YUAN CHING SECONDARY SCHOOL

Secondary Four Express Course
Preliminary Examination 2024

CANDIDATE NAME			
CLASS		INDEX NUMBER	

PHYSICS

6091 / 01

Paper 1 Multiple Choice

11 September 2024

Additional Materials : Multiple Choice Answer Sheet

1 hour

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class and index number on the Answer Sheet in the spaces provided unless this has been done for you.

There are **forty** questions for 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 booklet.
The use of an approved scientific calculator is expected, where appropriate.

The total number of marks for this paper is 40.

1 What is the order of magnitude of the diameter of a strand of hair?

A 10 mm **B** 10^3 cm **C** 10^4 μm **D** 10^5 nm

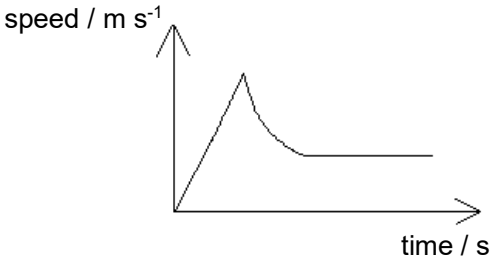
2 A newly purchased pendulum clock is found to be slower by 1 min.

Which of the following will correct the error?

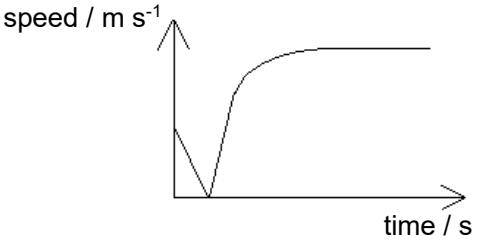
A decreasing the length of the pendulum
B decreasing the mass of the pendulum
C increasing the length of the pendulum
D increasing the mass of the pendulum

3 A diver jumps off from the diving board with an initial speed and decelerates uniformly to a momentary stop before falling with constant acceleration. On entering the water, he experiences a decreasing deceleration and then reaches a constant speed.

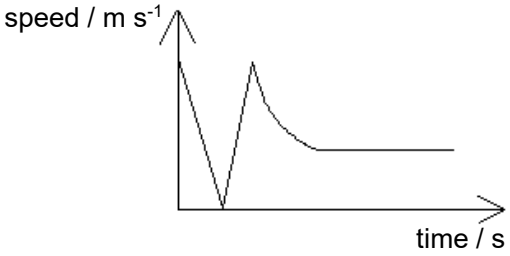
Which of the following speed-time graphs represents the motion of the diver?



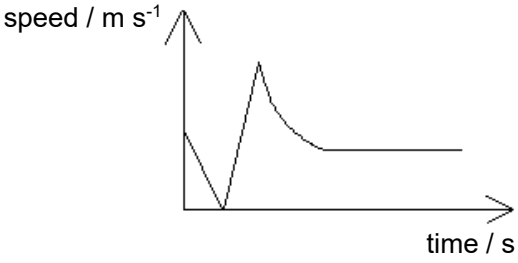
A



B

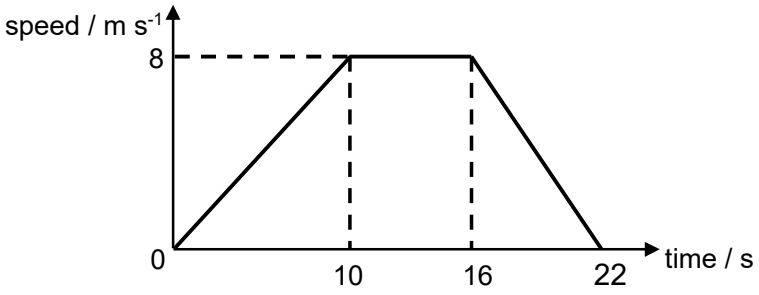


C



D

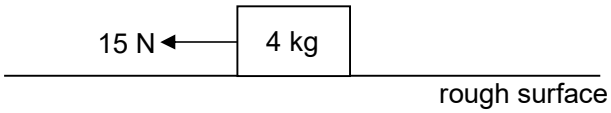
4 The speed-time graph below describes the motion of a toy car.



