



Centre Number

71

Candidate Number

General Certificate of Secondary Education  
2010–2011

## Science: Single Award (Modular)

Road Safety, Radioactivity  
and Earth in Space

Module 6

Higher Tier

[GSC62]



FRIDAY 25 FEBRUARY 2011, MORNING

### 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.

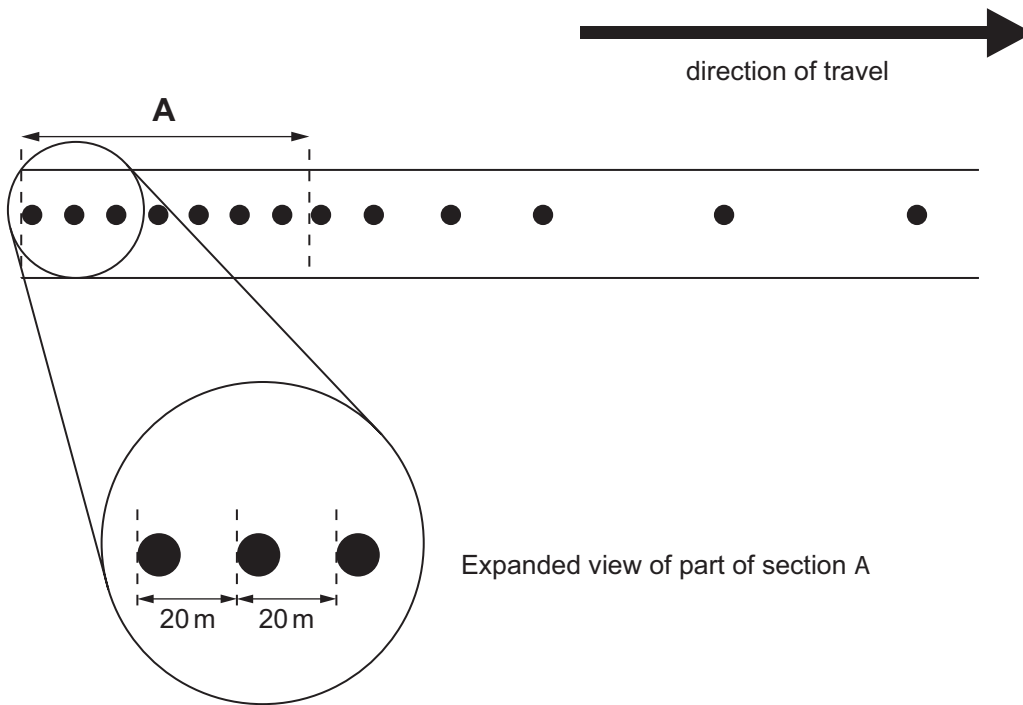
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

For Examiner's  
use only

Question Number	Marks
1	
2	
3	
4	
5	
6	

Total  
Marks

- 1 An oil tanker is leaking oil. The drops of oil hit the ground at a regular time interval of 2 seconds as shown in the diagram below.



- (a) In section **A** all the oil drops are 20 m apart.

Use the equation:

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

to calculate the speed of the tanker in section **A**.

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

- (b) Is the speed of the oil tanker increasing, decreasing, or staying the same over the entire journey? Explain your answer.

\_\_\_\_\_

\_\_\_\_\_

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

Examiner Only	
Marks	Remark

- 2 Radon is a naturally occurring radioactive gas. The table below shows the levels of radon in different council areas.

Council area	Number of houses tested	Highest radon concentration level/ Bq/m <sup>3</sup>
Carrickfergus	30	62
Down	3950	38
Derry	1343	4900
Newtownabbey	75	130
Fermanagh	549	3900

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

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

- (b) Explain fully why a nucleus may be radioactive.

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

- (c) (i) Use the information in the table to suggest how the results for Carrickfergus could be made more reliable.

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

- (ii) The government has set an action level of **200 Bq/m<sup>3</sup>**. Below this level there is little harm done to humans. Name the council areas which have high enough levels of radon to damage humans.

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

- (iii) Explain fully how radioactive radon can harm humans.

