WJEC CBAC

GCSE

4781/02

SCIENCE B
UNIT 1: Space, Energy and Life
HIGHER TIER

P.M. THURSDAY, 16 January 2014

1 hour 15 minutes

For Examiner's use only		
	Question	Maximum Mark	Mark Awarded
Section A	1.	18	
	2.	6	
Section B	3.	9	
	4.	12	
	5.	9	
	6.	8	
	7.	8	
	Total	70	

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator, a pencil and a ruler.

You will also need a copy of the Resource Folder to answer **Section A**.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

Section A is based upon the Pre-Release Article.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication used in your answer to questions **2** and **4**(c).

SECTION A

*Answer **all** questions in the spaces provided.*

Use the information in the separate Resource Folder to answer the following questions.

1. Use the information in **Table 1** to answer the questions that follow.

(a) (i) Which planet is closest in size to Earth? .... [1]

    (ii) Which planet has a day length longer than its year? .... [1]

    (iii) Name the only planet that does not have an atmosphere. .... [1]

(b) Suggest a relationship between the number of moons around a planet and **one** *other* factor in **Table 1**. [2]

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(c) (i) Describe how the temperature on a planet depends on the distance from the Sun.
[1]

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    (ii) Explain why Venus does not follow this trend. [2]

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(d) Ceres is a dwarf planet found in the asteroid belt.

    (i) **Estimate** its temperature. .... °C [1]

    (ii) **Estimate** its orbital time around the Sun. .... Earth years [1]

(e) (i) Plot a graph to show how the time it takes a planet to orbit the Sun depends on distance from the Sun.
Only include the planets **Earth**, **Mars**, **Jupiter** and **Saturn** in your graph. [4]
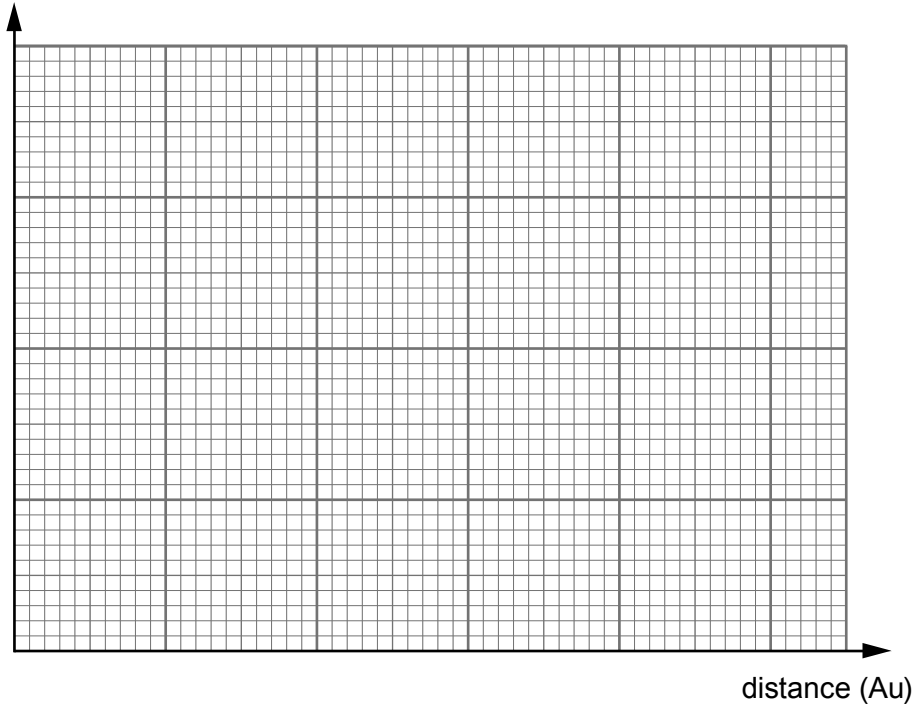
distance (Au)

(ii) It was once thought that the time of orbit would be proportional to distance from the Sun.

Does your graph agree with this statement? .... [1]

Give **one** reason for your answer.

....

(f) Answer the following question using **only** information from the Resource Folder.

