

Please write clearly in block capitals.

Centre number

Candidate number

Surname _____

Forename(s) _____

Candidate signature _____

INTERNATIONAL AS BIOLOGY (9610)

Unit 1 The diversity of living organisms

Wednesday 9 May 2018 07:00 GMT Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:

- a ruler with millimetre measurements
- a scientific calculator, which you are expected to use where appropriate.

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 75.
- All working must be shown.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
TOTAL	



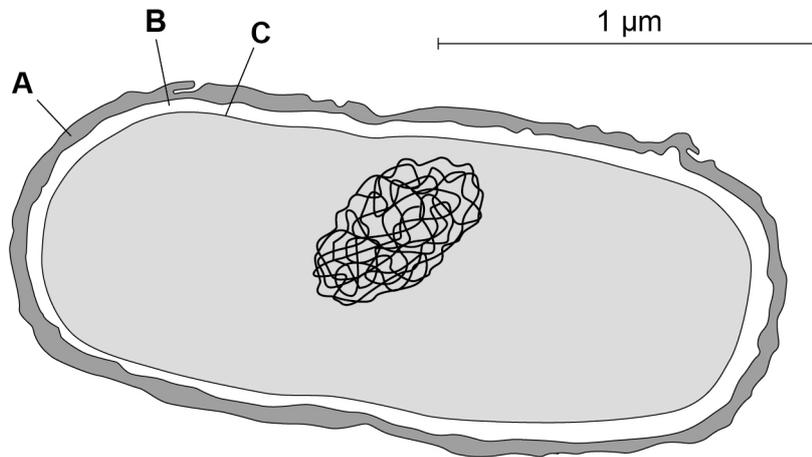
Answer **all** questions in the spaces provided.

Do not write
outside the
box

0 1

Figure 1 is a drawing of a transmission electron micrograph of an *E. coli* bacterium.

Figure 1



0 1 . 1

Name the three layers labelled **A**, **B** and **C** in **Figure 1**.

[3 marks]

A _____

B _____

C _____

0 1 . 2

Calculate the magnification of the image of the bacterium in **Figure 1**.

[1 mark]

Answer _____



0 1 . 3

Some types of cell contain special proteins called chaperones.
Chaperone proteins are mostly found on the endoplasmic reticulum.

Describe the role of chaperone proteins.

[2 marks]

0 1 . 4

A protein in a eukaryotic cell may have a different shape from a protein in a bacterium even though they are coded for by an identical gene.

Suggest **one** reason why.

[1 mark]