What is the average speed of the toy car while moving at constant deceleration?

A 4.0 m/s **B** 5.1 m/s **C** 8.0 m/s **D** 24 m/s

5 A block of wood of mass 4 kg moves with an acceleration of 0.8 m/s^2 when it is pulled along a rough surface with a force of 15 N.



What is the deceleration of the block when the 15 N force is removed?

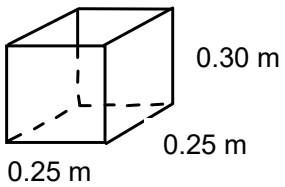
A 0.00 m/s^2 **B** 0.80 m/s^2 **C** 2.95 m/s^2 **D** 3.20 m/s^2

6 A rocket of mass 3.50 x 10^5 kg has a vertical lift off with an upward thrust of 4500 kN. The gravitational field strength is 10 N/kg.

What is the initial acceleration of the rocket?

A 0.0777 m/s^2 **B** 2.86 m/s^2 **C** 9.99 m/s^2 **D** 12.9 m/s^2

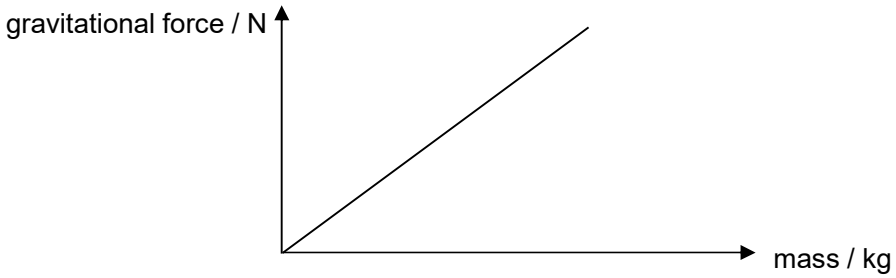
7 Six bags of flour, each of mass 2.5 kg, were used to fill up a box shown below. The box of dimensions 0.30 m × 0.25 m × 0.25 m has a mass of 0.5 kg.



What is the average density of the box after it is filled up?

A 26.7 kg/m^3 **B** 160 kg/m^3 **C** 800 kg/m^3 **D** 827 kg/m^3

8 The graph below represents the relationship between the gravitational force and the mass of a falling object in a vacuum container.



What is the gradient of the graph?

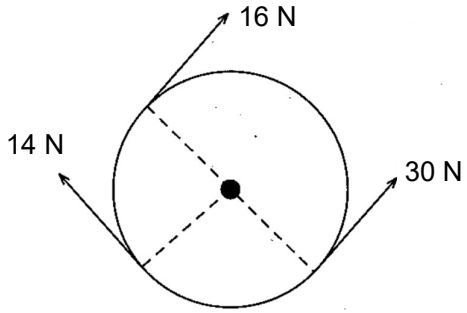
A acceleration of the object
B inertia of the object
C speed of the object
D weight of the object

9 The diagram shows a truck.

Which of the following is the best position for its centre of gravity and the reason for the position?

	best position	reason
A	as high as possible	accelerate more rapidly
B	as high as possible	more stable
C	as low as possible	accelerate more rapidly
D	as low as possible	more stable

