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Please check the examination details below before entering your candidate information

| Candidate surname | Other names |
|---|---|
| | |

**Pearson Edexcel International GCSE (9–1)**

Centre Number | Candidate Number

**Time** 2 hours

**Paper reference** **4BI1/1B 4SD0/1B**

# Biology

## Unit: 4BI1

## Science (Double Award) 4SD0

## PAPER: 1B

November 2021

**You must have:**
Calculator, ruler

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.
- Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

## Information

- The total mark for this paper is 110.
- 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.
- Try to answer every question.
- Check your answers if you have time at the end.
- Good luck with your examination.

*Turn over* ▶


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**Answer ALL questions.**

**1** Bread contains starch.

(a) Describe how you would test a piece of bread to show it contains starch.

**(2)**

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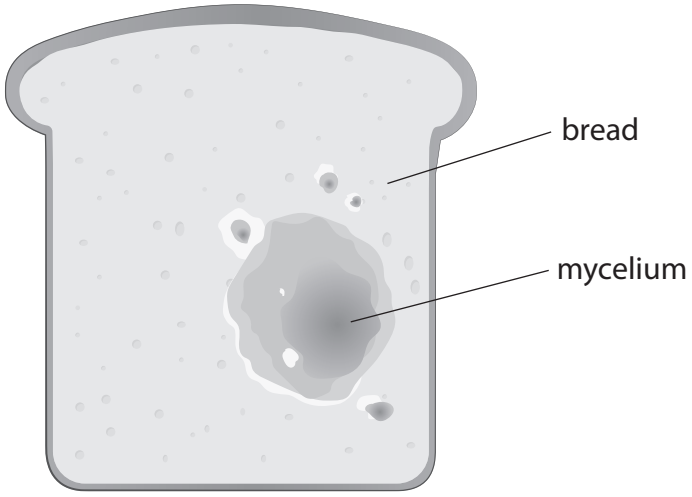
(b) The diagram shows the mycelium of an organism growing on a piece of bread.




(i) Which type of organism is shown growing on the bread?

**(1)**

- ☒ **A** bacterium
- ☒ **B** fungus
- ☒ **C** protoctist
- ☒ **D** virus

(ii) Which enzyme is released by the organism to digest starch?

**(1)**

- ☒ **A** amylase
- ☒ **B** ligase
- ☒ **C** lipase
- ☒ **D** protease

**(Total for Question 1 = 4 marks)**

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**2** Human blood contains red blood cells and white blood cells.

(a) The table shows the number of these blood cells in a sample of blood.

| Type of cell | Number of cells per $mm^3$ | Number of cells per $mm^3$ in standard form |
|---|---|---|
| red blood cell | 5 000 000 | $5.0 \times 10^6$ |
| white blood cell | 6000 | |

(i) Complete the table to give the number of white blood cells per $mm^3$ in standard form.

**(1)**

(ii) What is the number of red blood cells in 1000 $cm^3$ of this person's blood?

**(1)**

☒ **A** $5.0 \times 10^6$

☒ **B** $5.0 \times 10^9$

☒ **C** $5.0 \times 10^{11}$

☒ **D** $5.0 \times 10^{12}$

(b) The table gives names, descriptions and symptoms of two blood conditions.

| Name of condition | Description | Symptom |
|---|---|---|
| anaemia | low red blood cell count | often tired |
| leukopenia | low white blood cell count | likely to get infections |

(i) Explain why a person with anaemia is often tired.

**(2)**

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(ii) Explain why a person with leukopenia is more likely to get an infection.

