

Please write clearly in block capitals.

Centre number

--	--	--	--	--

Candidate number

--	--	--	--

Surname

StemUp Model Solution

Forename(s)

Candidate signature

A-level BIOLOGY

Paper 1

Thursday 6 June 2019

Morning

Time allowed: 2 hours

Materials

For this paper you must have:

- a ruler with millimetre measurements
- a scientific calculator.

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.
- Show all your working.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for the questions are shown in brackets.
- The maximum mark for this paper is 91.

For Examiner's Use

Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
TOTAL	



J U N 1 9 7 4 0 2 1 0 1

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

0 1 . 1

Describe how a **non-competitive** inhibitor can reduce the rate of an enzyme-controlled reaction.

[3 marks]

A non-competitive inhibitor attaches to the enzyme at a site other than the active site (an allosteric site).

This changes the tertiary structure of the enzyme, so the shape of the active site changes.

So the active site and the substrate are no longer complementary, so less substrate can fit / bind and fewer enzyme-substrate complexes form, reducing the rate of reaction.

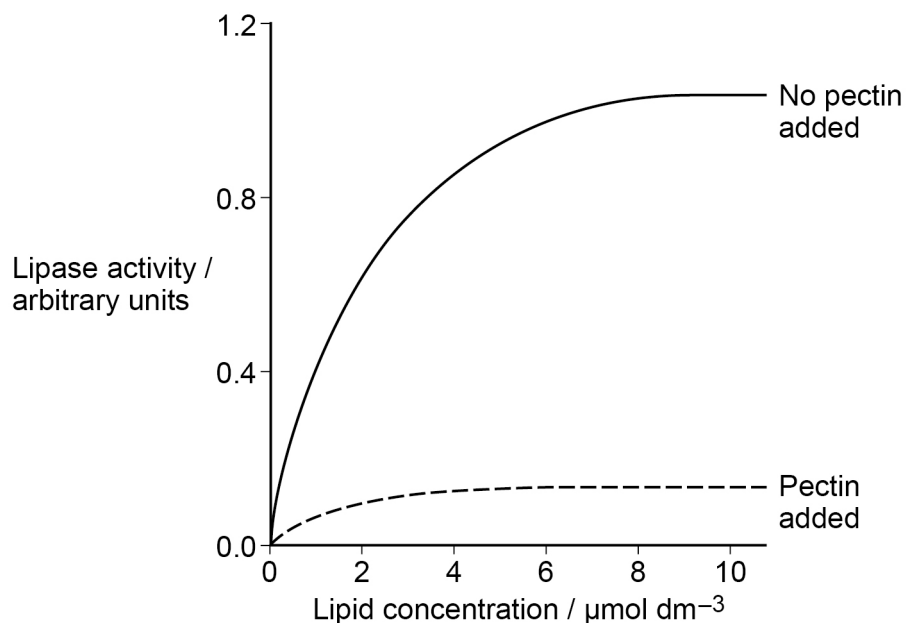


Pectin is a substance found in some fruit and vegetables.

A scientist investigated the effect of pectin on the hydrolysis of lipids by a lipase enzyme.

His results are shown in **Figure 1**.

Figure 1



0 1 2 The scientist concluded that pectin is a non-competitive inhibitor of the lipase enzyme.

Use **Figure 1** to explain why the scientist concluded that pectin is a **non-competitive** inhibitor.

[1 mark]

With pectin added, increasing the lipid (substrate) concentration does not increase the lipase activity, it stays low at about 0.15 units, so a high substrate concentration does not overcome the inhibition.

Question 1 continues on the next page

Turn over ►



The scientist also found that pectin stops the action of bile salts. He prepared two suspensions:

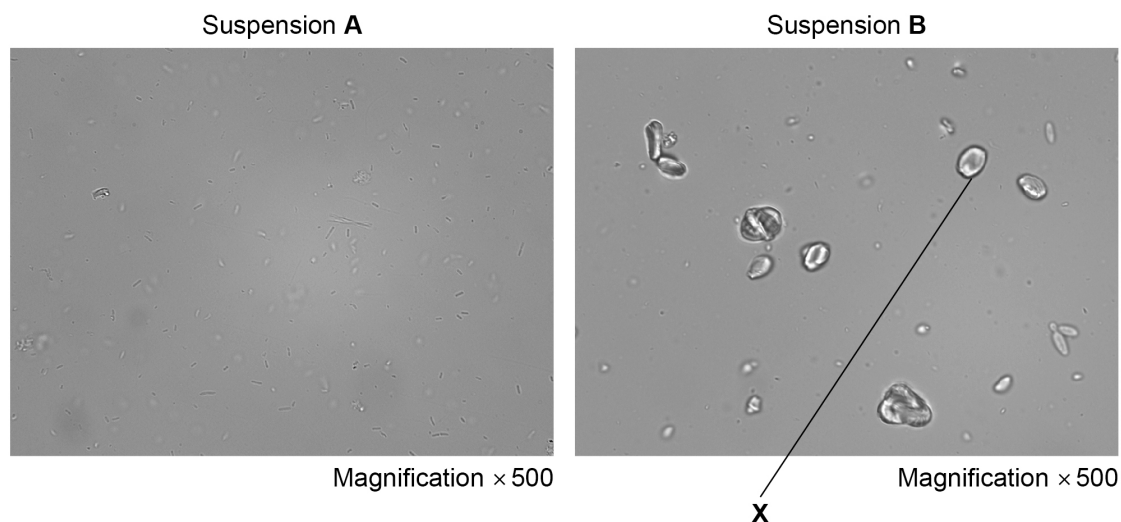
- suspension **A** – lipid and bile salts
- suspension **B** – lipid, bile salts and pectin.

