



General Certificate of Secondary Education
2023–2024

Centre Number

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Candidate Number

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Single Award Science: Physics

Unit 3
Higher Tier



[GSA32]

GSA32

FRIDAY 23 FEBRUARY 2024, 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 3.

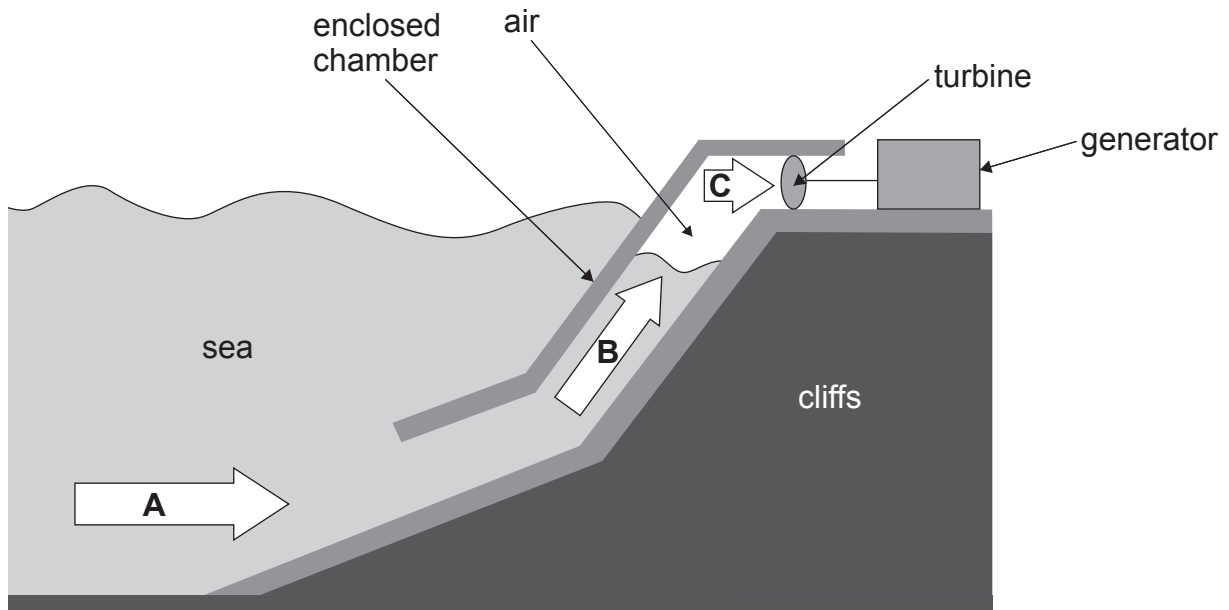


1 (a) Waves are a source of renewable energy.

(i) What is meant by the term **renewable energy**?

[1]

The diagram below shows a wave chamber used to generate electricity.



A waves push water up the chamber

B water pushes on air

C air forced through turbine

(ii) Explain how the **generator** produces electricity.

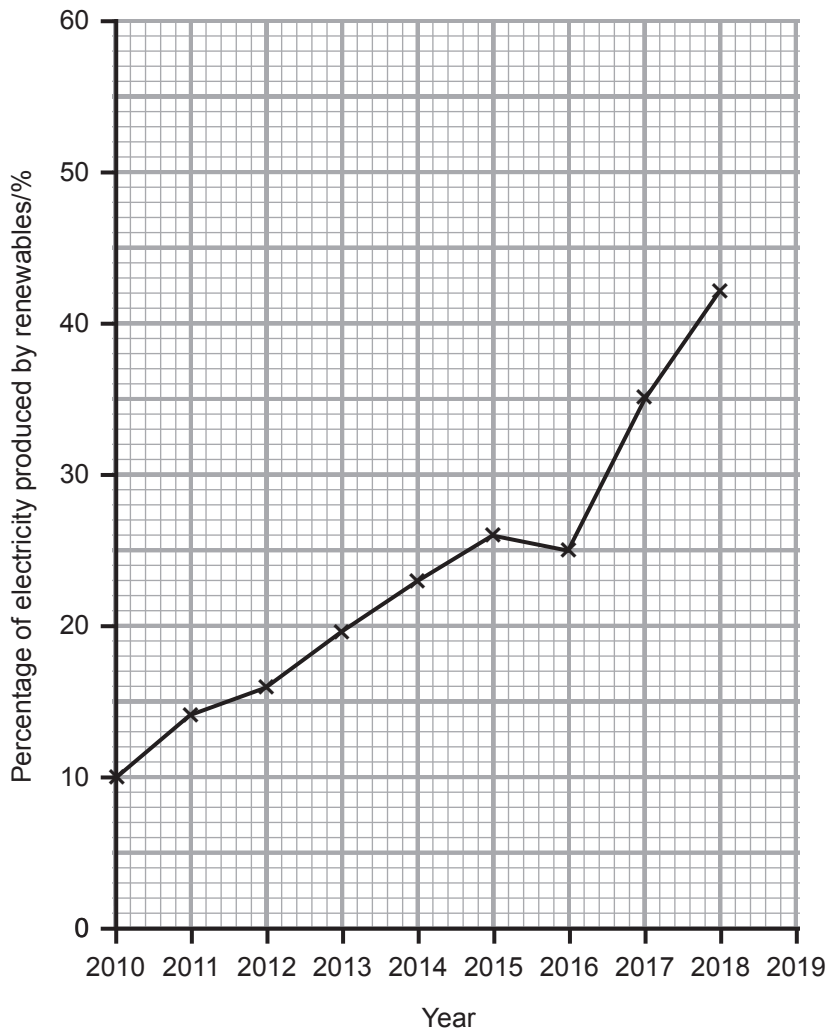
[2]

