2025.M44

2025L025A1EL

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2025

Biology

Sections A and B and Answerbook

Higher Level

Tuesday 10 June Afternoon 2:00 - 5:00

400 marks

Examination Number

Date of Birth

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

Centre Stamp

Instructions

Write your Examination Number and your Date of Birth in the boxes on the front cover.

Write your answers to all parts of the examination into this answerbook. This answerbook will be scanned and your work will be presented to an examiner on screen. Anything that you write outside of the answer areas may not be seen by the examiner.

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

There are three sections in this examination. Questions for Section **C** are supplied separately but your answers must be written in this answerbook.

It is recommended that you spend not more than 30 minutes on Section **A** and 30 minutes on Section **B**, leaving 120 minutes for Section **C**.

Section **A**	Answer any **five** questions from this section. Each question carries 20 marks.
Section **B**	Answer any **two** questions from this section. Each question carries 30 marks.
Section **C**	Answer any **four** questions from this section. Each question carries 60 marks.

Section A

Answer any five questions.
Write your answers in the spaces provided.

1. Answer any **five** of the following parts (a) to (f):

(a) Write the general formula for carbohydrates.

(b) Give the **four** chemical elements found in **all** proteins.

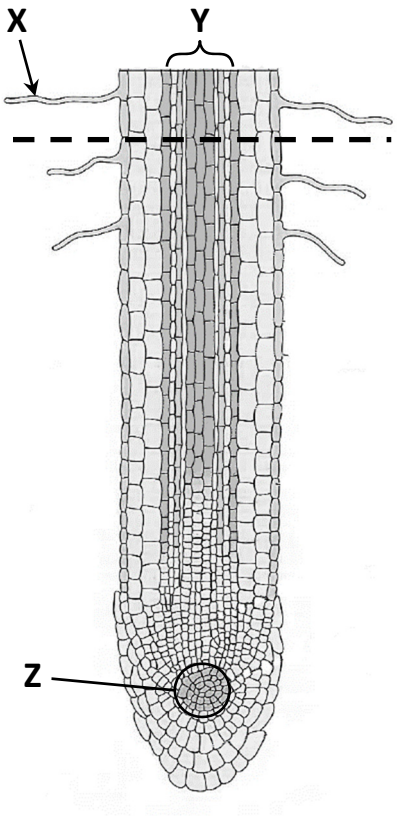
(c) State **one** structural role of proteins in the body.

(d) Name the small subunits that make protein.

(e) Name **one** water-soluble vitamin.

(f) Give **one** example of a trace element found in food.

2. The diagram shows a longitudinal section through the root of a plant.



(a) Name the structure indicated by the letter **X and** give its function.

Name:
Function:

(b) Name the tissue type indicated by the letter **Y and** give its function.

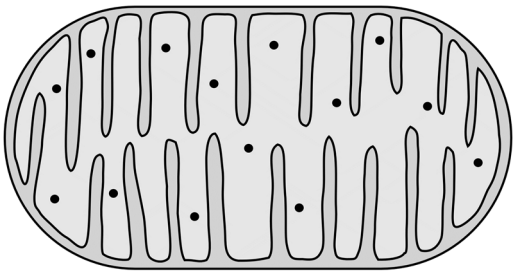
Name:
Function:

(c) Name the tissue indicated by the letter **Z** where rapid mitosis is occurring.

(d) In the space below, draw **and** label a transverse section of the root as it would appear if it was cut at the position of the dashed line (-------) in the diagram above.

Labelled diagram:

3. Aerobic respiration is a two-stage process.
Stage 2 occurs in the cell organelle shown.



(a) Name the cell organelle shown.

(b) Name the cycle of reactions that occurs in stage 2 of aerobic respiration.

(c) ATP is produced in large quantities by aerobic respiration.
What does ATP stand for?

(d) NAD^+ is an important molecule in respiration.
Give the function of NAD^+.

