

*Visit*  
**FREETESTPAPER.com**  
*for more papers*



Website: [freetestpaper.com](http://freetestpaper.com)



[Facebook.com/freetestpaper](https://www.facebook.com/freetestpaper)



[Twitter.com/freetestpaper](https://www.twitter.com/freetestpaper)



# DAMAI SECONDARY SCHOOL

## Preliminary Examination 2020

CANDIDATE NAME

CLASS

|  |  |  |
|--|--|--|
|  |  |  |
|--|--|--|

INDEX NUMBER

|  |  |
|--|--|
|  |  |
|--|--|

---

**SCIENCE (PHYSICS)**

**5076/01**

Paper 1

**18 September 2020**

Secondary 4 Express / 5 Normal (Academic)

**30 min**

Setter:

**20 Marks**

Additional Materials: Answer Sheet

---

**READ THESE INSTRUCTIONS FIRST**

Write your name, index number and class on the Answer Sheet Provided using a 2B-pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

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

There are **twenty** questions in this booklet. 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 **2B-pencil** on the Answer Sheet.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

---

This document consists of **11** printed pages including the cover page.

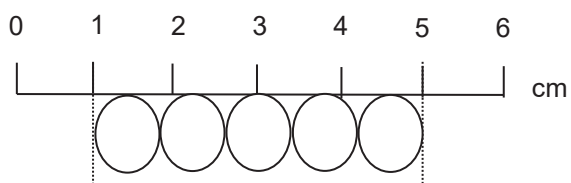
**[Turn over**

## 2

- 1 What is the correct order of magnitude for the diameter of an atom and for the diameter of the Earth?

|          | diameter of atom  | diameter of earth |
|----------|-------------------|-------------------|
| <b>A</b> | 0.1 nm            | 10 Mm             |
| <b>B</b> | 0.1 nm            | 10 Gm             |
| <b>C</b> | 0.1 $\mu\text{m}$ | 10 Mm             |
| <b>D</b> | 0.1 $\mu\text{m}$ | 10 Gm             |

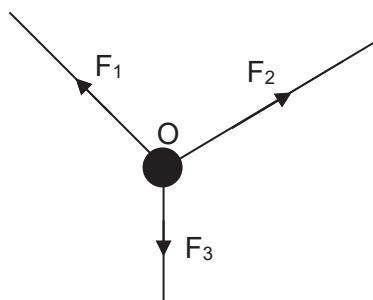
- 2 A student attempts to measure the radius of a steel ball by using a metre rule to measure five identical steel balls placed in a row as shown below.



What is the radius of a steel ball?

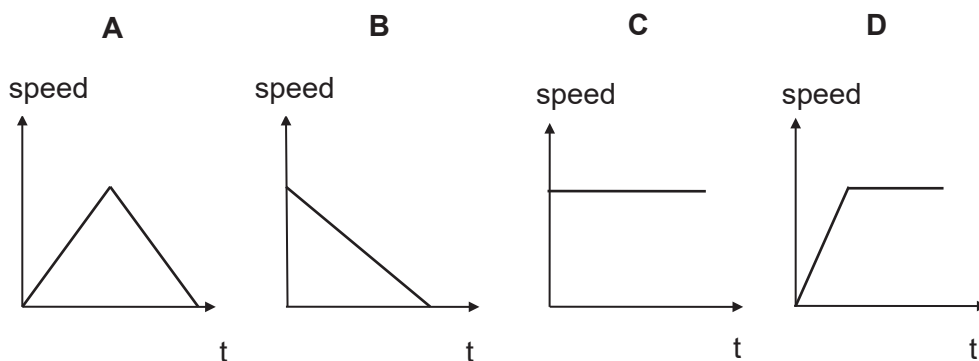
- A** 0.4 cm
- B** 0.5 cm
- C** 0.8 cm
- D** 1.0 cm

- 3 An object O is placed at rest on the surface of a level table. Three horizontal forces  $F_1$ ,  $F_2$  and  $F_3$  act simultaneously on the object O, which is in equilibrium.



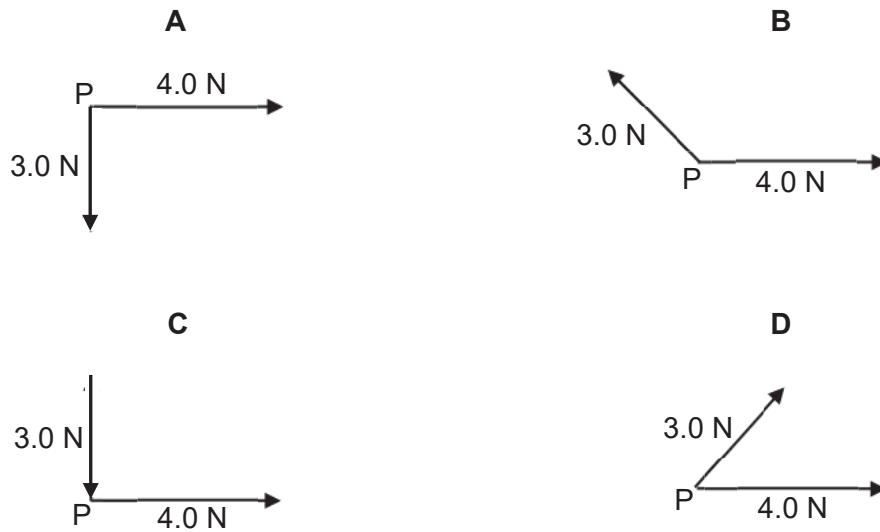
Which statement about object O is **incorrect**?

- A Object O will not accelerate.
  - B The resultant force that acts on object O is zero.
  - C If object O is heavier, the values of  $F_1$ ,  $F_2$  and  $F_3$  will change.
  - D Removing  $F_1$  and  $F_2$  will cause object O to move in the direction of  $F_3$ .
- 4 Which of the following speed-time graphs correctly represents an elastic rubber ball being dropped from the hand and bouncing up from the floor?

