Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2018–2019

Single Award Science: Physics

Unit 3

Higher Tier

[GSA32]

GSA32

FRIDAY 1 MARCH 2019, 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 eight** 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(b)**.

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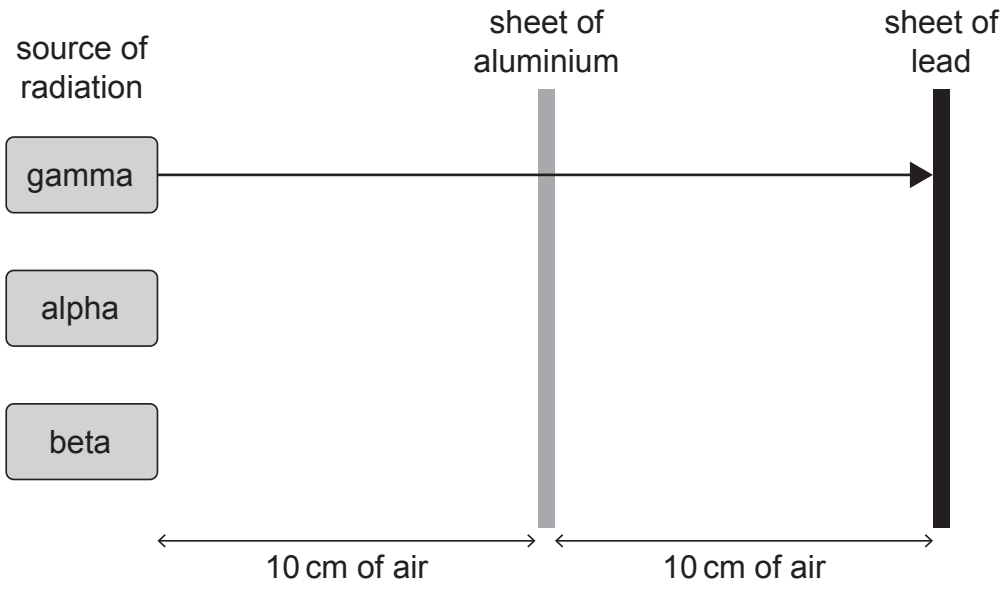
1 The diagram below shows how gamma radiation can penetrate air and aluminium, but is stopped by lead.



(a) Complete the diagram using arrows, to show the penetration you would expect for alpha and beta radiation. [2]

(b) Explain fully why some elements, such as radon, are radioactive.

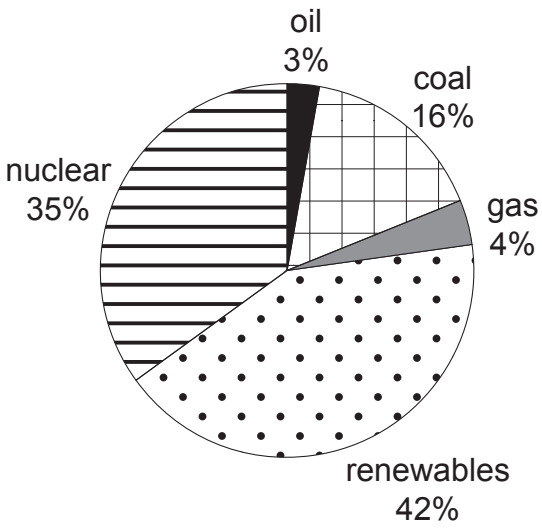
_____

_____

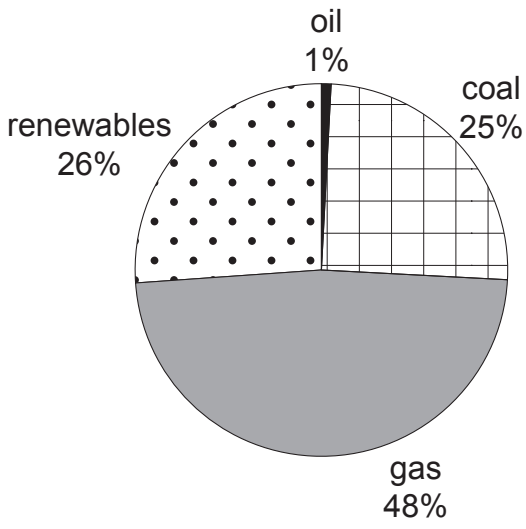
_____ [3]

[Turn over

2 The pie charts below show the energy sources used in Scotland and Northern Ireland to generate electricity.



Scotland



Northern Ireland

(a) Name **one** energy source that is used **more** in Northern Ireland than Scotland.

