



General Certificate of Secondary Education
2022–2023

Centre Number

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Candidate Number

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Single Award Science: Physics

Unit 3
Foundation Tier



[GSA31]

GSA31

FRIDAY 24 FEBRUARY 2023, 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**.

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28GSA3101

1 The diagram below shows some of the waves in the electromagnetic spectrum.

radio	microwave	A	visible light	B	X-ray	C
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(a) Which letter (**A**, **B** or **C**) shows the position of gamma rays in the spectrum?

_____ [1]

(b) Below are statements about some electromagnetic waves.
Using lines, match each statement with the correct electromagnetic wave.
One has been done for you.

Statement	Electromagnetic wave
forms a rainbow in the sky	radio
used to cook food quickly	X-ray
allows us to see broken bones in the body	visible
	microwave

[2]



(c) Complete the following sentence.

Choose from:

frequency

wavelength

speed

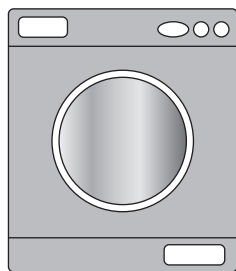
All waves in the electromagnetic spectrum travel at the same

_____ in a vacuum.

[1]



- 2 Shown below are two electrical appliances which change electrical energy into other forms of useful energy.



washing machine



television

- (a) Complete the table below, using ticks (✓), to show the useful energy outputs for a **television**.

Appliance	Useful energy output			
	kinetic	heat	light	sound
washing machine	✓	✓		
television				

[1]

- (b) Complete the following sentence.

The Principle of Conservation of Energy states that energy can be changed from one form to another but the _____ amount of energy does not change.

[1]

- (c) The total energy input to a kettle is 1600 J. The useful energy output is 1200 J. This is heat energy used to boil the water.

- (i) Calculate the amount of energy wasted.

_____ J [1]



(ii) Use the equation:

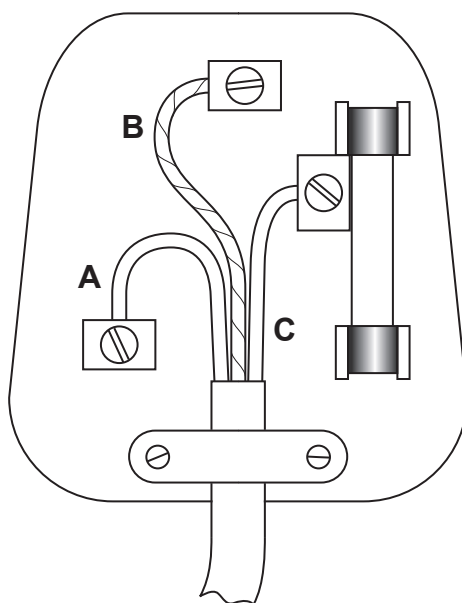
$$\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy input}}$$

to calculate the efficiency of this kettle.

(Show your working out.)

_____ [2]

The kettle will be connected to the mains using a 3-pin plug. The diagram below shows the wires (**A**, **B** and **C**) inside a 3-pin plug.



(iii) Which wire (**A**, **B** or **C**) is the live wire?

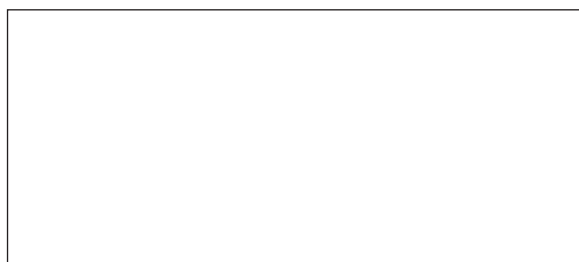
_____ [1]

[Turn over



3 (a) Electrical circuit diagrams can be drawn using symbols.

(i) In the box draw the symbol for an ammeter.



[1]

(ii) Name the unit of electrical current.

