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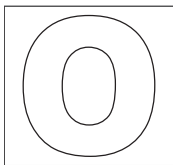
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GAN ENG SENG SCHOOL
Preliminary Examination 2020



**CANDIDATE
NAME**

CLASS

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**INDEX
NUMBER**

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SCIENCE (PHYSICS, CHEMISTRY)
FOUR EXPRESS / FIVE NORMAL ACADEMIC
Paper 1 Multiple Choice

5076/01
15 September 2020
1 hour

Additional Materials: OTAS

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 OTAS in the spaces unless this has been done for you.

There are **forty** questions in 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 OTAS.

Read the instructions on the OTAS 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.

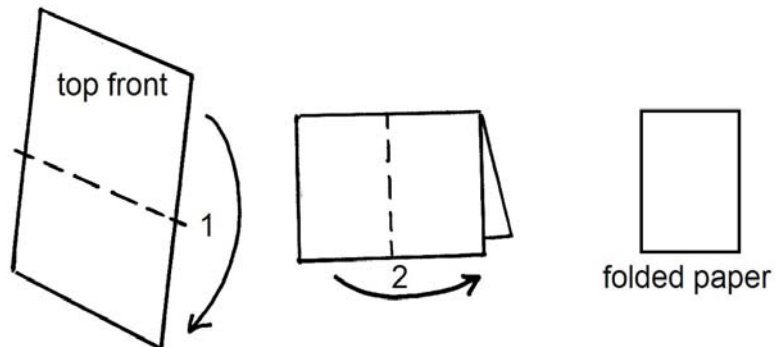
A copy of the Data Sheet is printed on page ??__.

A copy of the Periodic Table is printed on page ??__.

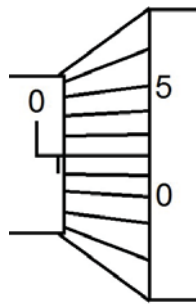
The use of an approved scientific calculator is expected, where appropriate.

Total Marks
40

- 1 A sheet of paper is folded twice as shown in the diagram below.

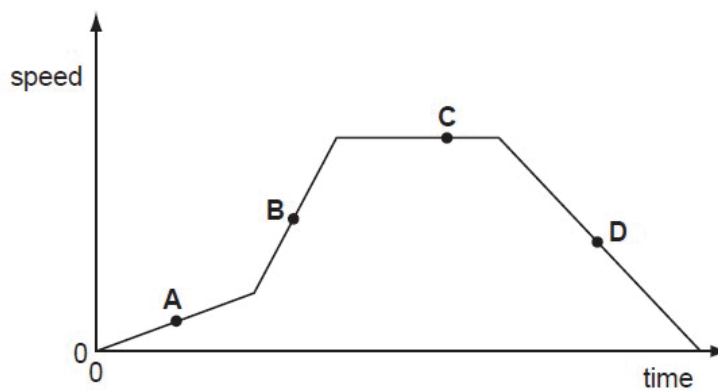


The thickness of the folded paper is measured using a micrometer screw gauge which gives a reading as shown below.



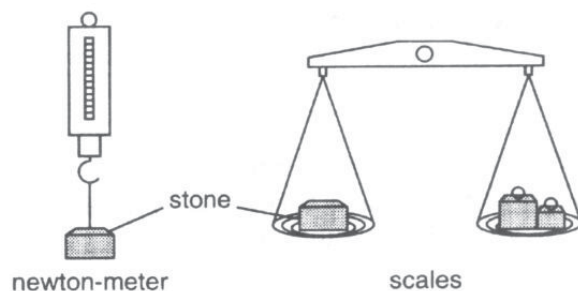
What is the actual thickness of the sheet of paper?

- A 0.02 mm
 - B 0.13 mm
 - C 0.26 mm
 - D 0.52 mm
- 2 The following speed-time graph shows the journey of a train.



At which point is the acceleration of the train the greatest in magnitude?

- 3 A lump of stone is weighed using a newton-meter (spring balance) and a pair of scales. This experiment is repeated on the Moon.

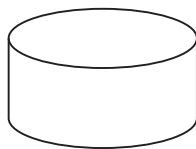


Are the readings for each balance the same or different when taken on Earth and on the Moon?

	Using newton-meter	Using scales
A	different	same
B	different	different
C	same	different
D	same	same

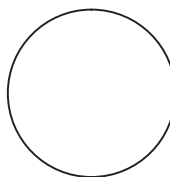
- 4 Which object below has the highest density?

A



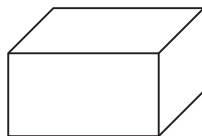
Cylinder
Radius = 6 cm
Height = 5 cm
Mass = 800 g

B



Sphere
Radius = 10 cm
Mass = 5400 g

C



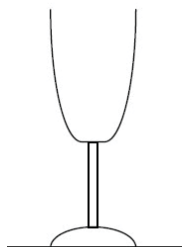
Rectangular
block
L = 8 cm
B = 6 cm
H = 5 cm
Mass = 1200 g

D



Hollow Cylinder
Outer Radius = 15 cm
Inner Radius = 10 cm
Height = 20 cm
Mass = 9000 g

- 5 The diagram shows an empty wine glass placed on a table.

