Electromagnetic Induction

Question Paper

Level	O Level
Subject	Physics
Exam Board	Cambridge International Examinations
Unit	Electricity and Magnetism
Topic	Electromagnetic Induction
Booklet	Question Paper

Time Allowed: **64 minutes**

Score: **/53**

Percentage: **/100**

Grade Boundaries:

1 Electrical power is transmitted by cables over long distances at very high voltages.

What are the effects of using a high voltage transmission system?

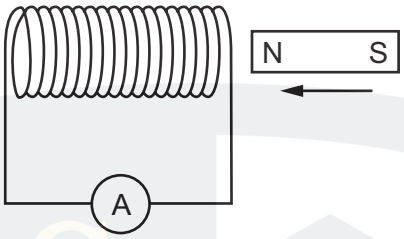
	power loss in the cables	current in the cables
A	high	high
B	high	low
C	low	high
D	low	low

2 Electric power cables transmit electrical energy over large distances using high-voltage, alternating current.

What are the advantages of using a high voltage and of using an alternating current?

	advantage of using a high voltage	advantage of using an alternating current
A	high current is produced in the cable	the resistance of the cable is reduced
B	high current is produced in the cable	the voltage can be changed using a transformer
C	less energy is wasted in the cable	the resistance of the cable is reduced
D	less energy is wasted in the cable	the voltage can be changed using a transformer

3 As a magnet is moved into the coil of wire as shown, there is a small reading on the sensitive ammeter.



Which change increases the size of the reading?

A moving the opposite pole into the coil

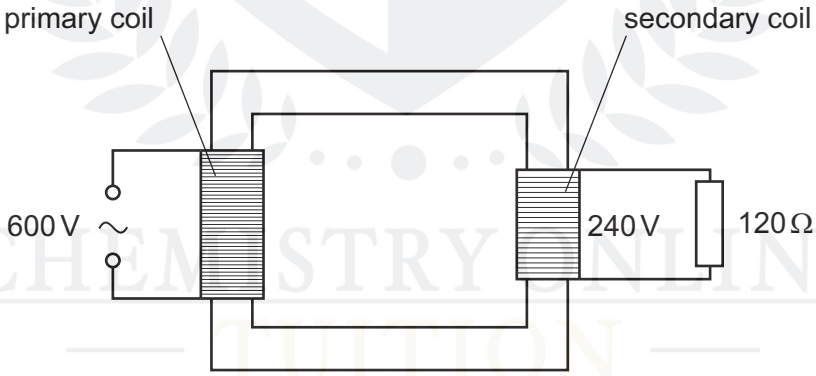
B pulling the magnet out of the coil

C pushing the magnet in faster

D unwinding some of the turns of wire

4 An ideal transformer has a primary voltage of 600 V and a secondary voltage of 240 V.

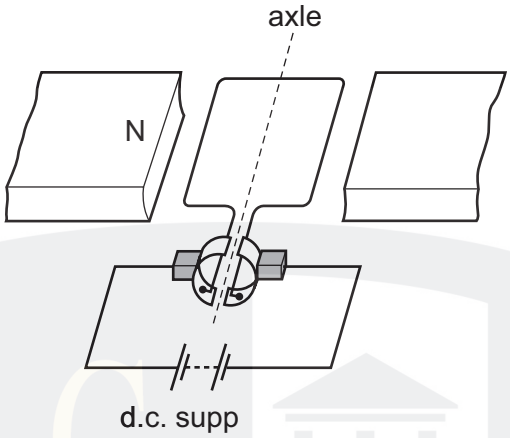
The secondary coil is attached to a resistor of resistance 120 Ω.



What is the power dissipated in the resistor and 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

5 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

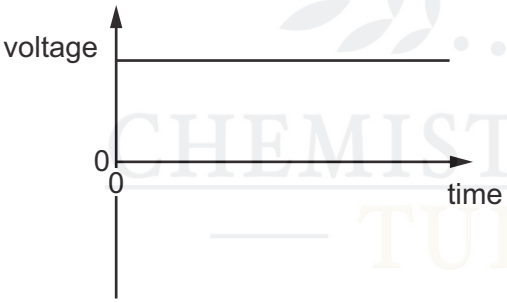
B to change the current direction in the coil as the coil passes the vertical position

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

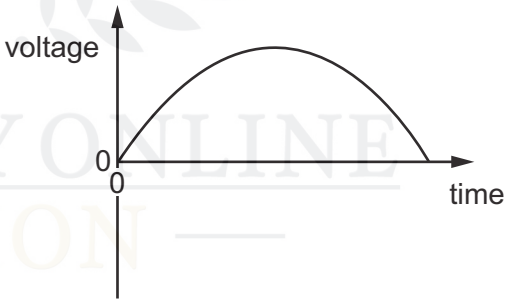
D to change the current direction in the d.c. supply as the coil passes the vertical position

6 Which graph shows the voltage output of an a.c. generator when the coil makes **one** complete revolution?

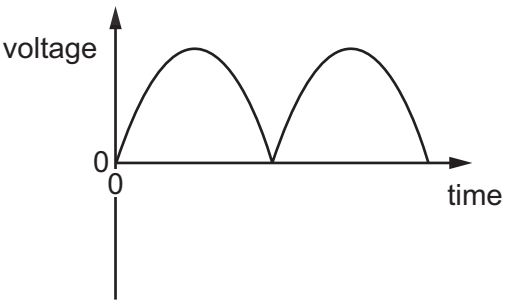
A



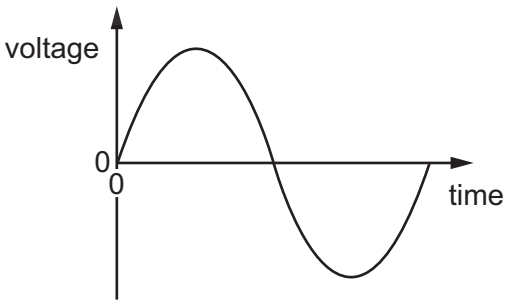
B



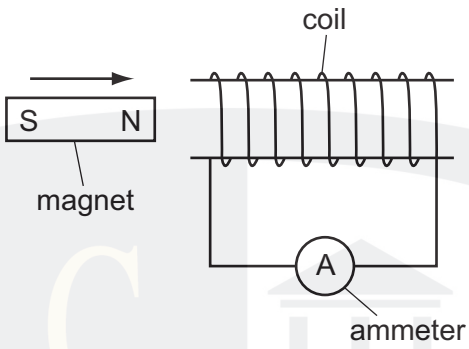
C



D



7 A student moves a magnet into a coil of wire as shown in the diagram. The coil of wire is connected to a sensitive ammeter.



Which change does **not** produce an increase in the reading?

A increasing the number of turns on the coil

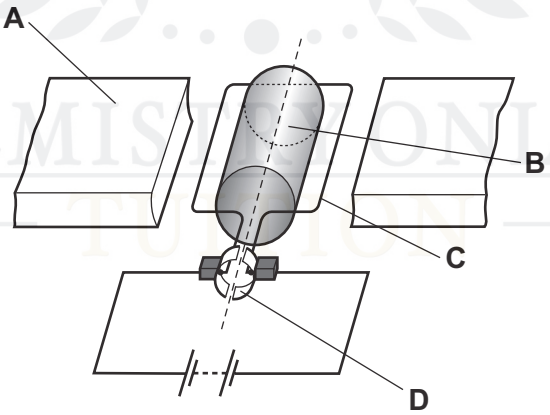
B increasing the resistance of the ammeter

C increasing the speed of the magnet

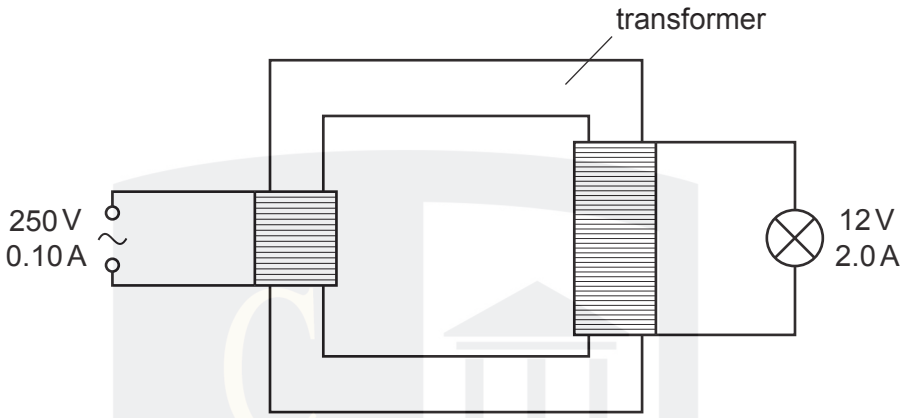
D increasing the strength of the magnet

8 The diagram shows a simple d.c. motor.

Which labelled part is the commutator?



