



General Certificate of Secondary Education  
2010–2011

## Science: Single Award (Modular)

Road Safety, Radioactivity  
and Earth in Space

Module 6

Higher Tier

[GSC62]



FRIDAY 20 MAY 2011, AFTERNOON

Centre Number

71

Candidate Number

### TIME

45 minutes.

### 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 six** questions.

### INFORMATION FOR CANDIDATES

The total mark for this paper is 45.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

For Examiner's  
use only

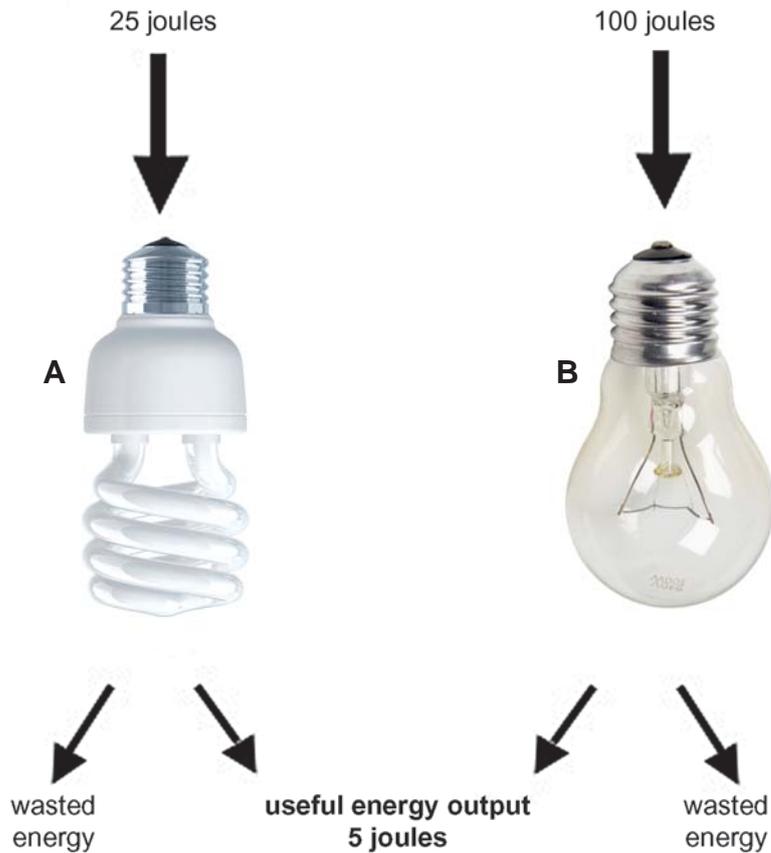
Question Number	Marks
1	
2	
3	
4	
5	
6	

Total  
Marks

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- 1 The diagram below shows the amount of electrical energy put into two types of lamp (**A** and **B**) to produce 5 joules of useful light energy per second.



© iStockphoto / Thinkstock  
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- (a) Name the type of energy wasted by the lamps.

\_\_\_\_\_ [1]

Examiner Only	
Marks	Remark



2 It is important that scientists try to work out how much fossil fuel remains in the world. Below are four statements about coal and oil reserves.

- In 2010 there was estimated to be 181 billion tonnes of oil left
- In 2010 there was estimated to be 847 billion tonnes of coal left
- The world supply of coal will last for approximately 119 years
- The world supply of oil will last for approximately 47 years

(a) (i) Use the information to estimate in what year the world supply of coal will run out.

\_\_\_\_\_ [1]

(ii) Suggest **two** reasons why it is difficult to predict how long reserves of coal and oil will last.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_ [2]

(b) In the Ballymoney area there is estimated to be 700 million tonnes of lignite.

(i) Suggest **one** reason why it might be an advantage to mine lignite in this area.

\_\_\_\_\_  
 \_\_\_\_\_ [1]

(ii) Give **one** disadvantage of mining lignite in the Ballymoney area.

