



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination
Sample 2

Biology

Ordinary Level

2 hours 30 minutes

300 marks

Examination Number

----------------------	----------------------	----------------------	----------------------	----------------------	----------------------

Date of Birth

		/			/		
----------------------	----------------------	---	----------------------	----------------------	---	----------------------	----------------------

For example, 3rd February
2005 is entered as 03 02 05

Centre Stamp

Instructions

There are **seven** questions on this examination paper. Each question carries 50 marks.

Answer **Question 1** and any **five other** questions.

Write your Examination Number and your Day, Month and Year of Birth in the boxes on the front cover.

Write your answers in blue or black pen. You may use pencil for sketches, graphs and diagrams only.

This examination booklet will be scanned and your work will be presented to an examiner on screen. All of your work should be presented in the answer areas, or on the given graphs, or diagrams. Anything that you write outside of the answer areas may not be seen by the examiner.

You are not required to use all the space provided. There is space for extra work at the back of the booklet. If you need to use it, label any extra work clearly with the question number and part.

You may lose marks if your solutions do not include relevant supporting work.

You may lose marks if the appropriate units of measurement are not included, where relevant.

Question 1 is compulsory

Question 1

50 marks

- (a) DNA is often found at the scene of a crime.
A forensic scientist gathers information including biological samples from victims and any suspects to provide DNA for analysis.
- (i) The images below show samples that may be collected at the crime scene.
Identify the **two** samples that could be used to provide DNA by placing a tick (✓) in the correct boxes.

Hair follicle		
Footprint		
Blood		



- (ii) These DNA profiles were produced from one of the samples above.

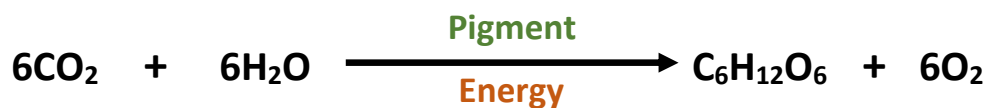
Analyse the DNA profiles and identify which **suspect** left their DNA at the crime scene.

Justify your answer.

	Crime scene
	Victim
	Suspect A
	Suspect B

Identify:
Justify:

- (b) The process of photosynthesis in plants is represented below by the balanced chemical equation.



- (i) State the source of the energy necessary for photosynthesis to occur.

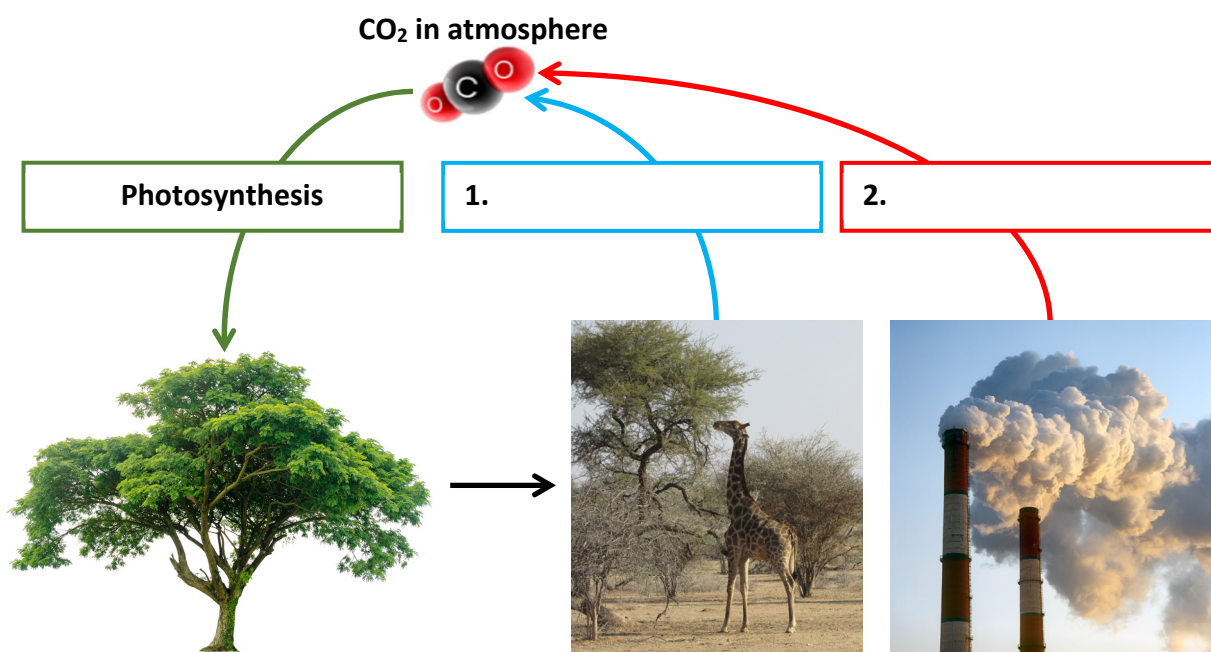
- (ii) What is the name of the pigment needed for photosynthesis?

- (iii) Choose whether the reaction above is catabolic **or** anabolic.
Put a tick (✓) in the correct box.

Catabolic	
-----------	--

Anabolic	
----------	--

- (iv) Photosynthesis plays a role in the carbon cycle.
The diagram shows part of the carbon cycle.
By writing in the boxes below, complete the diagram naming the **two** processes **1 and 2** which release CO₂ into the atmosphere.



- (c) Read the article and answer the questions that follow.

The natterjack toad (*Epidalea calamita*) is Ireland's only native toad and is unique to coastal ponds and sand dunes in Co. Kerry.

In order to protect this endangered species 9500 toadlets have been released into ponds created by local farmers in Co. Kerry, as part of a joint project between the National Parks and Wildlife Service (NPWS), Dingle Oceanworld and Fota Wildlife Park.



Adapted from *Hundreds of natterjack toads to be released into Kerry dunes*, Irish Examiner 22nd July 2024

- (i) Using the article above, identify the genus **and** species of the natterjack toad by placing a tick (✓) in the correct boxes.

	Genus	Species
<i>Epidalea</i>	☐	☐
<i>calamita</i>	☐	☐

- (ii) To which kingdom of life does the natterjack toad belong?

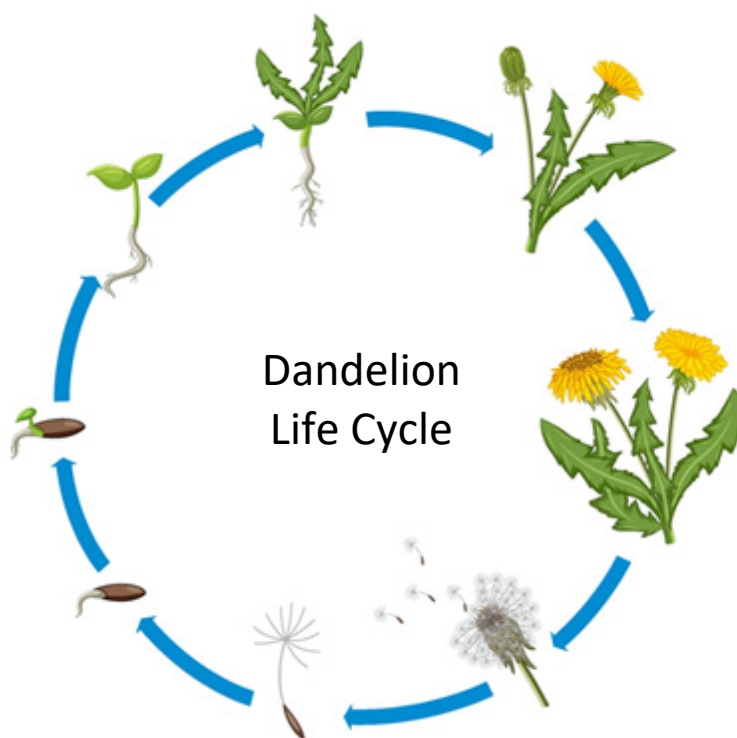
- (iii) Identify a suitable habitat of the natterjack toad.