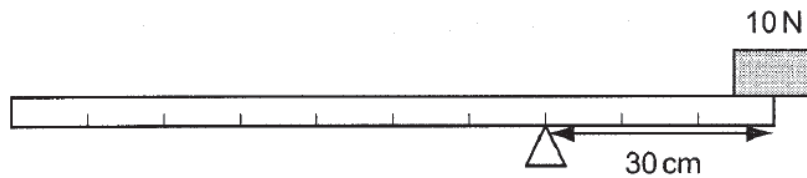


- 5 A 3.0 N force and a 4.0 N force act concurrently on an object at point P.

Which of the following diagrams shows the greatest resultant force acting on point P?



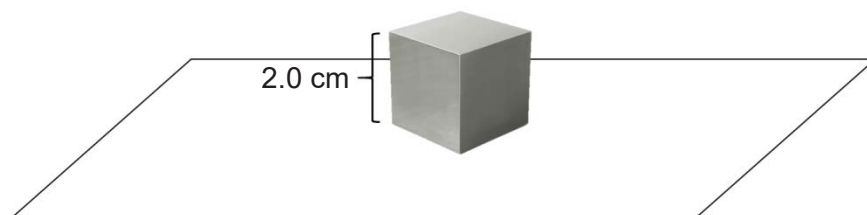
- 6 A uniform bar of length 1.0 m is supported 30 cm from one end. In order to balance the bar, a weight of 10 N is glued on its end as shown.



What is the weight of the bar?

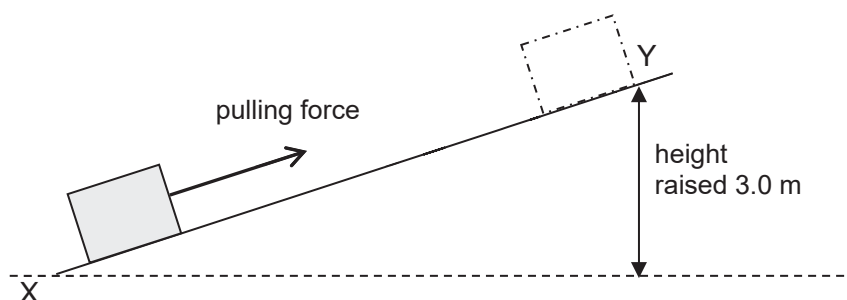
- A 4.3 N
- B 6 N
- C 15 N
- D 20 N

- 7 A cube of side 2.0 cm is placed on a table. The cube weighs 4.0 N.



What is the pressure the cube exerts on the table?

- A** 0.50 Pa  
**B** 1.0 Pa  
**C** 10 000 Pa  
**D** 500 000 Pa
- 8 The diagram shows a box of mass 20 kg being pulled up a slope from X to Y at a constant speed.



The work done by the pulling force from X to Y is 1000 J.

Take the gravitational field strength,  $g$  as 10 N/kg.

What is the work done against friction, if any, when the box moved from X to Y?

- A** 0 J  
**B** 400 J  
**C** 600 J  
**D** 1000 J

- 9 A small electric motor of power rating 3.0 W is connected to a battery which can deliver 3600 J of energy before the battery is exhausted.

How long can the motor operate?

- A 20 minutes
- B 180 minutes
- C 200 minutes
- D 10800 minutes

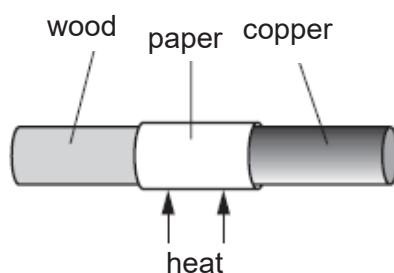
- 10 A substance consists of particles that are close together and are moving randomly past each other. The average speed of the particles is gradually decreasing.

Which of the following statements best describes this substance?

- A A liquid being heated.
- B A liquid being cooled.
- C A solid being melted.
- D A gas being cooled.

- 11 A bar made of half wood and half copper has a piece of paper wrapped tightly round it at its centre as shown.

The bar is heated strongly at the centre for a short time, and the paper turns brown at only one end.



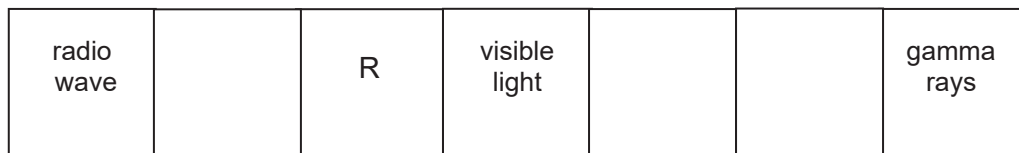
Which end of the paper turns brown, and what does this show about wood and copper?

|   | end that turns brown is nearer to | good insulator of heat | good conductor of heat |
|---|-----------------------------------|------------------------|------------------------|
| A | copper                            | copper                 | wood                   |
| B | copper                            | wood                   | copper                 |
| C | wood                              | copper                 | wood                   |
| D | wood                              | wood                   | copper                 |

- 12** A vibrating source emits waves of wavelength 0.20 m.

How long does it take for the waves to travel 2400 m if the vibration frequency is 1.0 kHz?

- A** 2.4 s  
**B** 6.0 s  
**C** 12 s  
**D** 24 s
- 13** The diagram shows the different waves of the electromagnetic spectrum in order of increasing frequency. Some of the waves are labelled.



—————→ increasing frequency

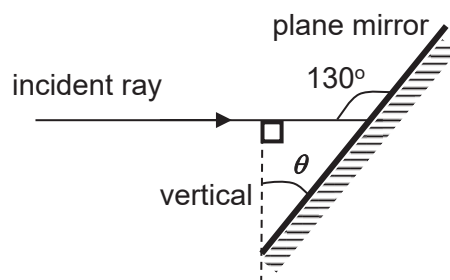
Wave R has a frequency just below that of visible light.

Which application uses wave R?