He did **not** add lipase to either suspension.

He observed samples from the suspensions using an optical microscope.

Figure 2 shows what he saw in a typical sample from each suspension.

Figure 2



0 1 . 3 Calculate the maximum length of the large lipid droplet marked **X** in **Figure 2**.

Using a ruler with millimetre intervals always includes an uncertainty in the measurement. Use the uncertainty in your measurement to determine the uncertainty of your calculated maximum length.

You can assume there is no uncertainty in the magnification.

[2 marks]

$$\text{Image length of X measured} = 4.5 \text{ mm } (\pm 1 \text{ mm}) = 4500 \mu\text{m}$$

$$\text{Actual length} = \text{image} \div \text{magnification} = 4500 \div 500 = 9 \mu\text{m}$$

$$\text{Uncertainty} = 1 \text{ mm} \div 500 = 1000 \mu\text{m} \div 500 = \pm 2 \mu\text{m}$$

Maximum length = 9 μm

Uncertainty of your calculated maximum length = ± 2 μm



0	1	4
---	---	---

No large lipid droplets are visible with the optical microscope in the samples from suspension **A**.

Explain why.

[2 marks]

The bile salts emulsify the lipid, breaking the large lipid droplets into many much smaller droplets.

These small droplets are too small to be seen because of the limited resolution of the optical microscope (the wavelength of light is too long to resolve them).

8

Turn over for the next question

Turn over ►



0 2 . 1

Table 1 shows cell wall components in plants, algae, fungi and prokaryotes. Complete **Table 1** by putting a tick (✓) where a cell wall component is present.

[3 marks]**Table 1**

Cell wall component	Plants	Algae	Fungi	Prokaryotes
Cellulose	✓	✓		
Murein				✓
Chitin			✓	

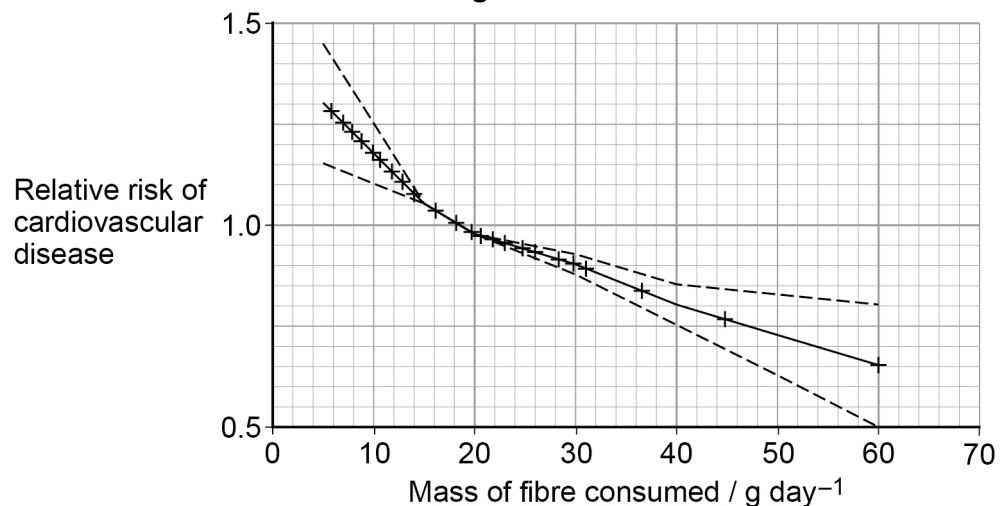
Cell walls make up much of the fibre that people eat.

Scientists investigated the relationship between the mass of fibre people ate each day and their risk of cardiovascular disease (CVD).

They gathered data from a large sample of people and used this to calculate a relative risk.

- A relative risk of 1 means there is no difference in risk between the sample and the whole population.
- A relative risk of < 1 means CVD is less likely to occur in the sample than in the whole population.
- A relative risk of > 1 means CVD is more likely to occur in the sample than in the whole population.

Their results are shown in **Figure 3**. A value of ± 2 standard deviations from the mean includes over 95% of the data.

Figure 3**Key**

— Mean relative risk

--- Line of best fit showing ± 2 standard deviations from the mean

Each '+' plotted point represents 1000 people



0 2 . 2

A student concluded from **Figure 3** that eating an extra 10 g of fibre per day would significantly lower his risk of cardiovascular disease.

Evaluate his conclusion.

[4 marks]

Figure 3 shows a negative correlation between the mass of fibre eaten per day and the relative risk of cardiovascular disease, so eating more fibre is associated with a lower risk.

However, we do not know how much fibre the student eats now, so it depends on his current intake.

Whether the decrease is significant depends on whether the ± 2 standard deviation ranges overlap for the two intakes. If his current intake is between 5 and 30 g day⁻¹, eating 10 g more would give a significant decrease in risk, because the ranges do not overlap (e.g. 10 g to 20 g). If his current intake is between 30 and 50 g day⁻¹, the ranges overlap, so there would be no significant decrease in risk.

Correlation does not mean causation: other factors such as smoking, exercise, age, genes or other parts of the diet may be involved.

There are few data points (little evidence) at high masses of fibre, and the large standard deviation at high and low fibre intakes makes the mean less precise. No statistical test was carried out.

[Extra space]

Question 2 continues on the next page

Turn over ►



0 2 . 3

The scientists estimated the mean mass of fibre eaten per day using a food frequency questionnaire (FFQ).

The FFQ asks each person how often they have eaten many types of food over the past year.

An alternative method to calculate fibre eaten is for a nurse to ask each person detailed questions about what they have eaten in the last 24 hours.

