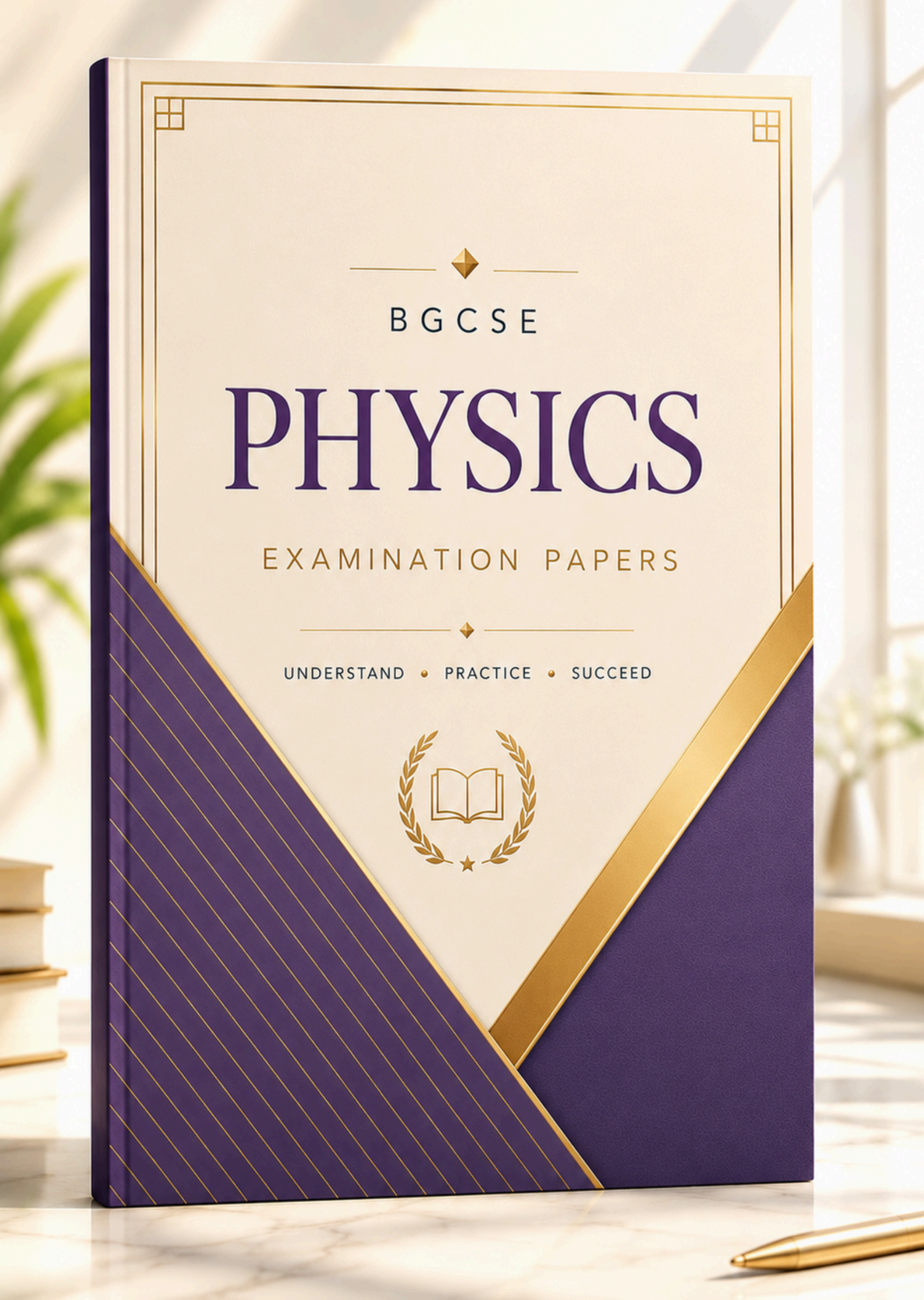
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PHYSICS

PAPER 2 3117/2

Thursday 30 MAY 2024 1:30 P.M.–3:00 P.M.