- A** mobile phone  
**B** satellite television  
**C** sterilisation of equipment  
**D** television remote control



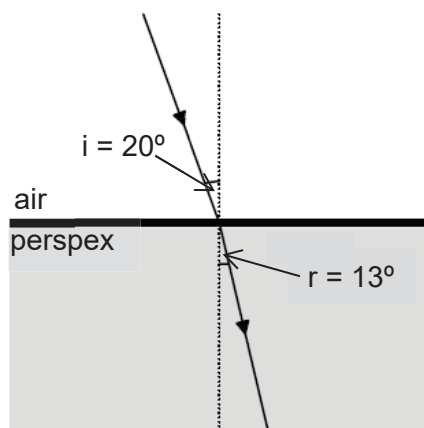
- 14** A plane mirror is tilted at an angle of  $\theta$  to the vertical. When an incident ray of light strikes the mirror, it makes an angle of  $130^\circ$  to the surface of the mirror as shown below.



Find the angle of reflection and the angle  $\theta$ .

|          | angle of reflection / $^\circ$ | angle $\theta$ / $^\circ$ |
|----------|--------------------------------|---------------------------|
| <b>A</b> | 40                             | 40                        |
| <b>B</b> | 40                             | 50                        |
| <b>C</b> | 50                             | 40                        |
| <b>D</b> | 65                             | 50                        |

- 15** The diagram shows a light ray entering a Perspex block.



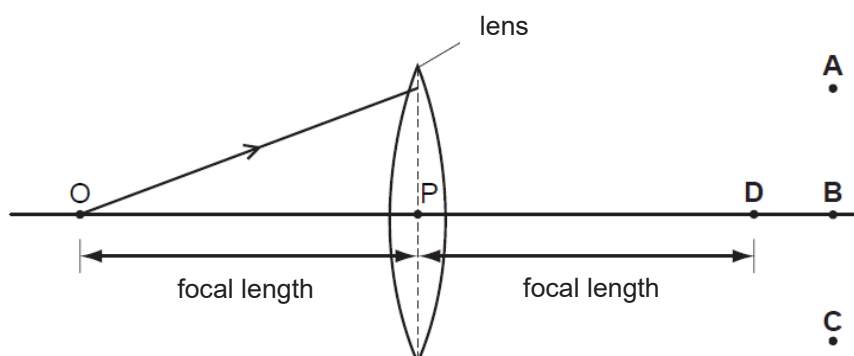
Assume light travels at  $3.0 \times 10^8$  m/s in air.

What is the speed of light in the Perspex block?

- A**  $1.95 \times 10^8$  m/s
- B**  $1.97 \times 10^8$  m/s
- C**  $4.56 \times 10^8$  m/s
- D**  $4.62 \times 10^8$  m/s

- 16** In the diagram, the distance OP is the focal length of the lens.

After refraction by the lens, through which point will the ray pass?

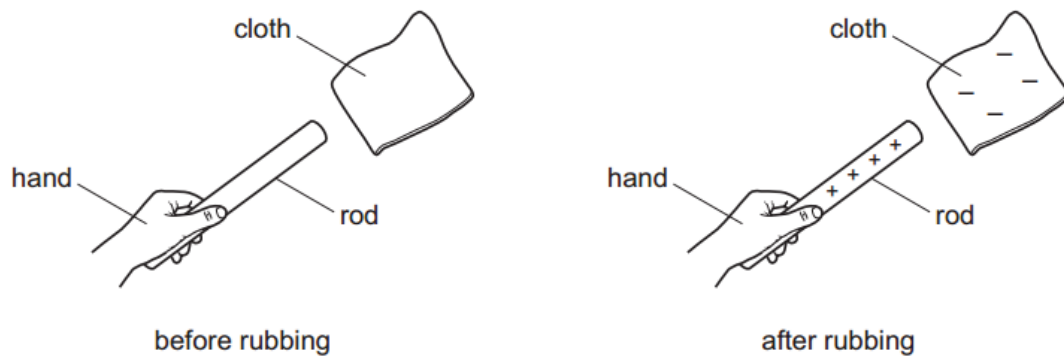


- 17** In a car test drive, a car horn is found to be too loud and the pitch is too high.

Which row correctly describes the amplitude and the frequency of the sound wave produced?

|          | amplitude | frequency |
|----------|-----------|-----------|
| <b>A</b> | too large | too high  |
| <b>B</b> | too large | too low   |
| <b>C</b> | too small | too high  |
| <b>D</b> | too small | too low   |

- 18** A student holds a rod in her hand. She rubs the rod with a cloth. The rod becomes positively charged, and the cloth becomes negatively charged.



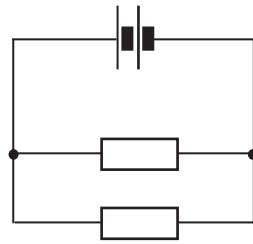
Which statement explains why the rod becomes positively charged?

- A** The negative charges from the cloth are transferred to the rod.
  - B** The negative charges from the rod are transferred to the cloth.
  - C** The positive charges from the cloth are transferred to the rod.
  - D** The positive charges from the rod are transferred to the cloth.
- 19** A 12 V rechargeable battery is charged for 20 minutes by connecting it to a power source. The battery is supplied with  $7.2 \times 10^4$  J of energy during this time.

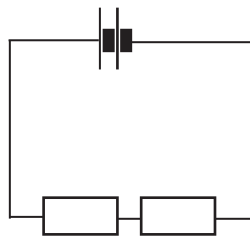
How much charge flows through the battery?

- A** 5.0 C
- B** 30 C
- C** 6000 C
- D** 864 000 C

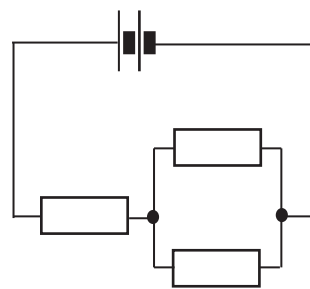
- 20** In the circuits below, the cells each have the same voltage. All the resistors have the same resistance.



circuit X



circuit Y



circuit Z

Which of the following shows the current through the cells in order of increasing magnitude?

|          | lowest current $\longrightarrow$ highest current |   |   |
|----------|--------------------------------------------------|---|---|
| <b>A</b> | X                                                | Y | Z |
| <b>B</b> | Y                                                | X | Z |
| <b>C</b> | Y                                                | Z | X |
| <b>D</b> | Z                                                | X | Y |

**END OF PAPER**



# DAMAI SECONDARY SCHOOL

## Preliminary Examination 2020

CANDIDATE NAME

|  |
|--|
|  |
|--|

CLASS

|  |  |  |
|--|--|--|
|  |  |  |
|--|--|--|

INDEX NUMBER

|  |  |
|--|--|
|  |  |
|--|--|

---

**SCIENCE (PHYSICS)**

**5076/02**

Paper 2

**3 September 2020**

Secondary 4 Express / 5 Normal (Academic)

**1 hour 15 minutes**

Setter:

**65 Marks**

Additional Materials: Nil

---

**READ THESE INSTRUCTIONS FIRST**

Write your name, index number and class on all the work you hand in.