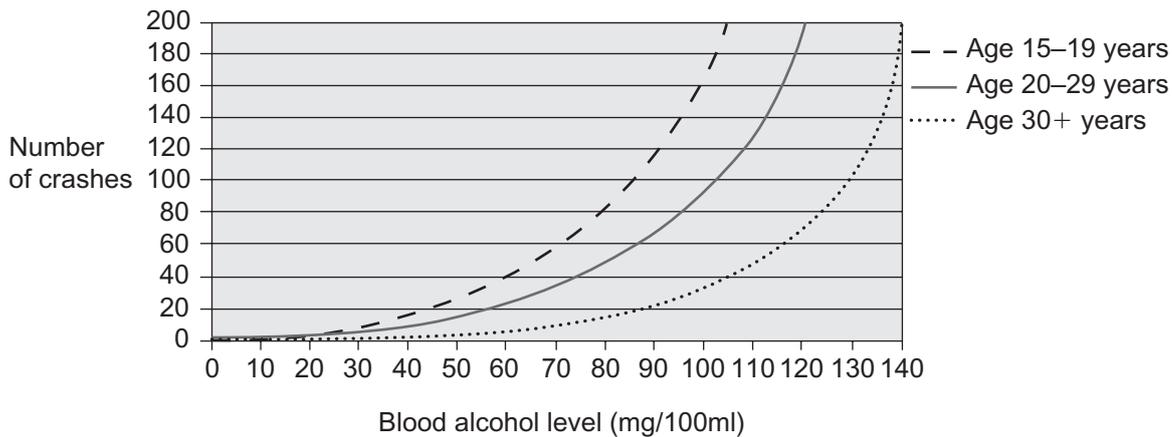
\_\_\_\_\_  
 \_\_\_\_\_ [1]

(c) Explain fully how fossil fuels are formed.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_ [2]

Examiner Only	
Marks	Remark

- 3 The graph below shows the link between the blood alcohol level and number of crashes for different age groups.



© NZTA – *The Influence of alcohol, age and number of passengers on the night-time risk of driver fatal injury in New Zealand* by M D Keall, W J Frith & Tui L Patterson, published by Land Transport Safety Authority, NZ, 2004

- (a) State two trends shown by this graph.

1. \_\_\_\_\_

\_\_\_\_\_

2. \_\_\_\_\_

\_\_\_\_\_ [2]

- (b) Explain fully why an increase in blood alcohol level increases the chance of crashing.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ [2]

- (c) The legal limit for a driver's blood alcohol level in Northern Ireland is 80 mg/100 ml.

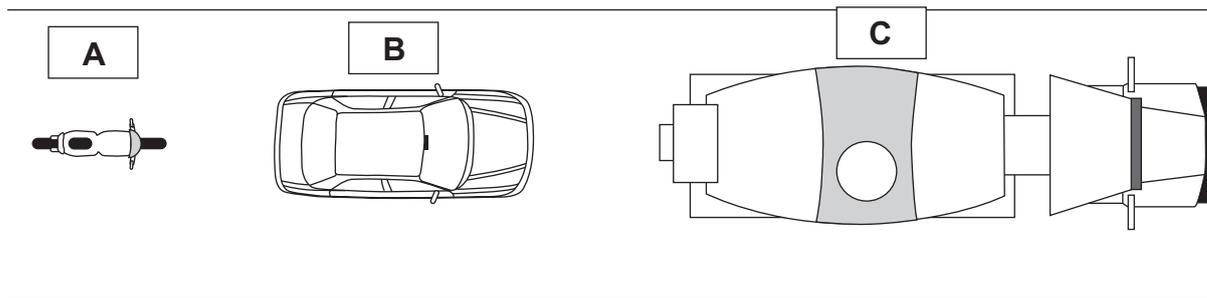
Suggest why a zero blood alcohol limit is not practical.

\_\_\_\_\_

\_\_\_\_\_ [1]

Examiner Only	
Marks	Remark

(d) Three vehicles are travelling on a road at the same velocity.



- (i) Which vehicle (**A**, **B** or **C**) has the greatest momentum? Explain your answer.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ [2]

- (ii) Vehicle C has a mass of 16 500 kg and a momentum of 198 000 kgm/s.

Use the formula:

$$\text{momentum} = \text{mass} \times \text{velocity}$$

to calculate the velocity of the vehicle.

Show your working out.

\_\_\_\_\_ m/s [2]

Examiner Only

Marks Remark

- 4 Technetium-99m is a radioactive isotope which is often used in hospitals. It has a half-life of 6 hours.