7

Turn over for the next question

Turn over ►



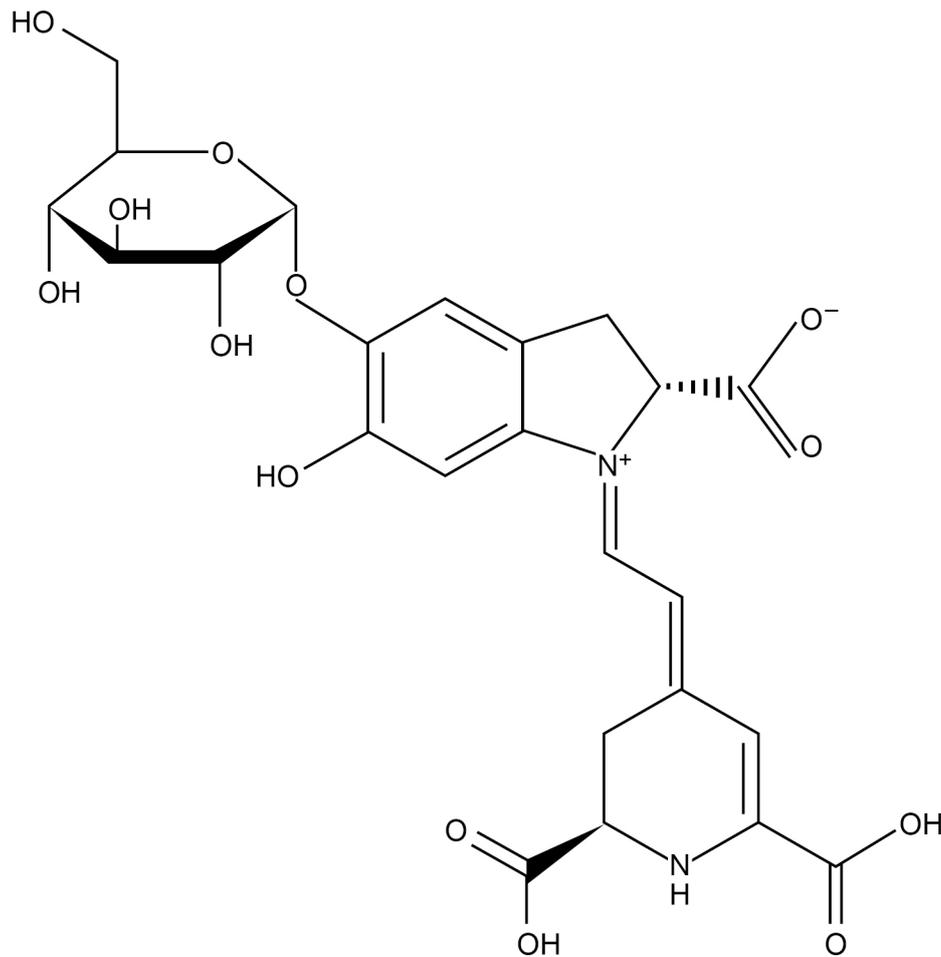
0 2

Beetroots are the swollen roots of some species of beet plant.

The vacuoles in the cells of beetroots contain a red, water-soluble pigment called betanin.

Figure 2 shows the structure of betanin.

Figure 2



0 2

. 1

Betanin does not usually cross the membrane of the vacuole.

Suggest **two** possible reasons why.
Use information from **Figure 2**.

[2 marks]

- 1 _____
- _____
- 2 _____
- _____



0 2 . 3 The student used an electric water bath for each temperature.

Give **one** reason why.

[1 mark]

0 2 . 4 The student repeated the experiment at 100 °C and found that the colour of the liquid was the same as the colour at 85 °C.

Explain why.

[2 marks]

0 2 . 5 Suggest **one** suitable control for this experiment.

[1 mark]

0 2 . 6 All of the beetroot pieces were cut to the same shape and size.

Explain why.

[2 marks]

12



0 3

Schistosomiasis is a serious disease affecting millions of people each year.

It is caused by infection with a parasitic flatworm.

Scientists studied the genetic diversity of the three species of flatworm known to cause the disease.

Samples of the flatworms were collected at random from different locations.

0 3 . 1

Why was it important that the samples were collected at random?

[1 mark]

0 3 . 2

The scientists isolated the DNA from the mitochondria of the flatworms. The mitochondrial DNA was used to measure the genetic diversity between the three species.

State **two** ways in which the structure of mitochondrial DNA is different from the structure of DNA inside the nucleus.

[2 marks]

1

2

0 3 . 3

In this study, scientists used DNA to determine the genetic diversity between the species of flatworms.

Explain **one** additional way in which genetic diversity could be measured.

[2 marks]

Question 3 continues on the next page

Turn over ►



03.4

Studying the genetic diversity of these parasitic flatworms is important in reducing the number of deaths caused by schistosomiasis.

Suggest why.

[1 mark]

6



There are no questions printed on this page

Turn over for the next question

*Do not write
outside the
box*

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**

Turn over ►



0 4

Emphysema is a disease that affects the alveoli and elastic tissue in the human lungs. It can be caused by the inhalation of irritants including chemicals found in cigarette smoke.

One effect of these chemicals is that they stimulate neutrophils (a type of white blood cell) to release an enzyme called elastase that breaks down elastic tissue.

