotation

D to ensure that the turning effect on the motor stays in the same direction at all times

86 A magnet is dropped vertically through a solenoid. This induces magnetic poles at both ends of the solenoid.

(extended only)

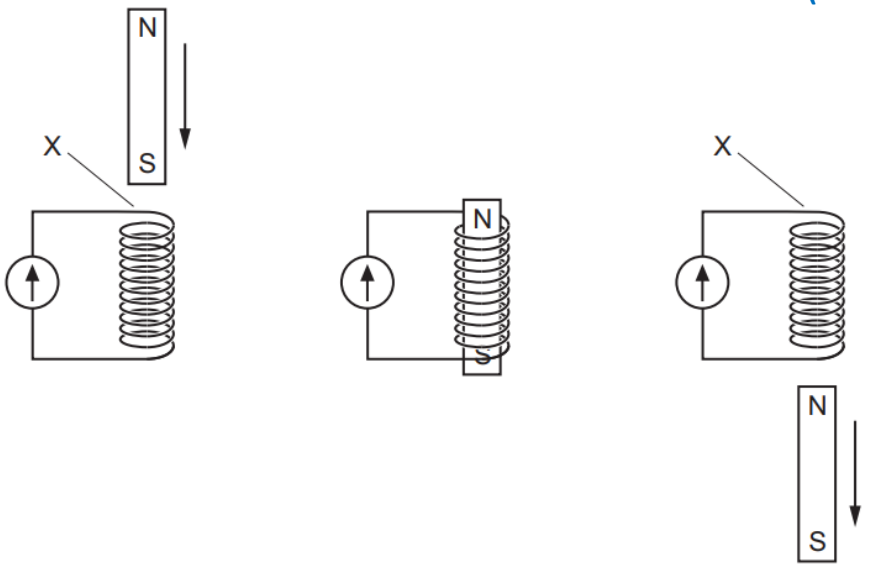


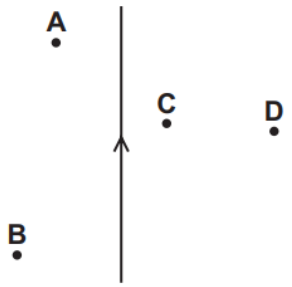
diagram 1 diagram 2 diagram 3

Which magnetic poles are induced at position X in diagram 1 and diagram 3?

	diagram 1	diagram 3
A	N pole	N pole
B	N pole	S pole
C	S pole	N pole
D	S pole	S pole

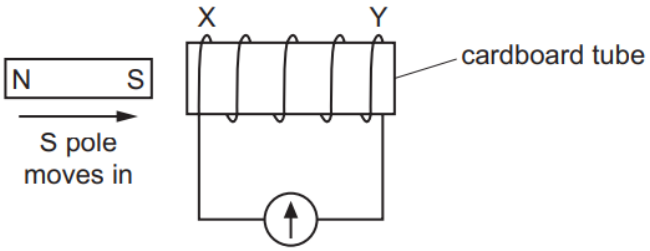
87 The diagram shows part of a long current-carrying conductor. **(extended only)**

At which point is the magnetic field strongest?



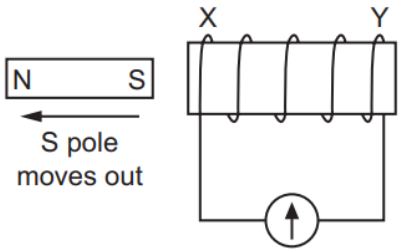
88 A coil XY is wound around a cardboard tube. **(extended only)**

When the S pole of a magnet is pushed into the coil XY, the galvanometer deflects to the left.

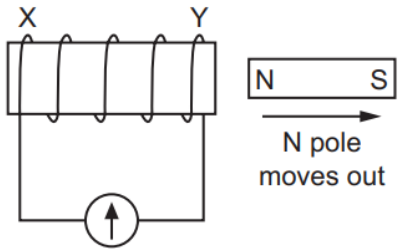


What other movement of the magnet will produce a deflection to the left?

