

Surname	Centre Number	Candidate Number
Other Names		0



**GCSE**

4461/01

**SCIENCE A/BIOLOGY**

**BIOLOGY 1  
FOUNDATION TIER**

P.M. TUESDAY, 10 June 2014

1 hour

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	4	
2.	5	
3.	6	
4.	4	
5.	7	
6.	5	
7.	5	
8.	6	
9.	6	
10.	6	
11.	6	
<b>Total</b>	<b>60</b>	

**ADDITIONAL MATERIALS**

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

**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**

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 question 11.

*Answer all questions*

1. The photograph below shows an insect called a water boatman (*Notonecta sp.*).



- (a) Water boatmen are invertebrates.  
State what is meant by the term invertebrate.

[1]

- (b) Read the following statements about water boatmen.

Water boatmen:

- A** live at the surface of ponds
- B** have long, flat back legs to help them swim
- C** have large eyes
- D** can dive below the surface of the water
- E** lay eggs on plants in the water
- F** have hairs sensitive to movement in water

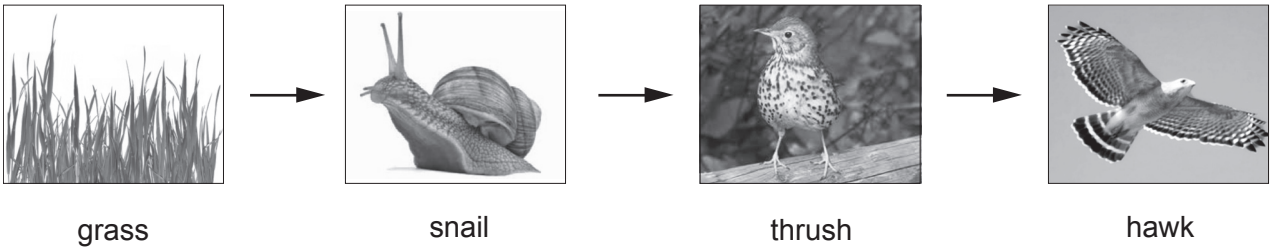
Water boatmen feed on small fish in the water.

Which **four** statements (**A** to **F**) are adaptations to help water boatmen **find** their food?

[3]

.....

2. The photographs below show a food chain.



(a) State the source of the energy used by the grass. [1]

.....

(b) Complete the following sentence:

Arrows in the food chain show the flow of ..... [1]

(c) The table below shows how much energy enters each organism in the food chain in one day.

