

Annual Examinations for Secondary Schools 2022

YEAR 9 **PHYSICS** **TIME: 2 hours**

Name: _____

Class: _____

INFORMATION FOR CANDIDATES

- Where necessary take acceleration due to gravity 'g' to be 10 m/s².
- The use of a calculator is allowed.
- The number of marks for each question is given in brackets [] at the end of each question.
- You may find these equations useful.

Density	$m = \rho V$		
Pressure	$P = \rho g h$	$F = P A$	
Forces	$W = m g$		
Moments	Moment = F × perpendicular distance		
Energy	$P.E. = m g h$	$K.E. = \frac{1}{2} m v^2$	Work Done = F s
	Work Done = Energy Converted		$E = P t$
Heat	$Q = m c \Delta \theta$		

INSTRUCTIONS TO CANDIDATES:

- Use blue or black ink. Pencil should be used for diagrams only.
- Read each question carefully and make sure that you know what you have to do before writing your answer.
- Answer ALL questions.
- All working must be shown.

This document consists of 12 printed pages

For Examiner's Use Only

Question	Max	Mark
1	8	
2	8	
3	8	
4	8	
5	8	
6	15	
7	15	
8	15	
Total	85	

SECTION A

Each question carries 8 marks.

This section carries 40 marks of the total marks for this paper.

1. The Solar system is part of the Milky Way.

a) Fill in the spaces:

The Milky Way is a _____. The solar system is made up of _____ major planets. The Earth orbits the Sun once in _____ days. [3]

b) Figure 1 shows the Earth orbiting around the Sun. A, B, C and D are four regions of the Earth.

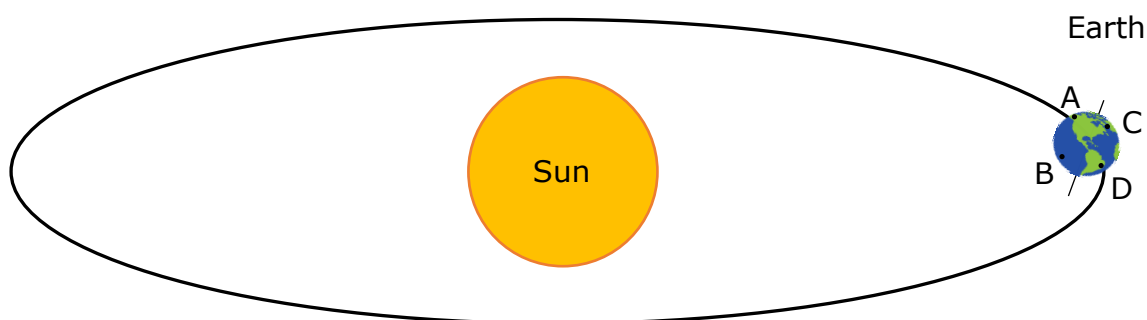


Figure 1

- i) State the regions experiencing night time. _____ [1]
- ii) State the regions experiencing summer time. _____ [1]
- c) Figure 2 shows the moon in orbit around the Earth. The direction of the Moon's velocity is shown with an arrow.

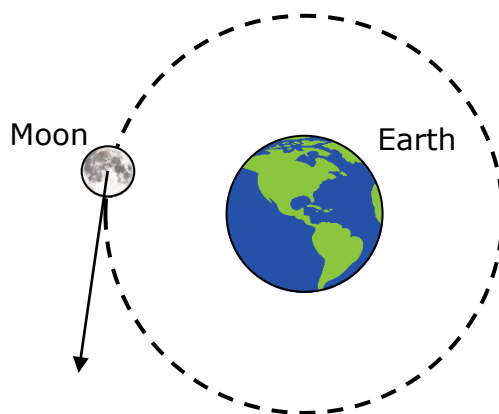


Figure 2

- i) Draw an arrow to show the direction of the force which keeps the Moon in orbit around the Earth. [1]
- ii) Name the force you have drawn. _____ [1]
- iii) Underline the correct word:
The size of this force depends on the (distance, direction) of the Moon from the Earth. [1]

2. Matter is classified into three states: solids, liquids, and gases. Figure 3 below shows an aluminium block immersed in water. Box C represents the particles of the aluminium block.

