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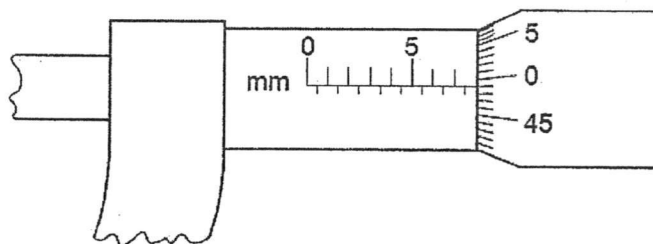


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**Multiple Choice Questions [40 marks]**

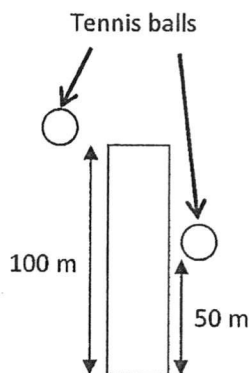
Answer **all** questions and shade your answers on the OMR sheet provided.

- 1 The diagram shows the reading on a micrometer screw gauge when it is used to measure the diameter of a water hose.



Given that the micrometer has a zero error of  $-0.01$  mm, what is the actual diameter of the water hose?

- A 7.49 mm                      C 7.98 mm  
B 7.69 mm                      D 8.00 mm
- 2 Two similar tennis balls are released from a building at different heights at the same time. One is released from 100 m above the ground, while the other is released from 50 m above the ground. Ignore the effects of air resistance.



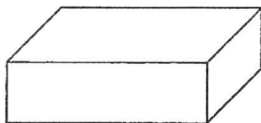
Which quantity is the same for both balls just before they reach the ground?

- A speed                      C kinetic energy  
B acceleration            D displacement
- 3 A car of mass 1500 kg moves at a constant speed of 5.0 m/s along a horizontal road when the driving force of the car is 1000 N.

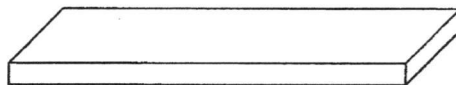
What is the resistive force that acts on the car?

- A 0 N                      C 1000 N  
B 500 N                  D 1500 N

- 4 A rectangular block is made of soft clay. The density of the clay is  $1500 \text{ kg/m}^3$ .

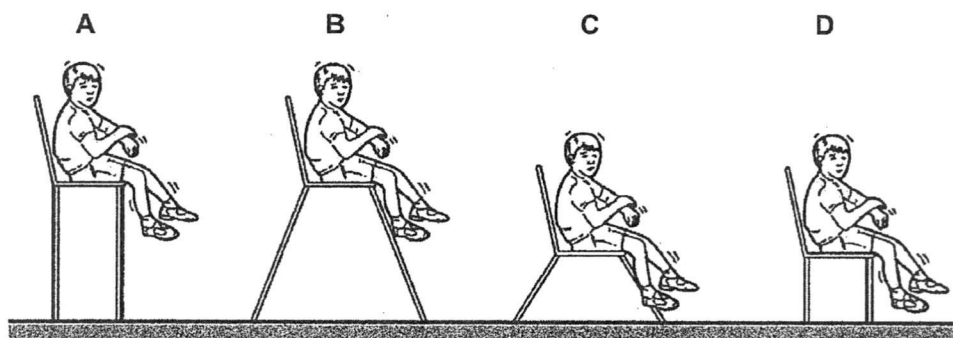


The block is cut into 3 equal parts. One part is reshaped to be twice as long and a quarter as thick.

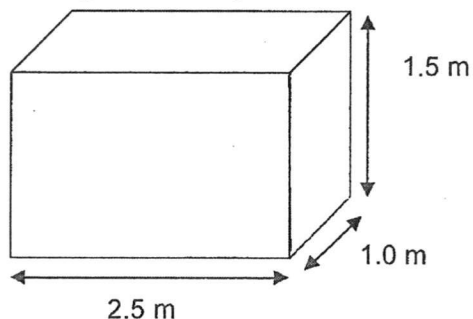


What is the density of the block now?

- A  $250 \text{ kg/m}^3$                       C  $1500 \text{ kg/m}^3$   
 B  $500 \text{ kg/m}^3$                       D  $4000 \text{ kg/m}^3$
- 5 Which chair is the most stable if the child moves in his seat?



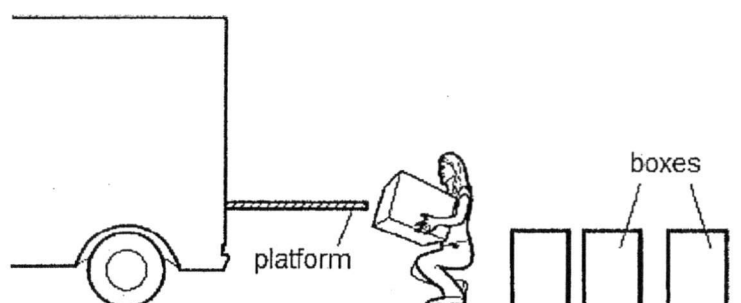
- 6 A block  $2.5 \text{ m}$  long,  $1.0 \text{ m}$  wide and  $1.5 \text{ m}$  high rests on the ground as shown. The gravitational field strength is  $10 \text{ N/kg}$ .



Given that the block has a mass of  $120 \text{ kg}$ , what is the largest possible pressure the block can exert on the ground?

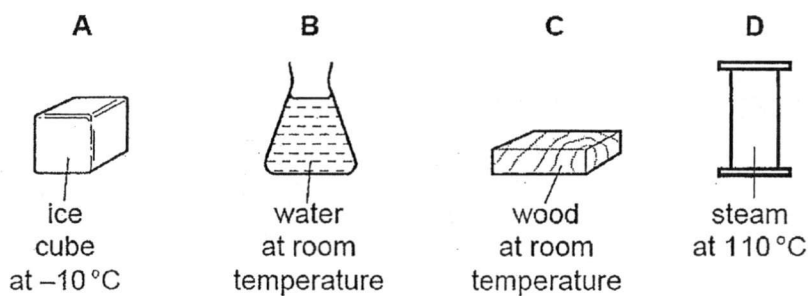
- A  $48 \text{ Pa}$                       C  $320 \text{ Pa}$   
 B  $80 \text{ Pa}$                       D  $800 \text{ Pa}$

- 7 A person lifts boxes of equal weight onto a platform.

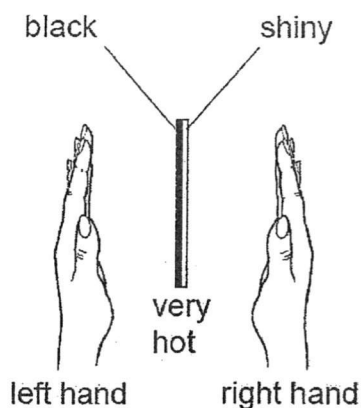


Which quantity would **not** affect the total work done by the person?

- A the time taken to lift the box
  - B the number of boxes lifted
  - C the mass of the boxes
  - D the height of the platform above the ground
- 8 Which of the following contains molecules with the **least** internal kinetic energy?