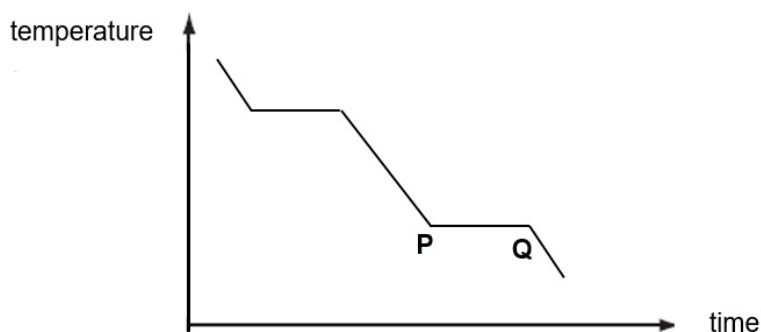


What is the effect on its stability and inertia when it is filled with water?

	stability	inertia
A	increases	increases
B	increases	decreases
C	decreases	decreases
D	decreases	increases

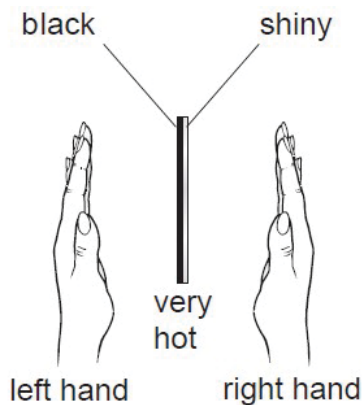
- 6 The four tyres of a truck are inflated to a pressure of 2.0×10^6 Pa. The contact area of each tyre with the ground is 0.02 m^2 . What is the weight of the truck?
- A** 40 000 N
B 80 000 N
C 120 000 N
D 160 000 N
- 7 In solids, thermal energy is transferred by conduction. What is the cause of conduction?
- A** change in density
B emission of infra-red radiation
C expansion of solid
D molecular vibration
- 8 Boiling and evaporation are different processes. Which statement is not correct?
- A** During boiling, bubbles are formed but not during evaporation.
B Evaporation is a slow process but boiling is a fast process.
C Evaporation takes place at the surface of the liquid but boiling takes place throughout the liquid.
D Evaporation only takes place from 0°C to 100°C but boiling takes place only at the boiling point.

- 9 A substance was heated in an enclosed space until it became a gas. After the heater was removed, the temperature of the substance was recorded at regular intervals. The graph shows the temperature plotted against time.



What does the section PQ represents?

- A boiling
 - B condensing
 - C melting
 - D solidifying
- 10 The diagram below shows a thick copper plate that is very hot. One side is black, the other is shiny. A student places her hands the same distance from each side.



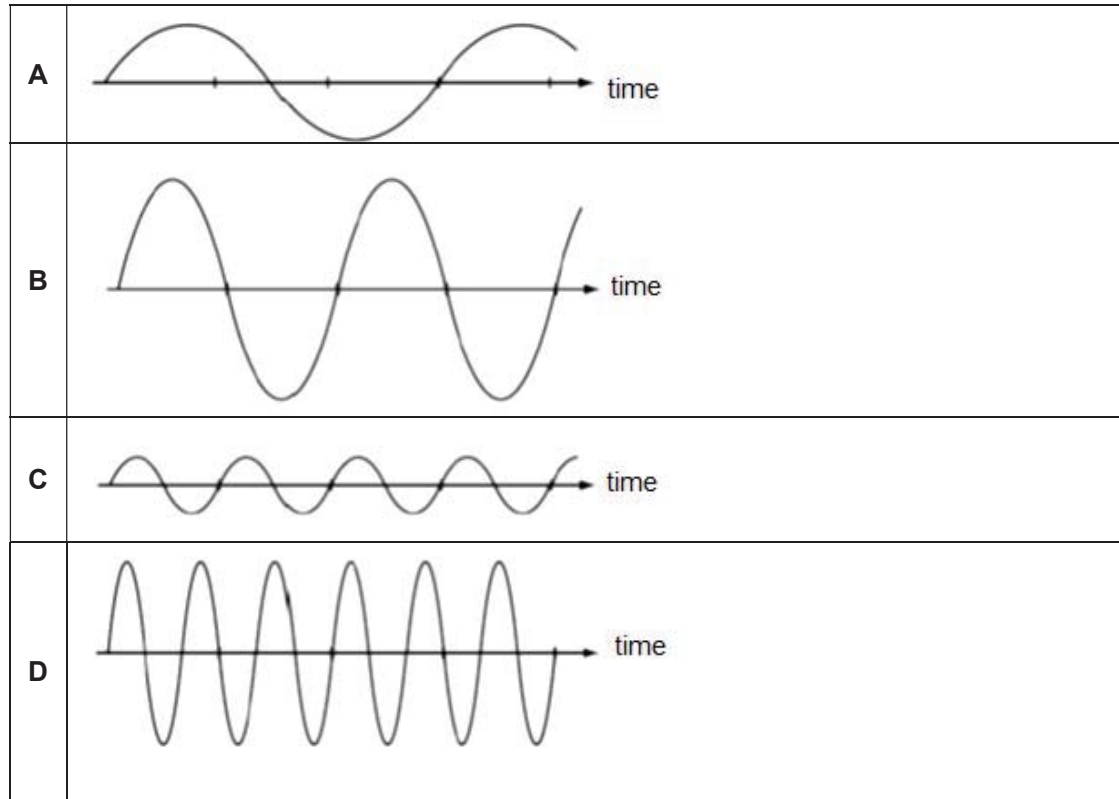
Her left hand feels warmer than her right hand.