**(2)**

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**(Total for Question 2 = 6 marks)**

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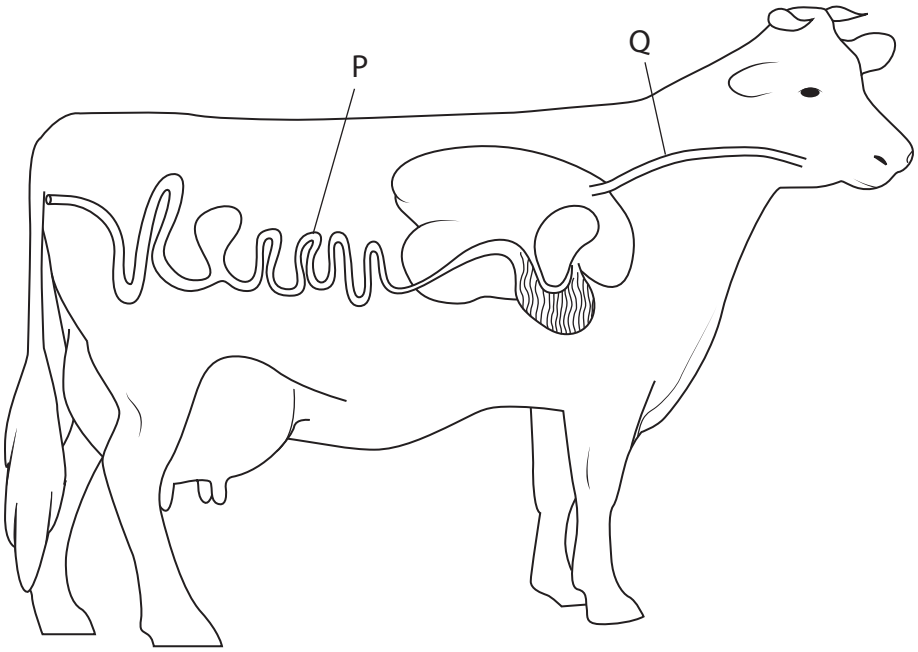
**3** The diagram shows part of the digestive system of a cow.




(a) Name the parts labelled P and Q.

**(2)**

P .....

Q .....

(b) The cow's stomach contains microorganisms that digest plant cell walls.

Suggest why these microorganisms are useful to a cow.

**(2)**

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(c) Farmers keep cows to produce milk.

Injecting cows with growth hormone (GH) will increase milk production.

This allows farmers to obtain the same volume of milk from fewer cows.

Digestion in cows releases methane gas into the atmosphere.

A scientist claims that injecting GH into cows would reduce climate change.

Comment on this claim.

**(4)**

**(Total for Question 3 = 8 marks)**

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**4** A balanced diet contains the correct proportion of vitamins.

(a) The table lists the functions of some vitamins.

Complete the table by stating the correct vitamins.

The first one has been done for you.

**(2)**

| Function of vitamin | Vitamin |
|---|---|
| prevents scurvy | C |
| improves vision | |
| helps bone growth | |

(b) Yeast is used to make bread.

A student investigates the effect of vitamin C on the growth of yeast cells.

This is his method.

- put 0.50 g of yeast into a flask containing 200 $cm^3$ of glucose solution and add 0.10 g of vitamin C
- put 0.50 g of yeast into another flask containing 200 $cm^3$ of glucose solution without vitamin C
- measure the dry mass of yeast in each flask after 30 hours

The table shows the student's results.

| Time in hours | Dry mass of yeast in g | |
|---|---|---|
| | with vitamin C | without vitamin C |
| 0 | 0.50 | 0.50 |
| 30 | 7.10 | 6.50 |

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(i) The student calculates that the mean rate of yeast growth with vitamin C is 0.22 g per hour.

Calculate the mean rate of yeast growth without vitamin C.

**(2)**

mean rate = ..... g per hour

(ii) Suggest how to find the dry mass of yeast in each flask.

**(2)**

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(iii) State the dependent variable in this investigation.

**(1)**

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(iv) The method gives some variables that the student controlled.

Justify two other variables the student should control.

**(4)**

1 .....

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2 .....

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**(Total for Question 4 = 11 marks)**

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**5** Genetic modification is a process used to improve crop yield.

(a) Describe the role of a named vector in the process of genetic modification.

