



Rewarding Learning

General Certificate of Secondary Education
2021–2022

Centre Number

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Candidate Number

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Single Award Science: Physics

Unit 3

Foundation Tier



[GSA31]

GSA31

FRIDAY 25 FEBRUARY 2022, MORNING

TIME

1 hour.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

You must answer the questions in the spaces provided.

Do not write outside the boxed area on each page or on blank pages.

Complete in black ink only. **Do not write with a gel pen.**

Answer **all ten** questions.

INFORMATION FOR CANDIDATES

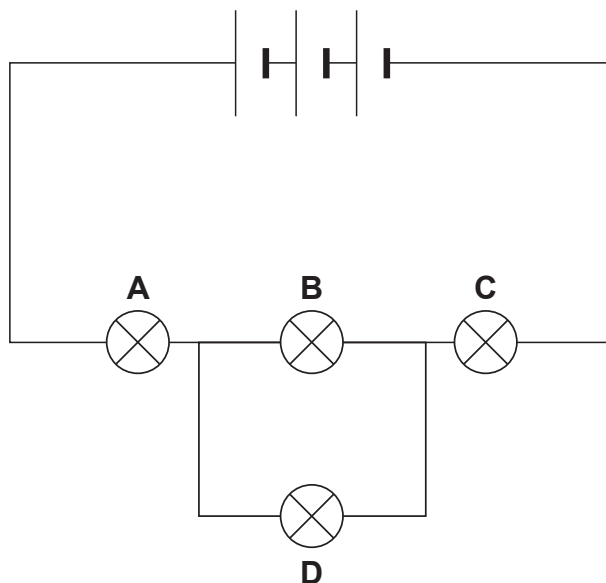
The total mark for this paper is 60.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

Quality of written communication will be assessed in Question **9(a)**.



- 1 The circuit diagram below shows four identical bulbs (**A**, **B**, **C**, and **D**) connected to three cells.



Source: Principal Examiner

- (a) Which **two** bulbs (**A**, **B**, **C**, **D**) are connected in parallel?

_____ and _____

[1]

Each cell supplies 1.5 V to the circuit.

- (b) What is the total voltage supplied to this circuit?

Circle your answer.

3.0 V

1.5 V

4.5 V

[1]

- (c) The current flowing through bulb **A** is 0.50 amps. How much current will flow through bulb **C**?

Circle your answer.

0.50 A

0.25 A

1.00 A

[1]



(d) What will happen to bulb **D** if bulb **C** goes out?

_____ [1]

(e) Give **two** changes that will happen in this circuit if another cell is added.

1. _____

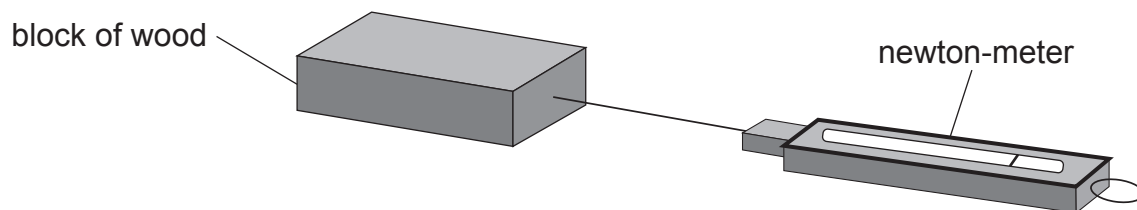
2. _____

_____ [2]

[Turn over



- 2 To investigate friction a student used a newton-meter to pull a block of wood across five different surfaces.



Source: Principal Examiner

The results are shown below.

Surface	Newton-meter reading/ N
wood	2.0
carpet	4.0
sandpaper	7.0
cardboard	2.5
plastic	1.5

- (a) Which surface has the most friction?

_____ [1]

- (b) Complete the following sentence to describe friction.

