Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2012–2013

Science: Single Award

Unit 3 (Physics)

Higher Tier

[GSS32]

ML

THURSDAY 23 MAY 2013, MORNING

TIME

1 hour 15 minutes, plus your additional time allowance.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all ten** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75.
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 questions **5** and **10(a)**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total Marks	

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Examiner Only	
Marks	Remark

1 Look at the table below. It shows how the percentage of children wearing seat belts in a car has changed from 1995 to 2012.

	Year				
Age group	**1995**	**2000**	**2005**	**2010**	**2012**
Under 1 year	96	97	98	98	100
1–4	65	82	92	96	97
5–9	49	68	82	94	94
10–13	47	65	82	93	95
All children	**59**	**74**	**86**	**93**	**96**

(a) Describe **two** trends that can be seen in this data.

1. _____

_____

2. _____

_____ [2]

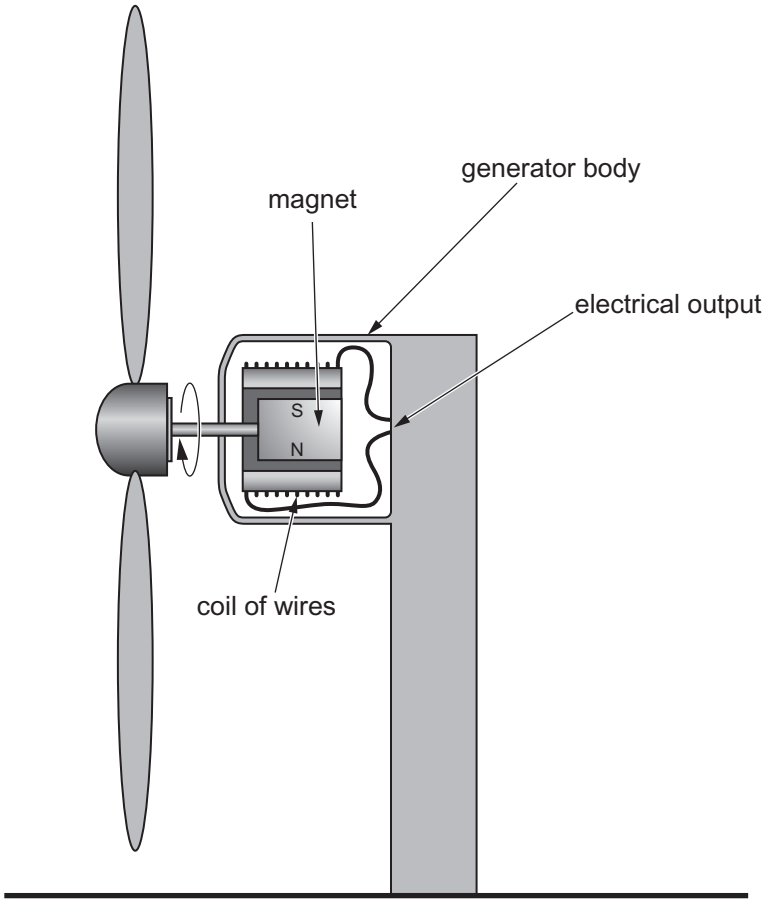
(b) The government are still advertising the need for children to wear seat belts. Use the information in the table to suggest why advertising is still necessary.

_____

_____ [1]

Examiner Only	
Marks	Remark

2 The diagram below shows a cross-section through a wind turbine. When the blade spins a current is produced.



(a) What happens to the amount of current produced if:

