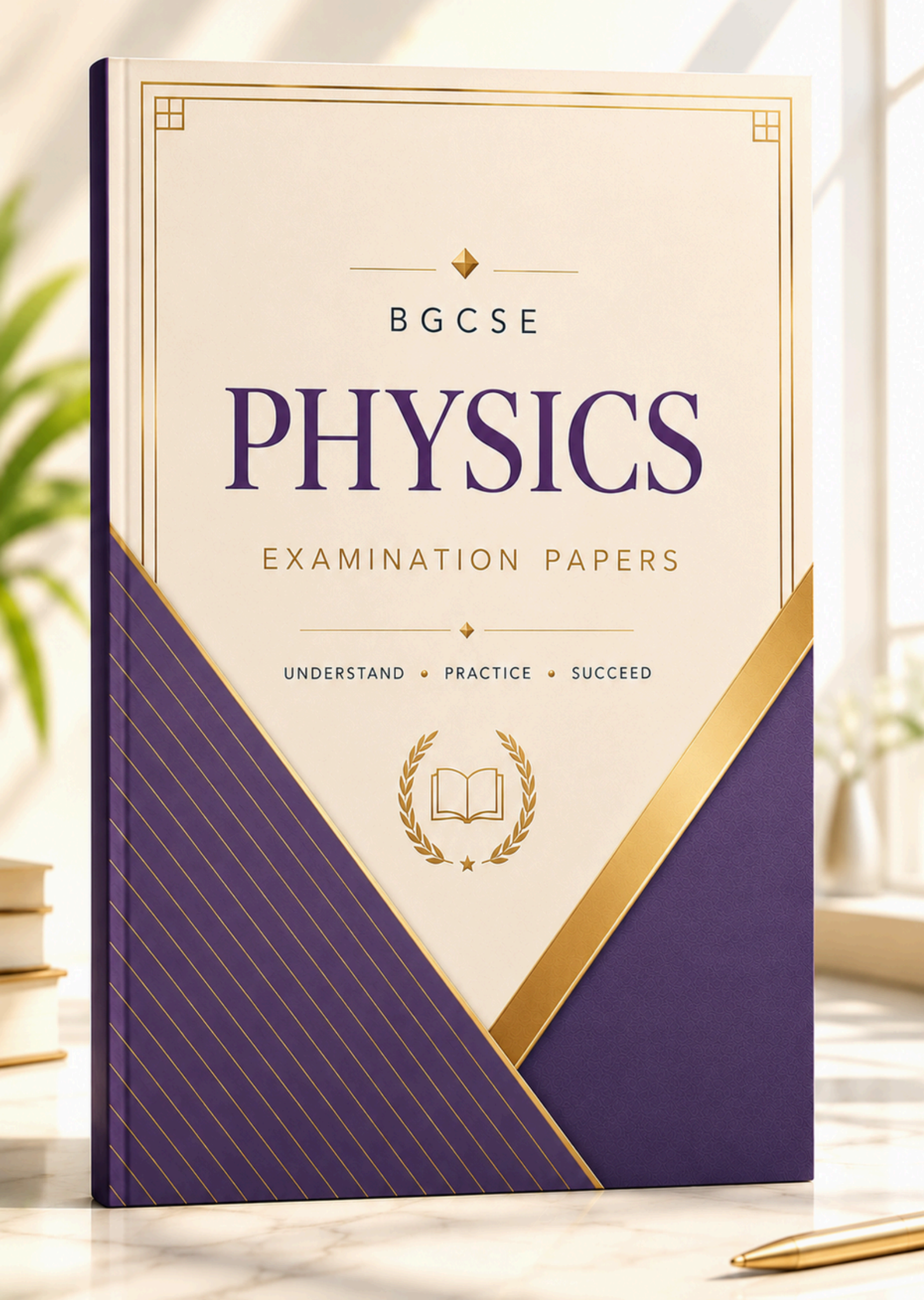
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PHYSICS

PAPER 2 3117/2

Tuesday 30 MAY 2023 1:30 P.M.–3:00 P.M.

Additional materials:
None

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Write your school number, candidate number, surname and initials in the spaces provided above.

Answer **ALL** the questions in this paper in the spaces provided.

Calculators may be used on this paper.