(iii) Give **one** disadvantage of using wave chambers to generate electricity.

[1]



(b) The graph below shows the percentage of electricity generated in Northern Ireland using renewable sources from 2010 to 2018.



(i) Use the graph to suggest the percentage of electricity generated from renewable sources in 2019.

_____ % [1]

(ii) Suggest **one** reason why the percentage of electricity produced by renewable sources has increased.

 _____ [1]

[Turn over



- 2 The table below shows the lowest and highest frequencies that can be heard by three types of dolphin.

Dolphin	Lowest frequency/kHz	Highest frequency/kHz
Bottlenose	0.1	150
Atlantic spotted	1.3	29
Striped	32.0	120

- (a) Name the type of dolphin which has the **smallest** frequency range.

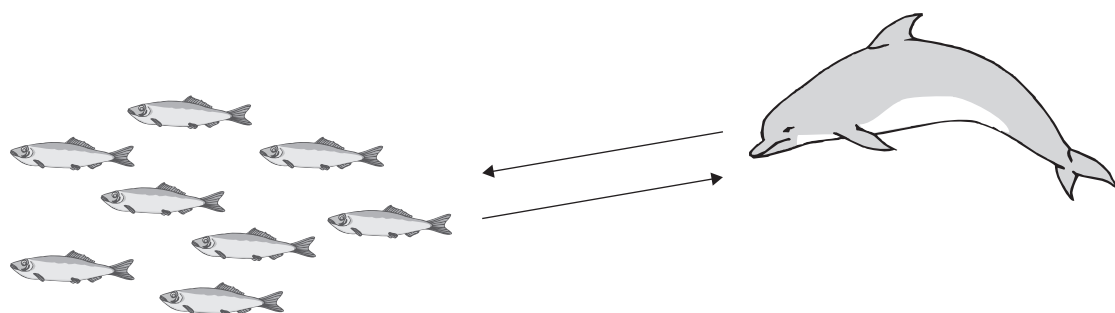
_____ [1]

- (b) What is the **highest** frequency that humans can hear?

_____ [1]



The diagram below shows a dolphin hunting for fish.



Sound travels at 1500 m/s in water.

The dolphin sends out an ultrasound pulse and the echo returns 0.2 seconds later.

(c) Use the equation:

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

to calculate the distance of the fish from the dolphin.

Show your working out.

_____ m [3]



3 The table below shows blood alcohol levels and the number of car accidents, for different age groups.

	Blood alcohol level/ mg/100 ml			
	20	40	60	80
Age	Number of accidents			
under 20	16	36	60	100
20–30	12	28	49	76
over 30	10	23	38	56

Use this information to describe the effect that alcohol has on the number of car accidents at different ages and explain this using your knowledge of how the brain reacts to alcohol.

Your answer should include:

- **two** conclusions from the information;
- the effect alcohol has on reaction time; and
- the effect alcohol has on thinking, braking and stopping distances.