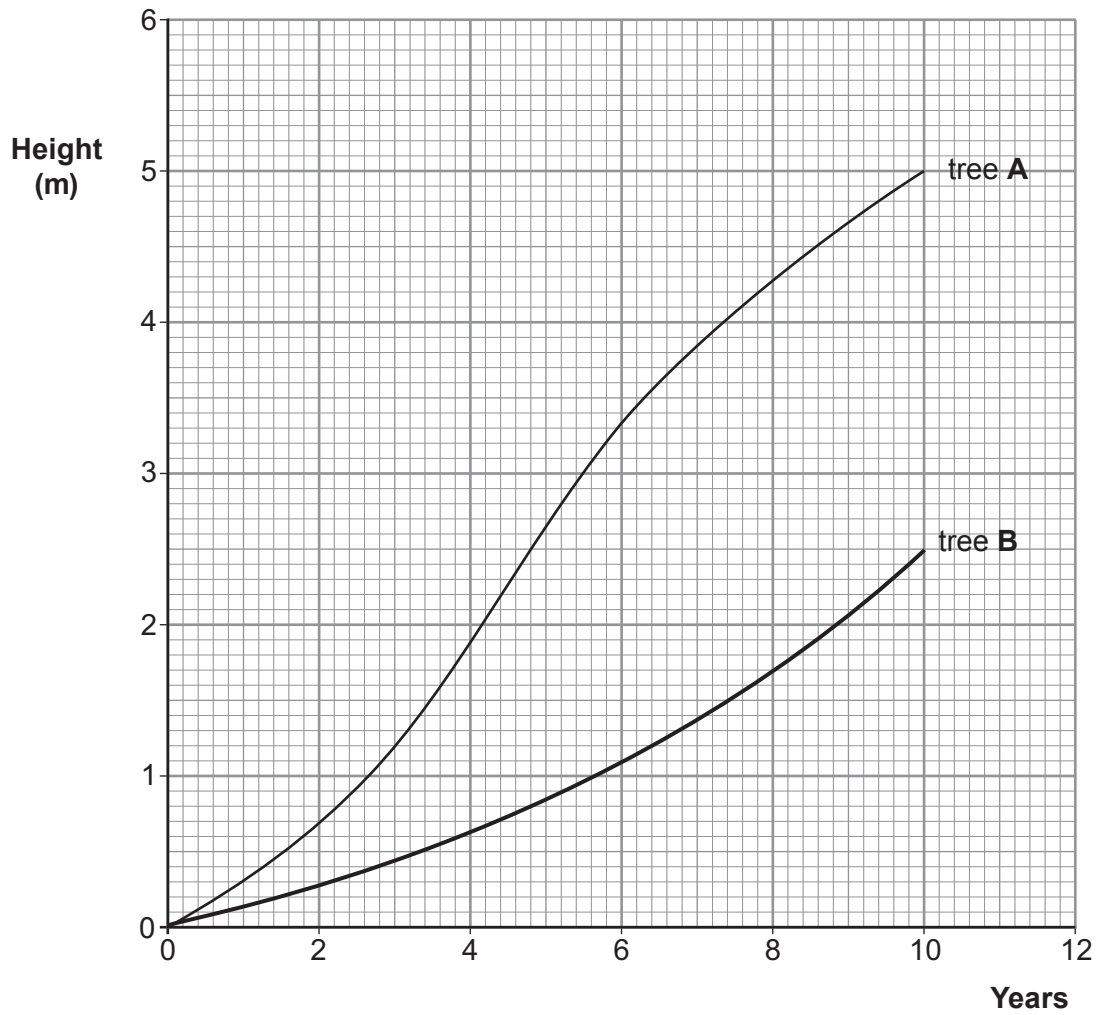
organism in food chain	energy entering each organism (kJ)	percentage energy in grass passed on (%)
grass	2500	
snail	500	.....
thrush	25	1
hawk	0.5	0.02

(i) Use data in the table to calculate the percentage of the energy **entering the grass** that is passed on to the **snail**. Show your working below and write your answer in the table. [2]

(ii) State the process occurring in cells that releases energy. [1]

.....

3. The graph below shows the growth of two trees (**A** and **B**) during a period of 10 years.



- (a) Give the difference in height between trees **A** and **B** at 10 years.

[1]

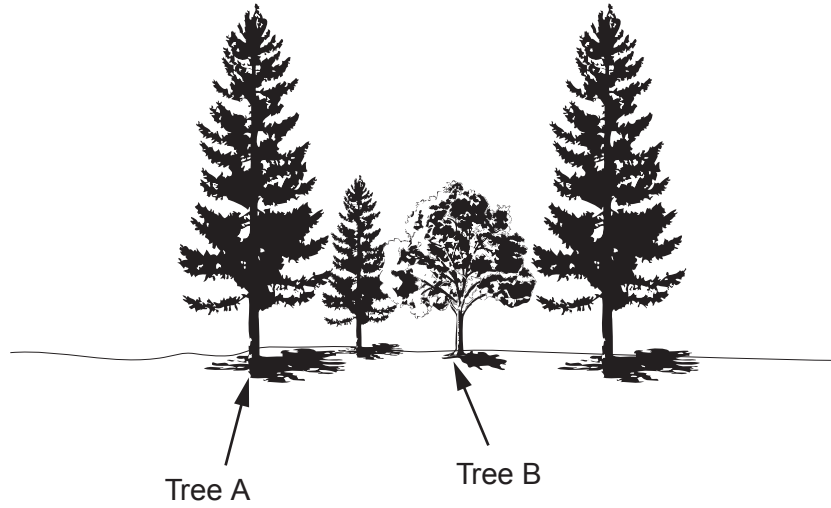
..... m

- (b) The mean (average) growth rate for tree **A** over 10 years was 0.5 m per year. Calculate the mean growth rate for tree **B**.