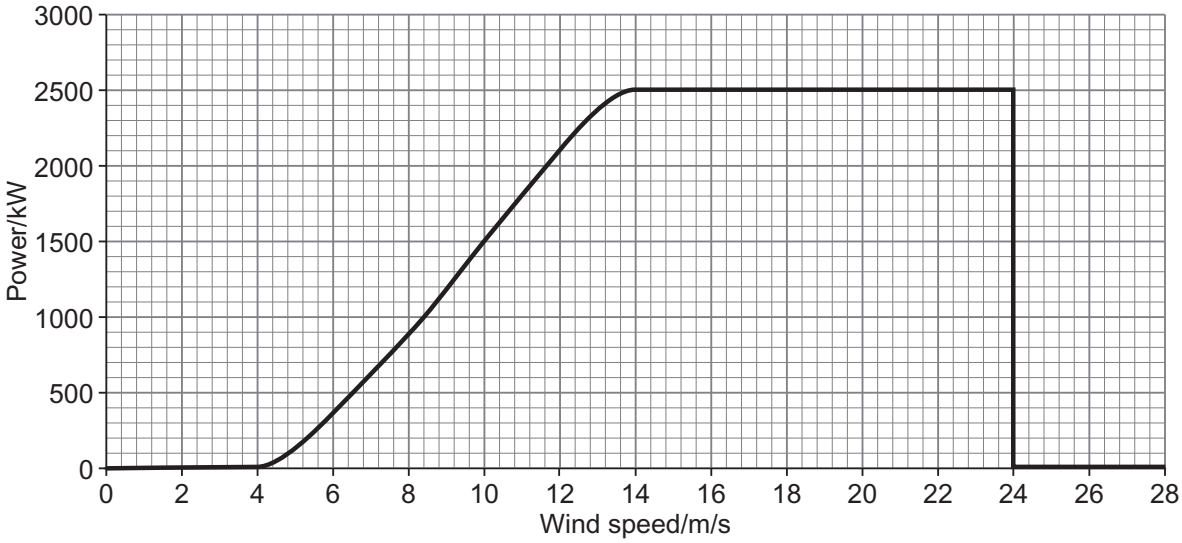
1. a weaker magnet is used?

_____

2. more coils of wire are used?

_____ [2]

(b) The graph below shows how the wind speed affects the amount of power produced.



(i) Describe fully how the power produced by the turbine changes with wind speed.

[3]

(ii) Why is the turbine designed to stop at high wind speeds?

[1]

(c) Explain fully why the government has built more wind turbines in the past ten years.

[2]

(d) Write down **one** reason why some people do not want wind turbines near their home.

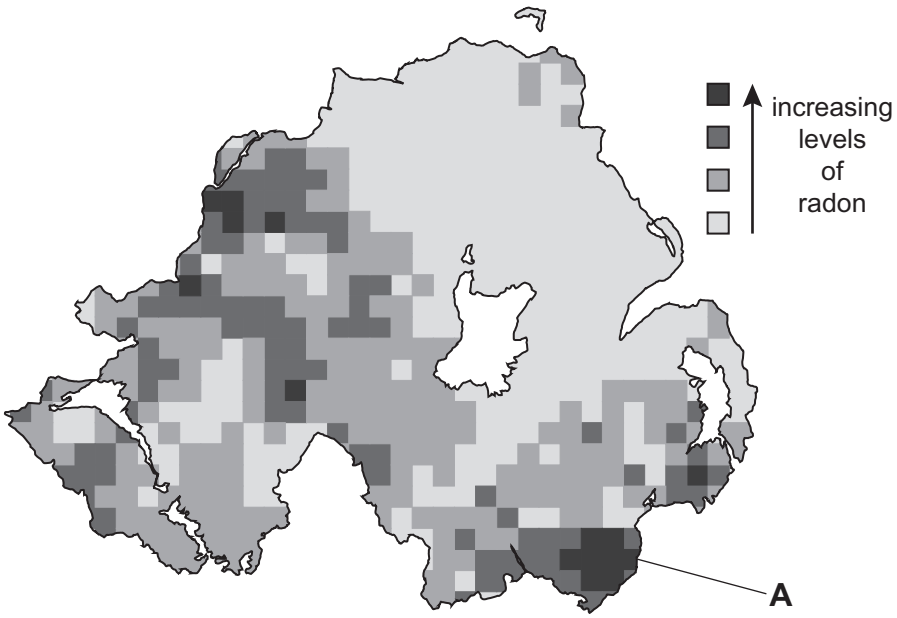
[1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

3 **(a)** The diagram below shows the amount of radon gas found naturally in Northern Ireland.



(i) Radon gas is a source of background radiation. What is meant by the term background radiation?