[1]

The table below shows how the resistance of a metal wire changes with the length of the wire.

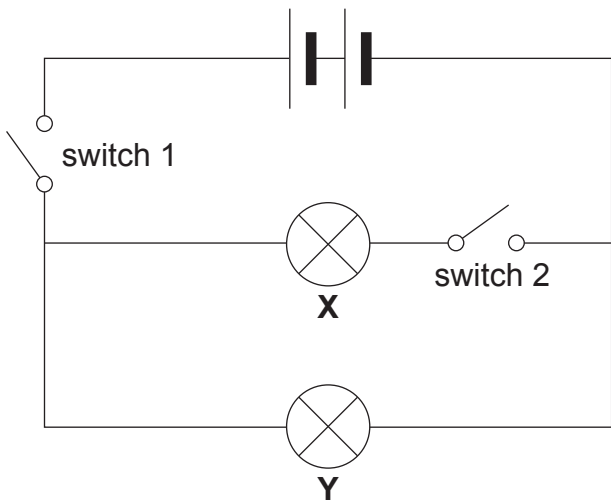
Length of wire/cm	Resistance/ Ω
20	4
40	8
60	12
80	16
100	20

(b) Give the trend shown by this information.

[1]



(c) The diagram below shows two bulbs (X and Y) in an electrical circuit with two switches.



(i) Complete the following sentence to describe this circuit.

The bulbs in this circuit are connected in _____ . [1]

(ii) Complete the table below to show whether the bulbs are lit (✓) or not lit (✗) when different switches are closed.
One has been done for you.

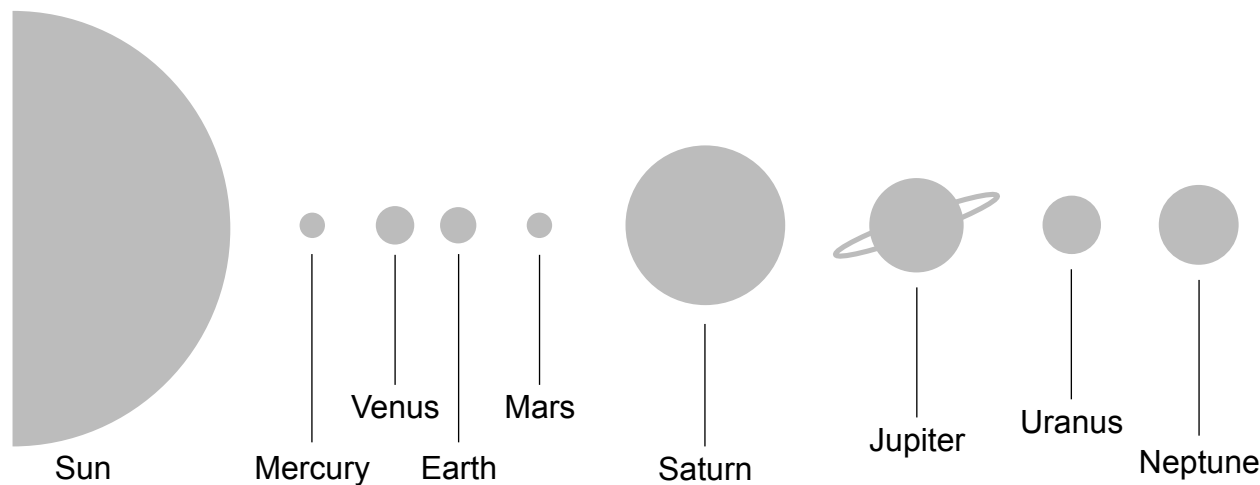
Switch(es) closed	Bulb X	Bulb Y
switch 1 only	✗	✓
switch 2 only		
both switch 1 and 2		

[2]

[Turn over



- 4 (a) The diagram below represents part of our Solar System, but two of the planets have been labelled incorrectly.



- (i) Name **one** planet that has been labelled incorrectly.

