Rewarding Learning

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]

GSC62

FRIDAY 12 NOVEMBER 2010, AFTERNOON

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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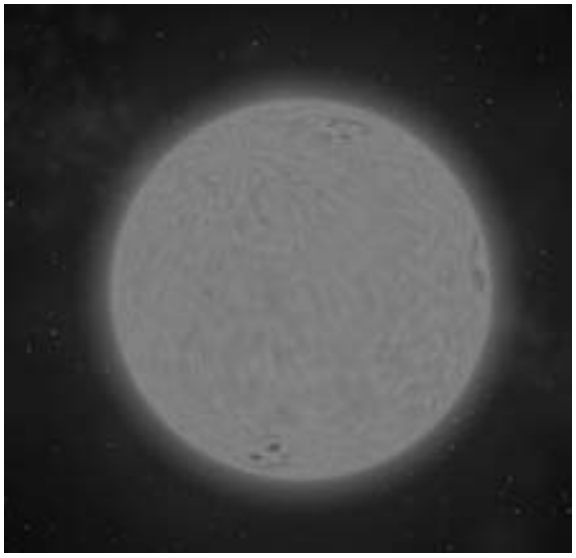
1 The photograph below shows a star called Proxima Centauri.



upload.wikimedia.org/.../19/Proxima_Centari.jpg

A student gave the following account of how a star is formed. However, it contains some mistakes.

"A star forms when a cloud of gas, mainly nitrogen, is pushed together by the force of gravity. As the cloud collapses the centre heats up and becomes a Protostar. Eventually it becomes a fully fledged star when nuclear fission takes place."

(a) Complete the table below to identify the three words mistakenly used and give each correction.

Wrong word	Correct word

[3]

(b) Proxima Centauri is 4.2 light years from Earth. If a spaceship could move at the speed of light how long would it take the spaceship to travel from Earth to Proxima Centauri and back again?