Suggest **one** advantage of using the FFQ method and **one** disadvantage of using the FFQ method compared with the alternative method.

[2 marks]

Advantage *The FFQ covers a longer period (a whole year), so it is more representative, because a person's diet over one 24 hour period may not be typical and varies from day to day.*

Disadvantage *It relies on long-term memory, so it may not be accurate; recall of the last 24 hours is likely to be more accurate. Also, it does not give portion sizes, so the mass of fibre is less accurate.*



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 ►

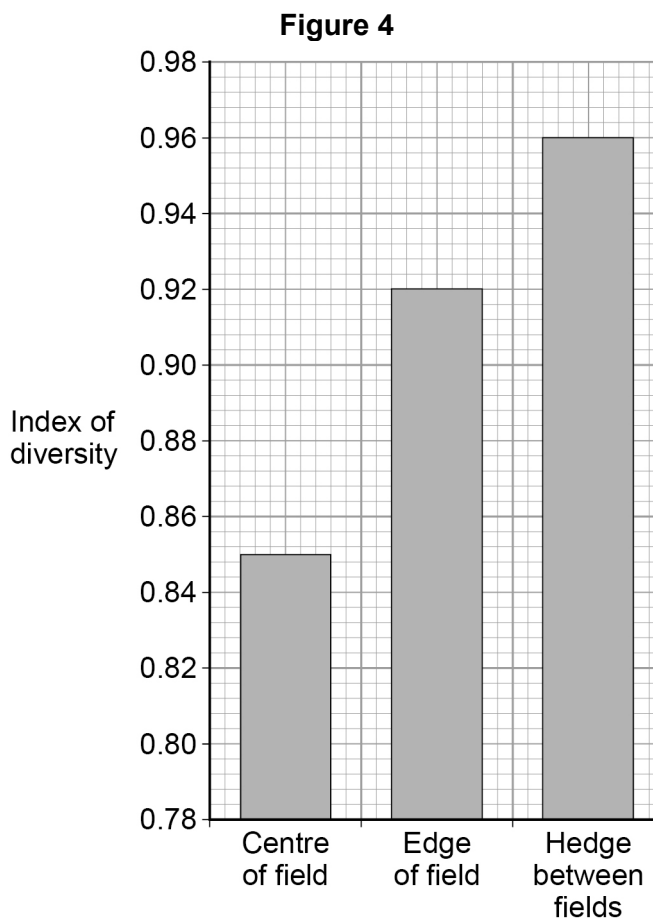


0 3

A group of students investigated biodiversity of different areas of farmland. They collected data in each of these habitats:

- the centre of a field
- the edge of a field
- a hedge between fields.

Their results are shown in **Figure 4**.



0 3 . 1

What data would the students need to collect to calculate their index of diversity in each habitat?

Do **not** include apparatus used for species sampling in your answer.

[1 mark]

The number of different species in each habitat and the number of individuals of each species in each habitat.



0 3 . 2

Give **two** ways the students would have ensured their index of diversity was representative of each habitat.

[2 marks]

1 *Take samples at random positions in each habitat (random sampling).*

2 *Take a large number of samples (e.g. at least 30), or keep sampling until the running mean is stable.*

0 3 . 3

Modern farming techniques have led to larger fields and the removal of hedges between fields.

Use **Figure 4** to suggest why biodiversity decreases when farmers use larger fields.

[1 mark]

Larger fields have relatively more centre and less edge (and less hedge), and the centre of a field has the lowest index of diversity (0.85 compared with 0.92 at the edge and 0.96 in the hedge), so there are fewer species.

Question 3 continues on the next page

Turn over ►



0 3 . 4

Farmers are now being encouraged to replant hedges on their land.

Suggest and explain **one** advantage and **one** disadvantage to a farmer of replanting hedges on her farmland.

[2 marks]

Advantage *Hedges increase biodiversity, so there are more predators of crop pests (and more pollinators), so less pesticide is needed and there is less damage to crops, giving a higher yield and income.*

Disadvantage *The hedges take up land that could be used for growing crops, so there is less land for crops and a lower yield / income. Hedges may also harbour pests, increasing crop damage.*