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

Examiner Only

Marks Remark

(d) You have been given a radioactive sample. You are provided with sheets of aluminium, paper and lead. You also have a radiation counter.

Describe a simple experiment to show which type of radiation (alpha, beta or gamma) is emitted. Include in your answer one way to keep your results valid.

---

---

---

---

---

---

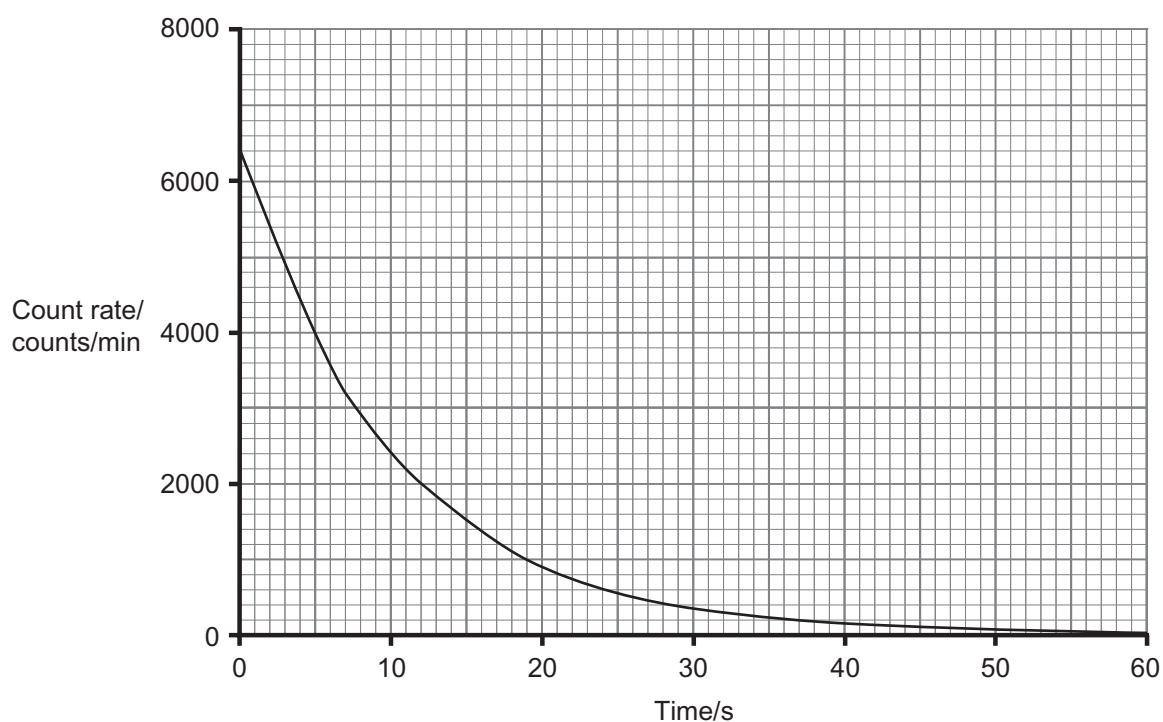
---

---

[4]

Examiner Only	
Marks	Remark

- 3 The graph below shows how the count rate of radioactive nitrogen-16 changes with time and can be used to find its half-life.



- (a) What is meant by the term half-life?

\_\_\_\_\_

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

- (b) Use the graph to calculate the half-life of nitrogen-16.

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

Examiner Only	
Marks	Remark

4 The photograph below shows the Toyota Prius.



© IFCAR 17 June 2008 Wikipedia

A student gave the following account on how the manufacturers thought this was an environmentally friendly car. However, it contains some mistakes.

*The Toyota Prius only uses hydrogen and electricity as energy sources. The Prius produces small amounts of oxygen which is a gas responsible for global warming. Most car fuels are produced from fossil fuels. There are over tens of thousands of years worth of reserves of fossil fuels left on Earth.*

(a) Give three facts that the student got wrong and state what he should have written.