Additional materials:
None

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INSTRUCTIONS AND INFORMATION TO CANDIDATES

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

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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Total	

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

1. **Fig. 1.1** shows particles of a gas inside a closed container.

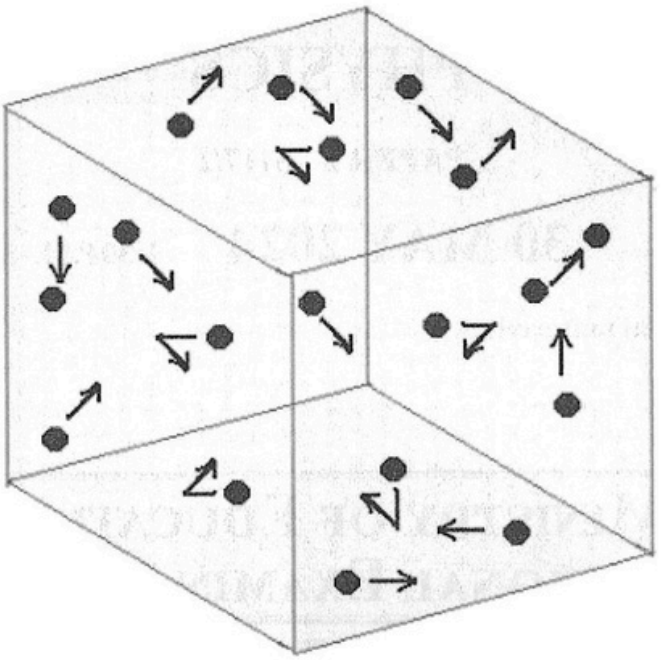

Fig. 1.1

The arrows indicate the movement of the particles inside the closed container.

(a) The gas exerts a pressure on the container.

Describe the movement of the particles in the gas that causes this pressure.

_____

_____ [2]

(b) The gas has a mass of 0.20 g and the container is a cube with sides having a length of 5.0 cm.

Calculate the density of the gas inside the block in g/cm^3.

[3]

(c) Name the process in which the gas is changed to a liquid.

_____ [1]

(d) State two ways in which the pressure of the gas in **Fig. 1.1** can be increased.

1 _____

2 _____

[2]

(e) Define diffusion.

_____

_____ [2]

TOTAL MARKS [10]

2. Trina leaves home and travels to her friend's house. Her journey is described in the table.

Part A	She accelerates from rest to a speed of 25 m/s in 20 s.
Part B	She continues to travel at this constant speed for 30 seconds.
Part C	Finally, she slows to a stop in 5 seconds and arrives at her friend's house.

(a) Draw a speed-time graph to represent each part of Trina's journey on the grid.