6



Turn over for the next question

*Do not write
outside the
box*

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

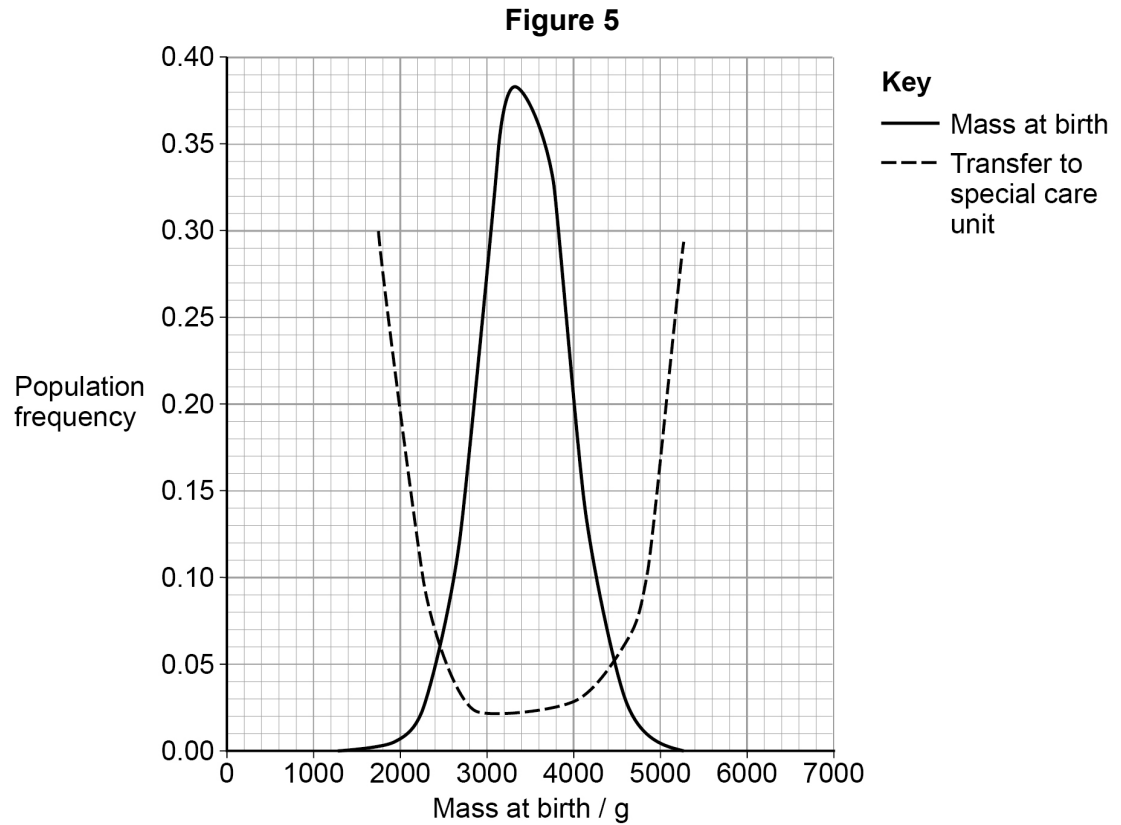
Turn over ►



0 4

Scientists collected data on 800 000 human births. The data showed the mass of each baby at birth and whether the baby needed to be transferred to a special care unit for very ill babies.

Their results are shown in **Figure 5**.



0 4 . 1

Use **Figure 5** to explain how human mass at birth is affected by stabilising selection.**[3 marks]**

Figure 5 shows that the babies most likely to be transferred to a special care unit are those with an extreme mass at birth: those under 2500 g or over 4500 g. Babies with a mass between 2800 g and 4200 g are least likely to be transferred.

So babies with an extreme mass at birth are least likely to survive and reproduce, so they are less likely to pass on their alleles for extreme birth mass to their offspring.

Over generations, the frequency of the alleles for extreme birth mass decreases in the population, so the frequency of extreme masses decreases and the mean (about 3300 g) is maintained, with a narrower range.

[Extra space]**Question 4 continues on the next page****Turn over ►**

0 4 . 2

The scientists studied the effect of one form, *KIR2DS1*, of the human *KIR* gene on mass at birth.

In the following passage the numbered spaces can be filled with biological terms.

KIR2DS1 is an _____ (1) _____ of the *KIR* gene, found at a _____ (2) _____ on chromosome 19. *KIR2DS1* is 14 021 bases long and is _____ (3) _____ into mRNA that is 1101 bases long. This mRNA is then _____ (4) _____ into a polypeptide 304 amino acids long. The polypeptide is then modified in the organelle, _____ (5) _____, before forming its functional _____ (6) _____ protein structure.

Write the correct biological term beside each number below, that matches the space in the passage.

[3 marks]

- (1) allele
- (2) locus
- (3) transcribed
- (4) translated
- (5) Golgi apparatus
- (6) tertiary



0 4 . 3

The scientists studied 1500 more births. They recorded the mass at birth of each baby and the nature of the *KIR* gene in the mother's genome.

Some of their results are shown in **Table 2**.

Table 2

Presence or absence of <i>KIR2DS1</i> in mother's genome	Number of babies with mass at birth:	
	between 2500 g and 4500 g	above 4500 g
Present	389	148
Absent	606	173

The scientists used a statistical test to test the following null hypothesis:

'The presence of *KIR2DS1* in the mother's genome does **not** affect the frequency of births above 4500 g'

Tick (✓) **one** box that gives the name of the statistical test that the scientists should use with the data in **Table 2** to test this null hypothesis.

[1 mark]

Chi-squared

☒

Correlation
coefficient

☐

Student's t-test

☐

Question 4 continues on the next page

Turn over ►



0 4 . 4

The scientists calculated a P value of 0.03 when testing their null hypothesis.

What can you conclude from this result? Explain your answer.

[3 marks]

P = 0.03 is less than 0.05, so the probability that the difference in the frequency of births above 4500 g is due to chance is less than 5% (it is 3%).

So the difference is significant, and we reject the null hypothesis.

So the presence of KIR2DS1 in the mother's genome does significantly affect the frequency of births above 4500 g (high birth mass).

10



0 5 . 1

Describe the structure of the human immunodeficiency virus (HIV).

[4 marks]

HIV has RNA as its genetic material, inside a protein coat called a capsid (made of capsomeres).

The capsid also contains the enzyme reverse transcriptase (and integrase).

Around the capsid is a viral envelope made of phospholipid (membrane taken from the host cell).

Attachment proteins (glycoproteins, gp120) stick out of the envelope, which bind to receptors (CD4) on T helper cells.

Question 5 continues on the next page**Turn over ►**

Some people infected with HIV do not develop AIDS. These people are called HIV controllers.

Scientists measured the number of HIV particles (the viral load) and the number of one type of T helper cell (CD4 cells) in the blood of a group of HIV controllers and also in a group of HIV positive patients who had symptoms of AIDS.

The median values and the range of their results are shown in **Table 3**.

Table 3

HIV status of people	Median viral load / virus particles per cm^3 of blood (range)	Median number of CD4 cells per mm^3 of blood (range)
HIV controllers	212 (<50 to 609)	693 (529 to 887)
HIV positive people with AIDS symptoms	66 274 (30 206 to 306 163)	248 (107 to 365)

0 5 . 2

A test sample of 500 mm^3 of blood is taken from an HIV controller to determine the viral load.

