BOON LAY SECONDARY SCHOOL

PRELIMINARY EXAMINATION

2024

Name	**( )**
Class	

Subject	:	**PHYSICS**
Paper No	:	**1**
Subject Code	:	**6091/01**
Level	:	**SECONDARY FOUR EXPRESS**
Date/Day	:	**27 AUGUST 2024 (TUESDAY)**
Time	:	**1200 – 1300**
Duration	:	**1 HOUR**

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name and index number on the Answer Sheet in the spaces provided.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

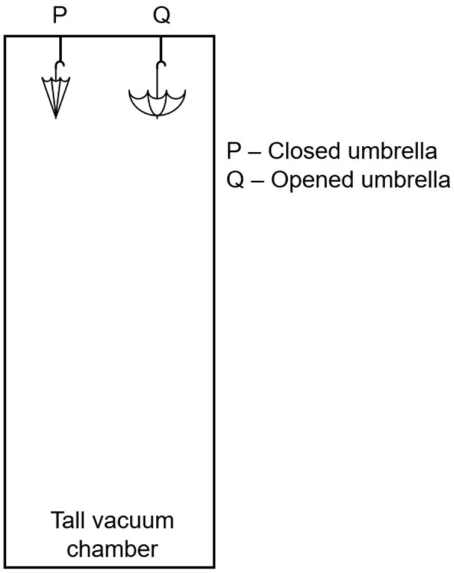
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this paper.
The use of an approved scientific calculator is expected, where appropriate.

Answer **all** the questions.

1 A closed umbrella, P, and an opened umbrella, Q, are suspended from a significant height in a tall vacuum chamber on Earth.

Both umbrellas are released at the same time.

Which of the following will be observed?



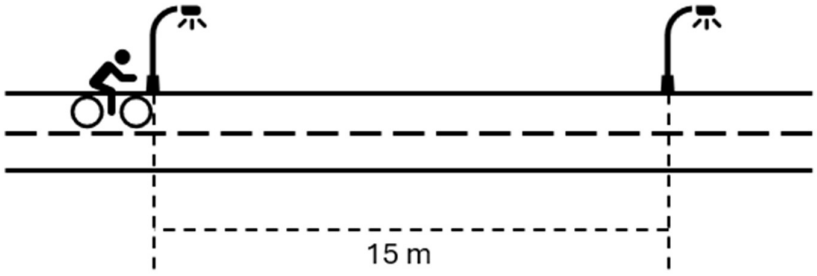
A Both umbrellas will not accelerate.

B The closed umbrella will reach the ground first.

C Both umbrellas will have the same instantaneous speed.

D The opened umbrella will fall slower than the closed umbrella.

2 A cyclist passes a lamp post with a speed of 10 m s^{-1}. His speed at the next lamp post, 15 m away, is 25 m s^{-1}. What is his acceleration between these two lamp posts?



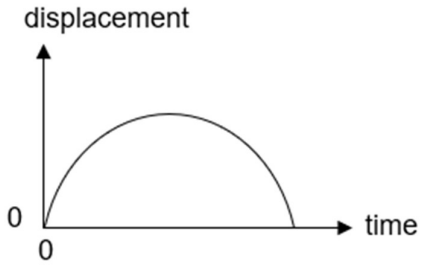
A 0.86 m s^{-2}

B 17.5 m s^{-2}

C 35.0 m s^{-2}

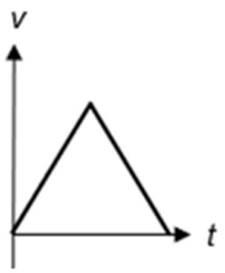
D 40.8 m s^{-2}

3 The graph shows the distance-time graph of a car.

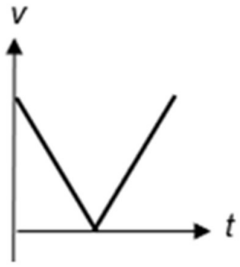


Which of the following is the correct velocity-time graph of the car in the same time period?