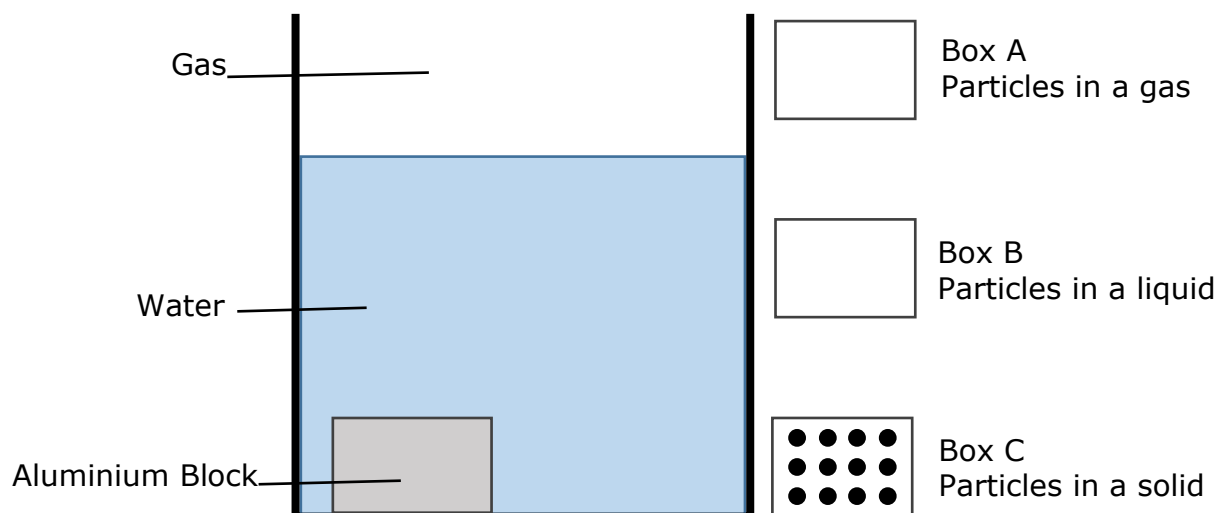


Figure 3

- a) Draw particles in Box A and Box B to represent the spacing of particles in a gas and in a liquid. [2]

- b) Describe the motion of the particles:

i) in a solid.

_____ [1]

ii) in a gas.

_____ [1]

- c) With reference to Figure 3 above, explain why gases can easily be compressed while liquids and solids cannot be compressed.

_____ [1]

- d) The block of aluminium has a volume of 0.000024 m^3 and a mass of 0.0648 kg . Determine its density.

_____ [2]

- e) If the density of water is 1000 kg/m^3 , explain how one can predict that the aluminium block will sink.

_____ [1]

3. Kyle sets up the apparatus shown in Figure 4 to determine the specific heat capacity of water. Before switching on the heater, he notes that the thermometer reading is 23°C . He then switches on the heater for 7 minutes and records the final temperature.

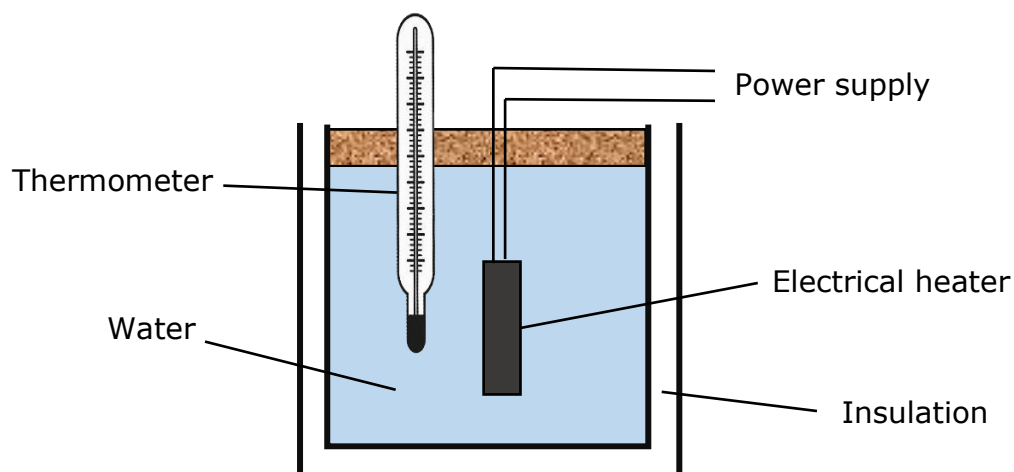


Figure 4

- a) Mention ONE piece of apparatus that Kyle needs to use to make sure that all the water inside the beaker has the same temperature.

_____ [1]

- b) The electrical heater has a power rating of 50 W. Calculate the energy supplied by the heater if it is switched on for 7 minutes.