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

\_\_\_\_\_

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

\_\_\_\_\_

3. \_\_\_\_\_

\_\_\_\_\_ [3]

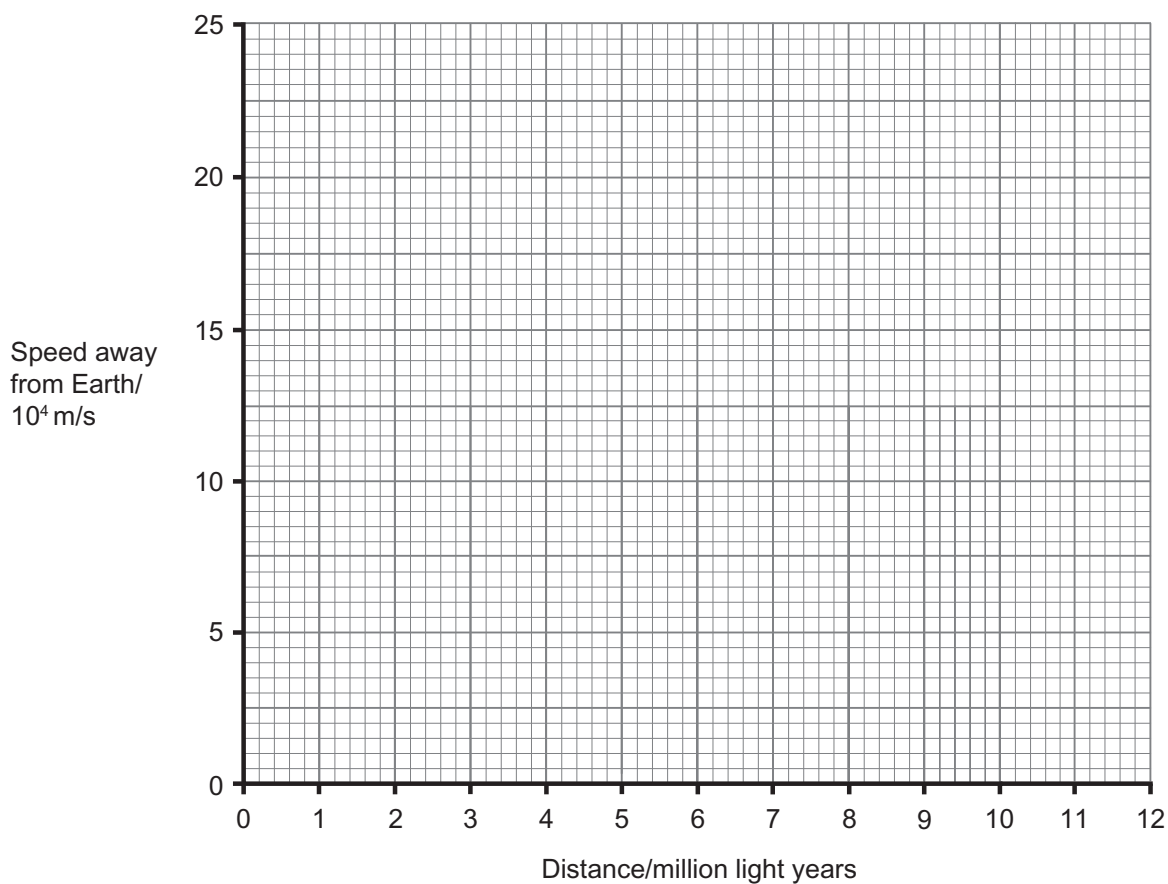
Examiner Only	
Marks	Remark



- 5 (a) The table below gives the distance to some galaxies and the speed they are moving away from us.

Name of Galaxy	Distance/million light years	Speed away from Earth/ $10^4$ m/s
M110	2.8	6
Sextans B	4.8	10
Dwingloo 1	9.0	20
Maffei 1	9.8	21
Holmberg 11	11.2	23

- (i) Plot a line graph for this information. [3]



Examiner Only	
Marks	Remark



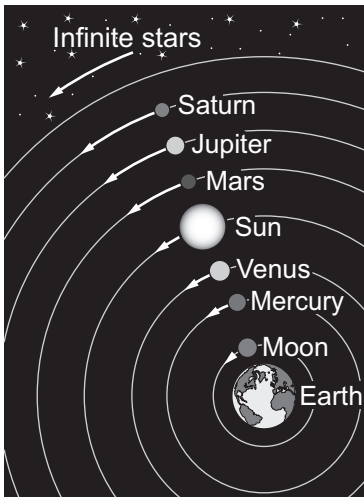
(ii) Give the trend shown by these results.

