OXFORD

INTERNATIONAL
AQA EXAMINATIONS

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

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Candidate signature _____
I declare this is my own work.

INTERNATIONAL AS
BIOLOGY (9610)

Unit 1 The Diversity of Living Organisms

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.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- All working must be shown.
- 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.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
TOTAL	

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

0 1 Starch and cellulose are polymers.

0 1 . 1 Define the word **polymer**.

[1 mark]

_____

0 1 . 2 Give **one** similarity and **one** difference between the structures of starch and cellulose.

[2 marks]

Similarity _____

_____

_____

Difference _____

_____

_____

0 1 . 3 Reducing sugars and starch are both carbohydrates.

Complete **Table 1** to show the biochemical tests for reducing sugars and starch.

[2 marks]

Table 1

Carbohydrate	**Reagent**	**Positive test result**
Reducing sugars		
Starch		

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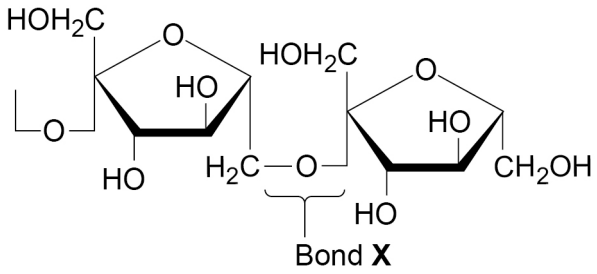
Inulin is a polysaccharide formed from fructose.

Figure 1 shows two of the monomers forming part of an inulin molecule.

Figure 1



0 1 . 4 During the hydrolysis of inulin, bond **X** is broken.

Complete **Figure 2** to show the result of the hydrolysis.

[2 marks]

Figure 2

0 1 . 5 Inulin is a storage polysaccharide found in plants.

Suggest **one** property of inulin that makes the molecule suitable for this function.

[1 mark]

_____

8

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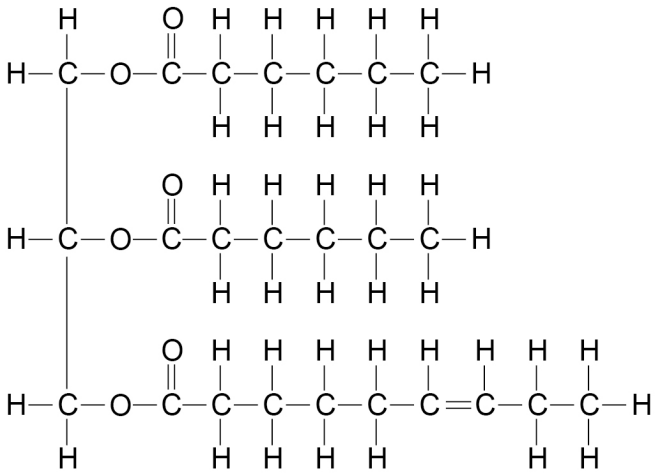
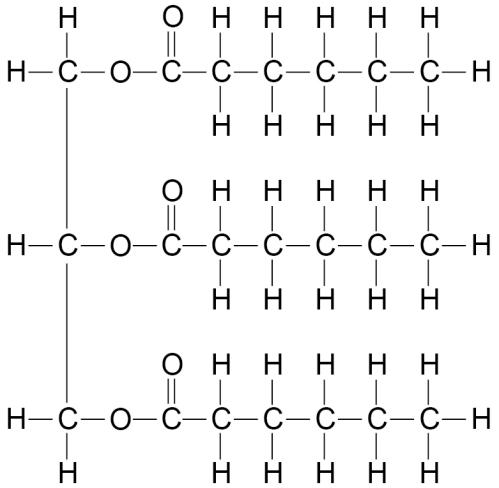
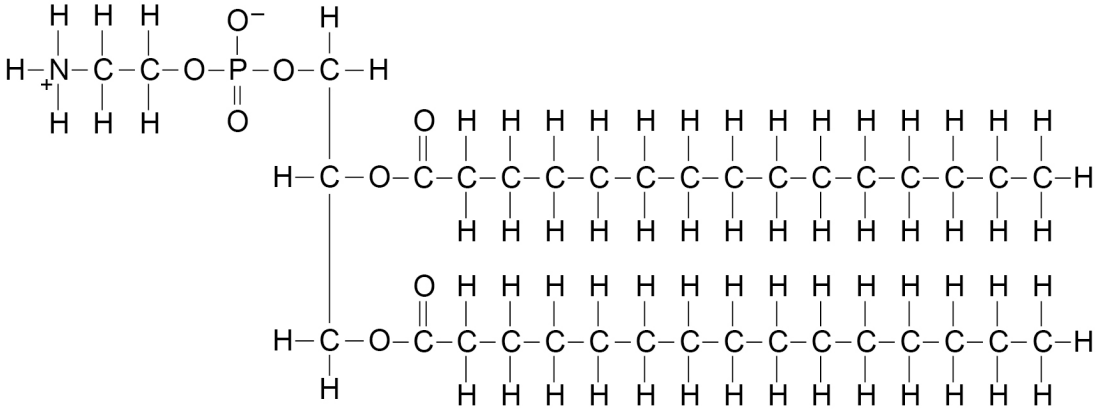
0 2 **Figure 3** shows three types of lipids, **A**, **B** and **C**.