- (iv) Different scientific groups often work together on a project.
Name **one** group that has been involved in this project.

- (v) Suggest **one** reason why so many (more than 9500) toadlets have been released in recent years.

- (d) The diagram opposite shows the life cycle of the dandelion, a type of flowering plant. Complete the sentences below in relation to the flowering plant using words from the following list.

Pollen
Testa
Flower
Germination
Pollination



- (i) The sexual reproductive structure in plants is the

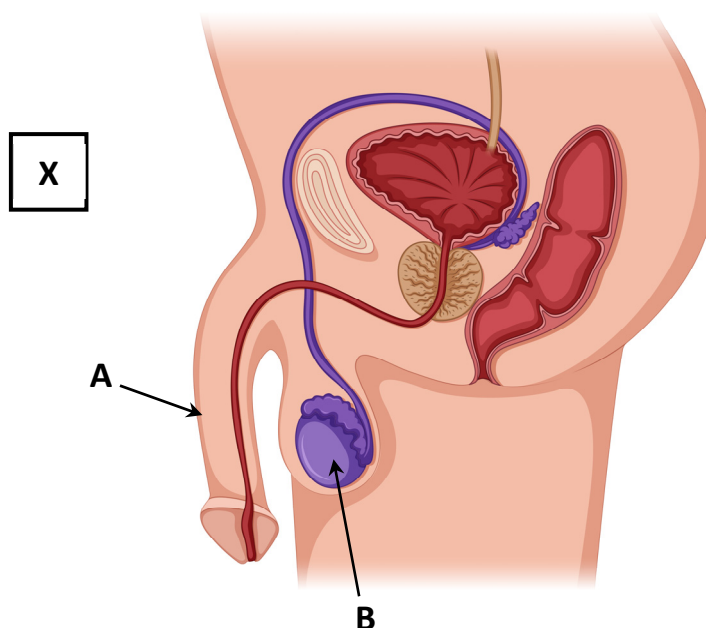
- (ii) The anther produces

- (iii) The transfer of pollen grains from an anther to a stigma is called

- (iv) The seed has a protective outer layer called the

- (v) The seeds are dispersed and then grow into a new plant in a process called

- (e) Sexual reproduction in humans involves fertilisation (fusing) of a male gamete (sperm) and a female gamete (egg) to produce a fertilised egg called a zygote. The diagram below represents the male reproductive system.



- (i) On the diagram above, draw an arrow from label **X** to the tube that carries **both** urine and semen.

- (ii) Name the parts labelled **A** and **B** of the male reproductive system.

A:

B:

- (iii) What hormone is produced by the part labelled **B**?

--

- (iv) Contraception is a method where fertilisation is prevented or the fertilised egg is not allowed to develop.

The condom is one method of contraception.

Name **one other** method of contraception.



--

- (v) Outline **one** health benefit of using a condom when engaging in sexual activity.

**Answer any five questions from the following questions 2 to 7.
Each question carries 50 marks.**

Question 2

50 marks

- (a)** Cells are the building blocks of all organisms.

A student wanted to examine the structures and organelles of plant cells using a light microscope, such as the one shown in the image.

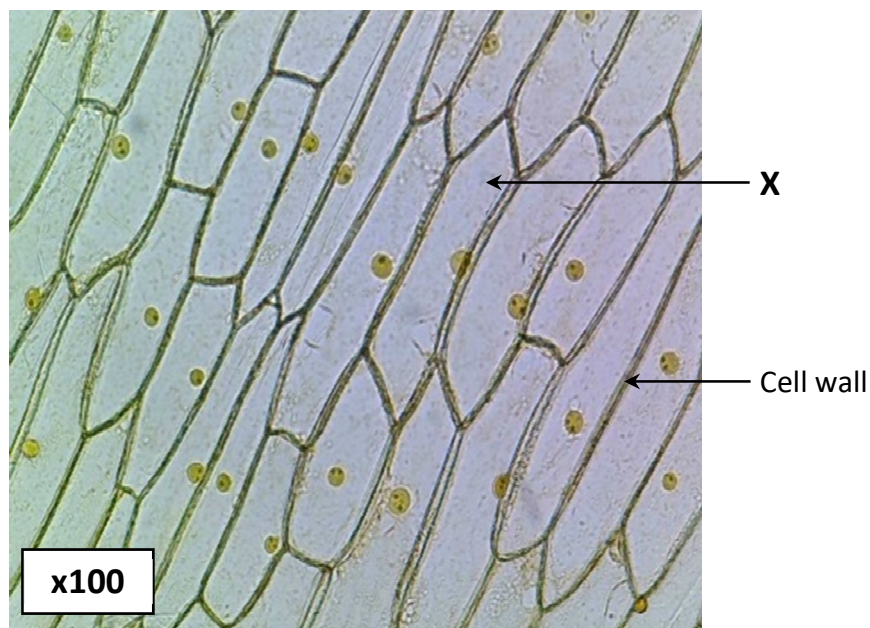
Describe how the student prepared **and** mounted these plant cells.
You may use a labelled diagram.



Labelled diagram:

--

- (b) A student took the photograph below of the plant cells at a magnification of **x100**. Analyse the photograph and answer the questions that follow.



- (i) Name the part of the cell labelled **X** in the photograph above.

--

- (ii) Living organisms can be classified as unicellular **or** multicellular. Identify if the cells shown in the photograph above belong to a unicellular **or** a multicellular organism by placing a tick (✓) in the correct box.

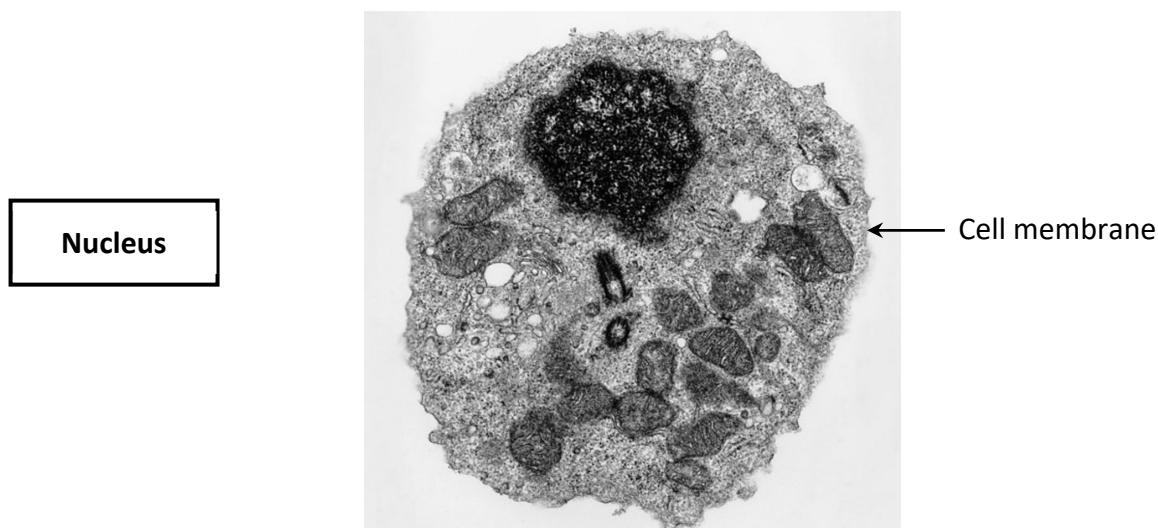
Unicellular organism	
Multicellular organism	

- (iii) State the function of the cell wall.

- (iv) How should the student refer to these results in the report?
Place a tick (✓) in the correct box.

Primary data	
Secondary data	

- (c) The image below is a micrograph of an animal cell.



- (i) The nucleus controls the activities of the cell.

Identify the nucleus on the above image, by **drawing an arrow** from the word **Nucleus** to its correct location on the image.