© Chris Priest/Science Photo Library

syringe

It is used to follow the flow of blood to different organs in the body by emitting gamma radiation which is detected outside the body. The test usually lasts about two hours.

- (a) Explain fully why the syringe has to be shielded by lead.

\_\_\_\_\_ [2]  
\_\_\_\_\_

- (b) Explain what the term half-life means.

\_\_\_\_\_ [2]  
\_\_\_\_\_

Examiner Only

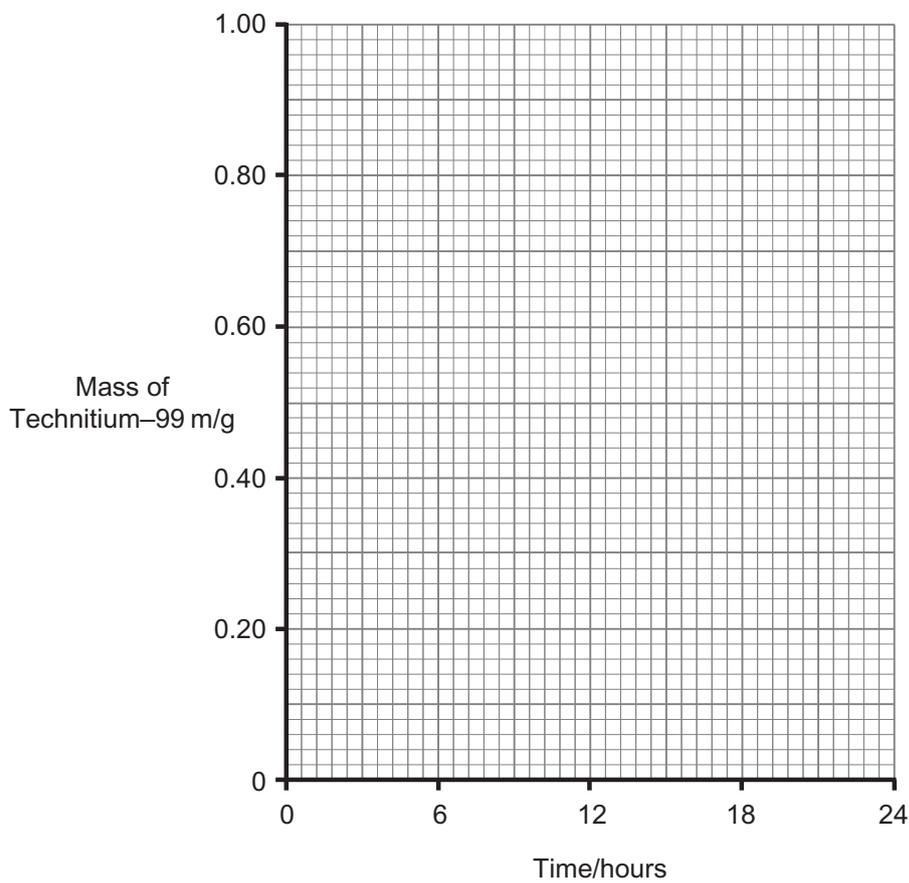
Marks Remark



- (e) The table below shows the mass of Technitium–99 m over a 24 hour period.