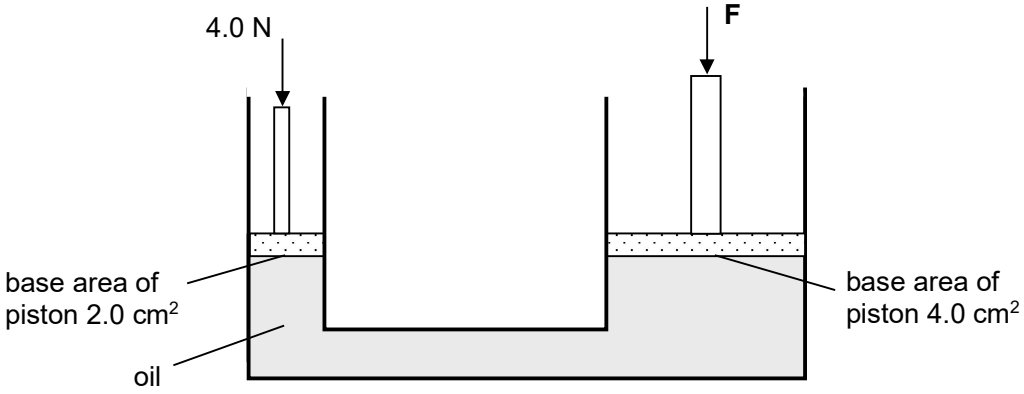
10 Three forces of magnitude 14 N, 16 N and 30 N are applied on a wheel as shown.



Which statement about the motion of the wheel is correct?

A The wheel will move and rotate.
B The wheel will move but not rotate.
C The wheel will not move and not rotate.
D The wheel will not move but will rotate.

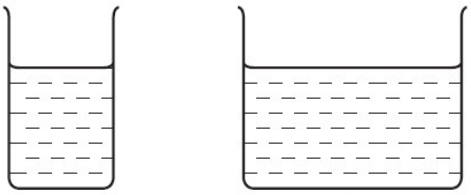
11 A simple hydraulic system has two closely–fitted smooth pistons connected as shown below.



What is the force **F** needed to balance the system?

A 2.0 N **B** 4.0 N **C** 8.0 N **D** 16.0 N

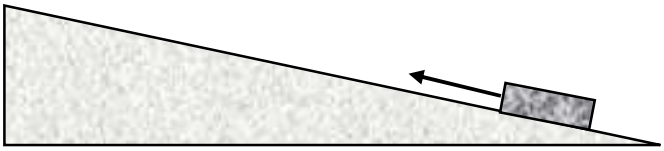
12 Two vessels **S** and **T** are filled to the same level with the same liquid. The base area of **S** is less than that of **T**.



Which statement is correct?

A The force on the base of **S** is greater than the force on the base of **T**.
B The force on the base of **S** is the same as the force on the base of **T**.
C The pressure on the base of **S** is greater than the pressure on the base of **T**.
D The pressure on the base of **S** is the same as the pressure on the base of **T**.

13 An object is pulled up along a rough slope at a constant speed.



Which of the following statements about the work done by the pulling force is correct?

A It is equal to the gain in energy in the gravitational potential store minus the work done against friction and energy in the kinetic store.

B It is equal to the gain in energy in the gravitational potential store minus the work done against friction.

C It is equal to the gain in energy in the gravitational potential store plus the work done against friction.

D It is equal to the gain in energy in the gravitational potential store plus the work done against friction and energy in the kinetic store.

14 In a fossil fuel power station, the fossil fuel is used to boil the water into steam. The steam is then used to turn the turbine which in turn rotates the generator.

Which of the following represents the main energy transfer taking place in the power station?

A chemical potential store → internal store → chemical potential store
B chemical potential store → internal store → kinetic store
C chemical potential store → kinetic store → internal store
D kinetic store → internal store → chemical potential store

15 In a Brownian motion experiment, illuminated smoke particles are seen to move randomly.

Which statement correctly explains the motion of the smoke particles?

A They are continuously bombarded by the air molecules.
B They are moved by the convection currents in the air.
C They are shaken by the vibration of the air molecules.
D They are supplied with energy by the light illuminating them.

16 A fixed mass of gas is heated in a sealed container of fixed volume.

Which statement is **incorrect**?

