Candidate Name	Form Class	Index Number

ANG MO KIO SECONDARY SCHOOL
END-OF-YEAR EXAMINATION 2025
SECONDARY THREE EXPRESS

SCIENCE (PHYSICS, CHEMISTRY) **5086/02**
Paper 2 Physics **7 October 2025**
1 hour 15 minutes

Setter: Mr Chow Yan Bin

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Name, Class and Index Number in the spaces at the top of this paper.
You may use an HB pencil for any diagrams, graphs or rough working.
Write in dark blue or black pen.
Do not use staples, paper clips, highlighters, glue or correction fluid/tape.

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

Section A
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B
Answer **one** question.
Write your answers on the spaces provided.

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

This document consists of **16** printed pages.

Section A

Answer **all** the questions in this section.

1 **(a)** Complete Table 1.1 by indicating the missing prefixes, symbol and value.

Table 1.1

prefix	symbol	value
kilo	k	10^{3}
		10^{9}
	μ	10^{-6}
mega	M	

[3]

(b) Circle all the scalar quantities in the list below.

velocity **time** **density** **energy** **pressure** **weight**

[1]

[Total: 4]

2 A student uses a metre rule to determine the diameter of a golden sphere.
Fig. 2.1 shows five golden spheres lined up beside each other with two wooden blocks supporting them at the sides.

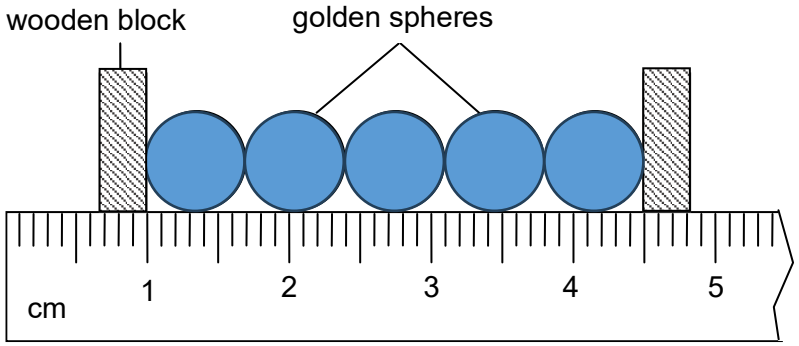

Fig. 2.1

(a) Determine the average diameter of one golden sphere.

average diameter = …….... cm [2]

(b) The student realised that this method is not accurate.

State the instrument he should use instead and explain why it is better to use this instrument to measure the diameter of one golden sphere.

……

……

……

……..... [2]

[Total: 4]

3 Fig. 3.1 shows a car of mass 850 kg travelling on a road. The forward driving force has a constant value of 2500 N.

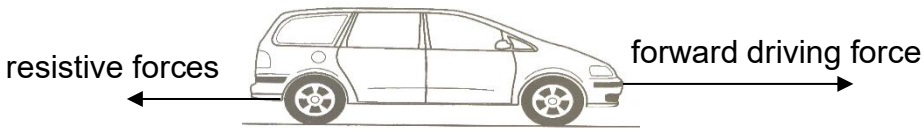

Fig. 3.1

Fig. 3.2 shows a graph of the resultant force that acts on the car against time.

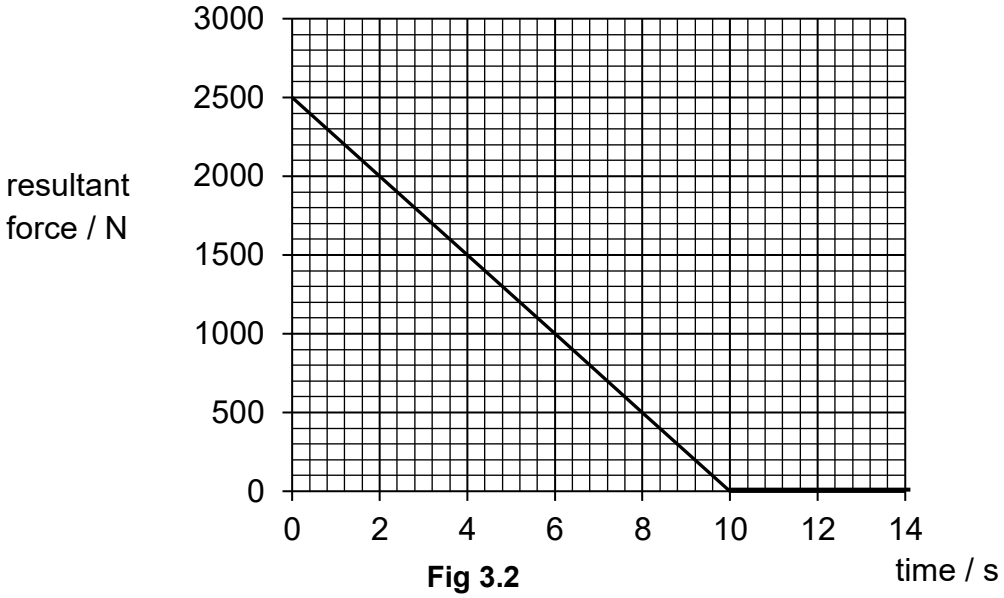

Fig 3.2

(a) Name **two** resistive forces acting on the car.