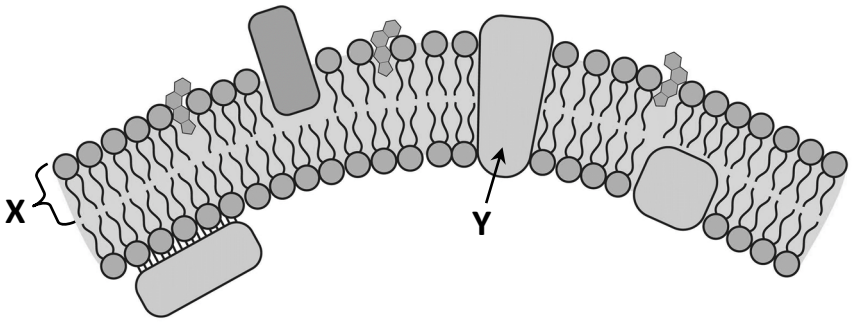
Anaerobic respiration may occur under certain conditions.

(e) Suggest a condition under which anaerobic respiration might occur.

(f) State where anaerobic respiration occurs in a cell.

(g) Name **one main** product of anaerobic respiration.

4. The diagram below shows part of the ultrastructure of a cell membrane.



(a) Name the parts labelled **X** and **Y**.

X:
Y:

(b) Give a function of the cell membrane.

(c) **(i)** What term describes cells **without** membrane-bound organelles?

(ii) What term describes cells **with** membrane-bound organelles?

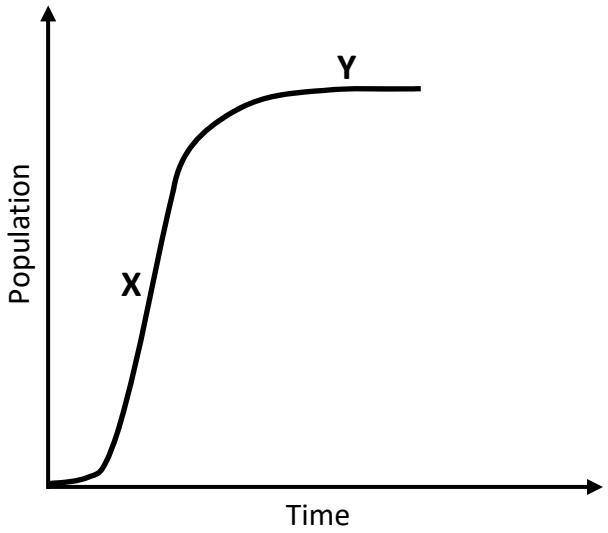
(d) Plant cells have a cell wall in addition to a cell membrane.

(i) Sketch the basic structure of a plant cell clearly labelling the cell membrane **and** the cell wall.

Sketch:

(ii) Give **one** function of a plant cell wall.

5. The image shows a piece of equipment that may be used in food processing.
Food processing is a type of bioprocessing involving enzymes and/or microorganisms.
The graph shows the population growth curve of a species of bacteria in the piece of equipment shown.



(a) What is the common name given to this piece of equipment?

(b) Name **two** factors controlled by the piece of equipment shown that could affect the growth of bacteria, other than nutrient availability.

1.
2.

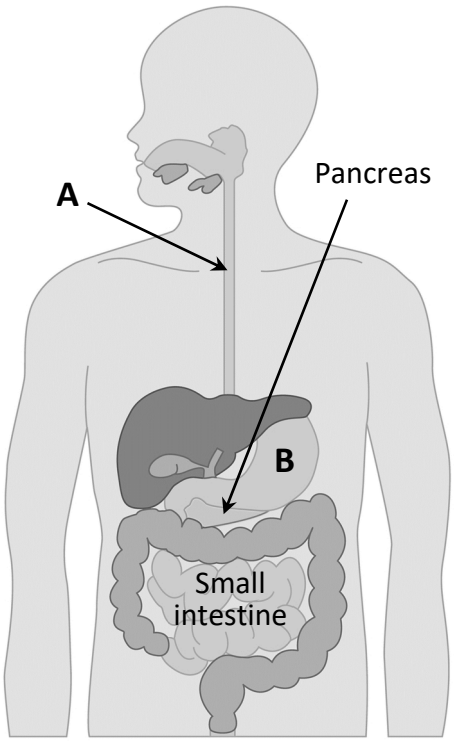
(c) Name the **two** stages **X** and **Y** on the population growth curve.

X:
Y:

(d) The piece of equipment is keeping the population of bacteria steady in growth phase **Y**.
Which type of food processing technique is represented by the growth curve shown?