_____

_____ [1]

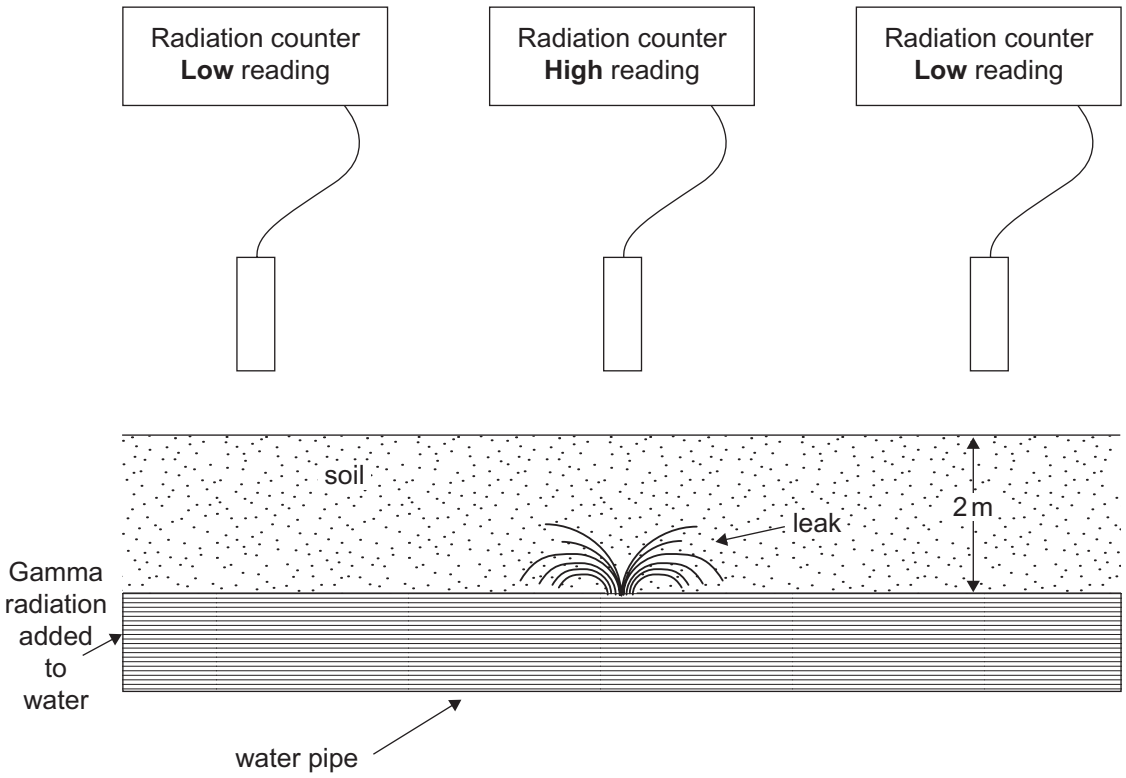
(ii) Explain fully why someone living in area **A** could be concerned about their health.

_____

_____

_____ [2]

(b) Gamma radiation can be used to check for leaks in water pipes.



Explain fully why gamma radiation is the best source to use.

_____

_____

_____

_____

_____ [2]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

4 The table below shows information about three types of bulb.
Each bulb produces the **same** light power output.

	Energy saving bulb	Filament bulb	LED spotlight
	 © CCEA	 © CCEA	 © CCEA
Power input/W	11	60	7
Cost to run for 1000 hours	£1.87	£10.20	£1.19
Average life/hours	10 000	1000	20 000
Cost to buy	£3.50	£0.90	£10.00

(a) Which bulb is the most efficient?

_____ [1]

(b) Which bulb, including the cost to buy, would be the cheapest to run for 1000 hours?

_____ [1]

(c) The energy saving bulb uses 11 J of energy per second and has an efficiency of 0.6. What is its light energy output per second?

Use the equation:

light energy output = efficiency × energy input

(Show your working out.)

Answer _____ J [2]

(d) Calculate how much energy this bulb wastes per second.

Answer _____ J [1]

(e) The efficiency of a filament bulb is much less than the efficiency of an energy saving bulb. Explain fully why the government has recommended that the use of filament bulbs should be stopped.

_____

_____ [1]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

5 Long sight is a common eye defect. Explain fully the **cause**, the **effect** and the **correction** of long sight. Your answer should refer to the parts of the eye involved and the passage of light through the eye.

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

[6]

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(Questions continue overleaf)

Examiner Only	
Marks	Remark

6 **(a)** The photograph below shows asteroid 243 Ida. It is 56 kilometres in length.

Source: NASA / Galileo Image Library

If an asteroid like the one shown above hit the Earth, describe fully how this could affect life on Earth.

_____

_____

_____

_____

_____

_____ [3]

(b) The table below shows data on the asteroids most likely to hit Earth.