Write in dark blue or black pen.

You may use a soft pencil for any diagram, graphs or rough working.

Do not use staples, paper clips, highlighters, 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.

| For examiner's use |    |
|--------------------|----|
| Section A          | 45 |
| Section B          | 20 |

---

This document consists of **17** printed pages including the cover page

**[Turn over**

## Section A (45 marks)

Answer **all** the questions in the spaces provided.

- 1 In Fig. 1.1, a block of wood of 5.3 kg is pulled along a rough horizontal ground from rest. When a force of 20 N is applied, it produces a uniform acceleration of  $2.0 \text{ m/s}^2$ . Assume that air resistance is negligible.

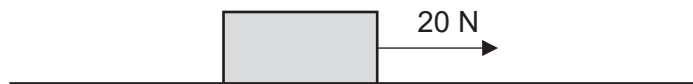


Fig. 1.1

- (a) On Fig. 1.1, draw and label all the forces acting on the block of wood. [1]
- (b) Calculate the magnitude of the frictional force.

frictional force = ..... N [2]

- (c) Determine its velocity after 3.5 s.

velocity = ..... m/s [2]

- (d) After the first 3.5 s, the block undergoes decreasing deceleration for 4.5 s before reaching a complete stop.

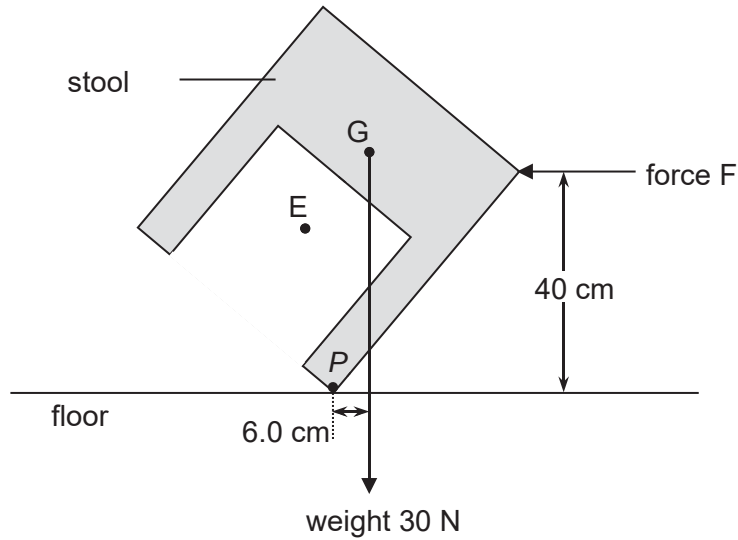
On the axes of Fig. 1.2, sketch the speed-time graph of the block for the whole journey, indicating any values on the axes where necessary.



Fig. 1.2

[2]

- 2 Fig. 2.1 shows a stool that is kept balanced by a horizontal force  $F$ .  $G$  is the centre of gravity of the stool and the weight of the stool is 30 N.



**Fig. 2.1**

- (a) With reference to the principle of moments, explain how the stool is able to balance.

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

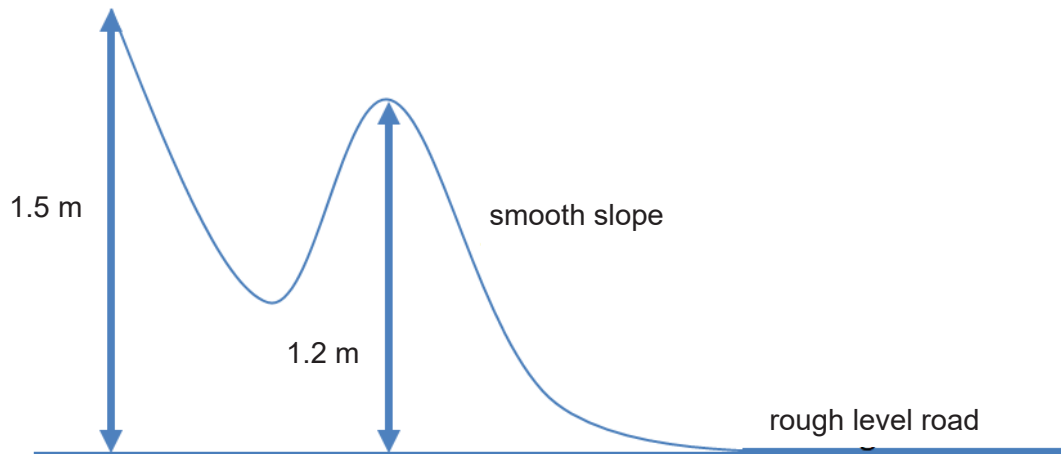
- (b) Using the distances marked in Fig. 2.1, calculate the value of force  $F$ .

$F = \dots\dots\dots$  N [2]

- (c) State a reason why a stool is more stable with centre of gravity at  $E$  rather than at  $G$ .

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

- 3 Originally at rest, a 600 g toy car rolls down a smooth slope from a height of 1.5 m, as shown in Fig. 3.1.



**Fig. 3.1**

- (a) Calculate the loss in gravitational potential energy of the car when it is at the height of 1.2 m. Take gravitational field strength as 10 N/kg.

loss in gravitational potential energy = ..... J [2]

- (b) Calculate the speed of the toy car when it just arrives at the bottom of the slope.

speed = ..... m/s [2]

- (c) Assuming the average frictional force on the rough level road is 2.5 N, determine the distance travelled by the toy car along the rough road before it comes to a complete stop.

