



General Certificate of Secondary Education
2019–2020

Centre Number

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Candidate Number

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Single Award Science: Physics

Unit 3
Higher Tier



[GSA32]

GSA32

FRIDAY 28 FEBRUARY 2020, 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 nine** questions.

INFORMATION FOR CANDIDATES

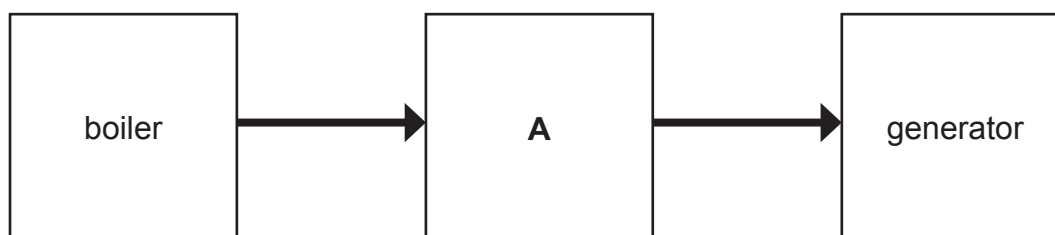
The total mark for this paper is 60.

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 3.



- 1 (a) The diagram below shows the parts of a coal-fired power station.



- (i) Name the part labelled **A**.

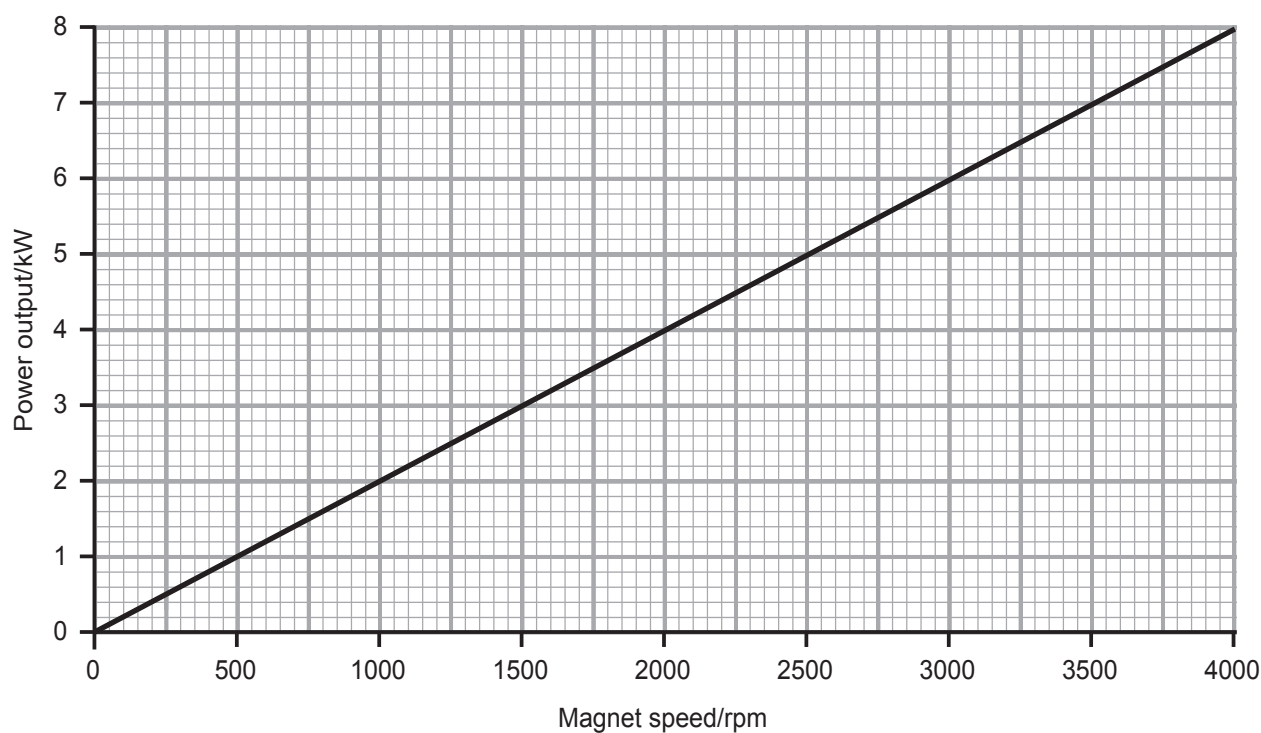
_____ [1]

- (ii) Complete the following sentence.