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





[6]

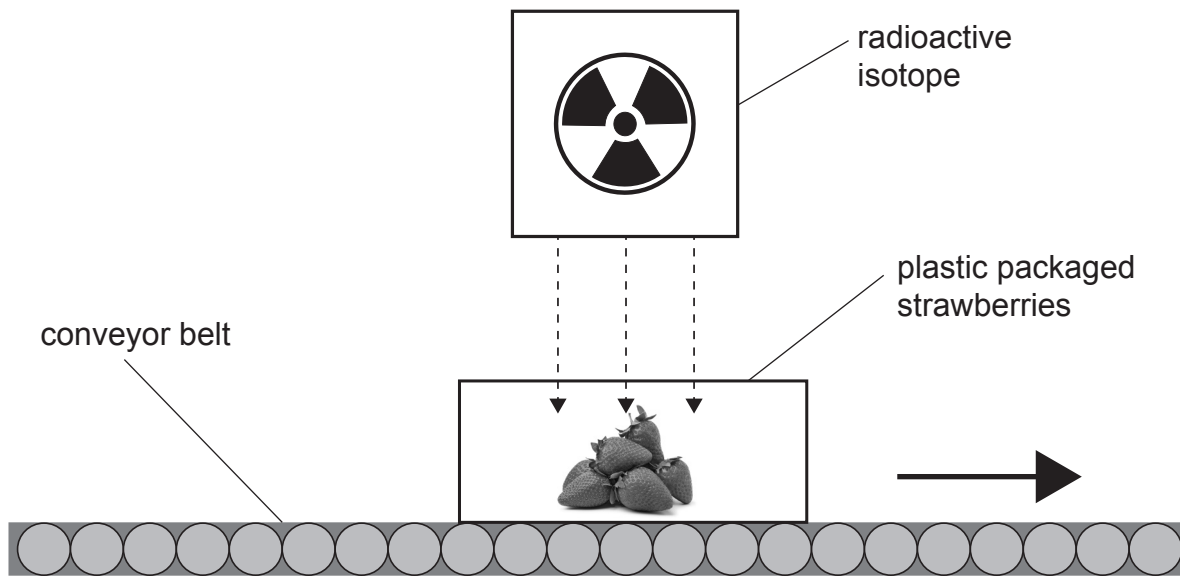
[Turn over

14374



24GSA3207

4 The diagram below shows strawberries being irradiated by a radioactive isotope.



The table below gives some information about isotopes.

Radioactive isotope	Type of radiation emitted	Half-life
bismuth-83	beta	61 minutes
cobalt-60	gamma	5 years
polonium-210	alpha	138 days
radon-220	alpha	55 seconds
technetium-99	gamma	6 hours

(a) Suggest which isotope would be the best for a food producer to use to irradiate a packet of fresh strawberries. Explain your answer.

Isotope _____

Explanation _____

[3]



(b) Explain why some fruit producers irradiate strawberries.

[2]

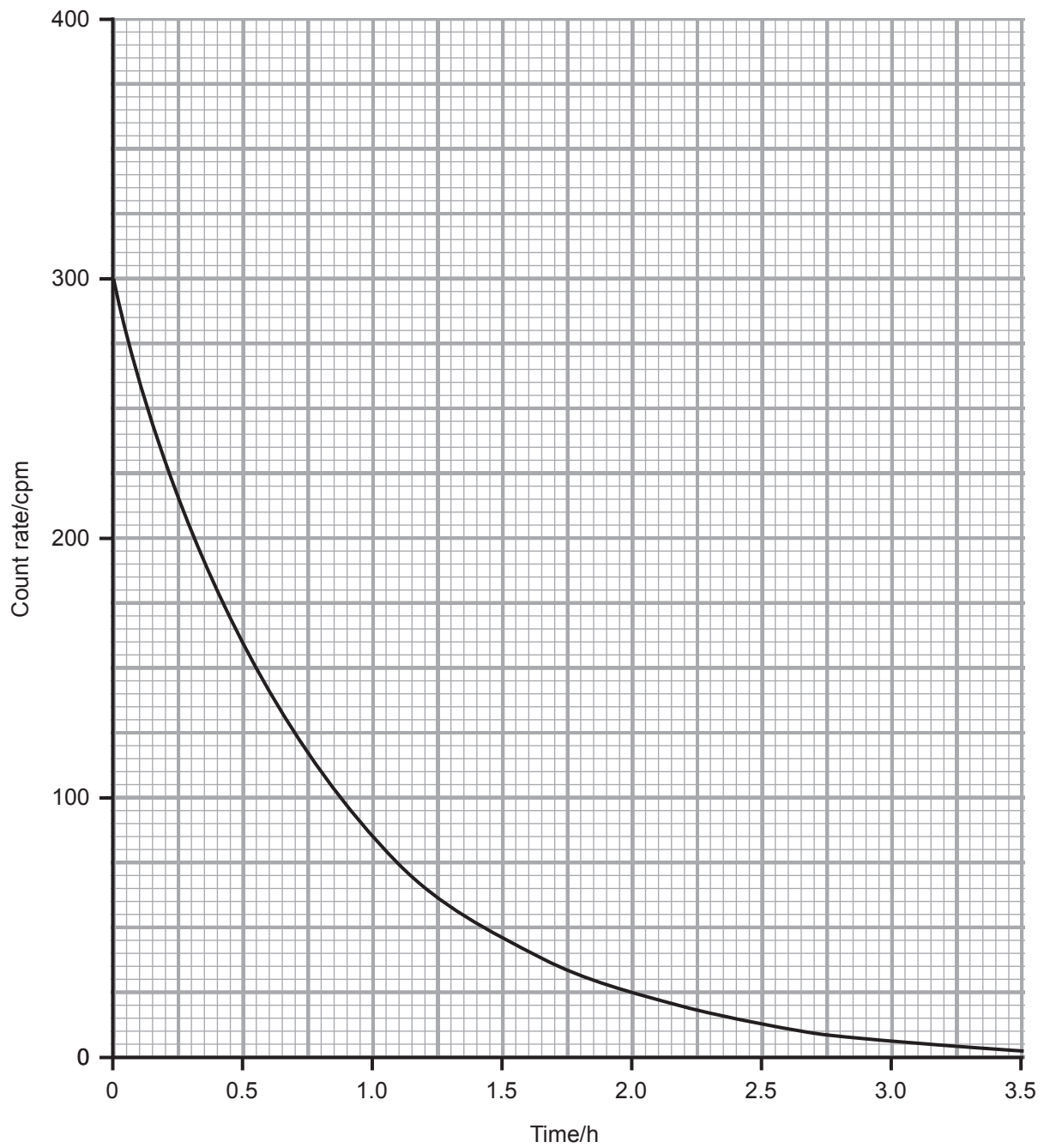
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14374



