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Candidate Number

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Biology

Unit: KBI0/4BI0

Paper: 2B

Friday 5 June 2015 – Afternoon

Time: 1 hour

Paper Reference

KBI0/2B
4BI0/2B

You must have:
Calculator

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- Show all the steps in any calculations and state the units.

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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PEARSON

Answer ALL questions.

- 1 Read the passage below. Use the information in the passage and your own knowledge to answer the questions that follow.

Alligators save lives



Many humans are frightened of being attacked and eaten by alligators. However, alligators may have a role as potential lifesavers. Scientists have discovered proteins in alligator blood called alligacins. They hope these proteins may provide a source of new antibiotics to help fight infections, particularly those associated with diabetic ulcers and severe skin burns.

The scientists collected blood samples from alligators. They extracted the antibiotic proteins from the white blood cells involved in destroying pathogens. In laboratory tests the protein extracts killed a wide range of bacteria, including MRSA (methicillin-resistant *Staphylococcus aureus*). These 'superbugs' are increasingly resistant to many antibiotics and cause thousands of deaths each year.

The investigation by the scientists of the antibiotic properties of alligacins discovered a range of other uses for these proteins. For example, they help to cure infection caused by the yeast *Candida albicans* in AIDS patients. The antibiotic proteins killed six out of eight different strains of *Candida albicans*. They also discovered that the blood proteins may help destroy HIV, the virus that causes AIDS.

Alligators have an immune system that is different from the immune system of humans. Humans need a vaccination to be able to respond quickly to infection by pathogens. However, the alligator immune system can quickly destroy pathogens without having had prior exposure to them. Scientists believe that natural selection has created this evolutionary adaptation as it promotes quick wound healing. These wounds are caused by alligators fighting to defend their territory from other alligators.

The scientists are hoping to identify the exact chemical structures of the antibiotic proteins. They can then begin to develop antibacterial or antifungal drugs.



(a) What is meant by the term **pathogens** (line 8)?

(1)

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(b) Describe how a non-resistant *Staphylococcus aureus* bacterium can produce a bacterium that is resistant to methicillin (lines 8 and 9).

(2)

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(c) A pathogen named in the passage is *Staphylococcus aureus*. Name one other pathogen named in the passage.

(1)

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(d) What term is used in the passage to describe pathogens that are resistant to antibiotics?

(1)

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(e) Suggest why an MRSA infection may have to be treated with many different antibiotics (line 10).

(1)

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(f) Explain how a vaccination will protect a human from having an infection.

(3)

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(g) Describe how natural selection increases the number of alligators with alligacin in their blood.

(3)

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(h) Suggest two reasons why an alligator defends its territory (line 24).

(2)

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(Total for Question 1 = 14 marks)



- 2 The table shows the results of an investigation into the rate of sweating of a person when resting or running at different air temperatures.

Air temperature in °C	Relative rate of sweating in arbitrary units	
	when resting	when running
31.5	2	3
32.0	2	5
33.0	2	8
34.5	4	17
35.0	5	20
36.0	8	34

- (a) Suggest why the investigation was carried out with the same person resting and running. (1)

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- (b) Compare the effect of increasing air temperature on sweat production when resting and when running. (3)

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(c) Suggest why the rate of sweating changes when a person does exercise, such as running.

(4)

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(d) Suggest a method that you could use to measure the rate of sweating.

(3)

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(Total for Question 2 = 11 marks)



3 Many hardwood trees are cut down and used to make outdoor furniture. This is because hardwood is less likely to decompose than other types of wood.

(a) Describe the process that decomposes wood.

(2)

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(b) Some hardwood tree species are becoming rare because of deforestation. To solve this problem scientists hope to use micropropagation (tissue culture) to produce clones of some hardwood tree species.

(i) Describe the process of micropropagation to clone plants such as hardwood trees.

(5)

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(ii) State two ways in which deforestation can lead to poor quality soil.

(2)

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2

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(Total for Question 3 = 9 marks)



4 The passage describes some of the roles of components found in human blood.

Complete the passage by writing a suitable word or words in each blank space.

(6)

The body uses white blood cells to combat infection. One type of blood cell ingests invading

bacteria and are called After ingesting bacteria they

produce that digest the bacteria breaking them down.

Other white blood cells are called and they release

specific molecules that bind to antigens on the surface of the pathogen.

Other components of the blood are also involved in helping wounds to heal.