Coal is a fossil fuel; it takes _____ of years
to form. [1]



- (b) A generator produces electricity by having a magnet spin in a coil of wire. On the axes below draw the graph you would expect if a stronger magnet had been used.

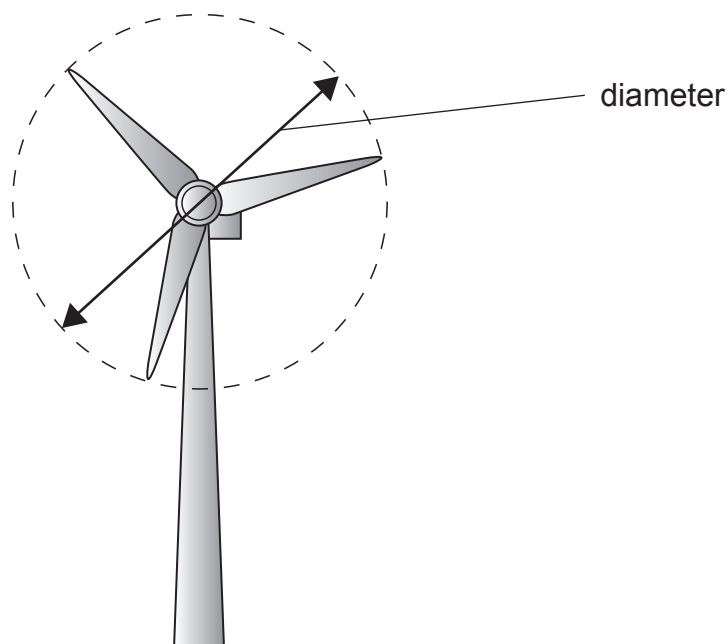


[2]

[Turn over]



(c) Electricity can also be produced by wind turbines.



Source: Principal Examiner

The table below shows how the electrical power output depends on the diameter of the blades and wind speed.

		Power output/W		
Blade diameter/m	Wind speed	5 m/s	10 m/s	15 m/s
2		50	400	1350
3		112	900	3040
4		200	1600	5400
5		310	2500	8500
6		440	3600	12 150



(i) Give **two** conclusions that can be made from the data opposite.

1. _____

2. _____

_____ [2]

(ii) Predict the power output of a 7 m diameter blade in a wind speed of 10 m/s.

_____ W [1]

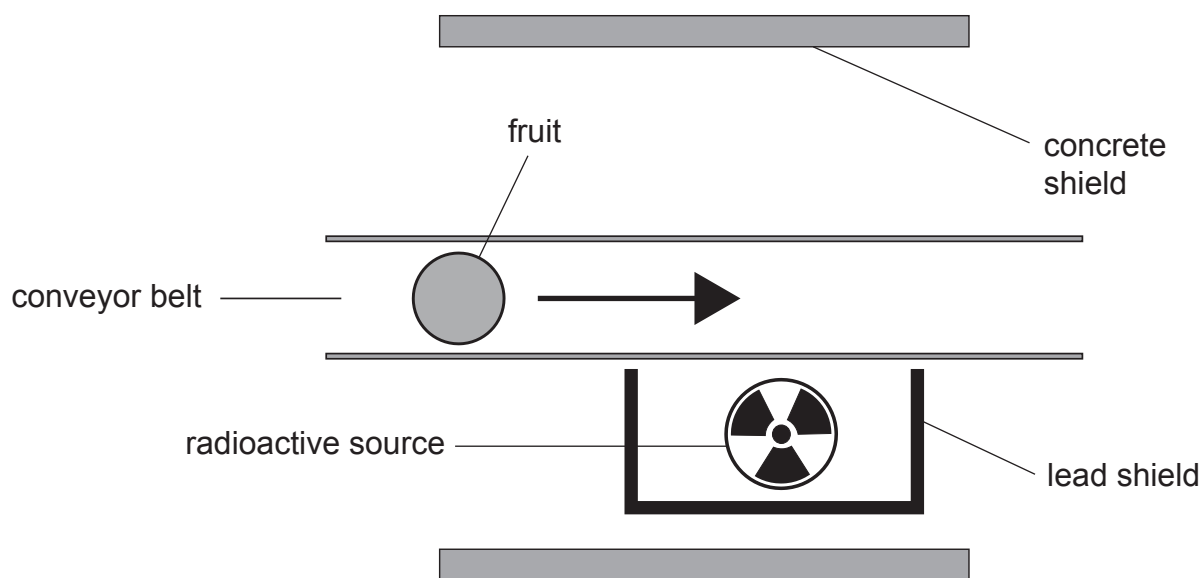
(iii) Explain why the Government wants to increase the use of wind turbines to generate electricity.

