2027.M43S1

2027L025G1ES1

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination
Sample 1

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.

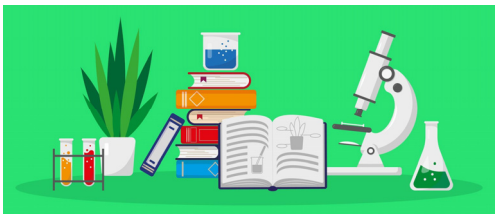
You may lose marks if your solutions do not include relevant supporting work.

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

Question 1 is compulsory

Question 1 **50 marks**

(a) Biologists engage in scientific inquiry.



Conducting an experiment is a form of scientific inquiry.

(i) Outline a feature of good experimental design.

(ii) State how a biologist might present their results **and** describe a benefit of presenting results in this way.

How:
Describe:

(iii) Below is a selection of equipment used in biology investigations.
Identify any **one and** briefly describe its use.

Use:

(b) The image below is of a flower, called a lily.

Anther

Petal

(i) **On the image above**, draw an arrow from **each** of the **two** labels to indicate their location.

(ii) What is the function of the anther?

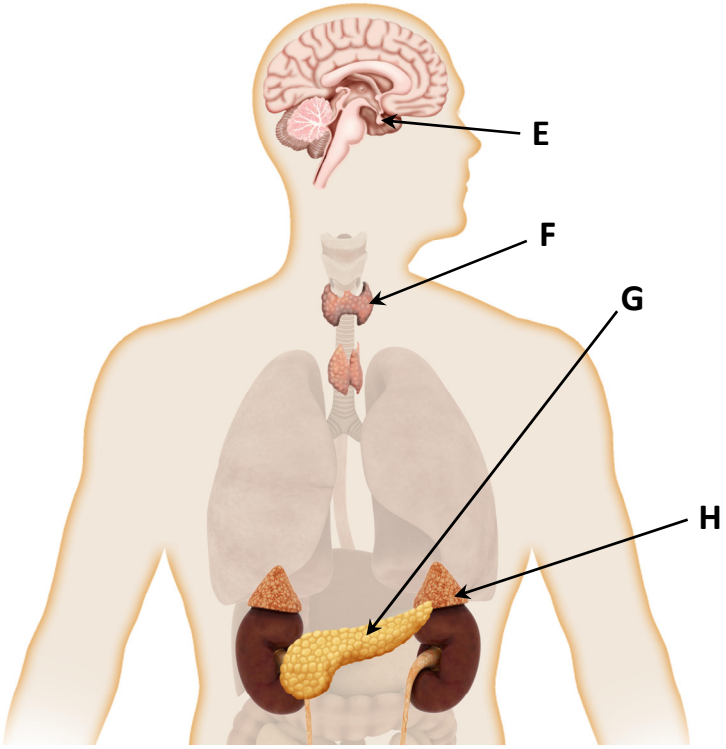
(iii) Is the lily flower adapted to wind **or** insect pollination?

(iv) Justify your answer to part (iii) above.

(c) The diagram below shows some of the main human endocrine glands.

(i) Study the diagram and complete the table using the names of the endocrine glands listed below.

Thyroid	Pancreas	Pituitary	Adrenal



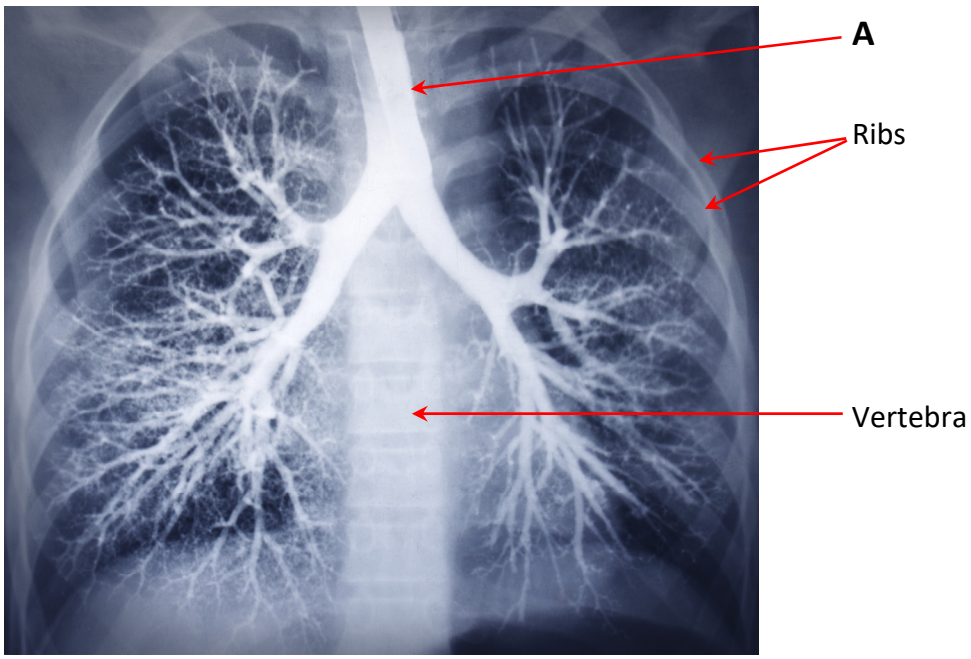
Letter on diagram	Name of endocrine gland
E	
F	
G	
H	

(ii) Choose **one** gland from the diagram above **and** name **one** hormone it produces.

Name of gland	Name of hormone produced

(iii) Identify the gland from the list above that is also associated with the digestive system.

(d) The image below shows the human chest cavity.



(i) Identify the structure labelled **A** from the list given below.

Bronchiole	Bronchus	Trachea

A:

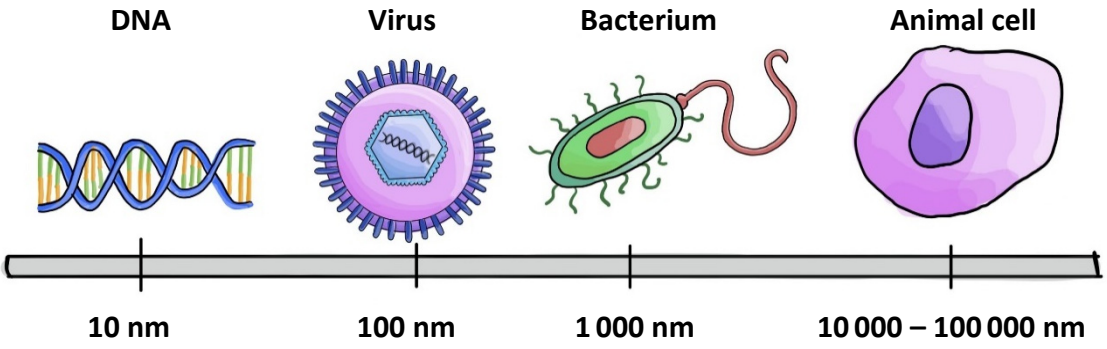
(ii) **On the image above**, draw an arrow to show the direction of air flow through tube **A** during inhalation (breathing in).