- (ii) Identify if the cell in the image above is a prokaryotic cell **or** a eukaryotic cell by placing a tick (✓) in the correct box. Justify your answer.

Prokaryotic	
Eukaryotic	

Justify:

- (iii) Name a type of microscope other than a light microscope.

--

- (iv) Suggest **one** reason why a biologist may need to use the microscope you named at part (iii) above when examining cells.

(d) Images **A** and **B** below are micrographs of two different cell organelles.



Image A



Image B

(i) Identify which image (**A** or **B**) is the mitochondrion.

--

(ii) Both organelles are involved in metabolism.
Explain the term *metabolism*.

(iii) Photosynthesis and respiration are two processes that occur in cells.
Complete the table below to match the organelles with their cellular processes by placing a tick (✓) in the correct boxes.

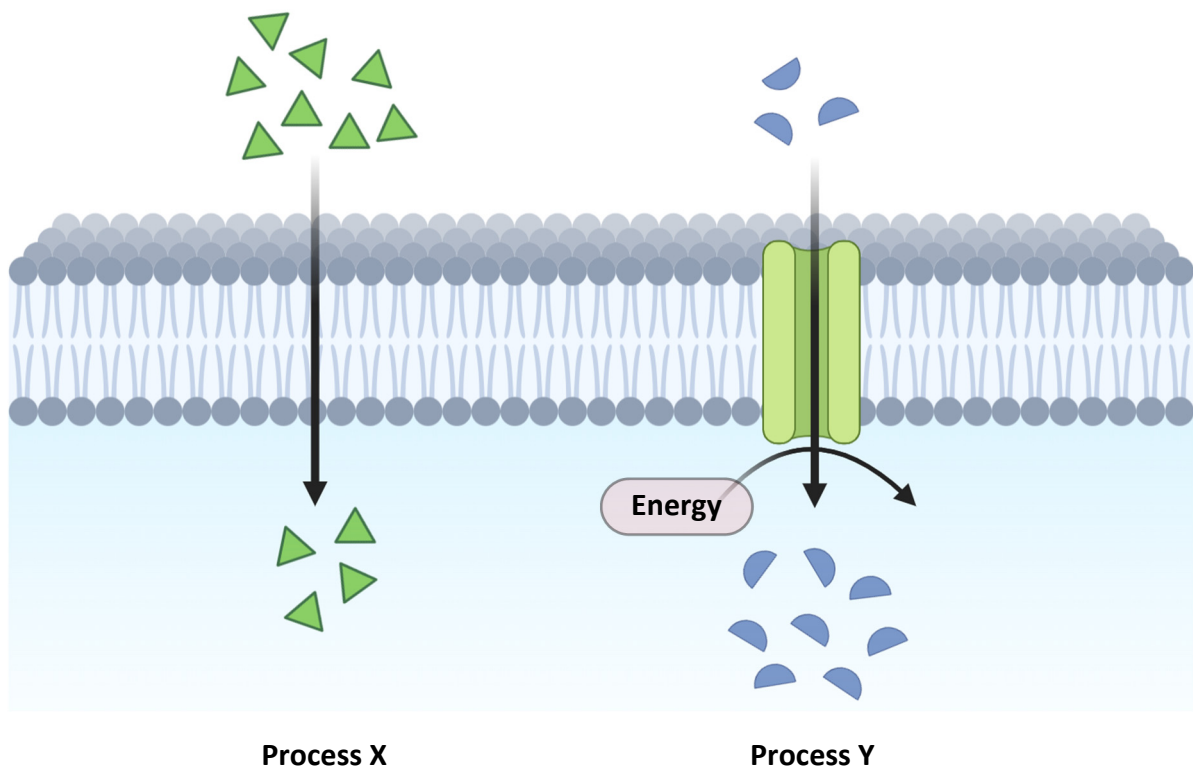
Cellular process	Image A	Image B
Photosynthesis		
Respiration		

(iv) What is the role of respiration in organisms?

Question 3

50 marks

- (a) All living cells have a semi-permeable membrane.
Molecules can move across membranes by passive transport (diffusion) and active transport.



- (i) The diagram above illustrates part of a cell membrane showing both active and passive transport of materials across it.
Identify which process (**X or Y**) is active transport.

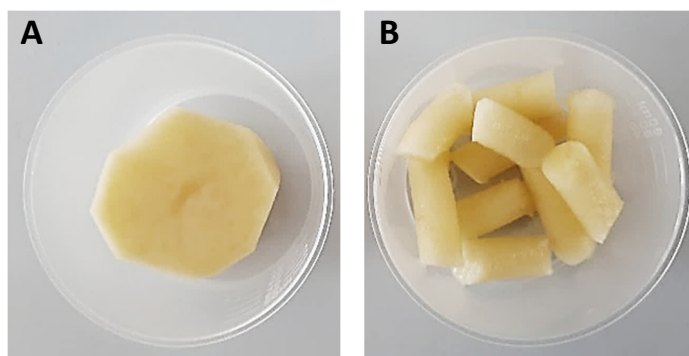
--

- (ii) Justify your answer to part (i) above.

- (iii) During breathing, oxygen passes into the blood in the lungs by diffusion.
Name **one other** gas that moves by diffusion during breathing.

--

- (b) The images and table below show how a student prepared an activity to investigate the effect of surface area on the rate of osmosis.



Preparation of potato

	A	B
Treatment of potato	Whole piece	Diced pieces
Mass	25 g	25 g
Volume of salt solution	250 cm ³	250 cm ³
Concentration of salt solution	20 %	20 %
Temperature	15 °C	15 °C

- (i) Analyse the information above and pose a hypothesis for this investigation.

- (ii) State **one** way in which the student ensured the investigation was fair.

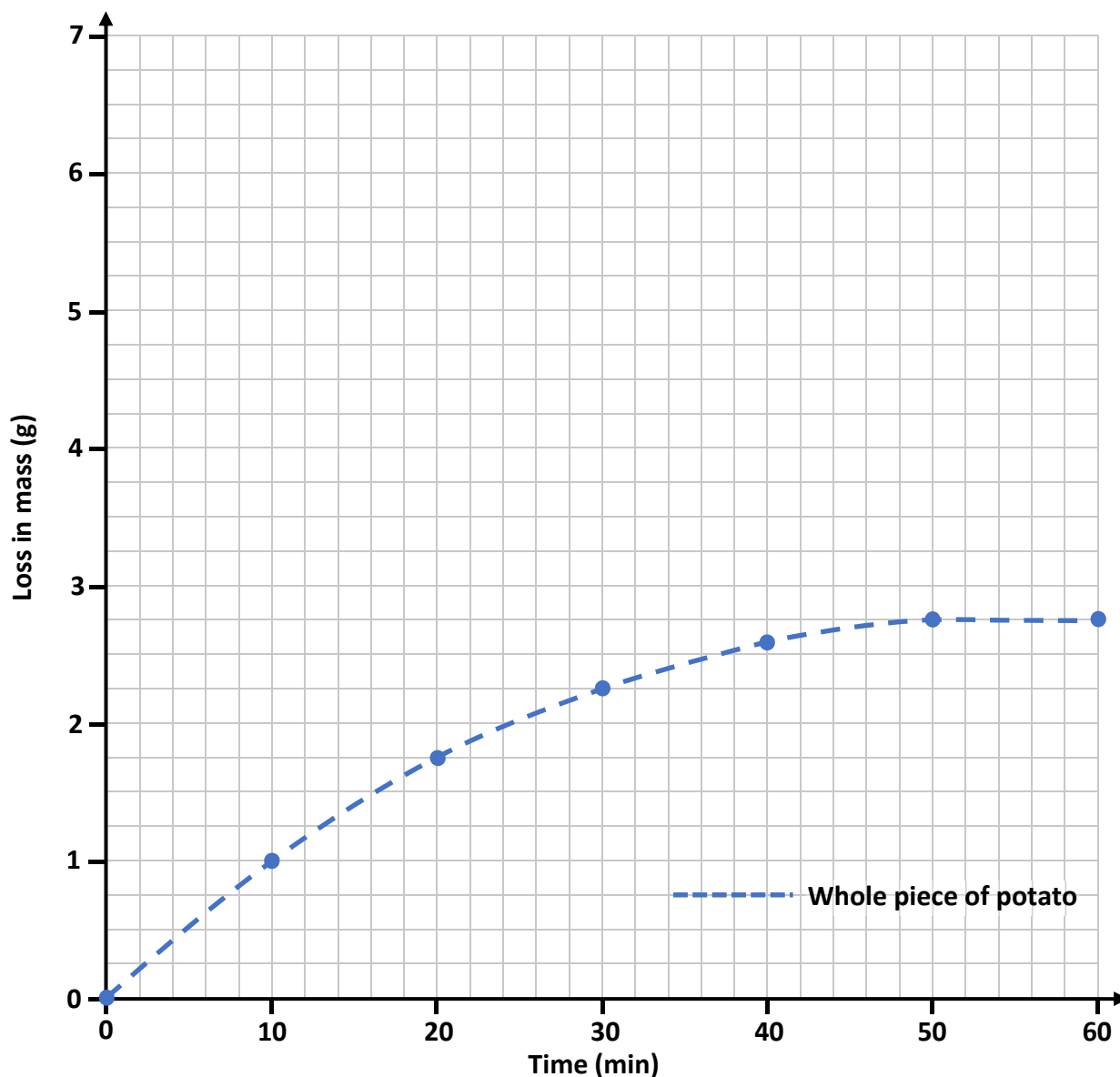
- (iii) Identify the dependent **and** independent variables in this investigation.