_____ [1]

[Turn over



- 2 In some countries fruit is irradiated with a radioactive source.



Source: Principal Examiner

- (a) The table below gives some information about four radioactive sources.

Source	Type of radiation emitted	Half-life
A	alpha	78 minutes
B	beta	432 years
C	gamma	6 hours
D	gamma	5.26 years

- (i) Which source **A**, **B**, **C** or **D** would be best to use to irradiate this fruit?
Explain your choice.

[2]



(ii) Explain fully why some fruit growers want to irradiate their fruit.

[2]

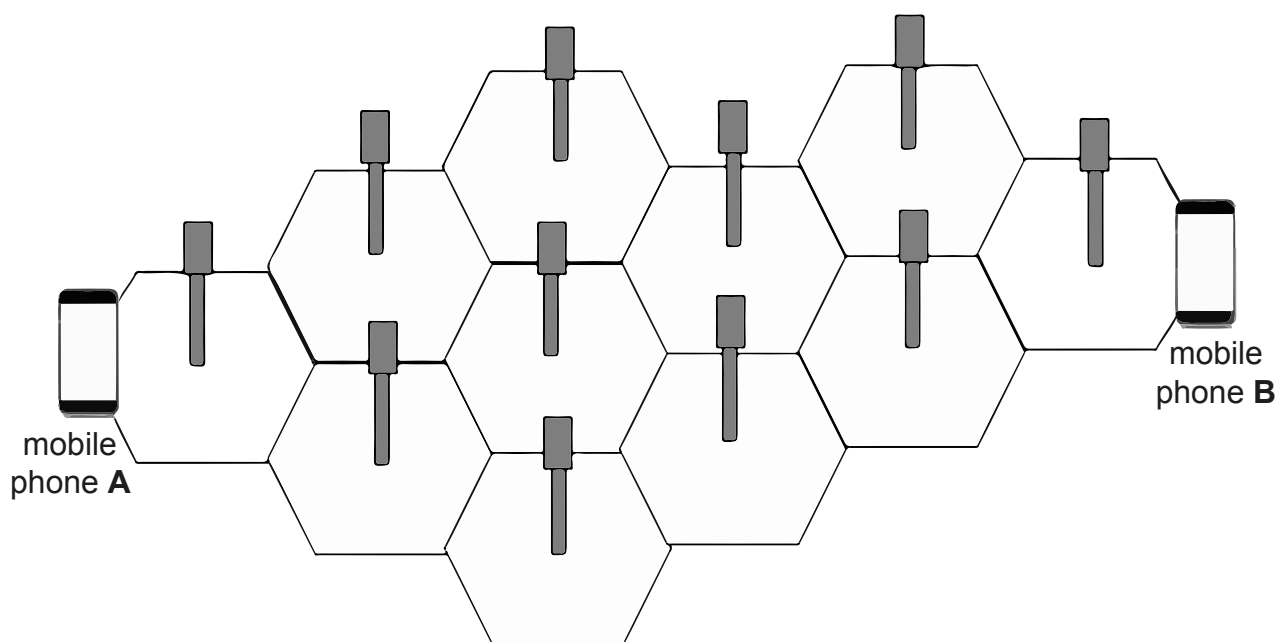
(b) Apart from irradiating fruit, give **one** other use for ionising radiation.

[1]

[Turn over



3 The diagram below shows a mobile phone network.



Source: Principal Examiner

Describe fully how a signal is transmitted from mobile phone **A** to mobile phone **B**.

Your answer should include:

- the type of electromagnetic wave used;
- the health risk of mobile phone use; and
- **two** ways that the risk can be reduced.

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





[6]

[Turn over

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- 4 The table below shows information about the stopping distances for a car driven at various speeds.