(iii) Structure **A** is surrounded by rings of cartilage.
State a function of this cartilage.

(iv) Gas exchange occurs in the alveoli.
Name a gas that leaves the blood at the alveoli.

(v) During inhalation muscles contract which allows us to breathe in.
Name the muscles located between the ribs that are involved in breathing.

(e) The diagram below shows DNA, a virus, a bacterium and an animal cell.
They are not drawn to scale. Their relative sizes are indicated (nm = nanometres).



(i) State any **two** characteristics of life.

1.
2.

(ii) Based on your knowledge of the characteristics of life, why do you think it is difficult to describe viruses as living organisms?

(iii) Domains of life include archaea, bacteria and eukaryota.
Place a tick (✓) in the correct box to identify which **one** of the above (virus **or** bacterium **or** animal cell) belongs to the eukaryota domain.

	Eukaryota domain
Virus	
Bacterium	
Animal cell	

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

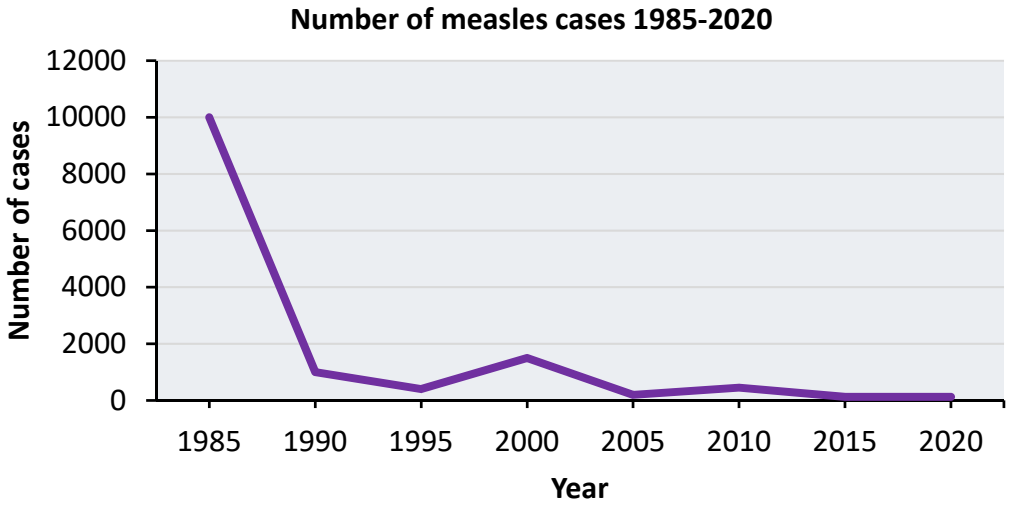
Question 2 **50 marks**

(a) The passage below relates to a serious viral infection called measles and its vaccine.

> In Ireland, the measles vaccine was introduced in 1985. Data from The European Centre for Disease Prevention and Control (ECDC) shows that 90% of measles cases occur in unvaccinated individuals, with one in four cases being in adults. They also highlight that infants are most at risk and state that vaccines remain one of the most effective life-saving measures.
>
> Adapted from *Measles Annual Epidemiological Report for 2023* – ecdc.europa.eu

(i) According to the passage, what group in society is most at risk from measles?

(ii) Suggest a reason for this group being most at risk.



(iii) Using the graph, in which year did Ireland have the highest number of measles cases?

(iv) From the time of the introduction of the measles vaccine, describe the overall trend in the number of measles cases in Ireland.

(v) If a large part of the population did not take the measles vaccination, what do you think would happen to the number of measles cases? Justify your answer.

(b) **(i)** Many other viruses can infect people.
Outline **two** ways that viruses can spread from person to person.

1.

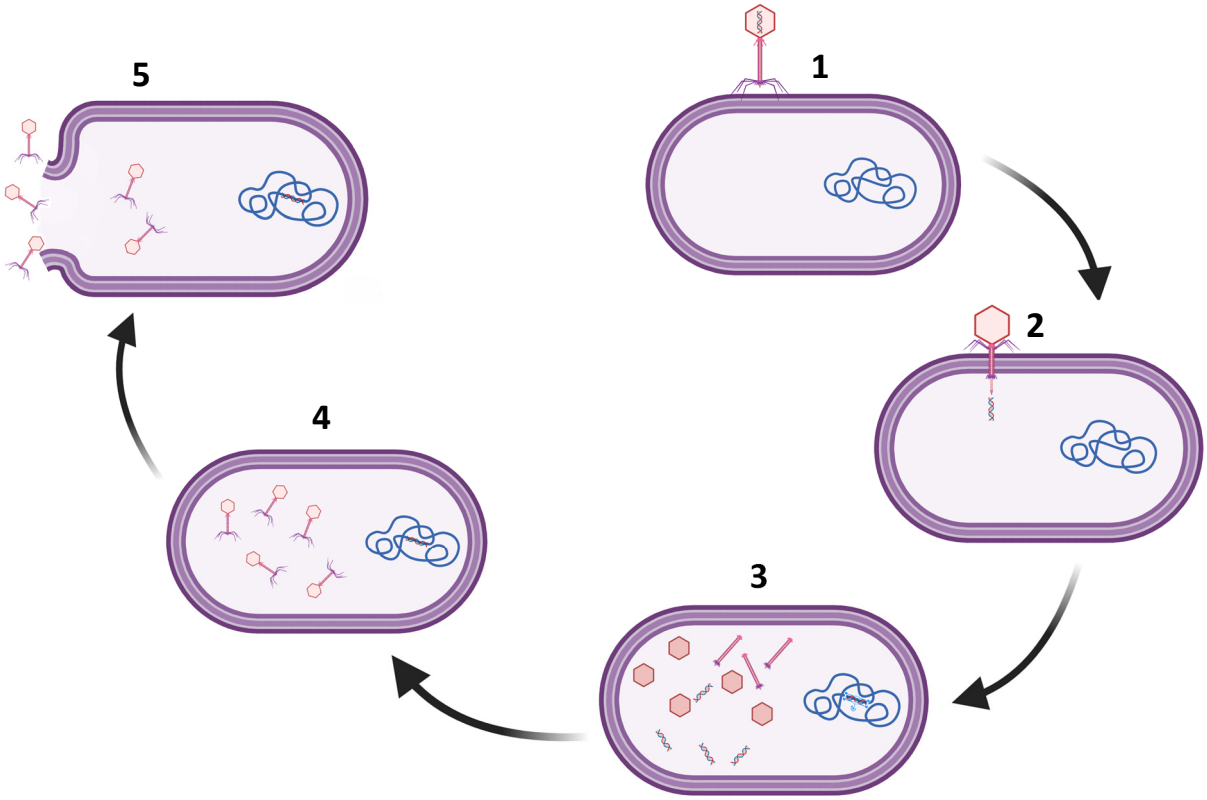
2.