Dependent variable:
Independent variable:

- (iv) The student measured the rate of osmosis by measuring the loss in mass of the potatoes every 10 minutes for 60 minutes.
The results of the investigation were presented in the table below. The student plotted the results for the whole piece of potato, as shown in the graph below.

Time (min)		0	10	20	30	40	50	60
Loss in mass (g)	Diced pieces of potato	0	2.0	4.0	5.0	5.5	6.0	6.0
	Whole piece of potato	0	1.0	1.75	2.25	2.6	3.0	3.0

1. Using the graph plotted below (blue dashed line), how long did it take for the whole piece of potato to lose 2 g of water?



On the graph on the previous page,

2. Plot a line graph of the results for the diced pieces of potato.
3. Sketch **another** line graph to predict the result if 25 g of potatoes were diced even smaller than those originally used.

(v) Analyse the data and state a conclusion for the student's investigation.

(c) The photograph shows a potato plant.

(i) On the photograph, draw an arrow from label R to identify the potato roots.



R

(ii) One function of roots in plants is to absorb water and minerals from the soil.
State **one other** function of roots.

(iii) The roots have root hairs. How do root hairs improve the rate of water absorption?

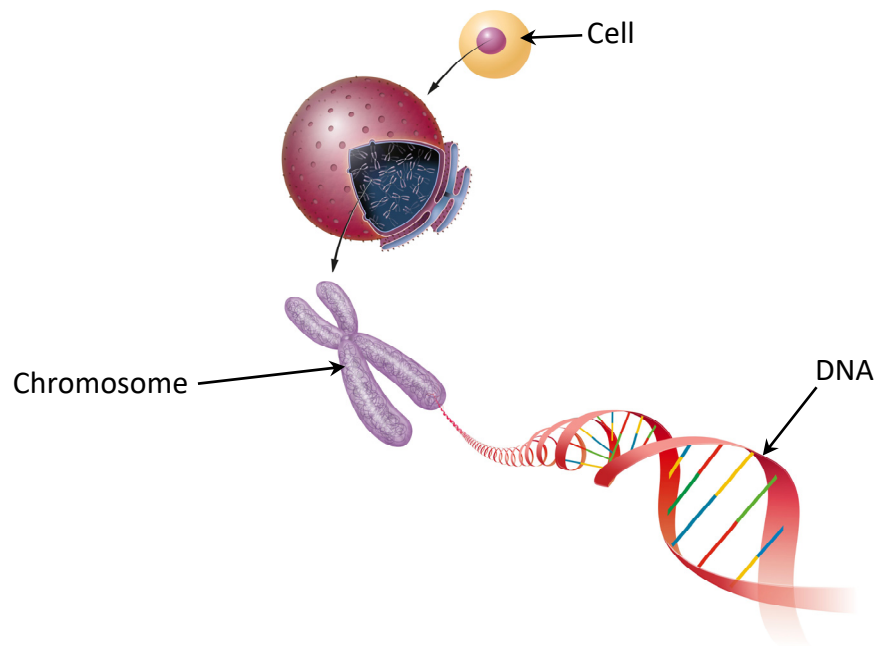
(iv) Water and minerals are transported in specialised plant vascular tissue.
Name this transport tissue in plants.

--

Question 4

50 marks

- (a) Chromosomes are found in cells and are composed of two substances. One of the substances is DNA.



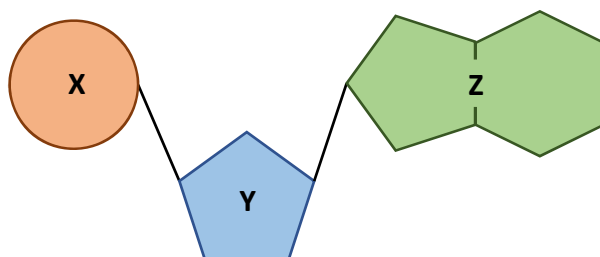
- (i) Identify the second substance that makes up chromosomes. Put a tick (✓) in the correct box.

Protein	
Fat	

- (ii) What name is used to describe the shape of a DNA molecule?

- (iii) DNA is made up of many nucleotides joined together (polynucleotide). The diagram below shows the structure of a DNA nucleotide. Match parts **Y** and **Z** to their correct names from the following list.

Deoxyribose sugar	Nitrogenous base
-------------------	------------------



X	Phosphate
Y	
Z	

- (iv) The base sequence of one part of a DNA strand is written in the table below. Complete the table to show the sequence on the complementary strand.

Base sequence of part of one strand	A	C	G	A	A	T	T	C	A	G
Complementary strand sequence										

- (v) A change in the base sequence of DNA is known as a mutation and results in variation within species.
Identify **one** other cause of variation.

--

- (b) Genetics is the study of inheritance, the passing on of DNA (genes) from parent to offspring. Some cats have patches of white fur known as white spotting. White spotting is inherited by a dominant allele.

	Cat 1	Cat 2
		
Genotype	Ww	ww
Phenotype	Cat with white spotting	Cat without white spotting

- (i) Is cat 2 described as homozygous **or** heterozygous?
Place a tick (✓) in the correct box.

Homozygous	
Heterozygous	

- (ii) Explain your answer to part (i) above.

- (iii) Cat 1 has the genotype **Ww**.
Which **other** genotype will result in a white spotted cat?

--

- (iv) A Punnett square is one way of modelling genetic inheritance.
Using the method below, or another method, show the pattern of inheritance in a cross between cat 1 and cat 2.

Parents:	Ww	x	ww						
Gametes:	<table border="1" style="display: inline-table; width: 80px; height: 30px;"> <tr><td style="width: 40px;"></td><td style="width: 40px;"></td></tr> </table>			x	<table border="1" style="display: inline-table; width: 160px; height: 30px;"> <tr><td></td></tr> </table>				
Genetic cross:	<table border="1" style="margin: auto;"> <tr> <td></td> <td></td> </tr> <tr> <td></td> <td></td> </tr> <tr> <td></td> <td></td> </tr> </table>								
Possible offspring genotypes:	<table border="1" style="width: 100%;"> <tr><td style="width: 50%; height: 30px;"></td><td style="width: 50%;"></td></tr> </table>								
Matching offspring phenotypes:	<table border="1" style="width: 100%;"> <tr><td style="width: 50%; height: 30px;"></td><td style="width: 50%;"></td></tr> </table>								

Other method:

- (v) What is the percentage chance of an offspring having white spotting?