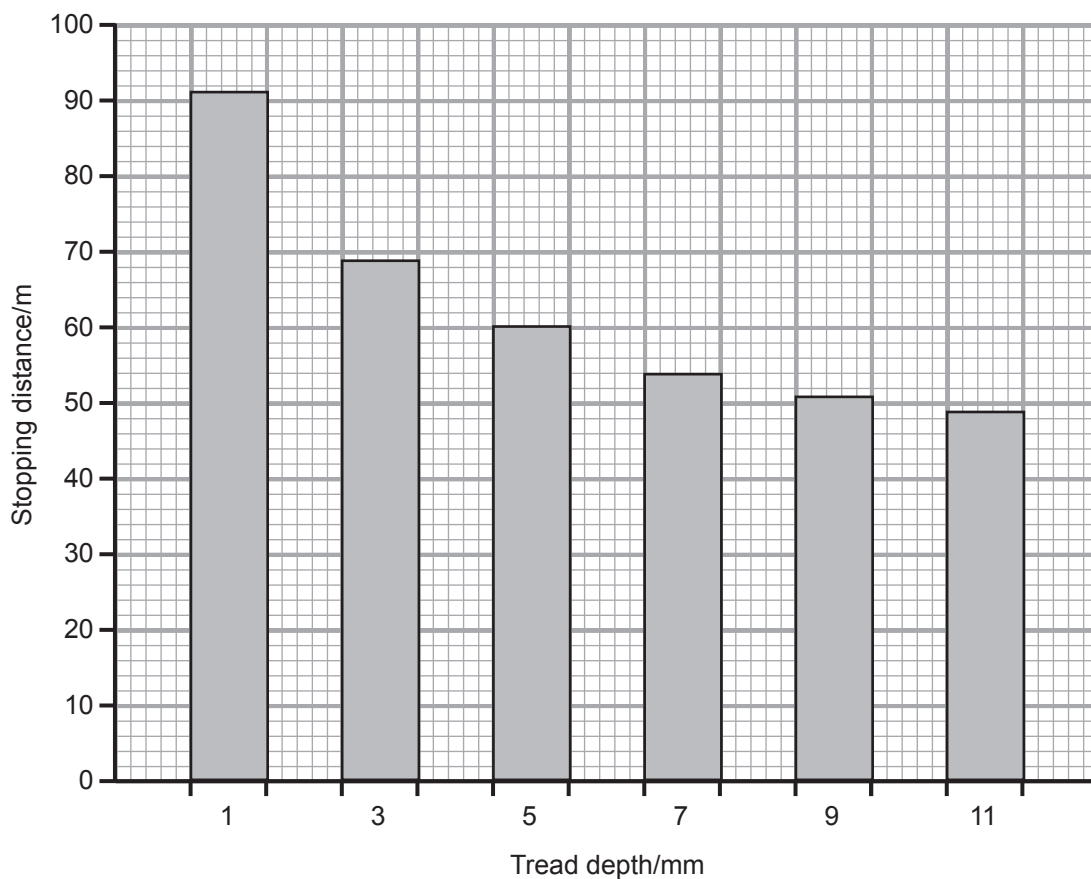
Friction is a _____ which _____ motion. [2]

- (c) Give **one** way that friction could be reduced on the plastic surface.

_____ [1]



- (d) The graph below shows how the tread depth of a tyre affects the stopping distance on a **wet** road.



- (i) What effect, if any, does increasing tread depth have on stopping distance?

Circle your answer.

increases : no effect : decreases

[1]

- (ii) Use the graph to estimate the stopping distance for a tread depth of 2 mm.

_____ m [1]

- (iii) How would the stopping distance change, if at all, on a **dry** road?

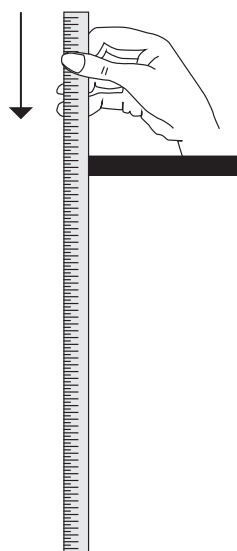
_____ [1]

[Turn over



- (e) Thinking distance is part of stopping distance and will be affected by the driver's reaction time.