9 A transformer is used to operate a 12 V lamp from a 250 V mains supply.

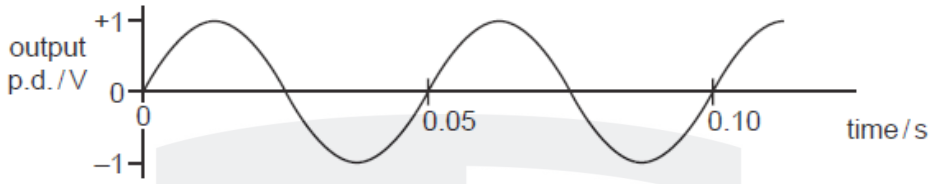


The mains current is 0.10 A. The current in the lamp is 2.0 A.

What is the efficiency of the transformer?

A 0.048 **B** 0.050 **C** 0.96 **D** 1.04

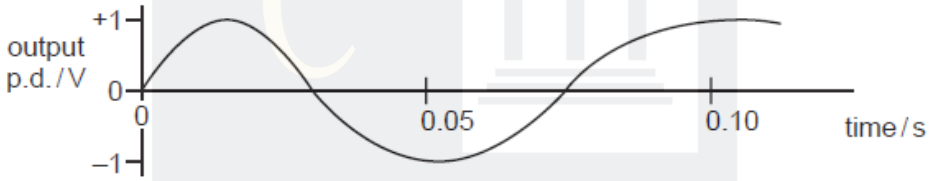
10 The graph shows the output of an a.c. generator. The coil in the generator rotates 20 times in one second.



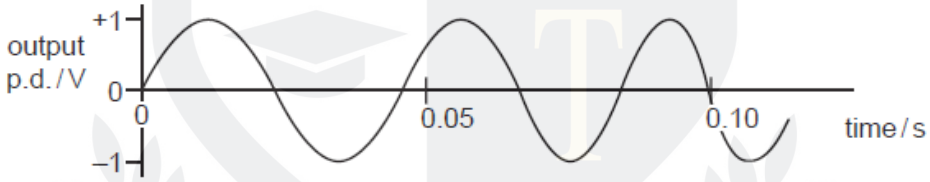
The speed of rotation of the coil steadily increases.

Which graph best shows how the output changes?

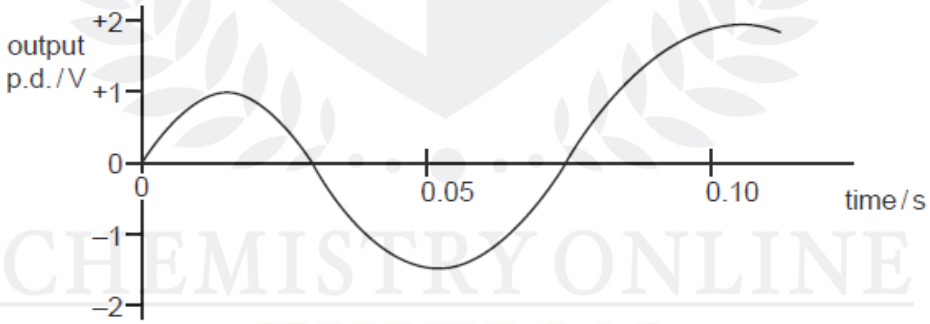
A



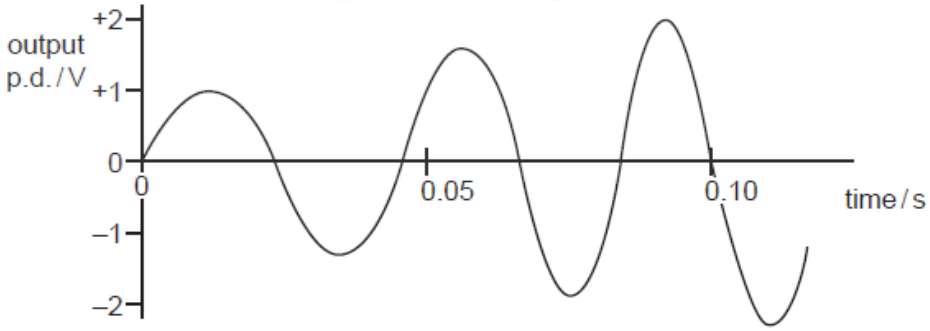
B



C



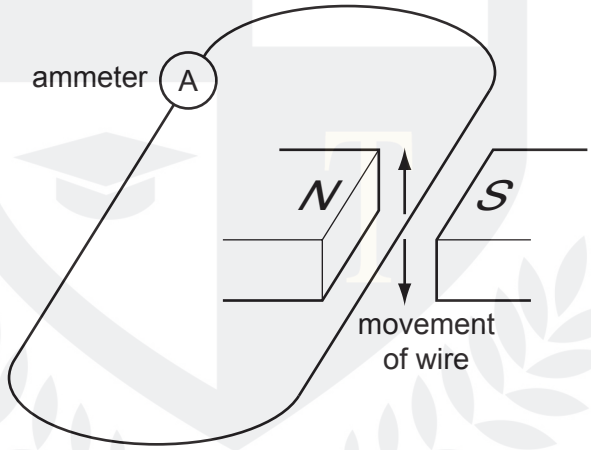
D



11 Which material is used for the core of a transformer and why?

	material	reason
A	copper	good conductor of electricity
B	copper	easy to magnetise and demagnetise
C	iron	good conductor of electricity
D	iron	easy to magnetise and demagnetise

12 A current is produced when a wire is moved between two magnets as shown.



Which device uses this effect?

A a battery

B a generator

C a motor

D an electromagnet

13 Why is a transformer used to connect a generator in a power station to a long-distance transmission line?

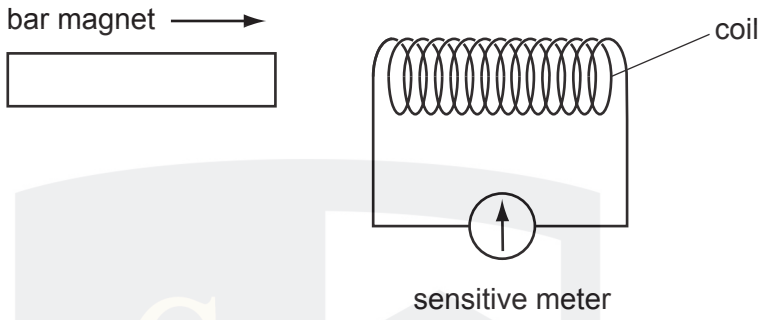
A to decrease the voltage and decrease the current

B to decrease the voltage and increase the current

C to increase the voltage and decrease the current

D to increase the voltage and increase the current

14 A bar magnet is pushed into one end of a long coil connected to a sensitive meter.



Which of the following affects the **magnitude** of the deflection of the meter?