**(2)**

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(b) Weeds are plants that grow where they are not wanted.

Removing weeds reduces competition for mineral ions and improves crop yield.

(i) Name the mineral ion used to make chlorophyll.

**(1)**

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(ii) Two different methods can be used to remove weeds to improve crop yield.

- Method A pull weeds out of the ground by hand
- Method B spray weeds with a chemical that kills them

Design an investigation to find out which method produces the highest crop yield.

Include experimental details in your answer and write in full sentences.

**(6)**

**(Total for Question 5 = 9 marks)**

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**6** Cholesterol is needed in the diet for making cell membranes.

(a) State the role of the cell membrane.

**(1)**

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(b) Too much cholesterol is a health risk because fatty deposits build up in arteries.

The lumen of an artery had a diameter of 4.0 mm before the build-up of a fatty deposit.

The fatty deposit covers 45% of the original area of the lumen.

Calculate the area in $mm^2$ of the lumen that is available for blood flow.

[area of the lumen = $\pi r^2$]

[$\pi = 3.14$]

**(2)**

area = ..... $mm^2$

(c) A scientist tests the blood cholesterol concentration in a sample of men between 25 and 34 years old.

The scientist groups the men in ranges of blood cholesterol concentration and counts the number of men in each range.

The table gives the scientist's results.

| Range of blood cholesterol concentration in mg per $cm^3$ | Number of men in each range |
|---|---|
| 80 to 119 | 13 |
| 120 to 159 | 150 |
| 160 to 199 | 442 |
| 200 to 239 | 299 |
| 240 to 279 | 115 |
| 280 to 319 | 34 |
| 320 to 359 | 9 |
| 360 to 399 | 5 |

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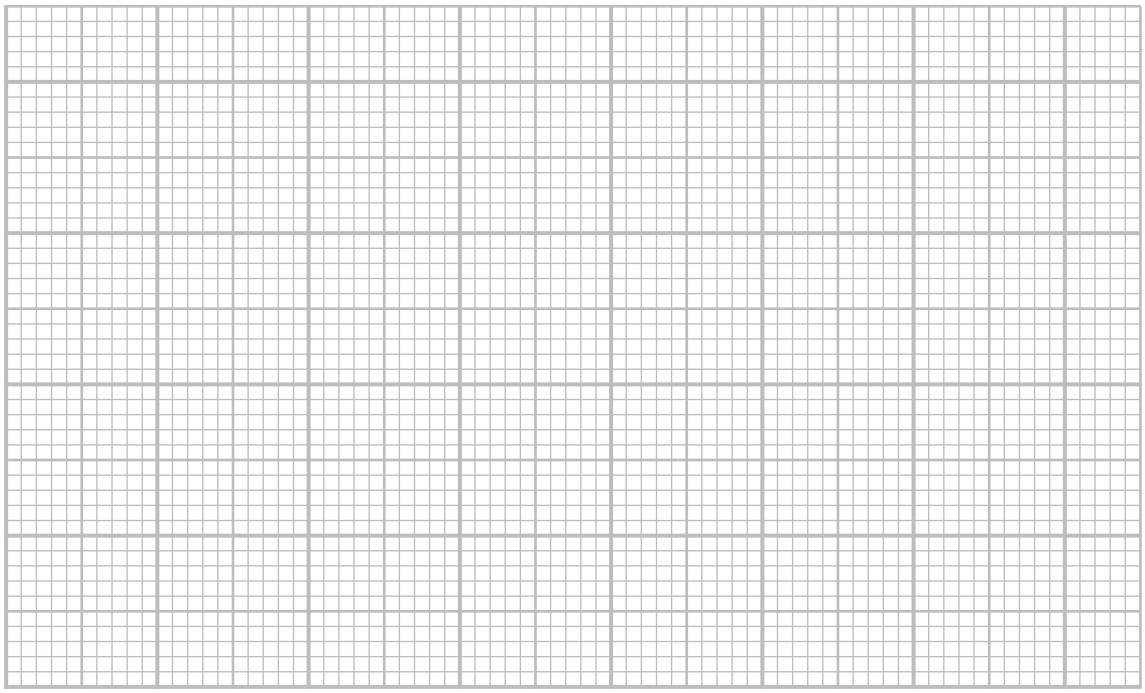
(i) Plot a suitable graph on the grid to show these results.