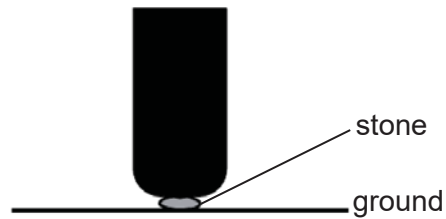
distance = ..... m [2]



- 4 Fig. 4.1 shows the front view of a section of a very old bicycle tyre that is made of solid rubber.



**Fig. 4.1**



**Fig. 4.2**

The solid rubber tyre exerts a pressure on the ground.

- (a) The mass of the bicycle and rider is 60 kg and the total area of the tyres in contact with the road is  $2.4 \times 10^{-3} \text{ m}^2$ . The gravitational field strength is 10 N/kg.

Calculate the pressure exerted by the bicycle on the road.

pressure = ..... Pa [2]

- (b) One of the solid rubber tyres goes over a small stone, as shown in Fig. 4.2.

State and explain how the pressure acting on the tyre changes as it moves from ground to over the stone.

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

- 5 Sarah sits in front of a plane mirror at a position S, while Domini sits at a position D, a distance away, as shown in Fig. 5.1.

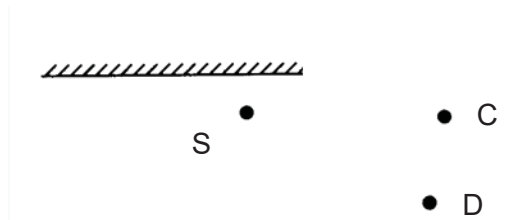


Fig. 5.1

- (a) (i) Mark and label D', the position of Domini's image as seen by Sarah in the mirror.

[1]

- (ii) On Fig.5.1, draw a suitable ray diagram to show how Sarah see Domini through the reflection from the mirror.

[2]

- (b) Another student Carl, C, is seated in front of Domini.

Will Sarah be able to see Carl's image in the mirror? Explain your answer.

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

- 6 Fig. 6.1 shows the components of the electromagnetic spectrum.

|            |        |   |               |   |             |             |
|------------|--------|---|---------------|---|-------------|-------------|
| gamma rays | X-rays | Y | visible light | Z | micro-waves | radio waves |
|------------|--------|---|---------------|---|-------------|-------------|

Fig. 6.1

- (a) Name the components labelled Y and Z in the spectrum.

Y: .....[1]

Z: .....[1]

- (b) State which component of the electromagnetic spectrum

(i) is used for satellite television : .....[1]

(ii) has the shortest wavelength : .....[1]

- 7 Naomi performs an experiment with a semi-circular glass block and a ray of red light. Fig. 7.1 shows the path taken by this ray of light as it enters the block at P until it hits the straight edge at Q. Q is the centre of the semi circular block. The block has a refractive index of 1.50.

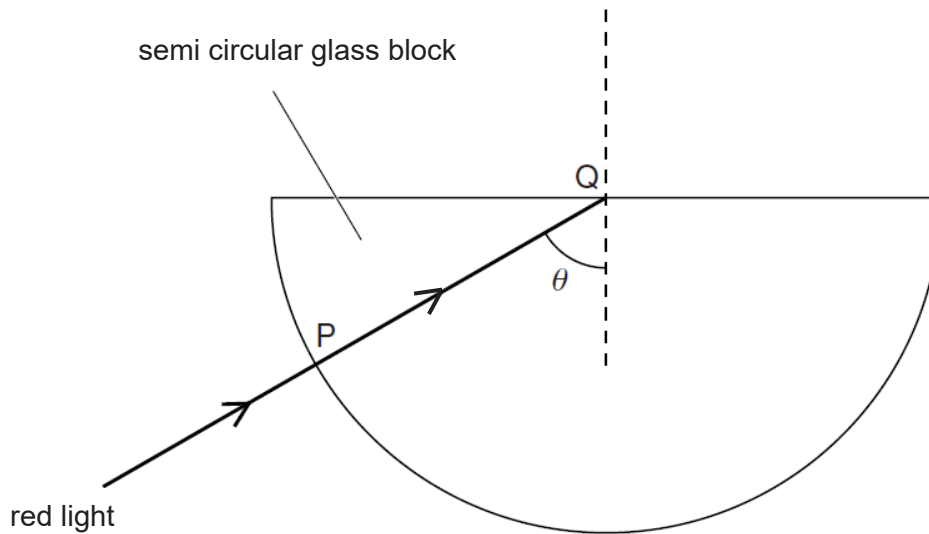


Fig. 7.1

Naomi finds that there is no change in direction as the ray enters the glass block at P. Angle  $\theta$  is  $47^\circ$ .

- (a) Explain why the ray of light does not change direction at P.

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

- (b) Calculate the critical angle of the semi-circular glass block.

critical angle = .....  $^\circ$  [2]

- (c) On Fig. 7.1, draw the path of the ray of red light after it strikes point Q. [1]

- (d) Explain your answer to (c).

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

- (e) Naomi directs the ray of red light into the glass along different paths, so that the angle  $\theta$  is slowly reduced from  $47^\circ$  to  $30^\circ$ .

Describe the changes to the path of light after it hits Q.

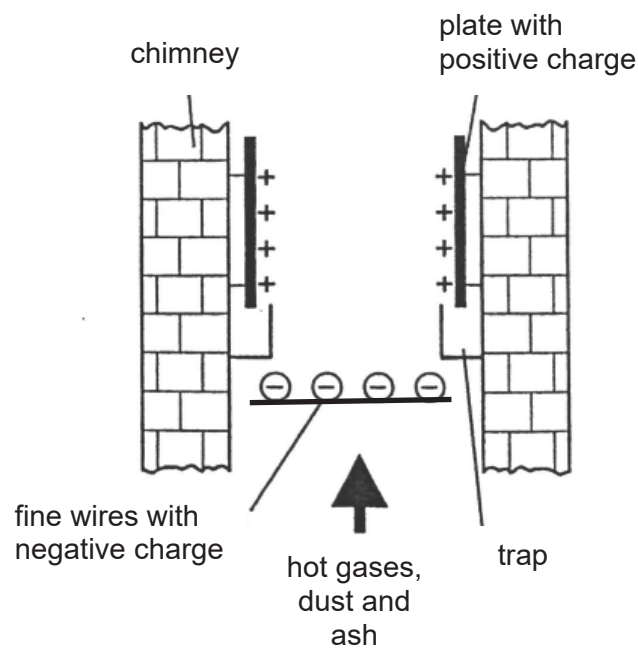
.....