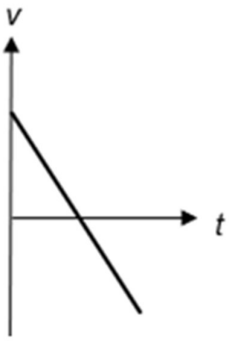
A



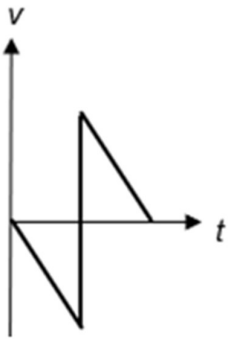
B



C



D



4 A force of 5.0 N and a force of 6.0 N act on a single point.

Which of the following is **not** a possible magnitude of the resultant force on the point?

A 1 N

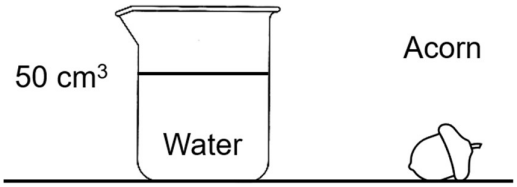
B 5 N

C 9 N

D 12 N

5 The displacement method is used to determine the volume of an acorn.

The mass and density of a particular acorn are 4.5 g and 1.03 g cm^{-3} respectively.



What is the final volume of water in the beaker when the acorn is fully submerged?

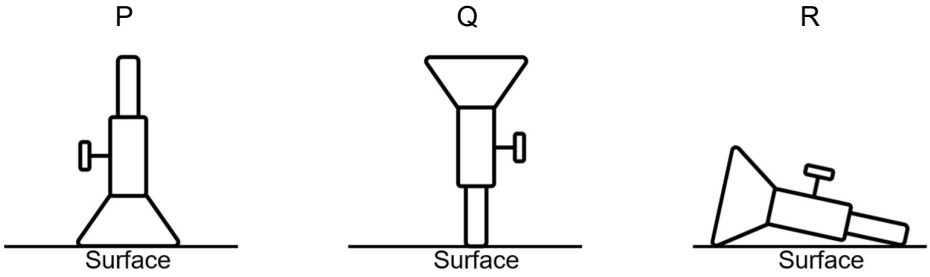
A 4.64 cm^3

B 45.63 cm^3

C 54.37 cm^3

D 54.64 cm^3

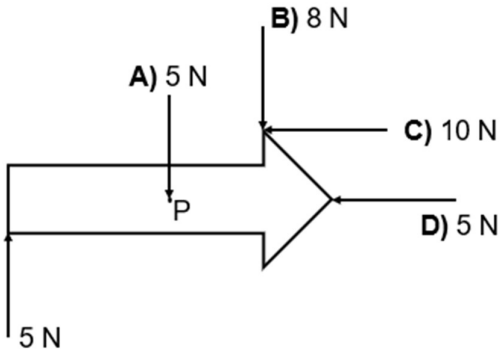
6 Three identical Bunsen burners are in different positions on a horizontal surface.



Which of the following correctly states the type of equilibrium they are in?

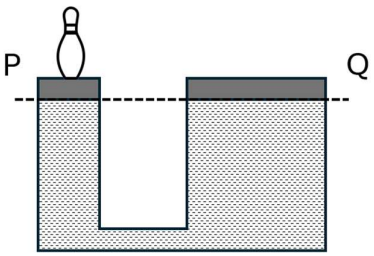
	P	Q	R
A	Stable	Neutral	Unstable
B	Neutral	Unstable	Stable
C	Stable	Unstable	Neutral
D	Neutral	Stable	Neutral

7 A 5 N force is applied on the signboard shown below, resulting in a turning effect about the pivot, P. Which of the following forces will stabilise the signboard?



8 The hydraulic press on the right is filled with an incompressible fluid and the cross-sectional areas of the platforms at P and Q are 2 m^2 and 10 m^2 respectively.

How many bowling pins can be placed at Q while maintaining equilibrium?