_____ [3]

- c) Kyle found the final temperature to be 31°C . Calculate the rise in temperature.

_____ [1]

- d) Calculate the specific heat capacity of water if it has a mass of 0.5 kg.

_____ [2]

- e) The actual value of specific heat capacity of water is $4200 \text{ J/kg}^{\circ}\text{C}$. Give a reason why the value obtained by Kyle is larger than the actual value of the specific heat capacity of water.

_____ [1]

4. Robert wanted to investigate Hooke's law.

- a) He hangs a spring next to a vertical ruler, as shown in Figure 5. Then he attaches a 20 N weight to the spring and reads the extension produced.

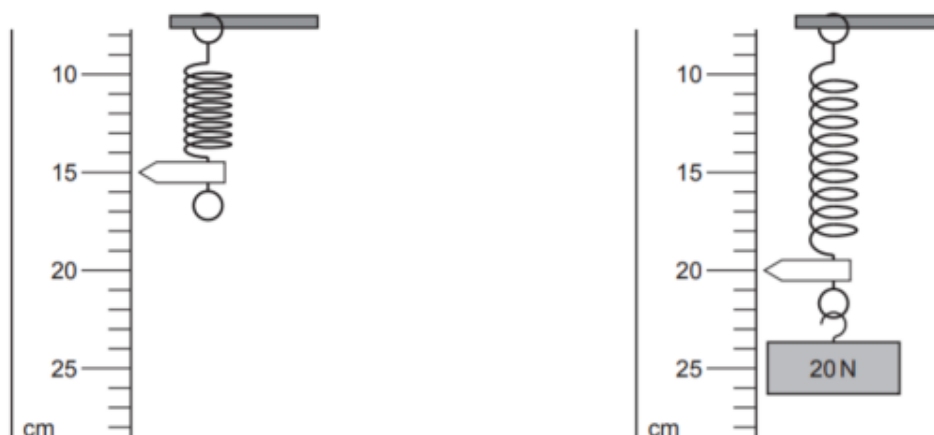


Figure 5

- i) Calculate the extension of the spring in metres.

_____ [2]

- ii) When he adds another 20 N weight, the extension doubles. Describe the relationship between force and extension.

_____ [1]

- b) Using a different spring, he obtained the data shown in the table below.

Force (N)	Extension (cm)
0	0
2	4
4	8
6	12
8	16
10	28

- i) Underline the correct answer:

From the results obtained, the stiffness of the new spring is (greater than, the same as, smaller than) the one used in part a). [1]

- ii) Explain your answer in b) i).

_____ [1]

- iii) Robert concluded that for the whole range of forces used, the spring obeyed Hooke's law. Using the data in the above table, explain if he is correct.

_____ [2]

- iv) State what happens to the spring if the elastic limit is exceeded.

_____ [1]

5. Figure 6 shows a force F acting in different situations.



Figure 6

a) State what is meant by moment of a force.

_____ [1]

b) Name the situation in Figure 6 where a moment is not produced.

_____ [1]

c) A student holds a ruler at one end and hangs a weight as shown in Figure 7.

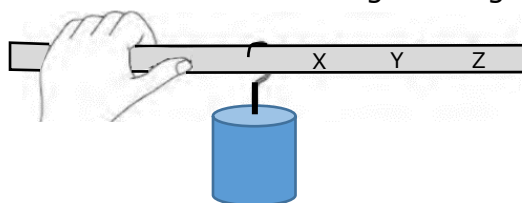


Figure 7

Name the point, X, Y or Z, where there is the greatest moment. Explain.

_____ [2]

d) In a human arm, the biceps muscle provides the force needed to hold the arm horizontal. Maria makes a model as shown in Figure 8, where she uses a rubber band to represent the biceps muscle.

i) Underline the correct answer:

To hold the model lower arm horizontal, the pull from the rubber band is (larger than, the same as, smaller than) the force caused by the weight. [1]

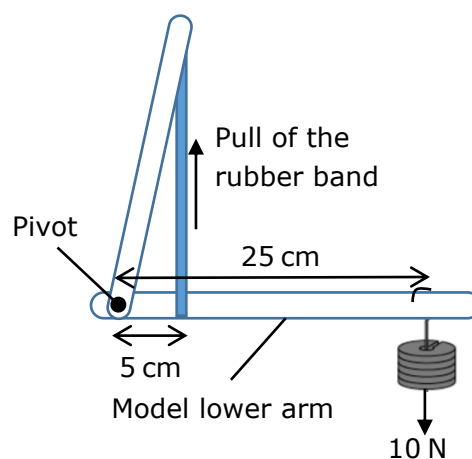


Figure 8

ii) State the law of moments and calculate the pulling force of the rubber band.