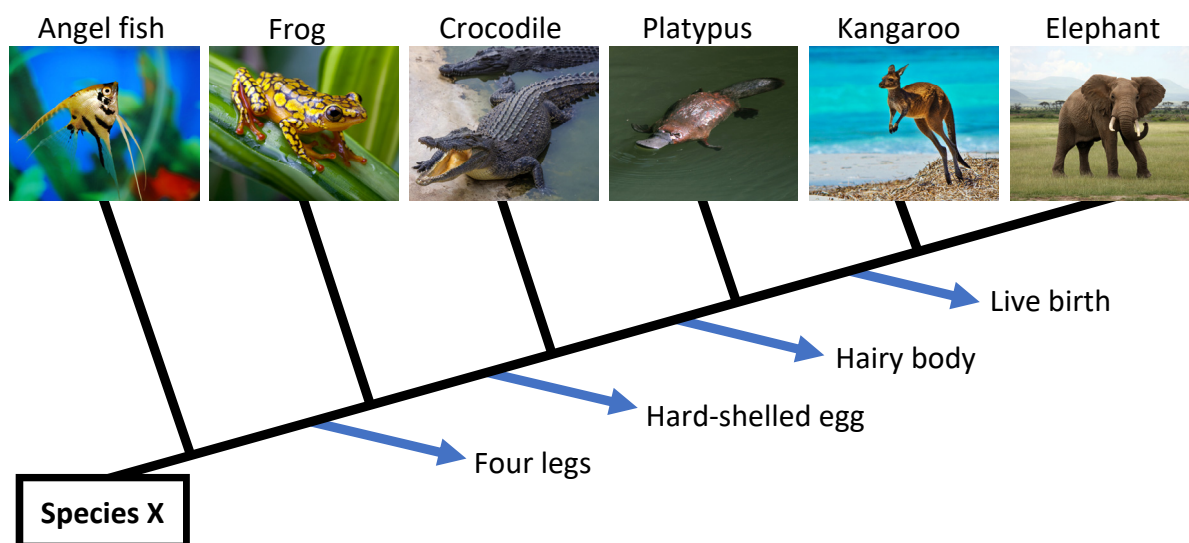
--

- (vi) Epigenetics is the study of how non-genetic factors such as diet and environment can influence gene expression.

Place a tick (✓) in the correct box to indicate if this statement is true **or** false.

True	
False	

- (c) Evolution refers to genetic changes in a species over time in response to changes in their environment. A phylogenetic tree, as shown below, can be used to represent evolutionary relationships between organisms.



- (i) Name **one** organism listed above which does not have hair.

- (ii) Identify the term scientists use to describe species X. Put a tick (✓) in the correct box.

Common descendant

☐

Common ancestor

☐

- (iii) Which organism above is most closely related phylogenetically to the elephant?

- (iv) Evolution by natural selection is a commonly accepted theory among scientists. Using the words from the list below, complete the paragraph to explain natural selection.

reproduce

adaptations

competition

Within a population there is great variation.

Organisms reproduce at high rates and there is .

This means there is a struggle for survival.

Those with better survive, known as survival of the fittest.

The others die out. The survivors and pass genes on to the next generation.

Question 5

50 marks

- (a) The image below shows foods with a range of nutrients.
A balanced diet involves eating the correct amount of each type of nutrient.



- (i) Identify a food from the image, or otherwise, that is rich in protein **and** a food that is rich in carbohydrate.

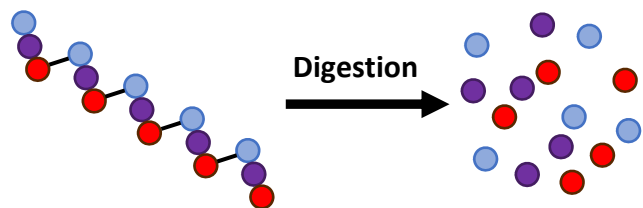
Protein:

Carbohydrate:

- (ii) State **one** factor that influences how much of each food type an individual needs.

--

- (iii) Digestion involves breaking large food molecules such as protein, lipids and starch into smaller food molecules.
Explain why we need to digest large food molecules, such as starch.



- (b) (i) The first table below shows a list of small food molecules.

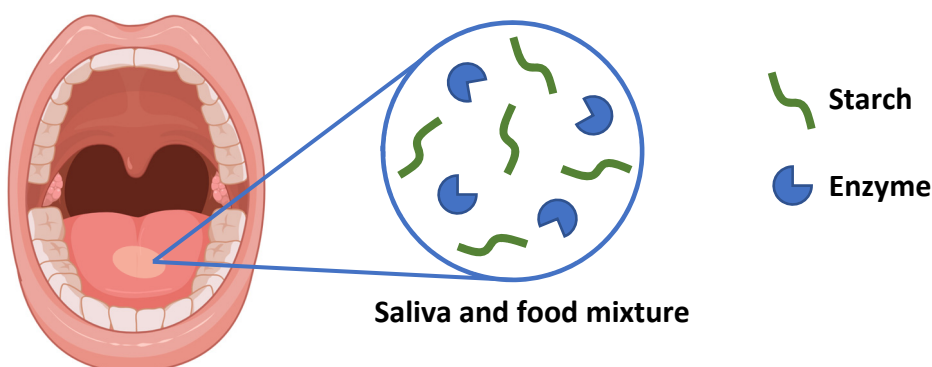
Small food molecules		
Peptides or amino acids	Glycerol and three fatty acids	Maltose

Using the list of small food molecules, complete the table below by matching each large food molecule with its corresponding small food molecule from the list.

Large food molecules	Corresponding small food molecule
Starch	
Protein	
Lipid	

Saliva is a liquid produced by salivary glands in the mouth. It consists of mostly water with some digestive enzymes.

The diagram shows food in the mouth being mixed with a digestive enzyme in saliva.

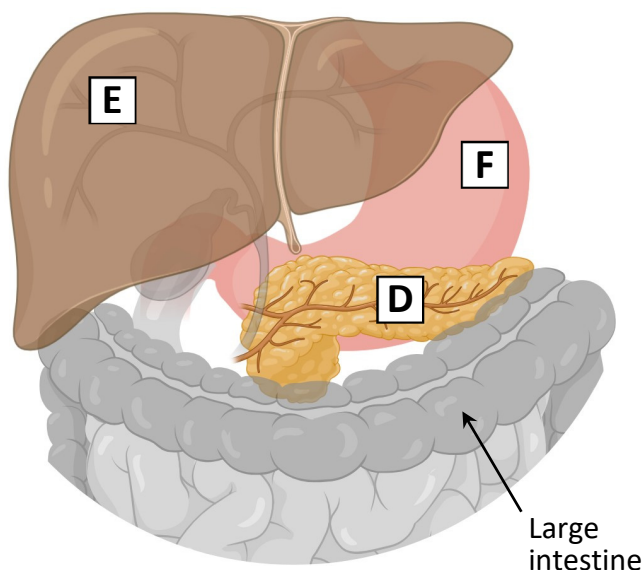


- (ii) Name the enzyme in saliva that breaks down starch in the mouth.

--

- (iii) Teeth are also visible in the diagram.
Describe the role of teeth in digestion.

- (c) (i) The diagram shows some of the organs involved in the human digestive system. Match the letters **D, E and F** on the diagram with the organs listed in the table below.

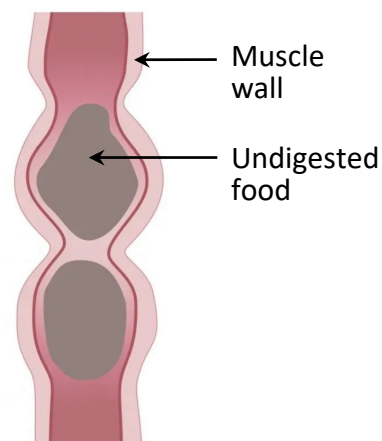


Organ	Correct letter
Liver	
Pancreas	
Stomach	

- (ii) Undigested food ends up in the large intestine and is eliminated from the body as faeces.