[1]

..... m per year

(c) The trees were growing in a wood as shown in the diagram below.



Trees compete for resources.

Use the diagram above and your knowledge to give **three** resources for which trees compete. [3]

- 1 .....
- 2 .....
- 3 .....

(d) Suggest **one** reason, apart from competition for resources, for the difference in mean growth rate between the two trees. [1]

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6

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4. The photograph below shows maggots. Maggots are the larvae (young) of flies.



Read the following information.

- In the First World War, many soldiers died from infection of their wounds by bacteria.
- Sometimes, maggots would hatch in the wounds from eggs laid by flies.
- An army doctor called William Baer observed that soldiers whose wounds had maggots were more likely to survive than soldiers who did not have maggots.
- The maggots seemed to clean the wound.
- He reasoned that maggots ate bacteria and dead flesh around the wound.
- Baer published his ideas in 1931. Since then, using maggots to treat wounds has become common.

(a) From this information:

- (i) What was Baer's observation? [1]

.....

.....

- (ii) What was Baer's hypothesis? [1]

.....

.....

- (iii) Suggest why it was important for Baer to publish his ideas. [1]

.....

.....

- (b) Suggest **one** reason (apart from cost) why using maggots to treat wounds may be preferred instead of using antibiotics on patients. [1]

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.....

5. (a) Use words from the list below to complete the following sentences about chromosomes. [3]

**nucleus   cytoplasm   circle   gene   protein   membrane**

Chromosomes are found in the ..... of a cell. Sections of DNA form units of inheritance. Each unit is called a ..... . Each unit is a code for the production of one .....

- (b) The table below gives the number of chromosomes in the **body** cells of some animals.

animal	number of chromosomes in body cells
human	46
meerkat	36
kangaroo	16
fruit fly	8
mosquito	6

The diagram below shows the chromosomes from an **egg cell** in one of the animals in the table above.



- (i) I How many chromosomes are shown in the diagram above? ..... [1]  
 II State the animal from which this egg cell was taken. Give a reason for your answer. [2]

.....  
 .....  
 .....

- (ii) State the chromosome number in a **fertilised** egg cell of a meerkat. [1]

.....

6. Some rats have evolved a resistance to the rat poison warfarin.

(a) The information below shows some stages in the development of this resistance **but not in the correct order**.

- 1 so the useful mutation is passed on to offspring
- 2 a mutation occurred in a gene
- 3 the mutation is useful
- 4 rats with the mutation survive to reproduce
- 5 as a result, there is an increase in the population of rats with the mutation

Complete the sequence below to show the stages in the correct order. *One has been done for you.*

..... **2** ..... → ..... → ..... → ..... → ..... [4]

(b) What may happen to **species** that do not adapt to new environmental conditions? [1]