5

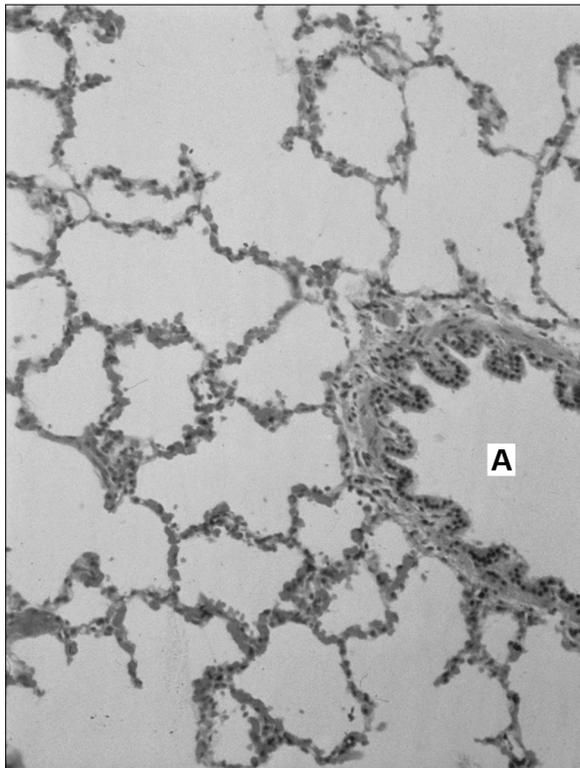
Elastase is a protease enzyme. It breaks down elastic tissue through the hydrolysis of peptide bonds in the target proteins. The specific peptide bonds broken are those on the carboxyl side of hydrophobic amino acids such as alanine and valine.

10

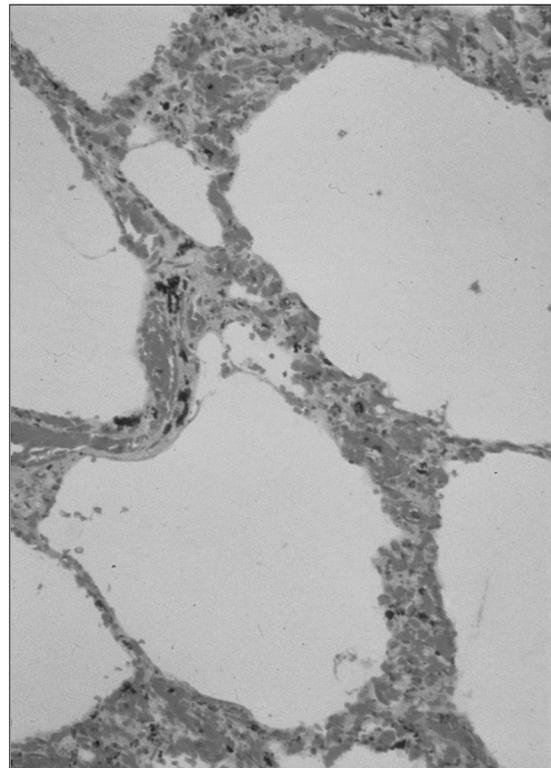
Figure 3 shows a section of lung tissue from a healthy person and a section of lung tissue from a person with emphysema.

Figure 3

**Section of lung tissue
from a healthy person**



**Section of lung tissue
from a person with emphysema**



0 4 . 1

Name the structure labelled **A** in **Figure 3**.

[1 mark]



0 4 . 2

Explain why people suffering from emphysema have less efficient gas exchange than healthy people.

Use information from the passage and **Figure 3**.

[3 marks]

0 4 . 3

Elastic tissue contains a structural protein. What type of tertiary structure does this protein have?

[1 mark]

Tick (✓) **one** box.

Conjugated

Fibrous

Globular

Prosthetic

0 4 . 4

Elastase only catalyses the breakdown of the structural protein in the elastic tissue.

Explain why elastase does **not** break down other molecules.