Speed/ m/s	Thinking distance/m	Braking distance/m	Overall stopping distance/m
5	3	2.5	5.5
10	6	10.0	16.0
15	9	22.5	31.5
20	12	40.0	52.0
30		90.0	

(a) Complete the table for a car travelling at 30 m/s.

[2]

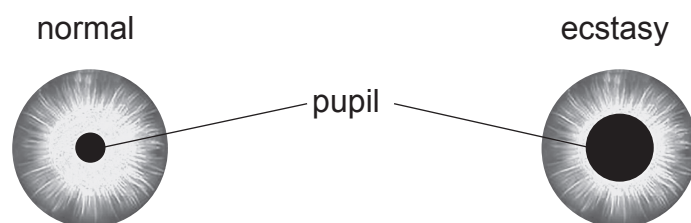


(b) People are advised not to drive after taking certain drugs.

- (i) Explain fully why a driver taking drugs could increase their chance of being involved in a car accident.

[2]

The diagrams below show normal pupil size of an eye and the pupil size when ecstasy is taken.



Source: Principal Examiner

- (ii) Use the chart below to find the pupil diameter of a person who has taken ecstasy.

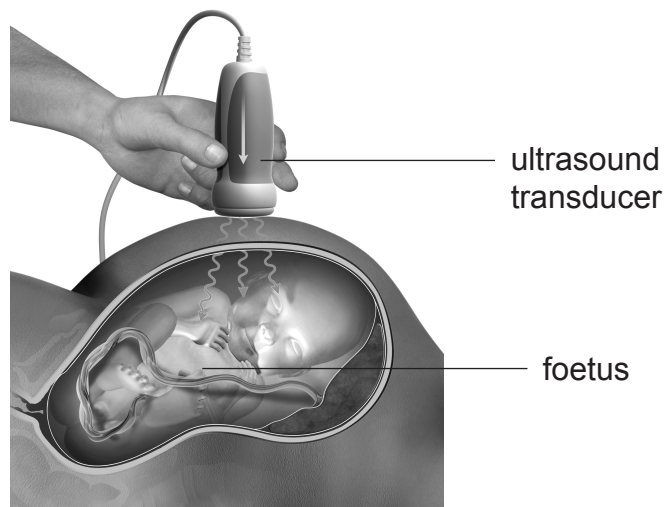
Diameter of pupil/mm								
1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
.	.	.	.	.	.	.	.	.

_____ mm [1]

[Turn over]



- 5 (a) Ultrasound can be used to produce an image of a foetus in the uterus.



© Claus Lunau / Science Photo Library

- (i) What is meant by the term **ultrasound**?

[2]



- (ii) The transducer sends a pulse of ultrasound and receives the reflected pulse.

The ultrasound travels at 1500 m/s through body tissue and the pulse returns 1×10^{-4} s later.

Use the equation:

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

to calculate the distance from the transducer to the foetus.

(Show your working out.)

_____ m [3]

- (b) X-rays are also used in hospitals.

Complete the table below by placing **one** tick (✓) in each row to show the type of wave.

	Type of wave	
	Transverse	Longitudinal
X-ray		
ultrasound		

[1]

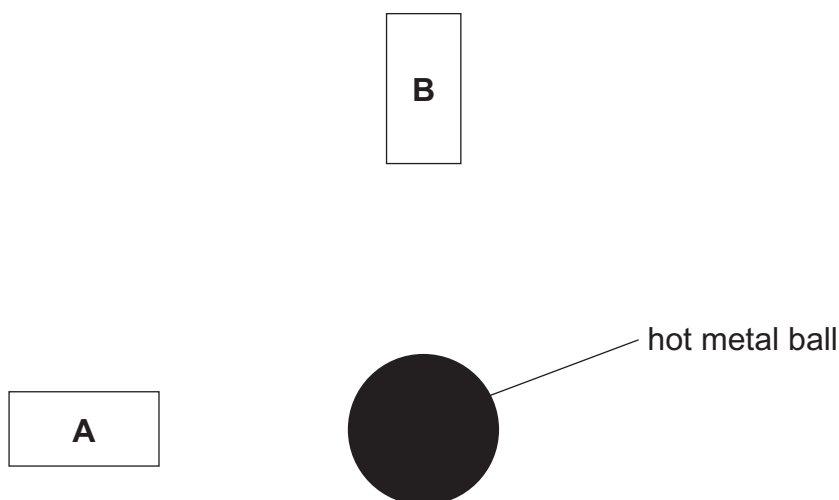
- (c) Give **one** property of all transverse waves.