Small cell fragments called platelets help the blood to

This seals the wound to prevent further and prevent

entry of

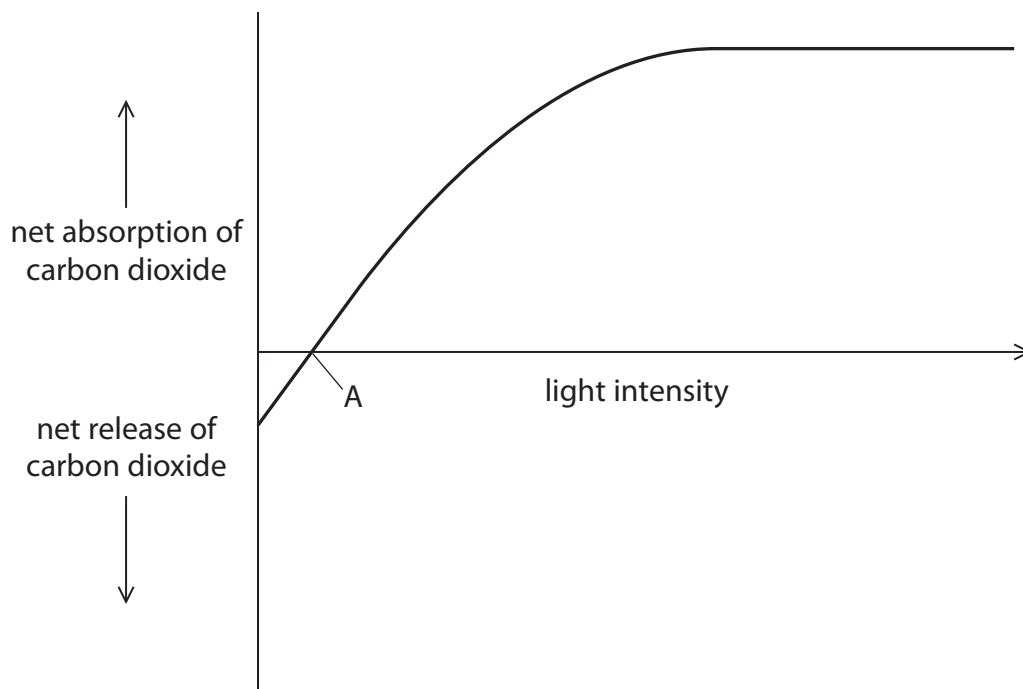
(Total for Question 4 = 6 marks)



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5 The graph shows the effect of increasing light intensity on the exchange of carbon dioxide in a green plant.



(a) Describe the effect of increasing light intensity on the exchange of carbon dioxide. (2)

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(b) Explain why there is no net exchange of carbon dioxide at point A. (1)

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(c) Describe how you could use an indicator to show how the exchange of carbon dioxide by a leaf changes in the dark and in the light.

(2)

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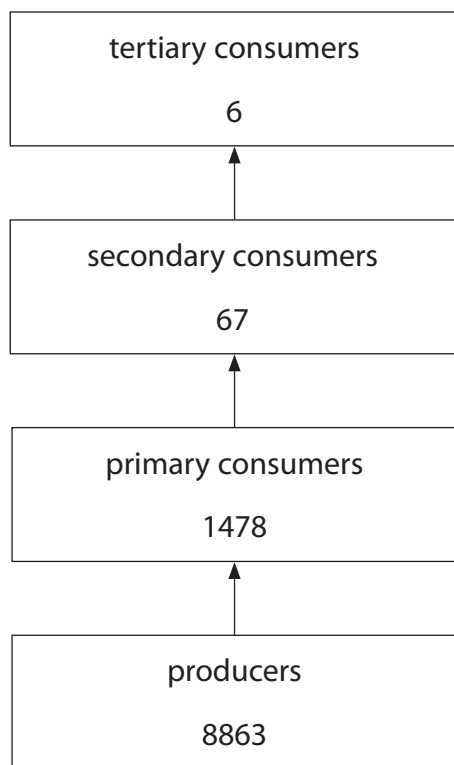
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(Total for Question 5 = 5 marks)



- 6 The diagram shows the energy transfer in a river ecosystem. The numbers on the diagram refer to the energy in the biomass at each trophic level in arbitrary units.



- (a) The formula shows how to calculate energy transfer efficiency as a percentage.

$$\text{percentage energy transfer efficiency} = \frac{\text{total energy in biomass}}{\text{total energy available}} \times 100$$

- (i) The total energy available to the producers from sunlight is 1 700 000 in arbitrary units.

Use this information, and the formula, to calculate the percentage energy transfer efficiency from sunlight to plants.

Show your working.

(2)

Answer %



(ii) Suggest why the percentage energy transfer efficiency from sunlight to plants is low.

(1)

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(b) The table shows the calculated energy transfer efficiencies between the different trophic levels in the river ecosystem.

Trophic levels	Percentage energy transfer efficiency
plants to primary consumers	16.7
primary consumers to secondary consumers	4.5
secondary consumers to tertiary consumers	9.0

Suggest two reasons why the energy transfer from plants to primary consumers is not 100%.

(2)

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(Total for Question 6 = 5 marks)



7 (a) Explain what is meant by the term **transgenic organism**.

(2)

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(b) Give one example of the use of transgenic organisms.