24GSA3209

- 5 The graph below shows the decay curve for a radioactive material. It has been adjusted for background radiation.



14374



24GSA3210

Use the graph to answer the following questions.

(a) Calculate the half-life of this material.

Show your working out.

_____ hours [2]

(b) What is background radiation?

_____ [1]

[Turn over

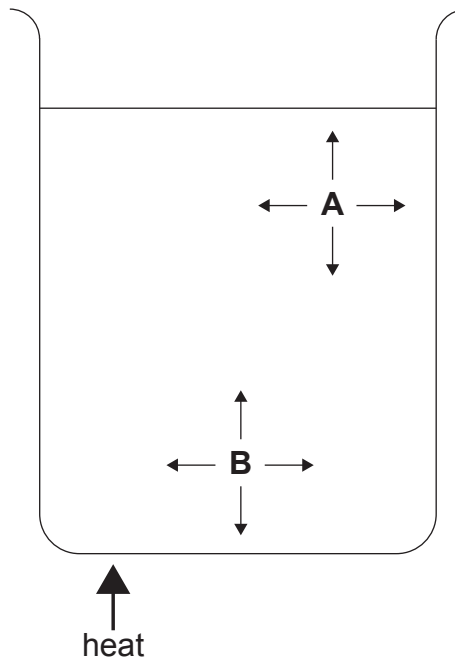


6 A metal rod was heated in a Bunsen burner flame.

(a) Explain how heat is conducted through the metal rod.

[2]

The diagram below shows a beaker of water being heated.

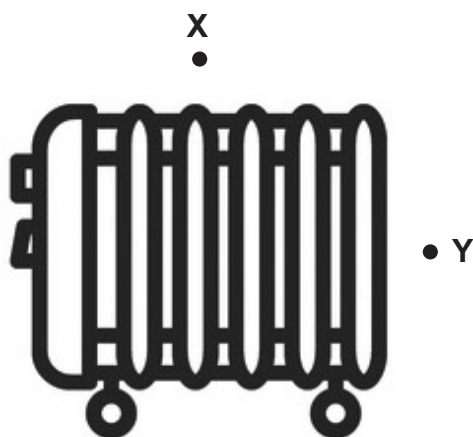


(b) Circle **one** arrow at **A** and **one** arrow at **B** which show the movement of water particles at these points.

[2]



The diagram below shows a hot metal radiator.



Point **X** is vertically above the radiator and point **Y** is to the side of the radiator.