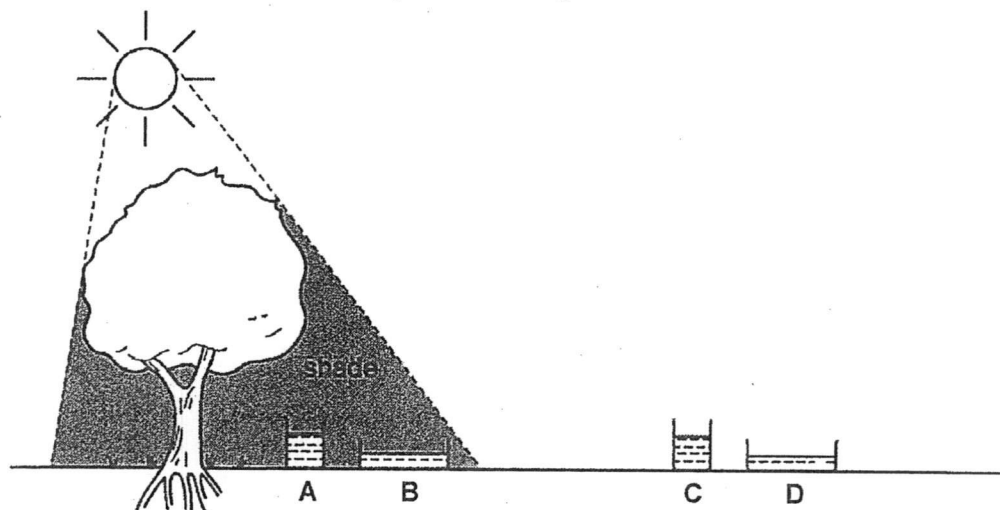
- 9 The diagram shows a thick copper plate that is very hot. One side is black while the other is shiny. A student places her hands the same distance from each side as shown.



Her left hand feels warmer than her right hand.

Which statement is the correct conclusion from the experiment?

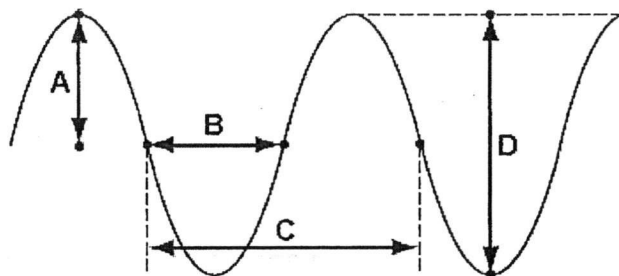
- A The black side is hotter than the shiny side.
  - B The black side radiates more heat.
  - C The shiny side is cooling down faster than the black side.
  - D The shiny side absorbs more heat.
- 10 Four containers are filled with equal volumes of water at the same temperature. Containers A and B are shaded by a tree. Sunlight falls on containers C and D.



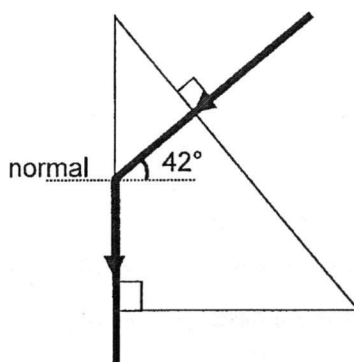
Which container of water will have the **slowest** rate of evaporation?

- 11 The drawing shows a wave.

Which labelled distance represents the amplitude of the wave?



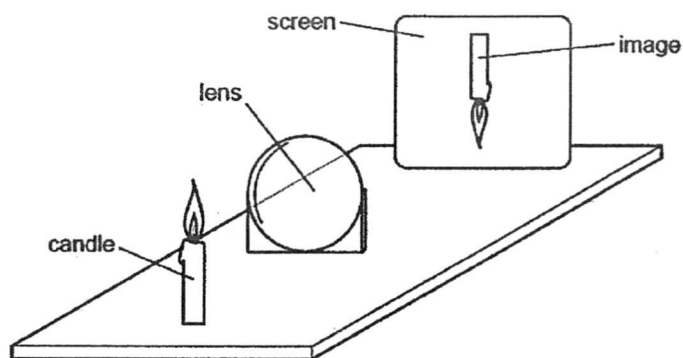
- 12 The diagram shows how a light ray enters and leaves a triangular glass prism.



What is the refractive index of the glass?

- |        |        |
|--------|--------|
| A 0.67 | C 1.35 |
| B 1.00 | D 1.49 |

- 13 A thin converging lens is used to produce, on a screen, a focused image of a candle.



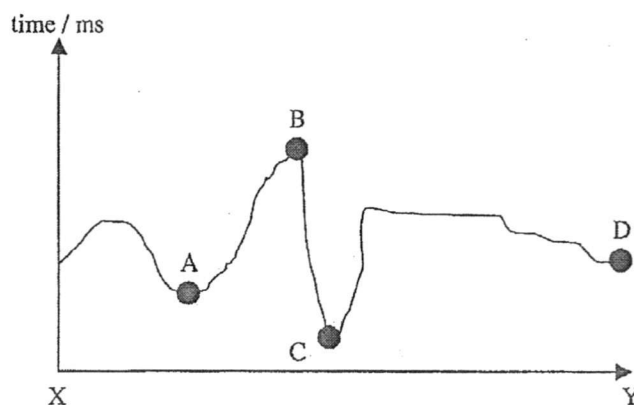
Various focused images are produced on the screen by moving the lens and the screen backwards and forwards. The lower half of the lens is covered with a cardboard.

Which of the following statements about the images formed on the screen is correct?

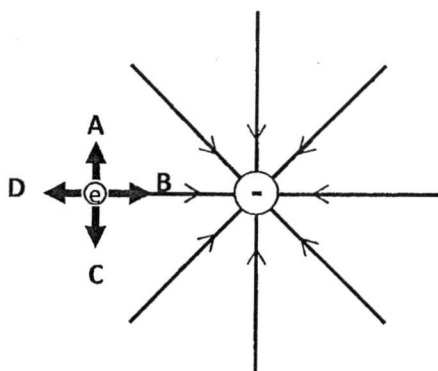
- A The height of the images will be halved.
  - B There will be no images formed.
  - C The images will be dimmer.
  - D The images will become virtual.
- 14 Which electromagnetic wave could be used to detect forgery?
- A infrared radiation
  - B ultraviolet radiation
  - C x - ray
  - D radio waves
- 15 Ultrasound is sent from a ship directly downwards into the water.

The diagram below shows the duration for ultrasound to return back to the receiver on the ship as the ship travelled from point X to point Y along the surface of the water.

At which position is the water deepest?



- 16 An electron is placed near a point charge as shown below. In which direction will the electron move?



- 17 A piece of wire has a cross-sectional area of  $1.0 \text{ cm}^2$  and is of length  $1.0 \text{ m}$ . If another piece of wire of the same material is to have a resistance half of that of the first wire, what should its length and cross-sectional area be?

|   | length / m | cross-sectional area / $\text{cm}^2$ |
|---|------------|--------------------------------------|
| A | 1.0        | 1.0                                  |
| B | 0.50       | 1.0                                  |
| C | 2.0        | 0.50                                 |
| D | 2.0        | 8.0                                  |

- 18 The potential difference between the ends of a conductor is  $6.0 \text{ V}$ . How much electrical energy is converted to other forms of energy in the conductor when  $80 \text{ C}$  of charge flows through it?

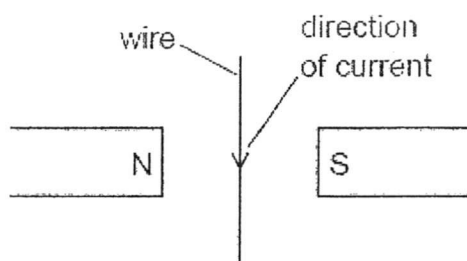
- A 13 J                                      C 480 J  
B 80 J                                        D 2880 J

- 19 An electric kettle should always be fitted with an earth connection as a protective device.

What is being 'protected' by the earth connection?

- A the cable connecting the kettle  
B the fuse in the circuit  
C the casing of the electric kettle  
D the person using the kettle

- 20 A current-carrying wire lies between the poles of two magnets as shown in the diagram below.