(ii) Immunity is the ability to resist infection.
State whether vaccination is an example of active **or** passive immunity.

(iii) Which of the following molecules is produced in the human body in response to a vaccine? Put a tick (✓) in the correct box.

Antigen		Antibody	

(c) **(i)** The diagram below shows viral replication in five steps.



The table below has a description of these steps, but they are **not** in the correct order.

Complete the table by matching the description with the correct number from the diagram. Steps 3 and 4 have been completed for you.

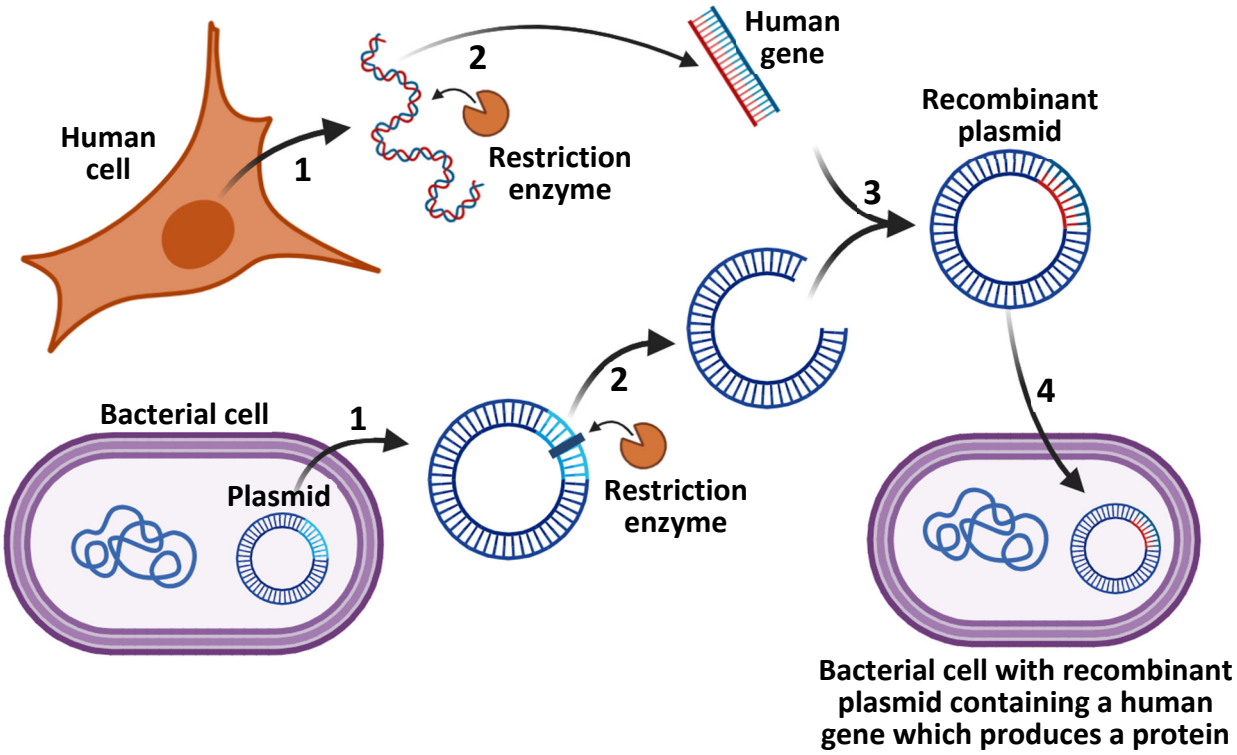
Viral replication process	Step in viral replication
Insertion of nucleic acid	
Production of viral parts	*3*
Release of viruses	
Attachment of virus	
Assembly of new viruses	*4*

(ii) Name **one** plant disease that is caused by a virus.

(d) Viruses can be used in genetic engineering.

(i) Explain the term *genetic engineering*.

The diagram shows the stages involved in genetic engineering.



(ii) Write the numbers **1**, **3 and 4** into the table below to indicate the correct order of the processes of genetic engineering.
The second step in the process has been completed for you.

Process in genetic engineering	Correct order
Ligation	
Transformation and expression	
DNA isolation	
Cutting with restriction enzymes	***2***

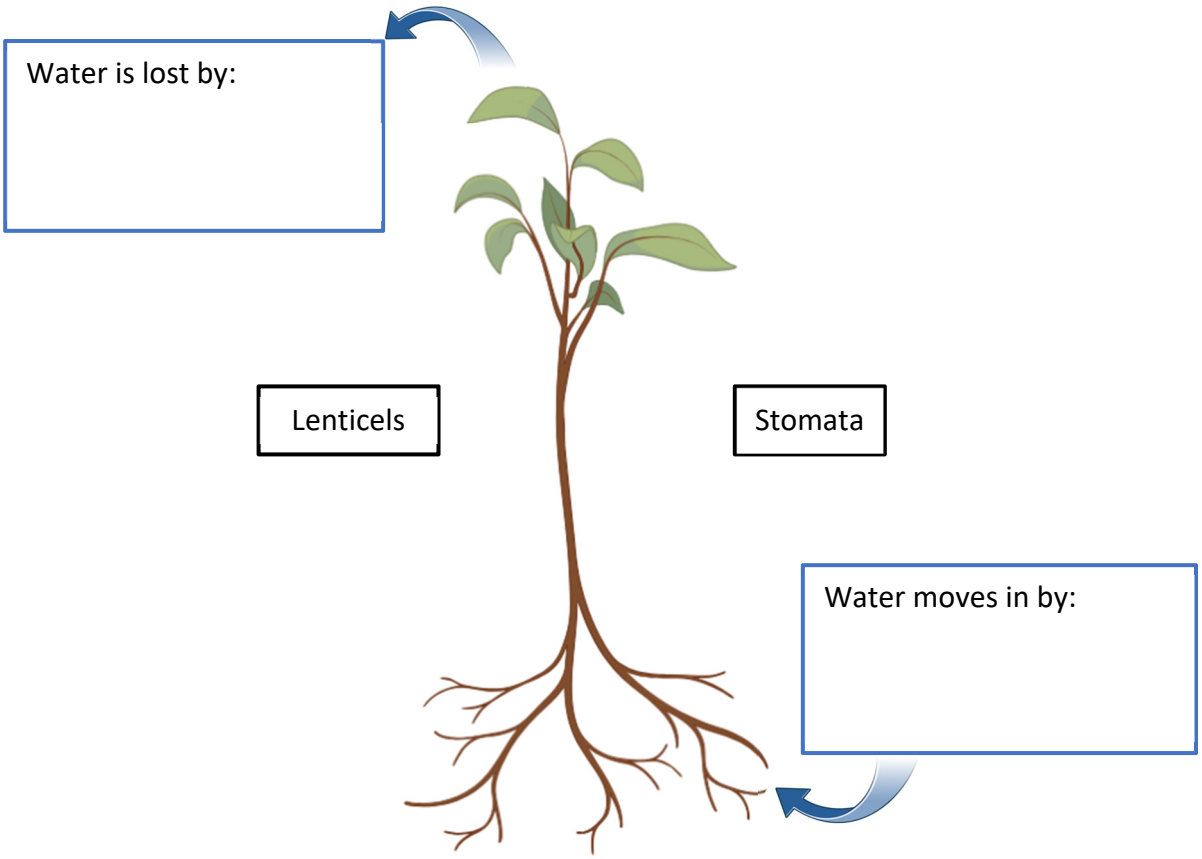
(iii) Describe **one** application (use) of genetic engineering.