   (i) Give **one** reason why an Earth-based telescope would not be able to see the surface of Venus. [1]

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   (ii) Give **one** reason why an Earth-based telescope may not be able to see the rings around Uranus. [1]

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(g) **Draw** a diagram to show the path of a comet as it orbits the Sun. [1]

● **Sun**

18

2. Use only the information in the Resource Folder to compare the four inner planets with the four outer planets of the Solar System. (6 QWC)

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SECTION B

*Answer **all** questions in the spaces provided.*

3. The koala bear is not really a bear.

    Bears have heavy bodies with extremely powerful limbs. Each limb has five strong, sharp claws used for tearing and digging. Most bears are partly carnivorous. They have a long snout.

    Koalas are *diprotodont* meaning "two front teeth". They are herbivores. They have a condition called "fused fingers". In diprotodonts, the second and third digits of the feet are completely fused together, except for the claws.

    (a) Which features of an animal would scientists use to decide whether to classify it as Diprotodontia? [2]

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    (b) The scientific classifications of koalas and other animals are shown in the table below.

Level of classification	Polar bear	Grizzly bear	Koala bear	Wombat	Kangaroo
Kingdom	Animalia	Animalia	Animalia	Animalia	Animalia
Phylum	Chordata	Chordata	Chordata	Chordata	Chordata
Class	Mammalia	Mammalia	Mammalia	Mammalia	Mammalia
Order	Carnivora	Carnivora	Diprotodontia	Diprotodontia	Diprotodontia
Family	Ursidae	Ursidae	Phascolarctidae	Vombatidae	....
Genus	*Ursus*	*Ursus*	*Phascolarctos*	*Vombatus*	....
Species	*maritimus*	*horriblis*	*cinereus*	*ursinus*	....

(i) Which level of classification shows that koalas are not related to grizzly bears? [1]

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(ii) In the 18th century Carl Linnaeus developed the system of giving all living organisms a two-word scientific name.

How does this system help scientists in different countries who are studying these animals? [1]

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(iii) What is the scientific name for koalas? [1]

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(iv) The scientific name for a kangaroo is *Macropus rufus* and it belongs to the family Macropodidae.

Use this information to **complete** the table opposite. [2]

(c) In the wild, koalas are found in Australia. The koala only eats eucalyptus leaves.
The koala climbs the tree to get the leaves. The koala will eat 1 kg of leaves a day.
Explain why the koala population is under threat. [2]

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4. The picture shows solar panels installed on the roof of a house. Each solar panel converts the Sun's radiant energy directly into electrical energy.

On a typical summer day in the UK, the solar radiation energy input per second to the panel is 6 000 W. The efficiency of the panel in converting solar power to electrical power is 15%.

(a) (i) Calculate the useful power transfer from the panel using the equation: [2]

$$\% \text{ Efficiency} = \frac{\text{useful power transfer}}{\text{total power input}} \times 100$$

Useful power transfer = ……………………………… W

(ii) Calculate the maximum current that this panel could supply to the 230 V house circuits using the equation: [2]

power = voltage × current

Current = ……………………………… A

(b) On most Summer days the assistants claim the panel will generate electricity, as described above, for 10 hours.
Calculate the maximum units produced in a day using the equation: [2]

Units produced (kWh) = power (kW) × time (hours)

Units produced = ……………………………… kWh

(c)   The typical cost of solar panels for a home is £10 000.
It is claimed that over a year the panels will produce a mean value of energy of 3 kWh per day.
Discuss the use of this solar panel to produce electricity for the home.   [6 QWC]

Include in your answer:

- A calculation to show the payback time of installing the panels if the cost of one unit of electricity is 15p;

- What factors will affect the payback time and how;

- Whether it is a practical option for a home.

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5. The table shows a life cycle analysis of PVC and wooden window frames. The data can be used to decide which is the more sustainable option. The table does not include any benefit from recycling the frames.

	Wooden	PVC
Total energy used in production, use and disposal	9150 MJ	9713 MJ
Natural gas consumption in replacing heat lost through window	178 kg	183 kg
Coal and oil used in production and/or painting	5.37 kg	18.23 kg
Greenhouse effect	457 kg CO_2	487 kg CO_2
Water Eutrophication (grammes of phosphate)	67	1.6
Depletion of non-renewable resources in production and painting	81 kg	88.5 kg
Wastes after use without recycling	16.5 kg	28.2 kg
Lifetime cost to consumer	£167	£122

(i) Use the data to describe why the wooden option is the most sustainable in terms of preserving natural resources. [3]

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(ii) Use the data to explain why using wood will have a greater detrimental effect on water animals. [3]

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(iii) Use the data to explain the benefits of recycling both types of windows after their lifetime. [3]

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6. Theories about the universe have changed over time as more evidence has become available. Initially the Steady-State theory was widely accepted. This believed the universe was not only homogenous in space but also in time, i.e. it looked the same at any place and at any time.