Read each question carefully and make sure you know what you have been asked to do before starting your answer.

Show **ALL** your working when answering numerical questions. Lines are provided on the question paper for your answers. You should write your answers on these lines only.

The mark for each part-question is given in brackets [ ].

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1	
2	
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6	
7	
8	
Total	

This question paper consists of 17 printed pages and 3 blank pages.

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1. This question is about density, the kinetic theory and changes of state.

(a) **Fig. 1.1** shows the heating curve of solid wax as it is gently heated from room temperature (20 °C).

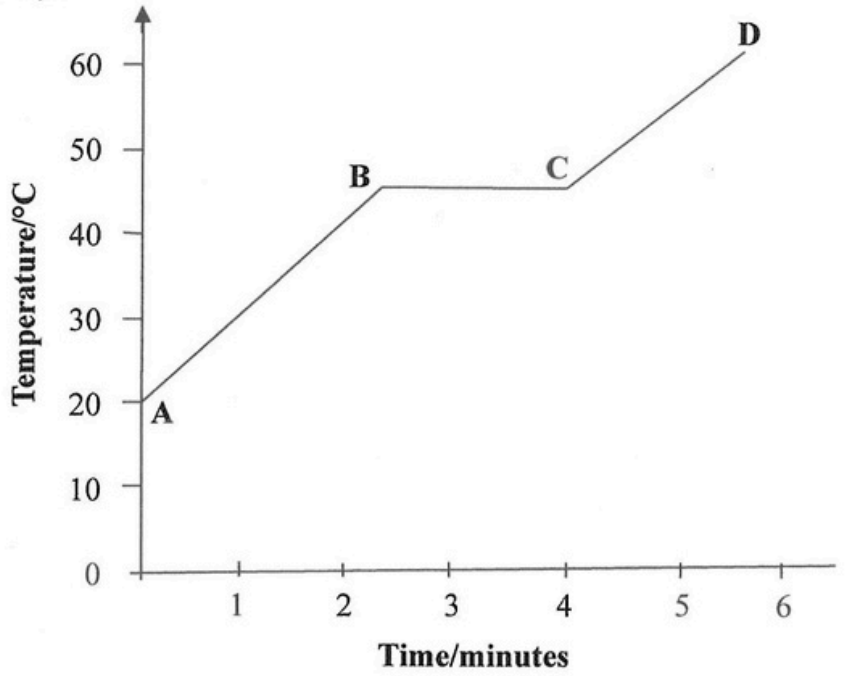


Fig. 1.1

The wax is gently heated.

Explain briefly, in terms of its particles:

- why the temperature of the wax increases from **A** to **B**.

_____

_____

- why the temperature of the wax remains constant from **B** to **C**.

_____

_____ [2]

(b) (i) Name the process occurring from **B** to **C**.

_____ [1]

(ii) State the phase of the wax from **C** to **D**.

_____ [1]

(iii) State what happens to the process occurring in (b) (i), if impurities are added to the wax.

_____

_____ [1]

(c) The table shows the densities of various liquids.

Liquid	**Density (g/cm^3)**
Corn oil	0.9
Rubbing Alcohol	0.8
Honey	1.4

(i) A flask contains 250 g of corn oil.

Use the information in the table to calculate the volume occupied by the corn oil.

[3]

(ii) When measured, the volume of the corn oil was lower than expected.

Suggest which other liquid in the table might have mixed with the corn oil. Give a reason for your answer.

Name of liquid _____

Reason _____

_____ [2]

TOTAL MARKS [10]

