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JURONGVILLE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2023
Secondary 4 Express

STUDENT NAME

CLASS

INDEX NUMBER

PHYSICS

6091/01

Paper 1 Multiple Choice

30 August 2023

Additional Materials: Multiple Choice Answer Sheet

1 hour

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, index number and class in the spaces at the top of this page.

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

Take acceleration due to gravity on Earth, g, to be 10 m/s² unless stated otherwise.

For Examiner's Use
40

Setter: Mr Raymond Tan

This document consists of 22 printed pages.

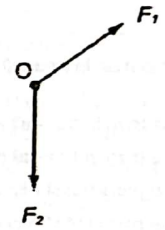
[Turn over

1 A wire has an approximate length of 80 cm and an approximate diameter of 0.2 cm.

Which pair of instruments is the most suitable for measuring accurately the length and diameter of the wire?

A calipers and micrometer
B metre rule and calipers
C metre rule and micrometer
D tape and micrometer

2 Two forces F_1 and F_2 act on an object O in the directions shown.



What is the direction of the resultant force?

A

B

C

D

[Turn over

3 A micrometer is used to measure the thickness of an aluminium sheet.

Diagram 1 shows the reading on the micrometer when it is tightened with nothing between the jaws.

Diagram 2 shows the reading taken when the aluminium sheet is between the jaws.

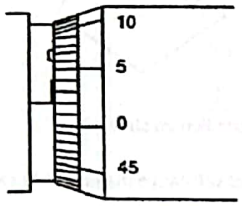


diagram 1

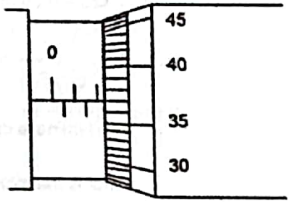


diagram 2

What is the thickness of the aluminium sheet?

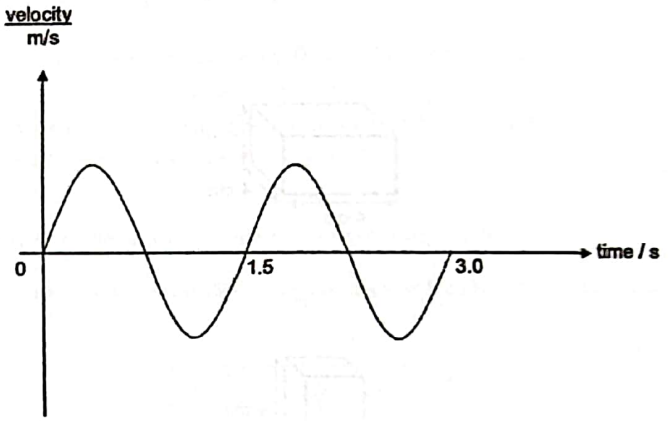
A 2.17 mm B 2.35 mm C 2.39 mm D 2.57 mm

4 A car travels at an average speed of 60 km/h for 15 minutes.

How far does the car travel in 15 minutes?

A 4 km B 15 km C 240 km D 900 km

5 The bob of a simple pendulum is pulled to one side and released. The variation of velocity of the pendulum from the point of release with time is shown.

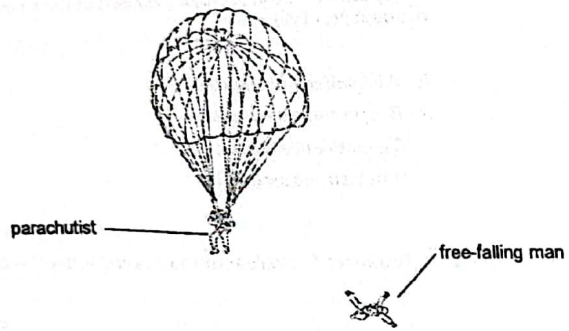


The time taken by a car to travel from point A to point B is the same as the time taken by the pendulum to complete 4 oscillations.

If the car is travelling at a constant speed of 25 m/s, what is the distance between point A and point B?

