Centre Number

71

Candidate Number

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]

WEDNESDAY 29 FEBRUARY 2012
11.00 am–11.45 am

GSC62

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.

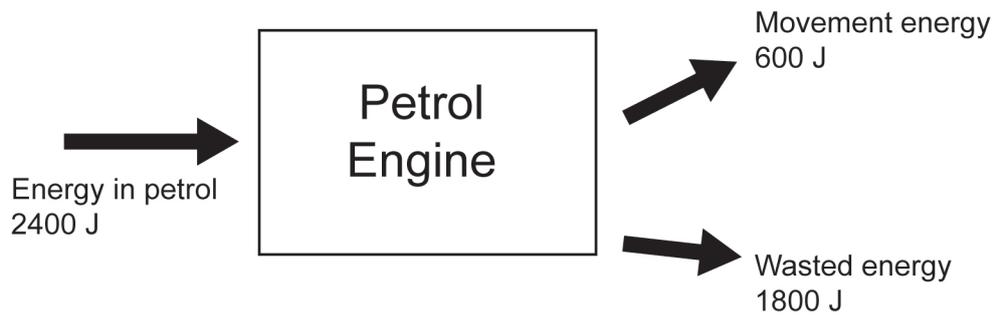**INFORMATION FOR CANDIDATES**

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 energy transfer in a petrol engine.

Energy in petrol
2400 J

Petrol
Engine

Movement energy
600 J

Wasted energy
1800 J

(a) Name a type of energy wasted by a car engine.

_____ [1]

(b) (i) Use the equation:

$$\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy input}}$$

to calculate the efficiency of the petrol engine.

(Show your working out.)

Efficiency _____ [2]

(ii) Explain fully how more efficient engines can reduce global warming.

_____

_____

_____ [2]

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2

2 **(a)** The Sun is the nearest star to Earth.

Describe how the Sun was formed. Your answer should include the materials and forces involved.

_____

_____

_____

_____

_____ [3]

(b) State **one** way that scientists study distant stars and galaxies.

_____ [1]

(c) Astronomers have detected planets orbiting distant stars many light years away.

Explain fully what is meant by the term 'light year'.

_____

_____ [2]

(d) Neptune is one of the outer planets in the Solar System. An unmanned satellite called Voyager-2 took 12 years to reach it.

Explain fully why it is unlikely that there will be a manned space flight to Neptune.

_____

_____

_____

_____

_____ [3]

3

[Turn over

3 The statement below is from a national newspaper.

"The speed limit on thousands of residential roads will be reduced to 20 mph under government moves over the next decade."

(a) Explain fully why the government wants to reduce the speed limit from 30 mph to 20 mph in residential areas.

_____

_____

_____ [2]

(b) Explain fully, in terms of forces, why drivers should reduce speed even more when there is ice on the road.

_____

_____

_____ [2]

(c) Each of these drinks contains 1 unit of alcohol.

| $\frac{1}{2}$ pint of ordinary strength beer lager or cider | 1 small glass of wine | 1 single measure of spirits | 1 small glass of sherry |

(i) Calculate the number of units of alcohol contained in two pints of beer.

_____ units [1]

4

The table below shows the effects of drinking up to 10 units of alcohol.

Number of units	Blood alcohol content mg/100 ml	Increased risk of having a crash
2	30	1.5
4	60	2.5
5	75	3.5
6	90	7.5
8	120	15
10	150	26

(ii) From the information provided give the blood alcohol content for a person who drinks two pints of beer.

_____ mg/100 ml [1]

(iii) Explain fully why a higher blood alcohol content will increase the risk of a driver having a crash.

_____

_____

_____ [2]

(iv) The legal limit for driving is 80 mg of alcohol in 100 ml of blood; many think this is too high. Using the information in the table give evidence to support lowering this limit.

_____

_____ [1]

5

(d) The diagram below shows the forces acting on a moving car.

400 N ⟵   ⟶ 400 N

    (i) Explain fully the motion of the car.

_____

_____

_____ [2]

    (ii) What would happen to the motion of the car if the forward force was decreased?