Time/hours	Mass of Technitium–99 m/g
0	1.00
6	0.50
12	0.25
18	0.12
24	0.06

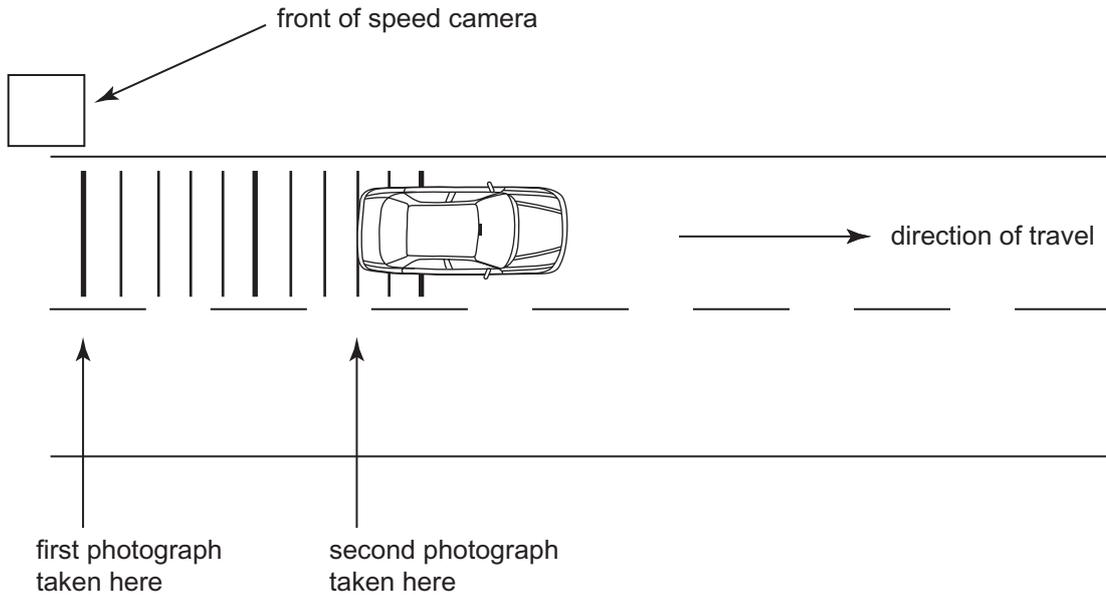
Plot and draw a line graph for these results on the grid below.



[3]

Examiner Only	
Marks	Remark

- 5 The diagram below shows the road markings in front of a speed camera. If a car is speeding, the camera takes two photographs 0.5 seconds apart. The markings on the road are 1.5m apart.



- (a) Calculate the speed at which the car is travelling.

Use the equation:

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

\_\_\_\_\_ m/s [3]

- (b) Explain why some drivers are ethically opposed to speed cameras.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_ [2]

Examiner Only	
Marks	Remark

(c) The photograph below shows the Truvelo speed camera which is becoming more common in the United Kingdom. These take photographs of the front of the car rather than the rear.



© Truvelo (UK) Ltd

Explain fully why you think this **type** of camera is more commonly used.

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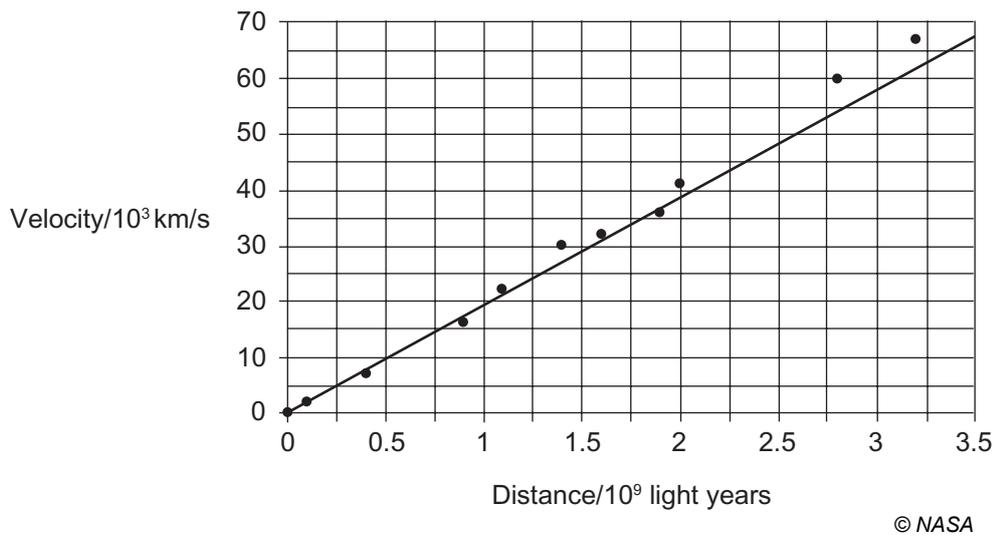
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[2]

Examiner Only	
Marks	Remark

- 6 The graph below shows how the velocity of galaxies changes with distance from the Earth.



- (a) Describe the relationship shown in the graph.

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[1]

- (b) Many scientists believe in the Big Bang theory. Describe this theory.

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[3]

- (c) The Big Bang theory is just one idea about the formation of the Universe. State an alternative theory for the formation of the Universe.

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[1]

Examiner Only	
Marks	Remark

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**THIS IS THE END OF THE QUESTION PAPER**

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