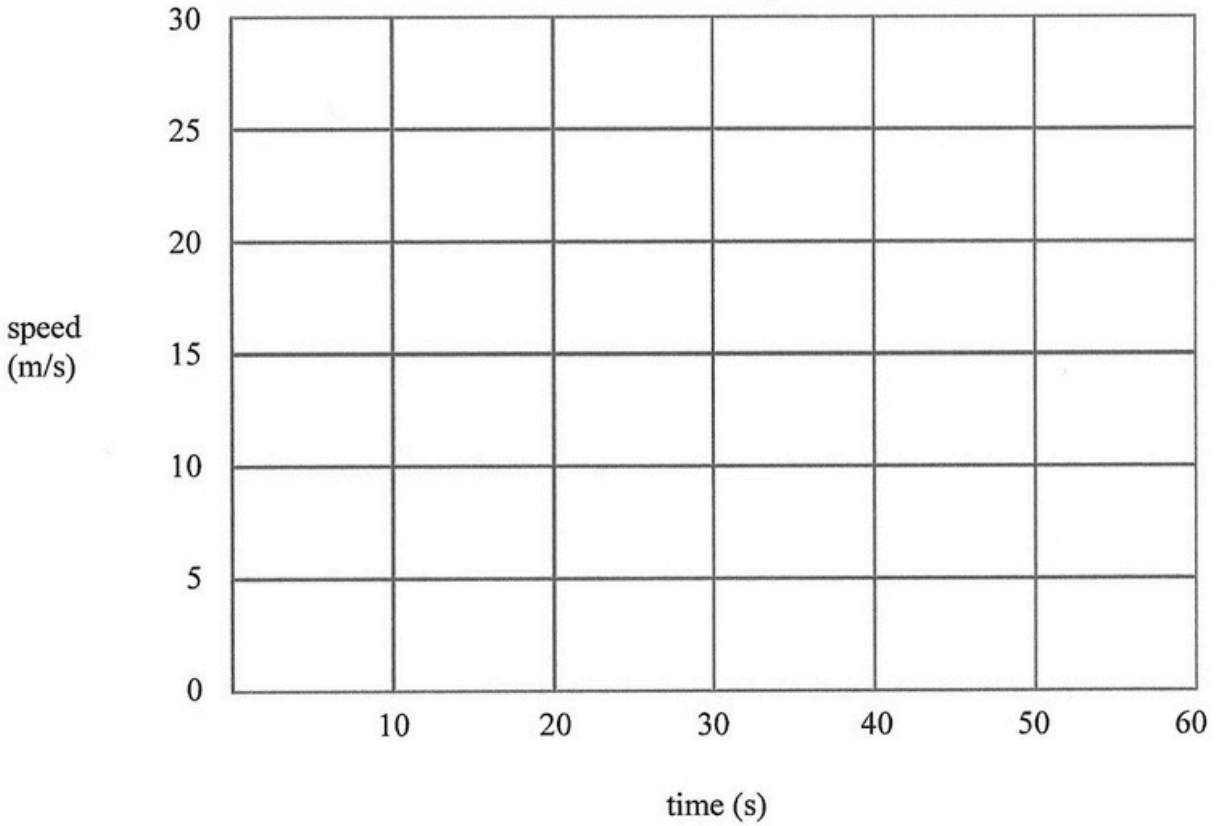

Fig. 2.1

[3]

(b) Calculate the total distance Trina travelled from her home to her friend's house.

[4]

(c) Calculate the average speed for the entire journey.

[3]

TOTAL MARKS [10]

3. **Fig. 3.1** shows a simplified diagram of a mount designed for moving a 0.50 kg camera smoothly over short vertical distances.

When in operation, the camera is placed between a pair of sliding rails and hung from a spring that obeys Hooke's Law. There is no friction between the camera and the rails. The length of the spring is 3.0 cm, when no load is attached.

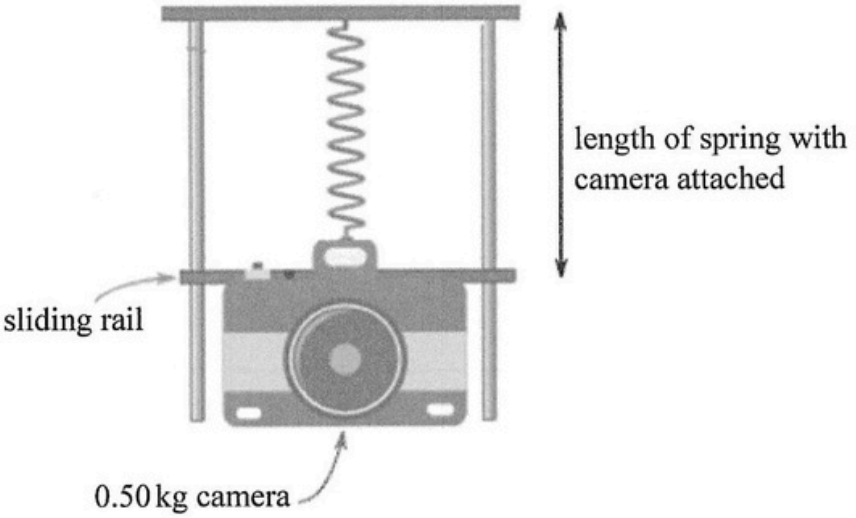

Fig. 3.1

(a) (i) Calculate the weight of the camera if the gravitational field strength acting on it is 10 N/kg.