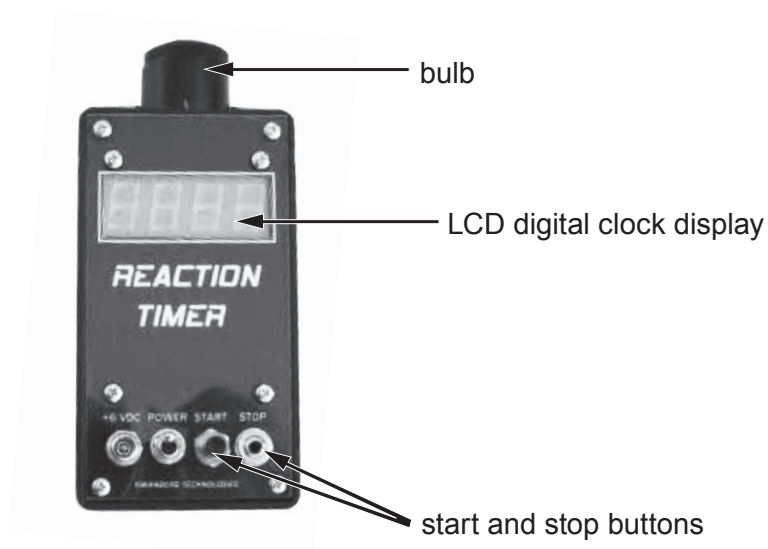
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7. Megan wanted to know if playing music affected Bob's reaction time.

She used a reaction timer as shown in the photograph below.



### Method

- The clock started timing as soon as the bulb lit up.
- When Bob saw the bulb light up, he pressed the stop button as fast as he could.
- Bob's reaction time with no music playing and then with music playing was recorded.

The results for five trials are shown below.

trial number	reaction time with no music playing (s)	reaction time with music playing (s)
1	0.20	0.53
2	0.20	0.44
3	0.20	0.40
4	0.20	0.38
5	0.20	0.25

(a) What conclusions can be made from the results of the experiment?

[2]

Examiner  
only

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(b) (i) State the name of the sense organ that detects light.

[1]

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(ii) Describe how information gets from sense organs to the brain.

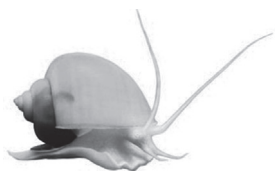
[2]

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5

8. Some organisms living in a large lake and their total biomass in kg are shown below.  
They are **not** drawn to scale.



Snails  
4 500 kg



Pike  
250 kg



Aquatic plants  
45 000 kg



Minnows  
500 kg



Beetles  
800 kg

- (a) (i) Which of the organisms above are likely to be present in the least numbers? [1]
- .....
- (ii) The organisms above all form part of the same food chain.  
In the space below, draw a **labelled** diagram to show a pyramid of biomass containing **all** of these organisms. [2]

- (iii) The pike in the lake are affected by a parasite, called a fish louse, which lives on their skin. There would be many of these parasites on each pike but their biomass would be less than the biomass of the pike.

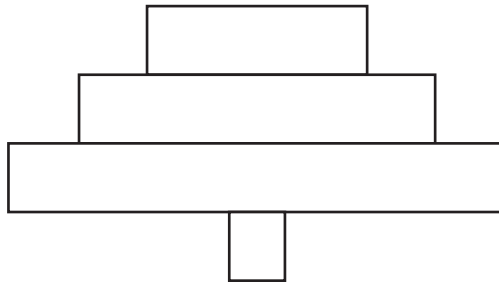
How would you add this information to the pyramid you drew in (a)(ii)?

Tick (✓) the correct answer.

[1]

- Place them at the tier above the pike
- Place them at the bottom of the pyramid
- Place them below the minnows
- Place them in the tier below the pike

- (b) Explain how a pyramid of **numbers**, for some organisms living on land, could look like the one shown below: [2]