Tick (✓) **one** box that shows the number of virus particles that would be present in a test sample of blood taken from an HIV controller with the median viral load.

[1 mark]

106 000

☐

10 600

☐

1060

☐

106

☒


0 5 3

Use the data in **Table 3** and your knowledge of the immune response to suggest why HIV controllers do not develop symptoms of AIDS.

[3 marks]

HIV controllers have a much lower viral load (median 212 compared with 66 274 particles per cm^3), so there are fewer viruses to infect and destroy T helper (CD4) cells.

So HIV controllers have more T helper cells (median 693 compared with 248 per mm^3).

These T helper cells can continue to activate B cells, cytotoxic T cells and phagocytes.

So B cells divide into plasma cells that produce antibodies, and cytotoxic T cells can kill virus-infected cells.

So the immune system can still destroy other pathogens (and cancer cells), so opportunistic infections do not develop and there are no AIDS symptoms.

[Extra space]

8

Turn over for the next question

Turn over ►



0 6

Scientists investigated the cell cycle in heart cells taken from mice 6 days before their birth and then at 4, 14 and 21 days after their birth.

Their results are shown in **Table 4**. Age 0 days = day of birth.

Table 4

Age / days	Percentage of heart cells undergoing mitosis	Percentage of heart cells undergoing DNA replication
–6	13.9	8.5
4	8.5	2.6
14	1.6	0.2
21	0.6	0.0

0 6 . 1

Describe and explain the data in **Table 4**.

[2 marks]

The percentage of heart cells undergoing mitosis and DNA replication both decrease from 6 days before birth to 21 days after birth (13.9% to 0.6%, and 8.5% to 0.0%).

DNA replication happens before mitosis (in interphase), so DNA replication falls first. The heart grows rapidly before birth, and its growth slows down as it becomes fully developed, because the cells lose the ability to divide.

[Extra space]



The scientists determined the percentage of heart cells undergoing DNA replication by using a chemical called BrdU. Cells use BrdU instead of nucleotides containing thymine during DNA replication.

0 6 . 2

Describe how BrdU would be incorporated into new DNA during semi-conservative replication.

[5 marks]

DNA helicase breaks the hydrogen bonds between the bases of the two

DNA strands, so the double helix unwinds and separates.

Each strand acts as a template. Free nucleotides, including BrdU

nucleotides, are attracted to their complementary bases on the template strands.

BrdU is used instead of thymine, so it is complementary to adenine and forms hydrogen bonds with adenine on the template strand.

DNA polymerase then joins the adjacent nucleotides together,

incorporating BrdU into the new strand, by condensation reactions

forming phosphodiester bonds.

Each new DNA molecule contains one original strand and one new strand containing BrdU (semi-conservative).

Question 6 continues on the next page

Turn over ►



0 6 . 3

Cells with BrdU in their DNA are detected using an anti-BrdU antibody with an enzyme attached.

Use your knowledge of the ELISA test to suggest and explain how the scientists identified the cells that have BrdU in their DNA.

[3 marks]

Add the anti-BrdU antibody with the enzyme attached to the cells / DNA. The antibody is complementary to BrdU, so it binds only to DNA containing BrdU.

Wash the cells / DNA to remove any excess antibody that has not attached.

Then add the substrate for the enzyme. The enzyme converts the substrate into a coloured product, causing a colour change in cells that have BrdU in their DNA, so these cells can be identified (and counted).

[Extra space]

10



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 ►

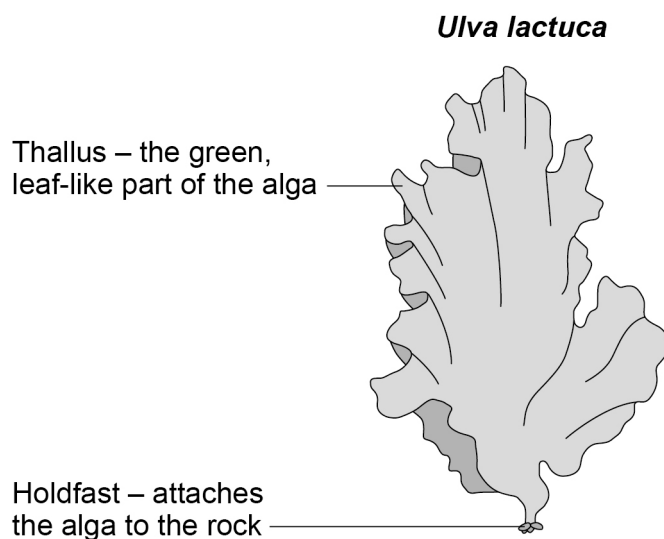


0 7

Ulva lactuca is an alga that lives on rocks on the seashore. It is regularly covered by seawater.

Figure 6 shows a diagram of one *Ulva lactuca* alga.

Figure 6



0 7 1

Unlike plants, *Ulva lactuca* does not have xylem tissue.

Suggest how *Ulva lactuca* is able to survive without xylem tissue.