A 1

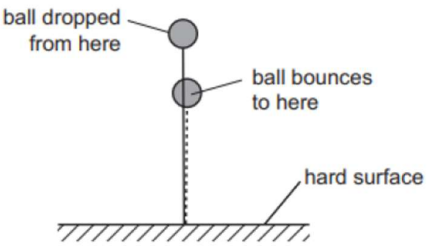
B 3

C 5

D 7

9 A ball is dropped on a hard surface and bounces back to a height that is lower than its starting point.

Which of the following accounts for the lower rebound height?



A Energy is destroyed along the way.

B The chemical and elastic potential energies of the ball have increased.

C The internal (heat) energy of the ball and its surroundings have increased.

D Energy is gained in the kinetic store of the ball when the ball bounces on hard surface.

10 A stone is shot vertically upwards with a slingshot with an initial speed of 32 m s^{-1}.

Calculate the theoretical maximum height that the stone reaches.

Take acceleration due to gravity, g as 10 m s^{-2}.

A 1.6 m

B 3.2 m

C 51.2 m

D 512 m

11 The braking force of a moving object is the amount of force required to bring it to a complete stop. A car of mass 1350 kg is travelling at 5 m s^{-1}.

What is the braking force required to stop the car in 18 m?

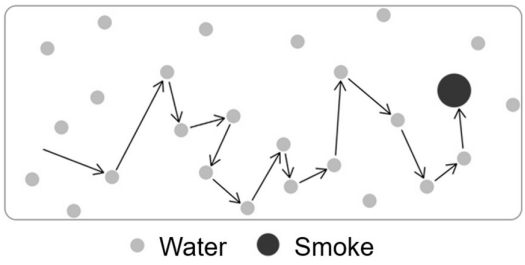
A 188 N

B 938 N

C 1875 N

D 9375 N

12 The diagram shows the path taken by a single smoke particle suspended in water over a short period of time.



Which of the following correctly explains the motion of the smoke particle?

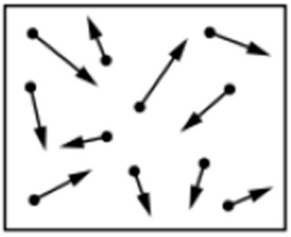
A The smoke particle moves along a pre-planned path.

B The smoke particle is following the path of least resistance.

C The smoke particle is expelling energy in random directions.

D The smoke particle is being bombarded by water particles in random directions.

13 The diagram shows particles of a gas enclosed in a container with a fixed volume.



What happens to the particles when the container is heated?

A The particles expand.

B The average speed of the particles will increase.

C The average distance between particles will increase.

D The average force the particles apply on the walls of the container will decrease.

14 A vacuum double-walled glass is commonly used to contain hot beverages like coffee or tea.

Which of the following correctly explains the reason for its use?

A The double-wall prevents heat lost through radiation.

B The double-wall prevents heat lost through convection.

C The double-wall increases heat gained from the surroundings through conduction.

D The double-wall increases heat gained from the surroundings through convection.

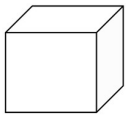
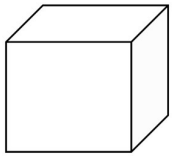
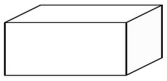
15 Which of the following statements is true about thermal radiation?

A Thermal radiation only occurs on hot objects.
B Absorption of thermal radiation is higher on shiny objects.
C Absorption of thermal radiation is higher on black objects.
D A medium is required to transfer energy via thermal radiation.

16 Two rods that are identical in shape and size are cooled to 20 °C. One rod is made of plastic and the other is made of metal. Which of the following statements is true?

A The metal rod will feel cooler as it is colder.
B The plastic rod will feel cooler as it is colder.
C The metal rod will feel cooler as it is a better conductor of heat.
D The plastic rod will feel cooler as it is a better conductor of heat.

17 Four cubes of the same mass are made from different materials. The same amount of thermal energy is transferred to each of them and the rise in temperature is recorded. Which of the cubes has the lowest specific heat capacity?