A 5.0 m B 25 m C 100 m D 150 m

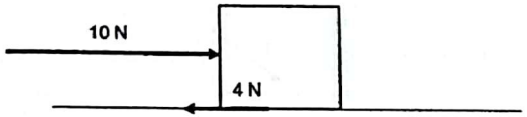
6 Two men jump out of an aeroplane at the same time. One of the men opens his parachute and the other man remains in free-fall.



Why is the man in free-fall moving faster than the parachutist?

A The man in free-fall experiences greater air resistance.
B The man in free-fall has a greater mass.
C The parachutist experiences greater air resistance.
D The parachutist has not reached terminal velocity.

7 When a block of wood of mass 2 kg is pushed along the horizontal flat surface of a bench, the friction measured is 4 N.



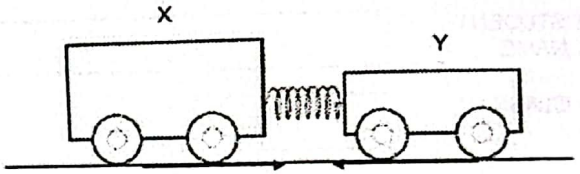
Which statement describes the motion of the block when it is pushed along the same bench with a force of 10 N?

A The block moves with a speed of 3 m/s.
B The block moves with a speed of 5 m/s.
C The block moves with an acceleration of 3 m/s^2.
D The block moves with an acceleration of 5 m/s^2.

8 Trolley X and trolley Y are joined by a stretched spring.

Trolley X has twice the mass of trolley Y.

When the trolleys are released, the acceleration of X is 2.0 m/s^2 to the right.



What is the initial acceleration of trolley Y to the left?

A 1.0 m/s^2 B 2.0 m/s^2 C 3.0 m/s^2 D 4.0 m/s^2

9 An object that has a mass of 15 kg on the Earth is taken to the Moon.

The gravitational field strength on the Earth is 10 N/kg and that on the Moon is 1.6 N/kg.

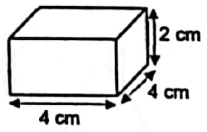
What are the mass and the weight of the object on the Moon?

	mass / kg	weight / N
A	15	24
B	15	150
C	24	15
D	150	24

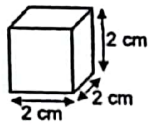
10 The diagram shows four blocks, each made of an element of density 22.5 g/cm³.

Which block has a mass of 180 g?

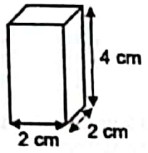
A



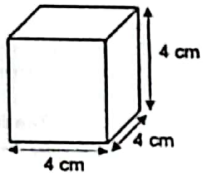
B



C

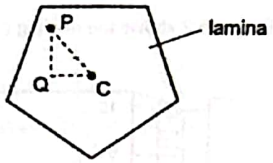


D



11 A plane lamina is freely suspended from point P. The weight of the lamina is 2.0 N and the centre of gravity is at C.

PC = 0.50 m
PQ = 0.40 m
QC = 0.30 m



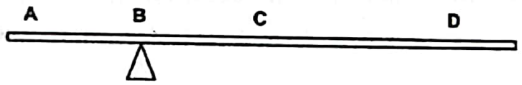
The lamina is displaced to the position as shown.

What is the moment about P that will cause the lamina to swing?

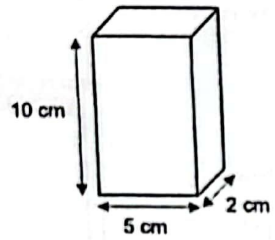
A 0.60 Nm clockwise
B 0.80 Nm anticlockwise
C 1.0 Nm anticlockwise
D 1.0 Nm clockwise

12 A non-uniform beam is balanced when a pivot is placed as shown in the diagram.

Which position most likely represents the centre of gravity of the beam?