To find his reaction time Keith caught a ruler dropped by another student and used the reaction-time chart shown below.



Reaction-time chart

cm	Reaction time
9	0.13 s
11	0.15 s
14	0.17 s
16	0.18 s
20	0.20 s
24	0.22 s
30	0.25 s

Source: Principal Examiner

- (i) Keith caught the ruler at 18 cm. Use the chart to find his reaction time.

_____ s [1]

- (ii) Give **one** factor that would increase Keith's reaction time.

_____ [1]





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(Questions continue overleaf)



- 3 (a) Three features of waves and their descriptions are shown below.
Using lines, match each feature with the correct description.

Feature	Description
amplitude	number of vibrations per second
wavelength	the height of a wave
frequency	length of one complete vibration

[2]

- (b) What do all waves transfer from one place to another?

[1]



The table below gives information about the frequency, wavelength and velocity of four different sound waves.

Frequency/Hz	Wavelength/m	Velocity/ m/s
1418	0.24	340
708	0.48	340
531	0.64	340
425	0.80	340

(c) Describe the effect, if any, of increasing frequency on:

(i) the wavelength.

_____ [1]

(ii) the velocity.

_____ [1]

(d) Humans can hear sounds with a frequency up to 20 000 Hz.

(i) What is the **lowest** frequency humans can hear?

Choose from:

20 Hz : **200 Hz** : **2000 Hz**

_____ [1]

(ii) What name is given to sounds with frequencies above 20 000 Hz?

_____ [1]

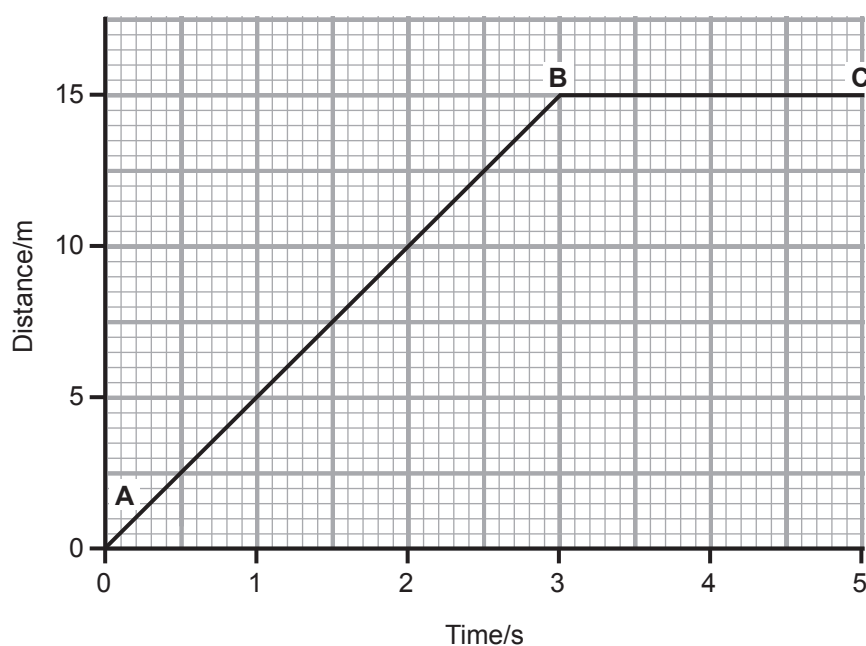
(e) What is a reflected sound wave called?

_____ [1]

[Turn over



- 4 Shown below is a distance–time graph for a short car journey.



- (a) Describe the motion of the car between:

A and **B**. _____

B and **C**. _____ [2]

- (b) Use the equation:

$$\text{average speed} = \frac{\text{total distance}}{\text{total time}}$$

to calculate the average speed for the whole journey from **A** to **C**.