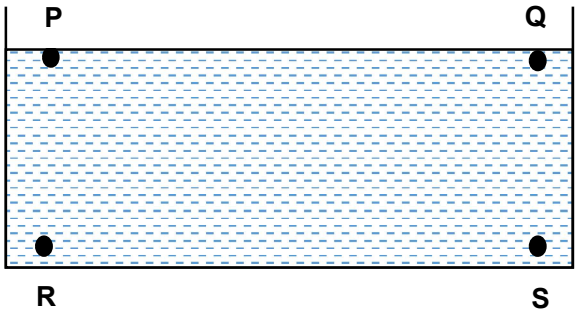
A The average distance between the gas molecules increases.
B The average force of collision on the wall by the gas molecules increases.
C The average frequency of collision of the gas molecules on the wall increases.
D The average kinetic energy of the gas molecules increases.

17 Four metal cans are identical except for the colour and texture of their outer surfaces. Equal volumes of water at 100 °C are poured into each can.

In which can is the rate of temperature drop the fastest?

black, rough surface	black, shiny surface	white, rough surface	white, smooth surface
A	**B**	**C**	**D**

18 A teacher has a large tank of water, a heater and an ice block. He wants to set up a convection current in the water in a clockwise direction.



Which of the following will help him achieve this?

A Place the heater at **P**.
B Place the heater at **S**.
C Place the ice block at **Q**.
D Place the ice block at **R**.

19 Three statements about boiling and evaporation in a liquid are stated below.

I. Intermolecular attractive forces are overcome during boiling but not during evaporation.
II. Boiling does not change the average kinetic energy of molecules of the liquid but evaporation does.
III. Boiling involves all the molecules in the liquid but evaporation does not.

Which of the above statements is/are true?

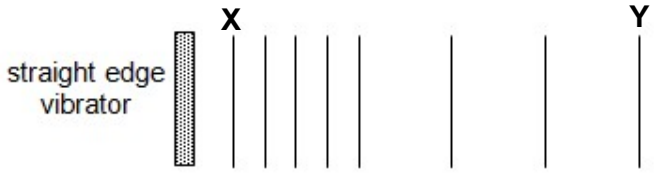
A I only
B II only
C I and II only
D II and III only

20 Two well-insulated blocks **P** and **Q** of the same material and initial temperature 20 °C are each heated for 10 minutes using an electric heater of the same electrical power. **P** and **Q** reached the final temperatures of 25 °C and 30 °C respectively. **P** has a mass of 40 g.

What is the mass of **Q**?

A 10 g **B** 20 g **C** 60 g **D** 80 g

21 The plane wavefronts of a water wave formed by a straight edge vibrator are shown below.



Which statement about the water wave as it move from region **X** to region **Y** is **correct**?

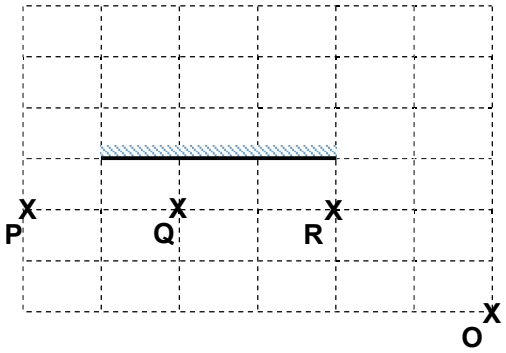
A The amplitude of the water is increasing.
B The frequency of the waves is increasing.
C The period of the waves is decreasing.
D The speed of the waves is increasing.

22 A wave of frequency 500 Hz has a wavelength of 0.660 m.

How long does it take for the waves to travel 1.00 km?

A 1.32 s **B** 2.00 s **C** 3.03 s **D** 7.58 s

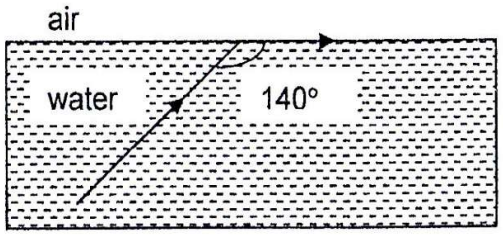
23 **P**, **Q** and **R** are objects placed in front of a plane mirror. An observer at **O** looks into the plane mirror.



Which image(s) can the observer see in the plane mirror?