_____ [1]

- (ii) Name **one** rocky planet.

_____ [1]

- (iii) Suggest which planet will take the shortest time to orbit the Sun.

_____ [1]

- (iv) Name the force that keeps the planets in orbit around the Sun.

_____ [1]

- (v) Apart from the Sun and planets, name **two** other natural objects found in the Solar System.

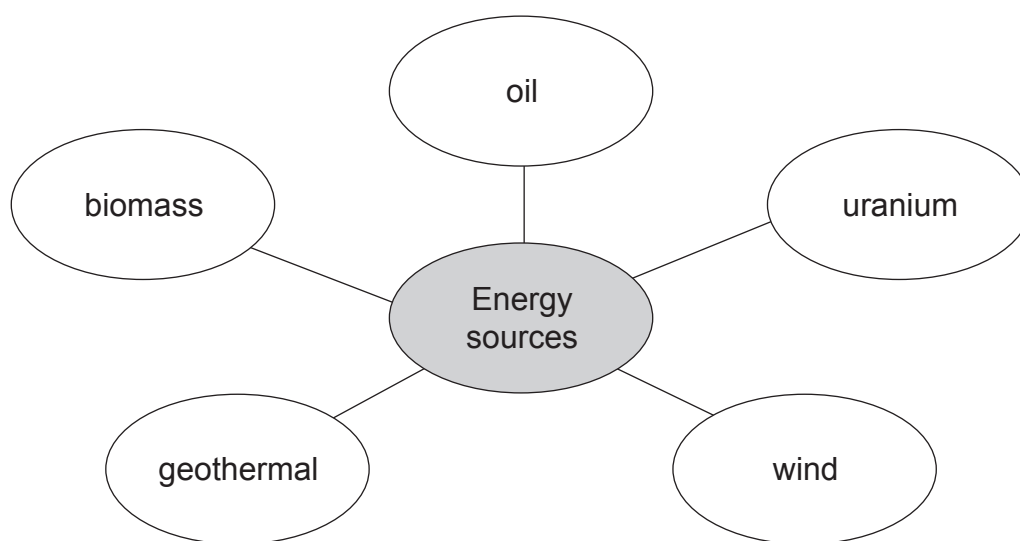
_____ and _____ [2]

- (b) The Earth has a large number of artificial satellites.
Give **one** use of artificial satellites.

_____ [1]



5 The diagram below shows five examples of energy sources.



(a) Use this information to complete the table below by naming the energy source that matches the description.

Description	Energy Source
non-renewable nuclear fuel	
renewable source using heat energy from under the surface of the Earth	

[2]

(b) What is meant by the term **non-renewable**?

[1]

These energy sources can be used to generate electricity in a power station.

(c) Complete the following sentence to describe how a generator works.

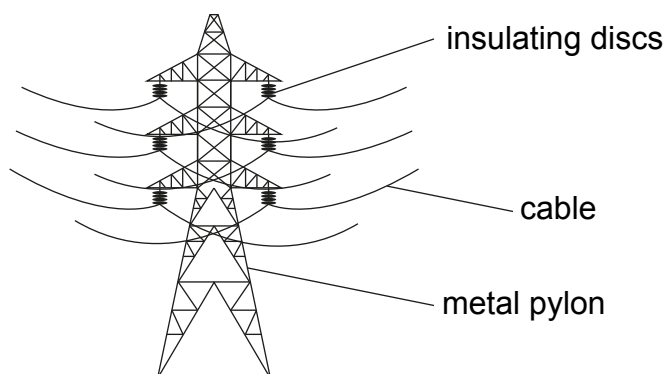
A generator produces electricity when a _____ moves
inside a _____ .

[2]

[Turn over



- (d) Electricity is distributed from a power station to our homes through cables held high off the ground by metal pylons. The cables are connected to the pylons by insulating discs.



The number of insulating discs depends on the voltage in the cables as shown in the table below.