Which statement is the correct conclusion from the experiment?

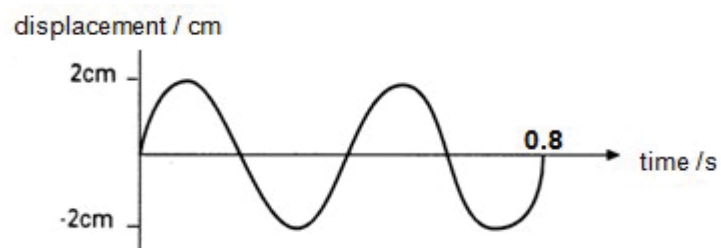
- A The black side reflects more radiant heat than the shiny side.
- B The black side radiates more radiant heat.
- C The shiny side is cooling down faster than the black side.
- D The shiny side radiates more radiant heat.

- 11 The diagrams represent the waves produced by four different sources of sound. The scales are the same for all diagrams.

Which source has the highest frequency?



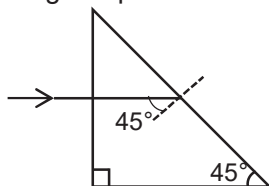
- 12 The figure below shows the displacement-time graph of a particle in a water wave.



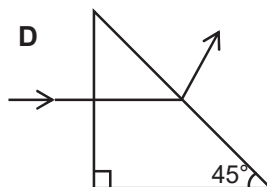
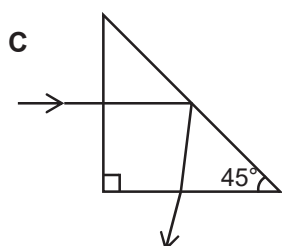
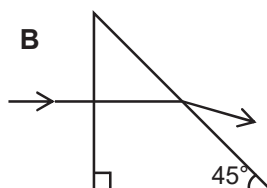
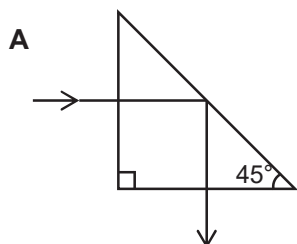
What is the amplitude and frequency of the water wave?

	amplitude (cm)	frequency (Hz)
A	2	1.25
B	2	2.50
C	4	1.25
D	4	2.50

- 13 A ray of light falls on a glass prism as shown. The glass has a critical angle of 42° .



Which of the following diagrams shows the correct path of the ray of light?



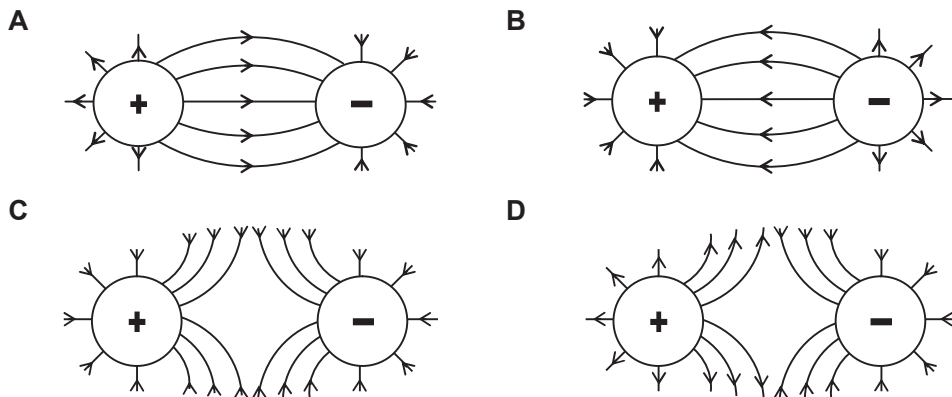
- 14 The following diagram shows part of the different regions of the electromagnetic spectrum.

gamma rays		Y	visible light			radio waves
------------	--	---	---------------	--	--	-------------

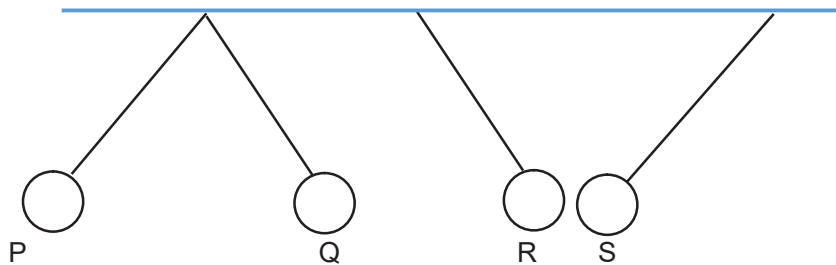
What does region Y represent?