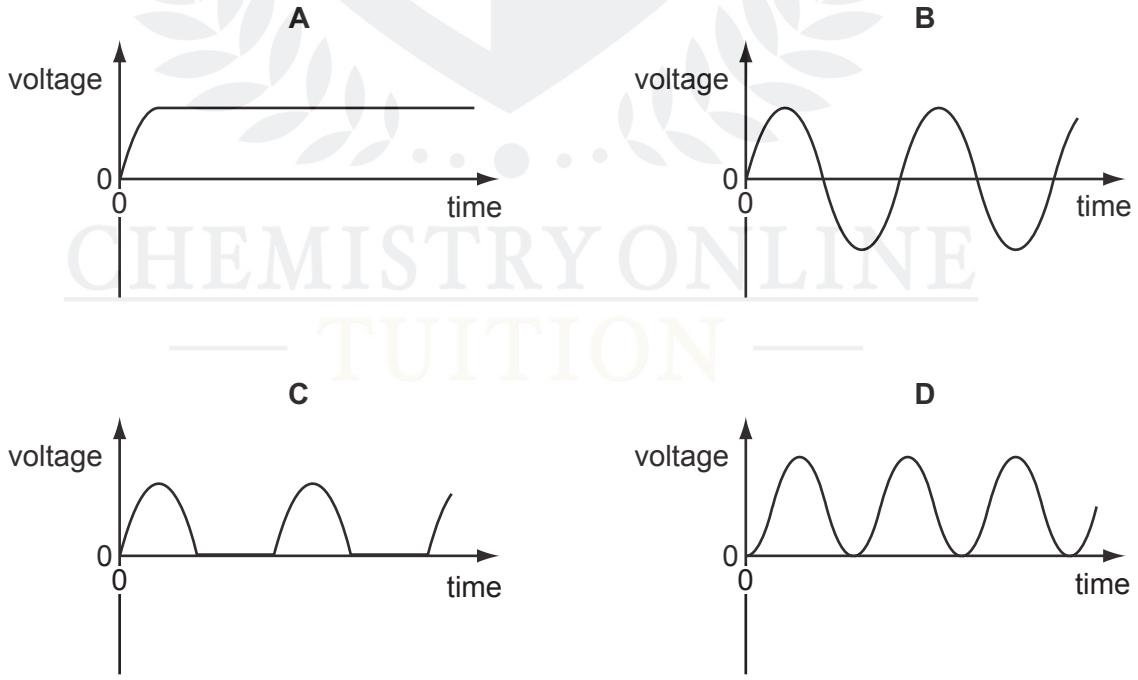
A the direction in which the coil is wound

B the speed with which the magnet enters the coil

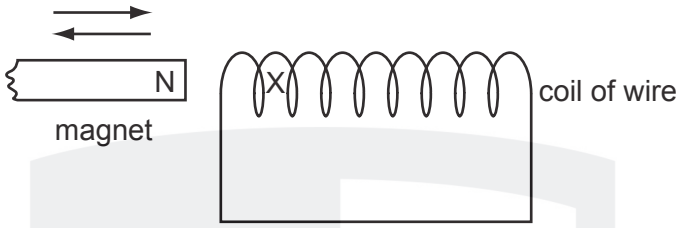
C which end of the coil is used

D which pole of the magnet enters first

15 Which graph represents the voltage output of a simple a.c. generator?



16 The diagram shows the N-pole of a magnet moving into, and out of, a coil of wire.

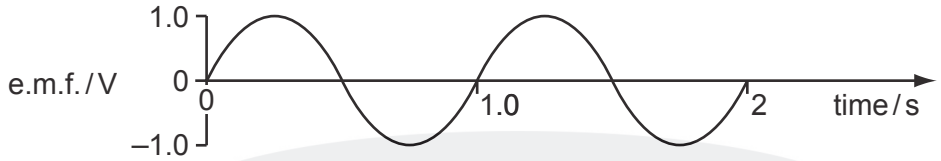


This movement produces a current in the coil of wire. The current produces a magnetic pole at X.

Which pole is produced at X when the magnet is moved in and when it is moved out?

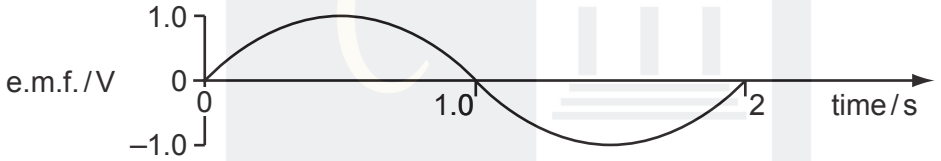
	magnet moved in	magnet moved out
A	N	N
B	N	S
C	S	N
D	S	S

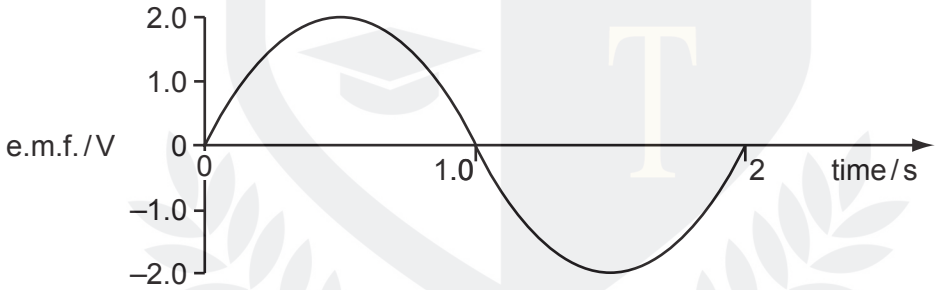
17 A simple a.c. generator produces an alternating e.m.f. as shown.

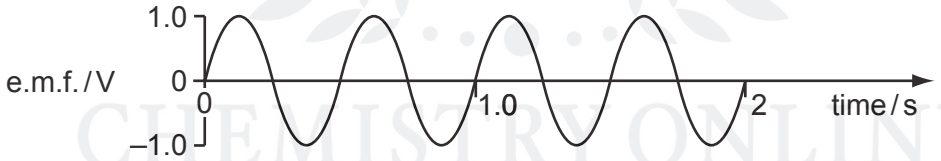


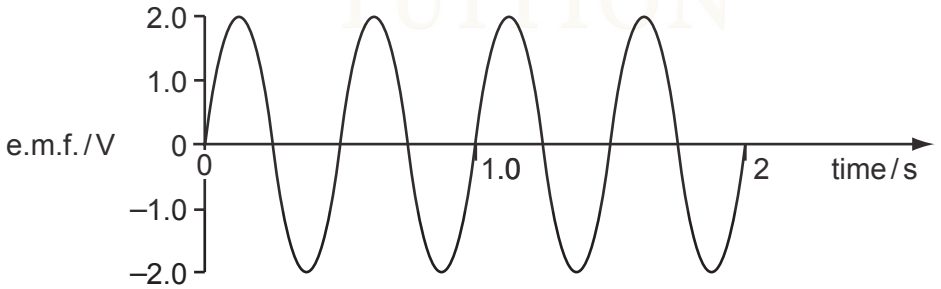
The speed of the generator is doubled.

Which graph best represents the new output?

A 

B 

C 

D 

18 A magnet is moved towards a coil of insulated wire. A voltmeter connected across the coil shows a positive reading.

What produces a higher reading on the voltmeter?

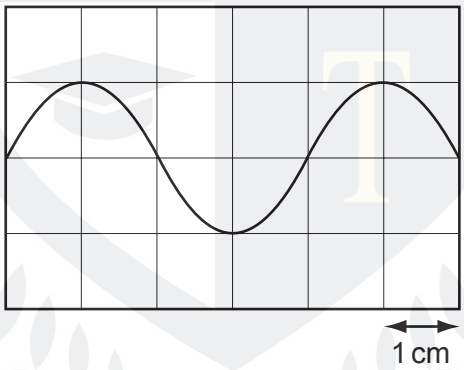
A moving the magnet away from the coil at the same speed

B moving the magnet away from the coil at a slower speed

C moving the magnet towards the coil at a faster speed

D moving the magnet towards the coil at a slower speed

19 The diagram shows the output of an a.c. generator as displayed on a cathode-ray oscilloscope. The horizontal scale is 5 ms / cm.



What is the time for one complete rotation of the coil of the generator?

A 5 ms **B** 10 ms **C** 20 ms **D** 30 ms

20 The electromotive force (e.m.f.) induced in a conductor moving at right-angles to a magnetic field does **not** depend upon

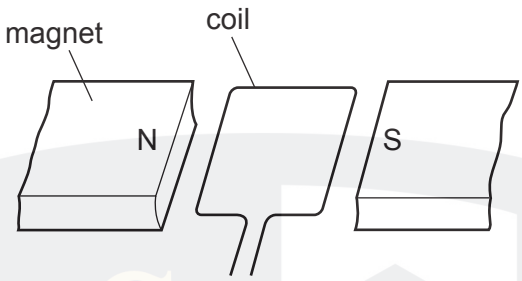
A the length of the conductor.

B the resistance of the conductor.

C the speed of the conductor.