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

24 The diagram shows the path of a ray of light as it strikes the water-to-air boundary.



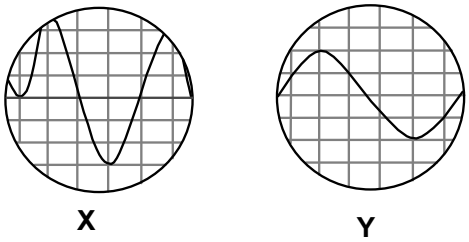
What is the speed of light in water?

A 1.93×10^8 m/s **B** 2.30×10^8 m/s **C** 3.00×10^8 m/s **D** 3.92×10^8 m/s

25 Which of the following components of the electromagnetic spectrum is used in satellite communication?

A infra-red radiation
B gamma ray
C microwaves
D ultra-violet radiation

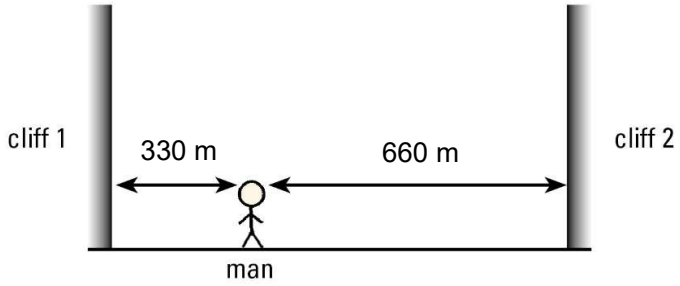
26 The waveforms of two notes **X** and **Y** are shown on a cathode ray oscilloscope screen with the same time-base and y-gain setting.



Which statement is correct?

A **X** has higher pitch and is louder than **Y**.
B **X** has higher pitch and is softer than **Y**.
C **X** has lower pitch and is louder than **Y**.
D **X** has lower pitch and is softer than **Y**.

27 A man stands between two tall cliffs as shown in the diagram.

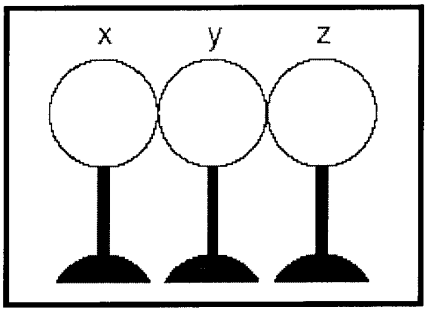


He fires a starting pistol and hears some echoes.

Assuming the speed of sound in air is 330 m/s, what is the time interval between the two loudest echoes?

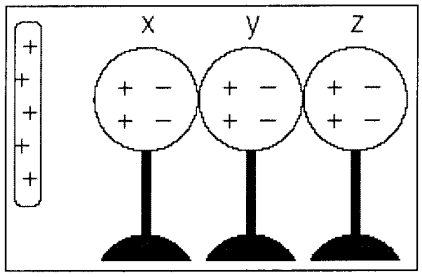
A 1.0 s **B** 2.0 s **C** 3.0 s **D** 4.0 s

28 The diagram below shows three neutral metal spheres, X, Y and Z, in contact and on insulating stands.

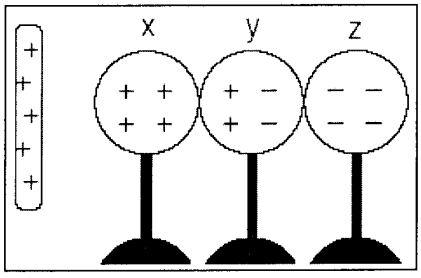


Which diagram best represents the charge distribution on the spheres when a positively charged rod is brought close to sphere X?