Question 3 **50 marks**

(a) Plants require water for photosynthesis. This water moves through the plant.

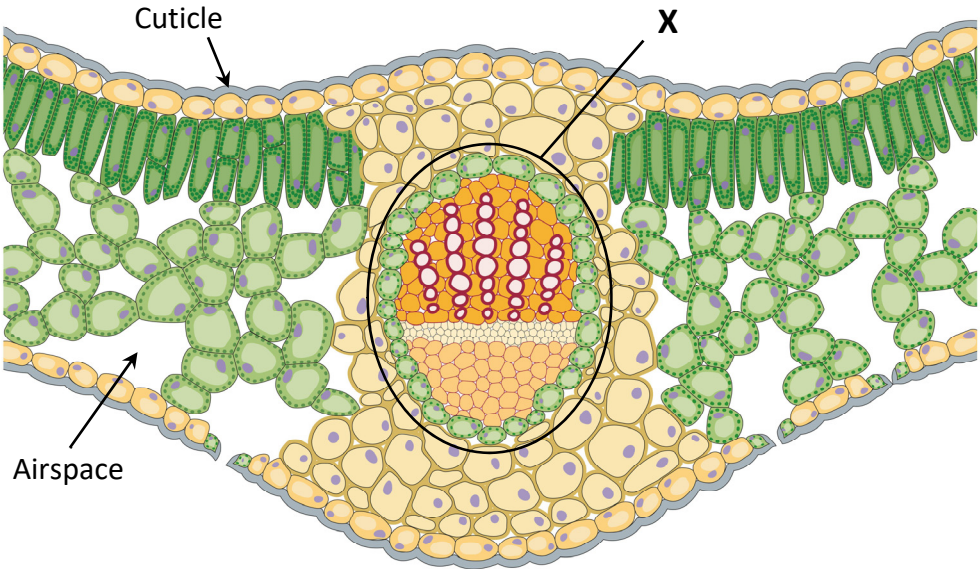
(i) Complete the diagram below by writing the terms **Transpiration** and **Osmosis** in the correct **blue** boxes.

Transpiration	Osmosis



(ii) **On the diagram above**, draw arrows from the terms **Stomata and Lenticels** to their correct locations on the plant.

(b) The diagram shows the internal structure of a leaf.



(i) Identify the **structure** labelled **X**.

(ii) Name **one** tissue type present within structure **X and** state its function.

Name:
Function:

(iii) State **two** ways the leaf is adapted to carry out photosynthesis.

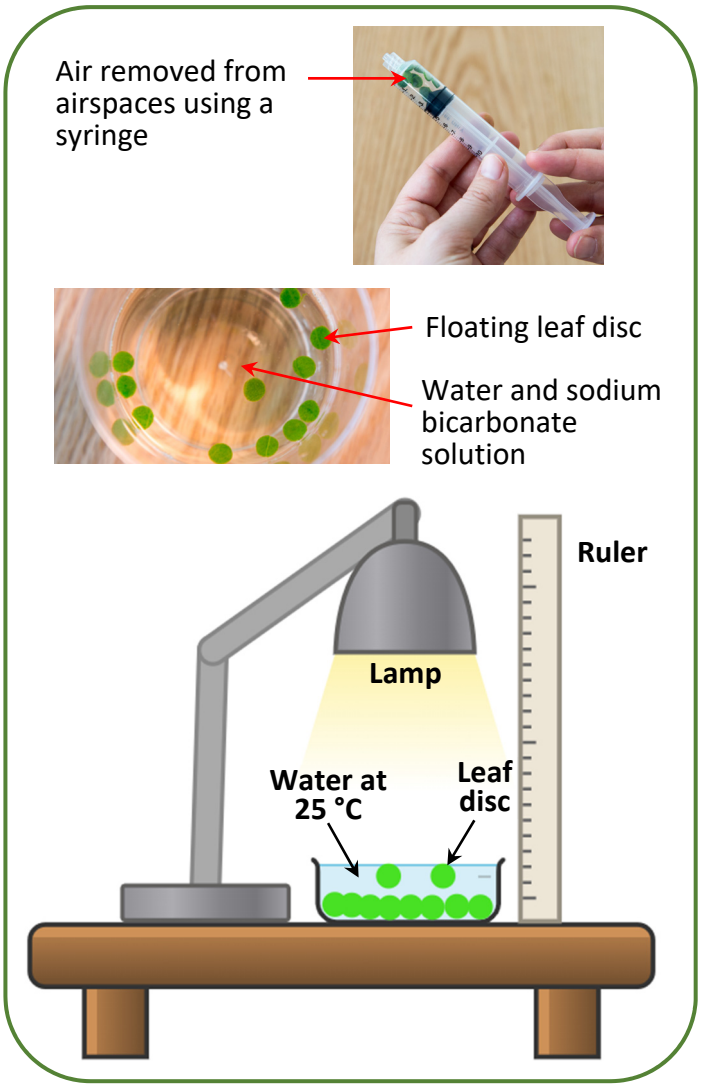
1.
2.

(c) A student set up the apparatus as shown to investigate the effect of light intensity on the rate of photosynthesis.

Leaves were cut into ten same-sized discs and the air taken from the airspaces using a syringe.

They were placed in a container of sodium bicarbonate solution to ensure a good supply of carbon dioxide to the plant tissue and exposed to light. Oxygen produced in the airspaces caused the leaf discs to float.

Light intensity was altered by changing the lamp height.
The number of discs that floated to the top over the course of 10 minutes was recorded.



(i) For this investigation, state the independent **and** dependent variables.

Independent variable:
Dependent variable:

(ii) Name **two** factors that were kept constant during this investigation.