The diagram on the right shows the movement of undigested food through the large intestine.

Briefly describe how undigested food is moved through the large intestine.



Large intestine

- (iii) Which term describes the removal of faeces from the body?
Place a tick (✓) in the correct box.

Ingestion	
Egestion	

- (d) Describe how you investigated the presence of a **named** food biomolecule. Include a description of a **control** in your answer. You may use a labelled diagram.

Named food:

Labelled diagram:

--

Question 6

50 marks

- (a) The circulatory system uses blood, blood vessels and the heart to deliver substances around the body. The image shows a unit (470 cm³) of blood donated in a blood donation clinic.

- (i) Identify component **R**.

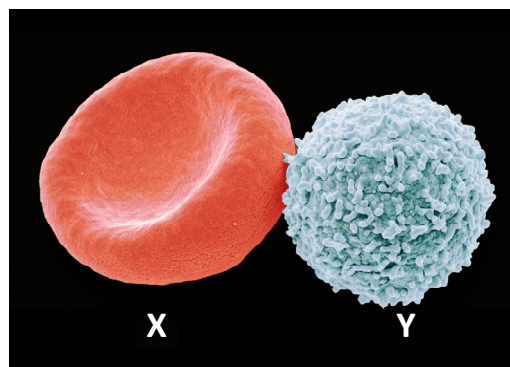
- (ii) Identify the substance which makes up most of component **R**.

Put a tick (✓) in the correct box.

Fat	☐
Water	☐
Cells	☐

- (iii) Two blood cells **X** and **Y** are shown in the image on the right. Name **X** and **Y**.

X:
Y:



- (iv) Identify the chemical in cell **X** that carries oxygen.

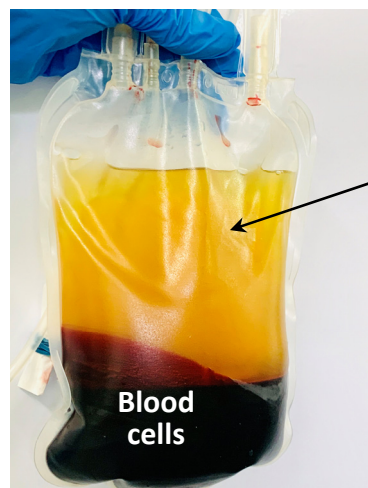
Put a tick (✓) in the correct box.

Glycogen	☐
Haemoglobin	☐

- (v) What is the function of cell **Y**?

- (vi) If a person is to receive a blood donation, their blood group (type) must be compatible with the blood they are to receive.

Name **one** blood grouping system.



R

Blood cells

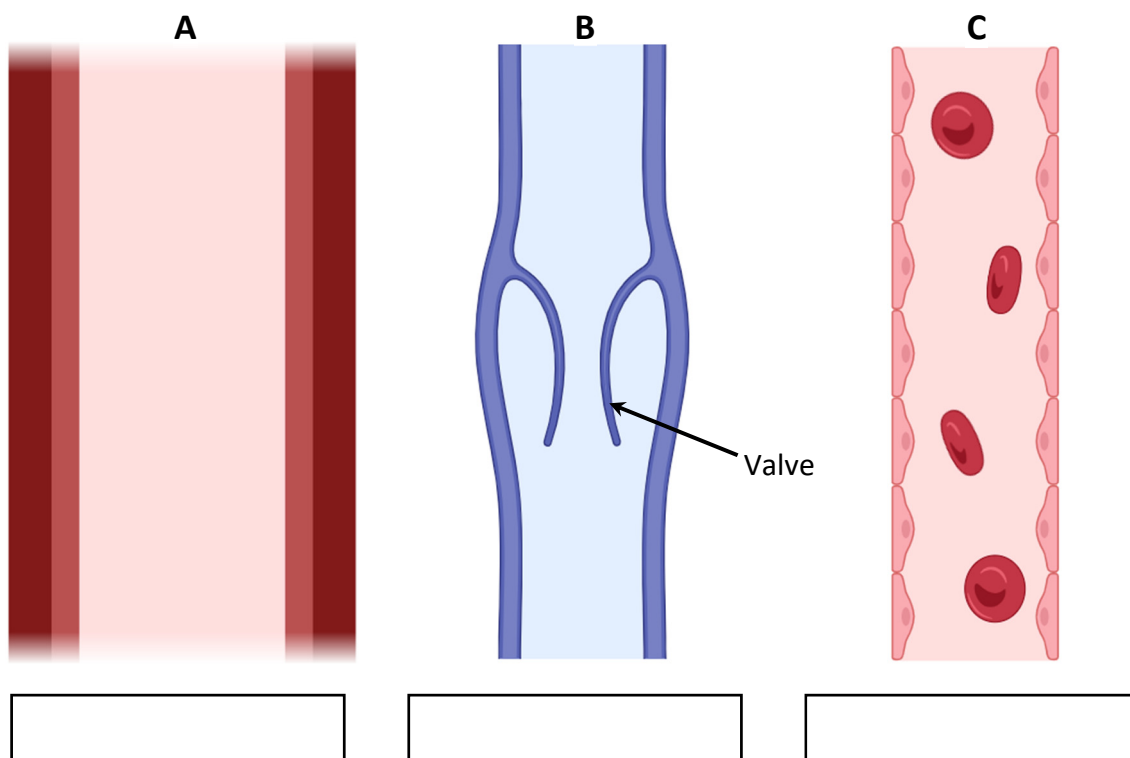
X

Y

(b) The diagrams show three types of blood vessels, not drawn to scale.

(i) Identify **each** type of blood vessel using the names from the following list:

Capillary	Vein	Artery
-----------	------	--------

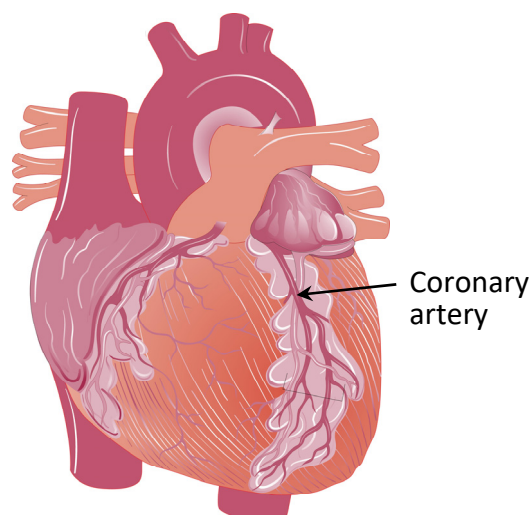


(ii) On diagram B above, draw an arrow to show the direction of blood flow.

The diagram below shows the structure of the heart and shows the coronary artery delivering blood to the cardiac muscle.

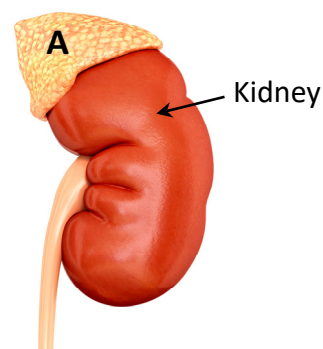
(iii) Suggest what might happen if this artery was blocked.

(iv) Suggest a lifestyle choice that makes it less likely that this artery will get blocked.



(c) Adrenaline is an important hormone in the body.

(i) Name the gland **A** that produces adrenaline.