 _____ [3]

SECTION B

Each question carries 15 marks.

This section carries 45 marks of the total marks for this paper.

6. Oliver and James are lifting bales of hay of the same mass by using a hay elevator, as shown in Figure 9.

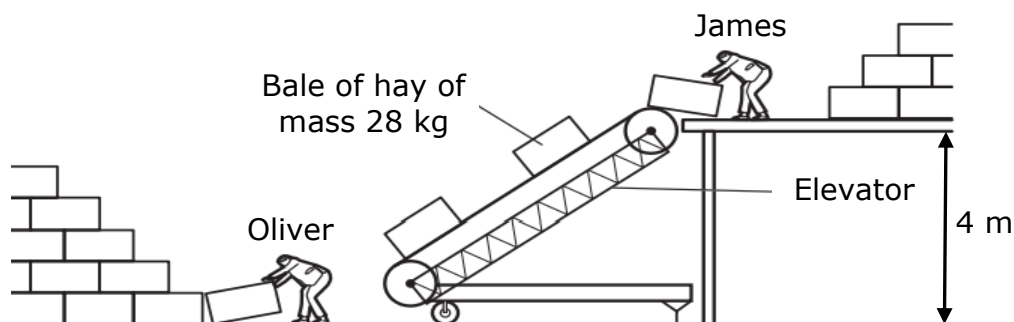
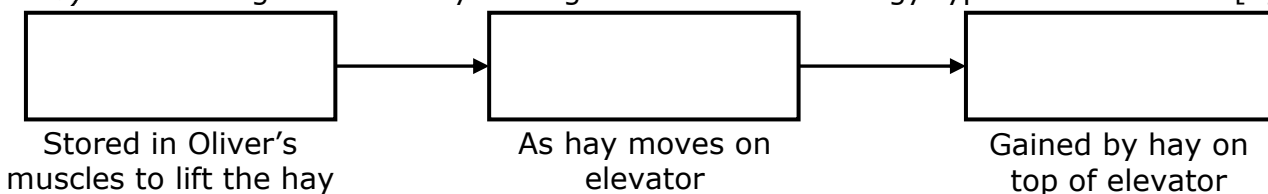


Figure 9

- a) Mark on Figure 9 the weight acting on the labelled bale of hay. [1]

- b) Fill the diagram below by writing down the main energy type in each box. [3]



- c) Calculate the weight of each bale if its mass is 28 kg.

_____ [1]

- d) Calculate the gravitational potential energy gained by a bale of hay.

_____ [2]

- e) Calculate the output power of the elevator if it takes 7 s to lift a bale of hay.

_____ [2]

- f) Calculate the power input of the system to lift one bale of hay. The system has an efficiency of 60%.

_____ [2]

- g) Explain in terms of energy why the power input is larger than the power output.

_____ [2]

- h) One bale of hay fell from the top of the elevator, a height of 4 m. Calculate the velocity with which the bale hits the ground.

_____ [2]

7. Jean and Yana trap some air inside a sealed syringe (Figure 10a). Yana compresses the syringe (Figure 10b).

a) Underline the correct words that describe the change, if any, to the following quantities:

- Volume of trapped air (increases, remains the same, decreases). [1]
- Mass of trapped air (increases, remains the same, decreases). [1]
- Density of trapped air (increases, remains the same, decreases). [1]

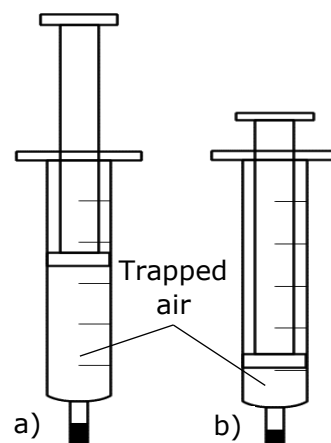


Figure 10

b) Jean finds that the cross-sectional area of the piston inside the syringe is 0.0002 m^2 . Calculate the pressure caused by the syringe when Jean pushes the piston with a force of 4 N.

[2]

c) Jean and Yana used a different syringe to investigate how the pressure inside the syringe changes when weights are added. During the experiment (Figure 11) Yana increased the weights and Jean used a pressure sensor and a data logger to measure the increase in pressure caused by the weights.