[2]

(ii) State **two** differences between mass and weight.

1 _____

_____

2 _____

_____

[2]

(b) The camera is suspended from the spring. The new length of the spring is 5.0 cm.

(i) Calculate the extension of the spring.

[1]

(ii) If the spring obeys Hooke's Law, determine the force needed to produce an extension of 5.5 cm.

[2]

(iii) The old camera is replaced by a new camera weighing 6.5 N.

Calculate the total length of the spring when the new camera is attached.

[3]

TOTAL MARKS [10]

4. **Fig. 4.1** shows a swimming complex with two diving boards, **A** and **B** placed at different heights above a pool. Divers can climb stairs to get to each diving board.

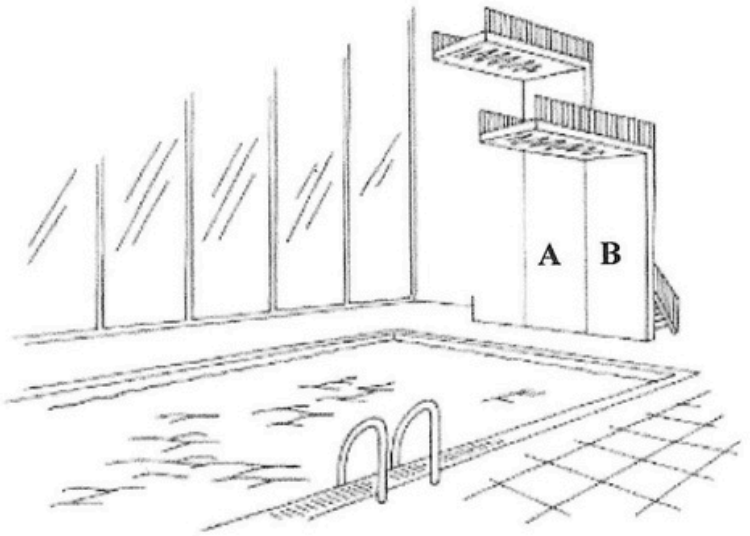

Fig. 4.1

While training, a diver with a mass of 60 kg routinely dives from the lower diving board **B**, and then from the higher diving board **A**. Gravitational field strength on the diver is 10 N/kg. Assume the effects of friction and air resistance acting on the diver are negligible.

(a) The diver climbs the stairs in 8.0 s to diving board **B**, which is at a height of 7.5 m.

(i) Calculate the gravitational potential energy of the diver when he is on diving board **B**.

[2]

(ii) Calculate the power developed by the diver in climbing the stairs onto diving board **B**.

[2]

(iii) State the energy change that take place as the diver dives from diving board **B**.

_____ [1]

(iv) Using the gravitational energy in (i) and the formula for kinetic energy, calculate the speed of the diver just before hitting the water.

[3]

(b) The diver then climbs from the pool onto diving board **A**. The useful work done by the diver in climbing onto diving board **A** is 6000 J.

Calculate the difference in heights of diving boards **A** and **B**.

[2]

TOTAL MARKS [10]

5. When white light passes through a glass prism, it splits into its constituent colours.

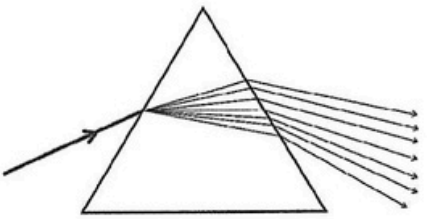

Fig. 5.1

(a) State the name given to this phenomenon.