13 A brick of weight 80 N rests on one of its flat surfaces on the ground.

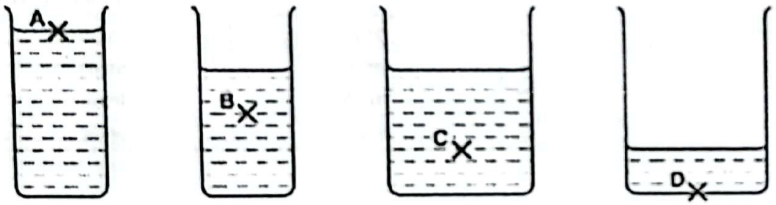


What is the minimum pressure the brick can exert on the ground?

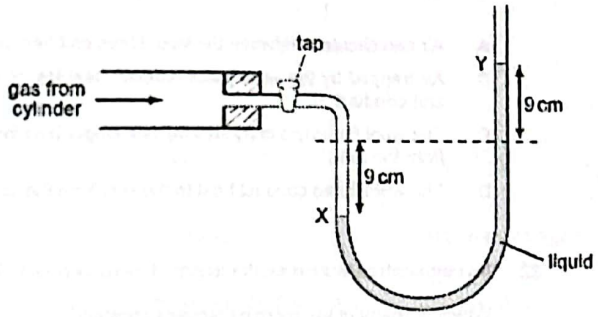
A 1.6 Pa B 4.0 Pa C 16 000 Pa D 80 000 Pa

14 Four beakers contain the same liquid.

At which point is the pressure the greatest?



15 The diagram shows the levels X and Y in a liquid manometer when the gas tap is opened.



What is the pressure of the gas in the cylinder?

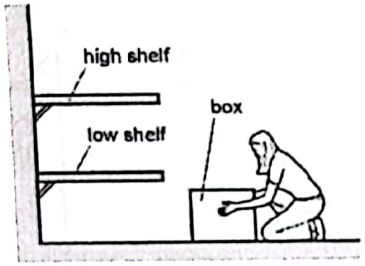
A atmospheric pressure + 9 cm of liquid pressure
B atmospheric pressure - 9 cm of liquid pressure
C atmospheric pressure + 18 cm of liquid pressure
D atmospheric pressure - 18 cm of liquid pressure

16 A coal-fired power station burns coal to convert water to steam, which is then used to spin turbines that turn generators.

Which row represents the main energy changes that take place in a coal-fired power station?

A chemical → heat → kinetic → electrical
B chemical → heat → light → electrical
C chemical → kinetic → electrical → potential
D kinetic → heat → light → electrical

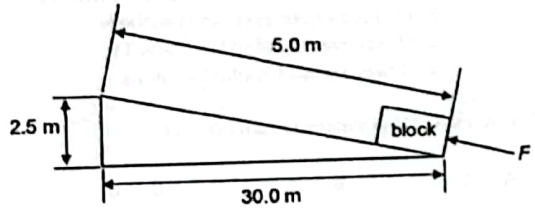
17 In a factory, a woman has to lift a box on to a shelf.



Which action requires the least amount of work?

A lifting the box quickly to the high shelf
B lifting the box slowly to the high shelf
C lifting the box to the low shelf first then lifting it to the high shelf
D lifting the box to the low shelf instead of to the high shelf

18 A constant force *F* pushes a block of mass 5 kg up the slope as shown.



The gravitational field strength is 10 N/kg.

What is the gravitational potential energy gained by the block when it reached the top of the slope?

A 5 J B 50 J C 125 J D 250 J

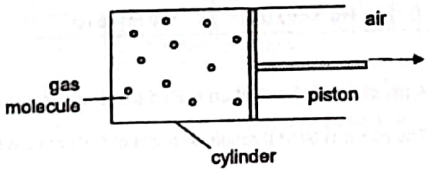
19 Smoke particles trapped in an illuminated smoke cell are observed under a microscope. Smoke particles are seen to be moving randomly in all directions.

What can be deduced from this observation?

A Air molecules are of the same size as smoke particles.
B Air molecules move faster when heated.
C Air molecules move randomly and collide onto the smoke particles.
D Smoke particles are not affected by gravitational force.