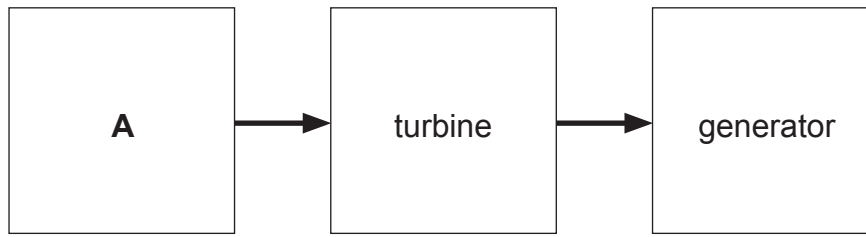
Both points **X** and **Y** are the same distance from the radiator.

(c) At which point **X** or **Y** will the temperature be higher? Explain your answer.

[1]



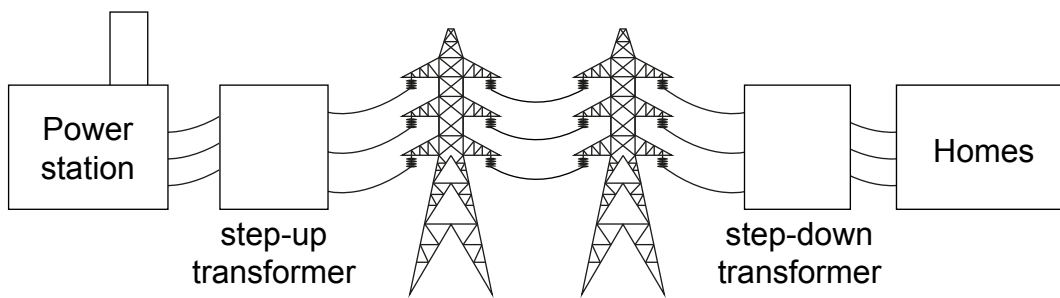
7 The diagram below shows some parts of a fossil fuelled power station.



(a) Name the part labelled A.

_____ [1]

Electricity generated in a power station is transferred to our homes across the National Grid as shown below.

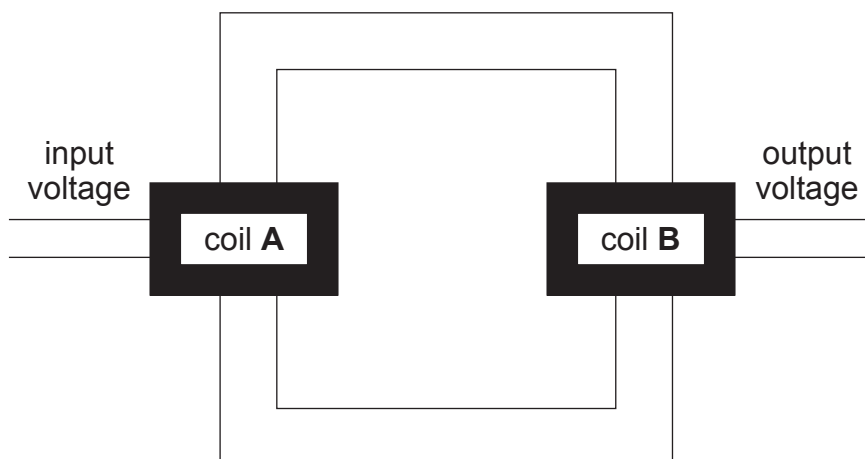


(b) Explain why a step-up transformer is used in the National Grid.

_____ [2]



(c) The diagram below represents a transformer.



In an investigation, a student changed the number of turns in coil **A** and coil **B** to find the effect on output voltage. The results are shown below.

Transformer	Number of turns in coil A	Number of turns in coil B	Input voltage/V	Output voltage/V
W	50	100	40	80
X	500	1000	40	
Y	100	50	40	20
Z	2000	500	40	10

(i) Calculate the ratio of the number of turns in coil **B** compared to coil **A** in transformer **W**.

_____ [1]

(ii) Calculate the output voltage for transformer **X**.

_____ V [1]

[Turn over



An 800 W microwave oven is used for 3 minutes.
Each unit (kWh) of electricity costs 20 p.

(d) Use the equation:

$$\text{energy} = \text{power} \times \text{time}$$

to calculate the cost of using the microwave.

Show your working out.

_____ p [3]



8 The table below shows the mass of biodiesel produced from 100 grams of four types of oil-bearing seed.

	Oil bearing seed	Mass of biodiesel produced /g
Edible seed	Palm	49
	Sunflower	39
Non-edible seed	Jatropha	78
	Neem	70

(a) Suggest **two** advantages of using non-edible seeds to produce biodiesel.

1. _____

2. _____

_____ [2]

(b) Biodiesel is used as a fuel substitute.

(i) What is meant by the term **fuel substitute**?