- A** infrared radiation
- B** microwaves
- C** ultraviolet rays
- D** X-rays

15 Which diagram shows the correct electric field pattern between two charged spheres?



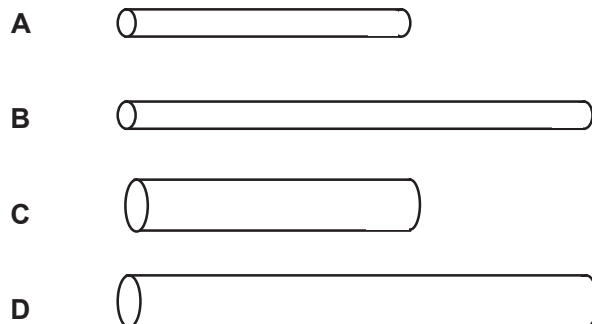
16 The diagram shows charged balls, P, Q, R, S suspended by insulated threads from a ceiling. Q and R have the same charge.



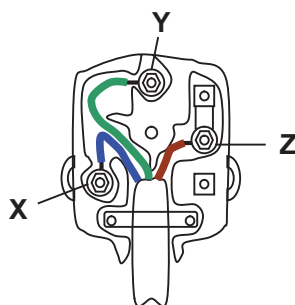
Which of the following is the possible charge on P, Q and S?

	P	Q	S
A	positive	positive	positive
B	positive	negative	positive
C	negative	positive	negative
D	negative	negative	positive

17 The diagram shows four electrical conductors made from the same material. Which conductor has the lowest electrical resistance?



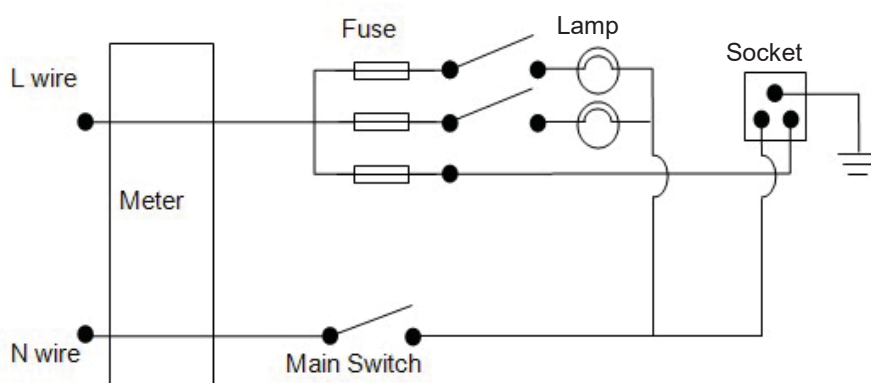
- 18 A person uses a 3 kW electric fire for 2 hours and a 2 kW heater for 4 hours. What is the total cost if the price of electrical energy is 23 cents per unit (kilowatt-hour)?
- A 138 cents
B 1844 cents
C 253 cents
D 322 cents
- 19 The diagram shows a three-pin plug used with a 12 A fuse.



Which row shows the correct values of the current flowing through the terminals X, Y and Z when there is no fault?

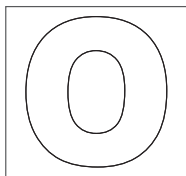
	Current of X / A	Current of Y / A	Current of Z / A
A	10	0	10
B	10	10	10
C	13	0	13
D	13	13	13

- 20 What is the mistake in the household circuit shown below?



- A The main switch should be installed at the live wire.
B The position of the earth wire in the socket is wrong.
C There should be an earth wire connected to the bulbs.
D The neutral and the live wire in the socket should be interchanged.

END OF PAPER



GAN ENG SENG SCHOOL
Preliminary Examination 2020



**CANDIDATE
NAME**

CLASS

**INDEX
NUMBER**

SCIENCE (PHYSICS)
FOUR EXPRESS / FIVE NORMAL ACADEMIC

5076/02
1 September 2020
1 hour 15 minutes

Paper 2

Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all the work you hand in.
You may use an HB pencil for any diagrams, graphs, tables or rough workings.
Write in dark blue or black pen.
Do not use staples, paper clips, glue or correction fluid.

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your working or if you do not use appropriate units.

Section A

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

Section B

Answer any **two** questions.

Write your answers in the spaces provided on the question paper.

At the end of the examination, fasten all work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

For Examiner's Use	
Section A	45
Section B	20
.....	
.....	
Total	65

Section A [45 marks]

For
Examiner's
UseAnswer **all** the questions in the spaces provided.

- 1 Fig.1.1 shows a catapult used to project an object. Force F pulls back the object, creating a tension in the rubber cords.