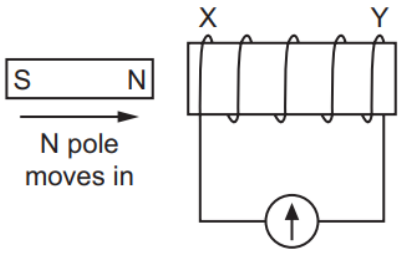
A



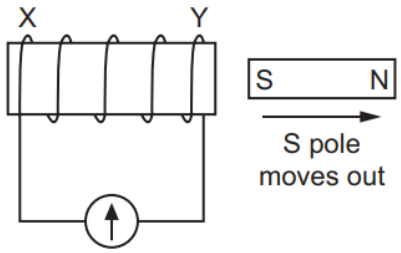
B



C



D



89 What is the function of the split-ring commutator in an electric motor with a single rotating coil?

(extended only)

A to enable the motor to function with an a.c. source

B to reverse the current in the coil once every revolution

C to reverse the current in the coil whenever its plane becomes perpendicular to the magnetic field

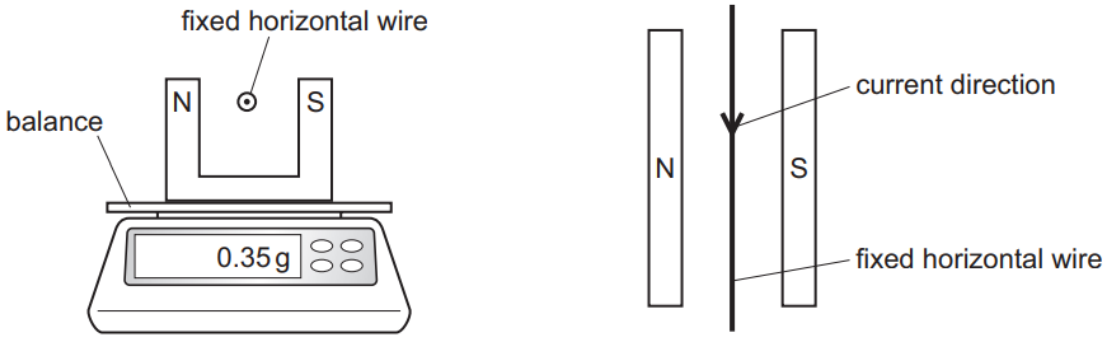
D to reverse the current in the coil whenever its plane is parallel with the magnetic field

90 The diagrams show a horizontal wire in a magnetic field. **(extended only)**

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?

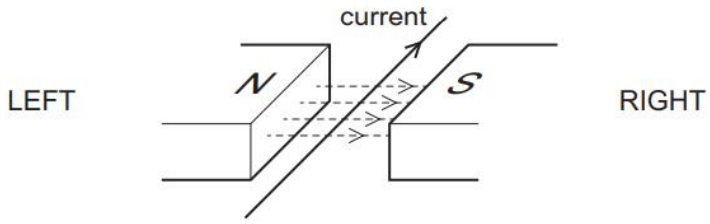
A smaller than 0.35 g

B no change

C changing from smaller to larger than 0.35 g repeatedly

D larger than 0.35 g

91 The diagram shows a current-carrying wire in a magnetic field. **(extended only)**



In which direction is the force acting on the wire?

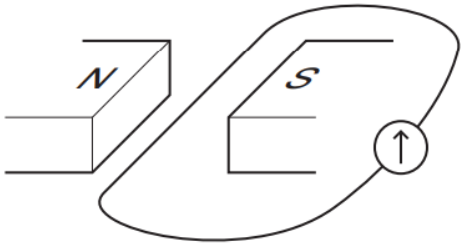
A towards the bottom of the page

B to the left

C to the right

D towards the top of the page

92 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.

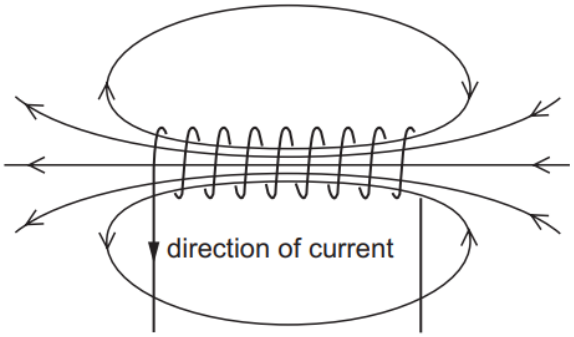
3 The wire is moved more quickly.

