Rewarding Learning


Candidate Number
$\qquad$

## Science: Single Award (Modular) Road Safety, Radioactivity and Earth in Space Module 6 <br> Higher Tier <br> [GSC62] <br> N O C1 <br> $\underline{\square}$

WEDNESDAY 29 FEBRUARY 2012
11.00 am-11.45am

## 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 <br> use only |  |
| :---: | :---: |
| Question <br> Number | Marks |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |
| 6 |  |
| Total |  |
| Marks |  |

1 The diagram below shows the energy transfer in a petrol engine.

(a) Name a type of energy wasted by a car engine.
$\qquad$
(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
(ii) Explain fully how more efficient engines can reduce global warming.
$\qquad$
$\qquad$
$\qquad$

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.
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
(b) State one way that scientists study distant stars and galaxies.
$\qquad$
(c) Astronomers have detected planets orbiting distant stars many light years away.

Explain fully what is meant by the term 'light year'.
$\qquad$
$\qquad$
(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.
$\qquad$
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$\qquad$
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$\qquad$
(i) Calculate the number of units of alcohol contained in two pints of beer.
$\qquad$ units [1]

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.
$\qquad$
$\qquad$
$\qquad$
(b) Explain fully, in terms of forces, why drivers should reduce speed even more when there is ice on the road.
$\qquad$
$\qquad$
$\qquad$
(c) Each of these drinks contains 1 unit of alcohol.

| $\frac{1}{2}$ pint of | 1 small <br> ordinary | 1 single <br> glass of <br> measure of <br> strength beer <br> lager or cider | wine |
| :---: | :---: | :---: | :---: | | 1 small |
| :---: |
| glass of |

lager or cider

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

| Number of <br> units | Blood alcohol content <br> $\mathbf{m g} / \mathbf{1 0 0} \mathbf{~ m l}$ | Increased risk of <br> 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.
$\qquad$ $\mathrm{mg} / 100 \mathrm{ml}$
(iii) Explain fully why a higher blood alcohol content will increase the risk of a driver having a crash.
$\qquad$
$\qquad$
$\qquad$
(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.
$\qquad$
$\qquad$
(d) The diagram below shows the forces acting on a moving car.
(i) Explain fully the motion of the car.
$\qquad$
$\qquad$
$\qquad$
(ii) What would happen to the motion of the car if the forward force was decreased?
$\qquad$
$\qquad$


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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.
(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 |

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

(ii) What is meant by the term half-life?
$\qquad$
(iii) Use the graph to find the half-life of carbon-14.

Answer $\qquad$ years
(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 $\qquad$ years [1]

5 (a) (i) Most astronomers believe the Universe started with the Big Bang. Explain fully the Big Bang Theory.
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$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
(ii) Suggest an alternative to the Big Bang Theory.
$\qquad$
(b) The diagram below shows part of the model of the Solar System which was suggested by Copernicus. This model is still accepted today.

(i) What name is given to this model?
$\qquad$

Before Copernicus scientists had a different model of the Solar System.
(ii) Describe how the previous model differs from this model.
$\qquad$
$\qquad$
(c) The diagram below shows our galaxy (the Milky Way) and some of our neighbouring galaxies.

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

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 $3 \mathrm{~m} / \mathrm{s}$.

(a) Use the formula:
momentum $=$ mass $\times$ velocity
to calculate the momentum of the block after impact.
(Show your working out.)

Momentum $\qquad$ kgm/s
(b) In a similar experiment an identical bullet is fired with a greater momentum. State how the momentum of the bullet is increased.
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