Name of asteroid	Possible impact year	Chance of hitting Earth/%	Impact velocity km/s	Estimated diameter m
2012 TY52	2014–2020	0.0003	14.13	180
2012 QD8	2042–2050	0.0007	20.77	18
2012 TC4	2020–2110	0.0049	6.51	16
2012 SY49	2031–2084	0.0013	15.66	23
2011 AG5	2040–2047	0.2000	9.55	140

(i) Explain fully why scientists are **not** very concerned about impact from the asteroids shown in the table opposite.

_____

_____

_____

_____

_____ [2]

(ii) Name the asteroid that is least likely to hit Earth.

_____ [1]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

7 The diagram below shows a microwave oven.

(a) Explain fully how microwave rays heat food.

_____

_____

_____

_____

_____ [3]

(b) Microwaves have a wavelength of 0.15 m and travel at a speed of 3.0×10^8 m/s.

Use the equation:

$$\textbf{frequency} = \frac{\textbf{speed}}{\textbf{wavelength}}$$

to calculate the frequency of these waves.

(Show your working out.)

Answer _____ Hz [2]

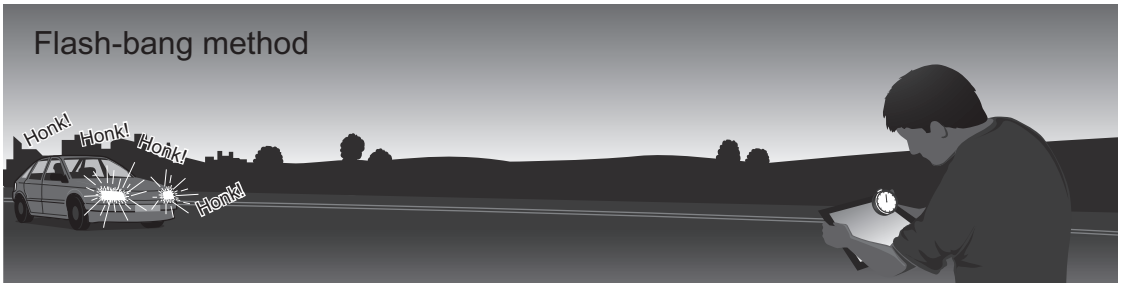
Examiner Only	
Marks	Remark

(c) Microwaves and gamma rays are both types of electromagnetic radiation. Explain fully why gamma rays cause more damage to living cells.

_____

_____ [2]

(d) Shown below are two pupils measuring the speed of sound.



(i) Describe fully how the flash-bang method can be used to measure the speed of sound in air.

_____

_____

_____

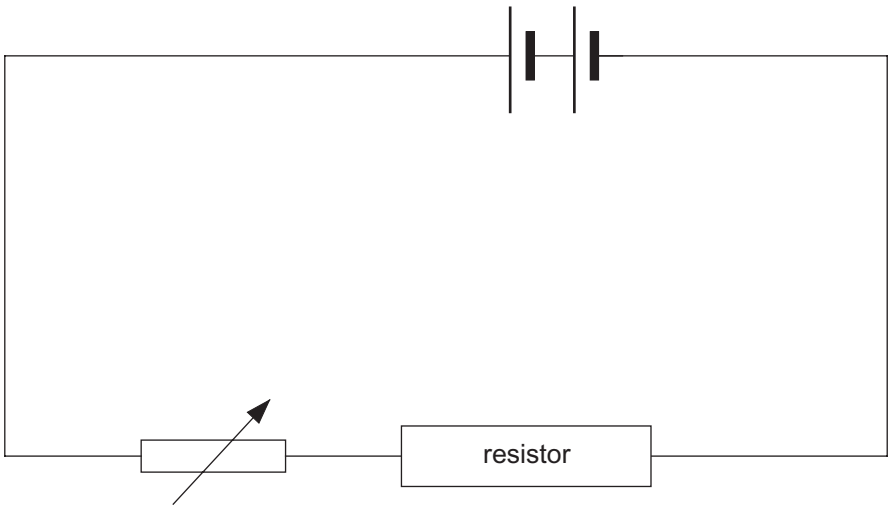
_____

_____ [3]

(ii) The speed of sound in air is 330 m/s. When this experiment was carried out the pupil got a result of 300 m/s. Suggest **one** reason why there is a difference.