2. This question is on forces and motion.

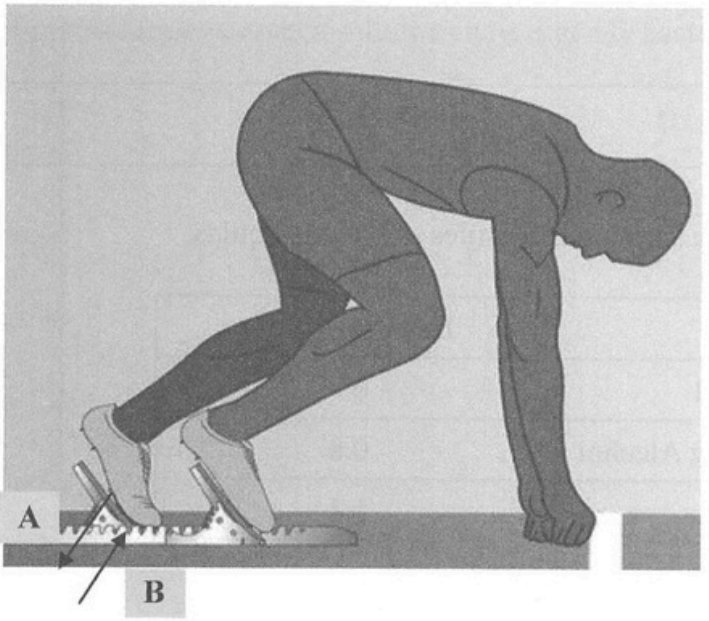


Fig. 2.1

(a) **Fig. 2.1** shows an athlete in the starting blocks.

The athlete pushes in direction **A** resulting in another force in direction **B**. This action occurs in both feet in the starting blocks.

(i) Compare the magnitude of the forces in directions **A** and **B**.

_____

_____ [1]

(ii) State the law of Physics being demonstrated by these two forces.

_____

_____ [1]

(b) In racing out of the starting block, the athlete pushes back and down on the ground as shown by the arrows labelled **C** in **Fig. 2.2**.

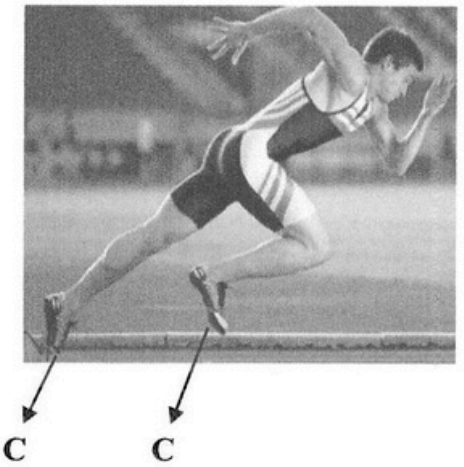


Fig. 2.2

Describe the forces of the ground on the athlete.

_____

_____ [1]

(c) There is a puddle of water on the track.

Explain the impact this can have on the athlete. Give a reason for your answer.

Impact on athlete: _____

_____

_____

Reason: _____

_____

_____

_____ [2]

(d) In the starting blocks, the athlete was initially at rest. The athlete's speed after 6 seconds is 8 m/s.

Calculate the athlete's acceleration in the first 6 seconds. Show working and correct units.

[3]

(e) For the last five seconds of the race, air resistance on the athlete increases.

Suggest how the increase in air resistance affects the motion of the athlete provided all other variables remain constant.

_____

_____ [1]

(f) State one practical way in which athletes could reduce the effect of air resistance during track and field meets.

_____ [1]

TOTAL MARKS [10]

3. This question is about radioactivity.

(a) Name the **two** sub-atomic particles present in the nucleus of an atom.

1 _____

2 _____ [2]

(b) Complete the table to describe the atomic structure of a radioisotope after decay.

Original Mass Number	148	162	163
Original Atomic Number	64	64	64
Emission	Alpha particle without Gamma ray	Beta particle with Gamma ray	Beta particle without Gamma ray
New Mass Number			
New atomic number			

[6]

(c) State the name of a radioactive isotope and give its use.

Name _____

Use _____ [2]

TOTAL MARKS [10]

4. This question is about forces and the stretching of springs.

Fig. 3.1

(a) A rover on Mars has a weight of 223 N. Its mass is 60 kg.

Determine the gravitational constant on Mars. Show working and correct units.

[3]

(b) The stretching of springs obeys Hooke's Law.

State Hooke's Law.

_____

_____

_____ [2]

(c) The apparatus shown is used to investigate the stretching of springs. A meter ruler is used to measure the length of an unloaded spring and it is found to be 7 cm. (g = 10 N/kg).