1 ……

2 ……

[2]

(b) Using Fig. 3.2, describe the speed of the car

(i) from 0 s to 10 s,

……

……

[2]

(ii) from 10 s to 14 s.

……

[1]

(c) **(i)** Explain, in terms of the forces acting, why the resultant force acting on the car decreases as the speed of the car increases.

……....

……
[1]

(ii) State the time interval when the total resistive force is a maximum value. Explain your answer.

Time interval

……....

explanation

…….....

.....……..
[2]

(d) Determine the time when the resistive force is 700 N.

time = ... s [2]

[Total: 10]

4 A student visited a farm to learn about modern farming techniques. The farmer drives a vehicle, as shown in Fig. 4.1, with six wheels across the field.

Fig. 4.1

(a) State what is meant by *pressure*.

……

…… [1]

(b) Assume that the weight of the vehicle is distributed uniformly over the six wheels.

The area of each wheel in contact with the ground is 0.040 m^2.
Each wheel exerts a pressure of 199 kPa on the ground.

(i) Calculate the force exerted by **each** wheel on the ground, leaving your answer in kN.

force = ……..……..... kN [2]

(ii) Using your answer in **(b)(i)**, calculate the **total** weight of the vehicle, leaving your answer in kN.

total weight = ……..……..... kN [2]

4 **(c)** The vehicle went on to a soft marshy ground.

The farmer stops the vehicle and steps down on to the soft marshy ground with both his boots touching the ground.

(i) The farmer has a weight of 850 N and the total area of the sole of his boots is 5.0×10^{-4} m.

Calculate the pressure exerted by the famer on the soft marshy ground.

pressure = ……..……..…… [2]

(ii) Explain why the farmer is more likely to sink into the soft marshy ground than the vehicle.

……..……

……..……

……..……

…… [2]

(iii) Suggest **one** way in which the farmer could avoid sinking into the soft marshy ground.

……..……..

…… [1]

[Total: 10]

5 **(a)** Fig. 5.1 shows a force *F* on an object at point P. The object is free to rotate about an axis at point X that is perpendicular to the page.

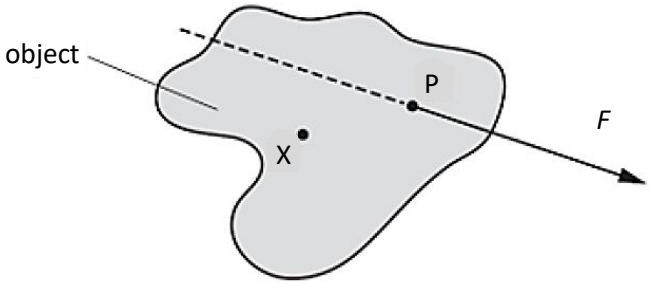

Fig. 5.1

Besides force *F,* state the other quantity used to calculate the moment of *F* about the axis at point X. Label this quantity on Fig. 5.1.

…… [1]

(b) A worker carries a ladder on his shoulder which acts as a pivot. Fig. 5.2 shows that the ladder is in a horizontal equilibrium position.

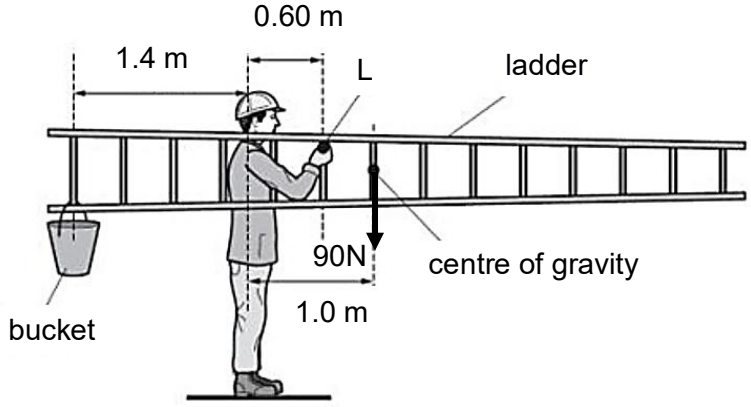

Fig. 5.2

The ladder is wider at one end than at the other end. The weight of the ladder is 90 N.