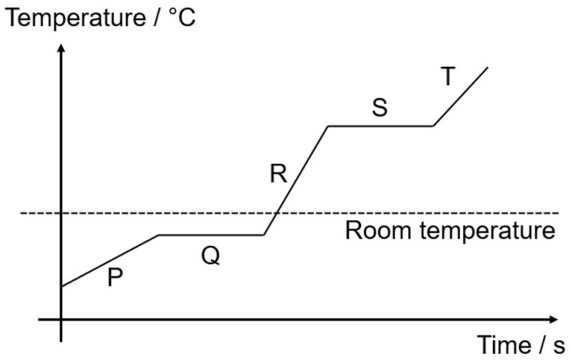
A	**B**	**C**	**D**
			
Temperature rise = 9 °C	Temperature rise = 2 °C	Temperature rise = 5 °C	Temperature rise = 4 °C

18 2000 J of thermal energy is used to heat up 10.0 g of ice. The specific latent heat of fusion of ice is 340 J g^{-1}. How much ice remains after heating?

A 0.17 g
B 4.12 g
C 5.88 g
D 9.83 g

The diagram shows the heating curve of 1 kg of an object made of a pure substance.

Answer questions 19 and 20 using information from the diagram.



19 Which of the following gives the correct state of matter for the range indicated?

	Range	State
A	P	Liquid
B	Q	Solid
C	R	Liquid
D	R	Gas

20 In which part of the heating curve (P, Q, R, S, T) does the average kinetic energy of the particles increase the most?

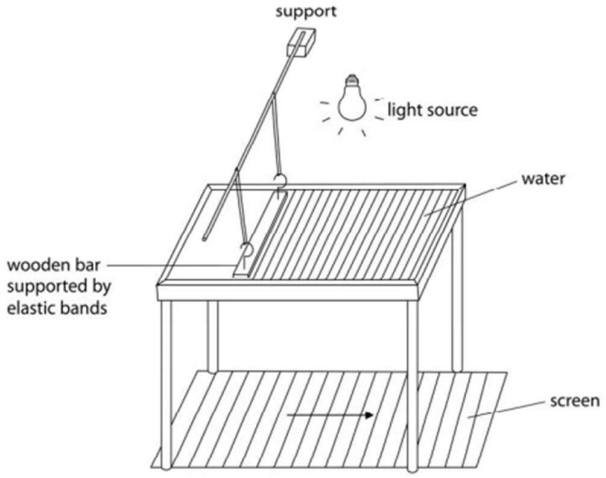
A P

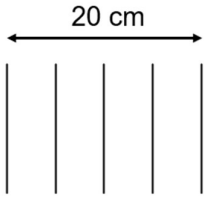
B R

C S

D T

21 The wave generator oscillates at 50 Hz and produces the wave shown on the right.





What is the speed of the wave?