(e) If the population of bacteria in the piece of equipment above were to run out of nutrients, draw **on the graph above** to show how the line would continue.

6. The diagram shows the human digestive system.



(a) Name the parts labelled **A** and **B**.

A:
B:

(b) Name **and** describe briefly the method by which food travels through structure **A**.

Name:
Describe:

(c) How does the pH of the food material change as it travels from **A** to **B**?

(d) Name the enzyme produced in the pancreas which digests lipids.

(e) The villus is present in the small intestine.
In the space below, draw **and** label the internal structure of a villus.

Labelled diagram:

7. Answer the following questions in relation to the scientific method.

(a) In the scientific method, a testable statement is known as a _____.
Write the missing word in the box below.

(b) How can this statement be tested?

(c) What is the function of a scientific control?

(d) Give **two** limitations of the scientific method.

1.
2.

(e) Where does a biologist normally publish their results?

(f) What is meant by the term *theory*?

Section B

Answer any two questions.
Write your answers in the spaces provided.
Part (a) carries 6 marks and part (b) carries 24 marks in each question in this section.

8. **(a)** **(i)** What is meant by the term *ecosystem*?

(ii) What could aid ecologists in identifying organisms in a study of an ecosystem?

(b) Answer the following questions based on your study of a sample area of a selected ecosystem.

(i) Describe how you carried out a quantitative study of a **named** *plant* species.

Name of plant species:
Describe:

(ii) Name any **two** abiotic factors you have investigated as part of your study **and** outline how you measured **each** factor.

Name:	Name:
Outline:	Outline:

9. **(a)** Explain the term *osmosis*.

(b) Answer the following questions in relation to a laboratory activity you carried out to demonstrate osmosis.

(i) Name the tissue **or** membrane that you used in the activity.

(ii) Describe how you carried out this activity, including the result.
You may include a labelled diagram if you wish.

Describe:

Labelled diagram:

10. **(a)** **(i)** To which kingdom of living organisms do yeast belong?

(ii) Working with microorganisms often involves sterility. Explain the term *sterility*.

(b) Answer the following questions in relation to an investigation you carried out to grow leaf yeast.

(i) Describe how you set up the investigation. Include **one** safety precaution. You may include a labelled diagram if you wish.

Describe:

Labelled diagram:

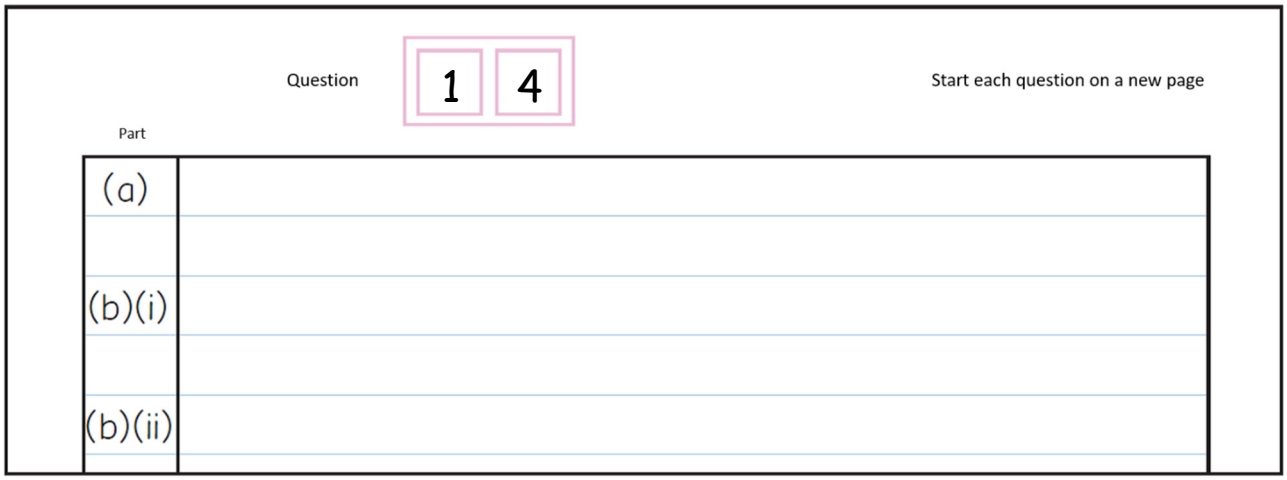
(ii) Describe the result of the investigation, assuming the leaf yeast grew successfully.