Voltage/kV	Number of insulating discs
45	4
69	5
92	7
115	8
138	9

- (i) Give the trend shown by this information.

_____ [1]

- (ii) Suggest why the insulating discs are needed.

_____ [1]



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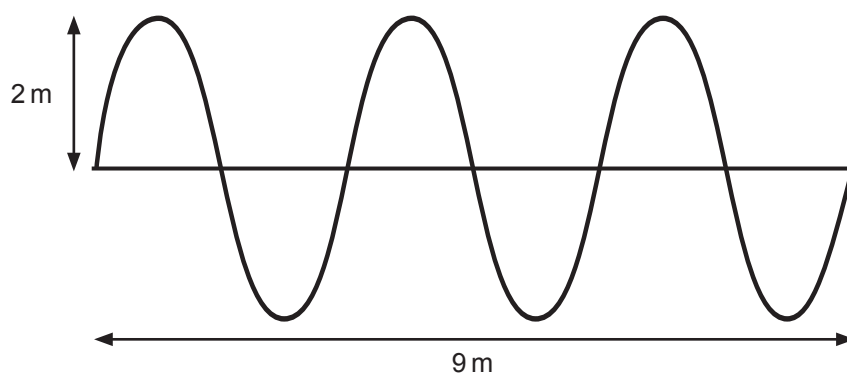
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28GSA3111

6 (a) The diagram below represents a sound wave.



(i) What is the amplitude of this wave?

_____ m [1]

(ii) What is the wavelength of this wave?

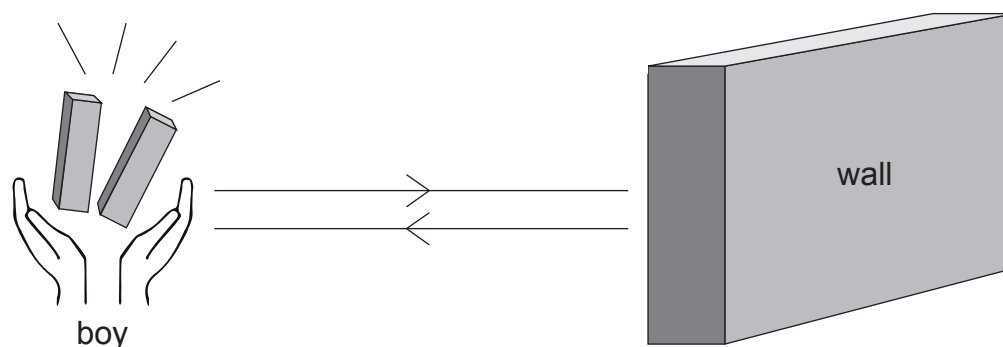
_____ m [1]

(b) What type of wave is a sound wave?

_____ [1]



- (c) A boy stands in front of a wall and makes a sound by banging two blocks together. He hears an echo 2 seconds later.



Sound travels 330 metres every second.

- (i) Calculate the distance a sound wave will travel in 2 seconds.

_____ m [1]

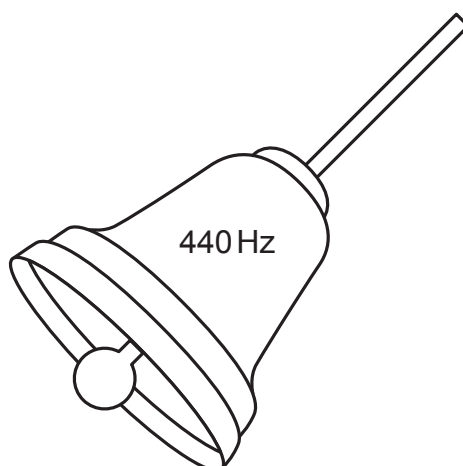
- (ii) Calculate the distance the boy is from the wall.

_____ m [1]

[Turn over



A musical bell rings a note of frequency 440 Hz.



The speed (velocity) of sound is 330 m/s.