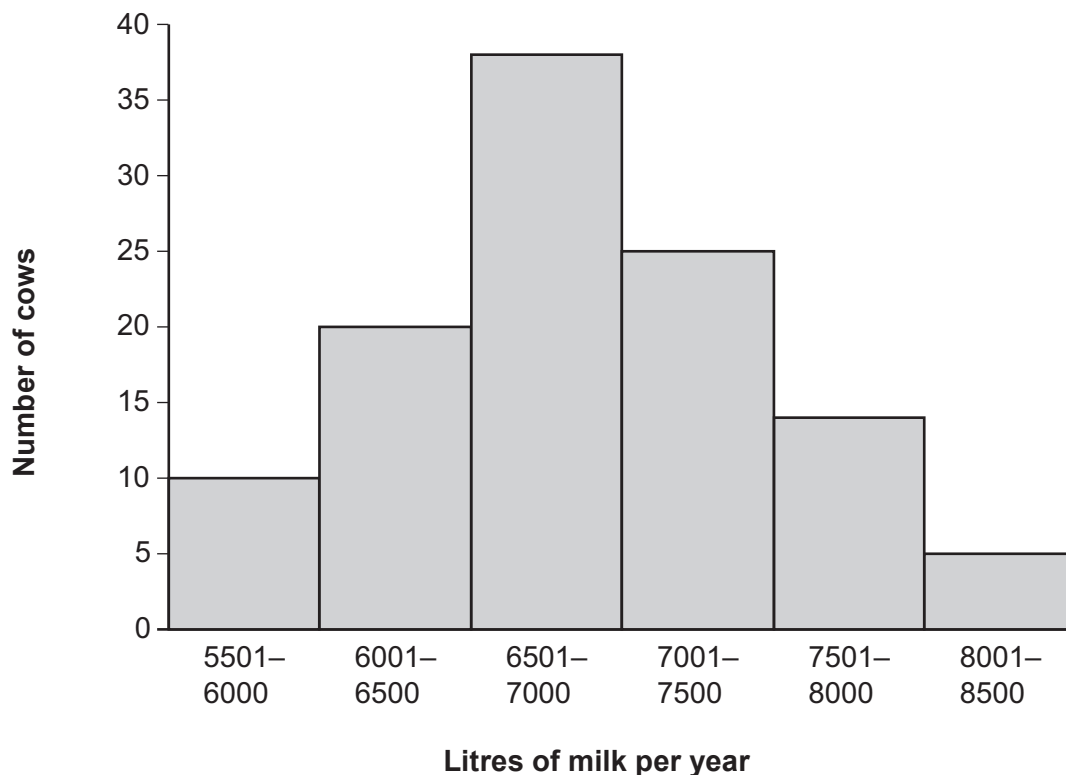
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9. (a) The graph below shows the variation in the volume of milk produced by a herd of cows in one year. All the cows were the same breed.



- (i) During the winter months, the herd is kept indoors in large barns. All the cows in the herd are fed exactly the same quality and quantity of food. Suggest a reason why the volumes of milk produced by the cows varied during the winter months. [1]

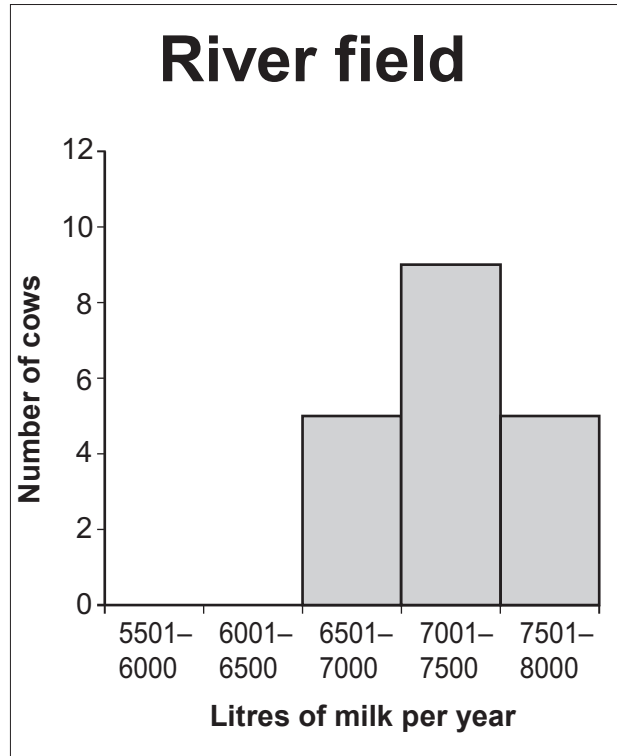
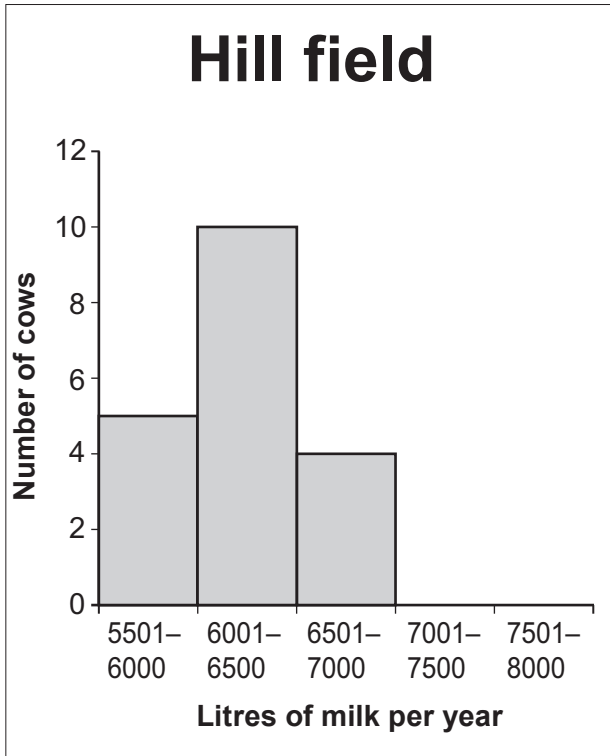
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During the summer months, the farmer noticed that the volume of milk produced by the cows varied depending on which fields on the farm the cows were grazing on.