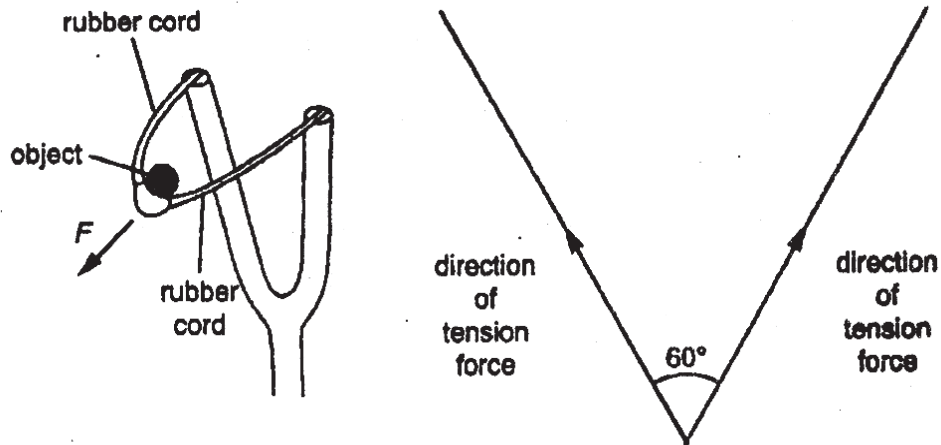


Fig. 1.1

The tension force in each rubber cord is 20 N and the two cords are 60° to each other as shown in Fig. 1.1. By making a scale drawing of 1 cm : 4 N, find the resultant of these two tension forces acting on the object. Indicate the direction of the resultant force.

resultant force =N [3]

- 2 When a car driver sees an emergency ahead while driving on a level road, he applies the brakes. During his reaction time the car travels at a steady speed and covers a certain distance. The braking distance is the distance travelled by the car after the brakes are applied.

Fig. 2.1 shows the speed-time graph of the car. The combined mass of the car and the driver is 850 kg.

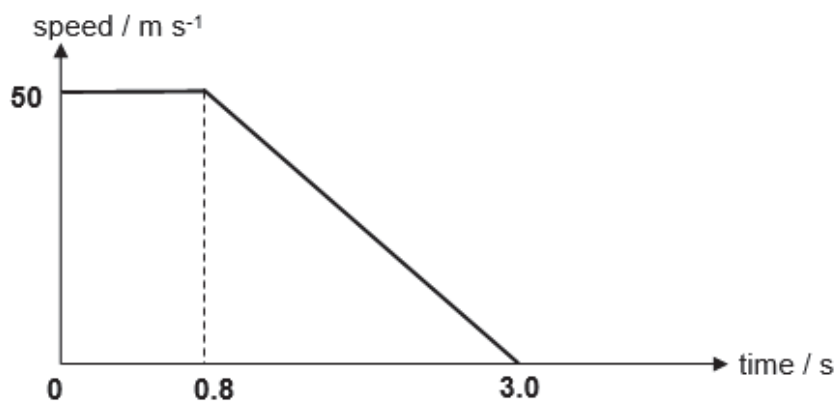


Fig. 2.1

- (a) State the resultant force acting on the car during the driver's reaction time.

resultant force = [1]

- (b) Find the braking distance.

braking distance = [1]

- (c) Find the deceleration of the car during braking.

deceleration = [2]

- (d) Hence, calculate the magnitude of the resultant force acting on the car during braking.

resultant force = [1]

- 3** A car of weight 10 kN is travelling at a constant velocity. The forces acting on the car are shown in Fig. 3.1. The total upward force on both front wheels is L while the total upward force on both back wheels is 4 kN.

For
Examiner's
Use

M is the force of air on the moving car. The driving force acting on the engine of the car is 5 kN.

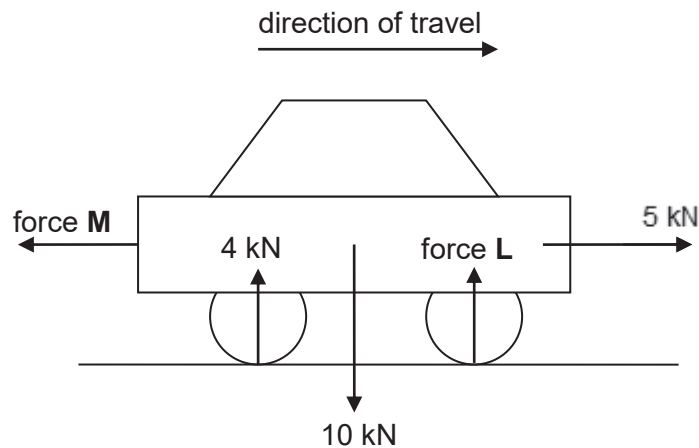


Fig. 3.1

- (a)** Calculate forces L and M.

force L = kN [1]

force M = kN [1]

- (b)** A strong gust of wind suddenly blows in the opposite direction of the motion of the vehicle and force M is doubled. Calculate the acceleration of the car in this instant.

acceleration = m/s^2 [3]

- 4 Fig. 4.1 shows the movement of a typical gas molecule.