(d) Use the equation:

$$\text{wavelength} = \frac{\text{velocity}}{\text{frequency}}$$

to calculate the wavelength of the sound produced by the bell.

(Show your working out.)

_____ m [2]





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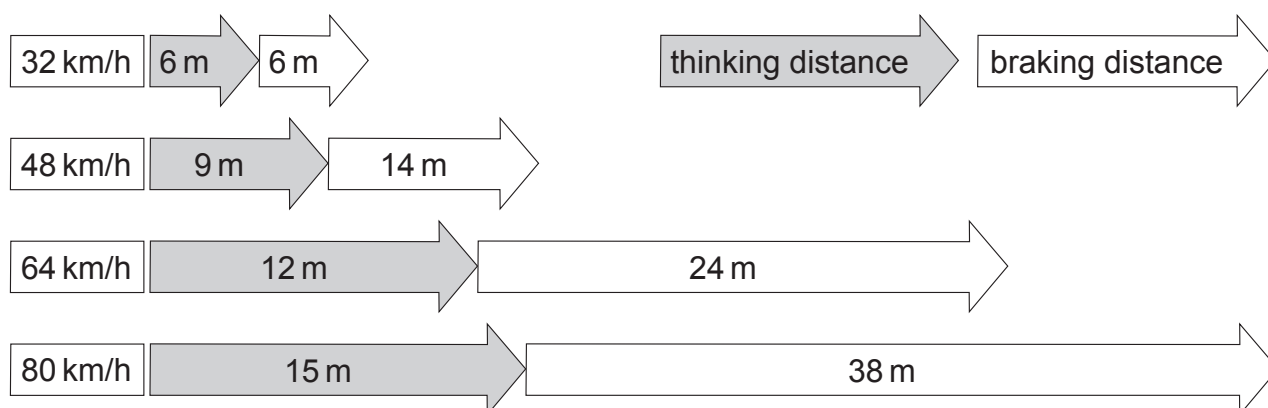
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[Turn over



28GSA3115

- 7 (a) The diagram below shows the thinking and braking distances for a car being driven at different speeds.



- (i) Use the equation:

$$\text{stopping distance} = \text{thinking distance} + \text{braking distance}$$

to calculate the stopping distance for a car travelling at 64 km/h.

_____ m [1]

A driver must leave enough distance between their car and the car in front to avoid a collision in the event of an emergency stop.

This distance is judged in car lengths, **an average car length is 4 m.**

- (ii) Use your answer to part (i), to calculate how many car lengths it would take to stop at 64 km/h.

_____ [1]



Thinking distance, braking distance and stopping distance may be affected by worn tyres or a tired driver.