_____ [1]

[Turn over



- 6 The diagram below shows a very hot metal ball with two heat sensors placed the same distance from it. Sensor **A** is at the side and sensor **B** is directly above.



The sensors detect the amount of heat given off by the metal ball.

- (a) Explain fully in terms of heat movement why sensor **B** gives a higher reading than sensor **A**.

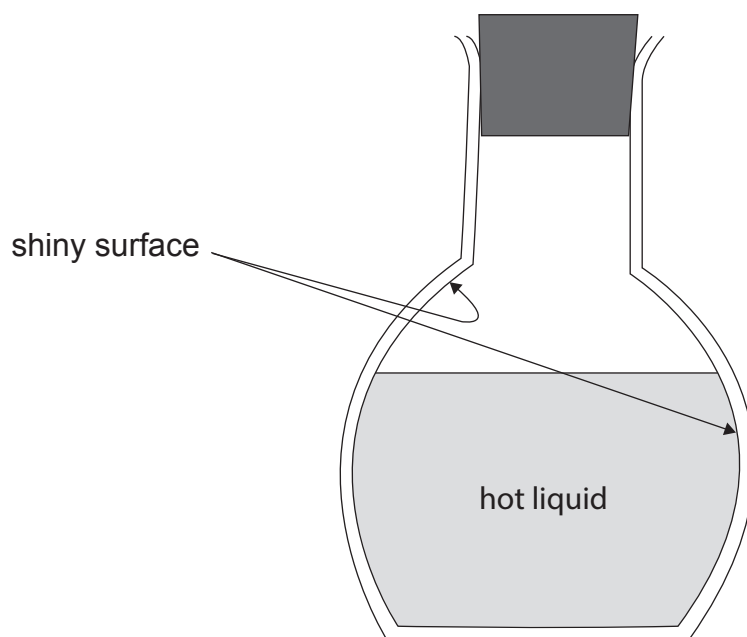
[3]

- (b) Explain why copper is a better conductor of heat than glass.

[1]



The diagram below shows a container designed to reduce the amount of heat lost from a hot liquid.



Source: Principal Examiner

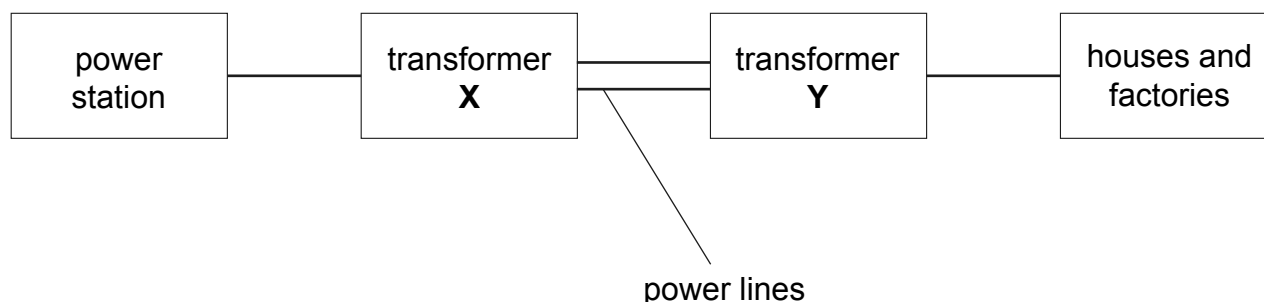
- (c) Explain fully how the shiny surface on the inside of the container helps to reduce heat loss.

[1]

[Turn over



- 7 (a) The diagram below shows how electricity is transmitted from a power station to houses and factories.



The efficiency of transmission of electricity through the power lines is not 100%.

- (i) What is meant by the term **efficiency**?

_____ [1]

- (ii) Explain fully how transformer **X** increases the efficiency of transmission through the power lines.