_____

_____ [1]

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(Questions continue overleaf)

4 The photograph below shows part of the Dead Sea Scrolls. They were discovered between 1947 and 1956.
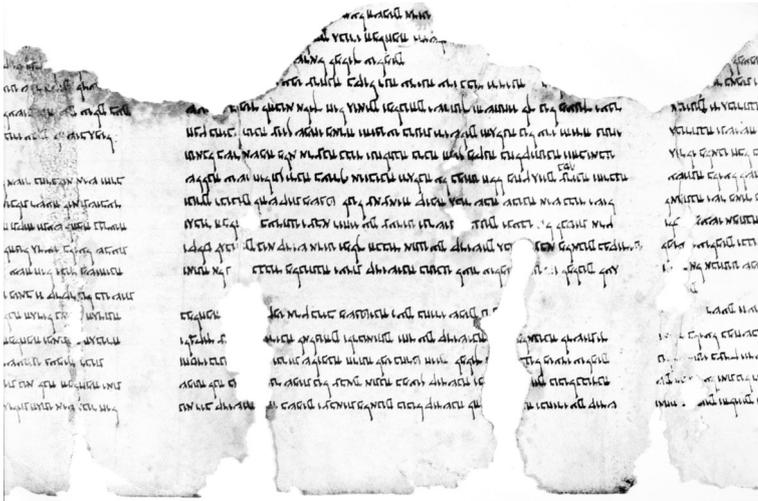
© Library of Congress / Science Photo Library

(a) The age of the scrolls was calculated using carbon dating which is the radioactive decay of carbon-14.
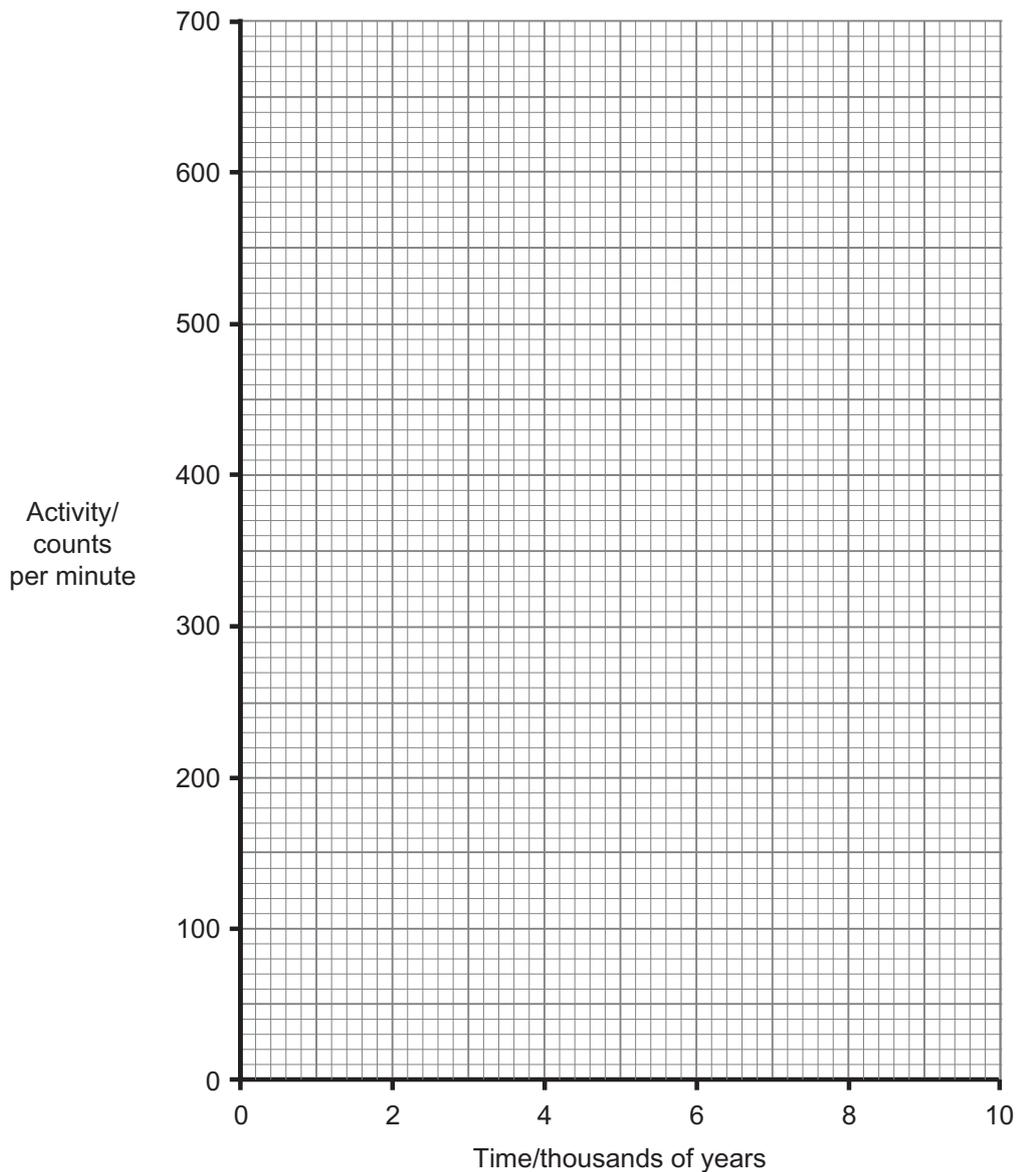
The table below shows how the activity of carbon-14 changes with time.