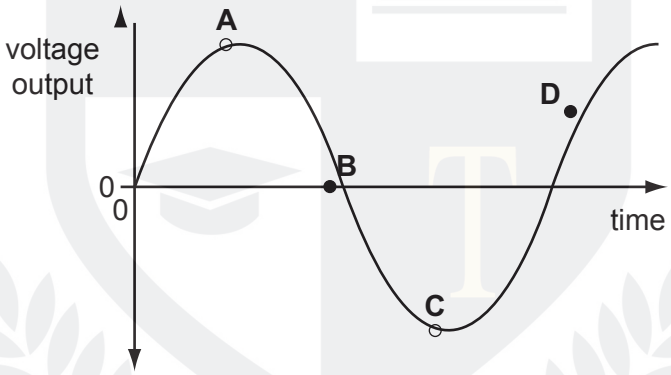
D the strength of the magnetic field.

21 The diagram shows part of an a.c. generator when its coil is in a horizontal position.

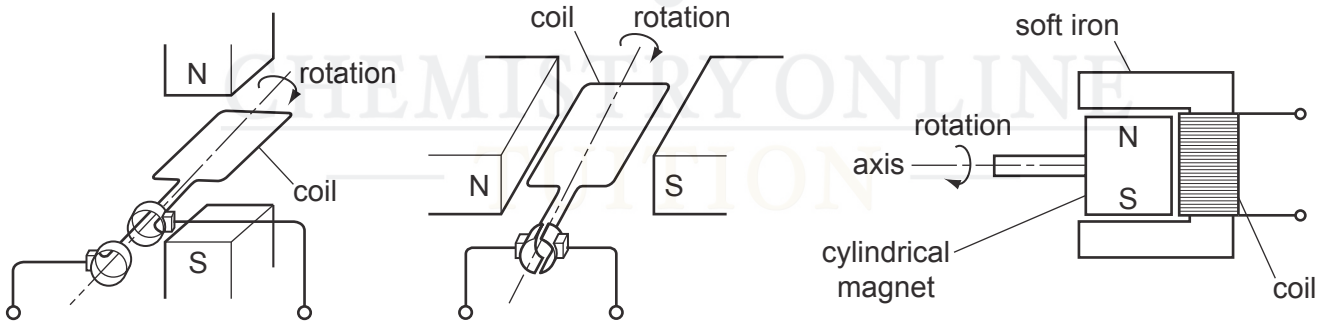


The graph shows the voltage output plotted against time.

Which point on the graph shows when the coil is in a vertical position?



22 The diagrams show three electrical devices, X, Y and Z.

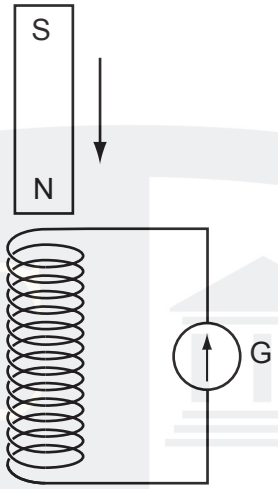


X Y Z

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

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

23 A small coil is connected to a galvanometer G, as shown.



When a magnet is allowed to fall towards the coil, the galvanometer pointer gives a momentary deflection to the right of the zero position.

The magnet moves through the coil.

What happens to the galvanometer pointer as the magnet falls away from the coil?

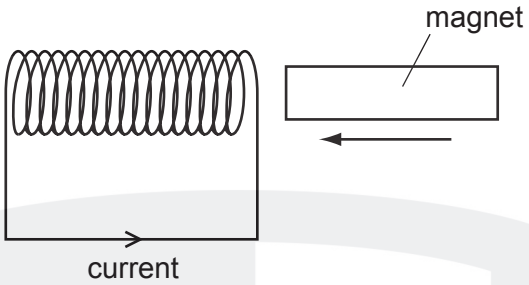
A It gives a continuous reading to the left.

B It gives a momentary deflection to the left.

C It gives a continuous reading to the right.

D It gives a momentary deflection to the right.

24 A magnet is pushed slowly into a coil and there is a current in the coil in the direction shown.

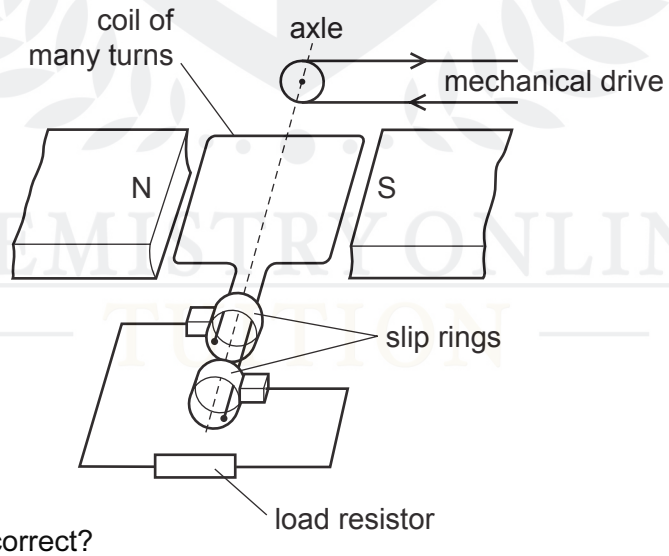


The magnet is then pulled out quickly from the same end of the coil.

What happens to the direction and the size of the current?

	direction	size
A	reversed	decreased
B	reversed	increased
C	unchanged	decreased
D	unchanged	increased

25 The diagram shows an a.c. generator connected to an electrical circuit (load resistor).



Which statement is correct?

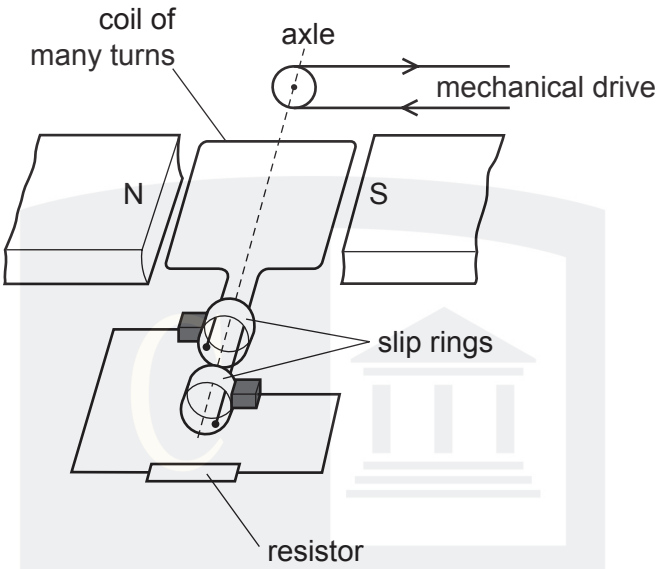
A The direction of the potential difference across the load resistor is always the same.

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.

26 The diagram shows an a.c. generator connected to a resistor.



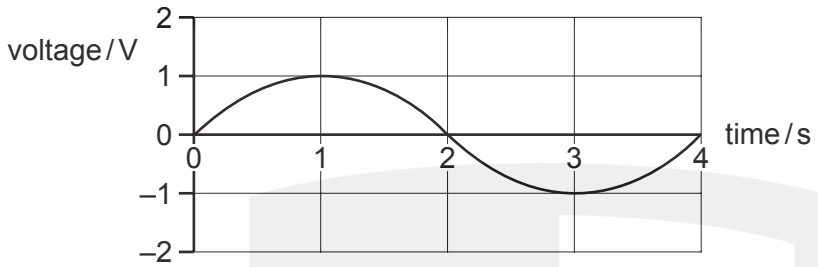
Some changes are made, one at a time.

- The speed of the drive is changed.
- The strength of the magnets is changed.
- The number of turns in the coil is changed.
- The value of the resistor is changed.

How many of these alter the value of the e.m.f. generated in the coil?