For
Examiner's
Use

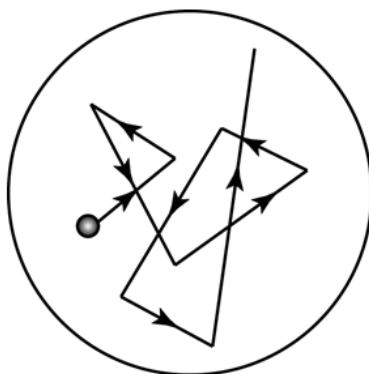


Fig. 4.1

- (a) Describe the difference between liquid and gas in terms of the movement of the molecules.

.....
.....
..... [2]

- (b) Explain in terms of the forces on the molecules, why gases do not have fixed volume and shape.

.....
.....
.....
..... [2]

- 5 Fig. 5.1 shows the structure of a solar water heating system that uses liquid as a heating fluid. The fluid is a mixture of water and propylene glycol.

For
Examiner's
Use

Water in copper pipes is heated by solar radiation. The hot water in the copper pipes is then used to heat cold water in a tank.

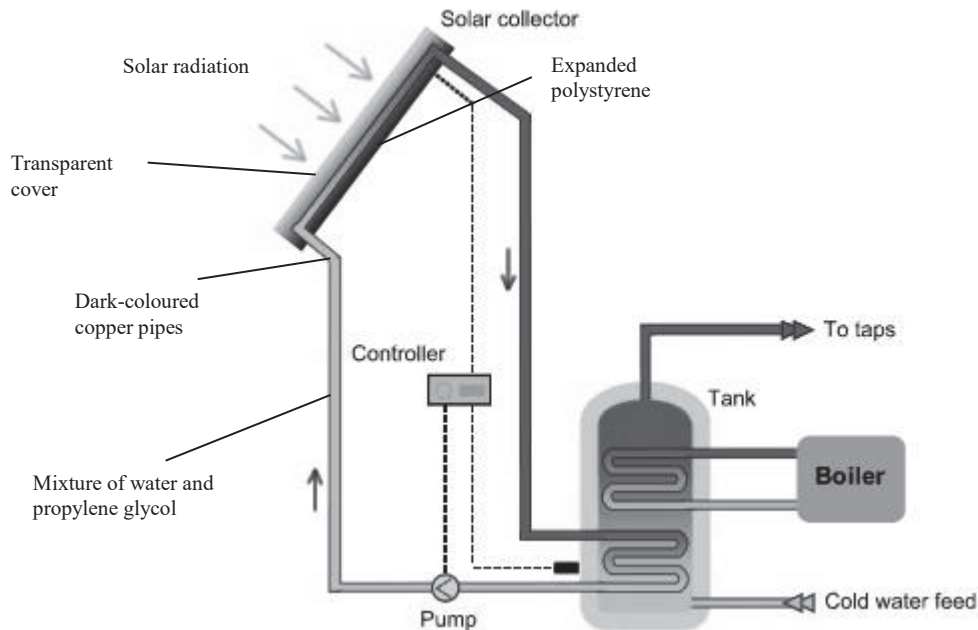


Fig. 5.1

(a) Explain the purpose of the

- (i) expanded polystyrene backing board.

.....
..... [1]

- (ii) dark-coloured copper pipes.

.....
.....
.....
..... [2]

- 5 (b)** Describe, in molecular level, how solar energy is transferred to the fluid through the copper pipes in the solar water heating system.

.....
.....
.....
..... [2]

- (c)** Explain why the cold water feed is at the bottom of the water tank while the hot water tap is at the top of the water tank.

.....
.....
.....
..... [2]

- (d)** The fluid used in the solar water heating system, which is a mixture of water and propylene glycol, has a lower freezing point than pure water. Suggest a reason why a fluid with low freezing point is important.

.....
..... [1]

- 6 Fig. 6.1 shows the speed of light in different materials.

material	air or vacuum	Bishan Park pond water	glass
speed of light / m s^{-1}	3.0×10^8	2.4×10^8	1.9×10^8

Fig. 6.1

- (a) Calculate the refractive index of glass.

refractive index = [2]

- (b) Show by calculation that the critical angle of the water in Bishan Park pond is 53.1° . [1]

For
Examiner's
Use

- 6 (c) A ray of light travels in Bishan Park pond water towards the water surface. Fig. 6.2 shows that the angle between the incident ray and the water surface is 60° .

For
Examiner's
Use

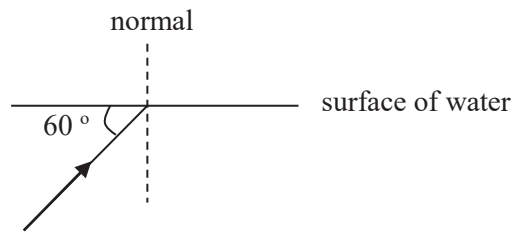


Fig. 6.2

Calculate the angle of refraction.

angle of refraction = [2]

- (d) Another ray of light travels in Bishan Park pond water towards the water surface. The angle between the incident ray and the water surface is 36° .

State and explain what happens to this ray of light after striking the water surface.

.....

 [2]

- 7 Fig. 7.1 shows the diagram of a speaker.

For
Examiner's
Use



Fig. 7.1

The lowest frequency that a human can hear is 20 Hz and the highest frequency that a human with normal hearing can hear is 20 kHz.