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

93 The diagram shows the magnetic field due to a current in a solenoid. **(extended only)**

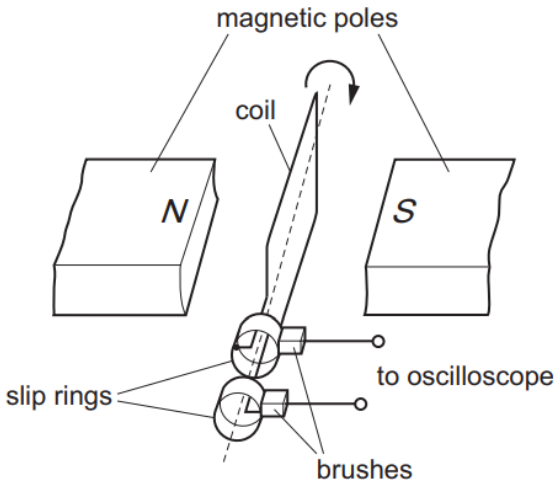


The direction of the current is reversed.

Which row describes the effect that this has on the magnitude and on the direction of the magnetic field?

	magnitude of magnetic field	direction of magnetic field
A	increases	changes
B	increases	unchanged
C	unchanged	changes
D	unchanged	unchanged

94 The diagram shows an electric generator with the coil in a vertical position. **(extended only)**



Which row describes the generator?

	the generator produces	the voltage output will be zero when
A	a.c.	the coil is horizontal
B	a.c.	the coil is vertical
C	d.c.	the coil is horizontal
D	d.c.	the coil is vertical

95 A 100% efficient transformer converts a 240 V input voltage to a 12 V output voltage. The output power of the transformer can be a maximum of 20 W. **(extended only)**

The output is connected to two 0.30 A bulbs in parallel. One of the bulbs fails.

How does the current in the primary coil change?

A It decreases by 0.30 A.

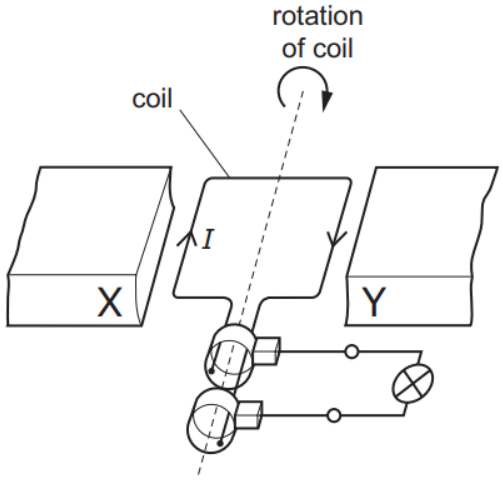
B It decreases by 0.015 A.

C It increases by 0.15 A.

D It remains unchanged.

96 The diagram shows an a.c. generator used to power a lamp. The coil rotates in a clockwise direction.

(extended only)

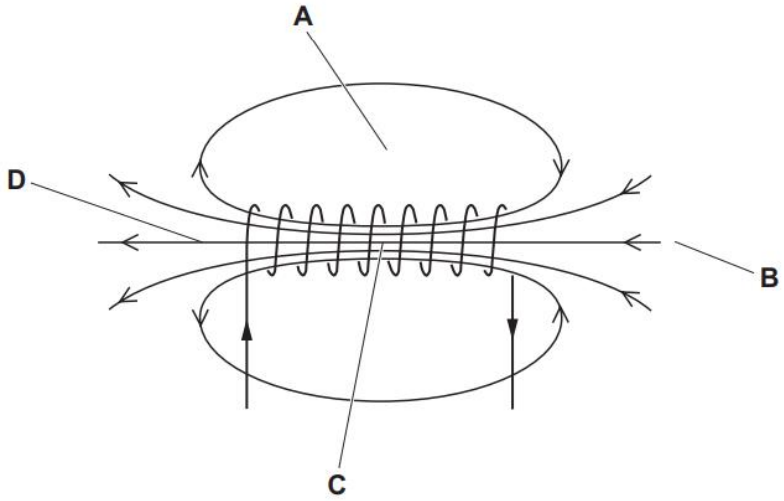


Which magnetic poles are X and Y?