**(5)**



(ii) Which range of blood cholesterol levels is the mode for this sample?

**(1)**

- ☒ **A** 80 to 119
- ☒ **B** 80 to 379
- ☒ **C** 160 to 199
- ☒ **D** 360 to 399

(iii) A blood cholesterol level greater than 239 mg per 100 $cm^3$ means a person has a higher risk of heart disease.

Calculate the percentage of men in the sample at a higher risk of heart disease.

**(2)**

percentage = ..... %

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(d) Statins are drugs that reduce blood cholesterol levels.

A scientist investigates the use of one type of statin on the risk of having a heart attack.

He gives the statin to one group of people and gives a control substance to another group of people.

He calculates the percentage of people in each group that have a heart attack during the next four years.

The table gives the scientist's results.

| Group | Percentage (%) having heart attacks |
|---|---|
| statin | 2.2 |
| control substance | 3.8 |

A conclusion from this data is that statins reduce the risk of heart attacks.

Discuss this conclusion.

**(4)**

**(Total for Question 6 = 15 marks)**

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**7** A scientist studies hair colour in mice.

Mice can have grey hair or white hair.

The hair colour is determined by a gene with two alleles.

In a first cross, a male mouse with white hair is mated with a female mouse with grey hair.

All the offspring have grey hair.

(a) (i) State what is meant by the term **gene**.

**(1)**

.....

.....

(ii) State the phenotype coded for by the dominant allele.

**(1)**

.....

(b) A male mouse and a female mouse with grey hair were chosen from the offspring of the first cross. These mice are mated in a second cross.

Some of the offspring of this second cross have grey hair and some have white hair.

Use a genetic diagram to show the second cross.

You should give the genotypes of the parents and the gametes formed. You should also give the genotypes and ratio of phenotypes of the offspring.

**(4)**

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(c) The scientist concludes that a mouse with grey hair could have two possible genotypes.

Explain how the scientist could use a cross to determine the genotype of a mouse with grey hair.

**(2)**

(d) Albino mice have white hair. These mice also have pink eyes as they do not have pigment in their irises.

They are also less likely to explore a new area when compared to mice with grey hair.

This is an example of one gene having many effects.

Describe how the genetic control of most phenotypic features differs from this example.

**(3)**

**(Total for Question 7 = 11 marks)**

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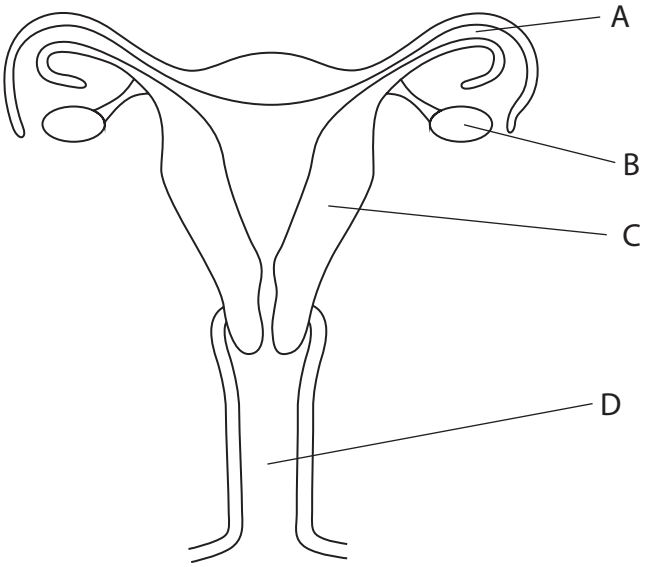
**8** All organisms carry out some form of reproduction such as asexual reproduction or sexual reproduction.