Figure 3

Lipid **A**	
Lipid **B**	
Lipid **C**	

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0 2 . 1 Give the letter of the lipid that is an unsaturated triglyceride.

Explain your choice.

[2 marks]

Letter ☐

Unsaturated because _____

_____

_____

Triglyceride because _____

_____

_____

0 2 . 2 The hormone oestrogen enters a cell by diffusing through the phospholipid bilayer of the plasma membrane.

Suggest **two** properties of oestrogen that allow it to diffuse through the phospholipid bilayer.

[2 marks]

1 _____

2 _____

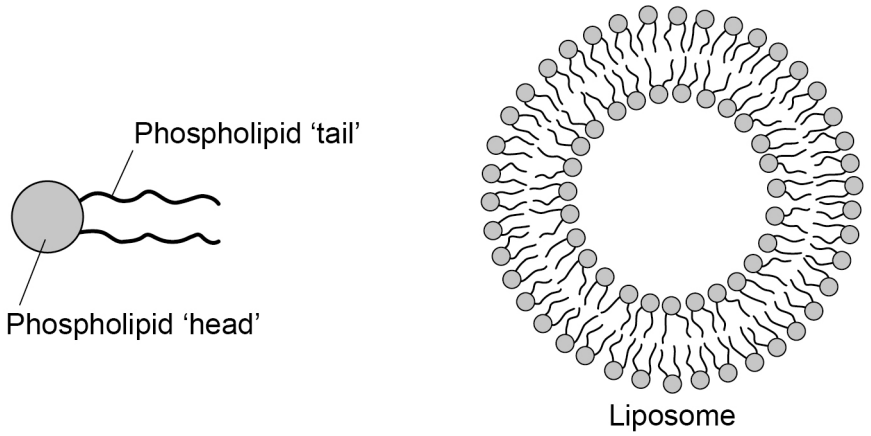
Question 2 continues on the next page

Do not write outside the box

Liposomes can be formed from phospholipids.

Figure 4 shows a liposome.

Figure 4



0 2 . 3 Explain why phospholipid molecules can form liposomes.

[2 marks]

_____

_____

_____

_____

_____

_____

6

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0 3 **Table 2** shows the surface area and volume for five species of insect.

Table 2

Insect species	Surface area / mm^2	Volume / mm^3	Surface area to volume ratio
Empis pennipes	14.7	2.3	6.4
Orellia falcata	69.3	16.0	4.3
Lucilia sericata	82.5	27.5	
Anthidium byssinum	191.5	100.8	
Habrosyne derasa	318.9	260.4	1.2

0 3 . 1 Calculate the surface area to volume ratio for *L. sericata* and *A. byssinum*.

Write your answers in **Table 2**.

Give your answers to a suitable number of significant figures.

[2 marks]

0 3 . 2 Describe the relationship between the size of an insect and the surface area to volume ratio of the insect.

[1 mark]

_____

_____

_____

0 3 . 3 Many insects live on land. Insects living on land have features that reduce water loss.