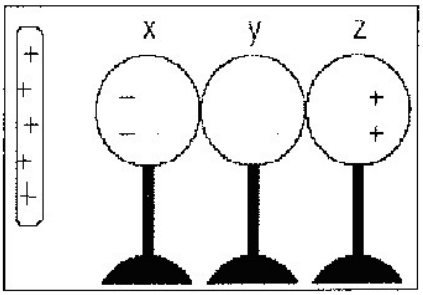
A



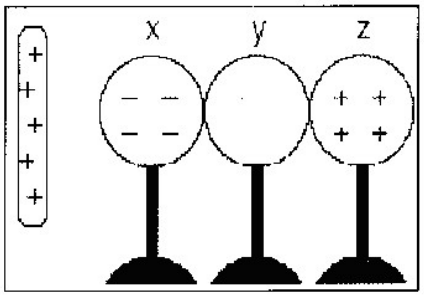
B



C



D



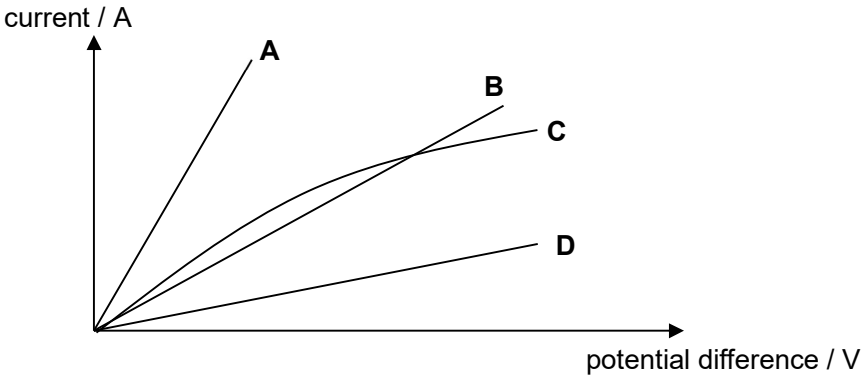
29 During a thunderstorm, a lightning strike sent an electric charge of 150 C from a thundercloud to the earth. The potential difference between the thundercloud and the earth was 2.00×10^{10} V during the discharge.

How much energy was produced during the lightning strike?

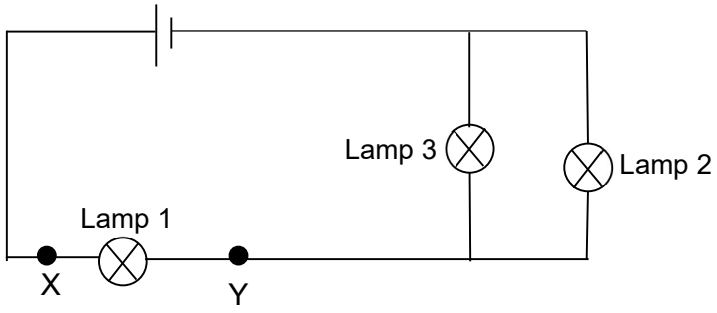
A 1.33×10^{8} J **B** 6.00×10^{8} J **C** 7.50×10^{11} J **D** 3.00×10^{12} J

30 The diagram shows a graph of current against potential difference across four wires, **A**, **B**, **C** and **D**. The wires are of the same material and length.

Which wire is the thickest?



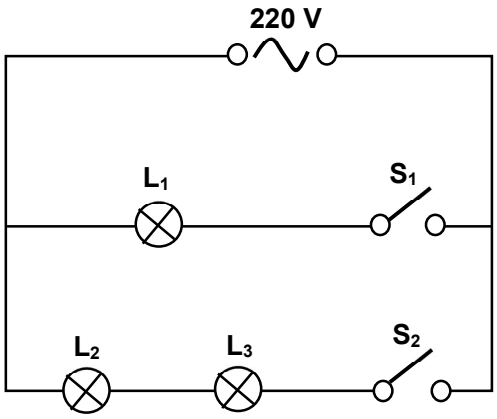
31 Three lamps are connected in the circuit shown below.



What would happen to the brightness of the lamps when points X and Y are connected together by a wire of negligible resistance?