	X	Y
A	N pole	N pole
B	N pole	S pole
C	S pole	N pole
D	S pole	S pole

97 The diagram shows the magnetic field due to a current in a solenoid. **(extended only)**

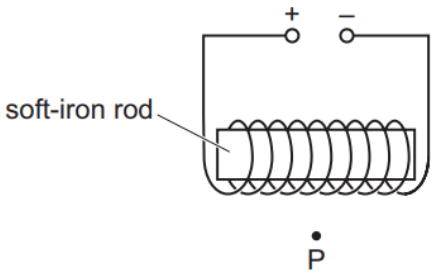
Where is the magnetic field the strongest?



98 The diagram shows a coil of wire wrapped around a soft-iron rod.

The wire is connected to a d.c. power supply as indicated.

The apparatus is in a region which is totally shielded from the Earth's magnetic field.



A small compass needle is placed at point P.

In which direction does the N pole of the compass needle point?

A towards the bottom of the page

B towards the left of the page

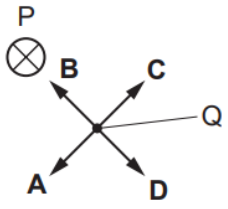
C towards the right of the page

D towards the top of the page

99 Wire P carries a current directed perpendicularly into the page. A compass is placed at point Q which is close to wire P.

The magnetic field at Q due to the current is very much larger than the magnetic field of the Earth.

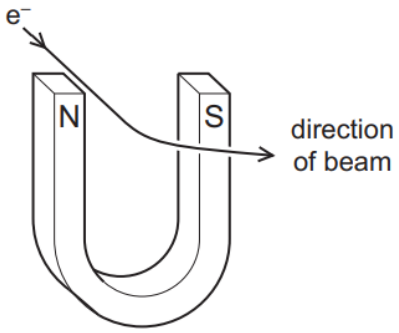
In which direction does the North pole of the compass point?



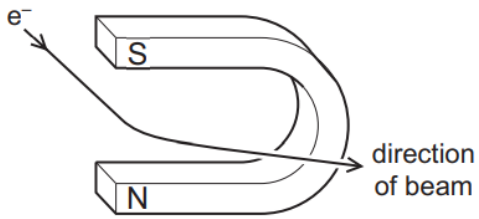
100 A beam of electrons is passed through the magnetic field of a magnet. **(extended only)**

How must the magnet be positioned to deflect the beam in the direction shown?

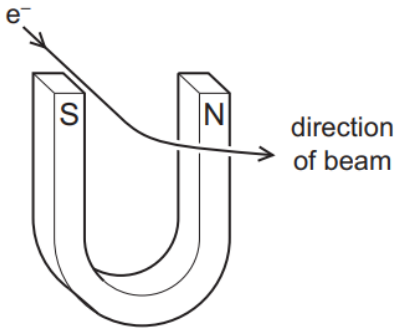
A



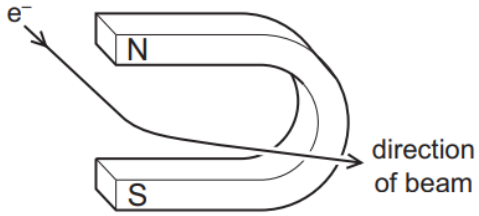
B



C

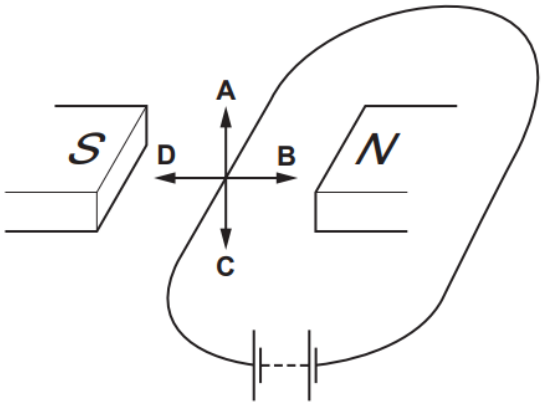


D



101 The diagram shows a current-carrying conductor in a magnetic field. **(extended only)**

Which arrow shows the direction of the force acting on the conductor?



102 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.

(extended only)

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.