20 Gas inside a cylinder is heated slowly to a higher temperature.

The pressure inside the cylinder remains constant as the piston moves outwards.



What are the changes to the values of the speed of the gas molecules and the rate of collision with the piston at the higher temperature as compared with the initial values at the lower temperature?

	speed of molecules	rate of collision
A	greater	greater
B	greater	reduced
C	greater	same
D	same	greater

21 After a sheep has its wool cut off, it is harder for it to stay warm when the air temperature falls.

How does the wool help the sheep to stay warm?

A Air can circulate between the wool fibres and heat up the skin by convection.

B Air trapped by the wool fibres reduces heat losses from the skin by convection and conduction.

C The wool fibres are curly so it takes a longer time for heat to be conducted away from the skin.

D The wool fibres conduct heat to the skin from the air outside.

22 As temperature increases, the length of mercury column in a thermometer increases.

Which property of the mercury remains constant?

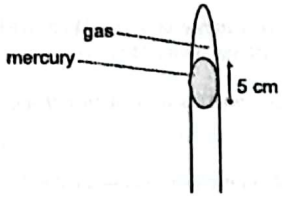
A density

B internal energy

C mass

D volume

23 The diagram shows a capillary tube with a 5 cm column of mercury.



Given the density of mercury is 13600 kgm^{-3}, what is the pressure of the gas, given that the atmospheric pressure is 760 mm Hg.

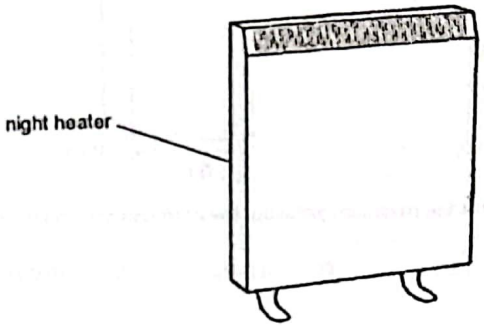
A 96600 Pa

B 103000 Pa

C 104000 Pa

D 110000 Pa

24 In many cold countries, a night storage heater is used to heat up rooms. It contains a large block of material that is heated electrically during the night to store heat in the blocks for use in the day. During the day the block cools down, releasing thermal energy into the room.



What heat capacity of the block and what night-time temperature increase will cause the most energy to be stored by the block?

	heat capacity of the block	night-time temperature increase
A	large	large
B	large	small
C	small	large
D	small	small

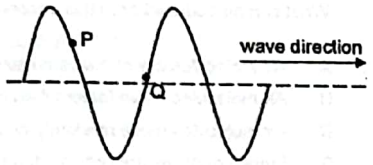
25 A boy throws a small stone into a pond. Waves spread out from where the stone hits the water and travel to the side of the pond.

The boy notices that eight waves reach the side of the pond in a time of 5.0 s.

What is the frequency of the waves?

A 0.20 Hz B 0.63 Hz C 1.6 Hz D 40 Hz

26 The diagram shows a wave on a string with two points P and Q marked on the string. The wave is moving to the right as shown.

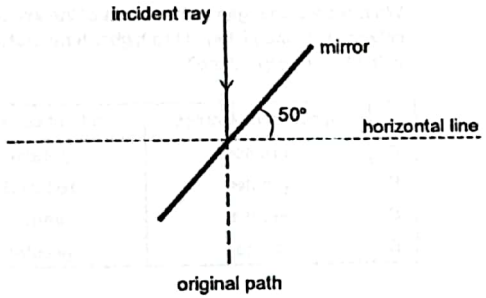


What will happen next?

	P	Q
A	will move down	will move down
B	will move down	will move up
C	will move up	will move down
D	will move up	will move up

27 A ray of light is incident on a tilted plane mirror as shown in the diagram.

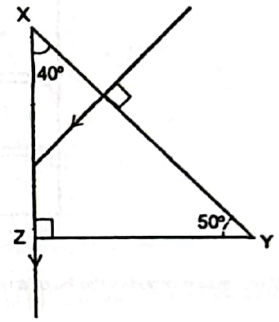
The mirror is tilted through an angle of 50° from the horizontal line.