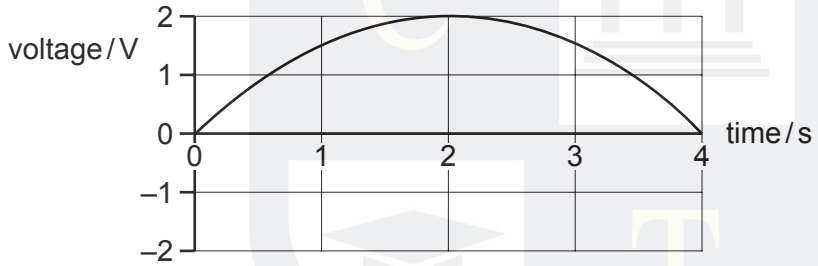
A 1 **B** 2 **C** 3 **D** 4

27 A simple a.c. generator produces a voltage that varies with time as shown.

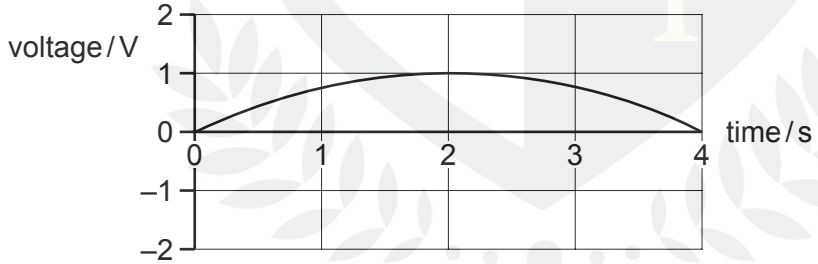


Which graph shows how the voltage varies with time when the generator rotates at twice the original speed?

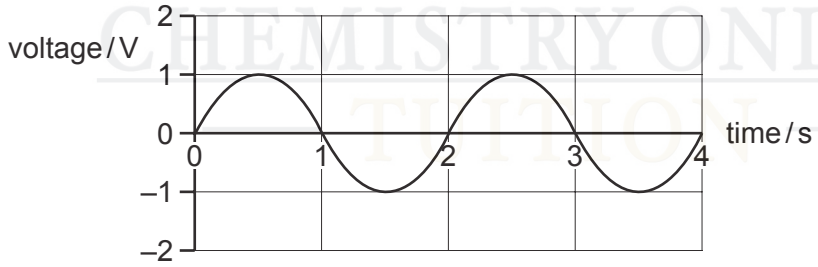
A



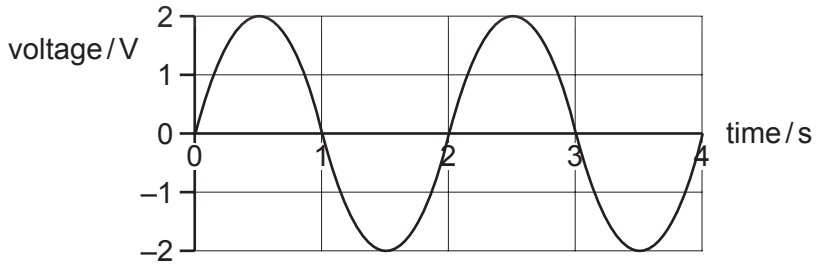
B



C



D



28 Why is electrical energy usually transmitted at high voltage?

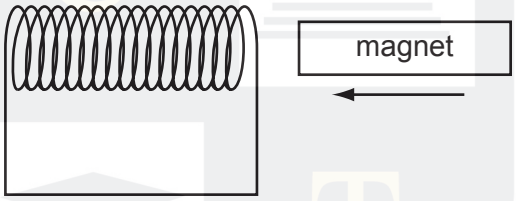
A As little energy as possible is wasted in the transmission cables.

B The current in the transmission cables is as large as possible.

C The resistance of the transmission cables is as small as possible.

D The transmission system does not require transformers.

29 A magnet is pushed horizontally towards a coil of wire, inducing an e.m.f. in the coil.



In which direction does the induced e.m.f. make the coil move?

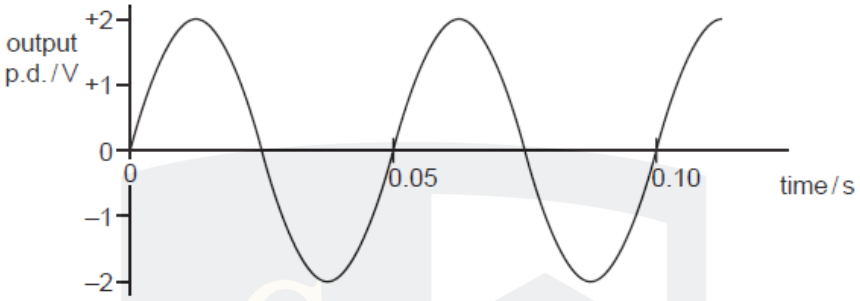
A away from the magnet

B towards the magnet

C downwards

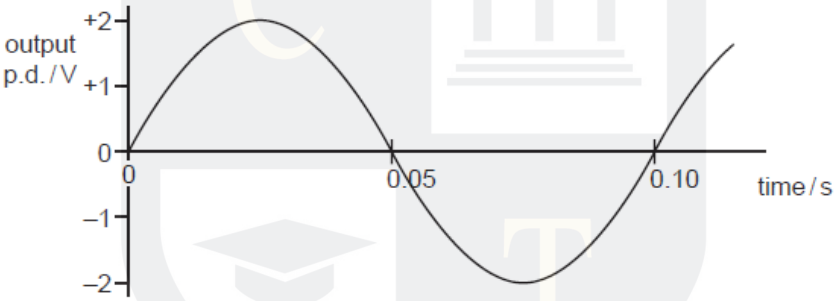
D upwards

30 The graph shows the output of an a.c. generator. The coil in the generator rotates 20 times in one second.

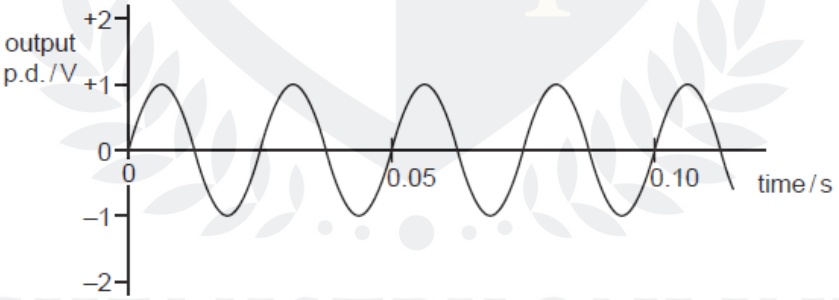


Which graph shows the output when the coil rotates 10 times in one second?

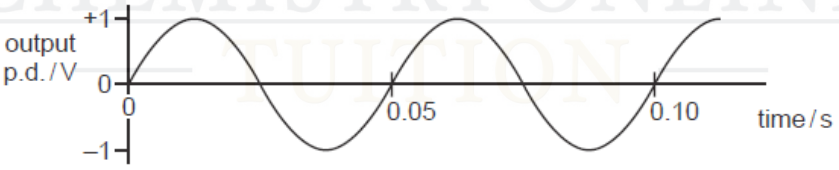
A



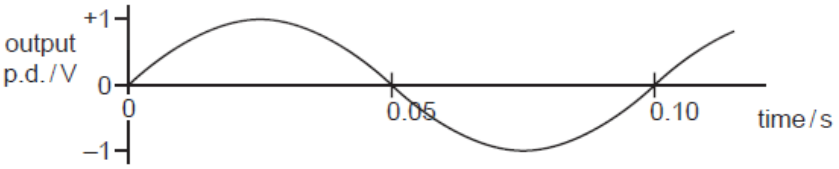
B



C



D



31 Why is a transformer used to connect a generator in a power station to a long-distance transmission line?

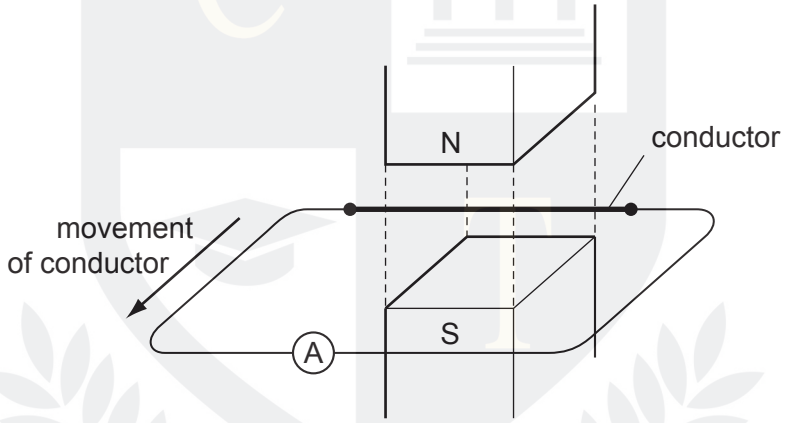
A to decrease the voltage and decrease the current

B to decrease the voltage and increase the current

C to increase the voltage and decrease the current

D to increase the voltage and increase the current

32 A conductor is moving horizontally across a vertical magnetic field.



An e.m.f. is induced in the conductor. No deflection is seen on the ammeter.