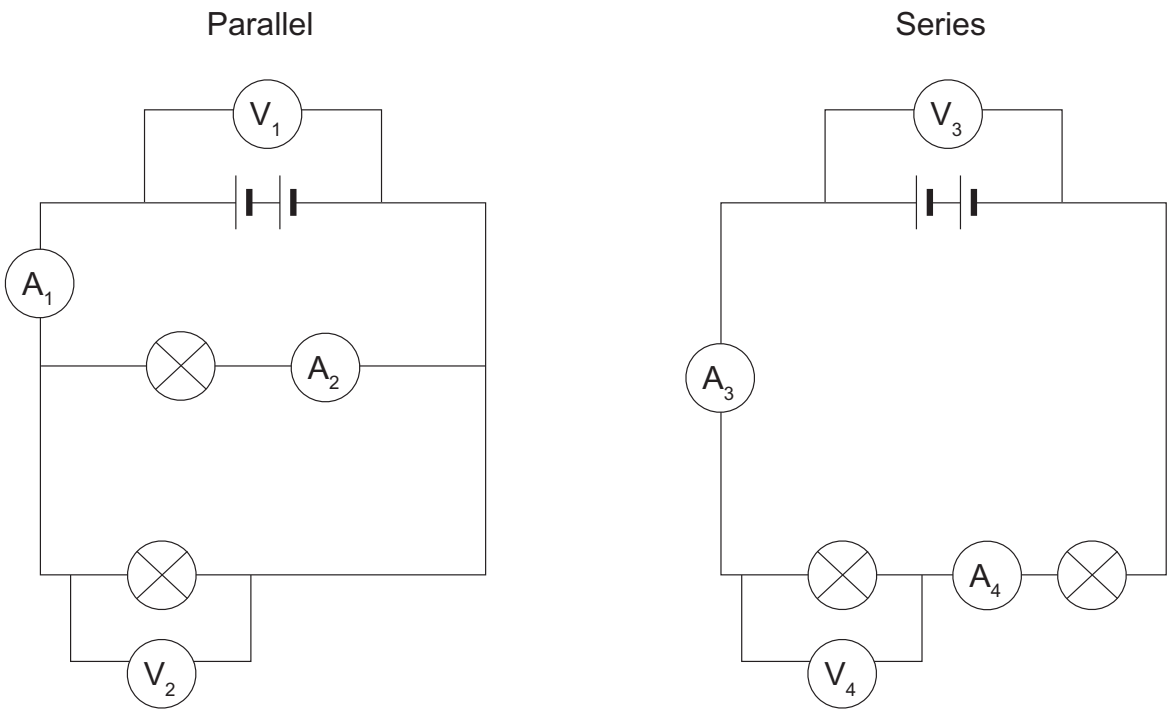
_____ [2]

- (iii) Name the type of transformer labelled **Y** on the diagram.

_____ [1]



The diagrams below show a parallel and a series circuit. Each contains identical bulbs.



(b) Complete the tables below.

Parallel			
Voltage/V		Current/A	
V ₁	12	A ₁	2
V ₂		A ₂	

Series			
Voltage/V		Current/A	
V ₃		A ₃	0.5
V ₄	6	A ₄	

[2]

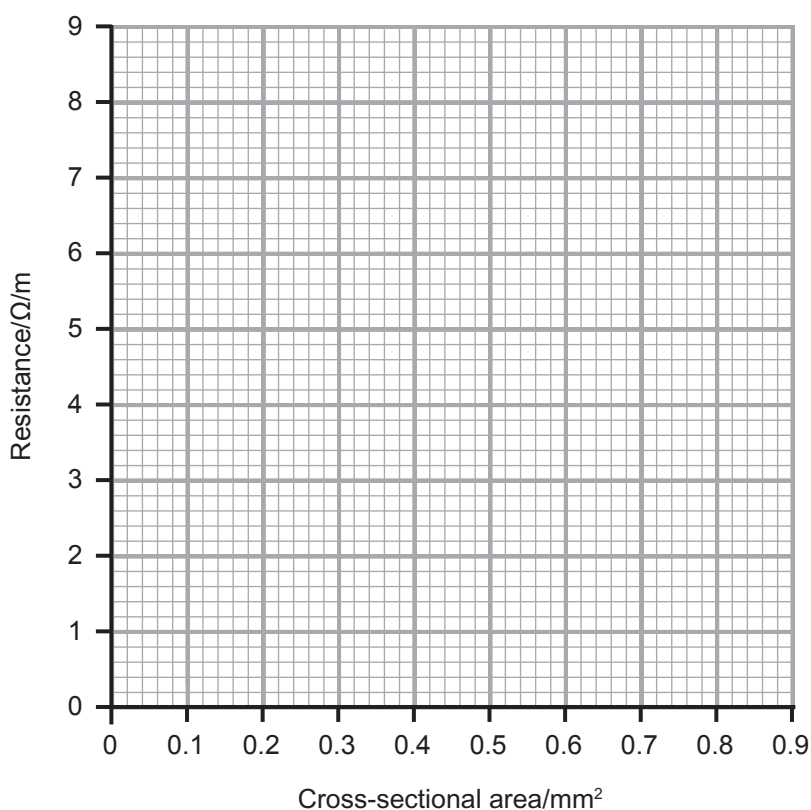
[Turn over



- (c) The table below shows how the cross-sectional area of two types of nichrome wire affects resistance.