By which angle does the incident ray deviate from its original path?

A 40° B 50° C 80° D 100°

28 The diagram shows a ray of light entering a glass prism at the surface XY and travelling along the surface XZ.



What is the refractive index of the prism?

A 1.31 B 1.42 C 1.50 D 1.55

29 Four statements about the uses of electromagnetic radiation are given.

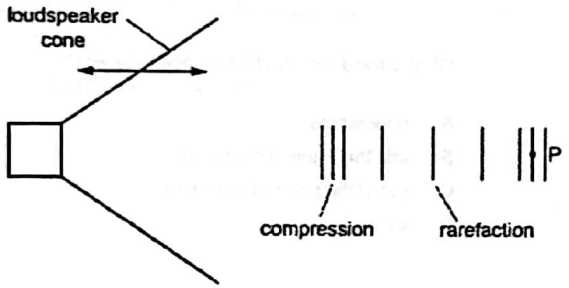
1 Gamma rays are used in medical treatment.
2 Infra-red waves are used in sunbeds.
3 Microwaves are used in satellite TV.
4 X-rays are used in intruder alarms.

How many of the statements are correct?

A 1 B 2 C 3 D 4

30 Compressions and rarefactions are sent out from a loudspeaker cone as it vibrates backwards and forwards.

The frequency of vibration is 50 Hz. A compression is at point P.



How much time does it take for the next rarefaction to arrive at P?

A 0.010 s B 0.020 s C 25 s D 50 s

31 A ship that is stationary on the surface of the sea sends pulses of sound vertically downwards towards the sea bed.

Time taken for each pulse to travel from the ship to the sea bed and back to the ship is 1.0 s. A whale swims under the ship and a pulse is received 0.60 s after it is sent out from the ship.

The speed of sound in sea water is 1500 m / s.

What is the distance of the whale above the sea bed?

A 300 m B 450 m C 600 m D 750 m

32 The diagram shows a positively-charged strip and a negatively-charged strip that are freely suspended.

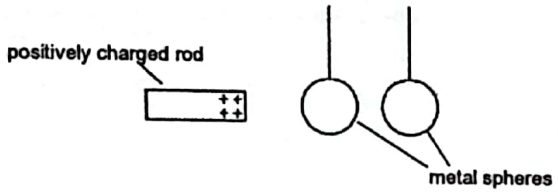
Two rods, X and Y, are brought near these strips one after the other.

Rod X attracts the positive strip but repels the negative strip.
Rod Y does not repel either the positive strip or the negative strip.

Which row describes the charges on X and Y?

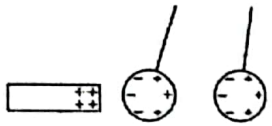
	X	Y
A	negative	positive
B	negative	uncharged
C	positive	negative
D	positive	uncharged

33 Two uncharged metal spheres, not touching one another, are suspended by means of cotton threads. A positively-charged rod is brought near to them as shown.

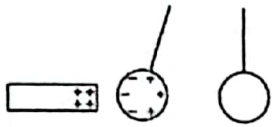


Which diagram shows what happens to the spheres?

A



B



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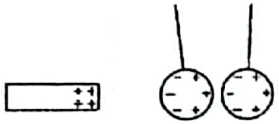

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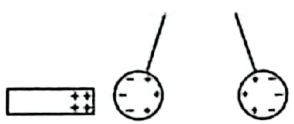
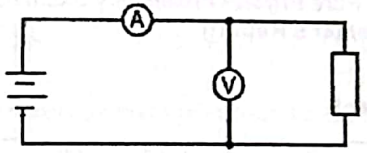


34 A cell is connected to a resistor.

What is the e.m.f. of the cell equal to?