(1)

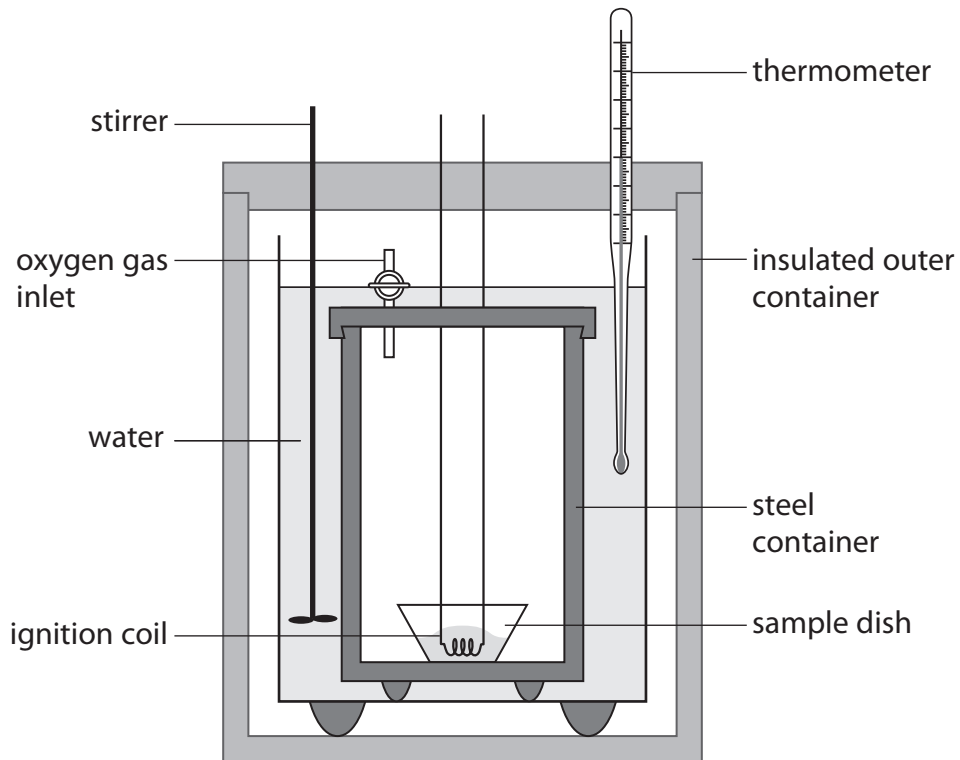
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(Total for Question 7 = 3 marks)



- 8 A calorimeter is a piece of apparatus used to calculate the energy content of a food sample. The diagram shows a calorimeter.



Food is placed in the dish and burnt in air with high levels of oxygen. The temperature rise of the water is measured using the thermometer. The energy content of the food is measured in joules per gram of food.

- (a) (i) The oxygen gas inlet allows the food to burn in air with high levels of oxygen.

Suggest why this gives a more accurate value of the energy content than burning food in normal air.

(1)

- (ii) Suggest why the calorimeter has an insulated outer container.

(2)



(b) Table 1 shows the mass of fat in five different types of food. The mass is measured in grams of fat per 100 grams of each food.

Type of food	Mass of fat in grams per 100 grams
A	0.1
B	2.5
C	7.4
D	27.2
E	30.9

Table 1

A student measures the energy content of the five different foods.

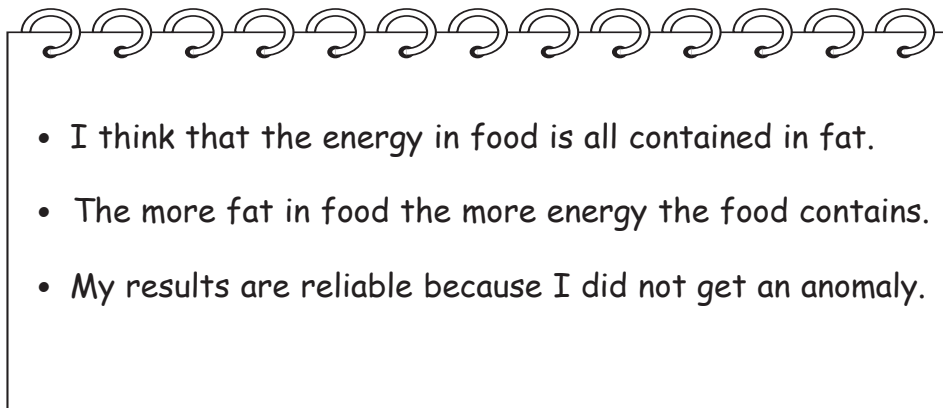
Table 2 shows her results.

Reading	Energy content of food in joules per gram				
	food A	food B	food C	food D	food E
1	227	1717	5325	7567	11 200
2	272	1960	4400	6650	10 300
3	280	1570	3696	5680	12 205
Mean	260	1749	4474	6632	11 235

Table 2



The student wrote three conclusions in her notebook.



(i) The student is wrong to believe that 'the energy in food is all contained in fat'.
Name two other large insoluble molecules in food that contain energy.

(2)

1

2

(ii) Explain whether the student's results support her conclusion that food with more fat contains more energy.

(1)

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(iii) The student states that her results are reliable because she did not get an anomaly.
What is meant by the term **anomaly**?

(1)

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(Total for Question 8 = 7 marks)

TOTAL FOR PAPER = 60 MARKS



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