	Lamp 1	Lamp 2	Lamp 3
A	dimmer	brighter	dimmer
B	dimmer	dimmer	dimmer
C	off	brighter	brighter
D	off	same	same

32 The diagram below shows part of the lighting circuit of a house.
All the bulbs are identical and are rated 100 W, 220 V.



What is the current flowing through L_3, when the switches S_1 and S_2 are closed?

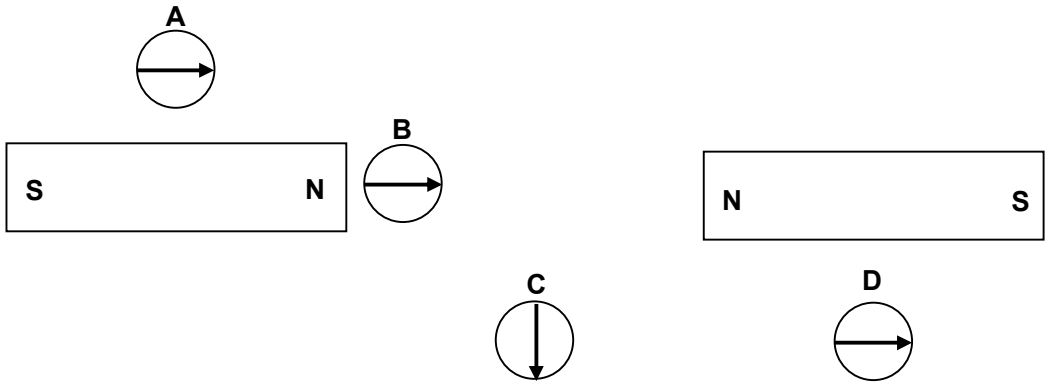
A 0.23 A **B** 0.45 A **C** 0.68 A **D** 1.10 A

33 In a water heating system, a 1 kW heater and a 50 W lamp are connected in parallel. They are both controlled by the same switch. In one month, the lamp alone consumes 1 kWh of electrical energy.

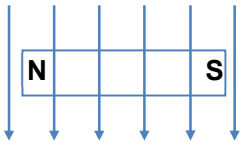
Given the cost of electricity is $ 0.30 per kWh, how much does it cost to use the water heating system in that month?

A $ 0.32 **B** $ 6.00 **C** $ 6.30 **D** $ 21.00

34 Three compasses are placed around two permanent magnets as shown below.
Which compass is pointing in the wrong direction?



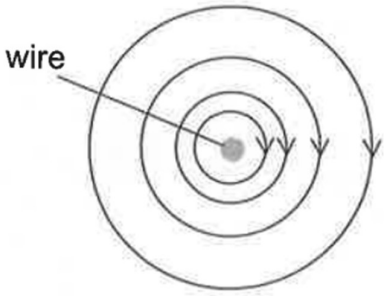
35 A bar magnet is placed on a smooth surface in a uniform magnetic field as shown below.



What will happen to the bar magnet?

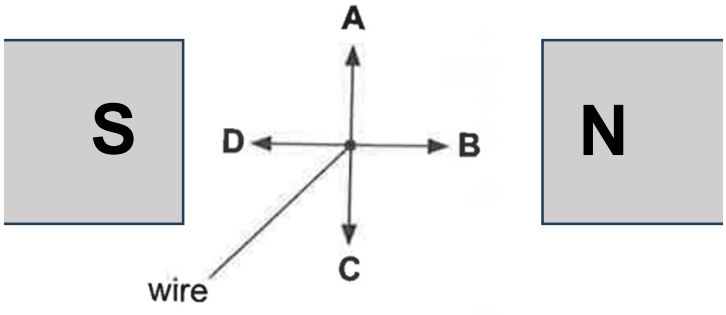
A It will remain stationary.
B It will turn 90° anti-clockwise.
C It will turn 90° clockwise.
D It will turn 180° anti-clockwise.

36 A wire carries a current and hangs vertically. The diagram shows the magnetic field around the wire when viewed from above.