_____ [1]

Examiner Only

Marks	Remark

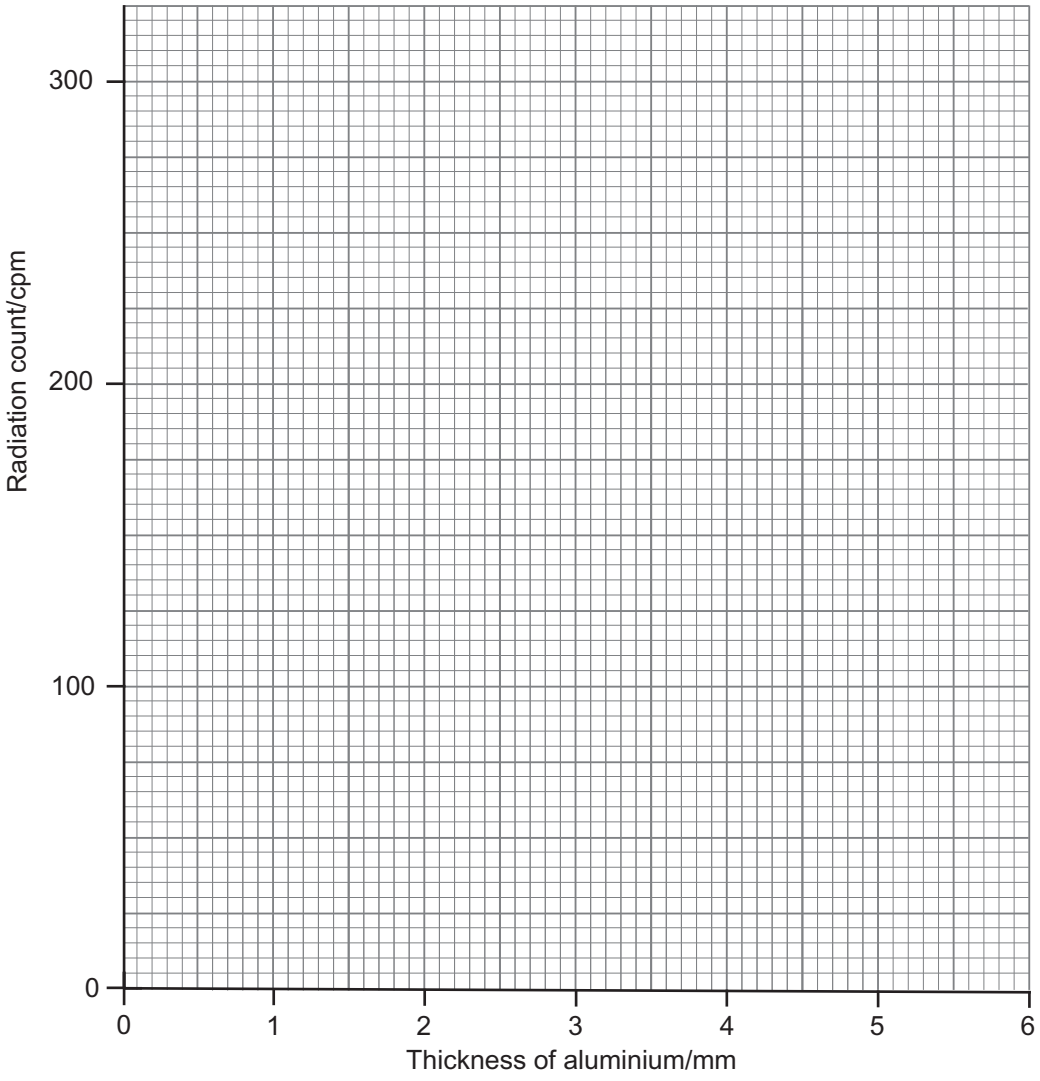
Examiner Only	
Marks	Remark

2 **(a)** A teacher performed an experiment to see how beta radiation passed through different thicknesses of aluminium.

His results are shown in the table below and include background radiation.

Thickness of aluminium/mm	1.0	2.0	3.0	4.0	5.0	6.0
Radiation count/ cpm	310	190	130	90	70	70

(i) Plot these points and draw a smooth curve on the axes below.



[3]

Examiner Only	
Marks	Remark

(ii) Use the information to suggest a value for background radiation.

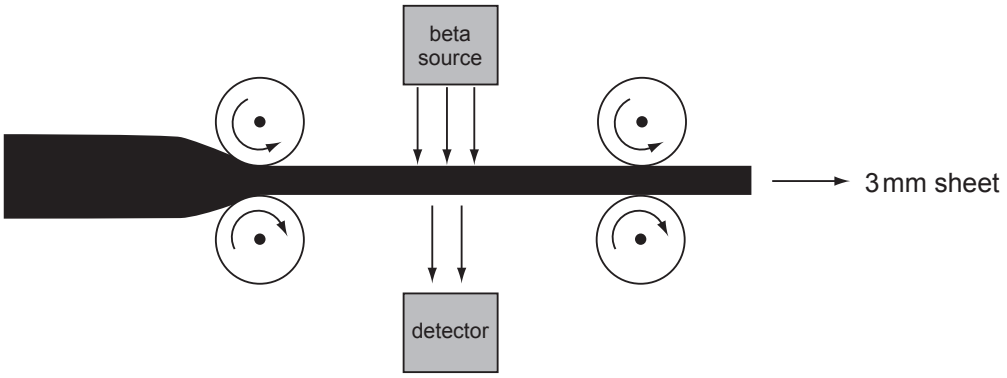
Answer _____ cpm [1]

(iii) Suggest two sources of background radiation.

1. _____

2. _____ [2]

(b) The machine shown below is used to produce aluminium sheets which are 3 mm thick by detecting a radiation count of 130 cpm.



(i) Use the information and your knowledge to explain fully why beta radiation is more suitable than alpha or gamma radiation in controlling the thickness of the aluminium sheets.