(i) Explain why the centre of gravity of the ladder is not half-way along its length.

……

…… [1]

(ii) State the *principle of moments.*

……

…… [2]

(iii) The centre of gravity of the ladder is 1.0 m from the worker's shoulder.

Calculate the moment due to the weight of the ladder about the worker's shoulder.

moment = …….. [2]

(iv) A bucket of weight 100 N is suspended from the ladder at a horizontal distance of 1.4 m from the worker's shoulder as shown on Fig 5.2.

The worker keeps the ladder horizontal by exerting a vertical force with his right hand at point L, at a horizontal distance of 0.60 m from his shoulder.

Determine the magnitude and direction of the force exerted at L.

magnitude of force = ……..

direction of force = …….. [3]

(v) Suggest what the worker should do to reduce the amount of force applied by his right hand at L in **(b)(iv)**.

……

…… [1]

[Total: 10]

6 Substance X has a melting point of 98 °C and a boiling point of 800 °C.

(a) Describe how the particles in substance X at 81 °C and 880 °C differ in terms of

(i) their arrangement,

……

……

……

…… [2]

(ii) their motion.

……

……

……

…… [2]

(b) Fig. 6.1 shows how three blocks made from three different substances X, Y and Z behave when each block is placed in the same liquid.

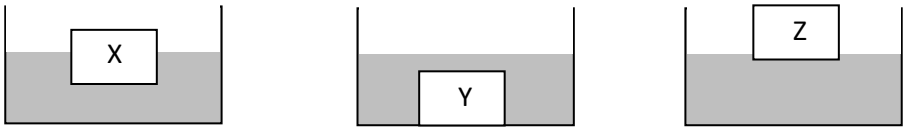

Fig. 6.1

(i) Arrange the blocks X, Y and Z in order of increasing density.

……→……→…… [1]

(ii) When Y is placed in a measuring cylinder containing 50 cm^3 of liquid, the liquid level rises to 75 cm^3, with Y completely submerged.

Given that the mass of Y is 23.8 g, calculate its density.

density = ……g/cm^3 [2]

[Total: 7]

7 Fig. 7.1 shows an electric heater placed near the surface of some water placed in a metal container. Two temperature sensors A and B are placed at the positions shown and the temperature data is recorded by a temperature recorder.

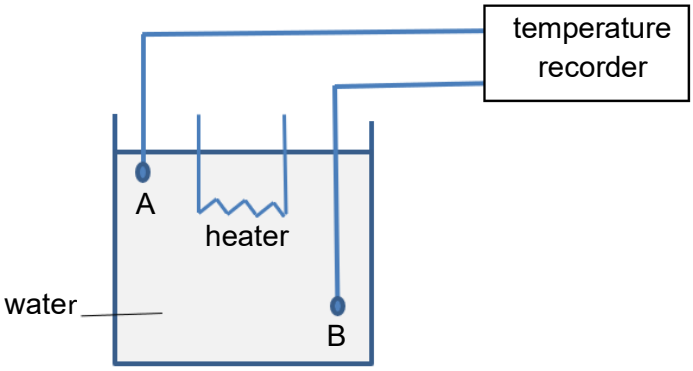

Fig. 7.1

Fig. 7.2 shows the how the temperatures of sensors A and B change over time.

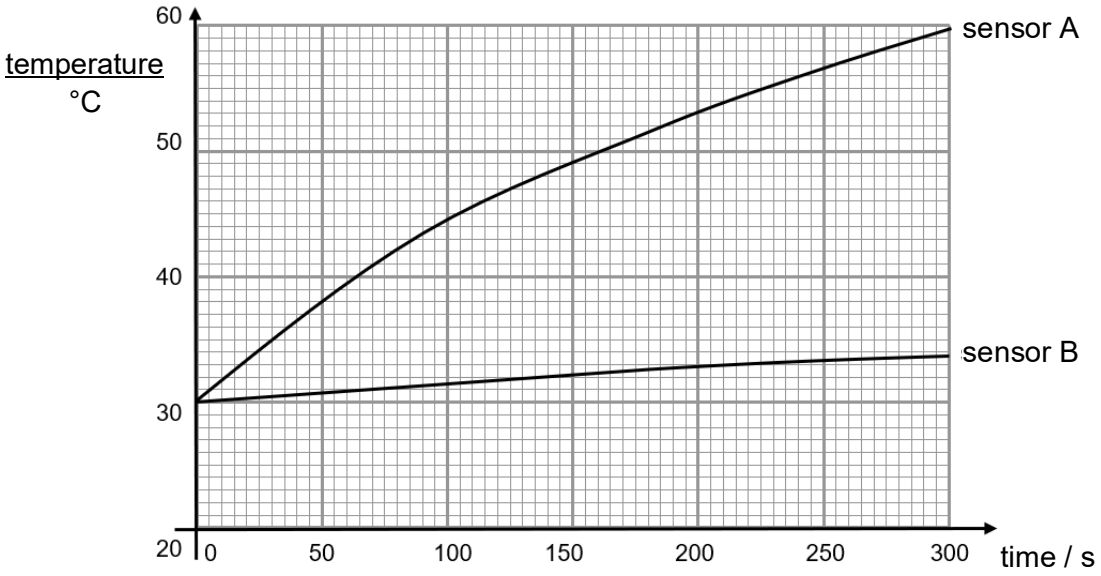

Fig. 7.2

(a) State one difference between conduction and convection.