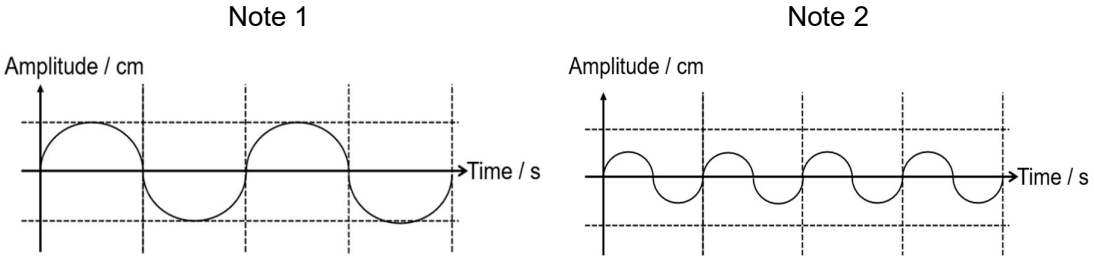
A 0.4 cm s^{-1}

B 2.5 cm s^{-1}

C 250 cm s^{-1}

D 1000 cm s^{-1}

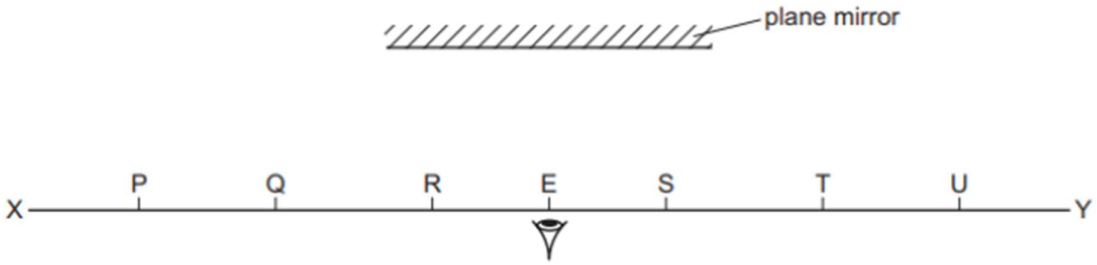
22 Two notes are played on a musical instrument, resulting in the two graphs shown below.



Which of the following correctly describes Note 2 when compared to Note 1?

	Loudness	Pitch
A	Higher	Higher
B	Higher	Lower
C	Lower	Higher
D	Lower	Lower

23 A camera eye is fixed at position E as shown below.



Objects are placed along line XY.

At which positions along XY will the camera be able to see the images of the objects through the plane mirror?

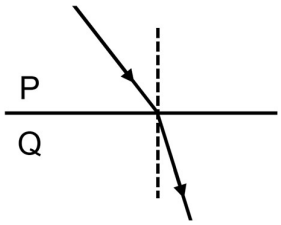
A P, Q, R, S

B P, R, S, T

C R, E, S, T

D Q, E, S, U

24 A ray of light is incident on an interface between two transparent mediums, P and Q. The ray produced the diagram shown below.



Which of the following statements is true?

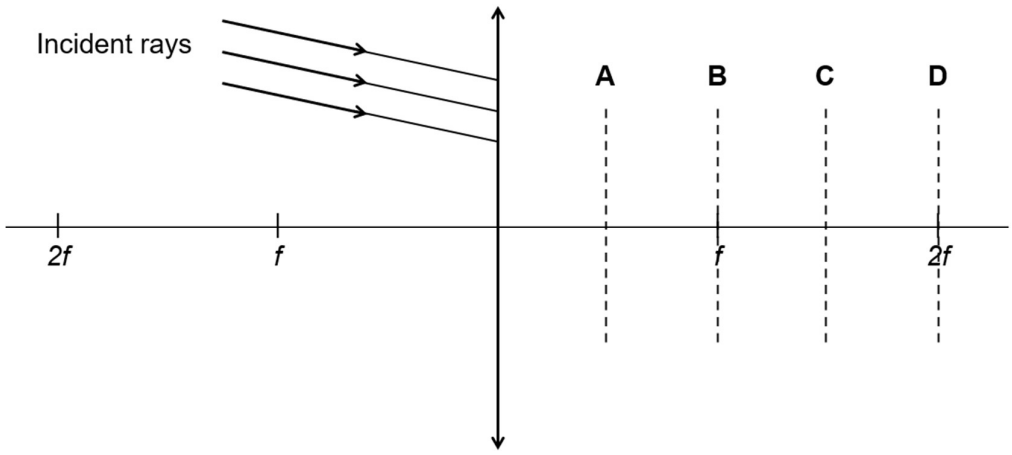
A Medium P is optically denser than medium Q.

B Medium Q is optically denser than medium P.

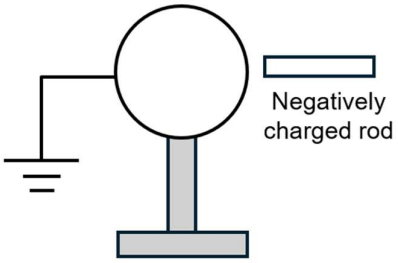
C Medium Q has a lower refractive index than medium P.

D Medium P has a higher refractive index than medium Q.

25 Parallel rays from the Sun are incident on a thin converging lens on Earth.
Where should a screen be placed to produce a focussed image?