_____ [1]

(b) The nuclear energy source used in Scotland is non-renewable.

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

_____

_____ [1]

(ii) Name **one** non-renewable nuclear fuel.

_____ [1]

(iii) Name the process that releases energy from this nuclear fuel.

_____ [1]

(c) Use the pie chart to calculate the percentage of fossil fuels used in Scotland.

Answer _____ % [1]

(d) The table below shows the percentage of electricity generated in Northern Ireland using renewable resources.

Year	Electricity generated/%
2012	15.9
2013	19.5
2014	21.9
2015	26.0

(i) State the trend shown by this information.

_____

_____ [1]

(ii) Name **one** renewable energy source.

_____ [1]

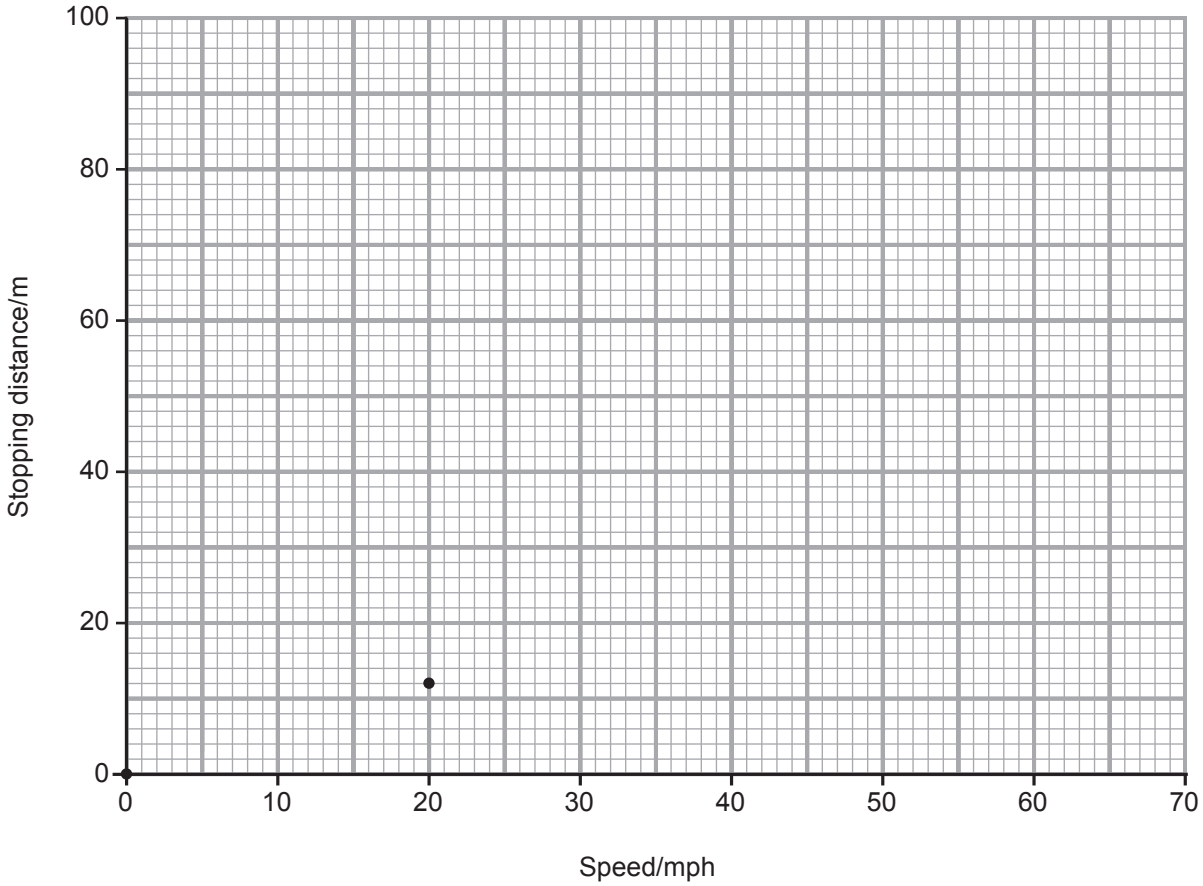
[Turn over

3 **(a)** The table shows the braking distance and the thinking distance of a vehicle at different speeds.

Speed/ mph	Thinking distance/ m	Braking distance/ m	Stopping distance/ m
0	0	0	0
20	6	6	12
30	9	14	23
40	12	24	36
50	15	38	53
60	18	55	73
70			96

(i) Complete the table to give the thinking distance and braking distance at a speed of 70 mph. [2]

(ii) On the grid below, plot and draw a line graph to show how **stopping distance** changes with speed.
The first two points have been plotted for you.



[3]

(iii) Use your graph to find the stopping distance at 45 mph.

Answer _____ m [1]