_____ [1]

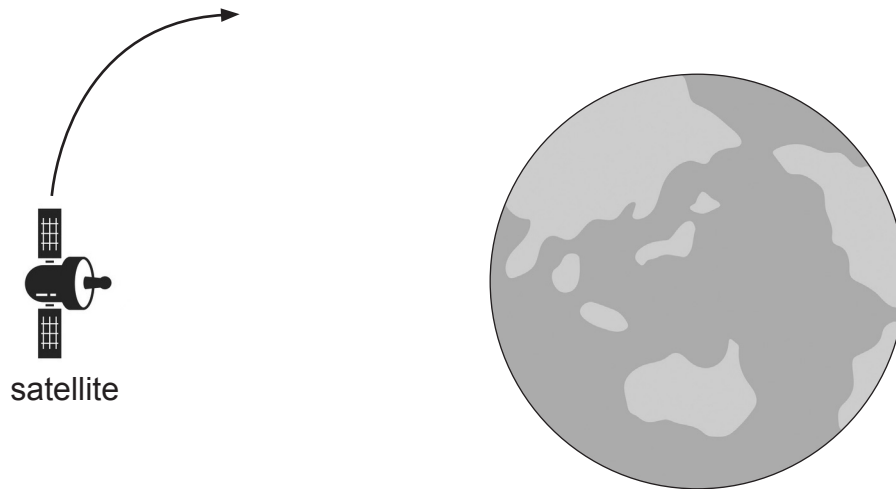
(ii) Name **one** substance used as a **fuel extender**.

_____ [1]

[Turn over



9 The diagram below shows a satellite orbiting the Earth.

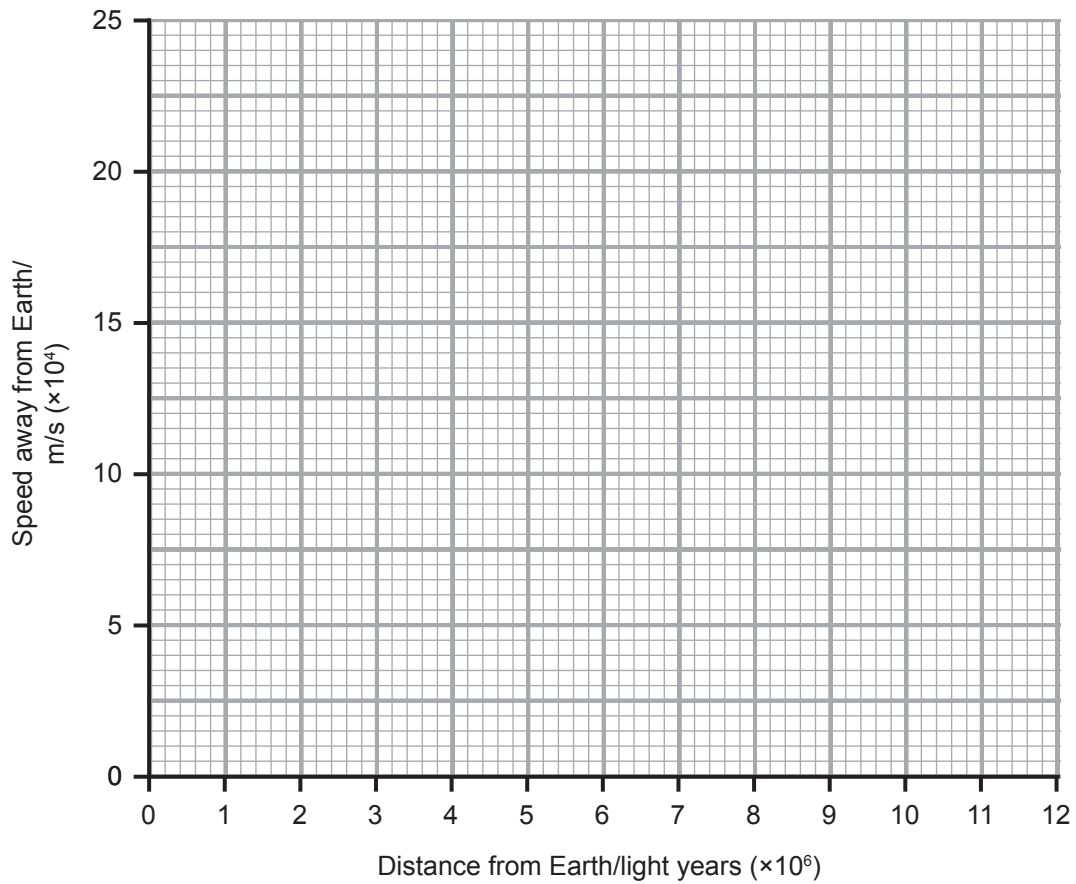


- (a) Draw **one** arrow on the diagram to show the direction of the gravitational force which acts on the satellite. [1]
- (b) The table below gives some information about five galaxies.