(Show your working out.)

_____ m/s [2]





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- 5 (a) The table below shows the costs involved in producing one unit of electricity using five different energy sources.

Energy source	Costs/p			Total cost/p
	Building	Fuel	Maintenance	
coal	1.1	1.5	0.3	2.9
gas	0.4	2.5	0.5	3.4
nuclear	1.5	0.5	0.5	2.5
wind	4.2	0.0	0.9	5.1
tidal	3.8	0.0	0.8	

- (i) Calculate the total cost to produce one unit of electricity using tidal energy.

_____ p [1]

- (ii) Use information in the table to give **one** economic reason why some people think using renewable sources of energy is the best way to produce electricity.

_____ [1]

- (iii) Name another fossil fuel that is **not** shown in the table.

_____ [1]



(b) Electrical energy is the most useful type of energy used in our homes.

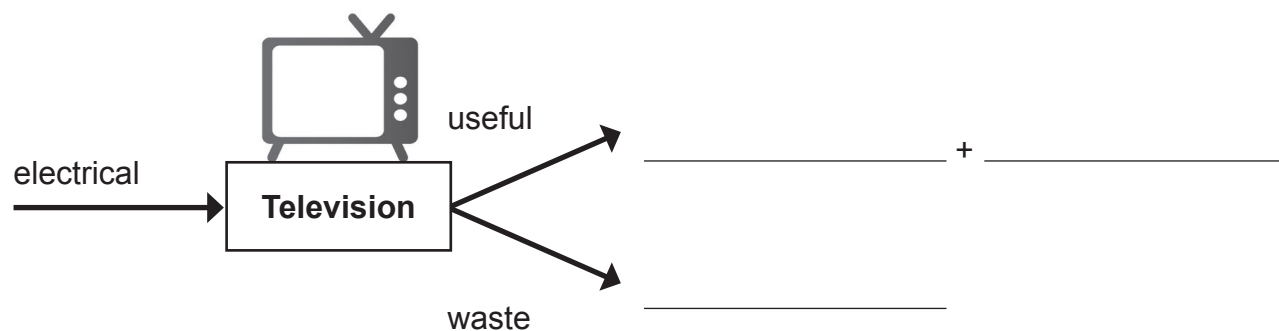
(i) Complete the following energy transfer diagram for a television.

Choose from:

sound

heat

light



[1]

Modern televisions are 90% efficient.

(ii) What percentage of energy is wasted by a television that is 90% efficient?

_____ % [1]

(iii) Why is electrical energy the most useful type of energy?

_____ [1]

[Turn over]



- 6 (a) The table below shows the type(s) of radiation emitted by six radioisotopes.

Radioisotope	Radiation emitted
A	beta and gamma
B	alpha
C	alpha and beta
D	beta
E	alpha and gamma
F	gamma

- (i) Which radioisotope (A, B, C, D, E or F) can be completely stopped by a sheet of paper?