_____

_____

_____

_____ [3]

(ii) Radioactive phosphorus has a half-life of about 20 days. Explain why phosphorus would not be a suitable beta source in this machine.

_____

_____ [1]

Examiner Only	
Marks	Remark

3 **(a)** The car below is a Toyota Prius. It has a hybrid engine.

© Used by permission of Toyota (GB) PLC

(i) Name the two energy sources this hybrid engine uses.

1. _____

2. _____ [2]

(ii) Explain fully why the manufacturer claims this car is much better for the environment.

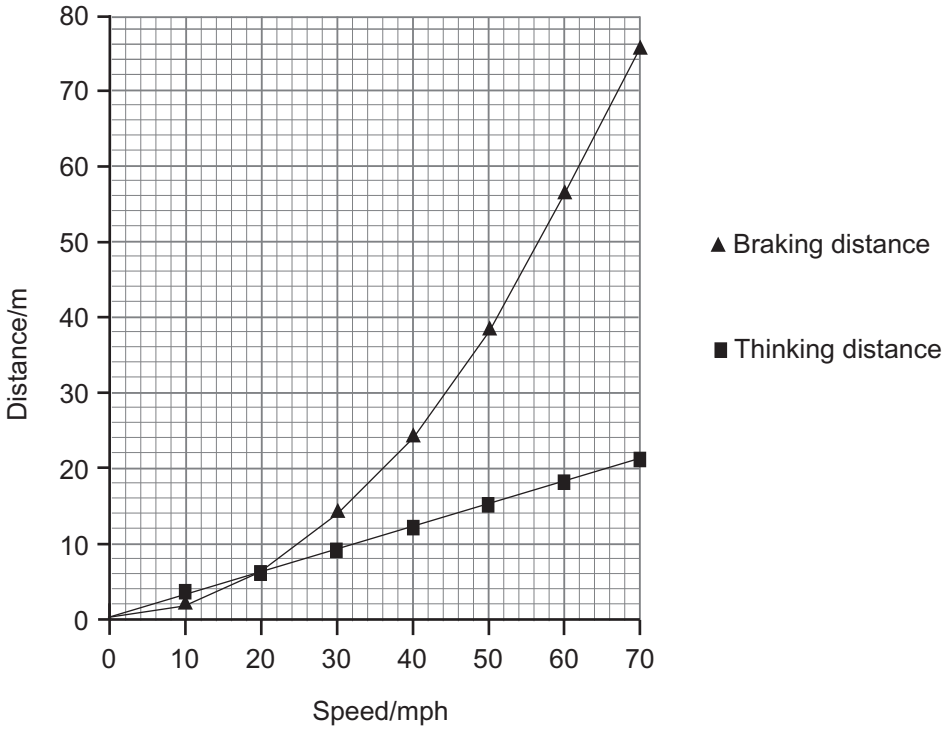
_____

_____

_____ [2]

Examiner Only	
Marks	Remark

(b) The graph below shows how thinking and braking distance are affected by speed.



(i) Use the graph to compare thinking and braking distance as the speed increases.

_____

_____

_____ [2]

(ii) The braking distances shown in the graph above are for ideal conditions. In terms of forces, explain fully how ice on the road would affect the braking distance.

_____

_____

_____ [2]

(iii) Explain fully how drinking alcohol affects the stopping distance.

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

4 The diagram below shows the forces acting on a boat moving through the sea in a straight line.

(a) Explain fully in terms of forces the motion of the boat.

_____

_____

_____ [2]

(b) The wind increases and the forward force increases to 120N. State what will happen to the boat's motion.

_____ [1]

Examiner Only	
Marks	Remark

5 **(a)** A car of mass 500 kg applied its brakes on a motorway and its velocity changed from 6 m/s to 4.2 m/s.

Use the equation:

momentum = mass × velocity

to calculate the change in momentum.
Show your working out.

Answer _____ kgm/s [3]

(b) The photograph below shows a crash barrier. These are often found in the central reservations of motorways.

