

Surname	Centre Number	Candidate Number
Other Names		0



GCSE

4781/02



S16-4781-02

SCIENCE B

**UNIT 1: Space, Energy and Life
HIGHER TIER**

A.M. FRIDAY, 10 June 2016

1 hour 15 minutes

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
Section A	1.	11
	2.	13
Section B	3.	8
	4.	8
	5.	7
	6.	8
	7.	9
	8.	6
Total	70	

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator 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.

INFORMATION FOR CANDIDATES

Section A is based upon the Pre-Release Article.
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 (QWC) used in your answer to question **1(c)** and question **8**.

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 **Diagram 1** to answer the questions below.

(a) Complete the table below:

[3]

Stored carbon pool	Quantity (billions of tonnes)
soil	2300
fossil pool	10000
atmosphere
oceans (total)
plant biomass

(b) Humans contribute 9 billion tonnes of carbon to the atmosphere every year. The net increase in the atmosphere is only 4 billion tonnes.

Give **two** reasons for this difference.

[2]

1.

2.

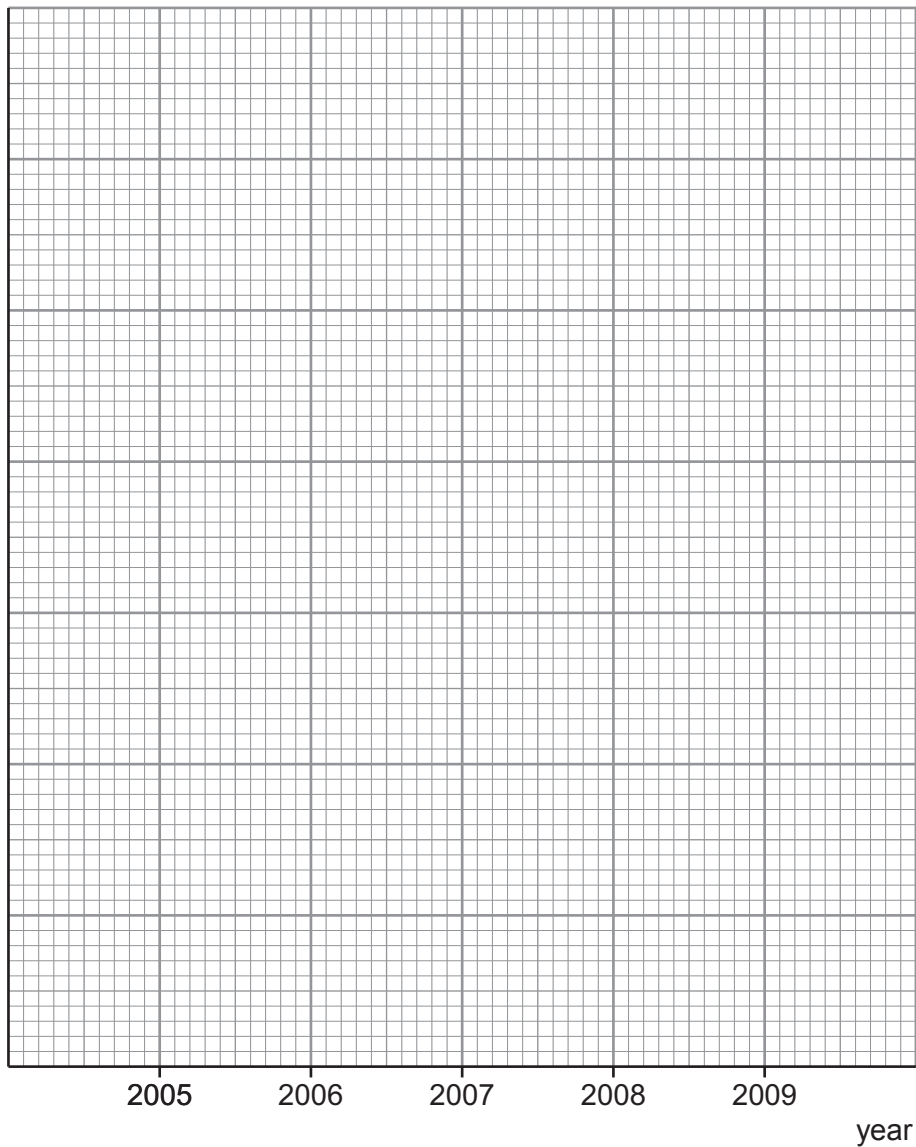
2. (a) Read the information about carbon footprint and **Table 1** to answer the questions below.

- (i) State the countries which produced the lowest carbon dioxide emissions in 2009. [1]
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- (ii) Name the country with the biggest increase in carbon dioxide emissions in tonnes per person per year between 2005 and 2009. [1]
-

- (iii) Plot a graph on the grid below to show how carbon dioxide emissions per person has changed over time in the UK. [4]

CO₂eq
(tonnes per
person per
year)



- (iv) Use the data to estimate the year in which the carbon dioxide emissions per person in the UK will reach the maximum allowed for sustainable living. Show how you arrived at your answer. [3]

year =

- (b) A homeowner installs photovoltaic cells on the roof of their house and a log burner in their living room. Describe how this will alter the pie chart of their personal CO₂ contributions shown in **Diagram 2**. [2]

.....

.....

- (c) A farmer supplies 2000kg of beef to the food industry every year. He is told that if he changed to supplying 2000kg of poultry instead, he would reduce his carbon footprint. Use the information in **Table 2** to calculate the savings in his carbon footprint. [2]

Savings in carbon footprint = kgCO₂eq

13

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SECTION B

Answer all questions in the spaces provided.