Explain how **two** of the features reduce water loss.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

Turn over ►

Do not write outside the box

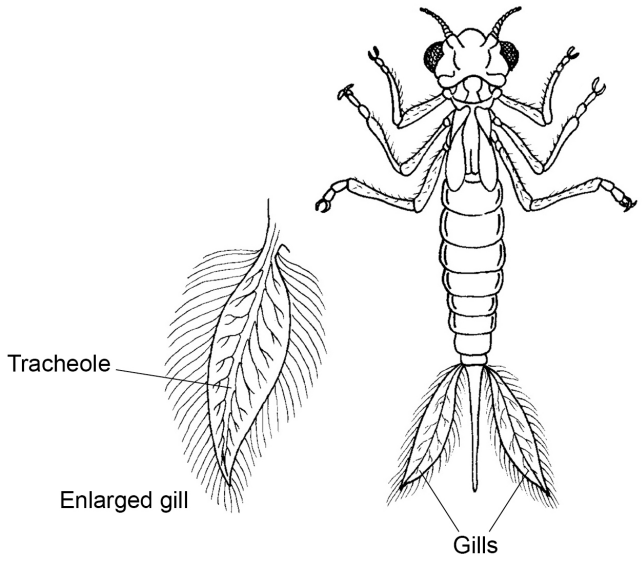
The life cycle of some insects includes stages where they are nymphs.

Nymphs live in water.

Some nymphs have gills.

Figure 5 shows the gills of a damselfly nymph.

Figure 5



0 3 . 4 Explain how **one** feature of the gill helps to increase the rate of gas exchange.

[2 marks]

0 3 . 5 The damselfly nymph is a predator.

Suggest how an efficient gas exchange system helps the damselfly nymph to survive.

[2 marks]

9

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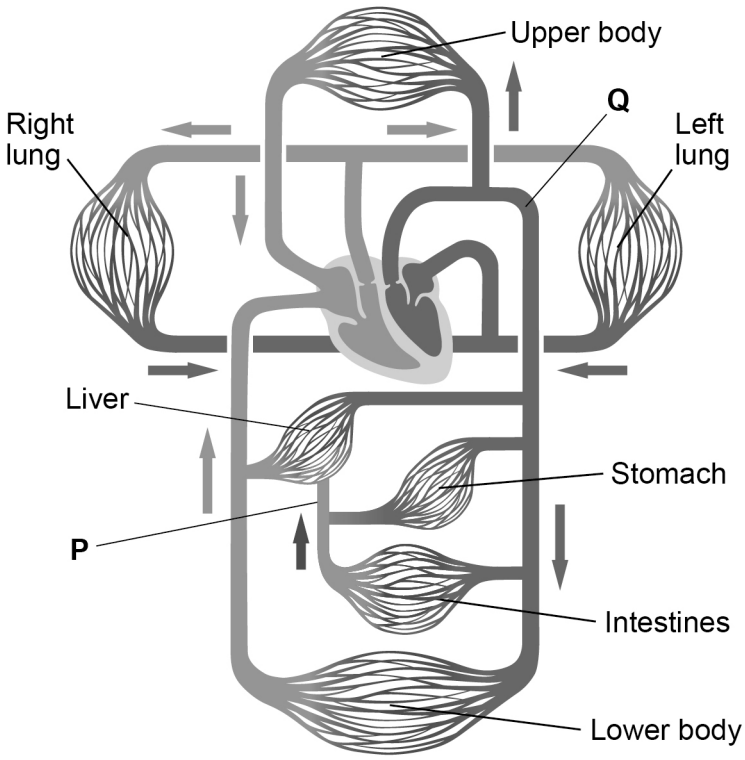
0 4 **Figure 6** is a simplified diagram of the human circulatory system.

Figure 6



0 4 . 1 Identify blood vessels **P** and **Q** shown on **Figure 6**.

[2 marks]

P _____

Q _____

0 4 . 2 In the lungs, oxygen from the air diffuses into the blood down a concentration gradient.

Describe the path a molecule of oxygen takes from the air in an alveolus to the blood.