What is the reason for this?

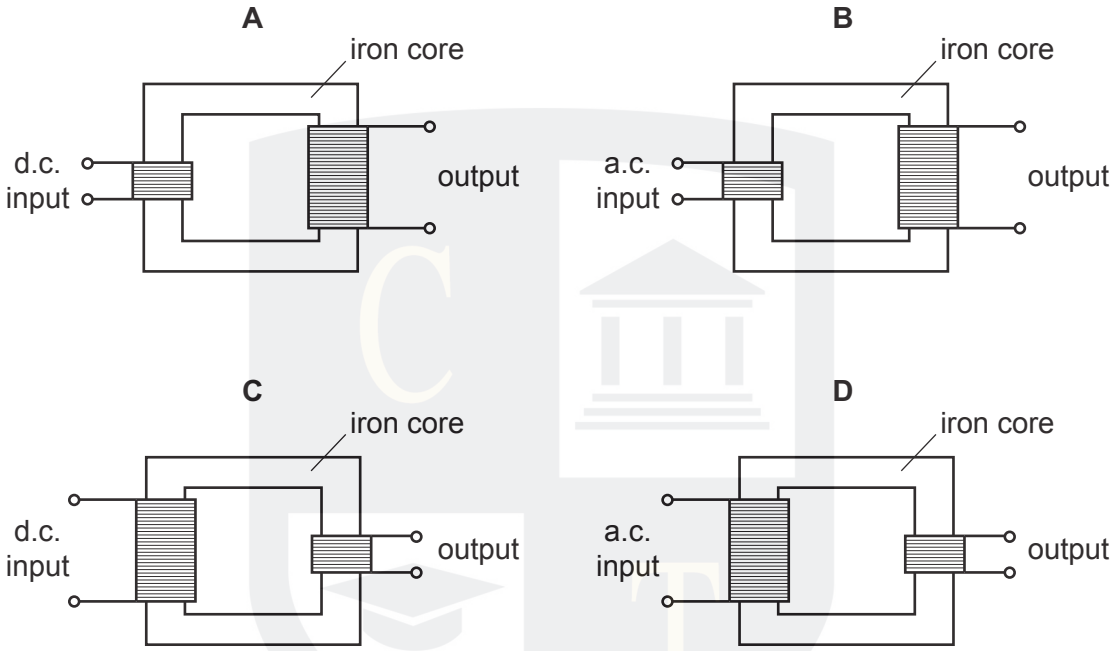
A The ammeter is not between the poles.

B The conductor is moving too slowly.

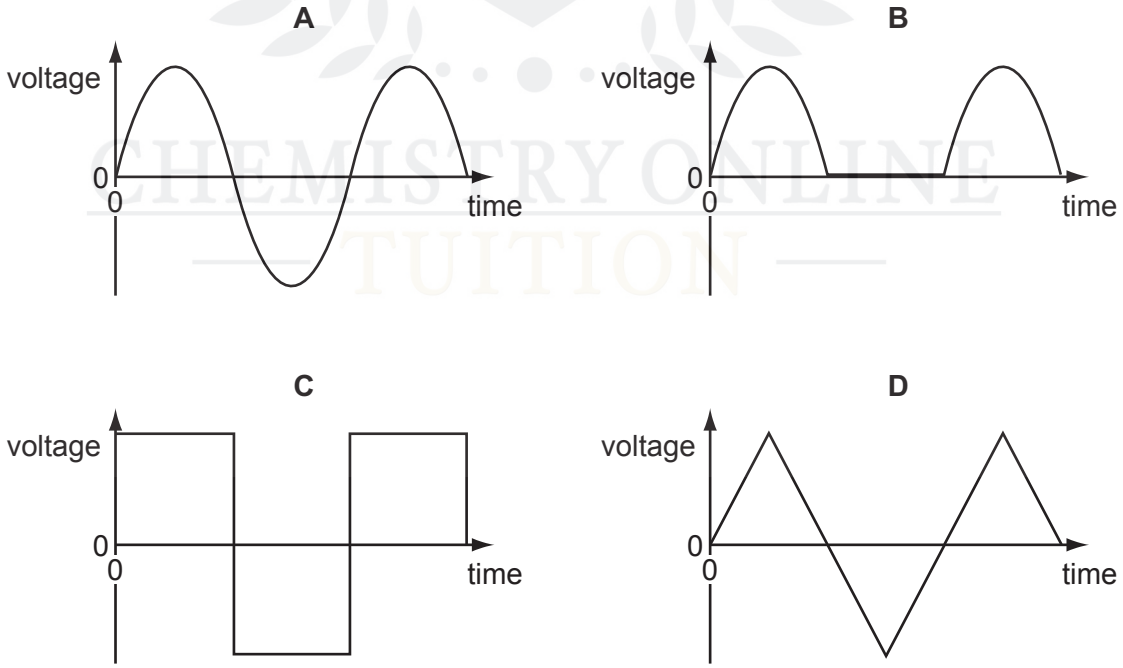
C The conductor is not cutting field lines.

D The poles are too close together.

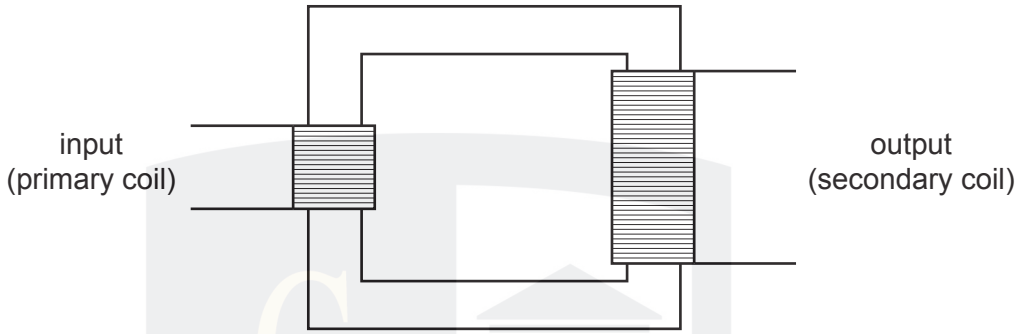
33 Which transformer arrangement produces an output voltage that is larger than the input voltage?



34 Which diagram shows how the voltage output of a simple a.c. generator varies with time?



35 The diagram shows a working transformer.



Which statement is correct?

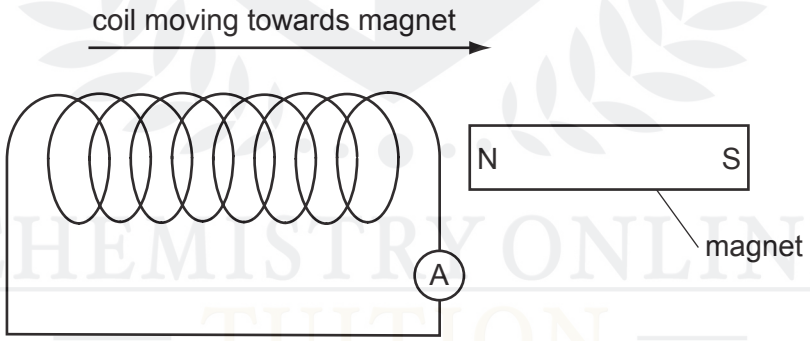
A The input voltage is d.c.

B The input voltage is greater than the output voltage.

C The input voltage is less than the output voltage.

D The input voltage is the same as the output voltage.

36 The diagram shows how a magnet and a coil may be used to induce an electric current.



How could the ammeter reading be increased?

A Move the coil more slowly.