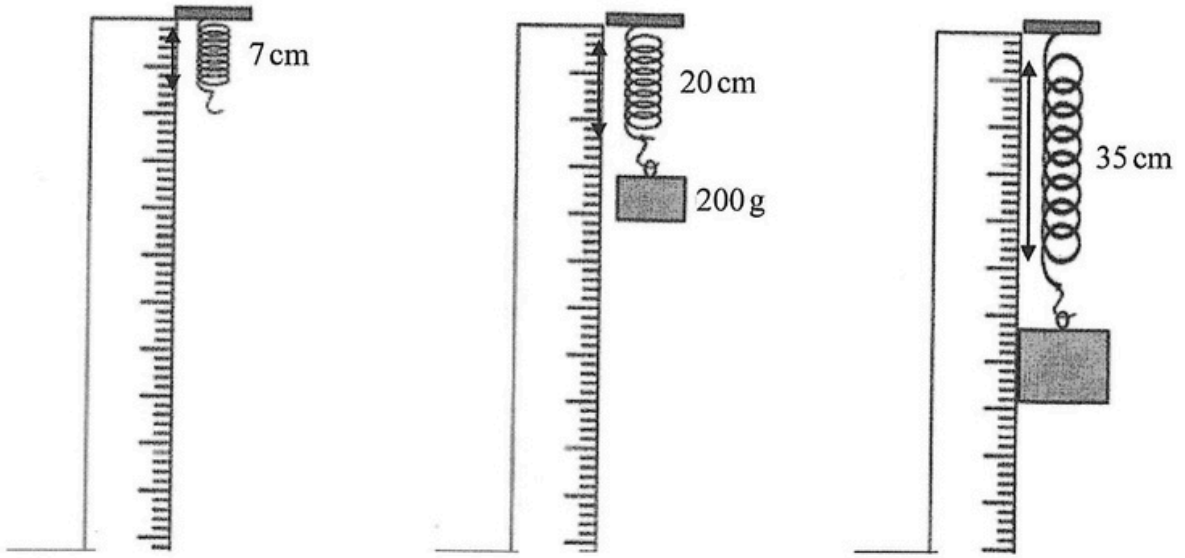


Fig. 3.2

The spring stretches to a length of 20 cm when a 200 g mass is placed at the end of the spring.

(i) Calculate the force, in Newtons, exerted on the spring when a 200 g mass is hung from it.

[2]

(ii) Calculate the extension of the spring when a 200 g mass is hung from it.

[1]

(iii) Calculate the spring constant in N/cm.

[2]

TOTAL MARKS [10]

5. This question is about thermal energy.

(a) Define heat.

_____

_____

_____ [2]

(b) The pot in **Fig. 4.1** has a handle made of wood.

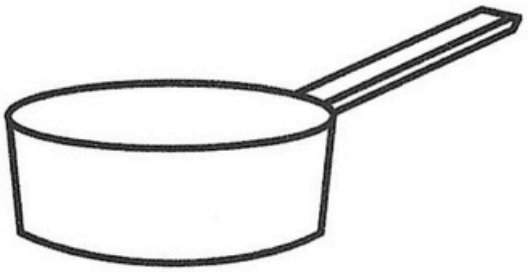


Fig. 4.1

(i) State why the pot handle is made from wood.

_____

_____ [1]

(ii) Name the type of material that may be used to make the pot.

_____ [1]

(iii) State the method of heat transfer that is reduced by the wooden handle.

_____ [1]

(iv) The pot is filled with water. State how heat is transferred throughout the water.

_____ [1]

(c) A greenhouse shown in **Fig. 4.2** is used to keep plants warm in colder climates.

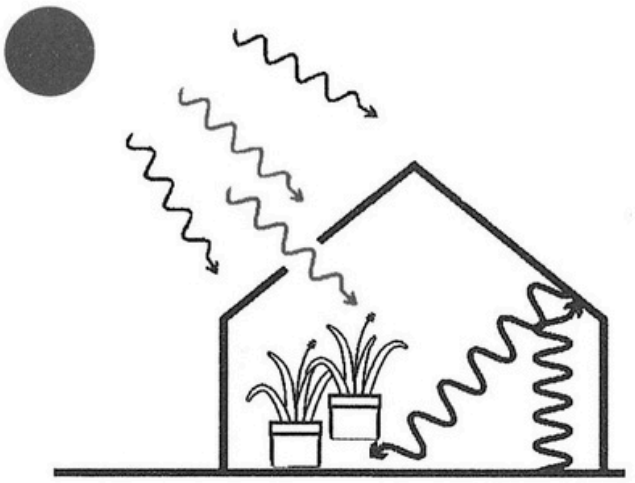


Fig. 4.2

(i) State the method of heat transfer that warms the greenhouse.