26 A negatively charged rod is brought near a hollow metal sphere placed on an insulating stand.
The sphere is earthed for an instance and the charged rod is removed.
Which of the following about the resulting charge on the sphere is correct?

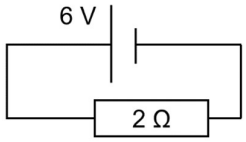


A The sphere will have a net negative charge as protons were discharged.
B The sphere will have a net negative charge as electrons were discharged.
C The sphere will have a net positive charge as protons were discharged.
D The sphere will have a net positive charge as electrons were discharged.

27 Three dry cells of 1.5 V each are connected in series. What are the maximum and minimum electromotive forces that can be supplied by the three dry cells?

	Maximum	Minimum
A	3.0 V	1.5 V
B	3.5 V	1.5 V
C	4.5 V	1.5 V
D	4.5 V	3.0 V

28 How much charge flows through the resistor in 1.5 minutes?



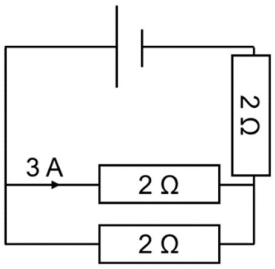
A 3 A

B 4.5 C

C 18 A

D 270 C

29 Three identical resistors are connected the circuit.
Calculate the electromotive force of the circuit.



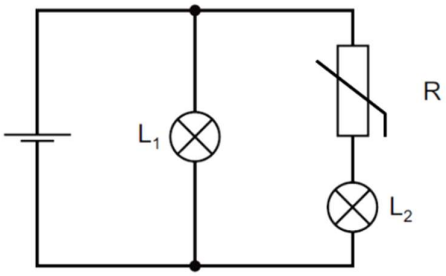
A 6 V

B 12 V

C 18 V

D 24 V

30 Two lightbulbs and a thermistor, R, are connected in the circuit.

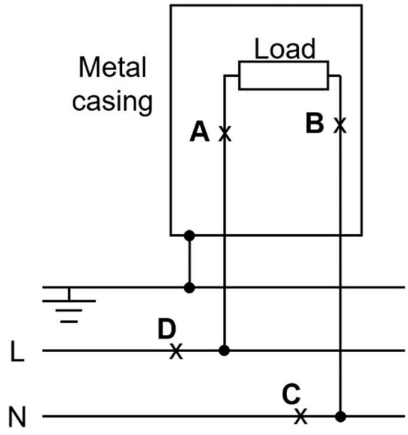


Which of the following correctly describes the effects on the brightness L_1 and L_2 when the temperature on R increases?

	L_1	L_2
A	Dimmer	No change
B	No change	Brighter
C	No change	Dimmer
D	Brighter	Brighter

31 An appliance with a metal casing is connected to mains socket through a standard three-pin plug.
The diagram shows the connections from the appliance to the electrical mains.

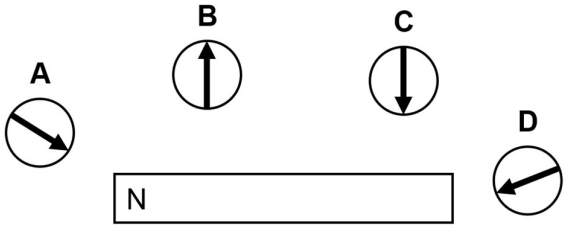
At which position (A, B, C, D) should a fuse be placed?



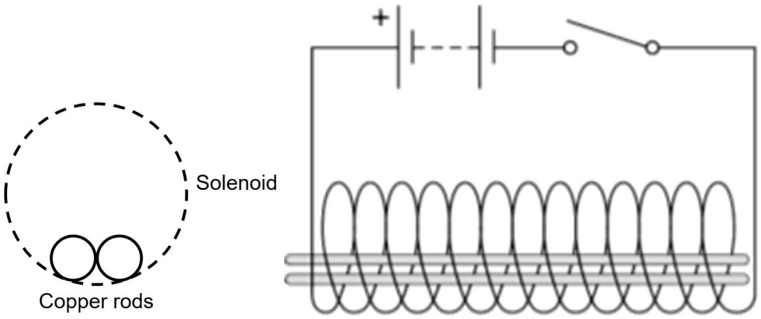
32 A washing machine and a drying machine are rated at 1400 W and 5000 W respectively. One load of laundry requires 1 hour in the washing machine and 2 hours in the dryer.
Singapore currently charges 32.6 cents for each kW h of energy used.
What is the cost of doing two loads of laundry?