Time/thousands of years	Activity/counts per minute
0	640
2.5	470
5.0	350
7.5	260
10.0	190

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8

(i) On the grid below plot and draw a line graph to show the information in the table.

Activity/ counts per minute

Time/thousands of years

[3]

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

_____

_____ [2]

(iii) Use the graph to find the half-life of carbon-14.

Answer _____ years [1]

(iv) The activity of carbon-14 from the Dead Sea Scrolls was found to be 490 counts per minute. Use the graph to find the age of the Dead Sea Scrolls.

Answer _____ years [1]

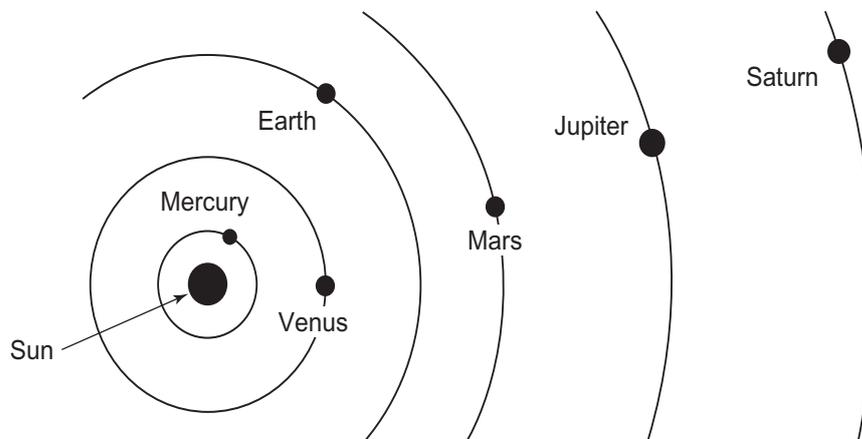**5** **(a)** **(i)** Most astronomers believe the Universe started with the Big Bang. Explain fully the Big Bang Theory.

_____

_____

_____

_____

_____

_____ [3]

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

_____ [1]

(b) The diagram below shows part of the model of the Solar System which was suggested by Copernicus. This model is still accepted today.

