



Rewarding Learning

General Certificate of Secondary Education  
2011–2012

**Science: Single Award (Modular)**

Road Safety, Radioactivity  
and Earth in Space

Module 6

Higher Tier

[GSC62]

MONDAY 14 NOVEMBER 2011

2.30 pm–3.15 pm



Centre Number

|    |  |
|----|--|
| 71 |  |
|----|--|

Candidate Number

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**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                       |       |

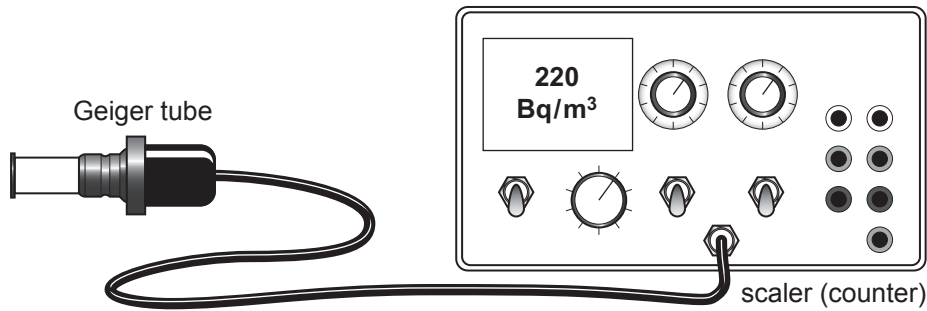
|                    |  |
|--------------------|--|
| <b>Total Marks</b> |  |
|--------------------|--|



1 (a) Below are some statements about radon gas.

- Radon is a radioactive gas that comes mainly from the ground
- Radon can enter houses and build up to dangerous levels
- The average radon level in Northern Ireland is  $20 \text{ Bq/m}^3$
- Once the radon level reaches an **action level**, which is ten times the average, the householder should take steps to reduce it

A householder set up a radiation counter to measure the background level of radon in his house.



(i) Use the information provided to explain fully why this householder should be concerned with this reading.

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[2]

(ii) Explain fully how breathing in radon gas can be harmful to health.

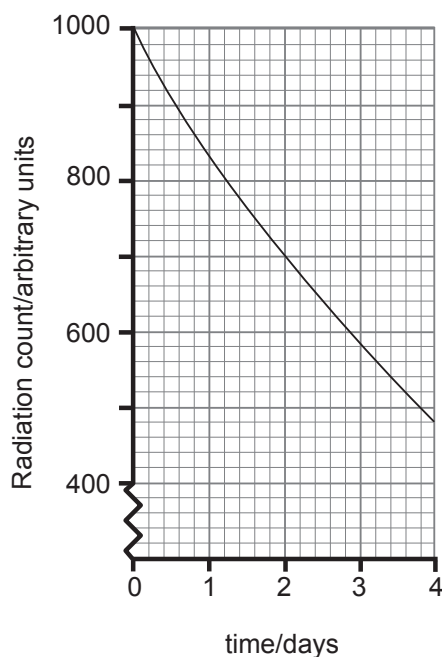
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[2]

| Examiner Only |        |
|---------------|--------|
| Marks         | Remark |
|               |        |

(b) The graph below shows how the count rate of radioactive radon changes with time.



(i) Use the graph to find the half-life of radon.

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

(ii) After how many days will the radiation count have fallen to 250 arbitrary units?

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

(c) Explain fully why a nucleus may be radioactive.

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

(d) Explain fully why some fresh fruits such as strawberries are treated with radiation.

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

| Examiner Only |        |
|---------------|--------|
| Marks         | Remark |
|               |        |



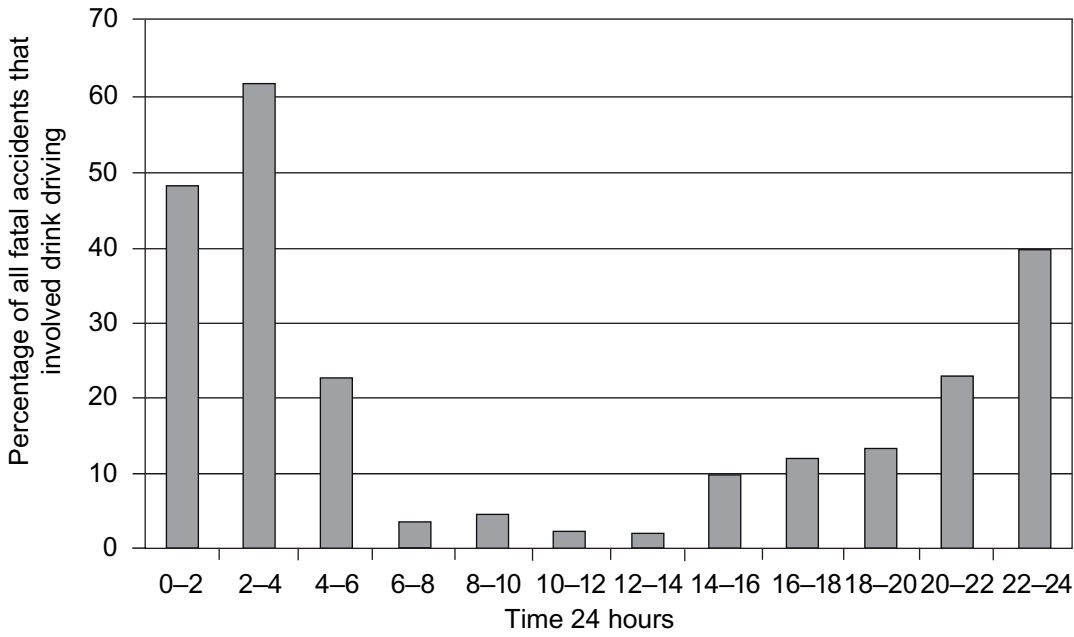
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**(Questions continue overleaf)**