\_\_\_\_\_

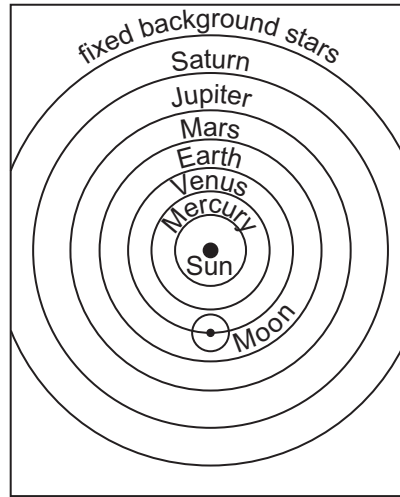
\_\_\_\_\_ [1]

(b) The diagrams below show two different models of the Solar System.

**Model A**



**Model B**



© [http://amazing-space.stsci.edu/resources/explorations/groundup/lesson/basics/g37/graphics/g37\\_ptolemy.gif](http://amazing-space.stsci.edu/resources/explorations/groundup/lesson/basics/g37/graphics/g37_ptolemy.gif)

(i) What name is given to model B?

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

(ii) Give two ways in which model A differs from the present model of the Solar System.

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

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

(c) (i) Many scientists think the Big Bang Theory describes the beginning of the Universe. Give **one** piece of evidence which supports this theory.

\_\_\_\_\_

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

(ii) Suggest an alternative theory to the Big Bang Theory.

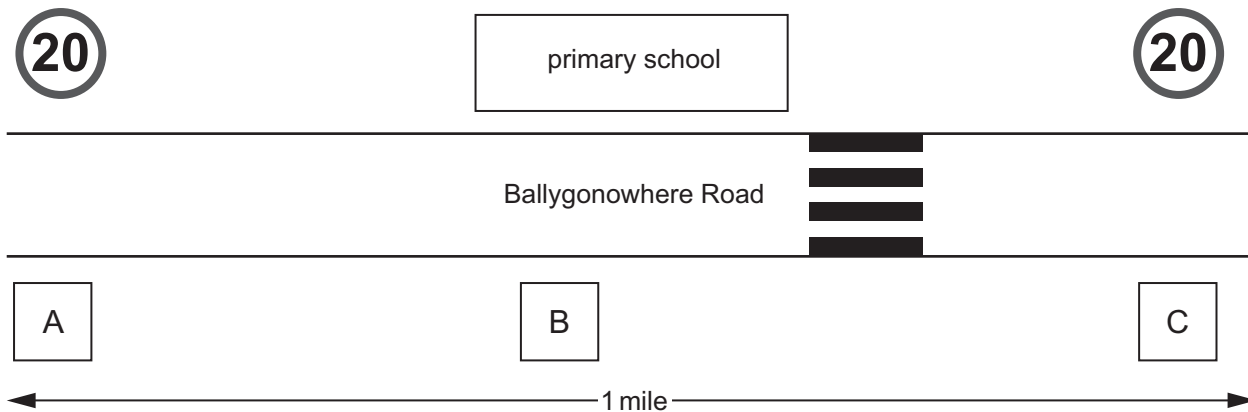
\_\_\_\_\_

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

Examiner Only	
Marks	Remark



- (b) The police have decided to reduce the speed limit outside a school to 20 mph. Many of the pupils do not use the zebra crossing but are crossing the road at random places within the 1 mile distance shown in the diagram.



- (i) They have two choices; to introduce an instantaneous speed camera at point B or to put average speed cameras at point A and C. Compare and contrast these choices in this locality.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ [3]

- (ii) Give two reasons why some motorists find the use of speed cameras unethical.

\_\_\_\_\_

\_\_\_\_\_

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

Examiner Only	
Marks	Remark

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

Permission to reproduce all copyright material has been applied for.  
In some cases, efforts to contact copyright holders may have been unsuccessful and CCEA  
will be happy to rectify any omissions of acknowledgement in future if notified.