[1 mark]

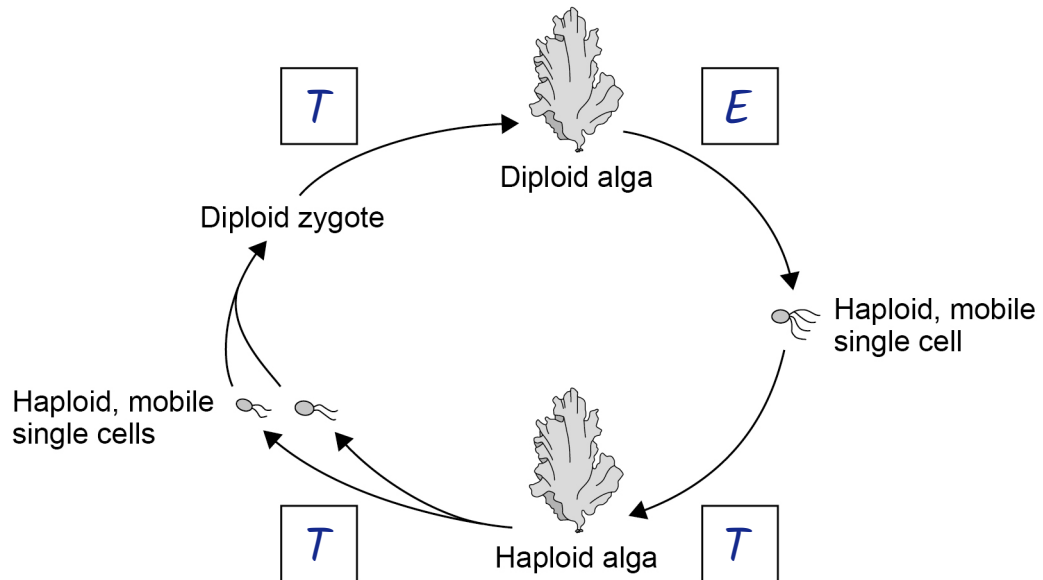
It has a short diffusion pathway, so water and ions can diffuse directly into all its cells across its permeable surface from the surrounding seawater (and it is supported by the water).



Ulva lactuca has a haploid and a diploid form.

Figure 7 shows the life cycle of *Ulva lactuca*.

Figure 7



- 0 7 . 2** On **Figure 7** complete each box with an appropriate letter to show the type of cell division happening between each stage in the life cycle. Use 'T' to represent mitosis and 'E' to represent meiosis.

[2 marks]

- 0 7 . 3** *Ulva prolifera* also produces haploid, mobile single cells that can fuse to form a zygote. Suggest and explain **one** reason why successful reproduction between *Ulva prolifera* and *Ulva lactuca* does **not** happen.

[2 marks]

Ulva prolifera and *Ulva lactuca* are different species.

So if their cells fused, the zygote would not develop into a fertile alga, because the chromosomes could not form homologous pairs, so meiosis could not occur. They may also be reproductively isolated, for example releasing their mobile cells at different times.



0 8

The water potential of leaf cells is affected by the water content of the soil.

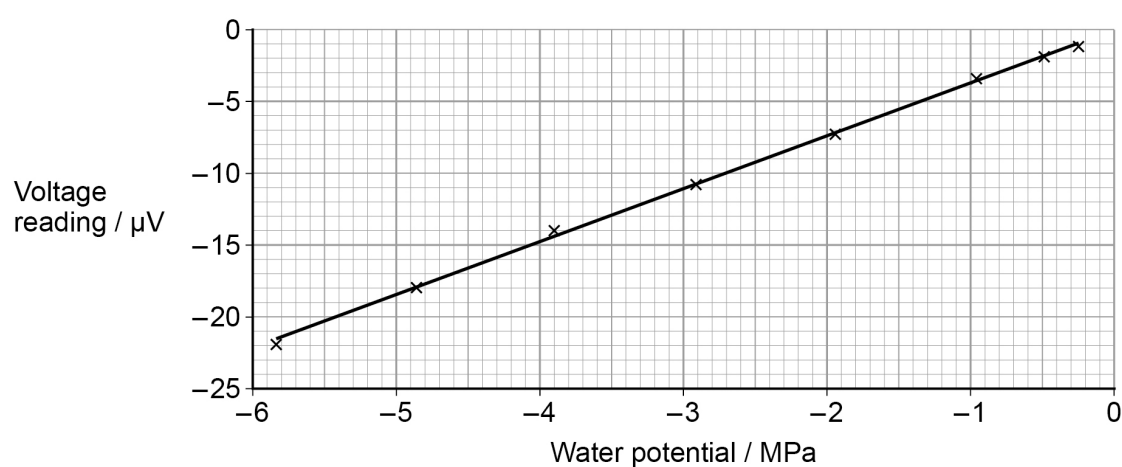
Scientists grew sunflower plants. They supplied different plants with different volumes of water.

After two days, they determined the water potential in the leaf cells by using an instrument that gave a voltage reading.

The scientists generated a calibration curve to convert the voltage readings to water potential.

Figure 8 shows their calibration curve.

Figure 8



0 8 . 1

The scientists needed solutions of known water potential to generate their calibration curve.

Table 5 shows how to make a sodium chloride solution with a water potential of -1.95 MPa

Complete **Table 5** by giving all headings, units and volumes required to make 20 cm^3 of this sodium chloride solution.

[2 marks]

Table 5

Water potential / MPa	Concentration of sodium chloride solution / mol dm^{-3}	Volume of 1 mol dm^{-3} sodium chloride solution / cm^3	<i>Volume of distilled water</i> / cm^3
-1.95	0.04	<i>0.8</i>	<i>19.2</i>

Table 6 shows some of the concentrations of sodium chloride solution the scientists used and the water potential of each solution.

Table 6

Concentration of sodium chloride solution / mol dm^{-3}	Water potential / MPa
0.04	-1.95
0.10	-4.87
0.12	-5.84

0 8 . 2

There is a linear relationship between the water potential and the concentration of sodium chloride solution.