(iv) These stopping distances are for dry road conditions. On the same grid, draw another line to show the stopping distances for **wet** road conditions. [2]

[Turn over

(b) Thinking distance depends on a driver's reactions.
Describe an experiment using a metre stick or ruler, that can be used to compare the reactions of two people.

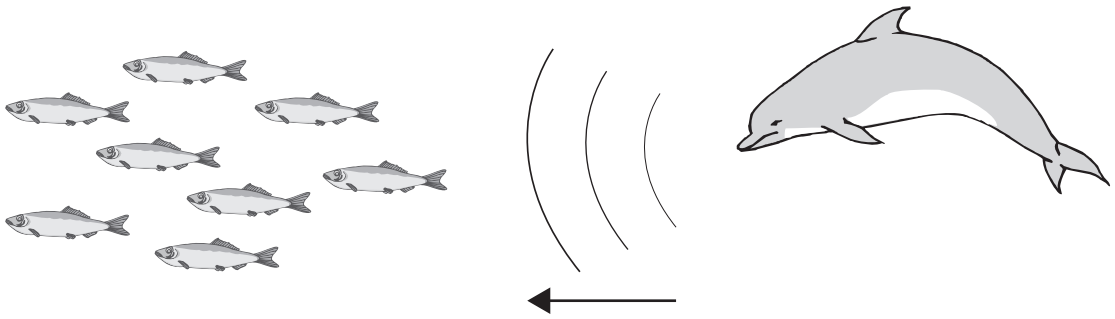
Your answer should include:

- how to make the results reliable
- **two** factors that would slow a driver's reactions.

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

[6]

4 **(a)** The diagram below shows a dolphin using sound waves to locate a shoal of fish.



Source: Principal Examiner

Dolphins can use sound with frequencies above 20 kHz.

(i) What is sound with a frequency above 20 kHz called?

_____ [1]

(ii) What is this method of detection called?

_____ [1]

(iii) Sound is an example of a longitudinal wave.
Describe fully the motion of particles in a longitudinal wave.

_____

_____ [2]

[Turn over

(b) A sound wave of frequency 1 kHz and wavelength 1.5 m travels through water.

Use the equation:

speed = frequency × wavelength

to calculate the speed of sound in water.

(Show your working out.)

Answer _____ m/s [2]

Shown below is a student's answer to a question about calculating the speed of sound.

A boy stands 250 m from a cliff and shouts 'Help!'
He hears the returning sound 1.5 s later.
Calculate the speed of sound.