(a) Describe how asexual reproduction differs from sexual reproduction.

**(3)**

(b) The diagram shows the structure of the human female reproductive organs.




(i) What is the site of fertilisation?

**(1)**

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

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(ii) Where does the fetus usually develop?

**(1)**

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(iii) Describe the role of the hormones produced by structure B.

**(4)**

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(c) The male reproductive system in humans produces sperm in a liquid called semen.

The production of sperm changes with age.

A scientist investigates how age affects mean semen volume and sperm concentration in one ejaculation.

The table shows the results of the investigation.

| In one ejaculation | Age in years | | | | | | |
|---|---|---|---|---|---|---|---|
| | 16–30 | 31–33 | 34–36 | 37–39 | 40–43 | 44–47 | 48–72 |
| mean semen volume in $cm^3$ | 3.45 | 3.44 | 3.35 | 3.30 | 3.22 | 2.92 | 2.49 |
| mean sperm concentration in millions per $cm^3$ | 61.5 | 64.2 | 64.1 | 61.1 | 62.1 | 62.4 | 56.9 |
| mean number of sperm released in millions | 212 | 221 | 215 | 202 | | 182 | 142 |

(i) Calculate the mean number of sperm released in one ejaculation from men aged 40–43

**(1)**

mean number of sperm = ..... million

(ii) Explain why mean number of sperm released is a better measure of fertility than either mean semen volume or mean sperm concentration.

**(2)**

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(iii) Calculate the percentage decrease in mean number of sperm between men aged 37–39 and men aged 48–72

**(2)**

percentage change = ..... %

**(Total for Question 8 = 14 marks)**

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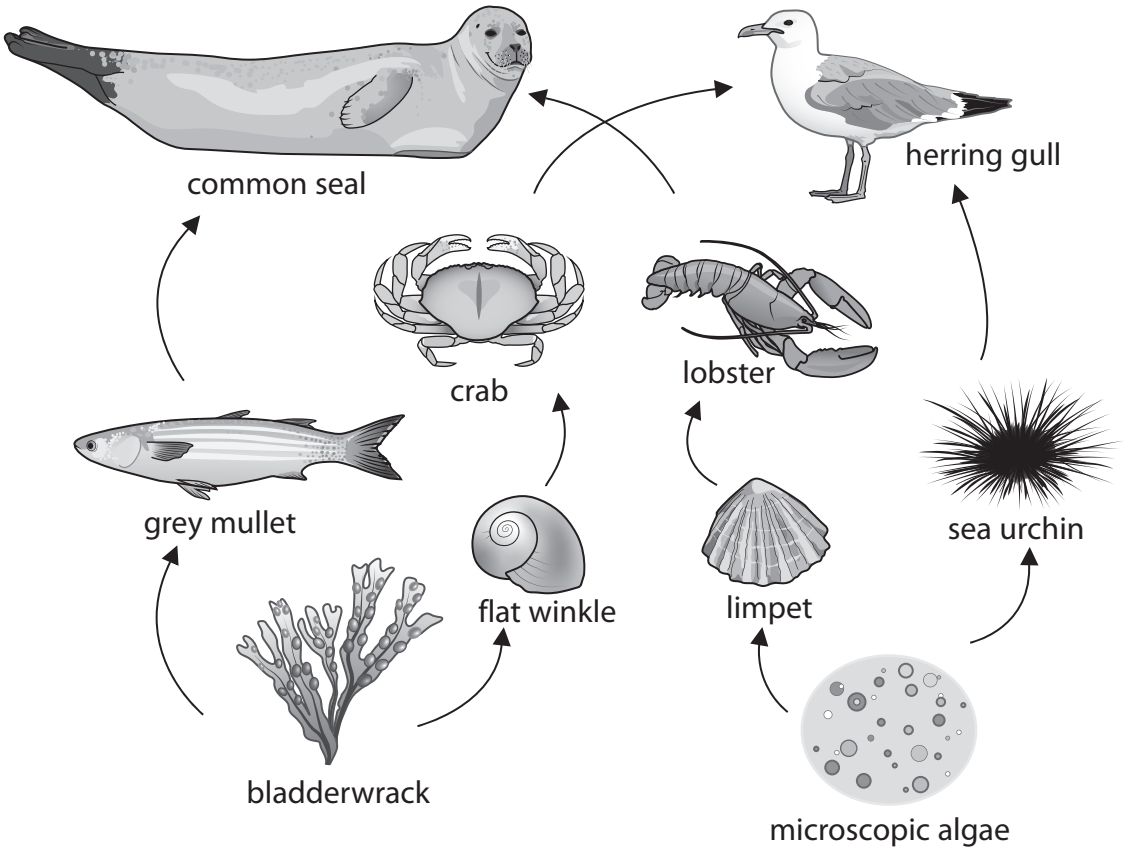
**9** The diagram shows an ocean food web.