Use the data in **Table 6** to calculate the concentration of sodium chloride solution with a water potential of -3.41 MPa

[2 marks]

$$\text{Gradient} = (4.87 - 1.95) \div (0.10 - 0.04) = 2.92 \div 0.06 = 48.67$$

$$\text{Concentration} = 3.41 \div 48.67 = 0.070\text{ mol dm}^{-3}$$

Answer = 0.07 mol dm^{-3}

Turn over ►

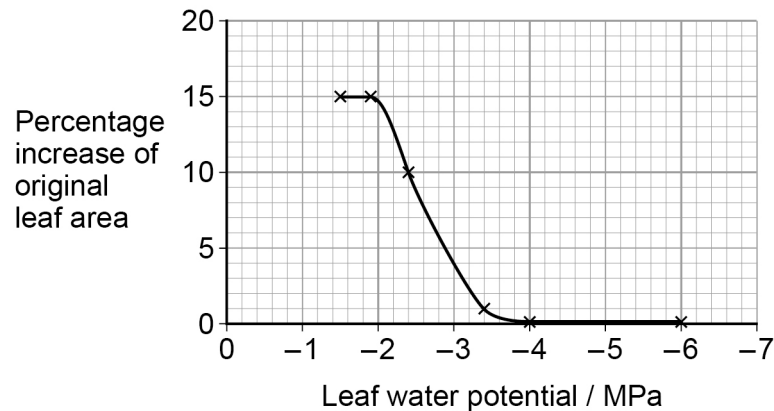


In addition to determining the water potential in the leaf cells, the scientists measured the growth of the leaves.

They recorded leaf growth as a percentage increase of the original leaf area.

Their results are shown in **Figure 9**.

Figure 9



0 8 . 3

One leaf with an original area of 60 cm^2 gave a voltage reading of $-7 \mu\text{V}$

Use **Figure 8** (on page 28) and **Figure 9** to calculate by how much this leaf increased in area.

Give your answer in cm^2

[2 marks]

$-7 \mu\text{V}$ on Figure 8 = water potential of -1.9 MPa

-1.9 MPa on Figure 9 = 15% increase in leaf area

Increase = $15 \div 100 \times 60 = 9 \text{ cm}^2$

Answer = 9 cm^2



0 8 . 4

Sunflowers are not xerophytic plants. The scientists repeated the experiment with xerophytic plants.

Suggest and explain **one** way the leaf growth of xerophytic plants would be different from the leaf growth of sunflowers in **Figure 9**.

[2 marks]

Xerophytic plants would have lower / slower leaf growth than sunflowers at high water potentials, because they have fewer stomata (a smaller area of stomata, sunken stomata), so less carbon dioxide is taken up for photosynthesis.

0 8 . 5

Use your knowledge of gas exchange in leaves to explain why plants grown in soil with very little water grow only slowly.

[2 marks]

With very little water in the soil, the stomata close to reduce water loss. So less carbon dioxide is taken up by the leaves, so there is less photosynthesis and less glucose is produced for growth (respiration and making new cells).

10

Turn over for the next question

Turn over ►



0 9

A scientist investigated the affinity for oxygen of horse haemoglobin and mouse haemoglobin.

Some of their results are shown in **Table 7**.

Table 7

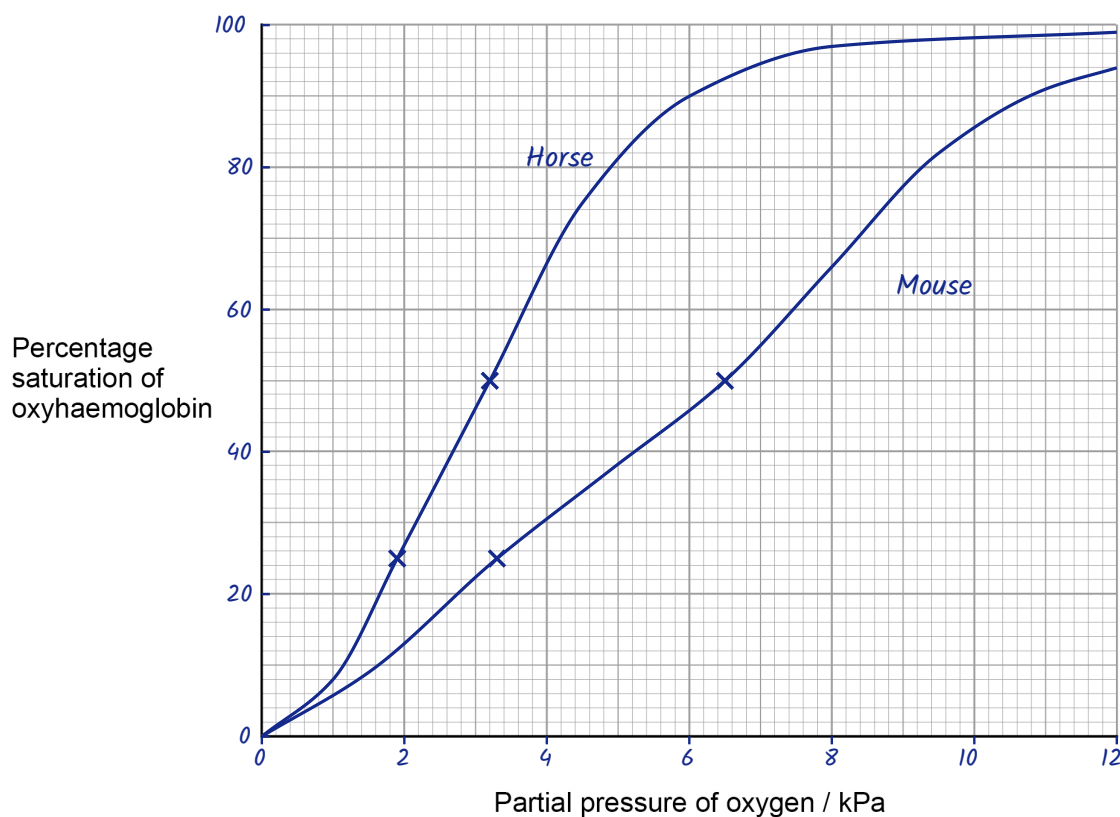
Animal	Partial pressure of oxygen when haemoglobin is 50% saturated / kPa	Partial pressure of oxygen when haemoglobin is 25% saturated / kPa	Body mass of one animal / g
Horse	3.2	1.9	550 000
Mouse	6.5	3.3	23