.....

.....

..... [3]

- 8 An electrostatic precipitator is used to remove dust and ash from hot gases as shown in Fig. 8.1.



**Fig. 8.1**

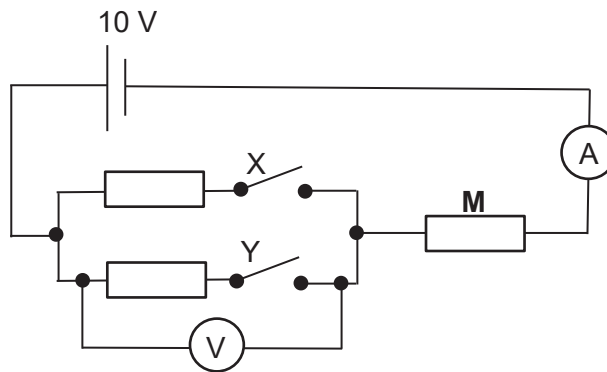
Explain what happens to the dust and ash particles in the hot gases after they pass through the fine wires with negative charge.

.....

.....

..... [2]

- 9 Fig. 9.1 shows an electrical circuit containing a 10 V power supply and a number of resistors.



**Fig. 9.1**

When switches X and Y are closed, the voltmeter and ammeter readings are 4.26 V and 1.92 A respectively.

- (a) Calculate the resistance of resistor M.

resistance = .....  $\Omega$  [2]

- (b) Calculate the amount of charge that passes through the battery in 20 s.

charge = ..... C [1]

- (c) Describe how the ammeter and the voltmeter readings will change when switch X is opened while switch Y remains closed.

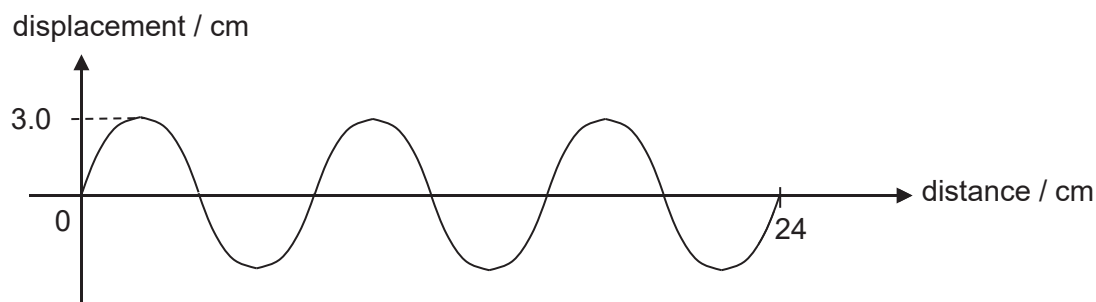
.....  
 ..... [1]

**Section B (20 marks)**

Answer any **two** questions in this section.

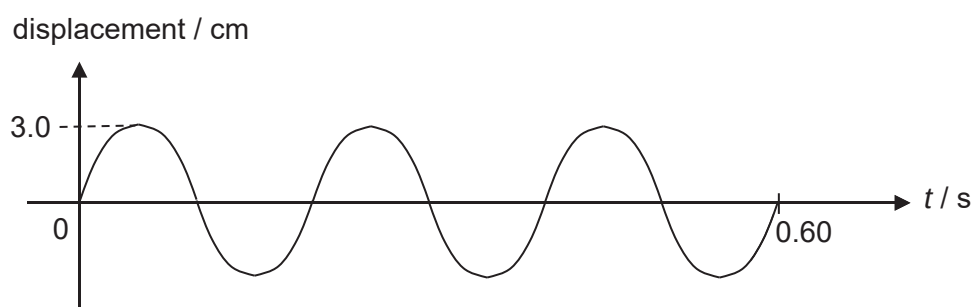
Write your answers in the spaces provided.

- 10 (a)** The displacement-distance graph of a wave travelling along a rope at time = 0.60 s is shown in Fig. 10.1.



**Fig. 10.1**

Fig. 10.2 shows the displacement-time graph of a point on the rope.



**Fig. 10.2**

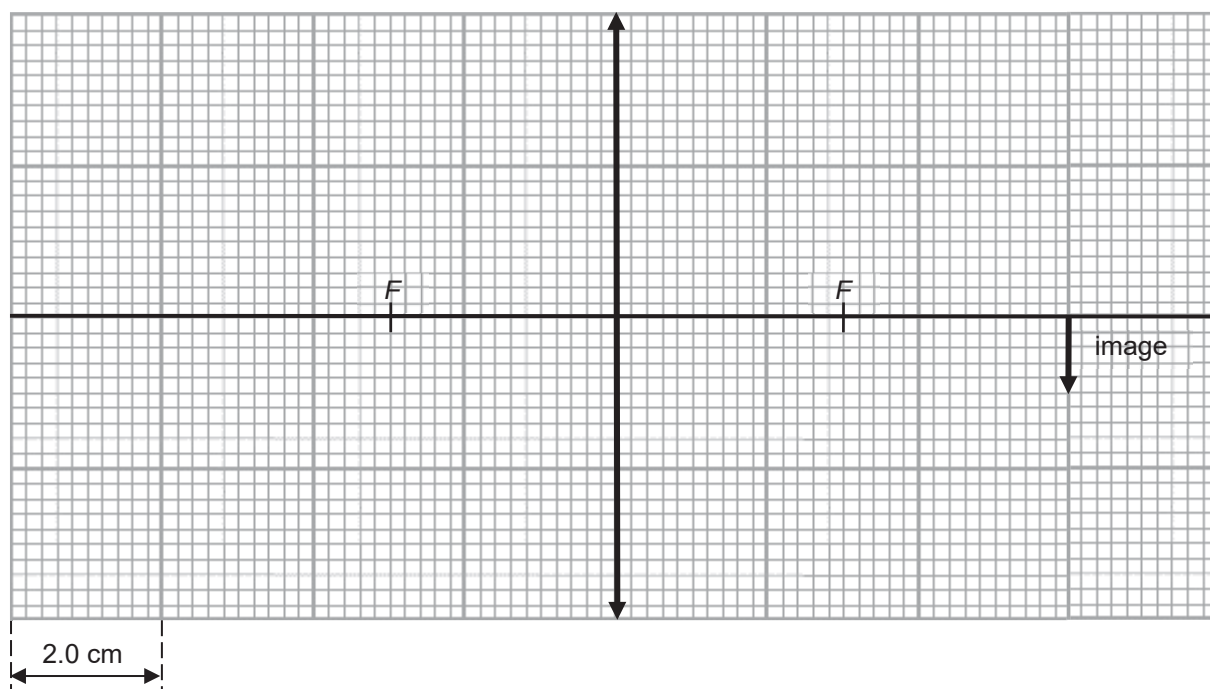
- (i)** Calculate the frequency of the wave.