_____ [1]

8 Colin set up the circuit below to measure the voltage across a resistor.



(a) Complete the circuit to show where he would place a voltmeter to measure the voltage across the resistor. [1]

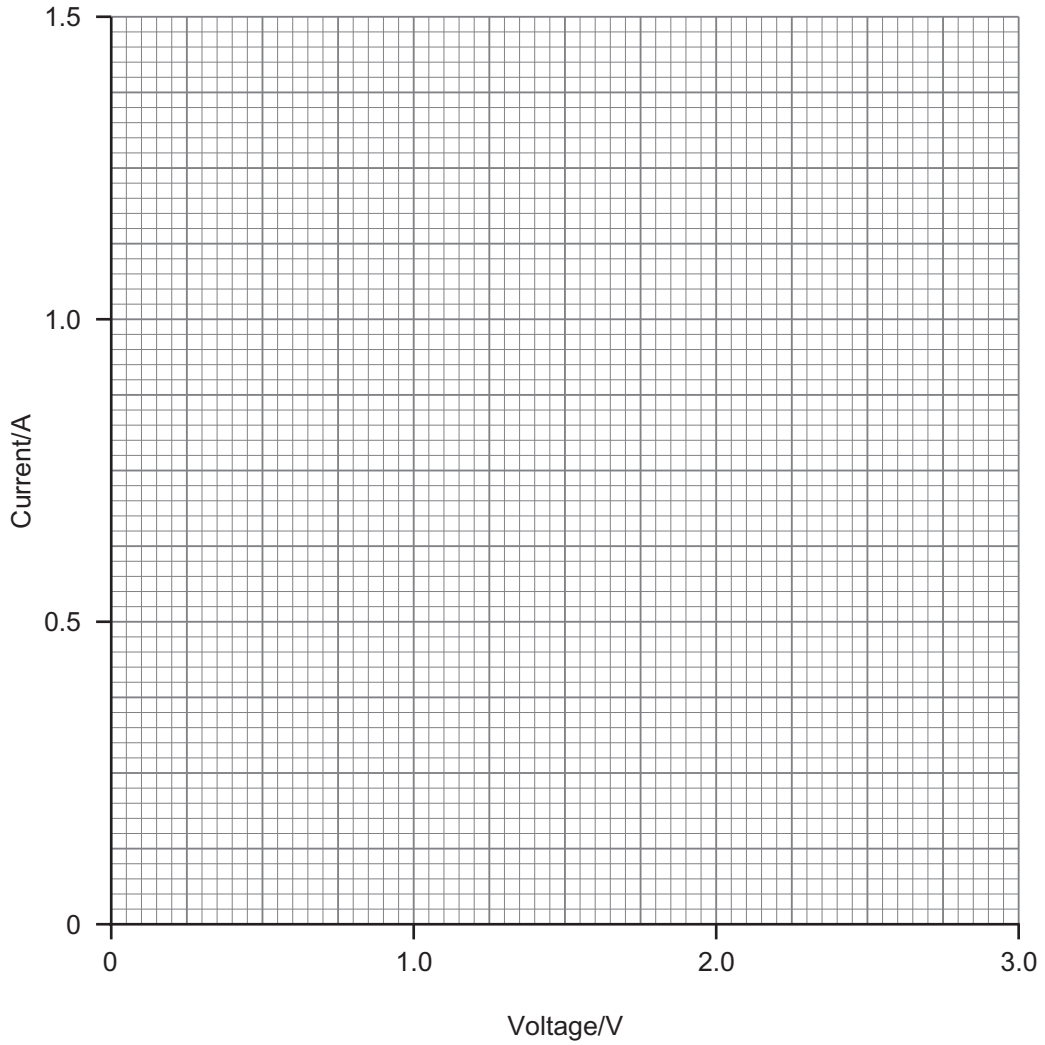
(b) Colin obtained the following results.

Voltage/V	Current/A
0.5	0.2
1.0	0.4
1.5	0.6
3.0	1.25

Examiner Only

Marks	Remark

(i) On the grid below plot and draw a line graph of these results.



[3]

(ii) What conclusion can be drawn from these results?

_____

_____ [1]

(iii) From the graph what current flows when the voltage is 2.0 V?

Answer _____ A [1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

(iv) The resistor was found to have a value of 2.5 ohms.