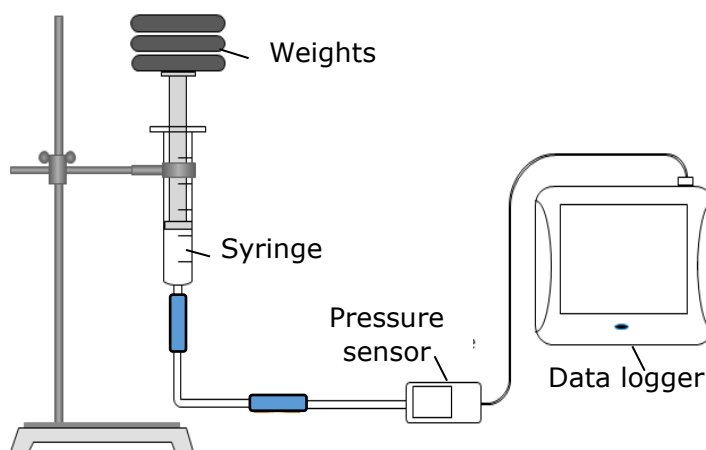


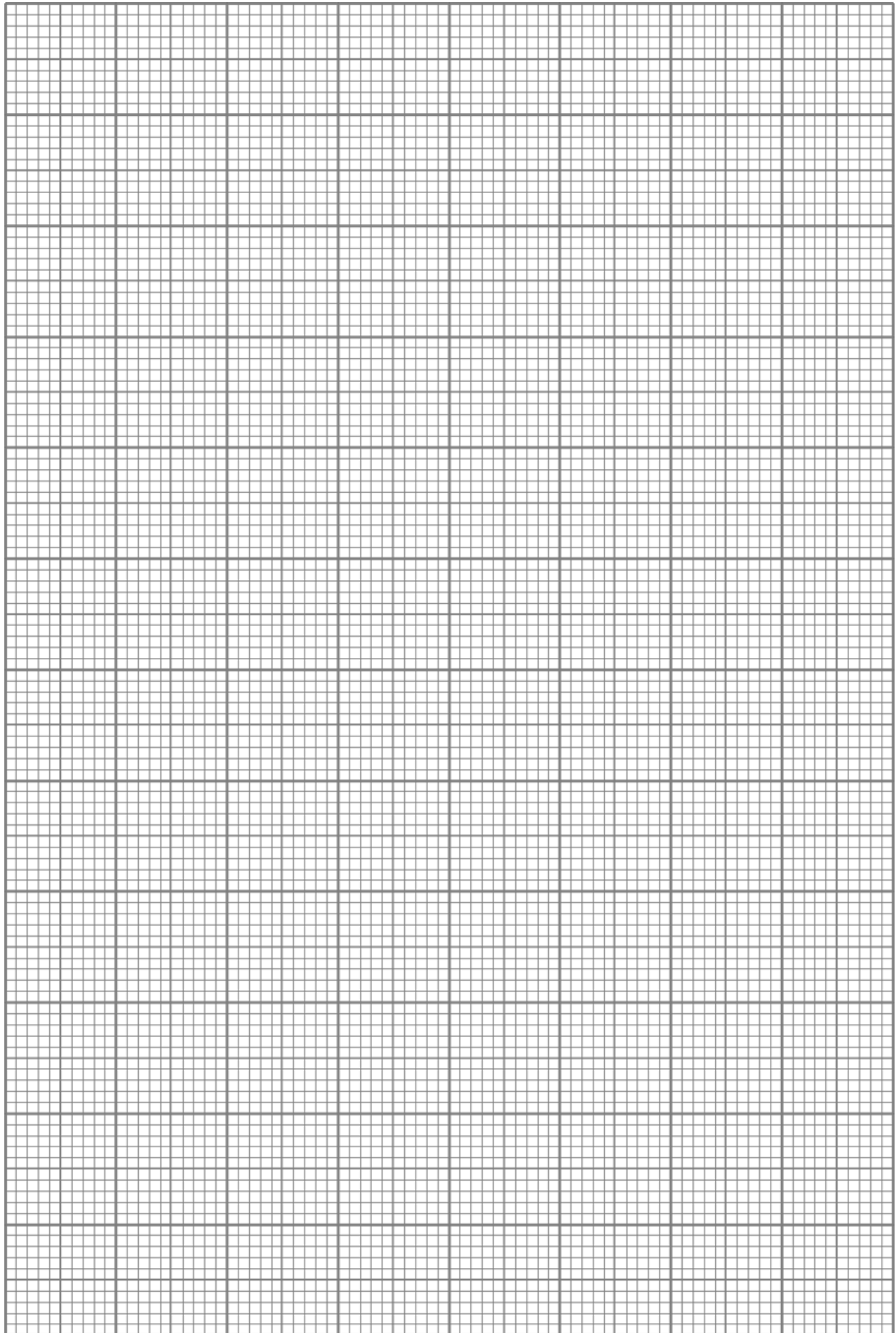
Figure 11

i) The table below shows the results they obtained.