[2 marks]

Turn over ►



0	4	.	5
---	---	---	---

Elastase breaks the peptide bonds on the carboxyl side of hydrophobic amino acids such as alanine and valine (Page 10, lines 7–8).

The R group in alanine is CH_3 .

Draw the structure of alanine.

[1 mark]

8



0 5

Scientists investigated the hydrolysis of cellulose from samples taken from recycled paper.

They measured the concentration of the products formed in the reaction.

0 5 . 1

Name the monomer that forms a cellulose molecule.

[1 mark]

0 5 . 2

Describe a biochemical test for the monomer you named in your answer to question **05.1**.

[2 marks]

Question 5 continues on the next page

Turn over ►

0 5 . 3

In the investigation, the scientists mix the enzyme cellulase with the paper and a buffer solution in an incubated flask.

To measure the progress of the hydrolysis reaction, samples are taken from the flask every twelve hours.

The concentration of the products in each sample is measured.

Table 2 shows the scientists' results.

Table 2

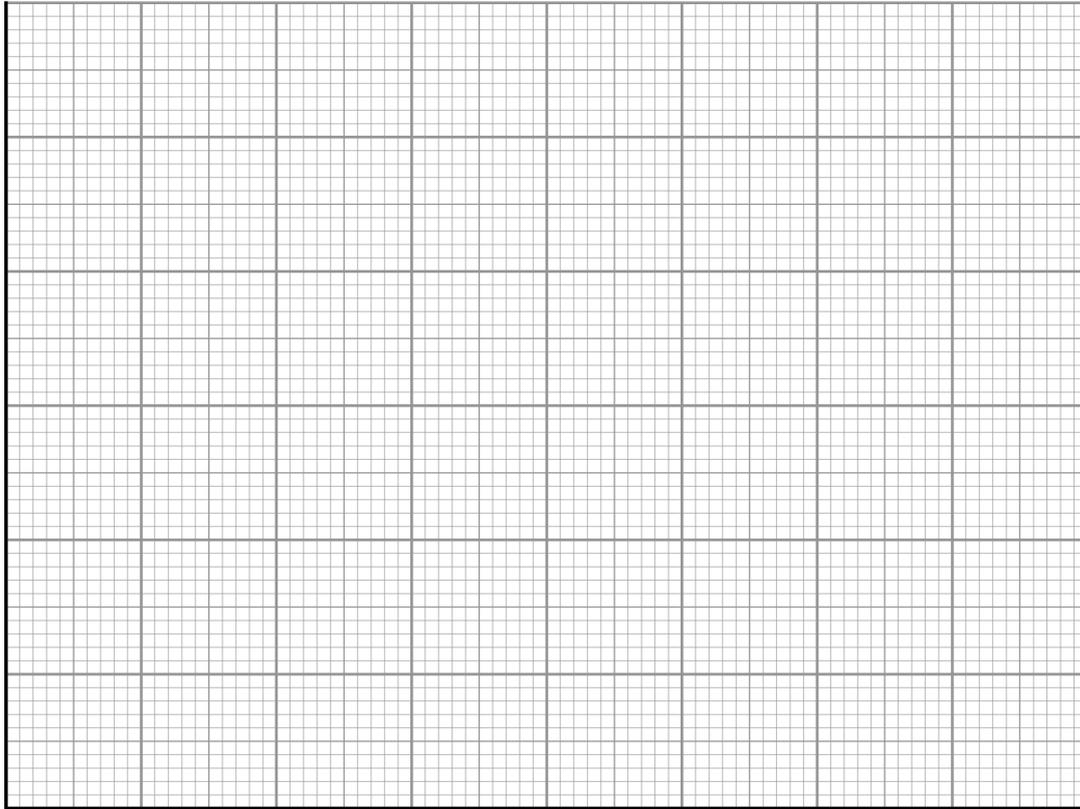
Hours	Concentration of products / g dm^{-3}	Rate of hydrolysis of cellulose / $\text{g dm}^{-3} \text{ minutes}^{-1}$
12	28.2	39.2×10^{-3}
24	42.9	20.4×10^{-3}
36	55.7	17.8×10^{-3}
48	59.2	4.9×10^{-3}
60	61.8	3.6×10^{-3}
72	62.5	

Calculate the missing rate of hydrolysis in **Table 2**. Write your answer in **Table 2**.