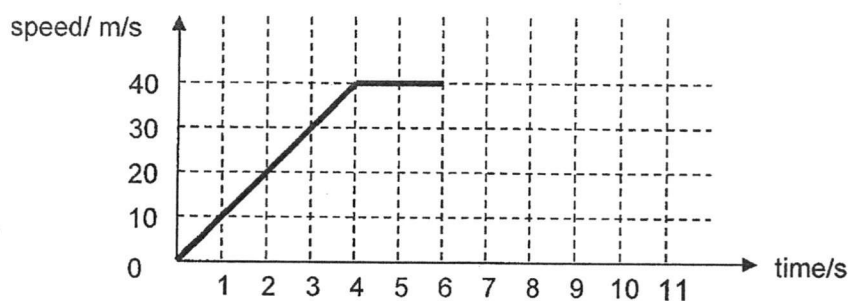


What is the direction of the force on the wire?

- A into the plane of the paper
- B out of the plane of the paper
- C towards the N-pole
- D towards the S-pole

**Section A: Structured Questions [45 marks]**Answer **all** the questions in this section in the spaces provided.

- 1 Fig. 1.1 shows the speed-time graph of a motorcyclist.

**Fig. 1.1**

- (a) Describe the motion of the motorcyclist for the first 6.0 seconds.

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[2]

- (b) The motorcyclist decelerates uniformly at  $20 \text{ ms}^{-2}$  from  $t = 6.0 \text{ s}$  until he comes to a stop before the traffic light. Sketch this part of the motion in Fig. 1.1 above.

[2]

- (c) Calculate the total distance travelled by the motorcyclist from  $t = 0 \text{ s}$  till the time he stopped at the traffic light.

total distance travelled = \_\_\_\_\_ m [2]

- (d) Hence, calculate the average speed of the motorcyclist in this whole journey.

average speed = \_\_\_\_\_ m/s [1]

- 2 Fig. 2.1 shows a buggy being towed by two vehicles which exert forces of 200 N and 250 N. The angle between the two ropes from the vehicles is  $60^\circ$ .

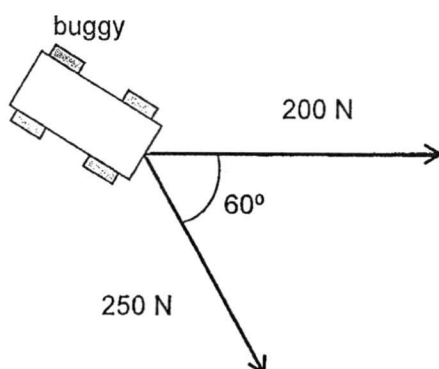


Fig. 2.1

Draw a suitable scale diagram to determine the resultant force and direction that the vehicles exert on the buggy.

scale : \_\_\_\_\_

resultant force = \_\_\_\_\_ N

direction of resultant force = \_\_\_\_\_ [4]

- 3 A water slide has a height of 3.5 m and a total length of 18 m as shown in Fig. 3.1. A boy of mass 50 kg starts from rest at the top and slides down the water slide. Take the acceleration due to gravity  $g$  to be  $10 \text{ m s}^{-2}$ .

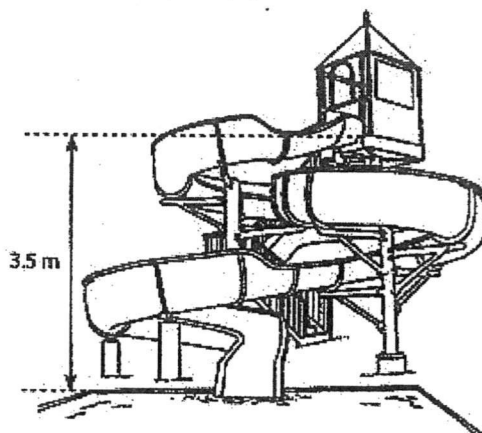


Fig. 3.1

- (a) State the principle of conservation of energy.

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[1]

- (b) Calculate the gravitational potential energy of the boy at the top of the slide.

gravitational potential energy = \_\_\_\_\_ J [2]

- (c) A frictional force that averages 10 N acts on the boy while he slides down. Calculate the speed of the boy when he reaches the bottom of the slide.

speed = \_\_\_\_\_ m/s [2]

- (d) Suggest, with explanation, a reason why the slide operates with water flowing continuously down the slide.

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[1]

- 4 Fig. 4.1 shows a uniform beam XY pivoted at its mid-point. Two masses of weight 25 N and 20 N, are suspended from the beam.

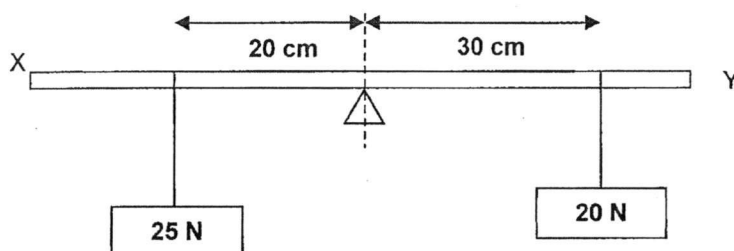


Fig. 4.1

- (a) Will end X of the beam move upwards or downwards? Use calculated values to support your answer.

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[2]

- (b) An additional weight of 10 N is placed on the beam to balance it.

Where should the position that the 10 N weight be placed in order to balance the beam?

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[2]

- (c) On Fig. 4.1, indicate the line of action of the weight of the beam. [1]

- (d) Explain why the weight of the beam does **not** have any effect on the moment of the beam.

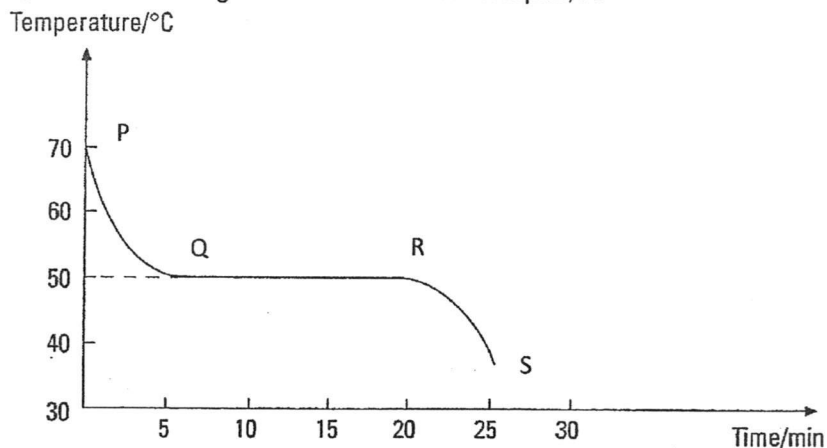
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[1]

- 5 Fig. 5.1 shows the cooling curve for an unknown liquid, X.



- (a) Explain why there is no change in temperature in section QR of the graph.

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[2]

- (b) Determine the state(s) of X between the following sections of the graph.

(i) PQ : \_\_\_\_\_

(ii) QR : \_\_\_\_\_

(iii) RS : \_\_\_\_\_

[2]

- (c) State two differences between boiling and evaporation.

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[2]

- 6 The following shows four components of the electromagnetic spectrum:

|           |           |                 |            |
|-----------|-----------|-----------------|------------|
| microwave | gamma ray | ultraviolet ray | radio wave |
|-----------|-----------|-----------------|------------|

- (a) Arrange the components in an increasing order of frequency.

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[1]

(b) State two common properties of the four components.