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

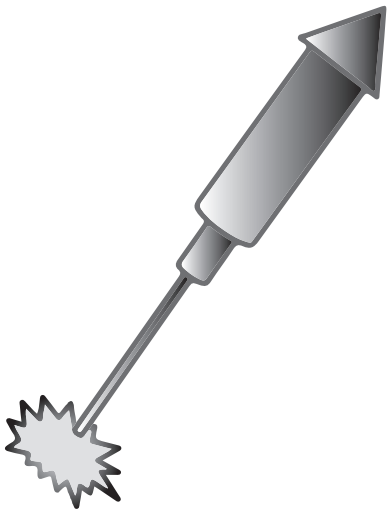
$$\text{Speed of sound} = \frac{250}{1.5} = 166.7 \text{ m/s}$$

(c) Explain the mistake that the student has made in doing this calculation.

_____

_____ [1]

(d) A firework explodes with a flash and a bang at a height of 250 m above the ground. This can be used to calculate the speed of sound.



Source: Principal Examiner

To use the equation that calculates the speed of sound, the time taken for the sound to travel 250 m needs to be measured.
Describe how a stopwatch is used to measure this time.

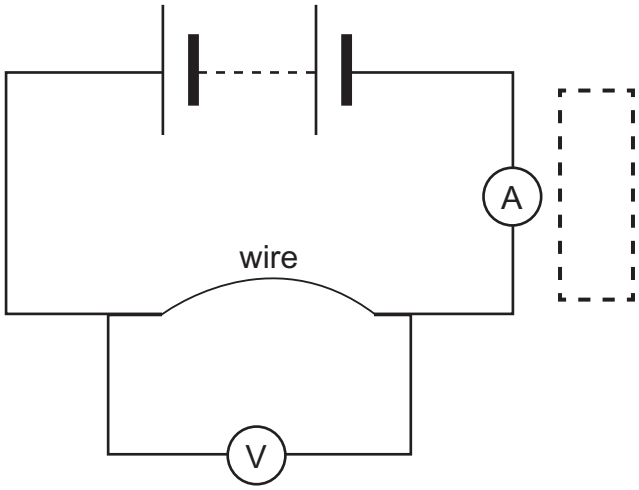
_____

_____

_____ [2]

[Turn over

5 **(a)** The circuit below was used to measure the current through a piece of wire and the voltage across it. These values were then used to calculate resistance.



(i) In the diagram above, draw an arrow in the box to show the direction of conventional current. [1]

(ii) Describe fully how current actually flows around a circuit.

_____

_____

_____ [3]

(b) The experiment was carried out using three wires. The results are shown in the table below.

Wire	Voltage/V	Current/A	Resistance/Ω
1	4.00	1.00	4.00
2	4.00	2.00	2.00
3	4.00	0.50	

(i) Use the equation:

voltage = current × resistance

to calculate the resistance of wire 3.

(Show your working out.)

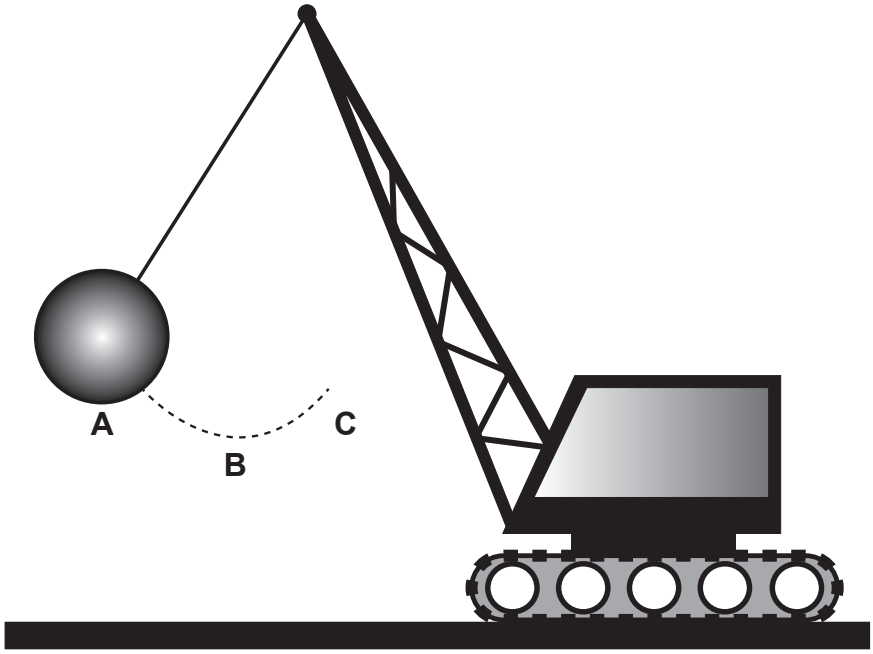
Answer _____ Ω [2]

(ii) The three wires were equal in length and made from the same material but the cross-sectional areas were different.
Which wire (**1**, **2** or **3**) had the smallest cross-sectional area?