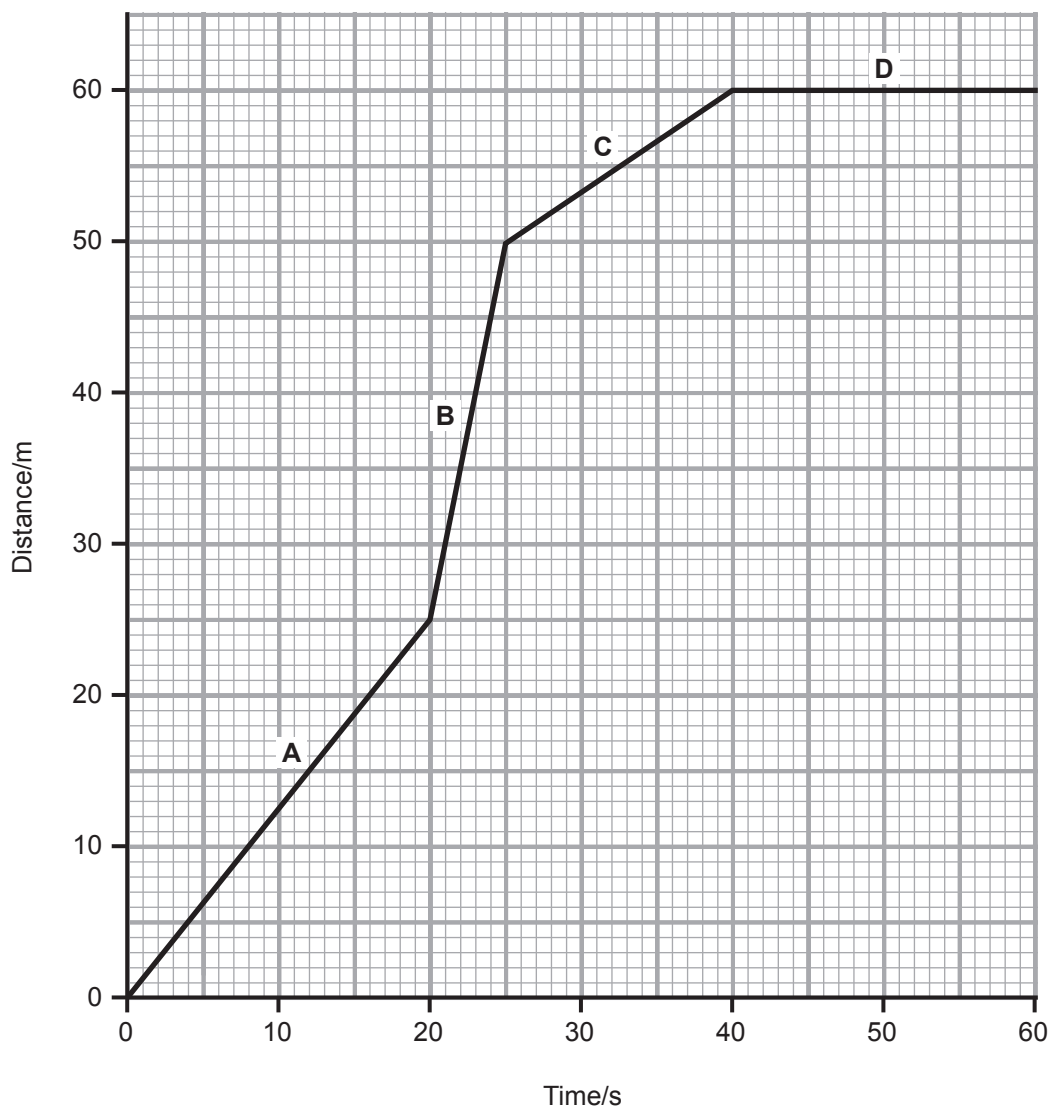
(iii) Complete the table below, using ticks (✓), to show the distances that are affected by each condition.

Condition Distance	Worn tyres	A tired driver
thinking		
braking		
stopping		

[2]



- (b) Shown below is a distance–time graph for a person walking a short distance then stopping to take a rest.



(i) On which part of the journey (**A**, **B**, **C** or **D**) was the person walking fastest?

_____ [1]

(ii) How far did the person walk in the first 40 seconds?

_____ m [1]

(iii) Use the equation:

$$\text{average speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

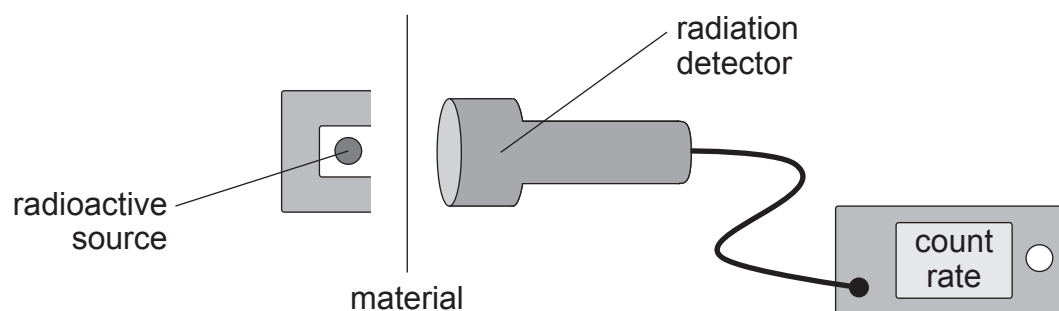
to calculate the average speed of the person when they were **walking**.