Name of galaxy	Distance from Earth/ light years ($\times 10^6$)	Speed away from Earth/ m/s ($\times 10^4$)
M110	2.8	6
Sextans B	4.8	10
Dwingloo 1	9.0	20
Maffei 1	9.8	21
Holmberg 11	11.2	24



(i) On the grid below, plot and draw a line graph for this information.



[3]

(ii) State the trend shown by this information.

[1]

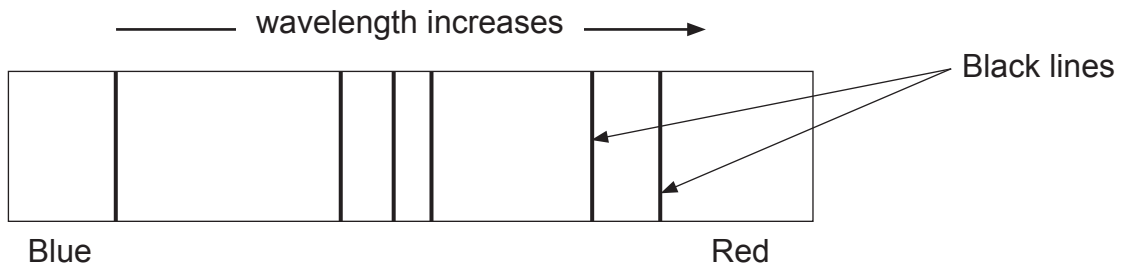
(c) Describe the formation of the Universe.

[3]

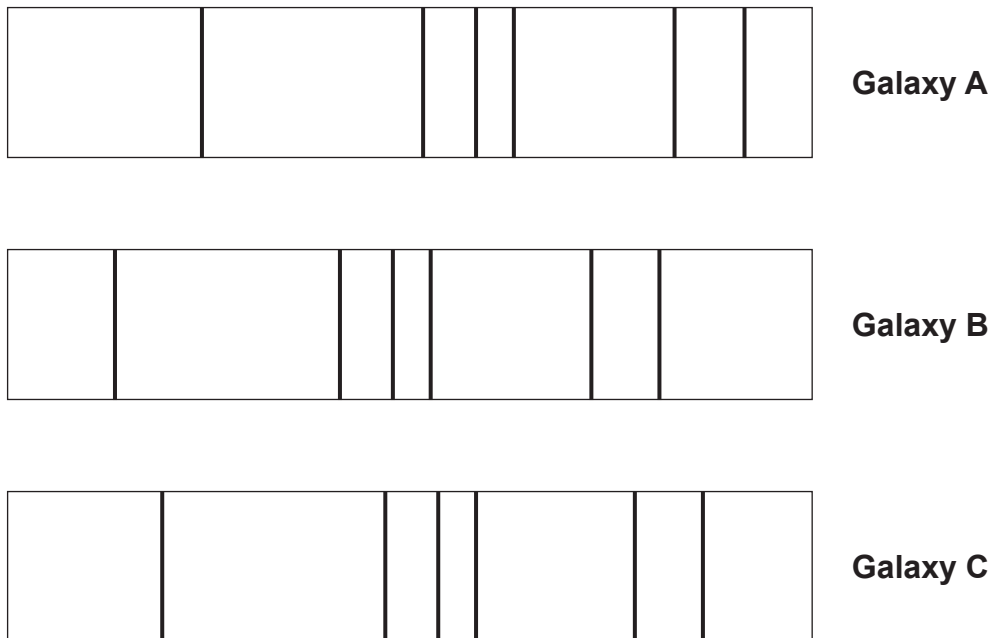
[Turn over



When scientists analyse the spectrum of light from our galaxy, they see the following black lines.



The spectra from three **different** galaxies are shown below.

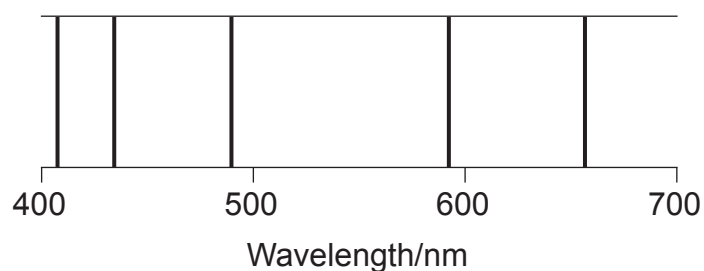


(d) Which galaxy **A**, **B** or **C** is farthest away from Earth? Explain your answer.