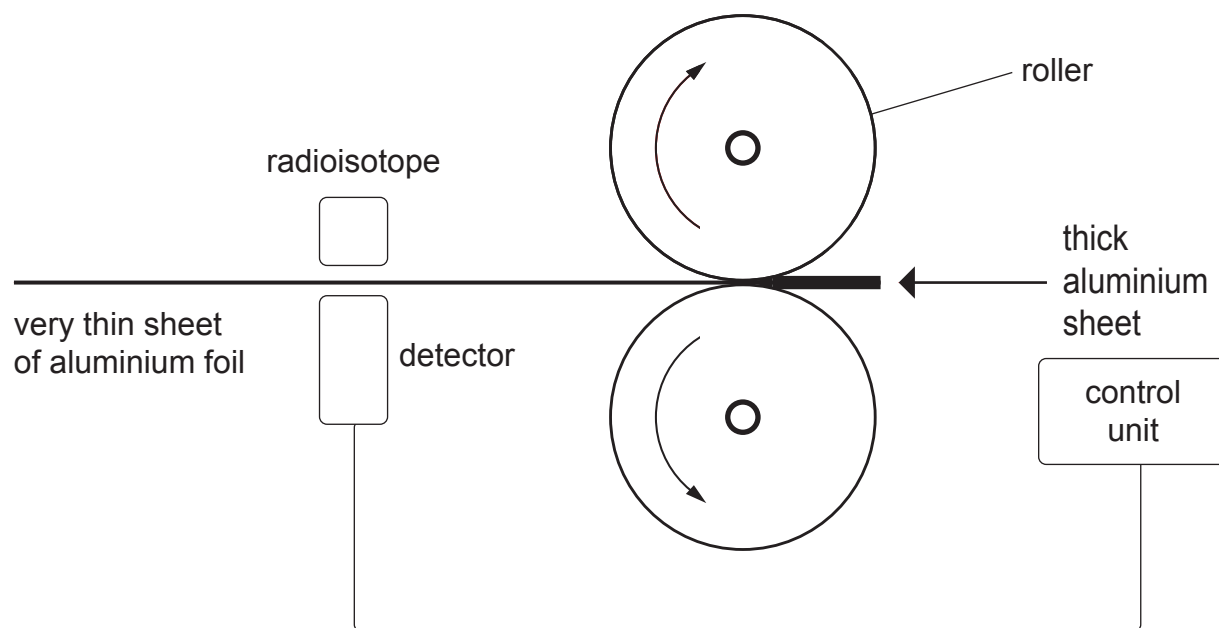
_____ [1]

- (ii) Name a metal that would completely stop the radiation emitted from radioisotope E.

_____ [1]



The diagram below shows how very thin sheets of aluminium foil are produced.



Source: Principal Examiner

If the sheets are **thicker** than needed, the detector receives no radiation and the rollers are moved closer together by the control unit.

(b) Explain fully why radioisotope **D** is more suitable than **F** to use for this process.

[2]

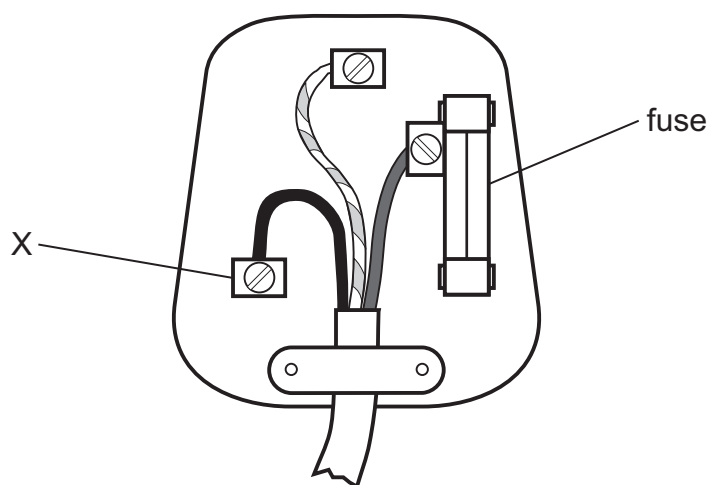
(c) State **one** medical use of radioactivity.

[1]

[Turn over



7 The diagram below shows a 3-pin plug.



Source: Principal Examiner

(a) Name the pin labelled **X** in the diagram.

_____ [1]

(b) What **colour** of wire should be connected to the fuse?

_____ [1]

(c) Describe fully how the fuse acts as a safety feature.

_____ [2]

(d) Name **one** other safety feature of a 3-pin plug.