_____ [1]

[Turn over

6 The diagram below shows a wrecking ball swinging from **A** to **C**.



Source: Principal Examiner

(a) In the table below, place a tick (✓) in the appropriate column to show what happens to the energy of the ball as it swings. Ignore the effects of all frictional forces.

	Increases	**Decreases**	**Stays constant**
Kinetic energy from **A** to **B**			
Gravitational potential energy from **B** to **C**			

[2]

(b) The wrecking ball has a mass of 450 kg. At position **A**, the ball is 3.6 m above the ground.

Use the equation:

$$E_p = mgh$$

to calculate the potential energy of the wrecking ball at position **A**.
Your answer must include the unit.
Assume g = 10 N/kg

(Show your working out.)

Answer _____ [3]

(c) State the Principle of Conservation of Energy.

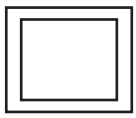
_____

_____

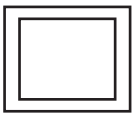
_____ [1]

[Turn over

7 **(a)** Shown below is the information found on the back of a television.

Samsong	
AC 220–240 V ~ 50/60 Hz 100 W  Made in Hungary	Model: 239657293C
CAUTION RISK OF ELECTRIC SHOCK DO NOT OPEN	

(i) The symbol below means the appliance has double insulation.



Explain fully how double insulation protects the user.

_____

_____ [2]

(ii) Calculate the electrical energy used by this television in 30 minutes.
Give your answer in kilowatt hours (kWh).

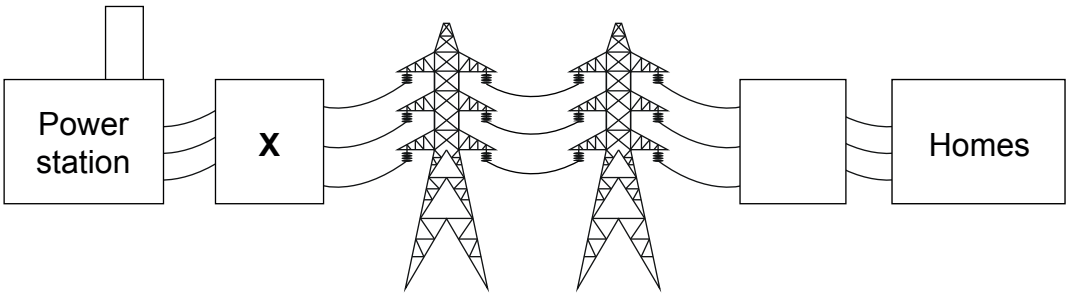
Use the formula:

energy = power × time

(Show your working out.)

Answer _____ kWh [3]

(b) Electricity for our appliances comes to our homes from power stations.
The diagram below shows the distribution of electricity across the grid.

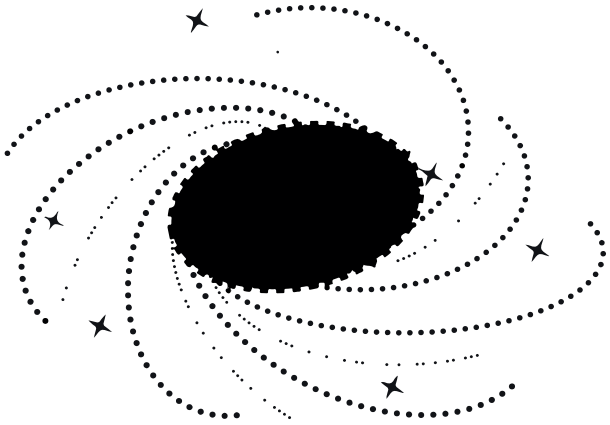


Name the component labelled **X**.