- (a) Explain what is meant by frequency is 20 Hz.

..... [1]

- (b) Given that the speed of sound in air is 340 m/s, calculate the shortest wavelength of sound that a human can hear.

wavelength = [2]

- 8 Fig. 8.1 shows 3 resistors connected to a 12 V battery.

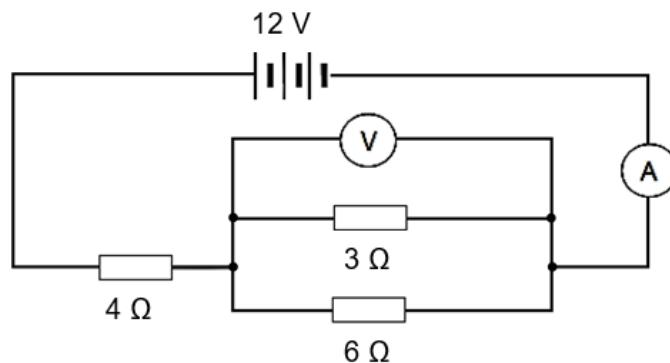


Fig. 8.1

- (a) Calculate the effective resistance of the 3 resistors.

resistance = [2]

- (b) Calculate the reading on the ammeter.

reading on ammeter = [1]

- (c) The circuit was switched on for 2 minutes. Calculate the total amount of charge that flowed through the ammeter.

total amount of charge = [1]

- (d) Calculate the reading on the voltmeter.

reading on voltmeter = [1]

- 9** An electric kettle designed to be operated from a 240 V supply has a power rating of 1680 W.

*For
Examiner's
Use*

- (a)** Calculate the magnitude of the current when the kettle is being used.

current = [2]

- (b)** Suggest a suitable rating for a fuse to be used with this kettle from the following available fuses: 5 A, 10 A and 13 A.

..... [1]

- (c)** In the normal operation of the electric kettle, write down the magnitude of the voltage in

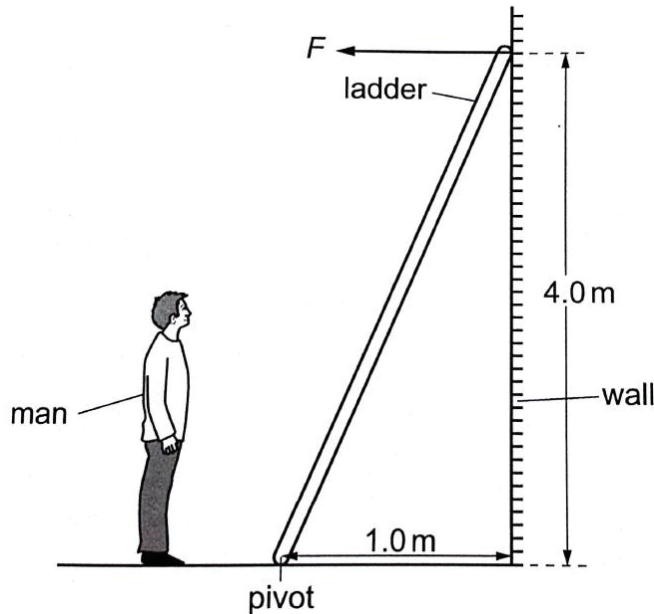
(i) the live wire, V, and [1]

(ii) the earth wire. V [1]

Section B [20 marks]For
Examiner's
UseAnswer any **two** questions in this section.

Write your answers in the spaces provided.

- 10** Fig. 10.1 shows a uniform ladder leaning against a wall. The bottom of the ladder is 1.0 m away from the wall. The top of the ladder is 4.0 m above the ground.

**Fig. 10.1**

The weight of the ladder is 110 N.

- (a)** On Fig. 10.1, draw the line of action of the weight of the ladder and determine the perpendicular distance between the line of action of the weight and the pivot.

distance = [2]

- 10 (b)** Calculate the force, F , exerted by the wall on the ladder.

force, $F = \dots\dots\dots$ [3]

- (c)** A man steps onto the ladder and slowly climbs to the top.

Suggest and explain how force F changes as the man climbs up the ladder.

.....

 [2]

- (d)** On Fig. 10.1, draw an arrow showing the direction and the line of action for these frictional forces on the ladder. [2]

Suggest how this force may be increased to make the ladder safer to use.

.....
 [1]

- 11 (a) A simple pendulum is made by hanging a metal ball of mass 250 g from a point O, as shown in Fig. 11.1.