_____ [1]

(ii) Explain how heat is trapped in a greenhouse. Your answer should include the words, **ultraviolet** and **wavelength**.

_____

_____

_____

_____

_____ [3]

TOTAL MARKS [10]

6. This question is about waves.

Several students investigate the properties of waves using a ripple tank filled with water. A motor is used to create waves at constant frequency and a light source is used to observe the motion of ripples created on the white screen below the tank as shown in **Fig. 5.1**.

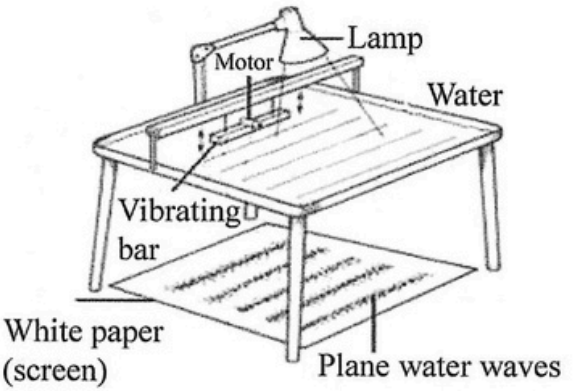


Fig. 5.1

(a) Plane wave fronts strike a barrier placed in the tank as shown in **Fig. 5.2**.

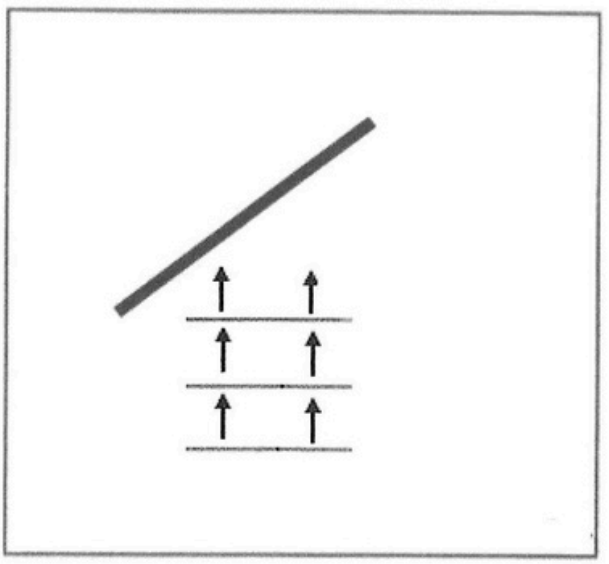


Fig. 5.2

(i) Name the process which occurs.

_____ [1]

(ii) On diagram **Fig. 5.2**, draw **three** wave fronts to show what happens when the water waves strike the barrier. [2]

(iii) State **one** property of the water waves that remain the same and **one** property that changes after the waves strike the barrier.

Property that remains the same _____

Property that changes _____ [2]

(b) The water waves then travel from a deeper to shallower region in the ripple tank as shown in **Fig. 5.3**.

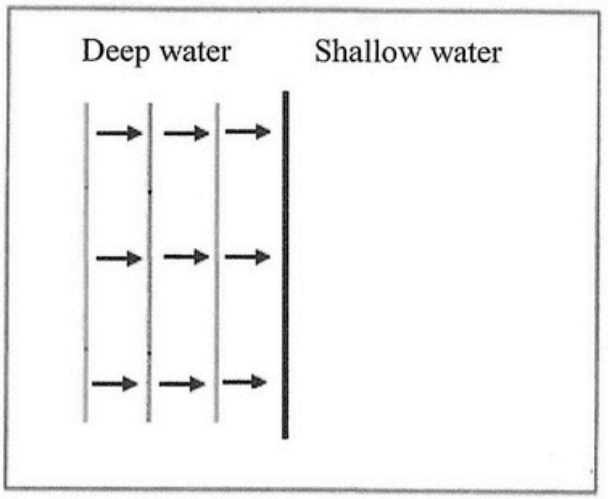


Fig. 5.3

(i) Name the process which occurs.