_____ [1]



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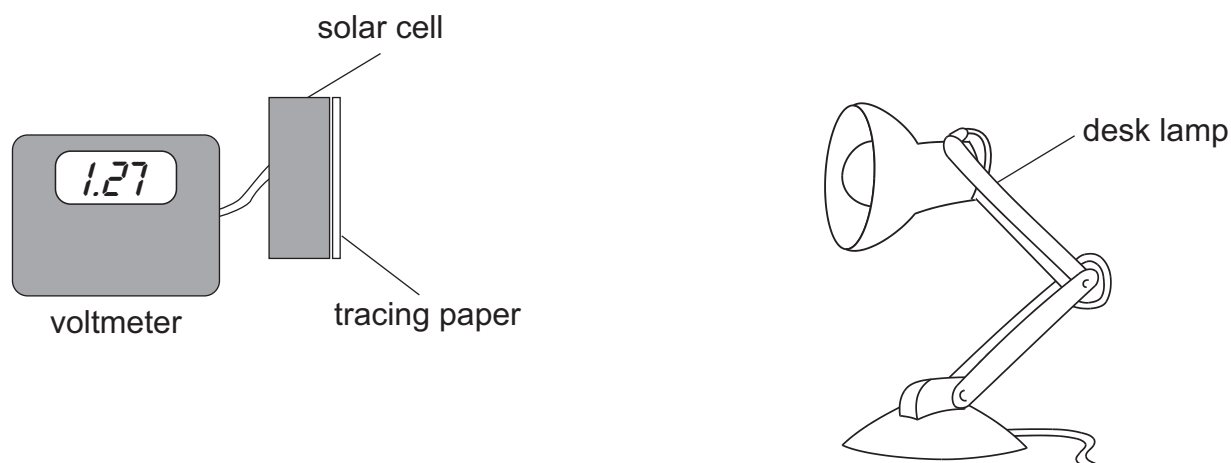
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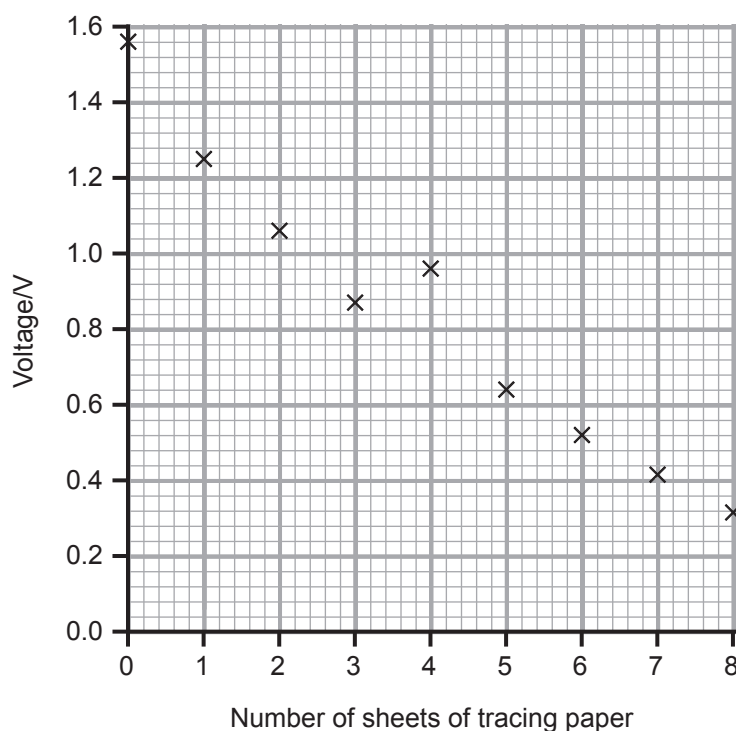
- 8 Some students used the equipment shown below to find out if dirt covering a solar cell affects its output voltage.

To represent the dirty surface the students used sheets of tracing paper.



Source: Principal Examiner

The results of the investigation are shown in the graph below.



(a) What conclusion can be made from these results?

[1]

(b) The result for four sheets of tracing paper does not follow the trend.

(i) What term is used to describe a result that does **not** follow the trend?