3. The table shows information about planets in our Solar System. Use this to answer the questions that follow.

Planet	Mean distance from the Sun (AU)	Diameter (10^6 m)	Time to spin on axis	Time to orbit the Sun (Earth years)	Number of known moons
Mercury	0.4	5	59 days	0.24	0
Venus	0.7	12	243 days	0.6	0
Earth	1.0	13	23 hours, 56 mins	1	1
Mars	1.5	7	24 hours, 37 mins	2	2
Jupiter	5.2	143	9 hours, 55 mins	12	63
Saturn	9.5	120	10 hours, 39 mins	29	61
.....	19.2	51	17 hours, 14 mins	84	27
Neptune	30.0	50	16 hours, 7 mins	165	13

(a) (i) Complete the table. [1]

(ii) Vesta is one of the largest asteroids. Estimate the distance of Vesta from the Sun and its time to orbit the Sun. [2]

distance of Vesta from the Sun = AU

time for Vesta to orbit the Sun = Earth years

(iii) Pluto is too small to be classed as a planet. Estimate the diameter of Pluto. [1]

..... $\times 10^6$ m

(b) It is suggested that Venus does not have any moons because it is too small to hold them in orbit.

Explain whether the data supports this suggestion. [2]

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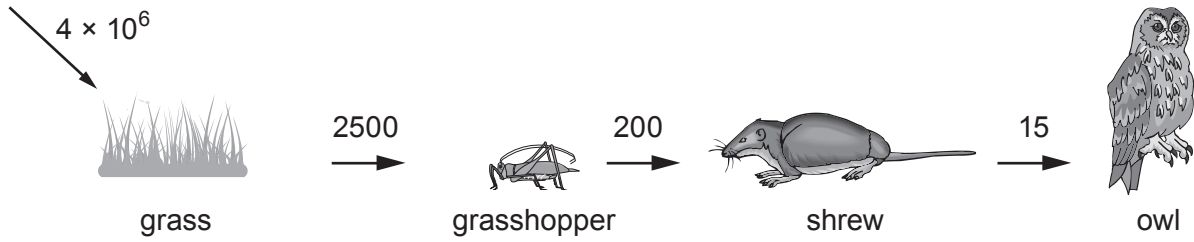
.....

(c) Explain whether the time for a planet to orbit the Sun is proportional to its distance from the Sun. [2]

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4. The diagram shows the flow of energy through a food chain (in kJ/m²).



(a) Name the producer in this food chain. [1]

(b) (i) Calculate the efficiency of the energy transfer from the sun to the owls. Use the equation: [2]

$$\text{efficiency \%} = \frac{\text{useful output energy}}{\text{total input energy}} \times 100$$

efficiency % =

(ii) Explain why the efficiency is low. [2]

.....

(iii) Explain the difference in the amount of energy transferred to the two predators. [3]

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5. In this question you will need to use the following equations:

$$\text{units used} = \text{power (kW)} \times \text{time (h)}$$

$$\text{total cost} = \text{cost per unit} \times \text{units used}$$

Some builders sharing a house were worried about their electricity bill. They decided to record how much electricity they used. They found that they used 145 units in one week. One unit of electricity costs 18p.

- (i) Calculate the cost of electricity for a week. [2]

cost = £

- (ii) Cooking using an electric oven costs the builders £4.80 a week. They found that if they did the cooking using a microwave they would use only 5 units in the week. They bought a microwave for £54.60. Calculate how many weeks it took for the saving on the electricity bill to cover the cost of buying the microwave. [3]

answer = weeks

- (iii) The builders used a kettle for a total of 30 minutes each day. The kettle used 8.4 units in the week. Calculate the power of the kettle. [2]

power = kW

6. (a) Describe and explain the importance of natural selection in the evolution of species. [4]

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(b) Changes in species can be brought about through genetic modification.

(i) State **two** advantages of genetic modification. [2]

1.

2.

(ii) State **two** disadvantages of genetic modification. [2]

1.

2.

8

7. The table shows properties of types of waves in the electromagnetic (em) spectrum.

Spectrum of Electromagnetic Radiation			
Type	Wavelength range (cm)	Frequency range (Hz)	Energy range (eV)
radio waves	> 10	$< 3 \times 10^9$	$< 10^{-5}$
microwave	10 – 0.01	$3 \times 10^9 - 3 \times 10^{12}$	$10^{-5} - 0.01$
infrared	$0.01 - 7 \times 10^{-5}$	$3 \times 10^{12} - 4.3 \times 10^{14}$	0.01 – 2
visible	$7 \times 10^{-5} - 4 \times 10^{-5}$	$4.3 \times 10^{14} - 7.5 \times 10^{14}$	2 – 3
ultraviolet	$4 \times 10^{-5} - 10^{-7}$	$7.5 \times 10^{14} - 3 \times 10^{17}$	$3 - 10^3$
X-rays	$3 \times 10^{17} - 3 \times 10^{19}$	$10^3 - 10^5$
gamma rays	$< 10^{-9}$	$> 3 \times 10^{19}$	$> 10^5$

(a) (i) Describe how the properties of the waves change from gamma rays to radio waves. [3]

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(ii) Complete the table using the equation: [3]

$$\text{speed} = \text{frequency} \times \text{wavelength.}$$

All em waves travel through space with a speed of 3×10^8 m/s.

Space for working.