Cross-sectional area/ mm^2	Resistance/ Ω/m	
	Nichrome 60 (60% nickel)	Nichrome 80 (80% nickel)
0.13	8.8	8.4
0.20	5.5	5.3
0.32	3.5	3.3
0.52	2.2	2.1
0.81	1.4	1.3

- (i) On the grid below, plot and draw a line graph for **nichrome 60** wire.



[3]



(ii) State the trend shown in the graph.

[1]

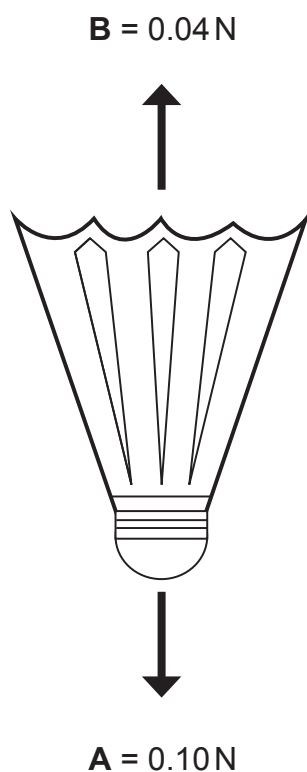
(iii) Nichrome is made from two metals, nickel and chromium. What effect, if any, does **increasing** the percentage of nickel have on the resistance?

[1]

[Turn over



- 8 The diagram below shows the forces **A** and **B** acting on a shuttlecock falling through the air.



Source: Principal Examiner

- (a) Describe fully, in terms of forces, the movement of the shuttlecock.

[3]

- (b) What causes the 0.04 N force at **B**?

[1]



- (c) A shuttlecock with a mass of 5.2g is held at a height of 4 m above the ground.

Use the equation:

$$E_p = mgh$$

to calculate the potential energy of the shuttlecock. Give your answer to 2 decimal places.

Take $g = 10 \text{ N/kg}$.