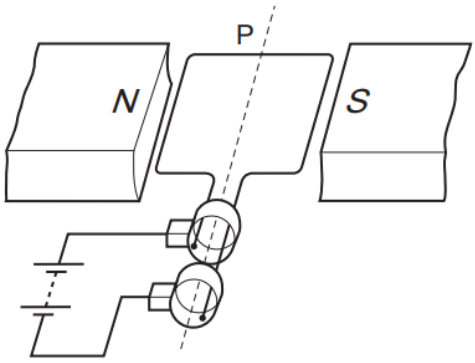


diagram 1

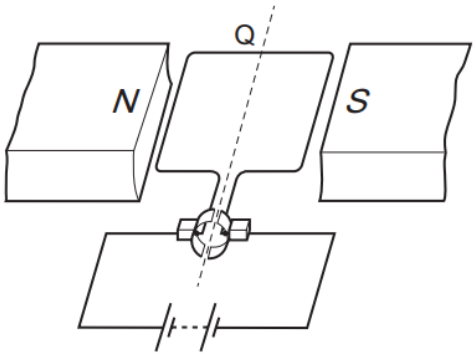


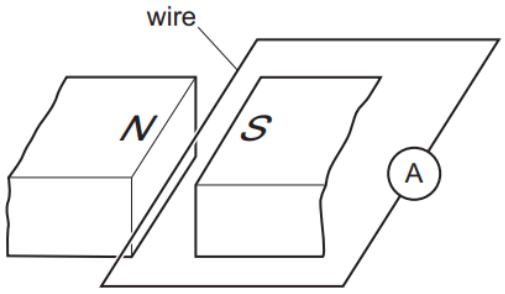
diagram 2

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

103 The diagram shows a wire between two magnetic poles. The wire is connected in a circuit with an ammeter.

(extended only)



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

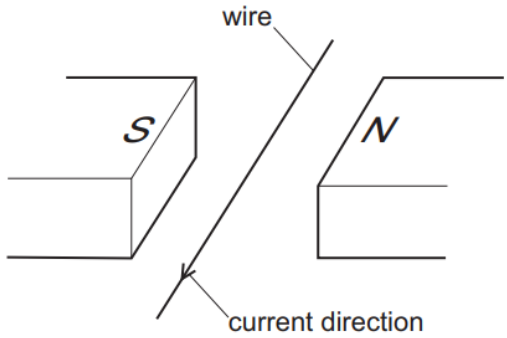
B towards the left of the page

C towards the right of the page

D towards the top of the page

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

(extended only)



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

105 Diagram 1 shows an a.c. generator. The coil is turning as shown. **(extended only)**

diagram 1

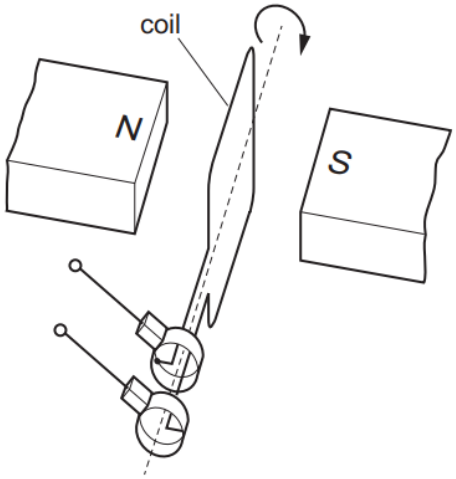
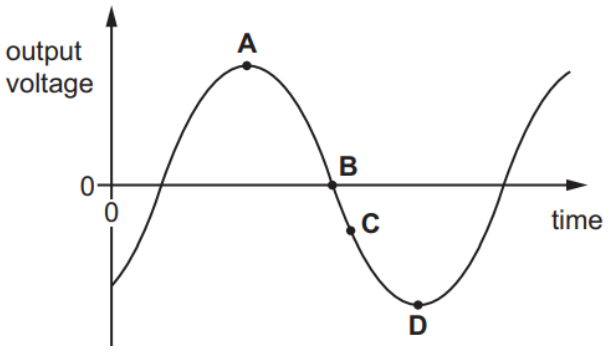


Diagram 2 shows the output voltage produced by the generator as the coil turns.

Which point on diagram 2 shows the voltage induced when the coil is moving through the position shown in diagram 1?

diagram 2



106 In an a.c. generator, a coil is rotated in a magnetic field and an electromotive force (e.m.f.) is induced in the coil.

In which position of the coil does the e.m.f. have the largest value? **(extended only)**