[1 mark]



0 5 . 4

Plot a suitable graph of the rates of hydrolysis as shown in **Table 2**.**[3 marks]**

0 5 . 5

Describe and explain the results of this investigation.

[3 marks]

Turn over ►

0	5	.	6
---	---	---	---

Explain how the structure of cellulose is related to its role in plant cell walls.

[3 marks]

13



0 6

When apples are cut, their flesh turns brown as a result of an enzyme controlled reaction. The enzyme polyphenol oxidase (PPO) converts colourless phenols on the exposed surface of the apple into a brown pigment called melanin.

The reaction can be summarised as:



A group of students investigate the effect of pH on the rate of browning of apples.

The students use the following method:

- cut a piece of apple and dip it into a pH4 buffer solution
- remove the apple slice and drain the excess solution
- record the time taken for the slice of apple to turn brown
- repeat the above steps with a range of different pH buffer solutions.

0 6 . 1

The size of the apple slices is constant.

State **one** other variable that should be controlled.

[1 mark]

Another group of students conducting the same investigation decide to set up a colour standard before starting the experiment.

In order to do this, the students leave a freshly cut slice of apple exposed to air for it to turn brown.

This slice of apple is then sealed in plastic film.

0 6 . 2

Suggest why the students seal this piece of apple in plastic film.

[1 mark]**Turn over ►**

0 6 . 3 Explain why having a colour standard is an improvement to the experiment.

[2 marks]

The results recorded by one student are shown in **Table 3**.

Table 3

pH buffer solution	Time taken for apple piece to turn brown / seconds
4	1200
5	959
6	675
7	482
8	994

0 6 . 4 Describe the results shown in **Table 3**.

[1 mark]



Sodium chlorite (SC) is an inhibitor of the enzyme PPO.

Scientists working in the food industry investigated how SC could be used to reduce browning in apples.

0 6 . 5

Suggest how SC reduces the rate of browning in fruit such as apples.

[3 marks]

8

Turn over for the next question

Turn over ►



0 7

A scientific magazine recently produced an article with the headline

‘At least 75% of the DNA in our genome is useless junk after all.’

0 7 . 1

Define the term ‘genome’.

[1 mark]

0 7 . 2

Use your knowledge of DNA to suggest what the author of the article meant by ‘useless junk’.

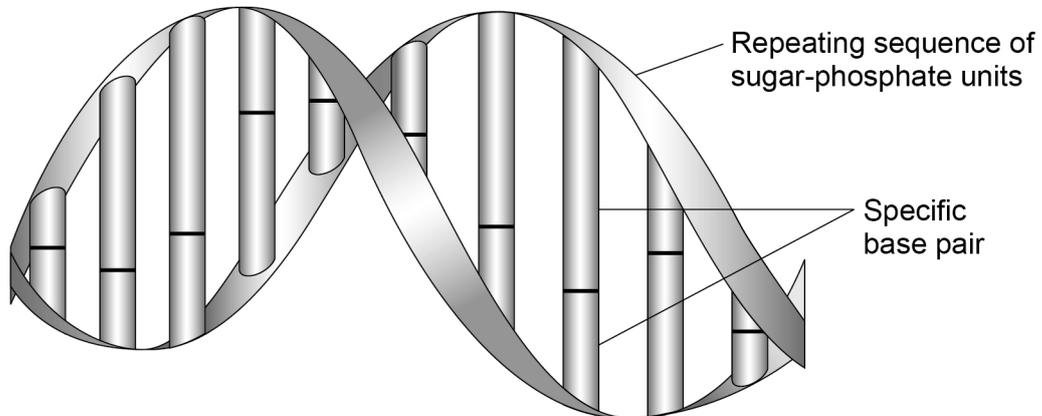
In your answer you should clearly describe where this junk DNA is located within the human genome.