_____ [1]

(b) Of the visible colours that emerge after the process described in (a), name the:

- colour that has the smallest wavelength.

_____ [1]

- colour that has the lowest frequency.

_____ [1]

(c) State **two** applications of sound waves.

1 _____

2 _____

[2]

(d) All electromagnetic waves travel at the speed of light (3×10^8 m/s).

(i) State **two** other properties of all electromagnetic waves.

1 _____

2 _____

[2]

(ii) The frequency of one such wave found to be is 300 kHz.

Calculate the wavelength of this wave.

[3]

TOTAL MARKS [10]

6. The diagram below shows the atomic arrangement of the particles in and around the nucleus of an atom.

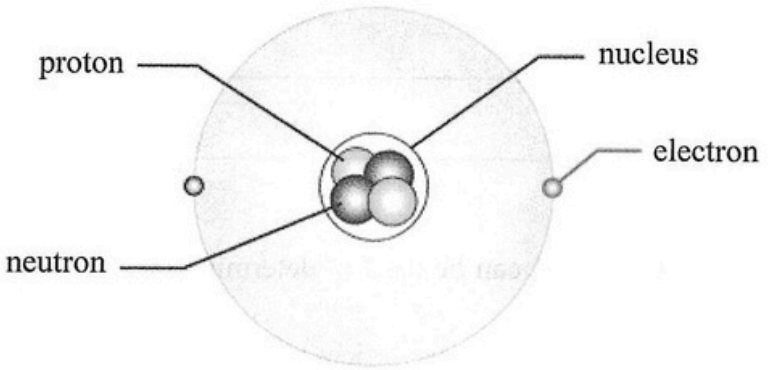

Fig. 6.1

(a) Complete the table below for each of the elements or isotopes listed. The atomic number of carbon is 6.

Element/Isotope	number of protons	number of electrons	number of neutrons
carbon-12			
carbon-14			

[3]

(b) Carbon-14 undergoes beta decay to form nitrogen-14 as shown in the equation.

$$ {}^{a}_{b}\mathrm{C} \longrightarrow {}^{c}_{d}\mathrm{N} + {}^{e}_{f}\beta $$

Complete the table below identifying the value of each of the letters shown.

a	b	c	d	e	f

[3]

(c) The half-life of carbon-14 is 5700 years. Explain the meaning of the word half-life.

[2]

(d) Explain how carbon-14 can be used to determine the age of fossils containing organic matter.

[2]

TOTAL MARKS [10]

7. This question is about simple electronic devices.

Fig. 7.1 shows a simplified circuit which uses a light dependent resistor (LDR) to operate a security lamp.

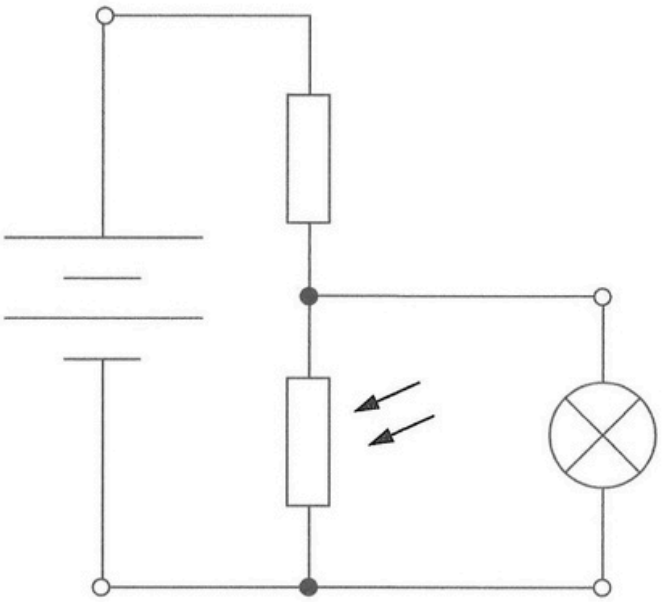

Fig. 7.1

(a) In dark conditions, state what happens to the:

- resistance of the LDR.