[2 marks]

_____

_____

_____

_____

Question 4 continues on the next page

Do not write outside the box

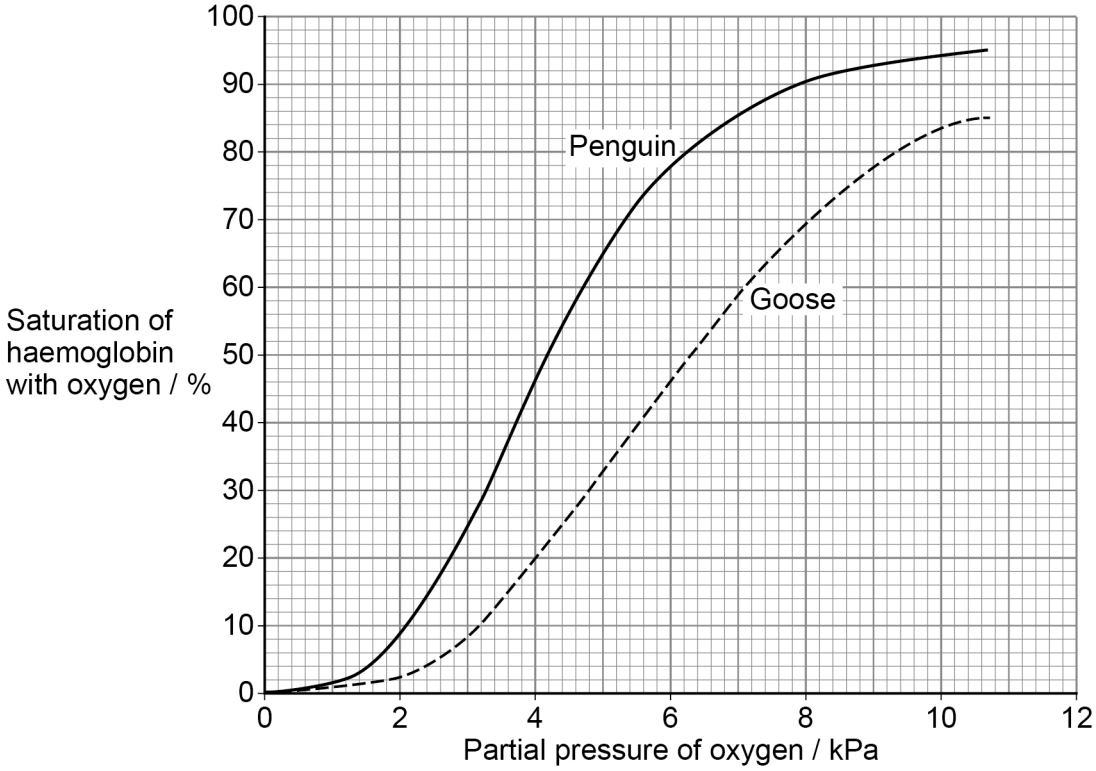
In the blood, oxygen binds to haemoglobin.

Organisms have different types of haemoglobin depending on their environment and way of life.

Figure 7 shows the percentage saturation of haemoglobin with oxygen at different partial pressures of oxygen for two types of bird:

- penguin
- goose.

Figure 7



0 4 . 3 The P_{50} is the partial pressure of oxygen when haemoglobin is 50% saturated.

Use **Figure 7** to find the difference in the P_{50} between the penguin and the goose.

[2 marks]

_____ kPa

Do not write outside the box

A penguin and a goose feed in different ways.

A penguin dives underwater to catch fish. Each dive can last for more than 23 minutes.

A goose feeds on plants and insects on land.

0 4 . 4 **Figure 7** shows the oxygen dissociation curves for a penguin and a goose.

Explain the advantage to the penguin of having an oxygen dissociation curve to the left of the curve for the goose.

[3 marks]

0 4 . 5 During a penguin's dive, the oxygen dissociation curve gradually shifts to the right.

Explain what causes this shift.

[2 marks]

11

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0 5 A student separates the photosynthetic pigments in leaves using chromatography.

The student:

- draws a pencil line approximately 1 cm from the bottom of a piece of chromatography paper
- makes a chromatography solvent using a mixture of organic solvents
- crushes leaves with a small volume of the solvent until a dark green liquid is produced
- adds a drop of the dark green liquid to the pencil line on the chromatography paper
- waits until the drop of liquid is dry, then adds another drop
- continues adding drops of liquid until there is a dark spot of green on the chromatography paper
- pours chromatography solvent into a boiling tube
- puts the chromatography paper in the tube so that the pigment spot is above the surface of the solvent
- puts a bung in the top of the boiling tube
- waits for 10 minutes
- removes the chromatography paper and immediately marks the position of the solvent front using a pencil.

0 5 . 1 Suggest **two** safety precautions the student should take when using solvents.