© iStockphoto/Thinkstock

Explain fully how crash barriers are designed to reduce the effect of serious accidents occurring on a motorway.

_____

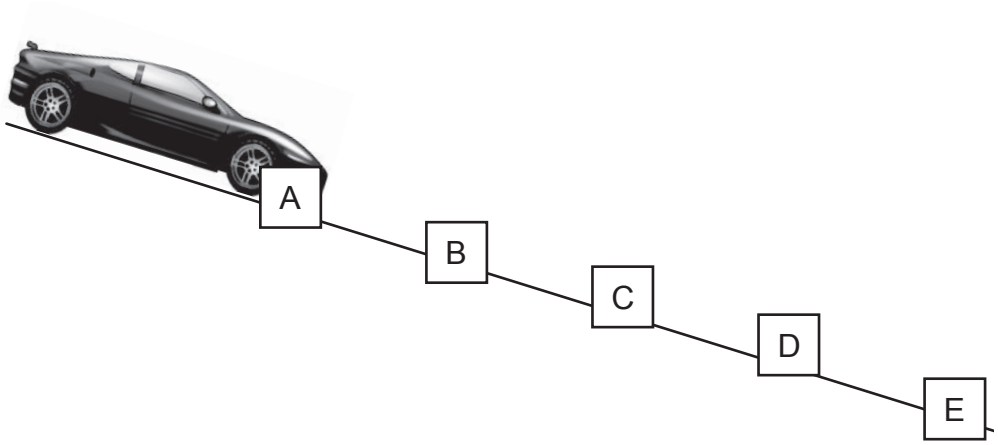
_____

_____

_____ [2]

Examiner Only	
Marks	Remark

(c) The diagram below shows a model car on a slope. The instantaneous speed of the car was measured by sensors placed at A, B, C, D and E.



The results are shown below.

Sensor	Distance/m	Time/s	Speed/m/s
A	0	0	0
B	0.25	1.0	0.35
C	0.50	1.4	0.86
D	0.75	1.6	1.80
E	1.00	1.7	3.00

Explain fully the difference between instantaneous and average speed.

_____

_____

_____ [2]

(d) Use the equation:

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

to calculate the average speed of the car between sensors B and D.
Show your working out.

Average speed = _____ m/s [3]

(e) Car speeds can be measured using instantaneous or average speed cameras. Suggest why safety campaigners promote the use of average speed cameras.

_____

_____

_____ [2]

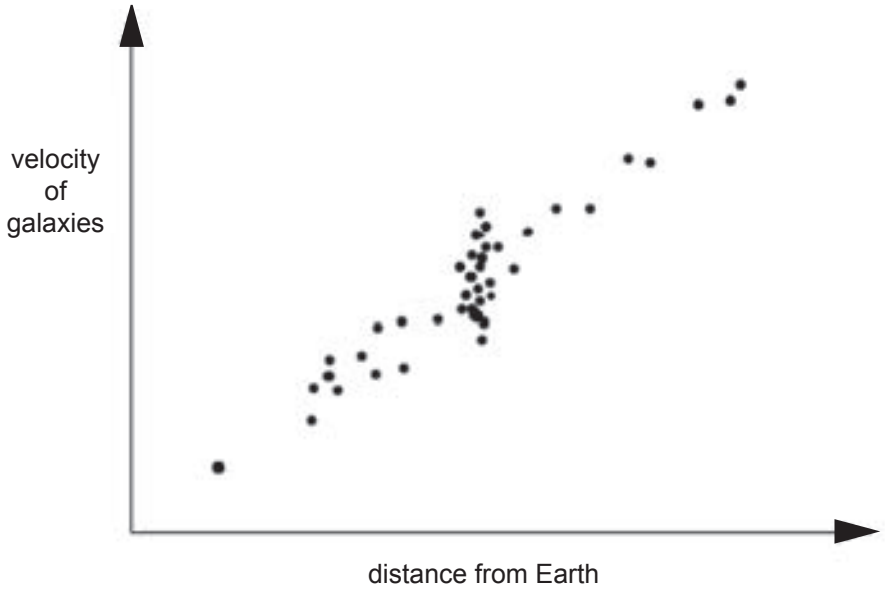
Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

6 **(a)** The astronomer Edwin Hubble calculated the distance of many galaxies from Earth. He also calculated the velocity at which the galaxies are moving away from Earth.