_____ [1]

- potential difference across the LDR.

_____ [1]

- current through the LDR.

_____ [1]

- current through the security lamp parallel to the LDR.

_____ [1]

(b) On **Fig. 7.2** below, sketch a graph which shows how the resistance of a light dependent resistor varies with light intensity.

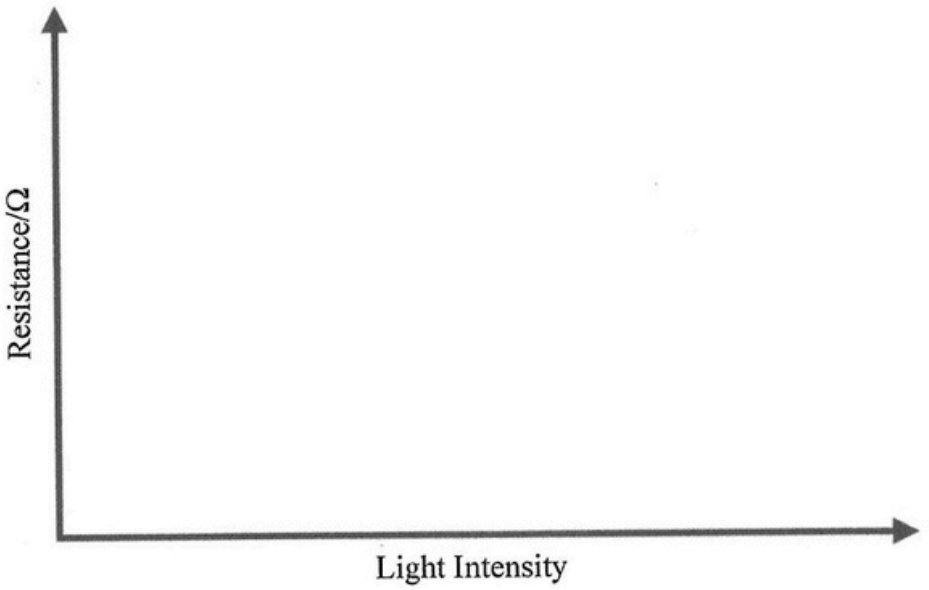

Fig. 7.2

[2]

(c) **Fig. 7.3** shows a circuit with a fixed resistor of resistance 2.0 kΩ in series with a LDR, whose resistance is 25 kΩ, at a particular light intensity. The 6.0 V battery used in the circuit has negligible resistance.

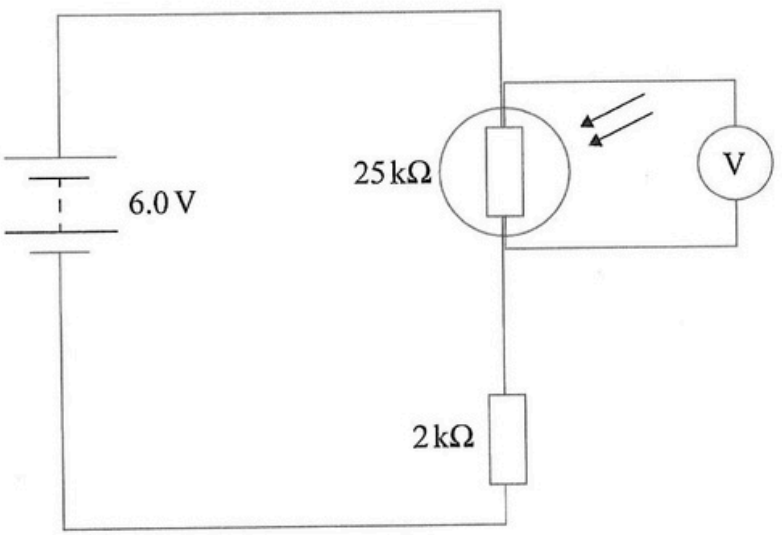

Fig. 7.3

At this light intensity, calculate the

- current in the circuit.