0 9

. 1

Plot the haemoglobin saturation data from **Table 7** and use these points to sketch the full oxyhaemoglobin dissociation curves for a horse and a mouse.

[3 marks]



0 9 . 2

The following equation can be used to estimate the metabolic rate of an animal.

$$\text{Metabolic rate} = 63 \times \text{BM}^{-0.27}$$

BM = body mass in grams

Use this equation to calculate how many times faster the metabolic rate of a mouse is than the metabolic rate of a horse.

[2 marks]

$$\text{Mouse: } 63 \times 23^{-0.27} = 63 \times 0.4289 = 27.02$$

$$\text{Horse: } 63 \times 550\,000^{-0.27} = 63 \times 0.02819 = 1.776$$

$$27.02 \div 1.776 = 15.2 \text{ times faster}$$

Answer = 15.2 times faster

0 9 . 3

The data in **Table 7** show differences between the oxyhaemoglobin dissociation curve for a mouse and the oxyhaemoglobin dissociation curve for a horse.

Suggest how these differences allow the mouse to have a higher metabolic rate than the horse.

[2 marks]

The mouse curve is to the right of the horse curve: mouse haemoglobin has a lower affinity for oxygen (it needs 6.5 kPa to be 50% saturated compared with 3.2 kPa for the horse), so at the same partial pressure it is less saturated.

So mouse haemoglobin dissociates / unloads more oxygen more readily to its tissues, providing more oxygen for aerobic respiration, so a higher metabolic rate is possible.

[Extra space]

Question 9 continues on the next page

Turn over ►



0 9 . 4

Mammals such as a mouse and a horse are able to maintain a constant body temperature.

Use your knowledge of surface area to volume ratio to explain the higher metabolic rate of a mouse compared to a horse.

[3 marks]

A mouse is much smaller than a horse, so it has a larger surface area to volume ratio.

So it loses heat faster in relation to its body size (more heat is lost per gram of body mass).

To maintain a constant body temperature, the mouse needs a faster rate of respiration (metabolism), which releases heat to replace the heat that is lost.

[Extra space]



1 0 1

Explain **five** properties that make water important for organisms.**[5 marks]**

Water is a metabolite in many reactions, e.g. it is used in hydrolysis, released in condensation, and used in photosynthesis and produced in respiration.

Water is a solvent (it is polar), so metabolic reactions can occur in it and substances can be transported dissolved in it, e.g. in blood plasma and xylem.

Water has a high specific heat capacity, so it buffers changes in temperature, keeping temperatures in organisms and aquatic habitats stable for enzymes.

Water has a large latent heat of vaporisation, so evaporation of a small amount of water (e.g. sweating) provides a large cooling effect.

There is strong cohesion between water molecules due to hydrogen bonding, so water can be pulled up the xylem as a continuous column (transpiration stream), and it produces surface tension, supporting small organisms such as pond skaters.

Ice is less dense than water so it floats, insulating the water beneath so aquatic organisms survive.

[Extra space]

Question 10 continues on the next page

Turn over ►



1 0 . 2

Describe the biochemical tests you would use to confirm the presence of lipid, non-reducing sugar and amylase in a sample.

[5 marks]

Lipid: add ethanol to the sample and shake, then pour into water and mix. A white / milky emulsion shows that lipid is present.

Non-reducing sugar: first do Benedict's test (heat with Benedict's reagent); it stays blue, showing no reducing sugar. Then boil a fresh sample with dilute hydrochloric acid to hydrolyse the sugar, and neutralise with sodium hydrogencarbonate (alkali). Then heat with Benedict's reagent in a boiling water bath; it turns orange / red (precipitate), showing that a non-reducing sugar is present.

Amylase: add biuret reagent; a purple / lilac colour shows that protein is present. To show it is amylase, add the sample to starch and leave it for a time, then test for reducing sugar with Benedict's (orange / red), or with iodine to show starch is absent (stays orange-brown instead of blue-black).

[Extra space]



1 0 3

Describe the chemical reactions involved in the conversion of polymers to monomers and monomers to polymers.

Give **two** named examples of polymers and their associated monomers to illustrate your answer.

[5 marks]

Monomers are joined to form polymers by condensation reactions. A condensation reaction joins two monomers together, forming a chemical bond between them and releasing a molecule of water.

Polymers are broken down into monomers by hydrolysis reactions. A hydrolysis reaction breaks the chemical bond between monomers and uses a molecule of water.

For example, many amino acids are joined by condensation to form a polypeptide (protein), with peptide bonds forming between the amino acids. Hydrolysis of the peptide bonds, e.g. by protease enzymes, releases the amino acids.

Another example is alpha glucose, which joins by condensation to form starch or glycogen, with glycosidic bonds forming between the glucose molecules; beta glucose forms cellulose. Similarly, nucleotides join by phosphodiester bonds to form polynucleotides such as DNA and RNA.

[Extra space]

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**



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**