_____ m/s [1]

[Turn over



- 8 (a) The diagram below shows a radioactive source being used to investigate how effective a material is at stopping alpha, beta and gamma radiation.



Different materials were placed, one at a time, between the source and the detector and the count rate measured.

The initial count rate of the source, when there was **no** material, was 2543 cps.

The results are shown below.

Material	Count rate/cps
paper	2543
aluminium	328
lead	26

- (i) Name the type of radiation that is **not** emitted by this source.
Use information from the table to explain your answer.

_____ [2]

- (ii) What is the value for background radiation in this experiment?

_____ cps [1]



(b) Explain why the nuclei of some materials are described as radioactive.

[2]

(c) State **one** use of radioactivity in medicine.

[1]

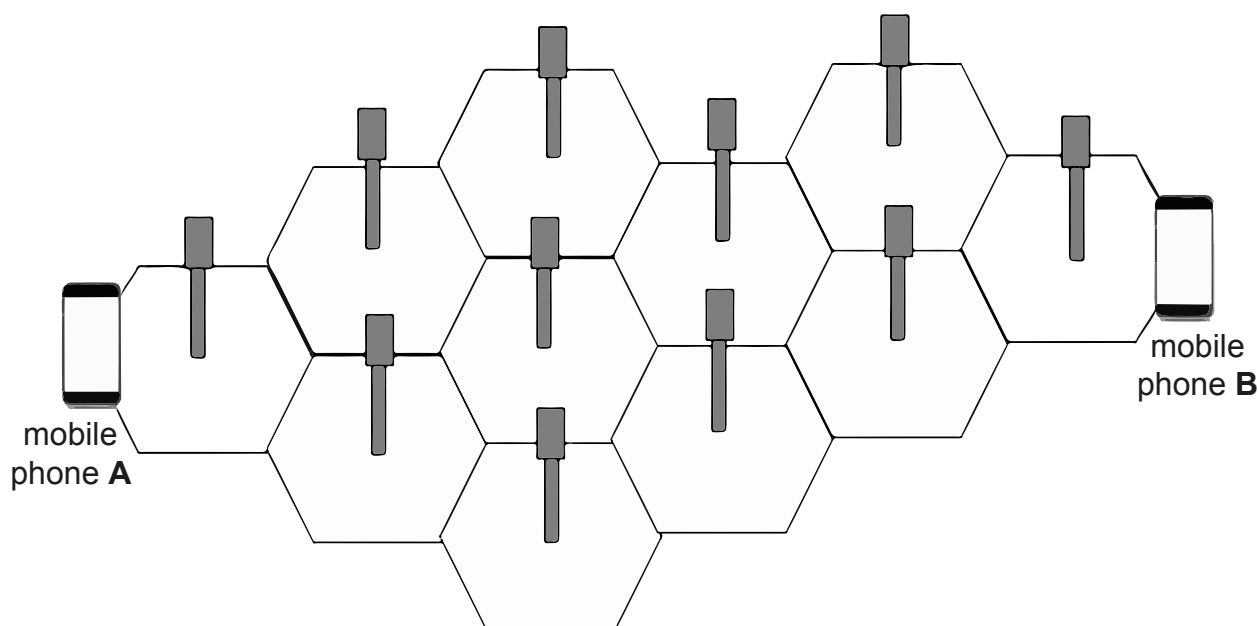
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28GSA3121

9 The diagram below shows a mobile phone network.



Describe fully how mobile phone **A** sends a signal to mobile phone **B**.

Your answer should include:

- the type of electromagnetic wave used;
- how the signal is transmitted through the network;
- the possible health risks of mobile phone use; and
- **two** ways these risks can be reduced.