Factor 1:
Factor 2:

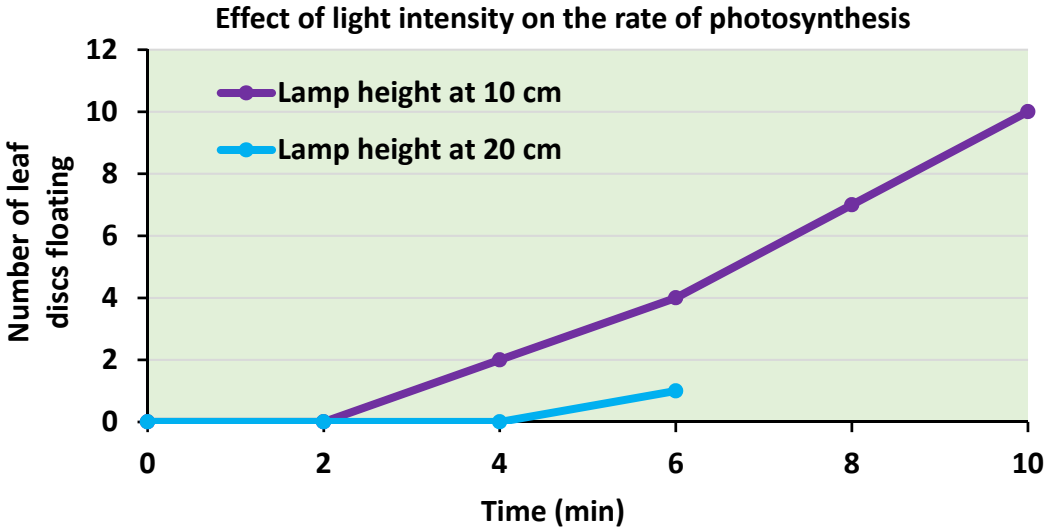
(iii) Describe how the student kept **one** of the named factors constant.

Named factor:

(d) The table below shows a record of the results taken by the student.

		Time (minutes)					
		0	**2**	**4**	**6**	**8**	**10**
Number of leaf discs floating…	**with lamp height at 10 cm**	0	0	2	4	7	10
	with lamp height at 20 cm	0	0	0	1	**2**	**3**

The student used this data to draw the graph below to represent their results.
Part of the graph for the results at 20 cm has **not** been completed.
Analyse the data and answer the questions that follow.



(i) Using the data in the table, **complete the graph** above to show all the results for a lamp height at 20 cm.

(ii) State a conclusion which can be drawn from the results.

(iii) If this investigation was conducted with the lamp height at 15 cm, predict the results by drawing on the graph above **or** writing in the space below.
State a reason for your prediction.

Predict:
Reason:

Question 4 **50 marks**

(a) The pictures below show members of a food chain from a woodland habitat.

(i) Explain the underlined term.




Oak leaves → Earthworms → Hedgehog → Fox

(ii) Identify a predator **and** its prey from the above food chain.

Predator:
Prey:

(iii) Which term describes the role of the earthworm in the food chain?
Put a tick (✓) in the correct box.

Producer		Decomposer	

(iv) Draw **and** label a pyramid of numbers to illustrate the food chain above.

(v) Predict what would happen to the population of foxes if the Irish wolf was reintroduced. Justify your answer.

Predict:
Justify:

(b) The photographs show biologists taking samples of aquatic organisms from a river and identifying them to determine the river's water quality.
They are using a method called 'kick sampling'.
The biologist walks slowly in the river, disturbing the riverbed and collecting any aquatic organisms.

(i) Name **one** piece of equipment that might be used to collect aquatic organisms in a river.

(ii) Analysing the photographs, describe any **one** way the biologists are displaying good health and safety practices.

(iii) The biologists collected a range of aquatic organisms during their sampling.
What could biologists use to help identify these aquatic organisms?

The table below shows four aquatic organisms.

Presence indicates good quality water		Dominant in poor quality water	
			
Flattened mayfly	**Green caddisfly**	**Freshwater snail**	**Water louse**

The table below shows the results collected after five samples were taken from the river. The total for the flattened mayfly has not been filled in.

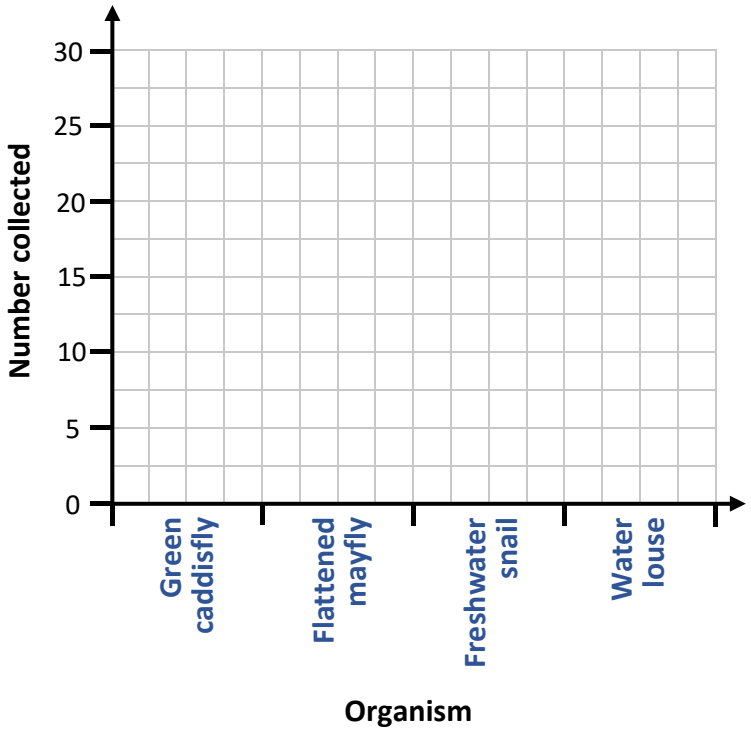
Name	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Total
Flattened mayfly	3	6	7	9	5	**T**
Green caddisfly	4	8	4	5	4	25
Freshwater snail	3	1	2	4	0	10
Water louse	0	2	0	1	2	5

(iv) Calculate the total (**T**) for the **flattened mayfly**.

Calculation:

Total:

(v) **In the space below**, draw a suitable graph to represent the data in the results table on the previous page.



(vi) Analysing the results, comment on the quality of the river water **and** state a reason for your answer.

Water quality:
Reason:

(vii) Abiotic factors can also affect the organisms found in ecosystems.
Name an abiotic factor that could be measured in any ecosystem.