Weight (N)	0	5	10	15	20	25	30	35
Increase in Pressure (kPa)	0	15	30	45	60	75	90	105

Plot a graph of Increase in Pressure (kPa) on the y-axis against Weight (N) on the x-axis.

[5]



- ii) State which features of the graph show that the plotted quantities are directly proportional.

_____ [1]

- iii) Calculate the cross-sectional area of the syringe used during the experiment.

_____ [3]

- d) When the pressure sensor is not attached to the syringe, the data logger measures the pressure caused by the surrounding air.

This pressure is called _____ [1]

8. Alessia wants to paint the roof of her penthouse in order to keep the inside cool during the hot summer months.

At the hardware store, two different roof paints are available. The first paint is white while the second one has a shiny silver colour. She buys a sample of each to investigate which one is better.



- a) Underline the correct answer:

- Heat from the Sun reaches Earth by (conduction, convection, radiation). (1)
- The painted roof helps to keep the inside of her penthouse cool mostly by (absorbing, reflecting, emitting) the heat from the Sun. (1)

- b) She models the situation by using two empty shoe boxes and paints the first one with white paint and the second one with shiny silver paint. Then she punches a hole at the centre of the lid of each shoebox and inserts a thermometer in each as shown in Figure 12.

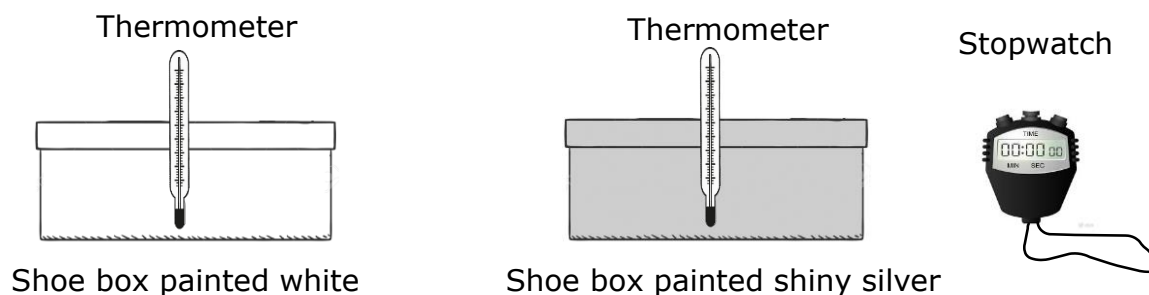


Figure 12

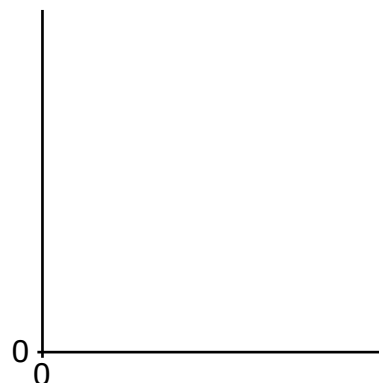
- i) On Figure 12, mark with a letter 'H', the position where a radiant heater should be placed. (1)
- ii) Complete:
In the setup used in Figure 12, the radiant heater (H) represents the _____ while each shoebox represents the _____. (2)
- iii) Describe briefly how she carries out an investigation that helps her choose the better roof paint.

_____ (3)

iv) After she analyses her results, she concludes that the shiny silver paint is better for the roof of her penthouse. On the axes below:

- Label each axis.
- Sketch the two graphs she obtains.
- Mark with a letter 'S' the graph of the shiny silver painted shoebox.
- Mark with a letter 'W' the graph of the white painted shoebox.

(4)



v) Apart from having the heater placed in a correct position, state ONE other precaution she takes to ensure fair results.

_____(1)

c) Alessia is told that there are other ways to keep the inside of her penthouse cool without making use of fans or air conditioners. Name TWO other ways which can also help with this.

_____(2)

End of paper