A 208.64 cents
B 371.64 cents
C 743.28 cents
D 371640 cents

33 A compass is placed near a bar magnet and the entire setup is shielded from the Earth's magnetic field. Which option shows the correct orientation of the compass?



34 Two copper rods are placed in a solenoid connected to a direct current (d.c.) power source.



Ignoring the effects of gravity, which of the following is observed when the switch is first closed, then opened?

A The rods will not move.

B The rods will repel each other, then stay repelled.

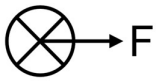
C The rods will repel each other, then move towards each other.

D The rods will move towards each other, then repel each other.

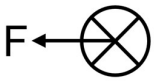
35 A current carrying conductor is placed between two magnets as shown below.

Which diagram shows the correct direction of the resultant force, F, on the conductor?

A



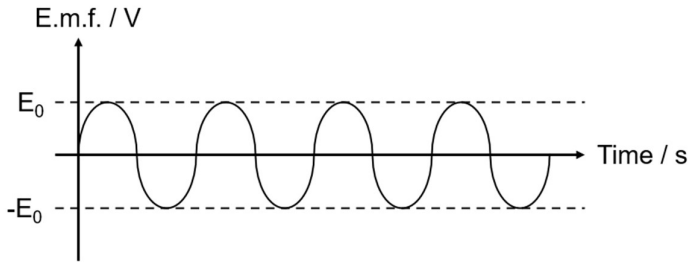
B



C

D

36 The following alternating current (a.c.) is produced by an a.c. generator with *x* number of coils.



What is the effect on the output current if the period of rotation of the coil is halved?

A E_0 becomes $2E_0$.

B The frequency is doubled.

C E_0 becomes $1/2E_0$ and the frequency is doubled.

D E_0 becomes $2E_0$ and the frequency is doubled.

37 A transformer is used to step down an input voltage of 240 V for use with a doorbell that is rated at 6 V, 2 A.

Which of the following transformers should be used for this application?

	Primary coil	Secondary coil
A	1680	84
B	42	1680
C	4560	114
D	228	4560

38 Atom Q is represented by $^{204}_{82}Q$.

Atom R is an isotope of Q, with 2 more neutrons than Q.

What is the correct nuclide notation of R?

A $^{204}_{84}Q$

B $^{206}_{82}Q$

C $^{206}_{84}Q$

D $^{204}_{80}Q$

39 Which of the following is true about radioactive decay?

A We can cause a radioactive nucleus to emit radiation by heating it.

B It is possible to determine when a radioactive nucleus will emit radiation.

C It is possible to predict where the emitted radiation will leave a nucleus.

D Nuclear decay occurs as the nuclear forces are not strong enough to bind the nucleons.

40 A neutron is used to probe a uranium-235 atom to undergo nuclear fission.

Which of the following is the correct possible nuclide equation?

A ${}_{0}^{1}n + {}_{92}^{235}U \rightarrow {}_{56}^{144}Ba + {}_{36}^{90}Kr + 2{}_{0}^{1}n$

B ${}_{0}^{1}n + {}_{92}^{235}U \rightarrow {}_{56}^{142}Ba + {}_{36}^{91}Kr + 2{}_{0}^{1}n$

C ${}_{0}^{1}n + {}_{92}^{235}U \rightarrow {}_{55}^{144}Ba + {}_{36}^{90}Kr + {}_{0}^{1}n$

D ${}_{0}^{1}n + {}_{92}^{235}U \rightarrow {}_{56}^{146}Ba + {}_{37}^{90}Kr + 2{}_{0}^{1}n$