Answerbook for Section C

Instructions

Questions for Section **C** are supplied separately.

Start each question on a new page. Write the question number in the box at the top of each page. Use the left-hand column to label each part, as shown below.



There are two pages of graph paper on the next two pages of this answerbook.
On pages with graph paper, the box for the question number is at the bottom of the page.

You do not need to use all of the pages in this answerbook. If you run out of space in this answerbook, you may ask the superintendent for more paper or graph paper.

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

Question

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Start each question on a new page

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Acknowledgments:

Images/graphs/diagrams:

Diagram on page 4:	Adapted from Taiz L, Zeiger E (1998), Plant physiology, 2nd Ed., Sinauer Associates, Sunderland, MA.
Diagram on page 5:	State Examinations Commission
Diagram on page 6:	alamy.com
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Leaving Certificate – Higher Level

Biology Sections A and B and Answerbook

Tuesday 10 June

Afternoon 2:00 - 5:00

2025.M44

2025L025A2EL

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2025

Biology

Section C

Higher Level

Tuesday 10 June Afternoon 2:00 - 5:00

400 marks

Do not hand this up.

This document will not be returned to the State Examinations Commission.

Section C

Answer any four questions.

Write your answers in the answerbook containing Sections A and B.

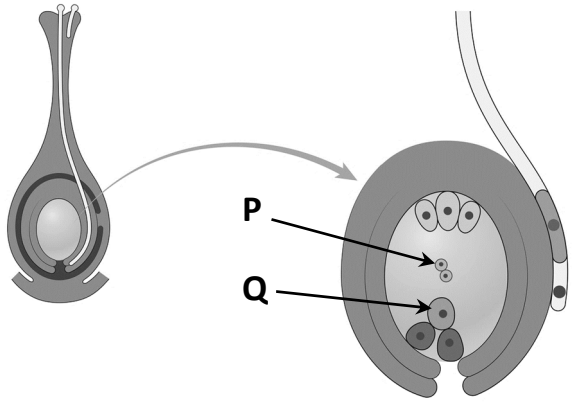
11. **(a)** Tropisms are important for plants.

(i) What is geotropism?

(ii) Name a part of a plant that responds positively to geotropism.

(iii) How does this growth response benefit plants? **(9)**

(b) The diagram shows the arrangement of the cells and nuclei of a mature embryo sac in a flowering plant.



(i) Give the collective name for:

1. The male reproductive parts of the flower.

2. The female reproductive parts of the flower.

(ii) Name the specific part of the flower that holds the embryo sac.

(iii) The embryo sac develops from a single diploid cell. Name this cell.

(iv) Name the parts labelled **P** and **Q** in the embryo sac that are involved in double fertilisation.

(v) Explain why parts **P** and **Q** are genetically identical.

(vi) State what **each** of the parts **P** and **Q** develop into **after** double fertilisation. **(27)**

(c) Sexual reproduction results in seed formation followed by seed dispersal and dormancy.

(i) Name **two** methods by which seeds are dispersed.

(ii) Give **two** advantages of seed dispersal to a plant species.

(iii) Give **two** advantages of dormancy to a plant species.

(iv) Some plants reproduce asexually by means of vegetative propagation.

1. Give **one** example of a plant that reproduces asexually using **leaves**.

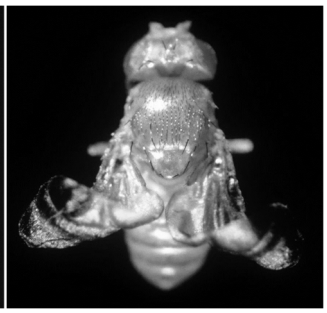
2. Give **one** example of a plant that reproduces asexually using **buds**. **(24)**

12. **(a)** **(i)** Explain the term *mutation*.

(ii) Give **two** causes of mutations. **(9)**

(b) In fruit flies, the genes for body colour and wing type are located on **different** chromosomes.
The allele for **ebony** body (**E**) is dominant over the allele for **black** body (**e**) and the allele for **normal** wing (**N**) is dominant over the allele for **curly** wing (**n**).