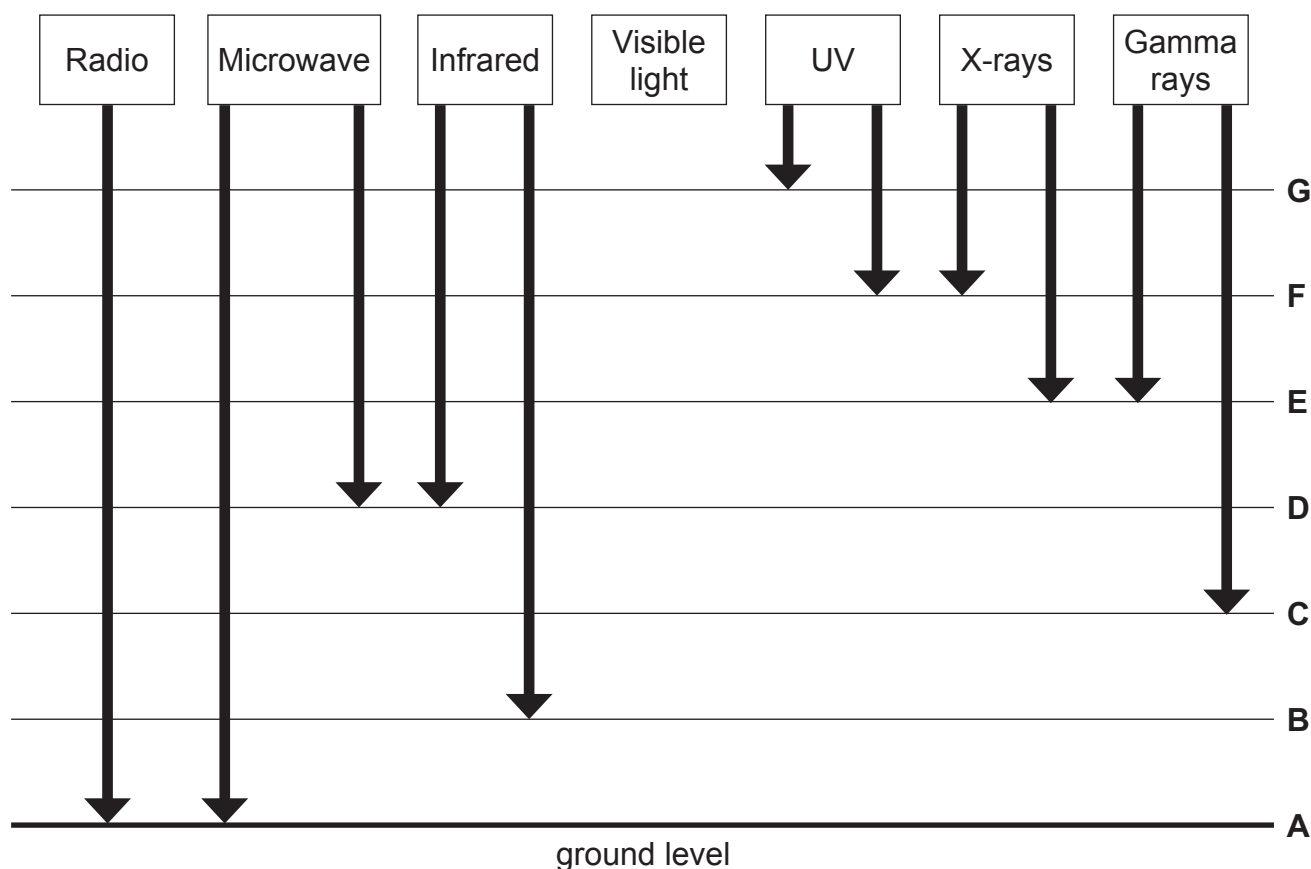
(Show your working out.)

_____ J [3]

[Turn over



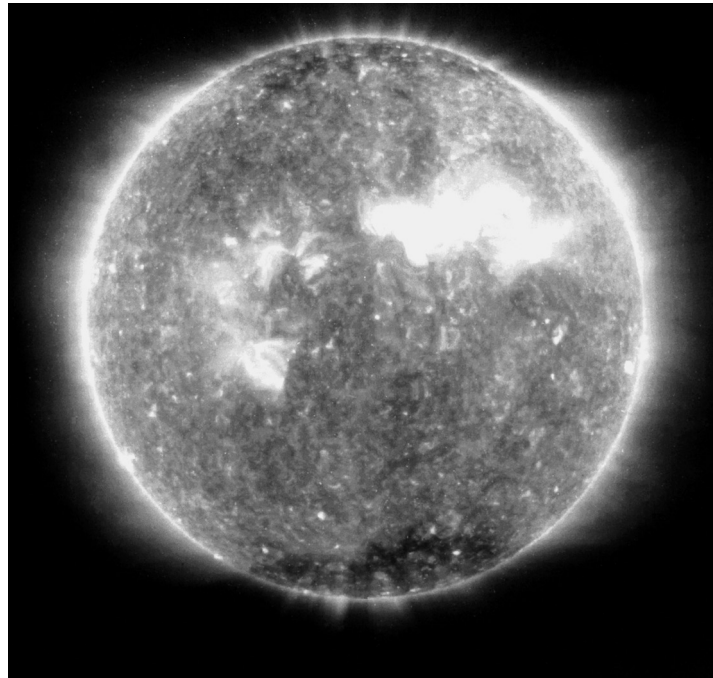
- 9 (a) The diagram below shows how far electromagnetic waves from space penetrate through the Earth's atmosphere towards the ground.



- (i) Complete the diagram above by drawing **one** arrow to show how far visible light penetrates the Earth's atmosphere. [1]
- (ii) Which line (**A – G**) represents the minimum height above ground level that a telescope could detect all the microwave and infrared waves coming from space? [1]
- (iii) Use the information to suggest why gamma ray telescopes are **not** placed at ground level. [1]



(b) The photograph below shows our Sun.



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Explain fully the formation of our Sun.

[3]

THIS IS THE END OF THE QUESTION PAPER



DO NOT WRITE ON THIS PAGE

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	

Total Marks	
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Examiner Number

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