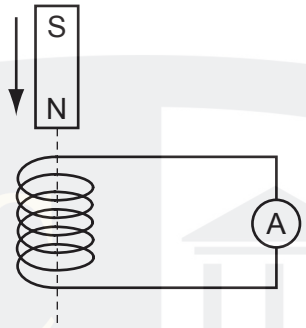
B Put a resistor in series with the ammeter.

C Turn the magnet round, then move the coil.

D Use a coil with more turns.

37 A small coil is connected to a sensitive ammeter. The ammeter needle can move to either side of the zero position.

As the magnet falls towards the coil, the ammeter needle moves quickly to the right of the zero position.



The magnet moves through the coil.

How does the ammeter needle move as the magnet falls away from the coil?

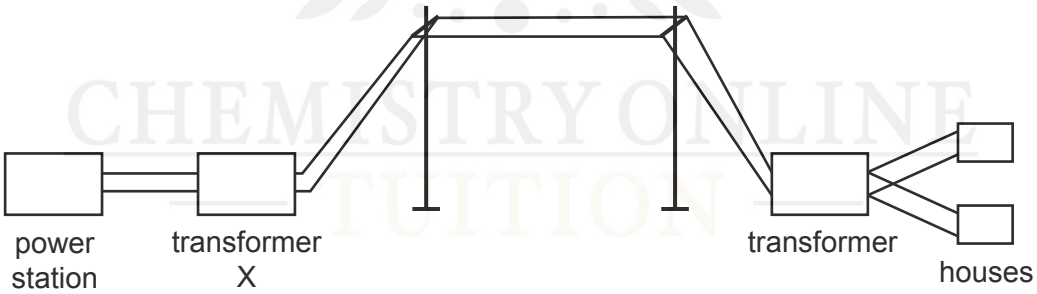
A It does not move.

B It gives a steady reading to the right.

C It moves quickly to the left of the zero position and then returns to zero.

D It moves quickly to the right of the zero position and then returns to zero.

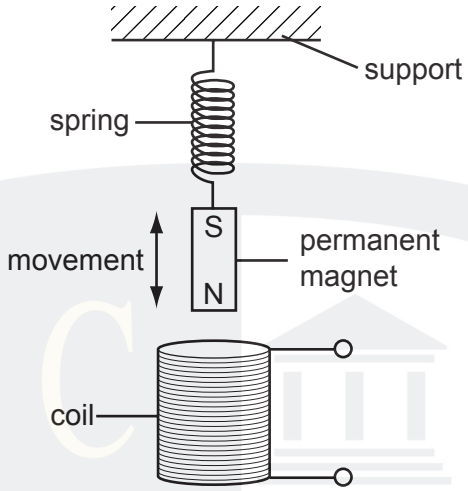
38 The diagram shows transformers and cables used to transmit electrical energy over long distances.



How does transformer X affect the voltage and the current from the power station?

	voltage	current
A	decreases it	decreases it
B	decreases it	increases it
C	increases it	decreases it
D	increases it	increases it

39 A permanent magnet moving up and down on the end of a spring induces an e.m.f. in a coil.



Which factor, on its own, would **decrease** the maximum value of the induced e.m.f.?

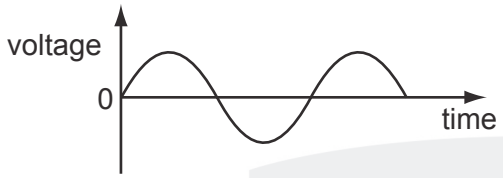
A increasing the number of turns in the coil

B increasing the strength of the magnet

C raising the coil

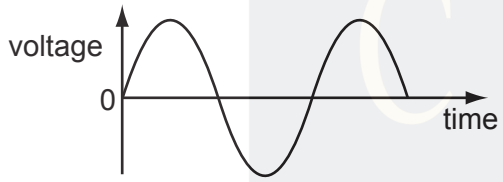
D raising the support of the spring

40 A transformer has more turns on the secondary coil than on the primary. The graph shows how the input voltage varies with time.

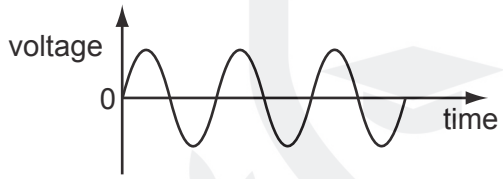


Which graph, drawn to the same scale as the input graph, shows how the output voltage varies with time?

A



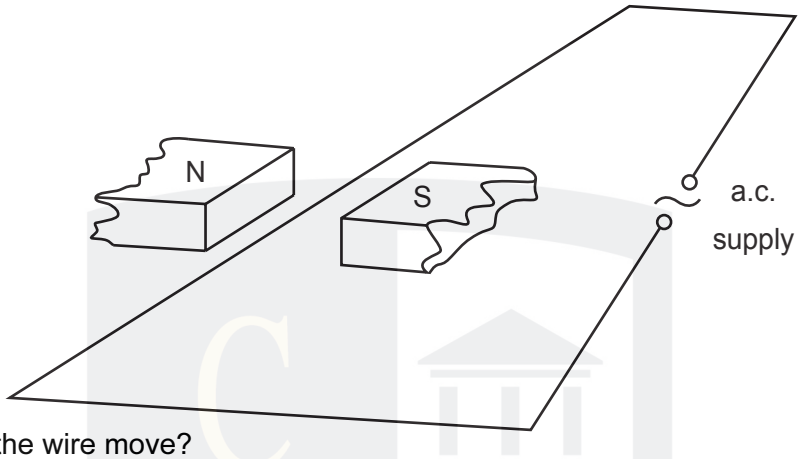
B



C

D

41 An alternating current is passed through a wire stretched between the poles of a magnet.



Which way will the wire move?

A left and right

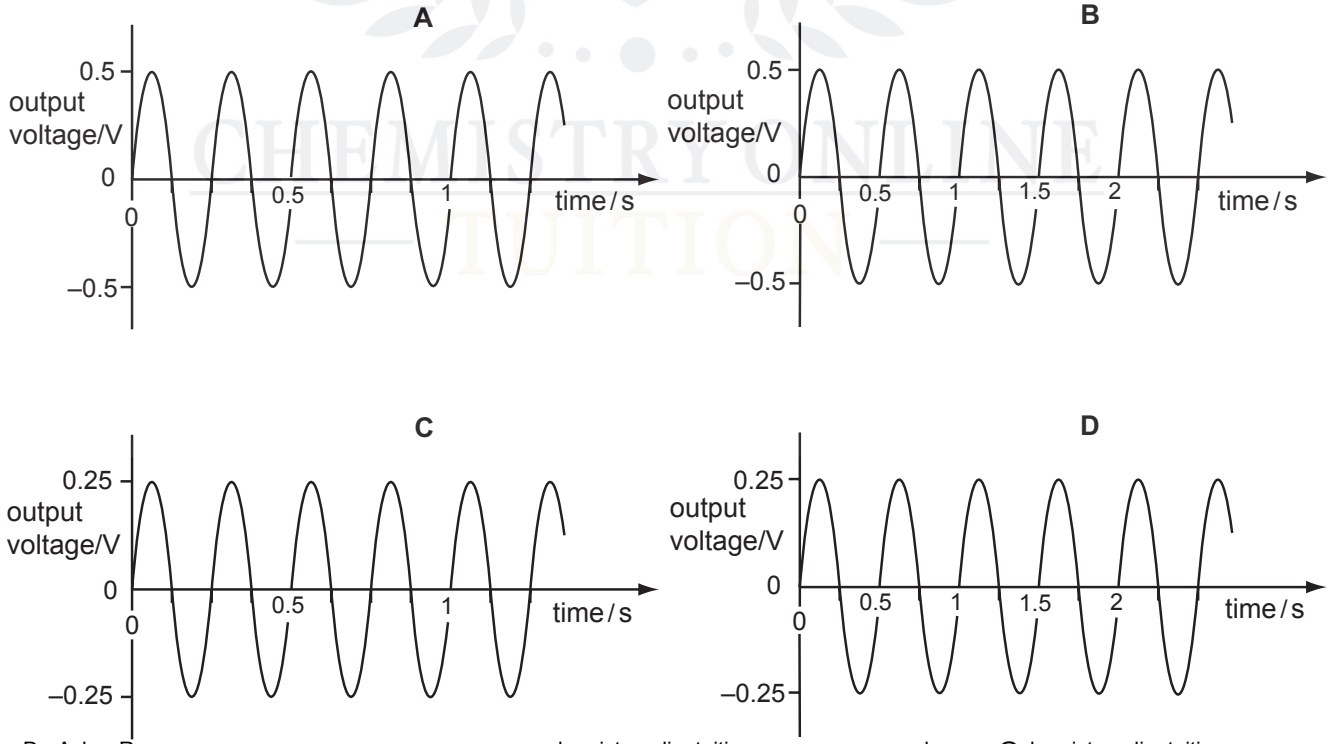
B right only

C up and down

D up only

42 A girl turns the handle of a small a.c. generator four times each second. The generator produces a maximum output voltage of 0.5 V.