Earth

Mercury

Mars

Sun

Venus

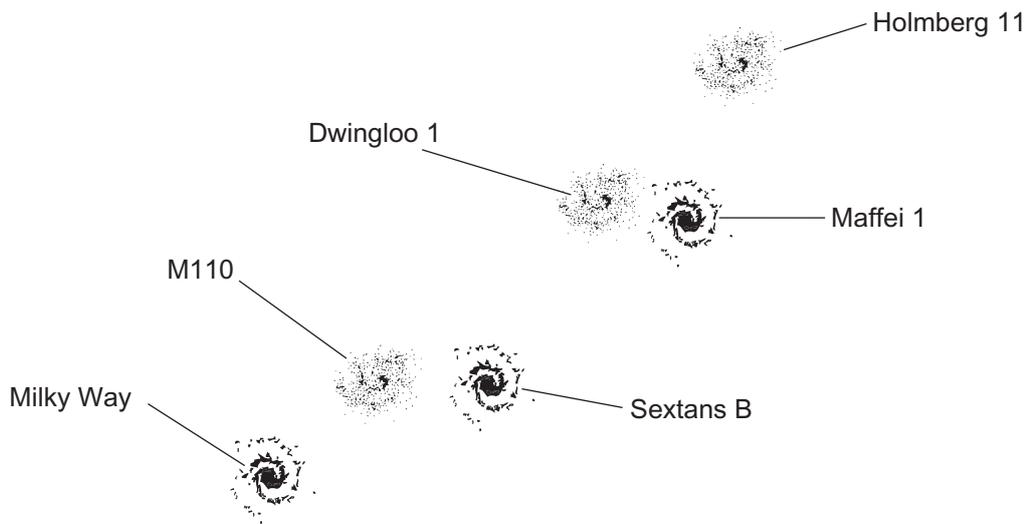Jupiter

Saturn

(i) What name is given to this model?

_____ [1]

Before Copernicus scientists had a different model of the Solar System.

(ii) Describe how the previous model differs from this model.

_____

_____ [1]

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10

(c) The diagram below shows our galaxy (the Milky Way) and some of our neighbouring galaxies.

Holmberg 11

Dwingloo 1

Maffei 1

M110

Milky Way

Sextans B

Name the galaxy which is moving at the greatest speed away from the Milky Way. Give a reason for your answer.

_____

_____

_____ [2]

11

6 A wooden block of mass 1.0 kg is freely hanging. A bullet of mass 0.01 kg is fired at the wooden block. The bullet hits the wooden block and becomes embedded in it. The block then moves with a velocity of 3 m/s.

bullet

wire thread

wooden block
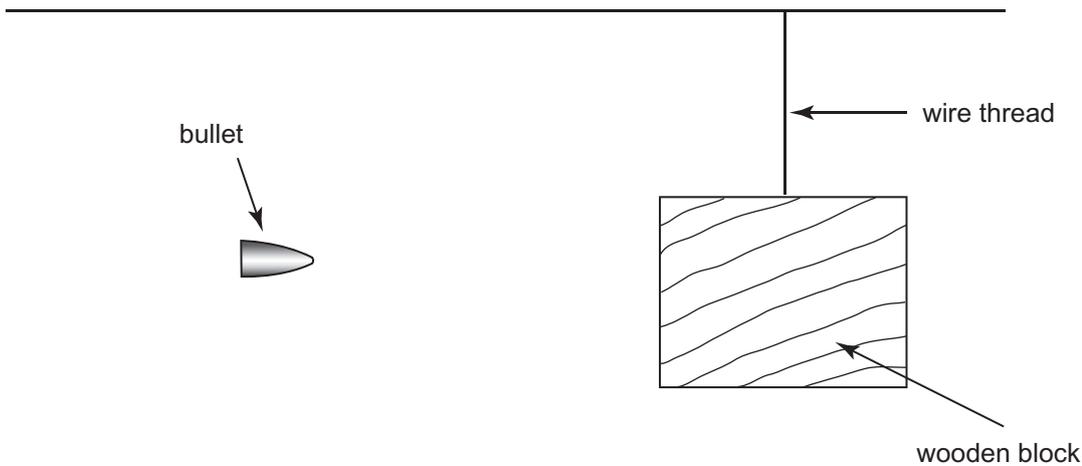
(a) Use the formula:

momentum = mass × velocity

to calculate the momentum of the block after impact.

(Show your working out.)

Momentum _____ kgm/s [3]

(b) In a similar experiment an identical bullet is fired with a greater momentum. State how the momentum of the bullet is increased.

_____ [1]

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THIS IS THE END OF THE QUESTION PAPER

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