[1]

(ii) Suggest **one** way the students should deal with this result.

[1]

(c) Suggest **one** way the students ensured a fair test was carried out.

[1]

[Turn over



9 (a) Describe fully the structure of the Solar System.

Your answer should include:

- the names and positions of two planets;
- a description of how these planets move; and
- the names of other objects in the Solar System.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

[6]



The table below gives the force of gravity on three planets.

Planet	Gravity/ N/kg
X	10
Y	16
Z	25

(b) An astronaut has a mass of 80 kg.

Use the equation:

$$\text{weight} = \text{mass} \times \text{gravity}$$

to calculate the **maximum weight difference** of the astronaut moving between these planets.

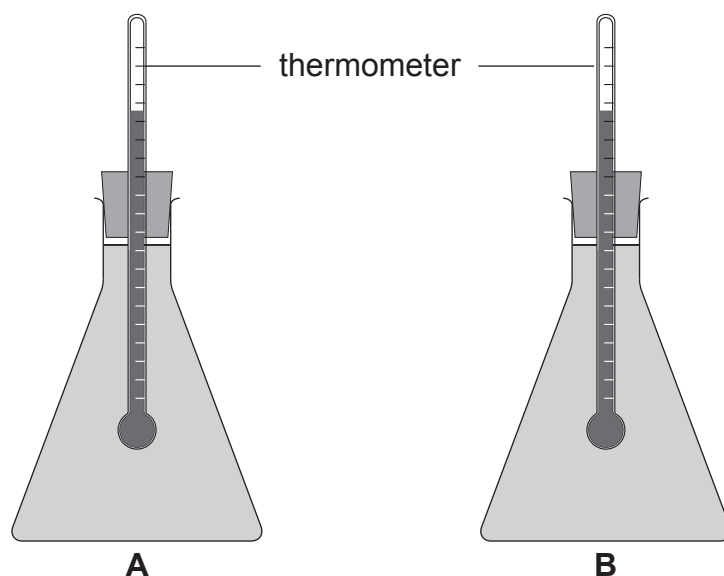
(Show your working out.)

_____ N [2]

[Turn over



- 10 (a) A student used two conical flasks, one with a dark matt cover and one with a light shiny cover, to investigate how an object's surface affects how quickly it cools down.



Source: Principal Examiner

The flasks were filled with boiling water and the temperature was measured every two minutes.
The results are shown below.

Time/mins	Temperature/°C	
	A	B
0	90	90
2	75	80
4	62	72
6	51	66
8	42	61
10	37	54



- (i) State the trend shown by the results for flask **A**.

_____ [1]

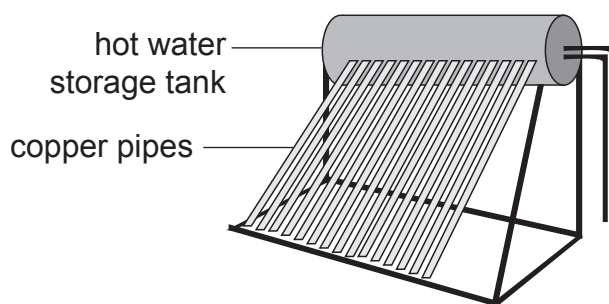
- (ii) Give **one** difference in the trend shown for flask **B** compared to flask **A**.

_____ [1]

- (iii) Which conical flask (**A** or **B**) has a dark matt covering?
Explain your answer.

_____ [1]

- (b) The diagram below shows a solar water heater, it uses energy from the Sun to heat water inside copper pipes. The hot water is then stored in a tank.



Source: Principal Examiner

- (i) Name the method of heat transfer that moves the heated water from the pipes up to the hot water storage tank.

_____ [1]

- (ii) Suggest **one** reason why the pipes are made from copper.

_____ [1]

THIS IS THE END OF THE QUESTION PAPER



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Question Number	Marks
1	
2	
3	
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10	

Total Marks	
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Examiner Number

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