……

……

…… [1]

(b) **(i)** Describe the difference in the temperature readings of the two sensors.

……

…… [1]

(ii) Describe how convection current is set up in the water in the metal container.

……..

……..…

……..…

…….. [2]

(iii) Hence, explain the difference in the temperature readings of the two sensors after 300 s.

……..……

……..……

……..……

……..…… [2]

(c) Describe, in molecular terms, how thermal energy is transferred from the hot water to the surrounding through the wall of the metal container by conduction.

……..

…….....

…….....

…….....

……..... [2]

(d) State and explain the colour to be painted for the container walls so that sensor A can reach a higher temperature.

……..

…….....

…….....

……..... [2]

[Total: 10]

Section B

Answer **one** question from this section.

8 A stunt man has one end of a thick elastic cord attached to him and the other end of the cord is firmly attached to a point on a high bridge.

When the man jumps from the bridge from rest, he falls freely under gravity for 2.5 s. Take acceleration of free fall to be 10 m/s^2 and assume that the man is initially at rest.

(a) (i) Calculate the vertical speed the man acquires at the end of his free fall.

vertical speed = …… m/s [2]

(ii) Sketch a speed-time graph for the vertical motion of the man during his free fall. Indicate clearly the speed and time involved.

[2]

(iii) Hence or otherwise, calculate the vertical distance fallen.

vertical distance = …… m [1]

(b) Suggest **one** reason why, in a real jump, the distance fallen in 2.5 s and the speed reached would be less than your calculated answers, even though the cord was slack throughout the 2.5 s

……..

……..
[1]

(c) After 2.5 s, the cord begins to stretch, and the man continues to fall downward. Eventually his downward acceleration becomes zero.

(i) Explain why his downward acceleration becomes zero.

……..

……..

……. [2]

(ii) Describe the energy pathway that brings about the energy transfer when the man bounces up again after reaching the lowest point.

……..

……..

……..

……. [2]

[Total: 10]

9 Fig. 9.1 shows a rollercoaster track with a carriage at **P**.
The total mass of the carriage and passengers is 3500 kg.
The carriage starts from rest at **P** and is pulled up to **P** by a motor.
The carriage moves along the frictionless track from point **P** to point **Q**, which is 30 m vertically below.

Assume that there is no air resistance.
The gravitational field strength, g, is 10 N/kg.

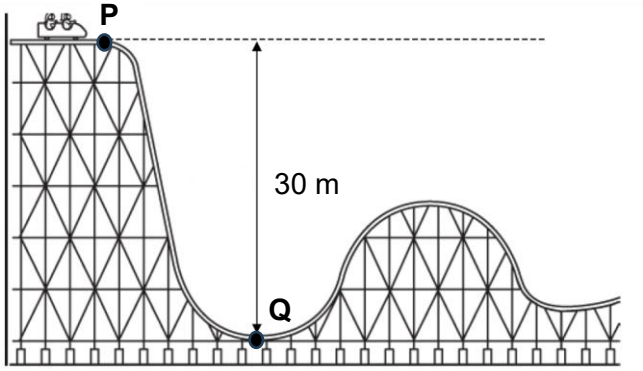

Fig. 9.1

(a) State the *Principle of Conservation of Energy*.

……

……

……

…… [2]

(b) Describe the energy transfer that takes place when the carriage moves from point **P** to point **Q**.

……

……

……

…… [1]

(c) **(i)** Calculate the amount of energy in the gravitational potential store of the carriage when it is at point **P**, relative to point Q.

energy in the gravitational potential store = ……....J [2]

(ii) The motor pulls the carriage to point **P** in 2 minutes.

Using your answer from **(c)(i)**, calculate the output power of the motor.

power = ……..……..…..W [2]

(d) **(i)** Using the Principle of Conservation of Energy, calculate the speed of the carriage as it reaches point **Q**.

speed = ……...m / s [2]

(ii) In an actual situation, state why the speed of the carriage at point **Q** would be *less than* the value calculated in **(d)(i)**.

……..……..……

……..….. [1]

[Total: 10]

END OF PAPER