(i) Explain how the detection of the Cosmic Microwave Background Radiation was a powerful blow against the Steady-State theory. [3]

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(ii) Name and explain other evidence, apart from CMBR, that shows that the universe continues to expand away from a Big Bang. [3]

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(iii) There are many galaxies observable from Earth. Describe what observations tell us about the motion of distant galaxies compared to those closer to us. [2]

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8

7. The graph shows the carbon dioxide levels in the atmosphere for the past 50 years.

The wavy line records the variation in levels during each year. Every year the maximum occurs in May, at the beginning of the plant growing season. Every year the minimum occurs in November, at the end of the growing season. The solid trend line shows the same data but with the yearly variations removed.

Atmospheric Carbon Dioxide During the Past 50 Years
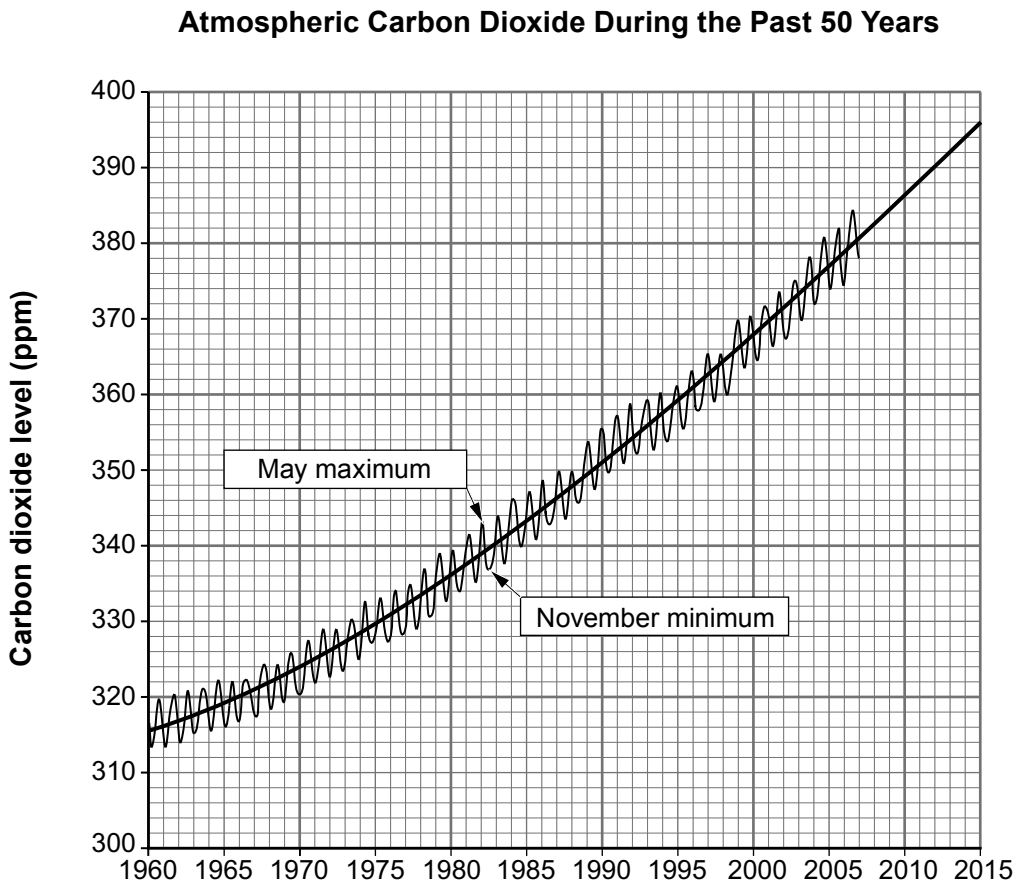
(a) Explain why the carbon dioxide level fluctuates between May and November every year.
[3]

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(b) (i) Describe the trend in carbon dioxide levels over time shown by the graph.   [2]

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(ii) State **three** methods of reducing the carbon dioxide levels in the atmosphere.   [3]

1. ....

2. ....

3. ....

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END OF PAPER

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