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





[6]

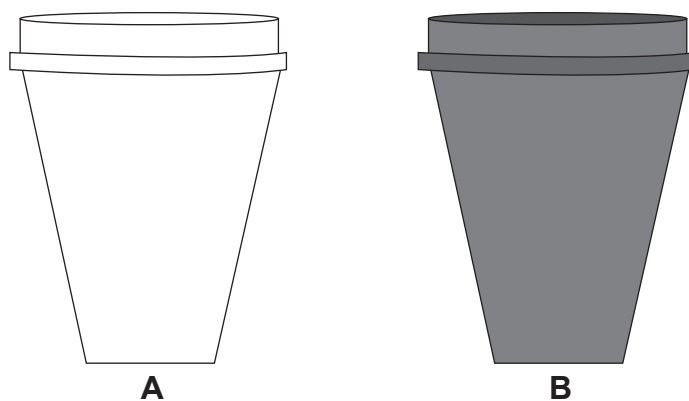
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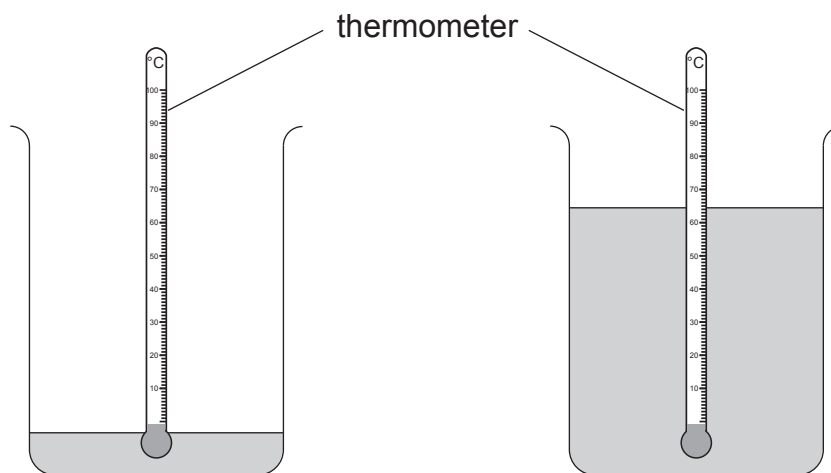
10 The diagram below shows two identical cups containing hot tea.



(a) Why will the tea in cup **A** stay hotter for longer than the tea in cup **B**?

[1]

(b) The temperature of different volumes of boiling water was measured over ten minutes.



One beaker contained 100 cm³ of boiling water and the other contained 600 cm³ of boiling water.



The temperature was recorded every minute and the results are shown below.

Time/minutes	Temperature/°C	
	100 cm ³ of boiling water	600 cm ³ of boiling water
0	100	100
1	82	92
2	77	88
3	74	84
4	71	81
5	68	78
6	66	76
7	64	74
8	62	72
9	60	70
10	59	68

(i) Give **two** conclusions that can be made from this information.

1. _____

2. _____
_____ [2]

The investigation continued until the temperature of the water in both beakers stayed at 20 °C.

(ii) Suggest why the temperature of the water did **not** go below 20 °C.

- _____
_____ [1]



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Sources:

- Question 2 Principal Examiner
- Question 2(c)(iii) . Principal Examiner
- Question 3(c) . . . Principal Examiner
- Question 4(a) . . . Principal Examiner
- Question 5(d) . . . Principal Examiner
- Question 6(a) . . . Principal Examiner
- Question 6(c) . . . Principal Examiner
- Question 6(d) . . . Principal Examiner
- Question 7(a) . . . Principal Examiner
- Question 8 Principal Examiner
- Question 9 Principal Examiner
- Question 10 . . . Principal Examiner
- Question 10(b) . . Principal Examiner

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For Examiner's use only	
Question Number	Marks
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Examiner Number

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