(a) (i) Name the producers in this food web.

**(2)**

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(ii) Name two secondary consumers in this food web.

**(2)**

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(iii) Draw a food chain from this food web that contains four organisms and includes the herring gull.

**(2)**

(b) (i) This food chain is found in the food web.

microscopic algae → limpet → lobster → common seal

Sketch and label the pyramid of energy for this food chain.

**(2)**

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(ii) Explain why the amount of energy available to the organisms changes along this food chain.

**(3)**

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**(Total for Question 9 = 11 marks)**

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**10** A student does an experiment to show that a leaf is only able to produce starch if it receives enough light.

(a) The student removes all the starch from the leaf before starting the experiment.

(i) Describe how the student could remove all the starch from the leaf.

**(2)**

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(ii) State why the student removes all the starch from the leaf before starting the experiment.

**(1)**

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(b) Before testing a leaf for starch, chlorophyll needs to be removed.

Give a safety precaution the student needs to take when removing chlorophyll.

**(1)**

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(c) Give a suitable control the student should use in this experiment.

**(1)**

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(d) Describe how the structure of the leaf is adapted for photosynthesis.

**(5)**

**(Total for Question 10 = 10 marks)**

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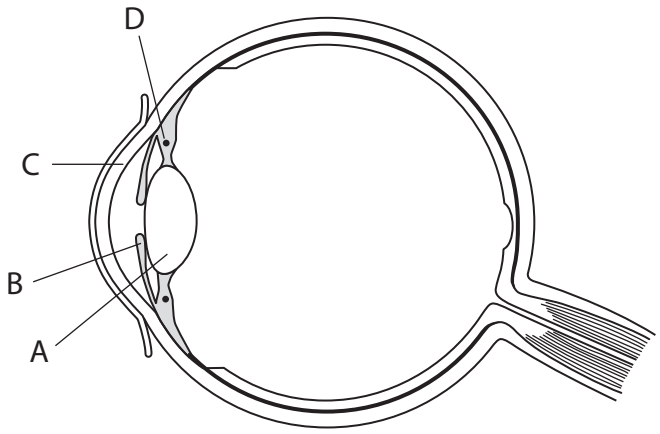
**11** The diagram shows a section through the human eye.




(a) (i) Describe the role of structures A, C and D in focusing light from a near object onto the retina.

**(4)**

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(ii) Bright light can damage the retina.

Explain how a reflex involving structure B protects the retina from this damage.

**(3)**

(b) There are tear glands that release liquid into the eye.

This liquid contains an enzyme called lysozyme that breaks down cell walls.

(i) Suggest why the liquid contains lysozyme.

**(2)**

(ii) Suggest why the liquid is maintained at pH 7

**(2)**

**(Total for Question 11 = 11 marks)**

**TOTAL FOR PAPER = 110 MARKS**

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