_____ [1]

[Turn over

8 The drawing below represents a galaxy.



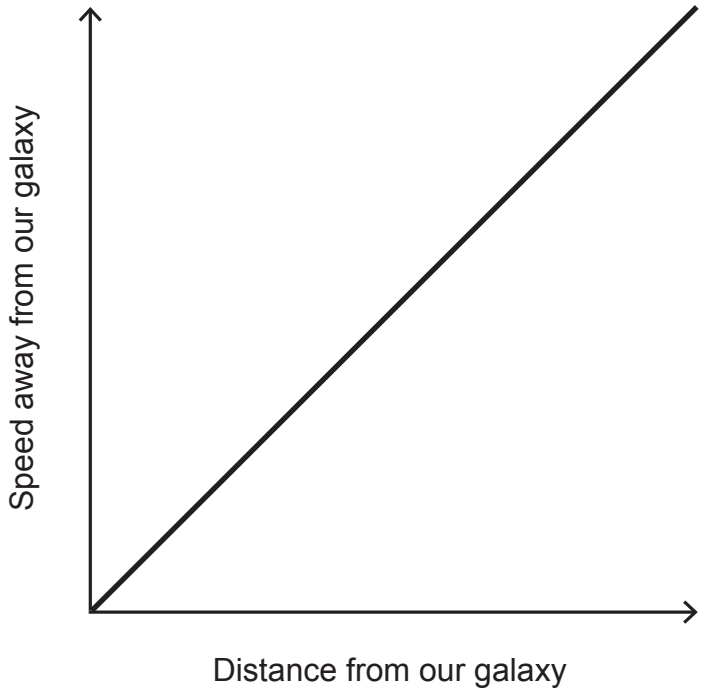
Source: Principal Examiner

(a) What is a galaxy?

_____

_____ [1]

(b) The graph below shows how the speed of a galaxy depends on its distance from our galaxy.



(i) What conclusion can be made from the information shown in this graph?

_____

_____ [1]

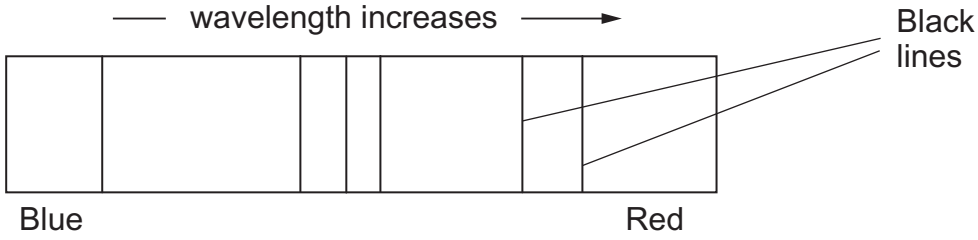
(ii) Distances between galaxies are measured in light years. What is meant by the term **light year**?

_____

_____ [1]

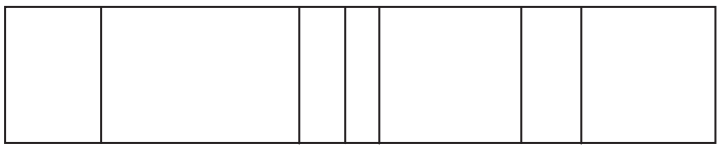
[Turn over

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

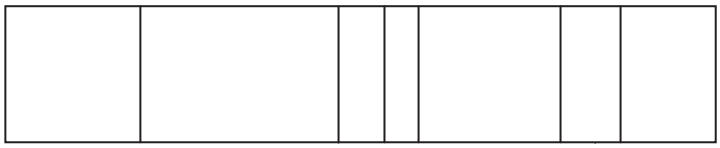


The spectra from three **different** galaxies are shown below.

Galaxy A



Galaxy B



Galaxy C

(c) Which galaxy **A**, **B** or **C** is furthest away from us?
Explain your answer.

_____

_____

_____ [3]

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For Examiner's use only	
Question Number	Marks
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Examiner Number