[2 marks]

1 _____

_____

2 _____

_____

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Question 5 continues on the next page

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0 5 . 2 **Table 3** describes some of the steps of the student's investigation.

Complete **Table 3** to give the importance of each of the steps.

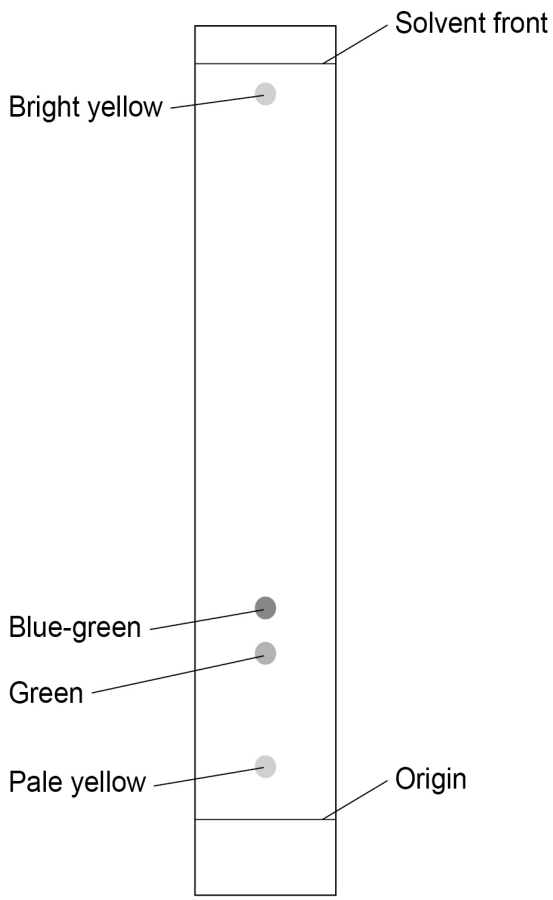
[3 marks]

Table 3

Description of the step	**Importance of the step**
Crushes leaves with a small volume of the solvent.	
Puts the chromatography paper in the tube so that the pigment spot is above the surface of the solvent.	
Immediately marks the position of the solvent front using a pencil.	

Figure 8 shows the student's completed chromatogram.

Figure 8



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0 5 . 3 For each pigment spot in **Figure 8**:

- measure the distance moved in millimetres
- calculate the R_f value using:

$$R_f = \frac{\text{distance pigment moved from origin}}{\text{distance solvent moved from origin}}$$

Complete the headings for **Table 4** and record all of your data in the table.

[4 marks]

Table 4

Colour of pigment spot		
Bright yellow		
Blue-green		
Green		
Pale yellow		

Table 5 shows the R_f value range for some photosynthetic pigments.

Table 5

Pigment	**R_f value range**
Carotene	0.89–0.98
Phaeophytin a	0.42–0.49
Phaeophytin b	0.33–0.40
Chlorophyll a	0.24–0.30
Chlorophyll b	0.20–0.26
Xanthophylls	0.04–0.19

0 5 . 4 Identify the bright yellow pigment in **Figure 8**.

Use your calculated value of the pigment's R_f value and information from **Table 5**.

[1 mark]

_____

Turn over ►

Do not write outside the box

0 5 . 5 Another student obtains an R_f value of 0.25 for one of the pigments.

What problem would the student have with identifying the pigment?

[1 mark]

0 5 . 6 Suggest a possible solution to the problem with identifying the pigment.

[1 mark]

0 5 . 7 The student measures the distance from the origin to the solvent front using a ruler with millimetre divisions.

Give the uncertainty of the student's measurement.

[1 mark]

13

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0 6 **Table 6** lists three enzymes and their possible functions.

0 6 . 1 Identify the functions of the enzymes.

Each enzyme may have more than one function.

Put a tick (✓) in **Table 6** for each correct function.

[3 marks]

Table 6

Name of enzyme	Functions of enzymes		
	Joins DNA nucleotides	**Forms a polynucleotide chain**	**Breaks hydrogen bonds**
DNA helicase			
DNA polymerase			
RNA polymerase			

One human gene is 5.4×10^4 base pairs in length.

The gene contains 10 exons.

The mean length of each exon is 288 base pairs.

0 6 . 2 Calculate the percentage of the gene that codes for amino acid sequences.