[2]



The diagram below shows the black lines in the spectrum of light from a distant star.



The position of the black lines shows which elements the star contains.

(e) In the table below, insert ticks (✓) to identify which elements **P**, **Q**, **R** or **S** are present in the star.

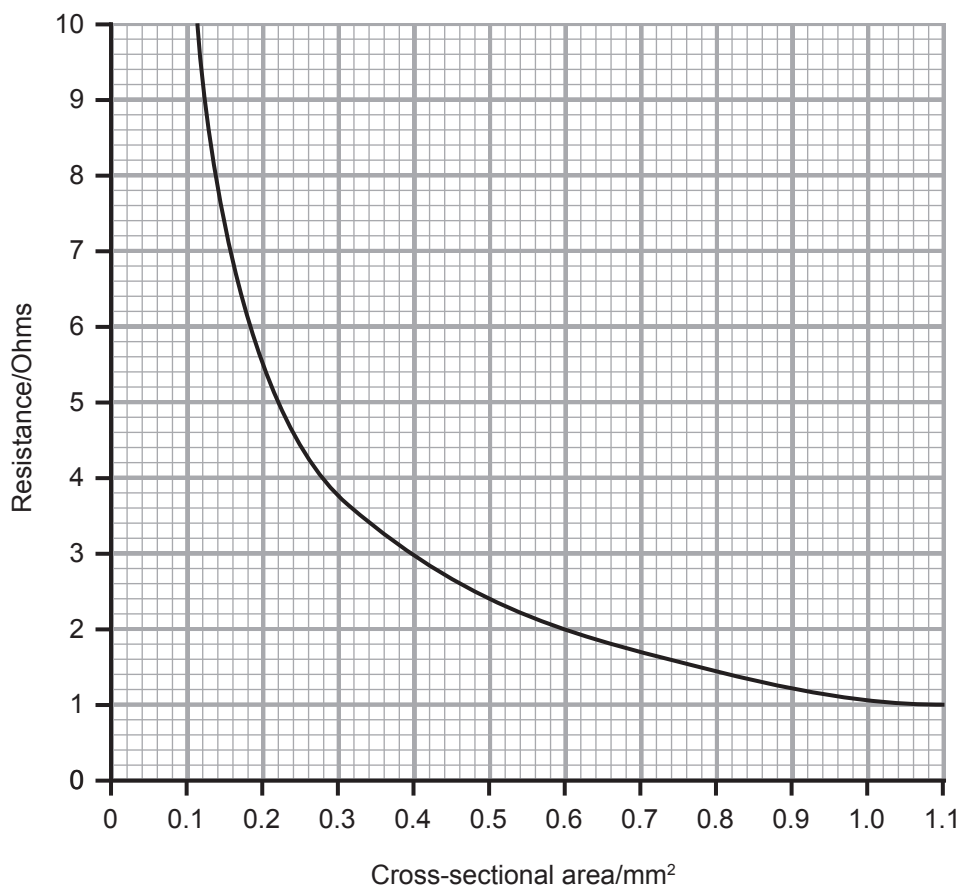
Element	Wavelength/nm	Element present (✓)
P	447, 502	
Q	590	
R	410, 434, 486, 656	
S	431, 467, 496, 527	

[2]

[Turn over



- 10 (a) The graph below shows how the cross-sectional area affects the resistance of one metre of nichrome wire.



- (i) Describe fully the trend shown by this graph.

_____ [2]

- (ii) Use the graph to find the resistance of one metre of nichrome wire with a cross-sectional area of 0.66 mm^2 .

_____ Ohms [1]



(iii) A new metal has been discovered called helenium. Helenium has a lower resistance than nichrome. On the grid opposite draw a line to show how the resistance of one metre of helenium changes as the cross-sectional area increases. [2]

(b) Apart from cross-sectional area, give **one** other factor which affects the resistance of nichrome wire. [1]

THIS IS THE END OF THE QUESTION PAPER



Sources:

- Question 1(a) . . . Principal Examiner
- Question 2(c) . . . Principal Examiner
- Question 4 Principal Examiner + © Getty Images
- Question 6(b) . . . Principal Examiner
- Question 6(c) . . . © Getty Images
- Question 7(a) . . . Principal Examiner
- Question 7(c) . . . Principal Examiner
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Question Number	Marks
1	
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Examiner Number

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