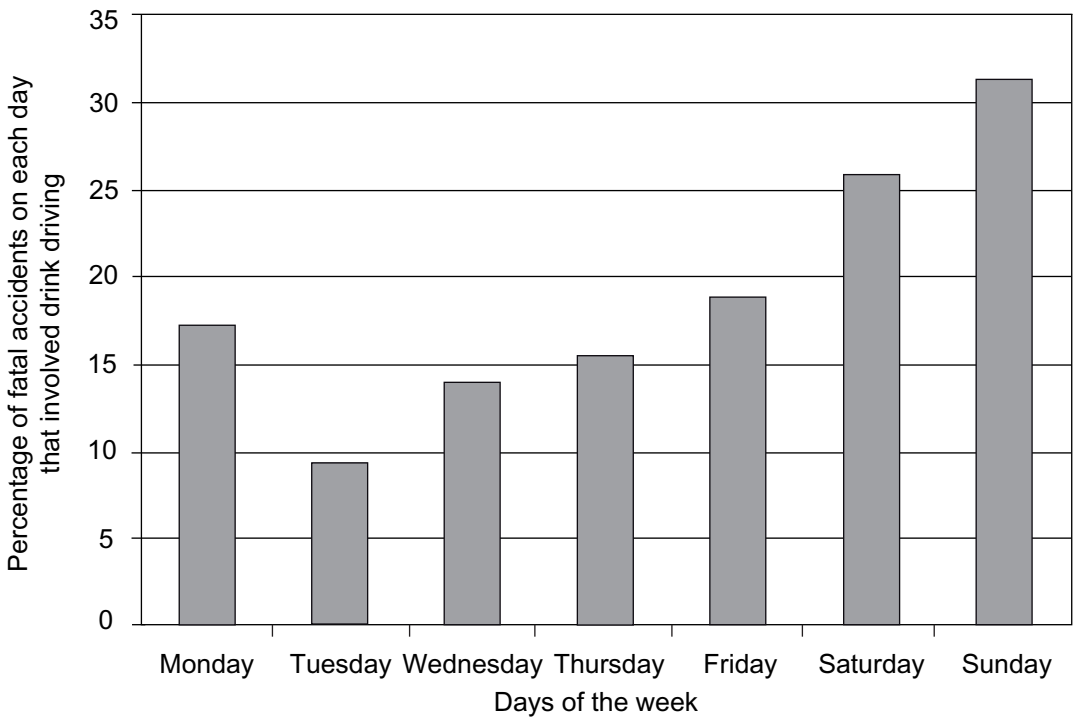
- 3 The graphs below show the percentage of all fatal accidents which involved drink driving at different times of the day and different days of the week.

| Examiner Only |        |
|---------------|--------|
| Marks         | Remark |
|               |        |

**Graph A**



**Graph B**



© Crown Copyright - Road Safety Research Report 75 Fatal Vehicle Occupancy Collision  
Dept of Transport HMSO Feb 2007



(c) The table below shows the change in price for a litre of diesel in Northern Ireland.

| Year | Price per litre/p |
|------|-------------------|
| 2010 | 123.6             |
| 2009 | 110.8             |
| 2008 | 109.1             |
| 2007 | 105.8             |
| 2006 | 92.6              |

(i) The Government take 62% of the cost of a litre of fuel in tax. Give two advantages and two disadvantages of the Government's decision to raise money through these taxes.

Advantages:

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

\_\_\_\_\_

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

\_\_\_\_\_

Disadvantages:

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

\_\_\_\_\_

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

\_\_\_\_\_

[4]

(ii) Apart from tax what has been the major cause for the rise in the cost of diesel since 2006?

\_\_\_\_\_

\_\_\_\_\_

[1]

Examiner Only

Marks

Remark



- 4 Nuclear medicine uses radioactive tracers which emit gamma rays, for example, iodine to study the thyroid gland. The table below shows three forms of radioactive iodine.

| Form of iodine | Half-life        | Radiation emitted |
|----------------|------------------|-------------------|
| iodine-123     | 13 hours         | gamma             |
| iodine-128     | 25 minutes       | beta              |
| iodine-129     | 15 700 000 years | beta and gamma    |

Explain fully why iodine-123 is the most suitable radioactive tracer to study the thyroid gland.

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[3]

| Examiner Only |        |
|---------------|--------|
| Marks         | Remark |
|               |        |







(c) Use the diagrams to explain fully what was observed and how this supports the idea of a 'Big Bang' start to the Universe.

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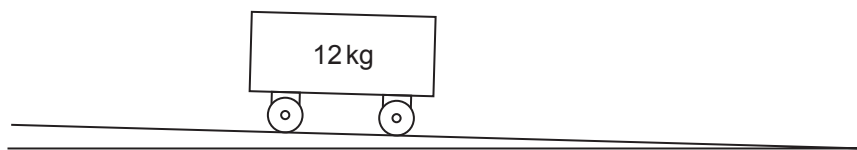
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[3]

| Examiner Only |        |
|---------------|--------|
| Marks         | Remark |
|               |        |

- 6 A truck of mass 12 kg is placed on a very slight slope as shown in the diagram below. The truck does not move.



- (a) (i) State, in terms of forces, why the truck does not move.

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

- (ii) The slope is now increased and the truck begins to accelerate. Explain fully, in terms of forces, why it accelerates.

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

- (b) At the bottom of the slope this truck has a momentum of 62.4 kgm/s.

Use the following equation:

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

to calculate its velocity at this point.

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

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

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Examiner Only

Marks Remark



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