He divided the cows that produced 6501 – 7000 litres of milk per year into two groups. One of these groups grazed on a field by the river and the other on a field on the hill.

The graphs below show the results.



(ii) Explain the differences in the results shown in the graphs. [2]

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(iii) When the farmer breeds from his cows he uses a method called artificial insemination (AI). The sperm are introduced into the cows mechanically rather than by using a bull directly. How does this information suggest that AI is a method of sexual reproduction? [1]

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(b) The table below shows the milk composition of five breeds of dairy cattle.

breed	milk composition (g/l)		
	fat	protein	milk sugar
Ayrshire	3.97	3.26	4.63
Brown Swiss	3.80	3.18	4.80
Guernsey	4.58	3.49	4.78
Holstein	3.56	3.02	4.61
Jersey	4.97	3.03	4.70

Milk from which breed of cattle would you recommend to a person suffering from heart disease? Give a reason for your answer. [2]

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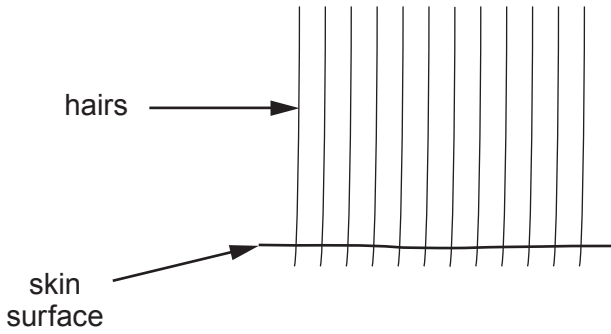
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10. The diagram below shows the hairs on the surface of the skin of a cat at different air temperatures.

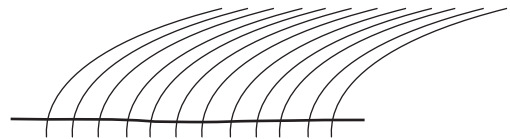
**Diagram A**

Mean air temperature 6.4°C



**Diagram B**

Mean air temperature 22.7°C



(a) Name the structures in the skin that raise each hair to the position shown in **Diagram A**. [1]

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(b) Explain why the skin in **Diagram A** loses less heat to the air than the skin in **Diagram B**. [3]

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.....

(c) State **two other** ways in which the skin reduces heat loss from the body. [2]

I .....

II .....



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