frequency = ..... [1]

- (ii)** Using your answer from **(a)(i)** or otherwise, calculate the speed of the wave in m/s.

speed = ..... [2]

- (b) A lens has a focal length of 3.0 cm. The image of the object O is found to be at the location as shown in Fig. 10.3. The focal point of the length is marked as 'F'.

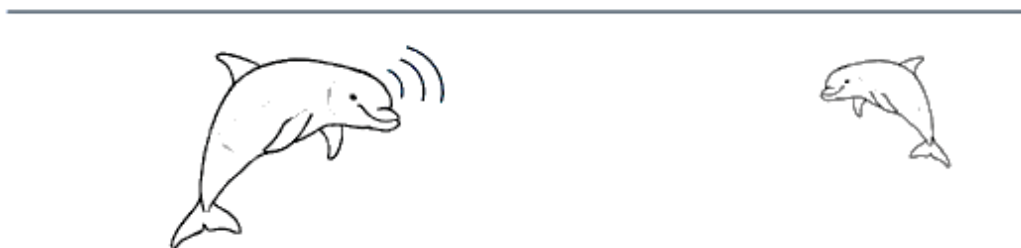


**Fig. 10.3**

- (i) Draw two light rays to locate the position of the object. Draw and label the object O. [2]
- (ii) State the characteristics of the new image formed when the object is shifted to a distance of 2.8 cm from the lens.

..... [1]

- (c) An adult dolphin makes a sound to communicate with its baby, as shown in Fig. 10.4.



**Fig. 10.4**

The frequency of sounds produced by a dolphin ranges from 0.20 kHz to 150 kHz. The lower frequency sounds (0.20 kHz to 50 kHz) are likely used in social communication. Higher frequency sounds (40 kHz to 150 kHz) are primarily used for echolocation.

- (i) Explain, using ideas on molecules, how the sound wave is transmitted through the water to the baby dolphin.

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

- (ii) The frequency of the sound emitted by the dolphin remains constant both in air and water.

Explain how the wavelength of sound waves changes when it goes from water to air.

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



- 11 (a) Six cubes, P, Q, R, S, T and U, each made of a different material, are all placed side by side on a horizontal ground.

The density and volume of the cubes are shown in Fig. 11.1.

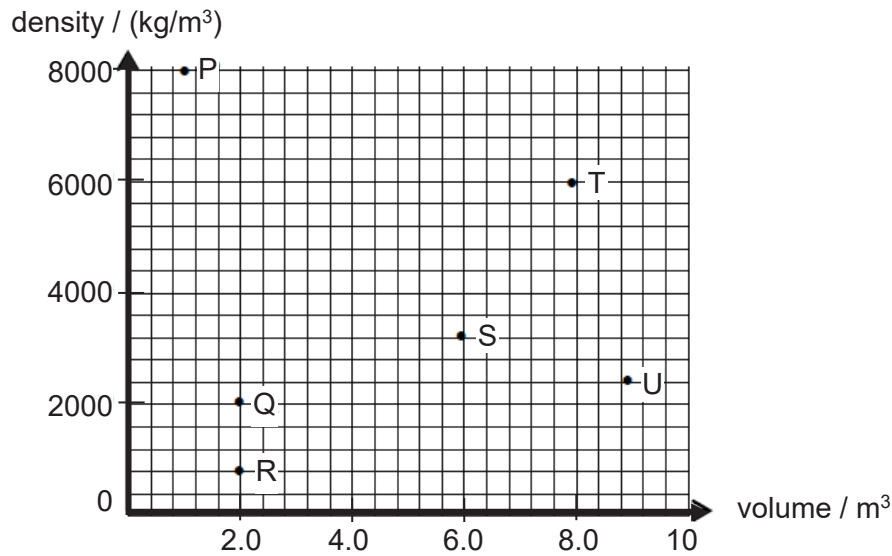


Fig. 11.1

- (i) Which cube has the smallest mass? Explain how you identify this cube without showing any calculations.

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

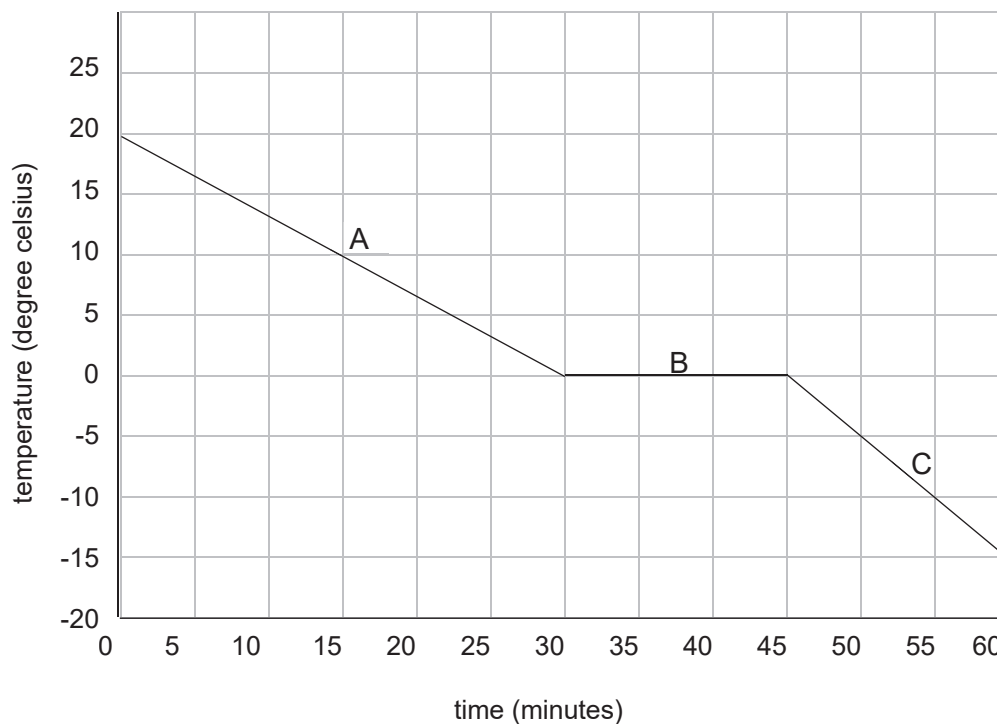
- (ii) Cube V has half the volume and twice the density of cube Q.