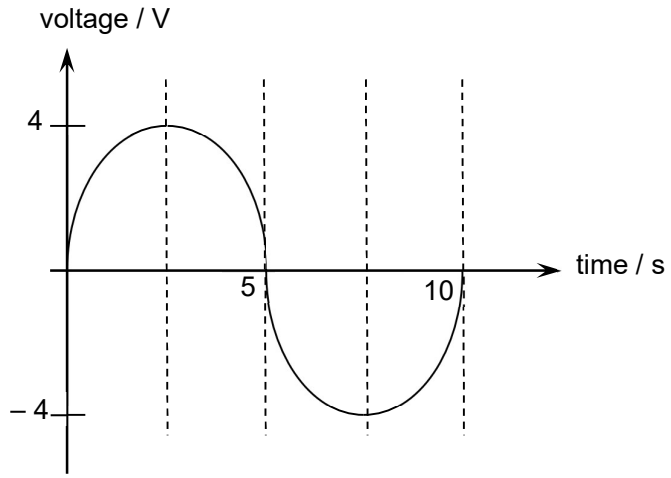


The poles of a magnet are placed either side of the wire.

What is the direction of the force on the wire caused by the magnet when viewed from above?



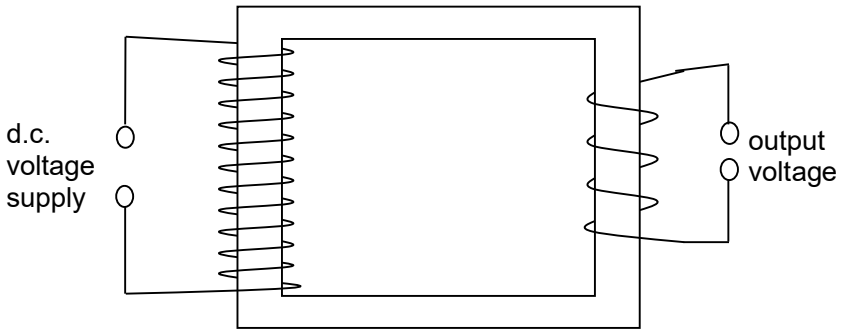
37 A simple a.c. generator produces a voltage that varies with time as shown.



How will the period and the peak induced voltage change if the speed of rotation of the coil in the generator is halved?

	period of wave / s	maximum voltage / V
A	5	2
B	5	8
C	20	2
D	20	8

38 The diagram shows an ideal step-down transformer connected to a 12 V d.c. voltage supply. The turn ratio of the primary coil to the secondary coil is 10:1.



What is the output voltage of the transformer?

A 0 V **B** 1.2 V **C** 12 V **D** 120 V

39 $^{238}_{92}\mathrm{U}$ decays through a two-step transformation to a final stable nuclide. It first emits an alpha particle followed by a beta particle.

What is the final stable nuclide?

A $^{228}_{88}\mathrm{Ra}$ **B** $^{234}_{90}\mathrm{Th}$ **C** $^{234}_{91}\mathrm{Pa}$ **D** $^{230}_{90}\mathrm{Th}$

40 Various sheets are placed between a radioactive source and a detector, which is capable of indicating the presence of alpha, beta and gamma emissions. The following observations are recorded.

material of sheets	effect on the count rate
paper	slight drop
aluminium	no further drop
paper + aluminium+ lead	a further drop

What is/are the emissions from the source?

A alpha and beta
B alpha and gamma
C beta and gamma
D gamma only

END OF PAPER 1

2024 PRELIMINARY EXAM PURE PHYSICS (6091)
ANSWERS

1.	D	2.	A	3.	D	4.	A	5.	C	6.	B	7.	D	8.	A
9.	D	10.	B	11.	C	12.	D	13.	C	14.	B	15.	A	16.	A
17.	A	18.	C	19.	D	20.	B	21.	D	22.	C	23.	A	24.	B
25.	C	26.	A	27.	B	28.	C	29.	D	30.	A	31.	C	32.	A
33.	C	34.	A	35.	B	36.	A	37.	C	38.	A	39.	C	40.	B