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[2]

(c) State a medical use of gamma rays.

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[1]

- 7 A cathode-ray oscilloscope displays three waveforms detected from a submarine under the sea shown in Fig. 7.1.

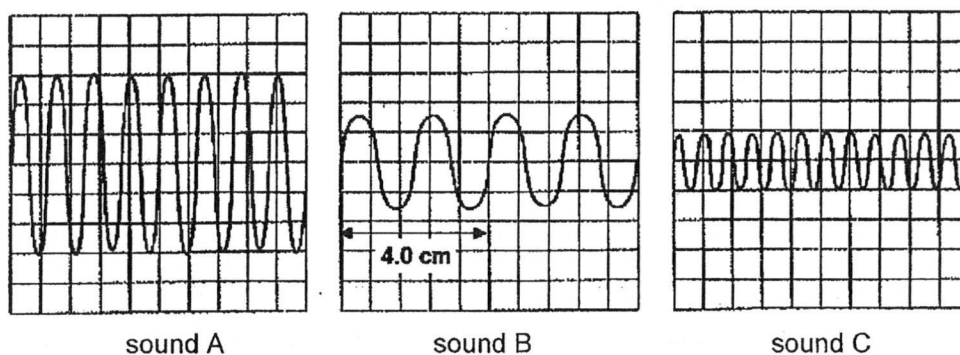


Fig. 7.1

(a) State and explain the difference between a sound wave and visible light.

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[2]

(b) State two differences in sounds A and B as shown in Fig. 7.1.

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[2]

(c) If sound B has a frequency of 75 kHz, what is its speed?

speed = \_\_\_\_\_ m/s [2]

- (d) State and explain how the speed of sound in air will differ from what you have calculated in (c).

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[2]

- 8 Fig. 8.1 shows a circuit in which all the switches are opened.

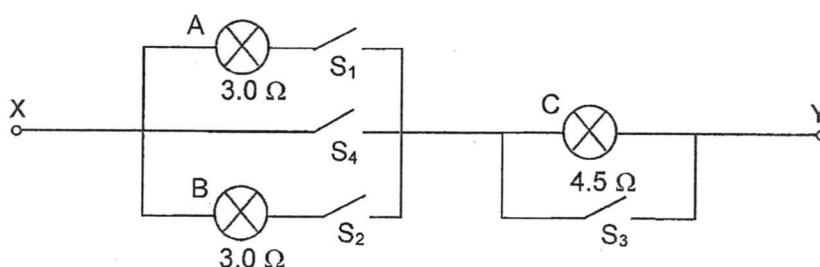


Fig. 8.1

- (a) Calculate the effective resistance between X and Y when  $S_1$  and  $S_2$  are closed.

effective resistance = \_\_\_\_\_  $\Omega$  [2]

- (b) Suggest which light bulb(s) will light up when all switches are closed. Explain your answer.

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[2]

**Section B: Free Response Questions [20 marks]**Answer **any two** questions in this section in the space provided.

- 9 An electric kettle with power rating of 2.5 kW is connected to a 240 V mains supply by a flexible cable to a 3-pin plug.

(a) State the names of the 3 wires found in the 3-pin plug and their respective colours.

| Name of wire | Colour |
|--------------|--------|
|              |        |
|              |        |
|              |        |

[3]

(b) Calculate the current flowing in the circuit when the electric kettle is operating under normal condition.

current = \_\_\_\_\_ A [2]

(c) Suggest a suitable fuse rating for this circuit. Explain your answer.

\_\_\_\_\_  
 \_\_\_\_\_

[2]

(d) If the cost of electricity is \$0.23 per kWh, calculate the total cost of using the electric kettle for 1 hour every day for 1 week.

cost = \$ \_\_\_\_\_ [2]

(e) Suggest where a heating element should be placed in the electric kettle so that the water can be heated efficiently.

\_\_\_\_\_  
 \_\_\_\_\_

[1]

- 10 (a) A strip of plastic becomes positively charged after it is rubbed with a piece of dry cloth and then hung over an insulating rod as shown in Fig. 10.1.

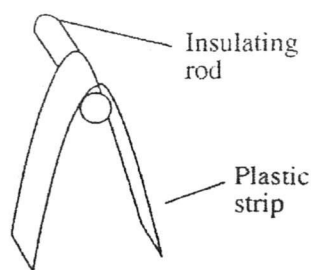


Fig. 10.1

- (i) State how the strip of plastic is charged when it is rubbed with the dry cloth. Explain your answer in terms of transfer of electrons.

\_\_\_\_\_

\_\_\_\_\_ [1]

- (ii) Why do the ends of the strip repel?

\_\_\_\_\_

\_\_\_\_\_ [1]

- (b) Fig. 10.2 shows a conducting sphere P mounted on an insulating stand. The sphere P is positively charged. A small neutral metal sphere S, suspended on an insulating thread, is brought near to P but not touching it.

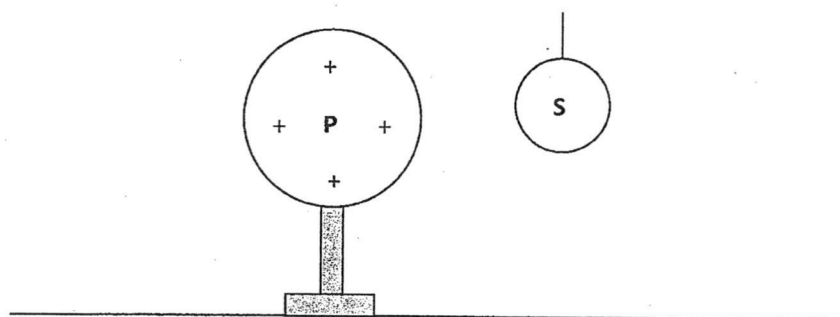


Fig. 10.2

- (i) State and explain the movement of the electrons in the sphere that occurs as sphere S is brought closer to sphere P.

\_\_\_\_\_

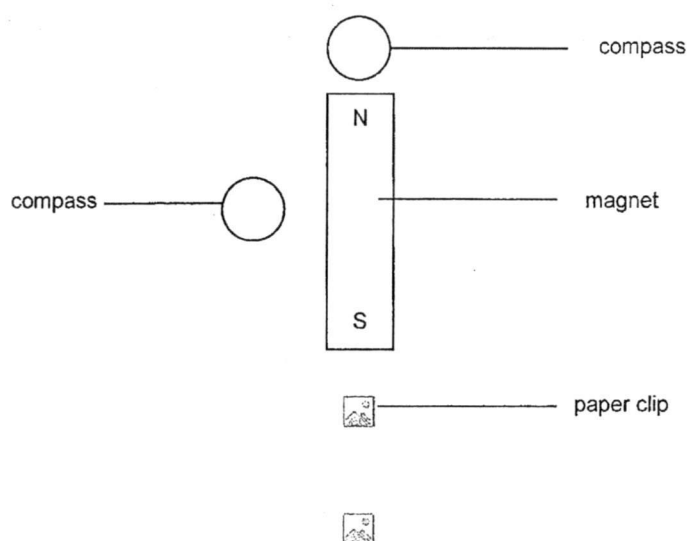
\_\_\_\_\_

\_\_\_\_\_ [2]

- (ii) On Fig. 10.2, draw the distribution of charges on sphere S.

[1]

(c) A magnet, two compasses, and two paper clips are shown in Fig. 10.2.



**Fig. 10.2**

(i) When the paper clips are brought close to the magnet, they become magnetised by induction. On Fig. 10.2, label **N** or **S** at both ends of each paper clip to show the magnetic poles produced as a result of the magnetic induction. [1]

(ii) Draw an arrow on each compass on Fig. 10.2 to show the direction of the magnetic field of the magnet at the two compass positions. [2]

(iii) When the magnet is removed, the two paper clips remain magnetised.