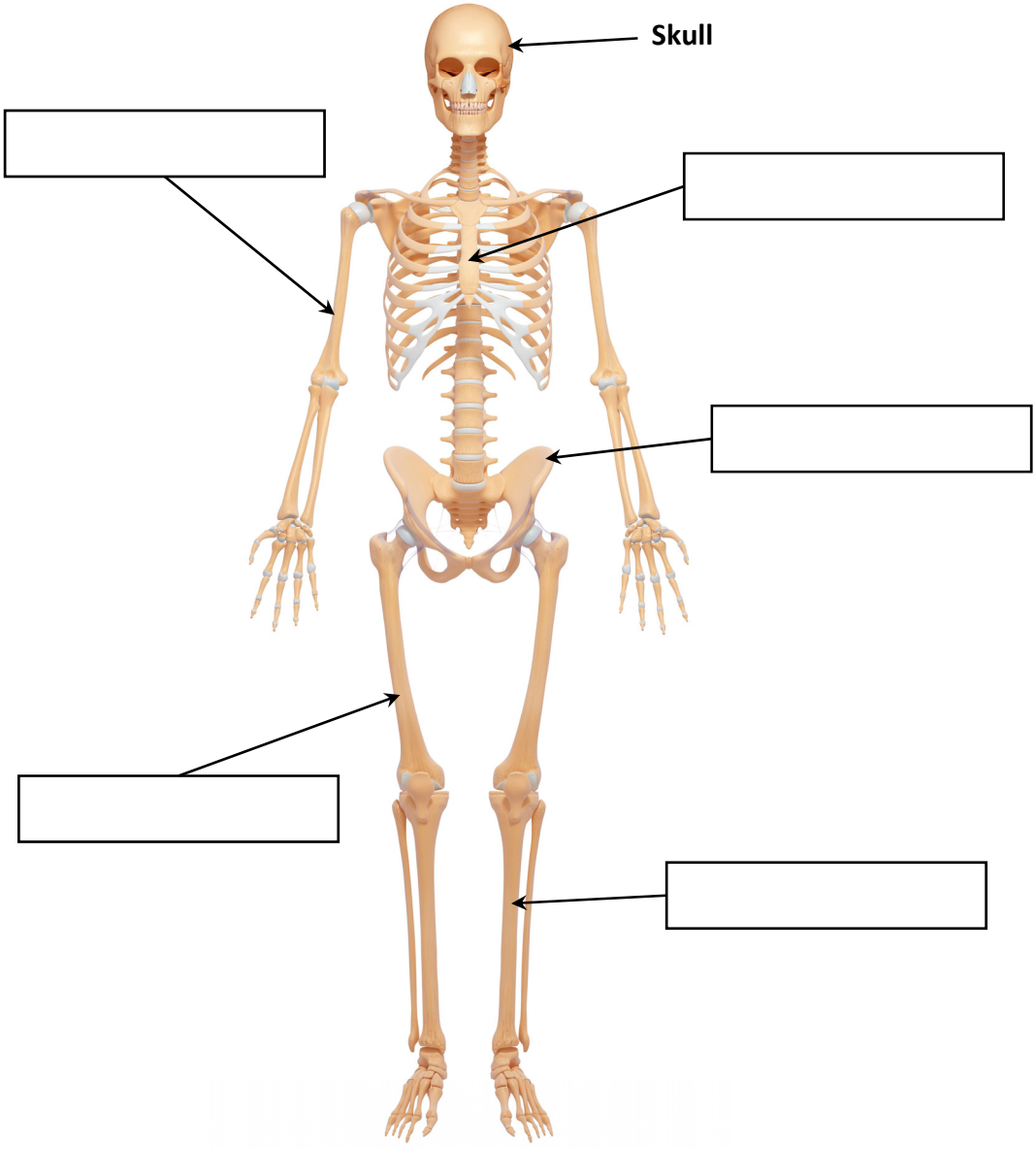
Question 5 **50 marks**

(a) The diagram below shows the human skeleton.

(i) Identify the **one** bone from the list below which is part of the **axial skeleton**, by **drawing a circle** around the name of the correct bone.

Humerus **Femur** **Sternum** **Pelvis** **Tibia**

(ii) On the diagram of the skeleton below, label the five bones listed above.

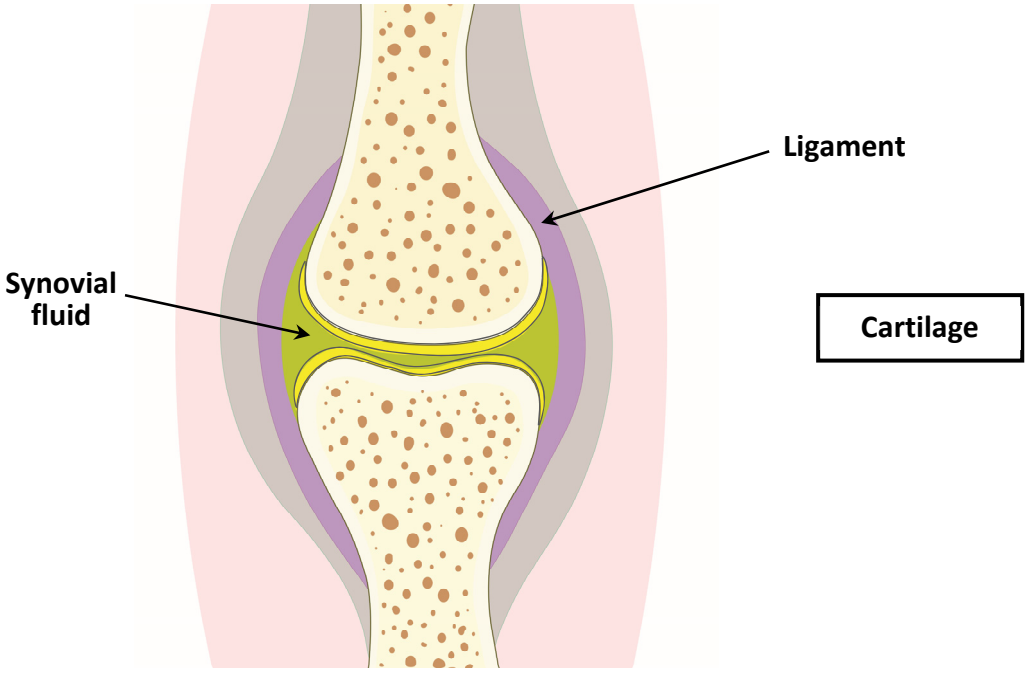


(iii) State the main function of the skull.

(iv) Discuss the importance of diet in relation to bone health.

(b) The diagram shows a synovial joint.

(i) **On the diagram below**, draw an arrow from the word **Cartilage** to show its correct location.



(ii) State the function of cartilage in a synovial joint.

(iii) What is the function of the ligaments in a synovial joint?

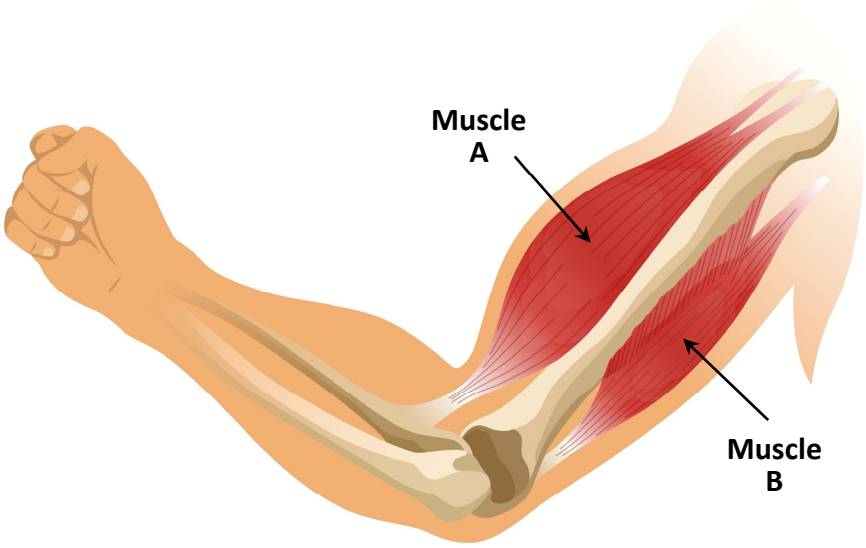
(c) Muscles can cause bones to move.