Take the gravitational field strength as 10 N/kg.

What is the weight of cube V?

weight = ..... [2]

- (b) A student places a bottle of orange drink in a freezer and records the temperature of the orange drink every five minutes, as shown in Fig. 11.2.



**Fig. 11.2**

- (i) Explain, in terms of the energies of the molecules, what happens during section B of the graph.

.....

.....

..... [2]

- (ii) Describe the changes in arrangement and motion of the molecules from section A to section C.

.....

.....

..... [2]

(c) Fishes are able to swim in a frozen pond, as shown in Fig. 11.3.

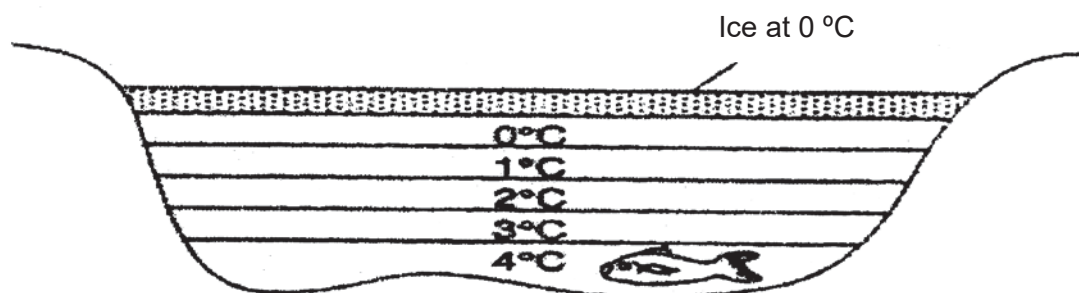


Fig. 11.3

The volume of water changes with temperature, as shown in Fig. 11.4.

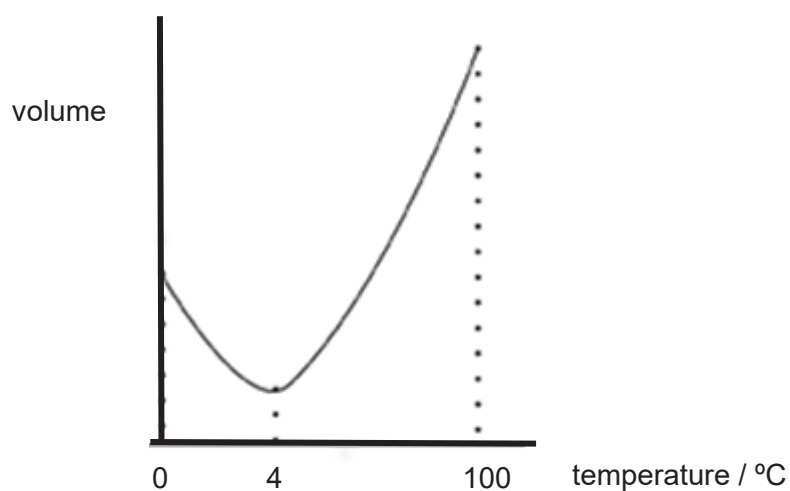


Fig. 11.4

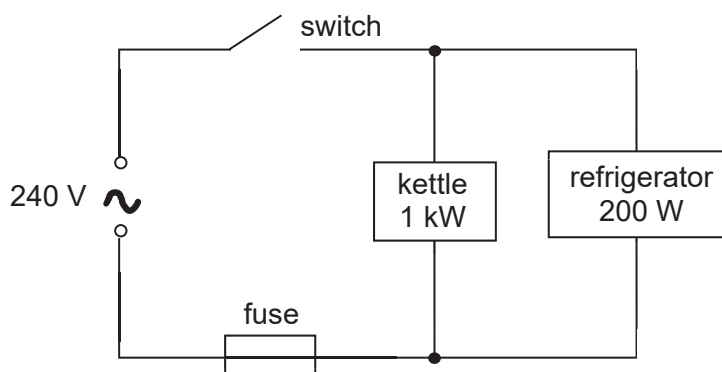
Describe how the density of water changes as the temperature decreases from 100 °C to 0 °C.

.....

.....

..... [2]

- 12** A refrigerator has a power rating of 200 W at 240 V operating voltage. It is connected to a 240 V a.c. mains with an electric kettle rated 1 kW, 240 V, as shown in Fig. 12.1.



**Fig. 12.1**

- (a)** Suggest a suitable rating for the fuse.

fuse rating = ..... [2]

- (b)** Given that each unit of electricity cost \$0.22, calculate the total cost incurred when both the kettle and the refrigerator are switched on for 40 minutes.

cost = ..... [2]

- (c)** Two new set of wires P and Q have the same length and are made of the same material. The cross-sectional area of wire P is three times larger than that of wire Q.

State and explain the value of resistance Q with respect to P.

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

(d) Fig. 12.2 shows an electric kettle.



**Fig. 12.2**

(i) Explain why the surface of the kettle is made of chromed silver.

.....

.....

..... [2]

(ii) State where the heating element of the electric kettle should be positioned and explain your answer.

.....

.....

..... [2]

**END OF PAPER**