Which of the following graphs best shows this?



43 Which statement about the action of a transformer is correct?

A An e.m.f. is induced in the secondary coil when an alternating voltage is applied to the primary coil.

B An e.m.f. is induced in the secondary coil when there is a steady direct current in the primary coil.

C The current in the secondary coil is always larger than the current in the primary coil.

D The voltage in the secondary coil is always larger than the voltage in the primary coil.

44 Electrical energy is transmitted at high alternating voltages.

What is **not** a valid reason for doing this?

A At high voltage, a.c. is safer than d.c.

B For a given power, there is a lower current with a higher voltage.

C There is a smaller power loss at higher voltage and lower current.

D The transmission lines can be thinner with a lower current.

45 Why can birds stand on an overhead high voltage transmission line without suffering any harm?

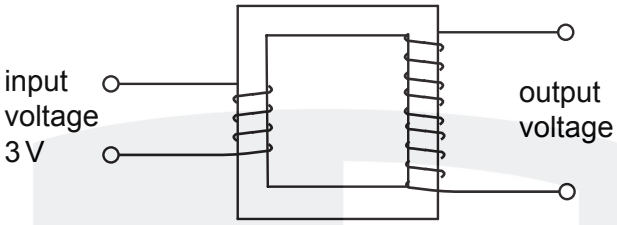
A Their bodies have a very high resistance.

B Their feet are very good insulators.

C The spaces between their feathers act as insulators.

D They are not connected to earth.

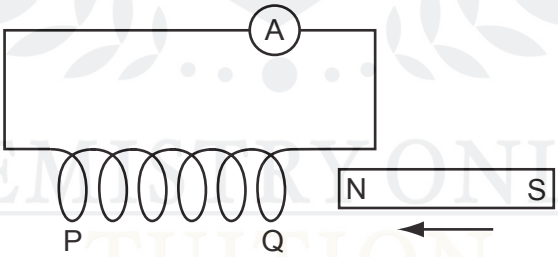
46 A step-up transformer with 100 % efficiency has an input voltage of 3 V and an input current of 2 A.



Under these conditions, what output voltage and output current could be obtained?

	output voltage / V	output current / A
A	1	6
B	2	3
C	4	1
D	6	1

47 A student pushes the N-pole of a bar magnet into the end Q of a long solenoid and observes a deflection to the right on the sensitive ammeter.



What will produce a deflection in the same direction?

A pulling the N-pole out of end Q

B pulling the S-pole out of end P

C pushing the N-pole into end P

D pushing the S-pole into end P

48 A step-down transformer changes 240 V a.c. to 12 V a.c. There are 600 turns on the primary coil.

How many turns are on the secondary coil?

A 20 **B** 30 **C** 600 **D** 12 000

49 Why are high voltages and low currents used to transmit electrical energy over long distances?

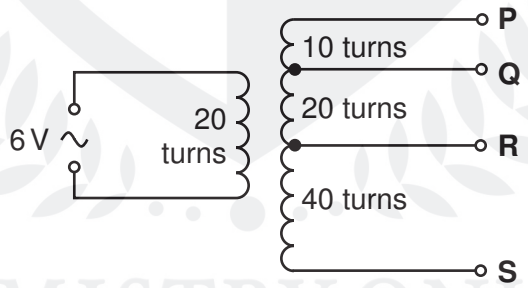
A to increase the electromagnetic radiation

B to increase the speed at which electrons move

C to reduce heat loss from the power line

D to reduce the resistance of the power line

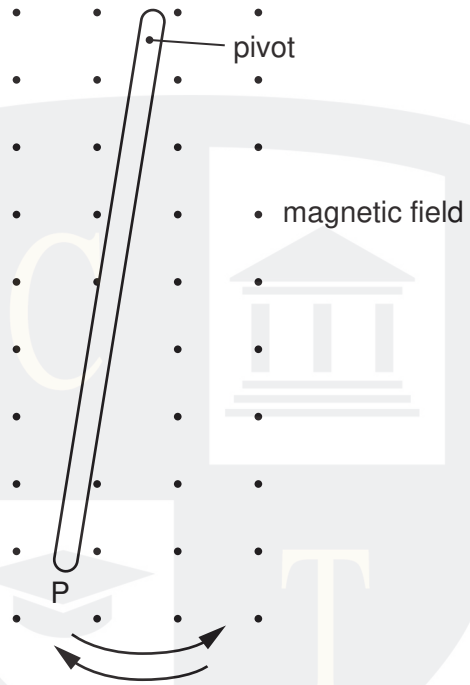
50 The number of turns between each pair of output terminals of a transformer is shown in the diagram.



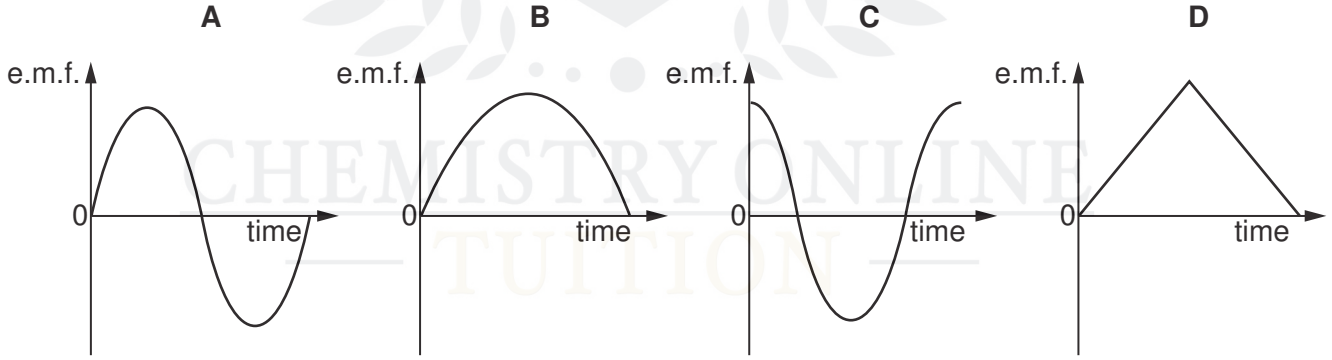
Between which two terminals will the output be 12 V?

A **P** and **Q** **B** **Q** and **R** **C** **R** and **S** **D** **P** and **R**

51 The diagram shows a metal bar swinging like a pendulum across a uniform magnetic field. The motion induces an e.m.f. between the ends of the bar.



Which graph represents this e.m.f. during one complete oscillation of the bar, starting and finishing at P?



52 Why is electricity transmitted along power lines at very high voltages?

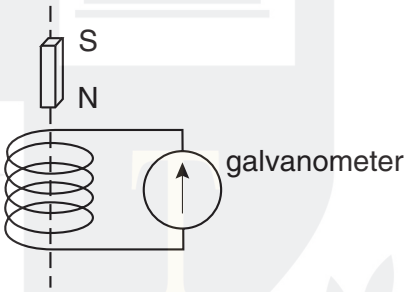
A to reduce the resistance of the cables

B so that transformers can be used

C to make sure that the current is the same all the way along the power lines

D to reduce loss of energy

53 A small coil is connected to a galvanometer as shown below. When the magnet is allowed to fall towards the coil, the galvanometer pointer gives a momentary deflection to the right of the zero position.



The magnet moves through the coil and, as it falls away from the coil, the galvanometer pointer

A gives a continuous reading to the left.

B gives a momentary deflection to the left.

C gives a momentary deflection to the right.

D gives a continuous reading to the right.