(i) Why are minerals, such as calcium, required by muscles?

(ii) Name any **two** muscles from an antagonistic muscle pair in the human body.

Muscle 1:
Muscle 2:

(iii) The diagram below shows an antagonistic muscle pair in the arm. Muscle **A** is contracted while muscle **B** is relaxed.



Describe what must happen to muscle **A and** to muscle **B** for the arm to be straightened.

(d) Motor neurons are nerve cells that are required for movement in the human body.

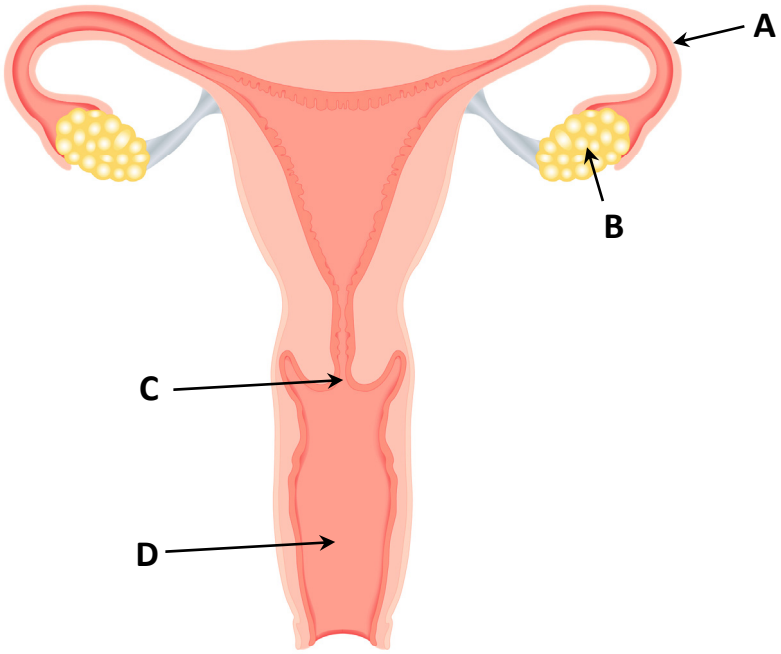
(i) **In the space below**, draw a diagram of a motor neuron.
Use the words listed below to correctly label the parts of the motor neuron.

Cell body	Dendrites	Axon	Schwann cell

(ii) **On your diagram**, draw an arrow to clearly show the direction of the nerve impulse.

Question 6 **50 marks**

(a) The diagram below shows the human female reproductive system.



Ovary	Fallopian tube	Cervix	Vagina

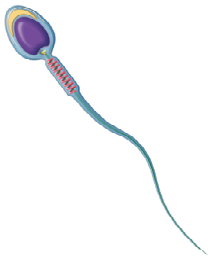
(i) Using the list above, complete the table below to identify the labelled parts **A**, **B**, **C and D** on the diagram.

Letter	Name of part of the female reproductive system
A	
B	
C	
D	

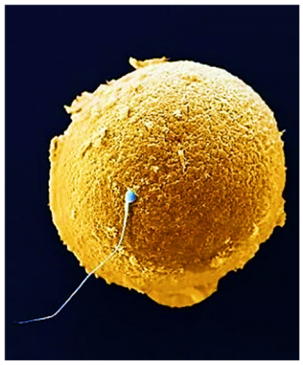
(ii) Match **each** statement in the table below with the correct location (letter) from the diagram above. **Note**: one letter is to be used more than once.

Statement	Letter from diagram
Meiosis occurs here	
Oestrogen and progesterone are produced here	
This part is also called the birth canal	
Fertilisation usually occurs here	

(b) **(i)** Sperm cells contain many mitochondria.
Suggest a biological reason for this.



(ii) During fertilisation, the head of the sperm enters the egg cell.
The head of the sperm contains a nucleus.
Identify how many chromosomes are present in the nucleus of a human sperm cell by placing a tick (✓) in the correct box.



46 chromosomes	
23 chromosomes	

(iii) After fertilisation a zygote is formed.
How many chromosomes are present in a human zygote?
Put a tick (✓) in the correct box.

46 chromosomes	
23 chromosomes	

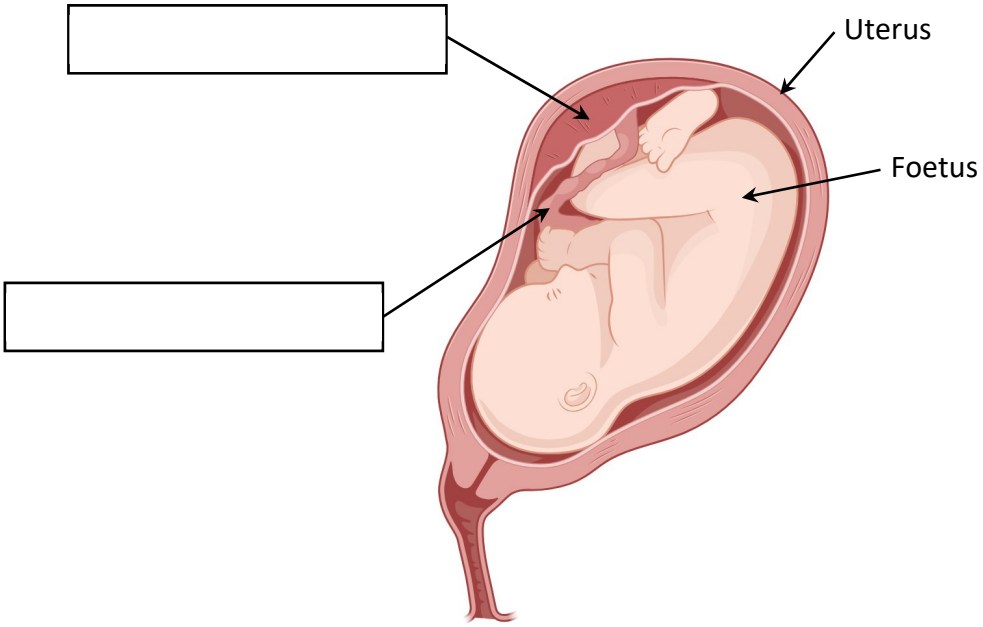
(c) **(i)** The following six stages occur during human reproduction.
Write the stages in the **correct order** by filling in boxes **2**, **4**, **5 and 6**.
Two have been completed as an example.