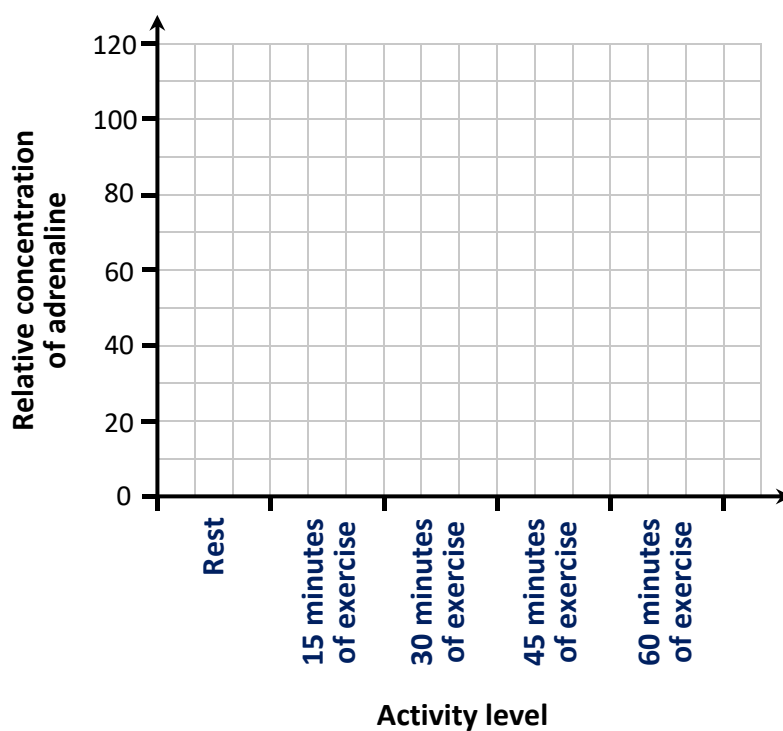


A scientist investigated the effect of exercise on blood adrenaline concentration.

Their data is shown in the table below.

Activity level	Rest	15 minutes of exercise	30 minutes of exercise	45 minutes of exercise	60 minutes of exercise
Relative concentration of adrenaline	20	60	80	100	120

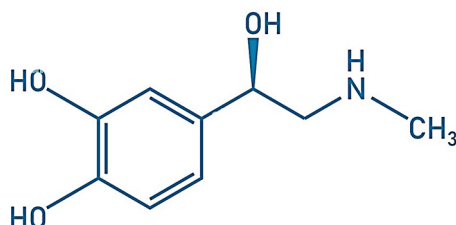
(ii) Using the data, draw a suitable graph in the space below.



(iii) What is the relationship between exercise levels and the amount of adrenaline in the blood?

- (iv) What do you think would happen to the concentration of adrenaline once the exercise had stopped?

- (v) The chemical structure for the hormone adrenaline is shown below.
It is made up of the elements carbon (C), hydrogen (H), oxygen (O) and nitrogen (N).



Identify the type of food biomolecule that is made up of these same four elements and is used to make hormones such as adrenaline in the body.
Put a tick (✓) in the correct box.

Carbohydrate ☐ Lipid ☐ Protein ☐

- (vi) State **one** use of hormonal manipulation in sport.



Question 7

50 marks

- (a) Bacteria and Fungi are two kingdoms of living things.



Bacteria growing on a nutrient medium



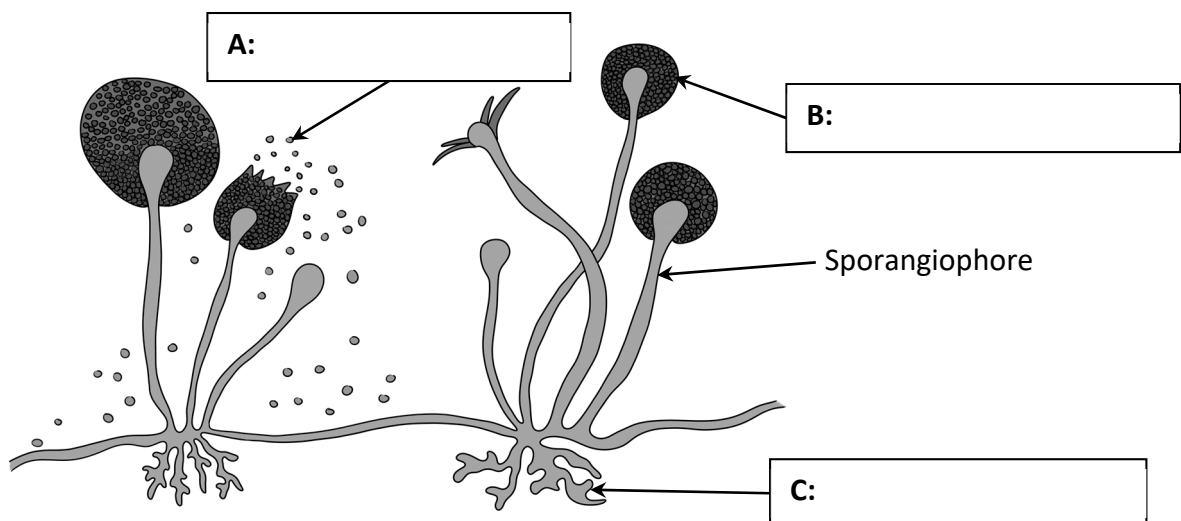
Fungus growing on bread

- (i) The table below contains statements about bacteria and fungi. Identify which organism is being described by **each** statement. Put a tick (✓) in the correct boxes.

	Bacteria	Fungi
All members are unicellular		
Some members can make their own food		
Cells contain a nucleus		

- (ii) The diagram below shows *Rhizopus*, a fungus that grows on bread. Use the list below to label **A**, **B** and **C** on the diagram.

Spores	Rhizoid	Sporangium
--------	---------	------------



(b) Some bacteria and fungi can cause disease.

(i) Identify the name which describes organisms or agents that cause disease by placing a tick (✓) in the correct box.

Antigen		Pathogen		Antibody	
---------	--	----------	--	----------	--

(ii) Identify **one other** agent **or** organism that can cause disease.

--

(iii) Draw a labelled diagram of a bacterial cell in the space provided below.

Labelled diagram:

(c) Antibiotics are chemicals that affect bacteria.

(i) What is meant by antibiotic resistance?

The image shows bacterial growth in a petri dish with nutrient agar (food for the bacteria). Antibiotic discs (A, B, C, D, E and F) were placed on the agar and the bacteria were allowed to grow.



(ii) Identify an antibiotic disc that was **not** effective against the bacteria.

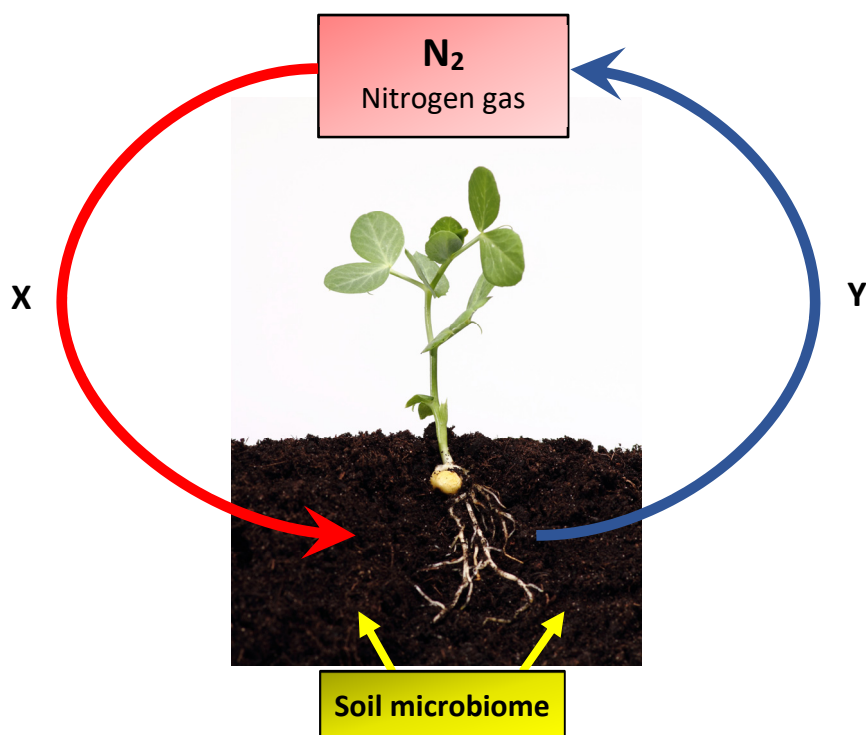
--

(iii) Identify an antibiotic disc that was **most** effective against the bacteria.