_____ [1]

(ii) On **Fig. 5.3**, draw **three** wave fronts to show what happens when the water waves travel from a deeper to shallower region. [2]

(c) State **two** properties of the water waves that remain the same when the waves enter the shallow region of water at the angle shown in **Fig. 5.3**.

1 _____

2 _____ [2]

TOTAL MARKS [10]

7. **Fig. 6.1** shows a simple direct current (d.c.) motor.

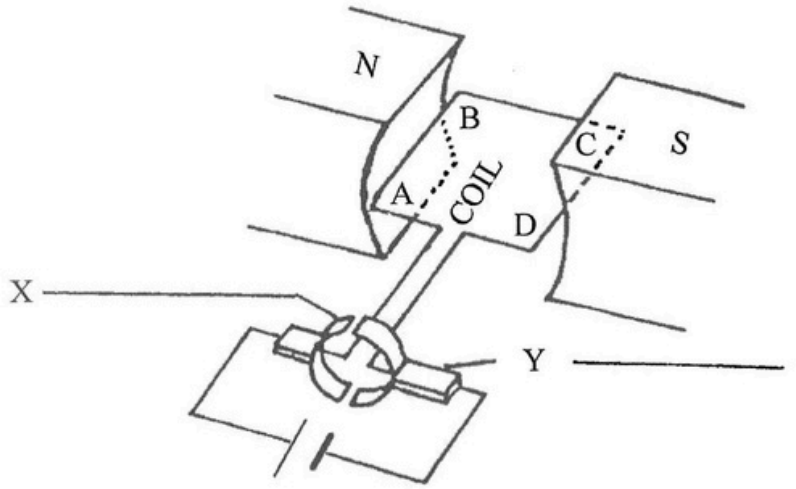


Fig. 6.1

(a) Using **Fig. 6.1**, give the names of the parts labelled **X** and **Y**.

X _____

Y _____ [2]

(b) Complete the table by naming materials suitable for the given parts of the motor.

Part	**Material used**
COIL	Copper Wire
MAGNET	
X	
Y	

[3]

(c) (i) Draw an arrow on the diagram between the magnets to show the direction of the magnetic field. [1]

(ii) Draw an arrow between **A** and **B** on the coil to show the direction of the current. [1]

(iii) Using Fleming's Left-Hand Rule, describe the direction of the force acting on sides **AB** and **CD** of the coil.

_____

_____ [2]

(iv) Describe what happens to the coil because of the forces acting on **AB** and **CD**.

_____ [1]

TOTAL MARKS [10]

8. The circuit diagram in **Fig. 8.1** shows a light-sensing circuit.

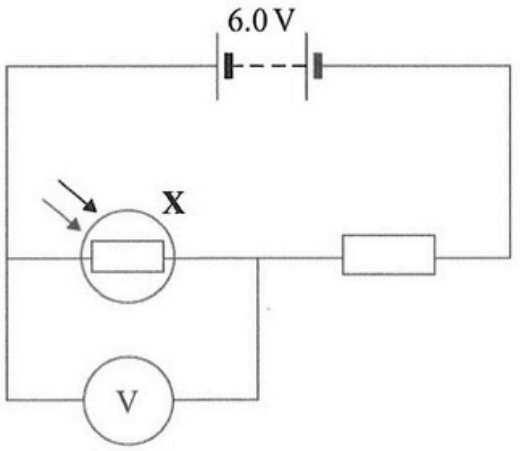


Fig. 8.1

The graph in **Fig. 8.2** shows how the resistance of component **X** varies with light intensity.