A The potential difference across the resistor for each unit of current.
B The power produced in the circuit for each unit of charge that passes.
C The work done in the circuit for each unit of charge that passes.
D The work done in the circuit for each unit of current.

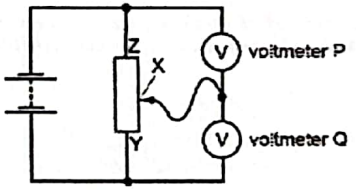
35 The diagram shows an electric circuit.



How will the ammeter and voltmeter readings change when a second resistor is added in parallel to the original resistor in the circuit?

	ammeter	voltmeter
A	decreases	decreases
B	decreases	remains the same
C	increases	decreases
D	increases	remains the same

36 The diagram shows two voltmeters, P and Q, connected to a potential divider.



The sliding connection at point X is moved towards Z.

Which statement describes the changes in readings on P and Q?

A Reading on P and Q decreases.
B Reading on P and Q increases.
C Reading on P decreases whereas reading on Q increases.
D Reading on P increases whereas reading on Q decreases.

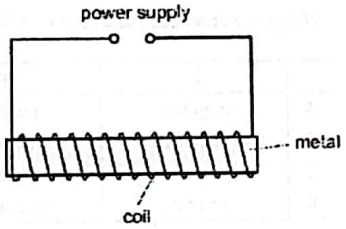
37 The plug of an electric iron contains a 5 A fuse. The normal operating current of the iron is 4 A.

A damaged insulation at the cable of the electric iron causes the live wire to come into contact with the metal casing of the iron. The metal casing is earthed.

Which statement describes what happens when the live wire touches the metal casing?

A The current flows to earth and the fuse is not be affected.
B The fuse melts and breaks the circuit.
C The metal case becomes live and will cause an electric shock when touched.
D The metal case becomes very hot.

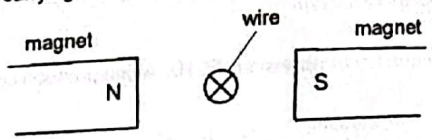
38 The diagram shows an apparatus that can be used to make a magnet.



Which metal and which power supply could be used to make a permanent magnet?

	metal	power supply
A	aluminium	3 V a.c.
B	iron	8 V d.c.
C	steel	10 V a.c.
D	steel	12 V d.c.

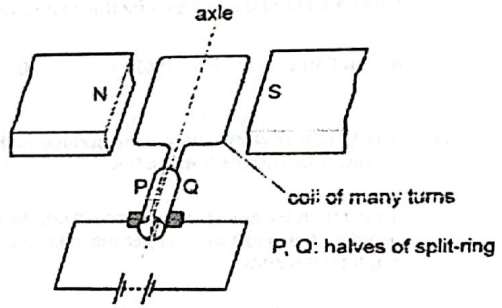
39 A current-carrying wire lies between the poles of two magnets.



What is the direction of the force on the wire?

A downwards
B into the plane of the paper
C out of the plane of the paper
D upwards

40 A d.c. motor consists of a coil of many turns rotating in a fixed magnetic field. The coil is connected to a d.c. supply through a split-ring commutator.



Some changes described below are made to the set-up to make the coil rotate in opposite direction.

1 The d.c. supply is reversed.
2 The coil is turned before switching on, so that P starts on the right and Q on the left.
3 The poles of the magnet are reversed.
4 The turns on the coil are increased in number.

How many of the above changes will make the coil rotate in the opposite direction?

A 1 B 2 C 3 D 4

End of Paper

Jurongville Secondary School
4E Pure Physics Preliminary Examination 2023
[Marker's Report]

Paper 1

1	2	3	4	5	6	7	8	9	10
C	C	B	B	D	C	C	D	A	B

11	12	13	14	15	16	17	18	19	20
A	B	C	C	C	A	D	C	C	B

21	22	23	24	25	26	27	28	29	30
B	C	A	A	C	C	C	D	B	A

31	32	33	34	35	36	37	38	39	40
A	B	A	C	D	C	B	D	A	B