Fertilisation	Labour	*Placenta formation*
Implantation	Birth	Foetus growth

1.	*Fertilisation*
2.	
3.	*Placenta formation*
4.	
5.	
6.	

(ii) The diagram shows a foetus in the uterus (womb). Label the diagram, using the words provided in the table.

Placenta
Umbilical cord



(iii) Read the paragraph below and answer the questions that follow:

Throughout pregnancy the mother may avail of prenatal and postnatal care.

Prenatal visits to a healthcare provider usually include a physical exam and a urine sample test. Depending on the stage of pregnancy, healthcare providers also do blood tests and imaging tests such as ultrasound exams.

Adapted from hse.ie

State a reason why **any one** of the following are carried out at prenatal visits to a healthcare provider.
Put a tick (✓) in **one** box below to clearly indicate which one you have chosen.

Urine sample test		Ultrasound exam		Blood test	

(iv) Describe the events that occur in the hours before birth **and** in the hours that follow the delivery of the baby.

In the hours before birth:
In the hours after delivery:

(v) The image shows a human sperm cell being inserted into a human egg cell which occurs in a type of IVF (*in vitro* fertilisation) treatment.

Discuss why IVF treatment may be needed for pregnancy to occur.

Question 7 **50 marks**

(a) The images show three common foods.
The table below contains some nutritional information about these foods.

Cheddar cheese **White rice** **Butter**

	100 g Cheddar cheese	100 g White rice	100 g Butter
Total fat	33 g	< 1 g	81 g
Total carbohydrate	1 g	28 g	< 1 g
Total protein	25 g	3 g	< 1 g

(i) Identify the food above that is the best source of protein.

(ii) Identify the primary function of proteins in humans, by placing a tick (✓) beside the correct answer.

Energy source	
Growth and repair	

(iii) Carbon (C), hydrogen (H) and oxygen (O) are three of the elements found in proteins.
Name the fourth element that is **always** present in protein.

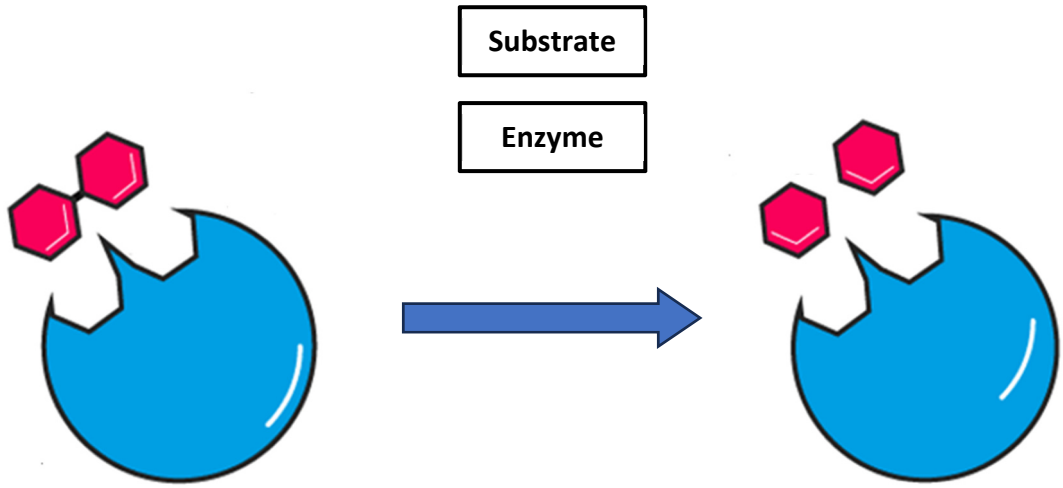
(iv) Name the cell structure where proteins are made.

(b) Enzymes are made of protein.

(i) Choose the correct statement which describes an enzyme by placing a tick (✓) in the correct box.

Enzymes are biological catalysts and are not used up in reactions	
Enzymes are biological catalysts and are used up in reactions	

(ii) The diagram below is a simple illustration of how an enzyme works.
On the diagram, draw an arrow from **each** box to identify the enzyme **and** substrate.



(iii) The rate of enzyme activity can be affected by many factors.
Name **one** factor that can affect the rate of enzyme activity.

(iv) During your studies you investigated how a factor affected the rate of enzyme-catalysed reactions. Describe how you carried out the investigation. You must include the name of the enzyme, its substrate and its product(s), the factor you investigated and how you measured the rate of reaction. You may use a labelled diagram.

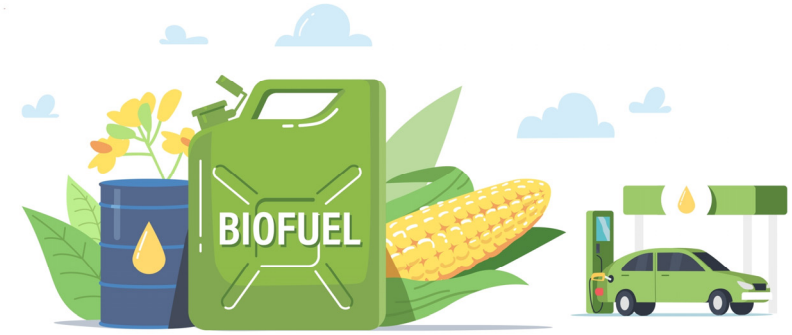
Factor investigated:

Labelled diagram:

(c) Read the passage below and answer the questions that follow.

Food processing generates waste that is rich in lipids, carbohydrates and protein. These compounds are valuable if transformed into biofuels and ingredients for animal feed. Enzymes are needed to convert the waste into these useful products. The conditions required to change the waste into more useable compounds can be less than ideal for the enzymes. Enzyme immobilisation can allow enzymes to work in these non-ideal environments.

Adapted from *Andler and Goddard, 2018*, npj Science of Food, nature.com



(i) Explain the underlined term.

(ii) What is an immobilised enzyme?

(iii) Apart from allowing enzymes to work in non-ideal environments, state **one** advantage of using immobilised enzymes.

Additional writing space.
Label all work clearly with the question number and part.

Additional writing space.
Label all work clearly with the question number and part.

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

Acknowledgements:

Images/graphs/diagrams:

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Image on page 4:	alamy.com
Diagram on page 5:	alamy.com
Image on page 6:	dreamstime.com
Diagram on page 7:	mypathologyreport.ca
Graph on page 8:	Adapted from *Measles Annual Epidemiological Report for 2023* – ecdc.europa.eu
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Texts/data:

Text on page 8:	Adapted from *Measles Annual Epidemiological Report for 2023* – ecdc.europa.eu
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Data on page 28:	Adapted from usda.gov
Text on page 31:	Adapted from Andler and Goddard, 2018, Transforming food waste: how immobilized enzymes can valorize waste streams into revenue streams, npj Science of Food, nature.com

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Leaving Certificate Examination – Ordinary Level

Biology

Sample 1

2 hours 30 minutes