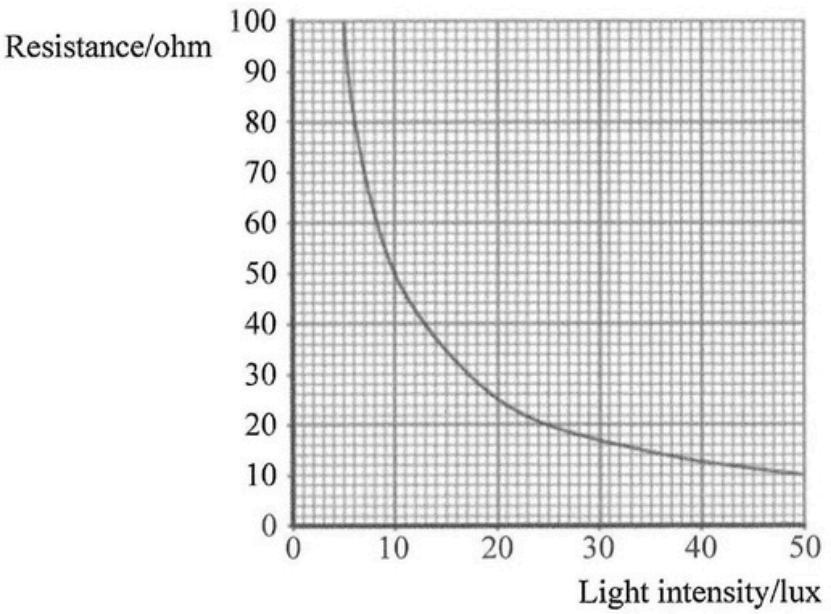


Fig. 8.2

(a) (i) Give the name of component **X** shown in **Fig. 8.1**.

_____ [1]

(ii) Use the graph in **Fig. 8.2** to find the resistance when the light intensity is 40 lux.

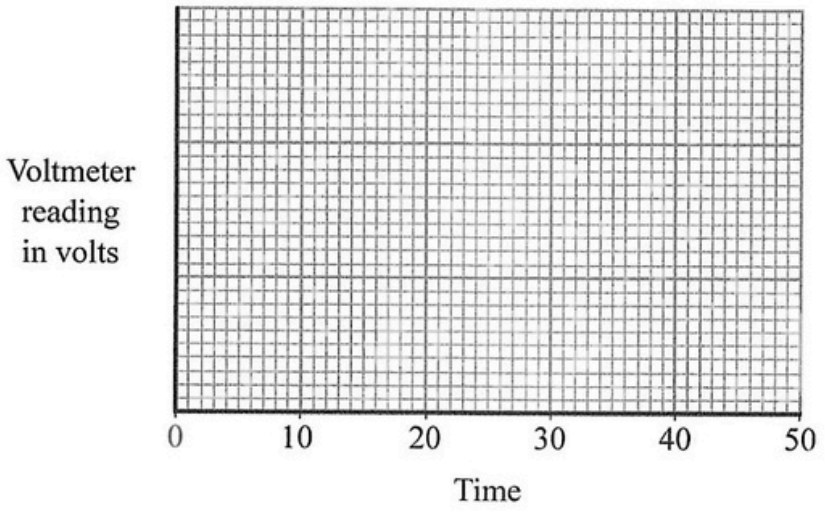
_____ [1]

(iii) At light intensity 40 lux, the current in the circuit is 0.3 A.

Calculate the reading in the voltmeter across component **X**.

[2]

(iv) On the grid shown sketch a graph to show how the voltage across component **X** varies with light intensity.



[2]

(b) **Fig. 8.3** shows a circuit diagram that can be used to perform half-wave rectification.

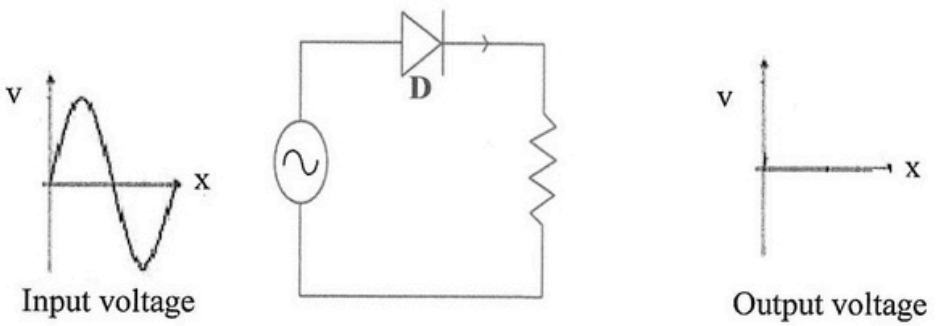


Fig. 8.3

(i) Give the name of component **D** in **Fig. 8.3**.

_____ [1]

(ii) Give the name of the type of input voltage shown in **Fig. 8.3**.

_____ [1]

(iii) On the output axis in **Fig. 8.3**, sketch a graph of the output voltage. [2]

TOTAL MARKS [10]

End]

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