Fruit fly with **ebony** body and **normal** wing



Fruit fly with **black** body and **curly** wing

(i) Distinguish between the terms, *gene* **and** *allele*.

(ii) **1.** Using the letters mentioned above, give the genotype of a fruit fly with **ebony** body and **normal** wing, heterozygous for both characteristics.

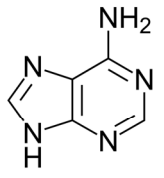
2. Give the genotype of a fruit fly with a **black** body and **curly** wings.

3. Give all the possible genotypes **and** matching phenotypes of the offspring of a cross between the two flies described in (iii) 1. and 2. above.

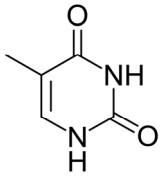
(iii) What term is used for genes found on the **same** chromosome? **(27)**

(c) **(i)** DNA contains a pattern of bases which stores hereditary information inside the cell. What do the letters DNA stand for?

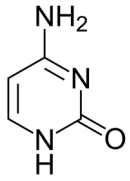
(ii) Adenine, thymine, cytosine and guanine are the four DNA bases shown in the diagram.
State which **two** are purines **and** which **two** are pyrimidines.



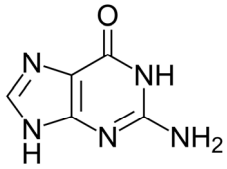
Adenine (A)



Thymine (T)



Cytosine (C)



Guanine (G)

(iii) Human cells contain both DNA and RNA.
State any **one** structural difference between DNA **and** RNA.

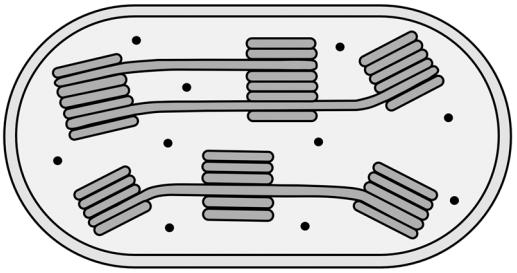
(iv) DNA profiling can be used to identify DNA left behind at a crime scene.
Describe the **four** main steps in creating a DNA profile. **(24)**

13. **(a)** Metabolic reactions can be classified as anabolic **or** catabolic.

(i) Explain why photosynthesis is an example of an anabolic reaction.

(ii) Write a balanced chemical equation to represent photosynthesis. **(9)**

(b) During photosynthesis chlorophyll absorbs light energy.



(i) Name the cell organelle shown in the diagram in which chlorophyll is located.

(ii) Name the energised particles released by chlorophyll.

(iii) These particles can enter one of two pathways which are known as pathway 1 and pathway 2.
State the difference between **each** of these **two** pathways **in terms of energised particle movement only**.

(iv) Two products of the light-dependent stage enter the light-independent stage.
Name the **two** products **and** describe **each** of their roles.

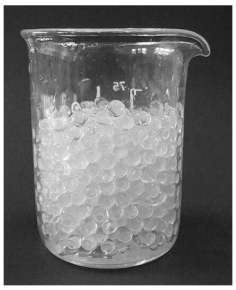
(v) Name the **two** products of the light-independent stage that are regenerated and used in the light-dependent stage. **(27)**

(c) Enzymes control metabolic reactions, such as respiration and photosynthesis.

(i) Briefly describe enzymes under the following headings:

1. Biochemical nature

2. Shape.



(ii) Based on the biochemical nature of enzymes, name the cell component where enzymes are made.

(iii) Enzymes can be <u>denatured</u>.
Explain the underlined term **and** state **one** way in which an enzyme can be denatured.

(iv) Enzymes can be immobilised, an example of which is shown in the image.
Describe a method of enzyme immobilisation. **(24)**

14. **(a)** The nervous system is composed of a central nervous system (CNS) and a peripheral nervous system (PNS).

(i) Distinguish between the *central nervous system* **and** *peripheral nervous system*.

(ii) Name **one** way in which the human central nervous system is protected. **(9)**

(b) The eye and the ear are both sense organs that detect external stimuli.