For
Examiner's
Use

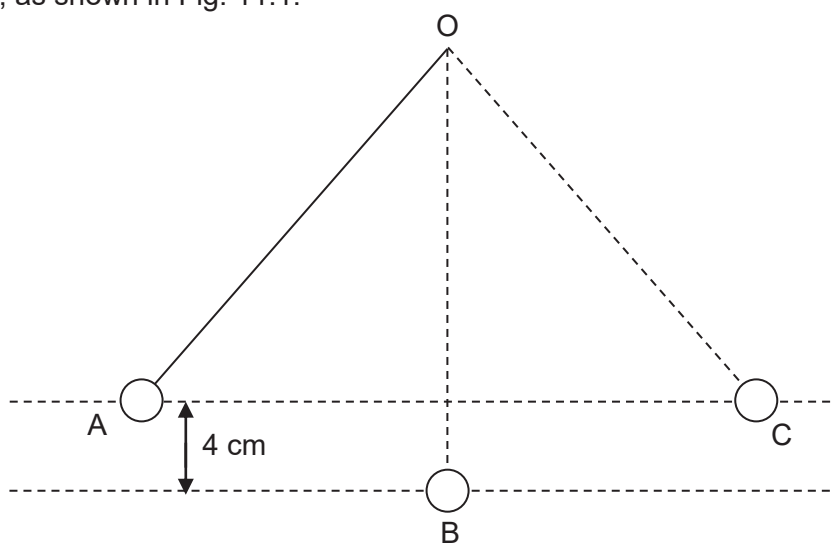


Fig. 11.1

The highest positions reached by the pendulum bob are A and C, which are 4 cm above B. At which position(s) A, B or C would the bob have

- (i) maximum potential energy, and

..... [1]

- (ii) maximum kinetic energy?

..... [1]

- (b) Calculate the gain in gravitational potential energy as the ball moves from B to C.

gain in gravitational potential energy = [2]

- 11 (c) Calculate the maximum speed of the pendulum bob.

maximum speed = [2]

- (d) If the pendulum bob takes 0.4 s to move from A to B, determine the period of the pendulum.

period = [1]

- (e) An escalator is used to move 20 passengers every minute from the first floor of a department store to the second. The second floor is located 5 metres above the first floor. The average passenger's mass is 60 kg. Determine the power requirement of the escalator in order to move this number of passengers in this amount of time.

power = [3]

- 12 Fig. 12.1 shows the scaled diagram of an object O and its image, I formed by a thin converging lens.

For
Examiner's
Use



Fig. 12.1

- (a) (i) Complete the ray diagram on Fig. 12.1 to show the position of the lens and principal focus. [2]
- (ii) Label the optical centre, C, on Fig. 12.1. [1]
- (iii) Indicate the position of the principal focus, F, on Fig. 12.1. [1]
- (b) Object O is now shifted towards the lens until it is 1.5 times of its focal length away from the lens ($u = 1.5 f$), state one difference and one similarity to the image formed in Fig. 12.1.

Difference:

.....

Similarity:

..... [2]

- 12 (c) A converging lens can also be used by a watchmaker as a magnifying glass to observe a mechanical part of a watch as shown in Fig. 12.2.

For
Examiner's
Use

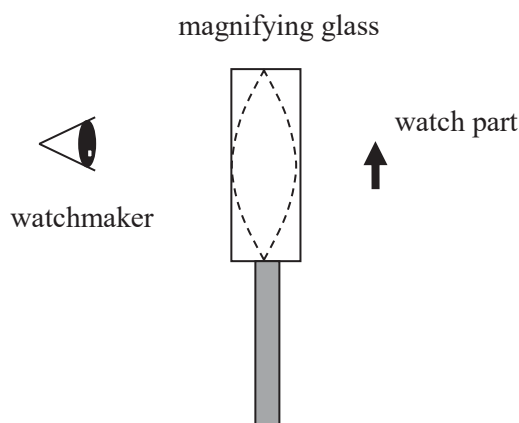


Fig. 12.2

Fig. 12.3 shows an incomplete ray diagram of the magnifying glass.

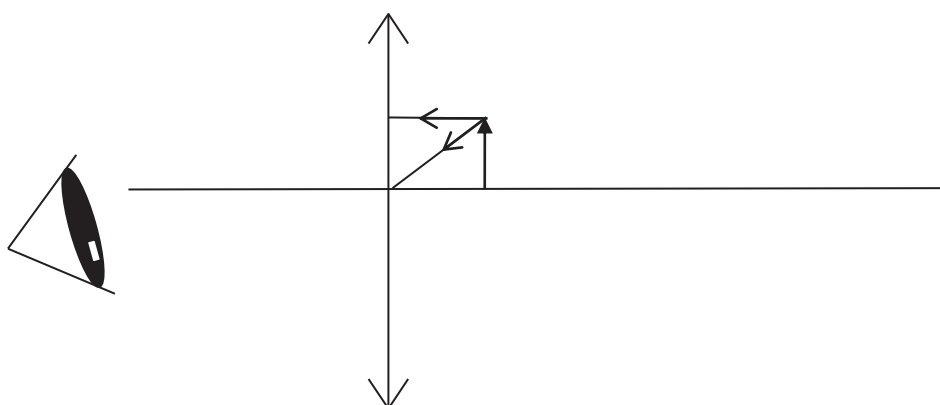


Fig. 12.3

- (i) Indicate on Fig 12.3 a possible focal point on each side of the lens. Label each point as F. [1]
- (ii) Complete the ray diagram in Fig. 12.3 to show how the magnified image of the watch part is seen by the watchmaker. Label the image as I. [1]
- (iii) The image of the watch part is magnified. State two other characteristics of the image.

.....

..... [2]

END OF PAPER