Suggest a material for the paper clips and explain your choice.

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[2]

- 11 (a) Fig. 11.1 shows a scale diagram of a converging lens that produces an image I of an object O.

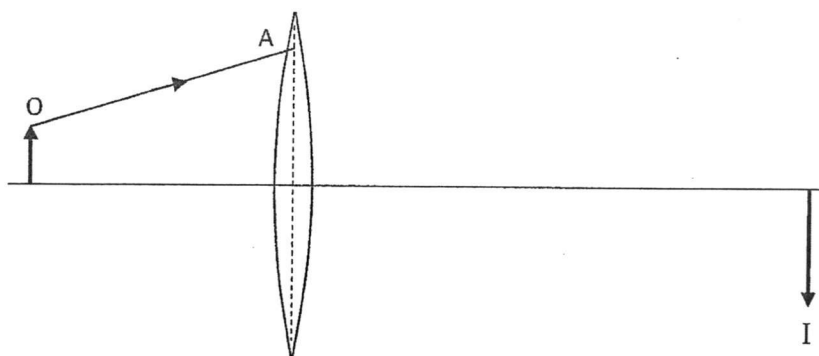


Fig. 11.1

- (i) Complete the path of ray OA and indicate clearly in Fig. 11.1 the principal focus and label it F. [2]

- (ii) State the focal length of the lens.

focal length = \_\_\_\_\_ cm [1]

- (iii) State one application of this set-up.

\_\_\_\_\_ [1]

- (b) Fig. 11.2 shows the path of a light ray passing through a rectangular block.

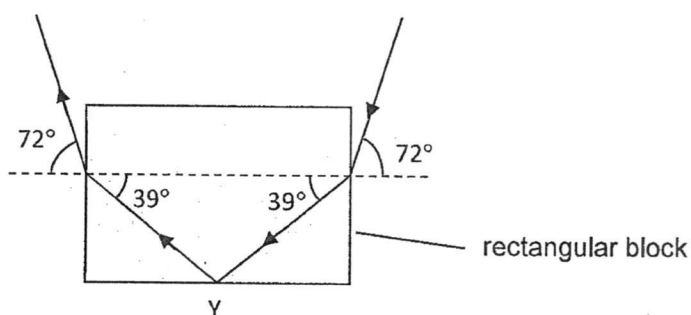


Fig. 11.2

- (i) Calculate the refractive index of the rectangular block.

refractive index = \_\_\_\_\_ [2]

(ii) Calculate the critical angle of the rectangular block.

critical angle = \_\_\_\_\_° [2]

(iii) Explain why the light ray does **not** exit the rectangular block at Y.

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[2]

-----The End-----

## Marking Scheme

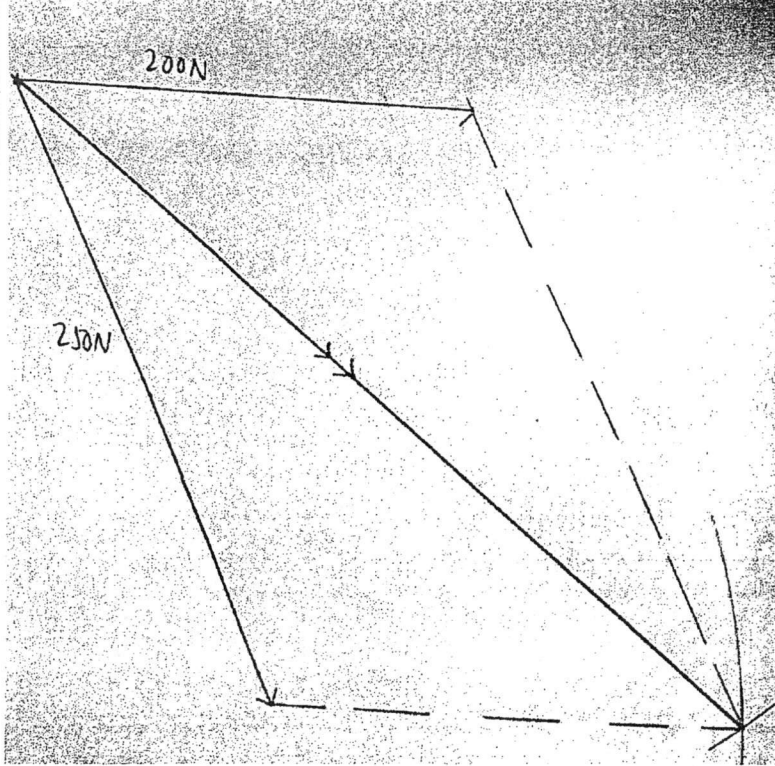
|           |           |           |           |           |           |           |           |           |           |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <b>1</b>  | <b>2</b>  | <b>3</b>  | <b>4</b>  | <b>5</b>  | <b>6</b>  | <b>7</b>  | <b>8</b>  | <b>9</b>  | <b>10</b> |
| D         | B         | C         | C         | C         | D         | A         | A         | B         | A         |
| <b>11</b> | <b>12</b> | <b>13</b> | <b>14</b> | <b>15</b> | <b>16</b> | <b>17</b> | <b>18</b> | <b>19</b> | <b>20</b> |
| A         | D         | C         | B         | B         | D         | B         | C         | D         | B         |



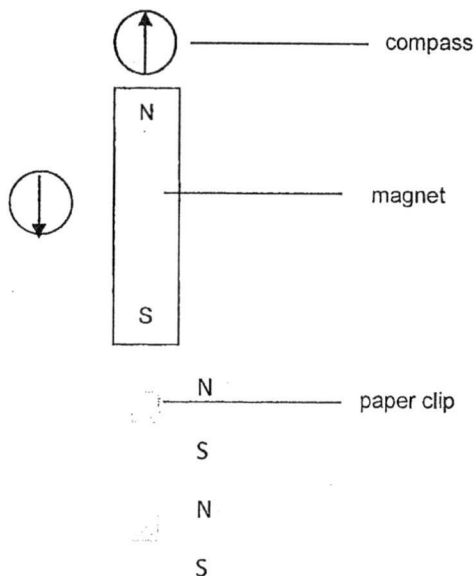
## Marking Scheme

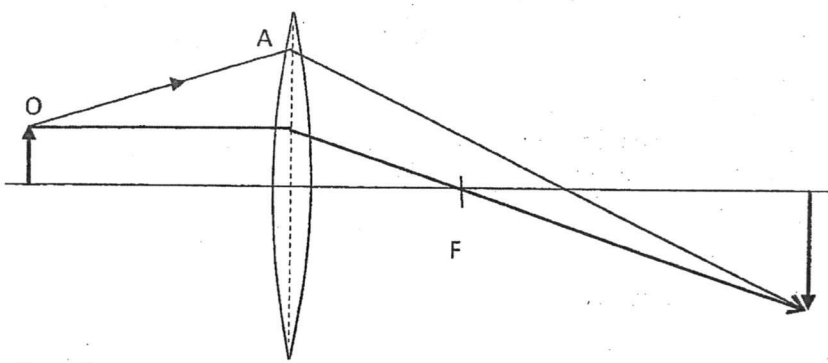
## Section A:

|   |                                                                                                                                                                                              |            |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| 1 | (a) The motorcyclist was travelling at <u>constant acceleration</u> from $t = 0$ s to <u>4.0 s</u> . He then travels at a <u>constant speed of 40 m/s</u> from $t = 4.0$ s to <u>6.0 s</u> . | [1]<br>[1] |
|   | (b)<br><br>[1] for the line<br>[1] for correct time                                                                                                                                          |            |
|   | (c) total distance = $\frac{1}{2}(2+8)(40)$<br>= 200 m                                                                                                                                       | [1]<br>[1] |
|   | (d) average speed = $200/8$<br>= 25 m/s                                                                                                                                                      | [1]        |
| 2 | Scale : 1.0 cm : 25 N [1]<br>Resultant force = $15.7 \times 25$<br>= 393 N [1]<br>Direction = $33^\circ$ from 200 N [1]<br>Parallelogram [1]                                                 |            |

|   |                                                                                                                                                                                                                                                                                                                                              |            |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
|   |                                                                                                                                                                                                                                                           |            |
| 3 | <p>(a) Principle of conservation of energy states that energy cannot be created nor destroyed. It can be converted from one form to another or transferred from one body to another. Total energy in an isolated system is constant.</p>                                                                                                     | [1]        |
|   | <p>(b) <math>GPE = (50)(10)(3.5)</math><br/> <math>= 1750 \text{ J}</math></p>                                                                                                                                                                                                                                                               | [1]<br>[1] |
|   | <p>(c) <math>1750 = (10)(18) + \frac{1}{2}(50)v^2</math><br/> <math>v = 7.92 \text{ m/s}</math></p>                                                                                                                                                                                                                                          | [1]<br>[1] |
|   | <p>(d) This is to <u>reduce friction</u> on the slide so that the boy can <u>slide down the slide smoothly</u>.</p>                                                                                                                                                                                                                          | [1]        |
| 4 | <p>(a) Upwards.<br/>         Clockwise moment <math>= (20)(0.3)</math><br/> <math>= 6.0 \text{ Nm}</math><br/>         Anti-clockwise moment <math>= (25)(0.2)</math><br/> <math>= 5.0 \text{ Nm}</math><br/>         There is a <u>net clockwise moment</u> acting on the beam about the pivot, hence, end X of beam will move upwards.</p> | [1]<br>[1] |
|   | <p>(b) 10 N weight should be placed <u>10 cm away</u> from the pivot on the <u>left side</u> of the beam.</p>                                                                                                                                                                                                                                | [1]<br>[1] |
|   | <p>(c) Line of action of weight acting through pivot</p>                                                                                                                                                                                                                                                                                     | [1]        |
|   | <p>(d) The line of action of weight acts through the pivot. Perpendicular distance between line of action of weight and pivot is zero. Therefore, moment due</p>                                                                                                                                                                             | [1]        |

|                                                | to its weight about the pivot is zero.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |             |                                  |                              |                  |                 |                                      |                                           |                                     |                                        |                                 |                           |                                                |                                                |     |
|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------|----------------------------------|------------------------------|------------------|-----------------|--------------------------------------|-------------------------------------------|-------------------------------------|----------------------------------------|---------------------------------|---------------------------|------------------------------------------------|------------------------------------------------|-----|
| 5                                              | (a) Liquid X is undergoing freezing. Thermal energy is released as <u>molecules come closer to form strong intermolecular forces of attraction. Average kinetic energy of the molecules remain unchanged.</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | [1]<br>[1] |             |                                  |                              |                  |                 |                                      |                                           |                                     |                                        |                                 |                           |                                                |                                                |     |
|                                                | (b)<br>PQ : Liquid<br>QR: Liquid + solid<br>RS: Solid<br>Any mistake – [1]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | [2]        |             |                                  |                              |                  |                 |                                      |                                           |                                     |                                        |                                 |                           |                                                |                                                |     |
|                                                | (c)<br>Any 2 differences <table> <tr> <th>Boiling</th> <th>Evaporation</th> </tr> <tr> <td>1. Occurs at a fixed temperature</td> <td>1. Occurs at any temperature</td> </tr> <tr> <td>2. Quick process</td> <td>2. Slow process</td> </tr> <tr> <td>3. Takes place throughout the liquid</td> <td>3. Takes place only at the liquid surface</td> </tr> <tr> <td>4. Bubbles are formed in the liquid</td> <td>4. No bubbles are formed in the liquid</td> </tr> <tr> <td>5. Temperature remains constant</td> <td>5. Temperature may change</td> </tr> <tr> <td>6. Thermal energy supplied by an energy source</td> <td>6. Thermal energy supplied by the surroundings</td> </tr> </table> | Boiling    | Evaporation | 1. Occurs at a fixed temperature | 1. Occurs at any temperature | 2. Quick process | 2. Slow process | 3. Takes place throughout the liquid | 3. Takes place only at the liquid surface | 4. Bubbles are formed in the liquid | 4. No bubbles are formed in the liquid | 5. Temperature remains constant | 5. Temperature may change | 6. Thermal energy supplied by an energy source | 6. Thermal energy supplied by the surroundings | [2] |
| Boiling                                        | Evaporation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |             |                                  |                              |                  |                 |                                      |                                           |                                     |                                        |                                 |                           |                                                |                                                |     |
| 1. Occurs at a fixed temperature               | 1. Occurs at any temperature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |             |                                  |                              |                  |                 |                                      |                                           |                                     |                                        |                                 |                           |                                                |                                                |     |
| 2. Quick process                               | 2. Slow process                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |             |                                  |                              |                  |                 |                                      |                                           |                                     |                                        |                                 |                           |                                                |                                                |     |
| 3. Takes place throughout the liquid           | 3. Takes place only at the liquid surface                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |            |             |                                  |                              |                  |                 |                                      |                                           |                                     |                                        |                                 |                           |                                                |                                                |     |
| 4. Bubbles are formed in the liquid            | 4. No bubbles are formed in the liquid                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |             |                                  |                              |                  |                 |                                      |                                           |                                     |                                        |                                 |                           |                                                |                                                |     |
| 5. Temperature remains constant                | 5. Temperature may change                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |            |             |                                  |                              |                  |                 |                                      |                                           |                                     |                                        |                                 |                           |                                                |                                                |     |
| 6. Thermal energy supplied by an energy source | 6. Thermal energy supplied by the surroundings                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            |             |                                  |                              |                  |                 |                                      |                                           |                                     |                                        |                                 |                           |                                                |                                                |     |
| 6                                              | (a) Radio wave, microwave, ultraviolet ray, gamma ray                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | [1]        |             |                                  |                              |                  |                 |                                      |                                           |                                     |                                        |                                 |                           |                                                |                                                |     |
|                                                | (b) They are all transverse waves. They travel at a speed of $3.0 \times 10^8$ m/s in vacuum. Or any other properties.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | [2]        |             |                                  |                              |                  |                 |                                      |                                           |                                     |                                        |                                 |                           |                                                |                                                |     |
|                                                | (c) Gamma knife surgery/cancer treatment/radiation therapy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | [1]        |             |                                  |                              |                  |                 |                                      |                                           |                                     |                                        |                                 |                           |                                                |                                                |     |
| 7                                              | (a) Sound wave is a longitudinal wave and the particles on the sound wave vibrate parallel to the direction of wave motion. Visible light is a transverse wave and the particles vibrate perpendicular to direction of wave motion.                                                                                                                                                                                                                                                                                                                                                                                                                                                       | [1]<br>[1] |             |                                  |                              |                  |                 |                                      |                                           |                                     |                                        |                                 |                           |                                                |                                                |     |
|                                                | (b) Sound B is <u>softer</u> and at <u>lower pitch</u> as compared to sound A.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | [2]        |             |                                  |                              |                  |                 |                                      |                                           |                                     |                                        |                                 |                           |                                                |                                                |     |
|                                                | (c) $V = (75000)(0.02)$<br>$= 1500$ m/s                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | [1]<br>[1] |             |                                  |                              |                  |                 |                                      |                                           |                                     |                                        |                                 |                           |                                                |                                                |     |
|                                                | (d) Speed of sound in air is <u>slower</u> as the air molecules are <u>spaced further apart</u> as compared to those in water.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | [1]<br>[1] |             |                                  |                              |                  |                 |                                      |                                           |                                     |                                        |                                 |                           |                                                |                                                |     |
| 8                                              | (a) Effective resistance = $(1/3 + 1/3)^{-1} + 4.5$<br>$= 6.0 \Omega$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | [1]<br>[1] |             |                                  |                              |                  |                 |                                      |                                           |                                     |                                        |                                 |                           |                                                |                                                |     |
|                                                | (b) When all switches are closed, <u>the light bulbs will not light up</u> as there is a <u>short circuit</u> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | [1]<br>[1] |             |                                  |                              |                  |                 |                                      |                                           |                                     |                                        |                                 |                           |                                                |                                                |     |