[2]

- voltmeter reading.

[2]

TOTAL MARKS [10]

8. (a) **Fig. 8.1** shows two conducting plates **A** and **B** which are parallel to each other and connected to a steady voltage. A steady beam of electrons is passed between the plates and aimed at a fluorescent screen, which illuminates when the beam strikes it.

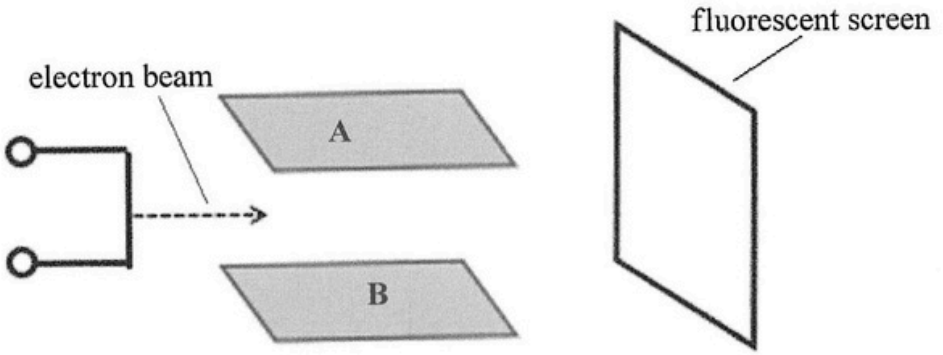

Fig. 8.1

(i) On **Fig. 8.1** draw the path of a beam of electrons which passes between plate **A** which is positively charged, and plate **B** which is negatively charged.

Indicate where the beam strikes the fluorescent screen. [1]

(ii) Explain why this path is observed.

_____

_____

_____ [2]

(iii) Describe what would happen to the path of the beam when the potential difference across the plates is zero.

_____

_____ [1]

(b) A student connects four resistors as shown in **Fig. 8.2**.

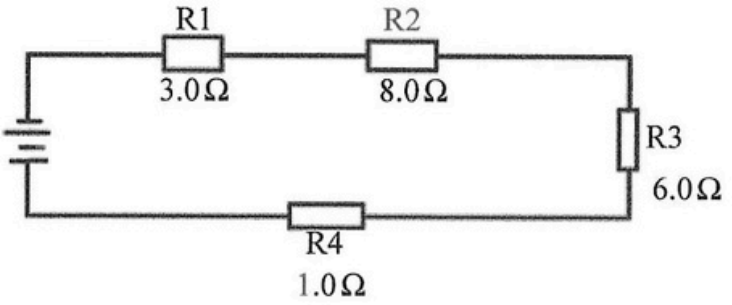

Fig. 8.2

(i) Determine the total resistance.

[2]

(ii) The student then connects an ammeter in the circuit. The reading is shown in **Fig. 8.3**.

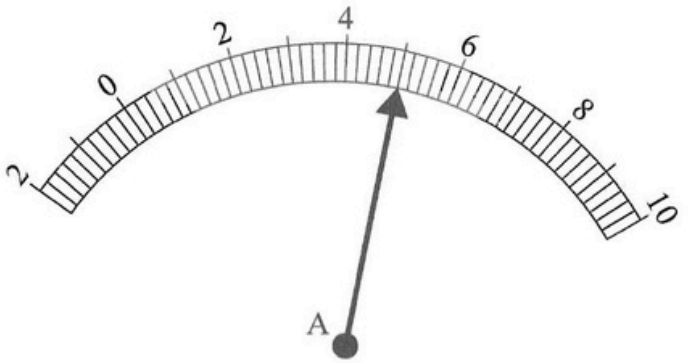

Fig. 8.3

State the reading on the ammeter.

_____ [1]

(iii) Calculate the smallest possible resistance that can be made by connecting two of the resistors in parallel.

[3]

TOTAL MARKS [10]

End]

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