[2 marks]



Figure 4 shows one complete turn of a DNA helix. Within the complete turn of the helix, each strand of DNA contains ten nucleotides.

Figure 4



0 7 . 3 A particular human chromosome is 1 metre long and contains 124 500 000 complete turns in its DNA helix.

Use this information to calculate the length of one nucleotide in nanometres.

[2 marks]

Answer _____ nm

Question 7 continues on the next page

Turn over ►



0 8 . 1

Table 5 shows the classification of a species of firefly called *Phosphaenus hemipterus*.

Complete **Table 5** by filling in the gaps.

[2 marks]

Table 5

Classification taxon	<i>Phosphaenus hemipterus</i>
Kingdom	<i>Animalia</i>
Phylum	<i>Anthropoda</i>
Class	<i>Insecta</i>
	<i>Coleoptera</i>
	<i>Lampyridae</i>
Genus	
Species	

Question 8 continues on the next page

Turn over ►

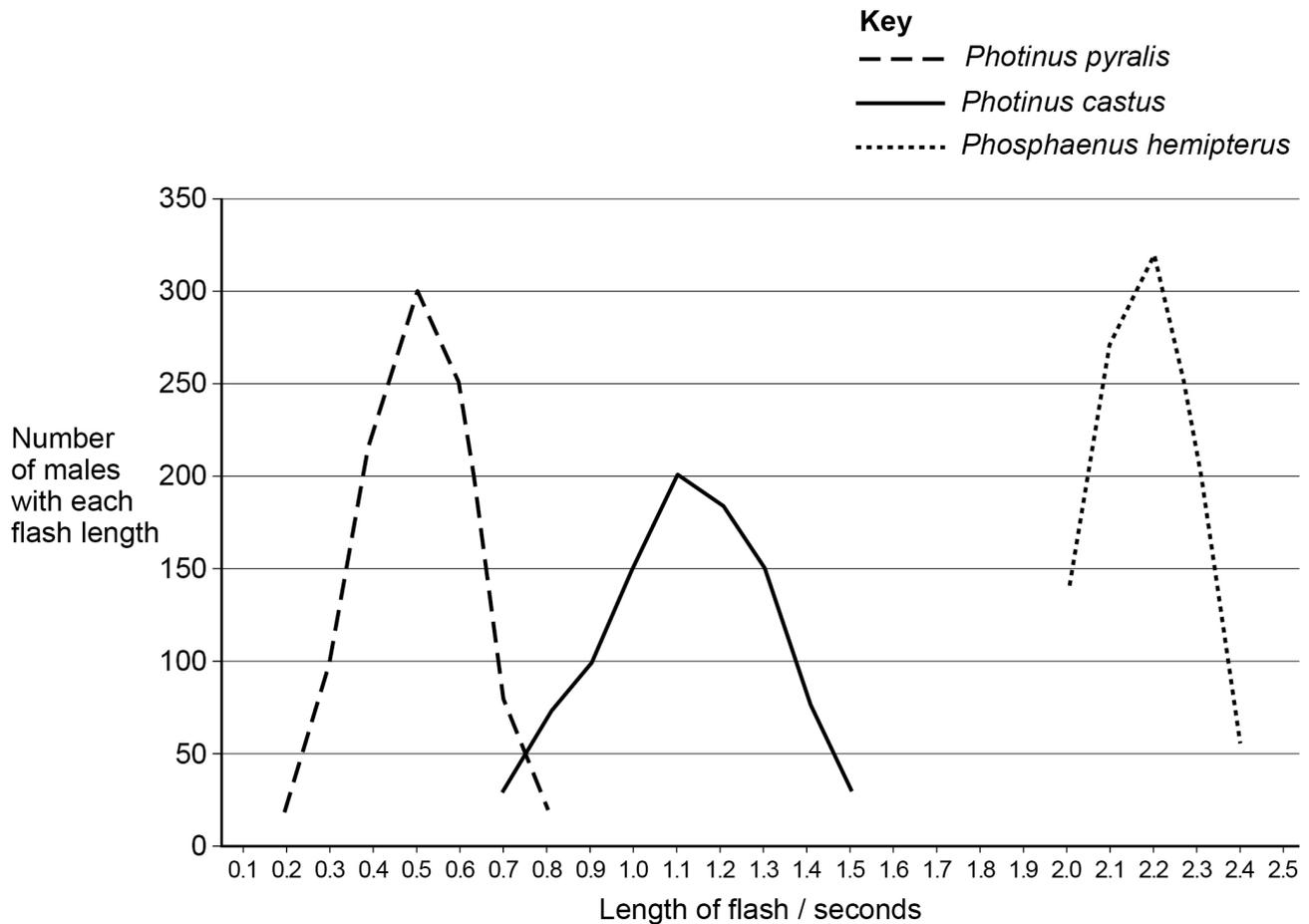


Male fireflies emit flashes of light as part of their courtship behaviour to attract females of the same species. Different species of firefly emit flashes lasting different lengths of time.

Scientists studied three different species of firefly living in the same community. They recorded the length of the flashes of 1000 males from each species.

Figure 5 shows the results they obtained.

Figure 5



0 8 . 2

Describe the results shown in **Figure 5**.

[2 marks]

0 8 . 3

Calculate the percentage of males in the *Photinus castus* sample shown in **Figure 5** that have a flash length of 0.75 seconds.

[1 mark]

Answer _____ %

0 8 . 4

Fireflies that have a flash length between 0.7 and 0.8 seconds are less likely to pass their alleles on to the next generation.

Suggest why.

[2 marks]

Turn over ►



08.5

Classification is based on a hierarchy of groupings.

What is meant by the term 'hierarchy'?

[2 marks]

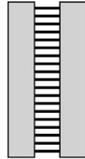
DNA hybridisation is a technique used for determining the degree of relatedness between two different species.