| Section B    |                                                                                                                                                                                                                                                    |              |        |           |       |              |      |            |                  |     |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------|-----------|-------|--------------|------|------------|------------------|-----|
| 9            | (a) <table border="1"><thead><tr><th>Name of wire</th><th>Colour</th></tr></thead><tbody><tr><td>Live wire</td><td>Brown</td></tr><tr><td>Neutral wire</td><td>Blue</td></tr><tr><td>Earth wire</td><td>Green and Yellow</td></tr></tbody></table> | Name of wire | Colour | Live wire | Brown | Neutral wire | Blue | Earth wire | Green and Yellow | [3] |
| Name of wire | Colour                                                                                                                                                                                                                                             |              |        |           |       |              |      |            |                  |     |
| Live wire    | Brown                                                                                                                                                                                                                                              |              |        |           |       |              |      |            |                  |     |
| Neutral wire | Blue                                                                                                                                                                                                                                               |              |        |           |       |              |      |            |                  |     |
| Earth wire   | Green and Yellow                                                                                                                                                                                                                                   |              |        |           |       |              |      |            |                  |     |
|              | (b) $I = 2500/240$<br>$= 10.4 \text{ A}$                                                                                                                                                                                                           | [1]<br>[1]   |        |           |       |              |      |            |                  |     |
|              | (c) Suitable fuse rating = 13 A<br>The fuse rating should be slightly higher than the current flowing in the circuit for the fuse to work under normal working conditions of the electric kettle.                                                  | [1]<br>[1]   |        |           |       |              |      |            |                  |     |
|              | (d) Total cost = $\$(0.23 \times 2.5 \times 7)$<br>$= \$4.03$                                                                                                                                                                                      | [1]<br>[1]   |        |           |       |              |      |            |                  |     |
|              | (e) The heating element should be placed at the bottom of the electric kettle.                                                                                                                                                                     | [1]          |        |           |       |              |      |            |                  |     |
| 10           | (ai) The plastic loses electrons and becomes positively charged.                                                                                                                                                                                   | [1]          |        |           |       |              |      |            |                  |     |
|              | (ii) Both ends of the strip are of the same charge. Since like charges repel, the ends of the strip diverge.                                                                                                                                       | [1]          |        |           |       |              |      |            |                  |     |
|              | (bi) The <u>electrons in S will be attracted to the side that is nearer</u> to sphere P. Since <u>unlike charges attract</u> .                                                                                                                     | [1]<br>[1]   |        |           |       |              |      |            |                  |     |
|              | (ii) electrons are on side nearer to P and positive charges are left on the side further away from P                                                                                                                                               | [1]          |        |           |       |              |      |            |                  |     |
|              | (ci) / (ii) <div></div>                                                                                                                                        | [1]          |        |           |       |              |      |            |                  |     |
|              | (iii) The paper clips are made of <u>steel</u> . Steel is a <u>hard magnetic material</u> that retains magnetism well. Therefore, it will remain magnetised.                                                                                       | [1]<br>[1]   |        |           |       |              |      |            |                  |     |

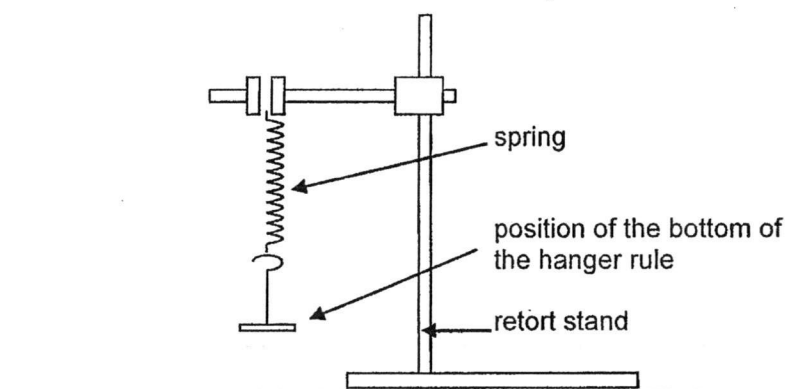
|    |                                                                                                                                                                                                                              |                                                                                                                    |            |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|------------|
| 11 | (ai)                                                                                                                                                                                                                         |  <p>[1] ray from A<br/>[1] F</p> |            |
|    | (ii) focal length = 2.3 cm                                                                                                                                                                                                   |                                                                                                                    | [1]        |
|    | (iii) projector                                                                                                                                                                                                              |                                                                                                                    | [1]        |
|    | (bi) $n = \sin 72^\circ / \sin 39^\circ$<br>$= 1.51$                                                                                                                                                                         |                                                                                                                    | [1]<br>[1] |
|    | (ii) $1.51 = 1/\sin c$<br>$c = 41.5^\circ$                                                                                                                                                                                   |                                                                                                                    | [1]<br>[1] |
|    | (iii) The <u>angle of incidence at Y is larger than critical angle</u> and light is travelling from an <u>optically denser medium to optically less dense medium</u> . Hence, <u>total internal reflection occurs at Y</u> . |                                                                                                                    | [1]<br>[1] |

**Aim:** To determine the value of  $g$  using the period of oscillation of a spring.

**Apparatus:** You are provided with the following:

1. stopwatch
2. spring
3. hanger
4. 6 x 50g mass
5. half metre rule
6. string loop
7. retort stand

**Diagram:**



**Procedure:**

- (a) Read the height of the bottom of the hanger from the table top using the half metre rule.
- (b) Add a 200 g mass to the hanger.
- (c) Read the new height of the bottom of the hanger.  
Record the difference between these two measurements as the extension,  $E$ , in cm.

$E = \underline{\hspace{2cm}}$  cm

[1]

- (d) Remove the 200 g mass from the hanger. Now add a mass,  $m$  of 100 g.
- (e) Pull down the hanger by about 2.0 cm and release it to set the spring oscillating in a vertical direction.
- (f) Time 20 oscillations and record this time,  $t_1$ , in Table 1.1.
- (g) Repeat the timing for 20 oscillations and record this in Table 1.1 as  $t_2$ .
- (h) Calculate the average value,  $t_{ave}$ , of the two readings.
- (i) Repeat steps (e) to (g) with four different values of mass with a range of 100 g – 300 g.
- (j) Complete Table 1.1 by calculating the time,  $T$ , for 1 oscillation.
- (k) Calculate  $T^2$  and record these values in Table 1.1.

| m/g | $t_1/s$ | $t_2/s$ | $t_{ave}/s$ | $T/s$ | $T^2/s^2$ |
|-----|---------|---------|-------------|-------|-----------|
|     |         |         |             |       |           |
|     |         |         |             |       |           |
|     |         |         |             |       |           |
|     |         |         |             |       |           |
|     |         |         |             |       |           |

[3]

Table 1.1

- (l) Plot a graph of  $T^2$  against  $m$ . [4]  
 (m) Draw the best straight line through your points.  
 (n) Calculate the gradient of the line, showing clearly on your graph how you did this, and record your calculations below.

gradient of line = \_\_\_\_\_ [2]

- (o) Use the gradient from (n) and the extension,  $E$ , from (c) to find the value of  $g$ , using the following formula.

$$g = \frac{E}{100} \times \frac{0.2}{\text{gradient}}$$

$g =$  \_\_\_\_\_ N/kg [2]

- (p) Identify one source of inaccuracy in this experiment. Suggest a modification to improve the accuracy of the experiment and explain why your modification would improve the accuracy.