Use the equation:

$$\textbf{resistance} = \frac{\textbf{voltage}}{\textbf{current}}$$

to calculate the current that flows when the voltage is 4 V.

(Show your working out.)

Answer _____ A [2]

(c) The photograph below shows a step-down transformer that is part of the National Grid system.

© Andrew Lambert Photography / Science Photo Library

Describe fully what changes, if any, the step-down transformer makes to the current and voltage. Explain why transformers are used in the National Grid.

_____

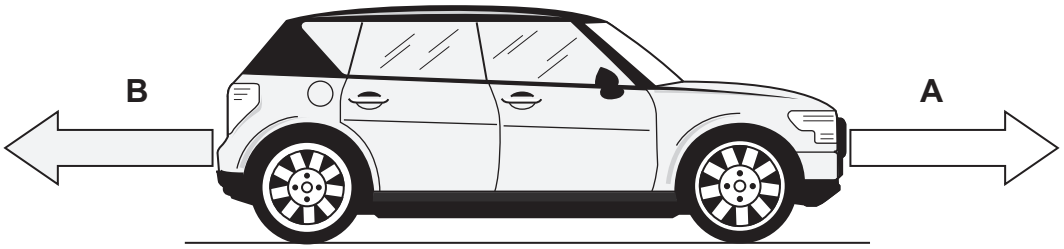
_____

_____

_____ [3]

Examiner Only	
Marks	Remark

9 **(a)** The diagram below shows a car on a straight road. The forces **A** and **B** are equal.



(i) What is the value of the resultant force on the car?

_____ [1]

(ii) What are the **two** possible states of motion of this car?

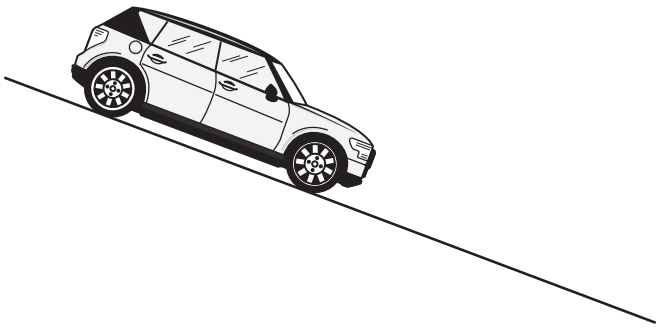
1. _____

2. _____ [2]

(b) Force **A** is now decreased. What effect, if any, will this have on the movement of the car?

_____ [1]

(c) The car below is at rest on a slope.



The handbrake is released and the car begins to accelerate. Explain fully in terms of forces, why it accelerates.