DNA from the same part of a chromosome is removed from each species, separated into two strands using heat, and then cooled and allowed to recombine together.

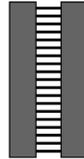
Figure 6 shows this process.

Figure 6

DNA from species 1



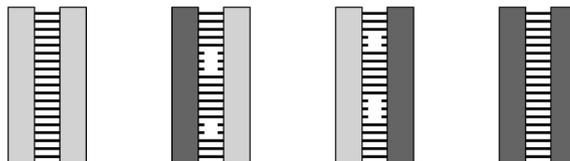
DNA from species 2



DNA is heated in order to break hydrogen bonds between strands



The DNA strands from each species are mixed together and then cooled to allow any hydrogen bonds to form between the two strands



08.6

DNA taken from *Photinus pyralis* and *Photinus castus* was hybridised and then reheated. The hybrid strands separated at 80 °C.

DNA from *Photinus pyralis* and *Phosphaenus hemipterus* was also hybridised and then reheated. The hybrid strands separated at 75 °C.

Use these results to conclude which two species are most likely to share the most recent common ancestor.

[3 marks]

Two species sharing the most recent common ancestor are

_____ and _____

Explain how you reached this conclusion.

12

END OF QUESTIONS

There are no questions printed on this page

*Do not write
outside the
box*

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**

Copyright information

For confidentiality purposes, acknowledgements of third party copyright material will be published in a separate booklet rather than including them on the examination paper or support materials. This booklet is published after each examination series and is available for free download from www.oxfordqaexams.org.uk after the live examination series.

Permission to reproduce all copyright material has been applied for. In some cases, efforts to contact copyright-holders may have been unsuccessful and Oxford International AQA Examinations will be happy to rectify any omissions of acknowledgements. If you have any queries please contact the Copyright Team, AQA, Stag Hill House, Guildford, GU2 7XJ.

Copyright © 2018 Oxford International AQA Examinations and its licensors. All rights reserved.