Source : \_\_\_\_\_

\_\_\_\_\_

Modification : \_\_\_\_\_

\_\_\_\_\_

Explanation : \_\_\_\_\_

\_\_\_\_\_

[3]

End Of Paper

## Marker's report for 5076 Paper 2

Section A

- 1) Most of the students were able to answer this question well.
- 2) Students are to take note of using appropriate scale. (Diagram should occupy at least 50% of the space provided). Most of the students were not able to indicate the direction of the resultant force correctly. Most of the unacceptable answers only mention southwest direction etc.
- 3a) Some students did not include "total energy in an isolated system is constant".
- 3b) Most of the students were able to answer this part of question well.
- 3c) Majority of the students were not able to answer this part of the question. They did not include work done against friction in their calculations.
- 3d) Most of the students were able to state that water reduces friction along the slide.
- 4a) Most of the students were able to state that end X will move upwards. However, they are not able to explain their answer using unbalanced moments about the pivot.
- 4b) Most of the students answered this part of question well.
- 4c) This part of the question was not well-answered. Students did not label the line of action of weight but only used W to label.
- 4d) This part of the question was not well-answered. Students were not able to explain why the weight of beam has no effect on the moment of the beam by using zero perpendicular distance from line of action of weight to pivot.
- 5a) Students were not able to answer this part of question well.
- 5b) Students were able to answer this part of question well.
- 5c) Students to take note that evaporation occurs at any temperature and not "at any time".
- 6) This question was well-answered.
- 7a) Answers stating that particle "move"/"travel" were not accepted. Students are expected to indicate "vibration of particles" instead.
- 7b) Answers like Sound B has lower amplitude and lower frequency were given half credit (1 mark). Students are expected to state that sound B is softer and has lower pitch.
- 7c) Most of the students did not answer this part of question well. They did not convert 2 cm to metres before using it for calculations.
- 7d) Students were able to answer this part of question well. However, some misconceptions include speed of sound in air is  $3.0 \times 10^8$  m/s.
- 8a) Students were able to answer this part of question well.
- 8b) Many of the students failed to see that when all switches are closed, it would result in short circuit and hence no light bulbs will be lighted.

Section B

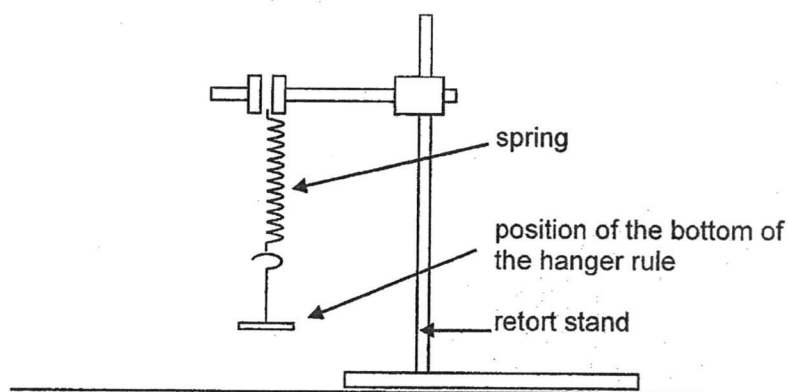
- 9) This question is generally well-answered. Students to take note that naming of wire should include e.g: "earth wire"
- 10a) Some misconceptions included: Positive electrons, like poles repels
- 10b) Some students missed out the information that the sphere S did not touch P. And went on to mention that electrons get transferred to sphere P. Students to ensure that there are equal number of positive and negative charges in sphere S.
- 10c) This part of question was quite well-answered.
- 11a) Most common misconception is the indicating of focal length, F when ray joining A to I cuts principal axis.
- 11b) Most of the students were able to answer i) and ii) correctly. Students to take note that the 3 key points must be present for full credit to be awarded. Any missing key points will result in 1 mark being deducted.

**Aim:** To determine the value of  $g$  using the period of oscillation of a spring.

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**Diagram:**



**Procedure:**

- (a) Read the height of the bottom of the hanger from the table top using the half metre rule.
- (b) Add a 200 g mass to the hanger.
- (c) Read the new height of the bottom of the hanger.  
Record the difference between these two measurements as the extension,  $E$ , in cm.

$$E = \underline{9.7} \text{ cm}$$

[1]

- (d) Remove the 200 g mass from the hanger. Now add a mass,  $m$  of 100 g.
- (e) Pull down the hanger by about 2.0 cm and release it to set the spring oscillating in a vertical direction.
- (f) Time 20 oscillations and record this time,  $t_1$ , in Table 1.1.
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- (h) Calculate the average value,  $t_{ave}$ , of the two readings.
- (i) Repeat steps (e) to (g) with four different values of mass with a range of 100 g – 300 g.
- (j) Complete Table 1.1 by calculating the time,  $T$ , for 1 oscillation.
- (k) Calculate  $T^2$  and record these values in Table 1.1.

| m/g | $t_1/s$ | $t_2/s$ | $t_{ave}/s$ | $T/s$ | $T^2/s^2$ |
|-----|---------|---------|-------------|-------|-----------|
| 100 | 10.44   | 11.06   | 10.75       | 0.538 | 0.289     |
| 150 | 12.20   | 11.78   | 11.99       | 0.600 | 0.360     |
| 200 | 13.21   | 13.79   | 13.50       | 0.675 | 0.456     |
| 250 | 15.19   | 14.88   | 15.04       | 0.752 | 0.566     |
| 300 | 16.13   | 15.97   | 16.05       | 0.803 | 0.645     |

[3]

Table 1.1

- (l) Plot a graph of  $T^2$  against  $m$ . [4]  
 (m) Draw the best straight line through your points.  
 (n) Calculate the gradient of the line, showing clearly on your graph how you did this, and record your calculations below.

$$\text{gradient of line} = \underline{0.0018} \quad [2]$$

- (o) Use the gradient from (n) and the extension,  $E$ , from (c) to find the value of  $g$ , using the following formula.

$$g = \frac{E}{100} \times \frac{0.2}{\text{gradient}}$$

Range accepted = 9.18 – 12.4 N/kg

$$g = \underline{10.8} \text{ N/kg} \quad [2]$$

- (p) Identify one source of inaccuracy in this experiment. Suggest a modification to improve the accuracy of the experiment and explain why your modification would improve the accuracy.

Source : Human reaction time error of 0.3 – 0.5 s.

Modification : Conduct experiment and measure time taken for 30 oscillations instead of 20 for 2 times and find average period.

Explanation : Time taken for 30 oscillations will be longer and hence percentage error due to human reaction time error will be reduced. This will result in a more accurate period of oscillation.

Alternatively: Students can also indicate finding time taken for 20 oscillations for 3 times instead of 2. This will average out the human reaction time error and result in more accurate period of oscillation.

[3]

End Of Paper