--

(iv) Explain how you decided this antibiotic disc was the most effective.

- (d) Microorganisms have many roles in nature, including in the nitrogen cycle. The diagram below shows part of the nitrogen cycle. **X** and **Y** represent two processes of the cycle.



- (i) Identify processes **X** and **Y**.

X:
Y:

- (ii) Name **one** process (other than **X** and **Y**) in the nitrogen cycle that promotes a healthy soil microbiome.

--

- (iii) Describe how climate warming affects the soil microbiome.

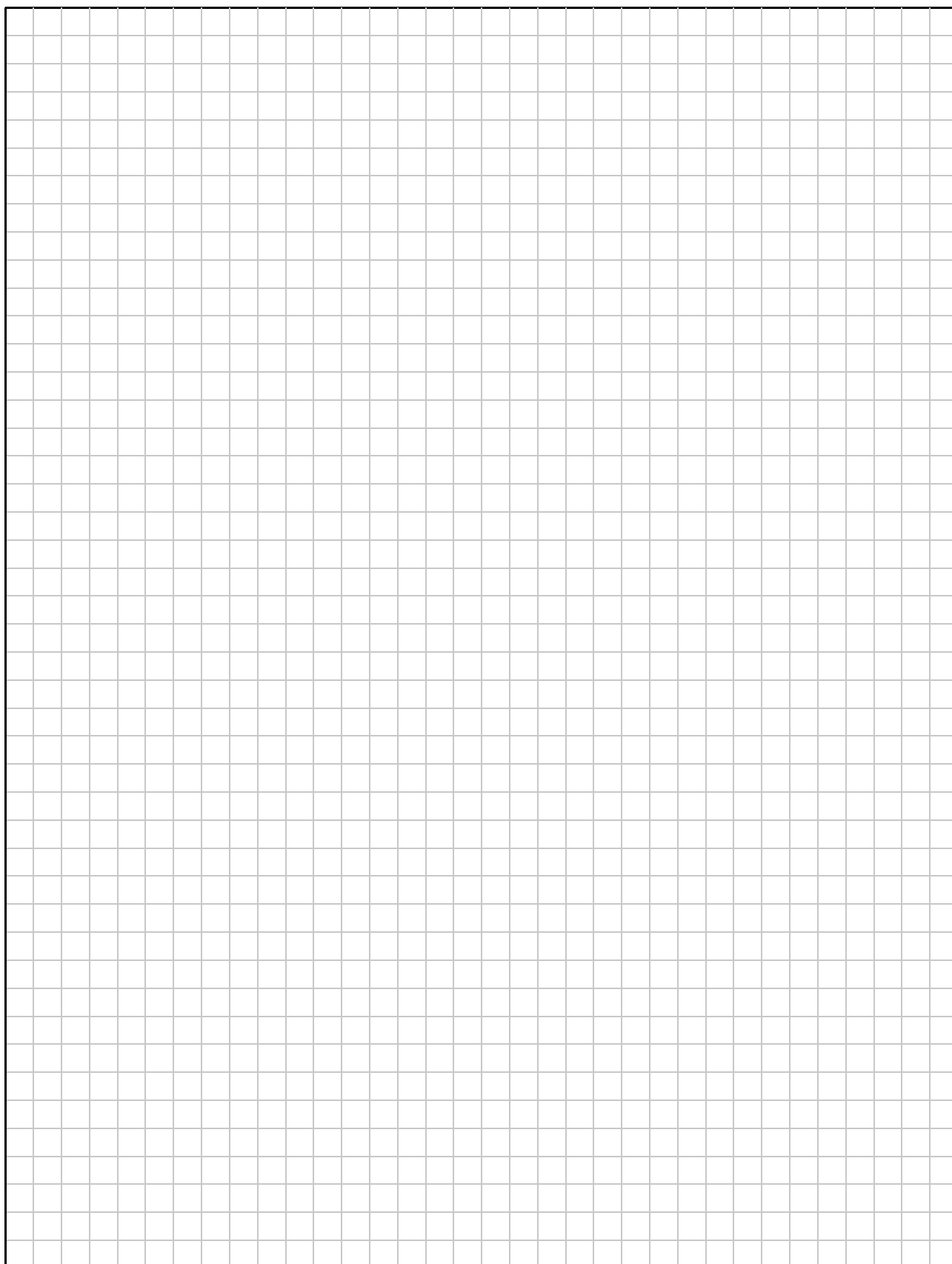
- (iv) Soil is one example of a microbiome.
State **one** location of a microbiome in or on the human body.

--

[illegible]

[illegible]

Additional graph paper.
Label all work clearly with the question number and part.



Acknowledgements:

Images/graphs/diagrams:

Images on page 3:	shutterstock.com; alamy.com; dreamstime.com
Diagram on page 3:	State Examinations Commission
Images on page 4:	shutterstock.com; dreamstime.com; alamy.com
Diagram on page 4:	State Examinations Commission
Images on page 5:	maps-ireland-ie.com; dreamstime.com
Image on page 6:	shutterstock.com
Diagram on page 7:	shutterstock.com
Image on page 7:	shutterstock.com
Image on page 8:	dreamstime.com
Image on page 9:	State Examinations Commission
Image on page 10:	bbc.co.uk
Image A on page 11:	album-online.com
Image B on page 11:	shutterstock.com
Diagram on page 12:	Created on biorender.com
Images on page 13:	State Examinations Commission
Graph on page 14:	State Examinations Commission
Image on page 15:	dreamstime.com
Image on page 16:	shutterstock.com
Diagram on page 16:	State Examinations Commission
Images on page 17:	dreamstime.com; shutterstock.com
Diagram on page 19:	dreamstime.com; State Examinations Commission
Image on page 20:	shutterstock.com
Diagram on page 20:	State Examinations Commission
Diagram on page 21:	Created on biorender.com
Diagram in Q5(c)(i) on page 22:	Created on biorender.com
Diagram in Q5(c)(ii) on page 22:	Adapted from gutscharity.org.uk
Images on page 24:	istockphoto.com; alamy.com
Diagram on page 25:	Created on biorender.com
Diagram on page 25:	alamy.com
Image on page 26:	alamy.com
Image in Q6(c)(v) on page 27:	alamy.com
Image in Q6(c)(vi) on page 27:	vecteezy.com
Images on page 28:	shutterstock.com; istockphoto.com
Diagram on page 28:	alamy.com
Image on page 30:	dreamstime.com
Image on page 31:	Adapted from dreamstime.com

Texts/data:

Text on page 5:	Adapted from <i>Hundreds of natterjack toads to be released into Kerry dunes</i> , Irish Examiner 22nd July 2024
Data on page 14:	State Examinations Commission
Data on page 26:	State Examinations Commission

Material may have been adapted, for the purpose of assessment, without the authors' prior consent.

Do not write on this page

Copyright notice

This examination paper may contain text or images for which the State Examinations Commission is not the copyright owner, and which may have been adapted, for the purpose of assessment, without the authors' prior consent. This examination paper has been prepared in accordance with section 53(5) of the Copyright and Related Rights Act, 2000. Any subsequent use for a purpose other than the intended purpose is not authorised. The Commission does not accept liability for any infringement of third-party rights arising from unauthorised distribution or use of this examination paper.

Leaving Certificate Examination – Ordinary Level

Biology

Sample 2

2 hours 30 minutes