_____

_____

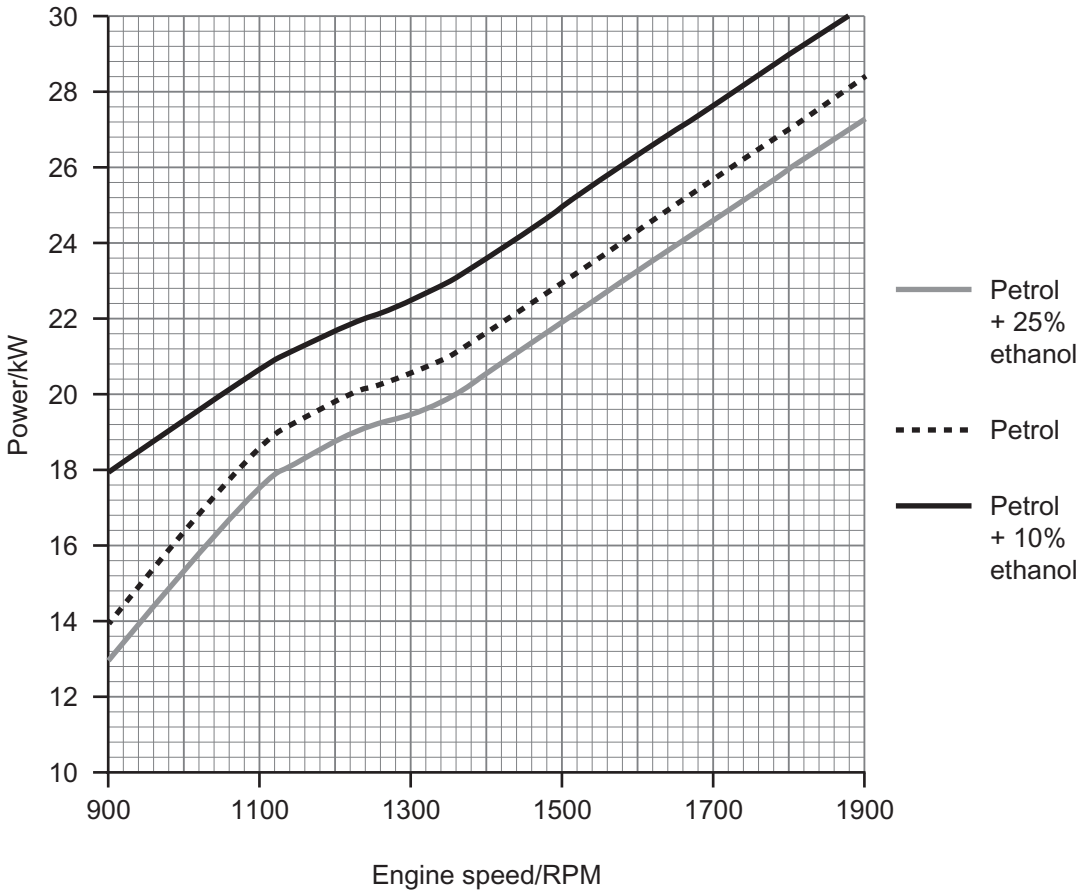
_____

_____

_____ [3]

Examiner Only	
Marks	Remark

(d) The graph below shows how extenders affect the power produced by an engine.



To save fossil fuels, manufacturers are designing cars to use petrol which contains an extender (ethanol). Use the graph to fully describe the effect of the extenders.

_____

_____

_____ [2]

(e) Name **one** substitute fuel that can be used instead of fossil fuels.

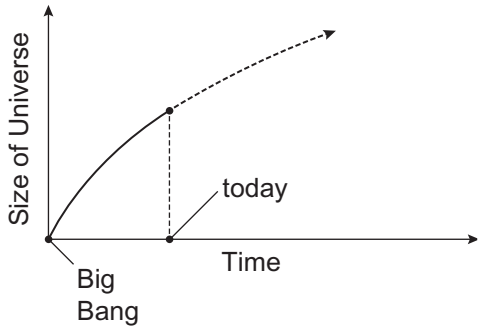
_____ [1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

10 (a) The graph below shows how the size of the Universe changes with time.



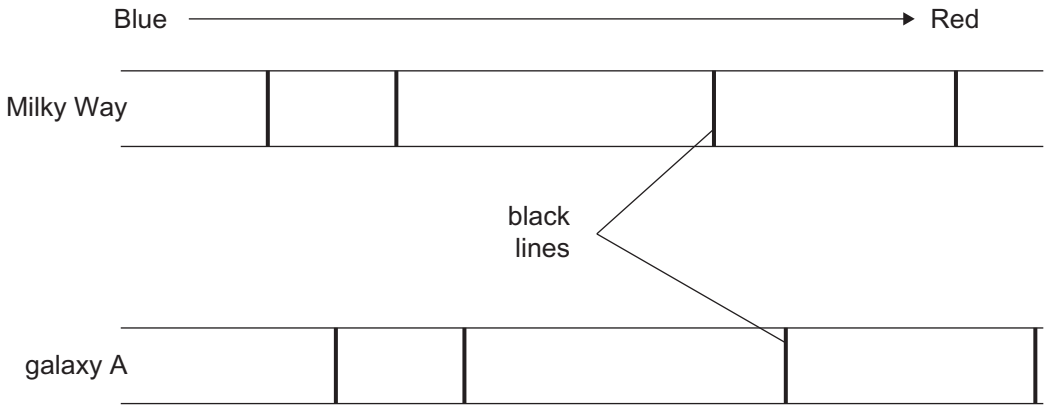
Describe fully the Big Bang theory. Explain how the graph above supports this theory.

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

[6]

Examiner Only	
Marks	Remark

(b) When scientists analyse light from the Milky Way and galaxy A they see the following black lines in the spectrum.



(i) Name the phenomenon shown in these diagrams.

_____ [1]

(ii) What do these diagrams tell us about galaxy A?

_____ [1]

THIS IS THE END OF THE QUESTION PAPER