The graph below summarises his results.



© NASA http://imagine.gsfc.nasa.gov/YBA/M31-velocity/hubble-more.html

Give the trend shown by this data.

_____

_____ [1]

(b) Explain fully the Big Bang theory.

_____

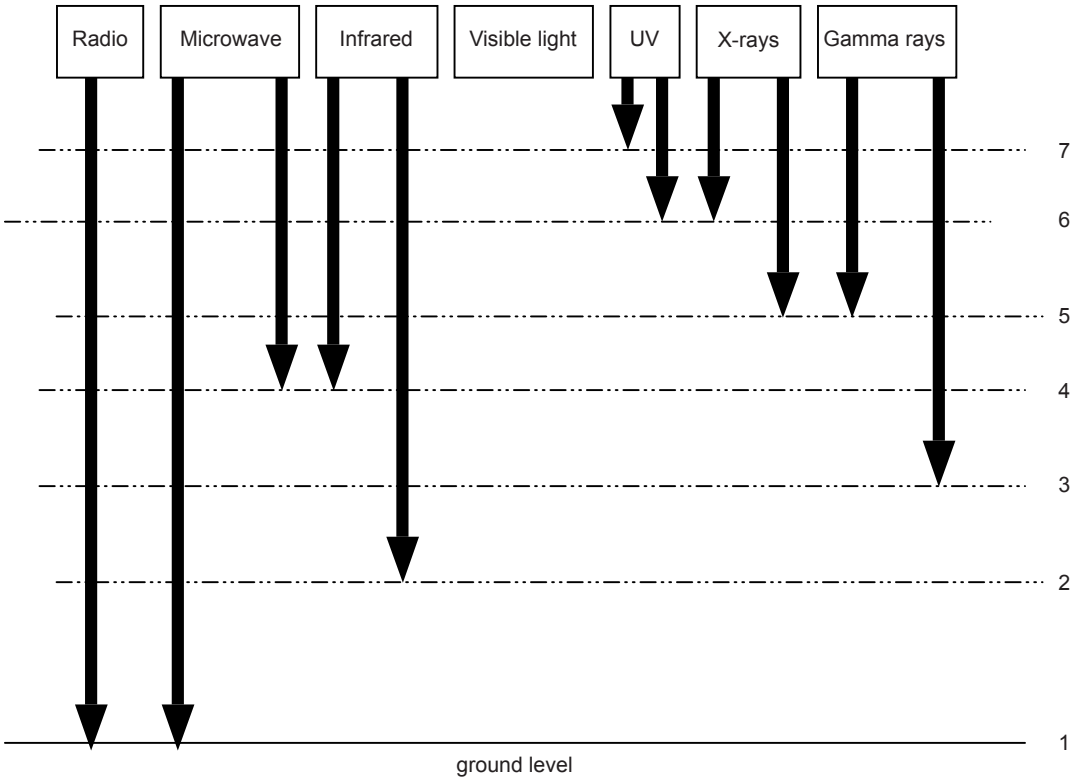
_____

_____

_____ [3]

Examiner Only	
Marks	Remark

(c) Electromagnetic radiation from space is used to explore the Universe. The diagram below shows how far electromagnetic waves penetrate the atmosphere.



(i) Complete the diagram above by drawing one arrow to show how far visible light penetrates the atmosphere. [1]

(ii) Which line (1 to 7) represents the **minimum** height above the Earth that a telescope could detect all the gamma rays and all the X-rays. [1]

THIS IS THE END OF THE QUESTION PAPER

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