Give your answer to 2 significant figures.

[2 marks]

Answer = _____ %

Question 6 continues on the next page

Do not write outside the box

0 6 . 3 Calculate the number of amino acids that the gene codes for.

[1 mark]

Answer = _____

0 6 . 4 Transcription of a human gene produces pre-mRNA.

The pre-mRNA is processed to produce mRNA.

Explain why a molecule of mRNA has a lower number of bases than a molecule of pre-mRNA.

[2 marks]

_____

_____

_____

_____

_____

_____

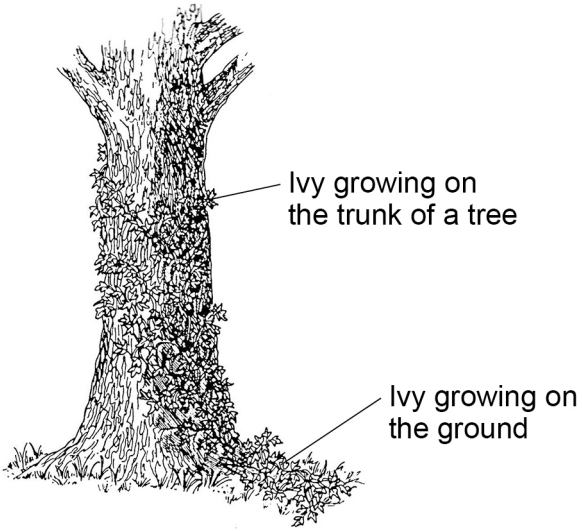
8

Do not write outside the box

0 7 A student investigates intraspecific variation in an ivy plant.

Figure 9 shows that the ivy plant grows on the ground and on the trunk of a tree.

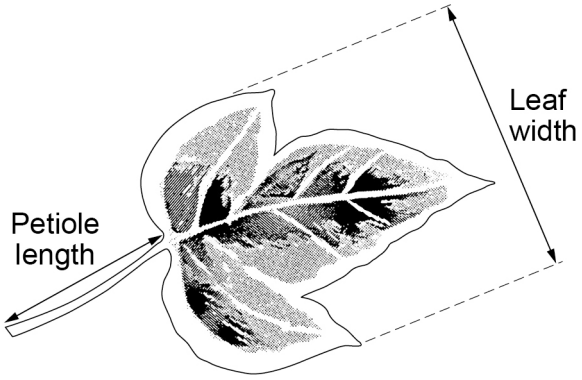
Figure 9



The student:
- randomly samples 50 ivy leaves growing on the ground and 50 ivy leaves growing on the trunk of the tree
- measures the petiole length and width of each ivy leaf.

Figure 10 shows the measurements that the student takes of each ivy leaf.

Figure 10



0 7 . 1 Give **one** reason why the student uses random sampling to choose which leaves to measure.

[1 mark]

_____

_____

_____

Turn over ►

Do not write outside the box

0 7 . 2 The student measures 100 leaves in total.

Give **one** reason why the student uses a large sample size.

[1 mark]

_____

_____

_____

Table 7 shows the student's results.

Table 7

	Mean petiole length ± SD / mm	**Mean leaf width ± SD / mm**	**Mean ratio of petiole length to leaf width ± SD**
Ivy leaves growing on the trunk of the tree	63 ± 23.9	56 ± 17.3	1.14 ± 0.35
Ivy leaves growing on the ground	42 ± 11.8	38 ± 7.4	1.07 ± 0.21

SD = standard deviation

0 7 . 3 Give **two** reasons why the student cannot conclude that the leaves growing on the trunk of the tree are larger than the leaves growing on the ground.

Use information from **Table 7**.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

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0 7 . 4 The standard deviations are larger for leaves growing on the trunk of the tree than the leaves growing on the ground.

State what this tells us about the data used to calculate each mean.

[1 mark]

0 7 . 5 The mean ratios of petiole length to leaf width in **Table 7** are greater than 1.00

What does this suggest about the relationship between petiole length and leaf width?

[1 mark]

0 7 . 6 The student measured leaves from different parts of the same ivy plant.

Suggest the cause of variation in leaf size.

[1 mark]

7

Turn over for the next question

Do not write outside the box

0 8 Read the following passage.

In 1894, the chemist Emil Fischer proposed the ‘lock and key’ model of enzyme action. This model suggests that the ‘key’ (substrate) has a specific shape that allows it to fit into the ‘lock’ (active site).

Binding of a substrate to the enzyme forms an enzyme–substrate complex and a reaction can occur. Only the correct substrate is complementary to an enzyme’s active site.

Models of enzyme action have changed over time. In 1958, Daniel Koshland suggested that the binding of a substrate to an enzyme changes the structure of the enzyme so an enzyme–substrate complex can form.

Methanol poisoning is a rare but serious condition that can cause blindness and death.

Although the condition is referred to as ‘methanol poisoning’, methanol itself is not poisonous. Methanol is converted to methanal in the liver by alcohol dehydrogenase (ADH). The methanal is then converted to methanoic acid by aldehyde dehydrogenase (ALDH). Methanoic acid is toxic.

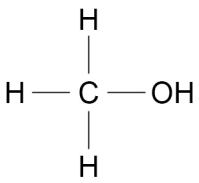
Methanol poisoning can be treated with ethanol.

Use information from the passage and your own knowledge to answer the questions.

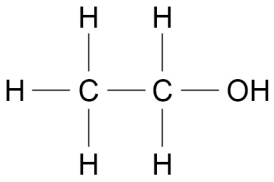
Figure 11 shows the structures of methanol and ethanol.

Figure 11

Methanol



Ethanol



0 8 . 1 Name Koshland’s model of enzyme action (lines 7–9).

[1 mark]

_____

Do not write outside the box

0 8 . 2 Explain how the binding of a substrate to an enzyme can result in the formation of an enzyme–substrate complex (lines 7–9).

[2 marks]

0 8 . 3 Explain why ethanol can be used to treat methanol poisoning (line 16).

Use information from **Figure 11**.

[3 marks]

6

Turn over for the next question

Do not write outside the box

0 9 **Table 8** shows the classification of four animals belonging to the order Primates.

Table 8

	Primate			
Taxon	Chimpanzee	Gibbon	Gorilla	Orangutan
Y	Hominidae	Hylobatidae	Hominidae	Hominidae
Genus	*Pan*	*Hylobates*	*Gorilla*	*Pongo*
Species	*troglodytes*	*muelleri*	*gorilla*	*pygmaeus*

0 9 . 1 Give the binomial name of the gibbon.

Use information from **Table 8**.

[1 mark]

_____

0 9 . 2 Three of the primates belong to the taxonomic group Hominidae.

This taxon is shown as **Y** in **Table 8**.

Name taxon **Y**.

[1 mark]

_____

0 9 . 3 **Table 8** only shows the three smallest taxonomic groups.

Name the largest taxonomic group.

[1 mark]

_____

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Scientists investigate the phylogenetic relationships between the four primates.

The scientists analyse the sequence of amino acids in haemoglobin molecules from each of the primates.

The amino acids at seven locations in the molecule are compared.

Table 9 shows the scientists' results. The letters represent different amino acids.

Table 9

	Amino acid found at location						
Primate	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Chimpanzee	N	T	R	P	A	E	H
Gibbon	D	K	R	Q	T	D	H
Gorilla	N	T	K	P	A	D	L
Orangutan	N	K	R	Q	T	D	L

0 9 . 4 Explain which **two** species are the most closely related primates.

Only use evidence from **Table 9**.

[2 marks]

_____

_____

_____

_____

_____

_____

Question 9 continues on the next page

Do not write outside the box

The scientists also used an immunological technique to investigate the taxonomic relationships between the primates.

The technique uses antibodies against proteins found in human blood.

The scientists:

- collect blood serum from a human
- inject the human serum into a rabbit so the rabbit produces antibodies against human blood proteins
- collect serum from the rabbit
- add serum from the rabbit to serum from each of the four primates
- measure the percentage of precipitation.

0 9 . 5 Suggest **one** factor the scientists should control so they can compare the percentage of precipitation from each of the four primates.

[1 mark]

_____

_____

Table 10 shows the scientists' results.

Table 10

		Percentage precipitation with antibodies against human blood proteins
Primate	**Chimpanzee**	95
	Gibbon	82
	Gorilla	95
	Orangutan	85

0 9 . 6 Which **two** primates are the most closely related?

Give a reason for your choice.

Only use evidence from **Table 10**.

[1 mark]

_____

_____

7

END OF QUESTIONS

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