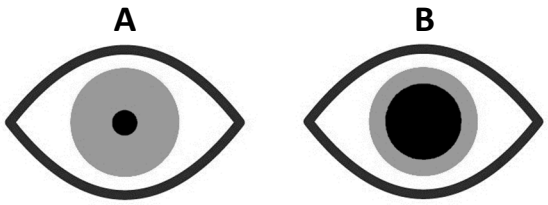
(i) Describe the role of **each** of the following in the eye:

1. Cornea

2. Retina

3. Optic nerve

4. Lens.



(ii) The diagram shows two eyes.
Which eye (**A** or **B**) is exposed to low light levels?
Justify your answer.

(iii) Describe the role of **each** of the following in the ear:

1. Ossicles

2. Cochlea

3. Eustachian tube.

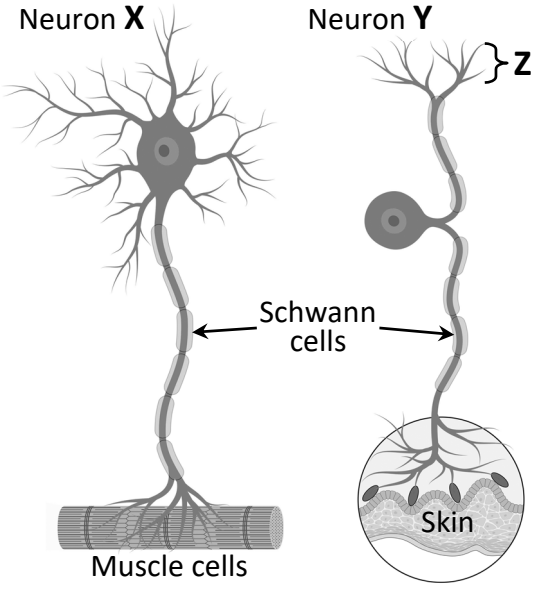
(iv) Describe **one** corrective measure for **one** of the following: long sightedness **or** short sightedness **or** a hearing defect.
In your answer, state clearly to which disorder you are referring. **(27)**

(c) Neurons are the functional unit of the nervous system.

(i) The diagrams show two neurons (**X** and **Y**).

1. Which neuron (**X** or **Y**) is a motor neuron?
Justify your answer.

2. Which neuron (**X** or **Y**) is a sensory neuron?
Justify your answer.



(ii) Neurotransmitters are found at position **Z**.
Describe how neurotransmitters work.

(iii) Schwann cells are associated with both neurons.
What is the function of a Schwann cell?

(iv) In relation to Parkinson's disease **or** paralysis, give **one** possible cause **and** **one** possible treatment.
In your answer, state clearly to which disorder you are referring. **(24)**

15. **(a)** Explain the following **three** ecological terms:

(i) *Biosphere*

(ii) *Niche*

(iii) *Competition* **(9)**

(b) White-tailed sea eagles were once widespread on the island of Ireland, but numbers diminished as a result of hunting by humans.

One hundred white-tailed eagle chicks were brought from Norway and released into Killarney National Park in County Kerry as part of a rewilding project. However, experts say the birds still face many challenges in terms of repopulation. These include poisonings, bird flu and even wind turbines.

White-tailed sea eagles have well-developed and powerful flexor muscles in their legs and large sharp talons (claws) to capture prey. They hunt marine and freshwater fish (such as salmon), seabirds (such as gulls), hares and other small mammals.

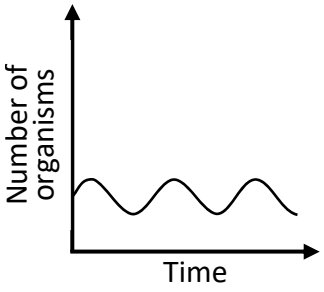
Adapted from *White-tailed eagles breed….*, breakingnews.ie 27 Sept 2024

(i) Distinguish between the terms, *predator* **and** *prey*.

(ii) Name an adaptation useful for the survival of the white-tailed sea eagle.

(iii) Name **one** human activity that impacts on the population of white-tailed sea eagles.

(iv) **1.** The graph shows the periodic changes in the number of white-tailed sea eagles over time in a habitat. **Copy the graph into your answerbook**. Then, using a dashed line (**- - - -**), draw a graph to show how the number of any **one** of its prey would vary over the same time period.



2. Give a detailed explanation of the graph that you have drawn for the prey species.

(v) Explain why food chains, such as the those involving the white-tailed sea eagle, are limited in length. **(27)**

(c) **(i)** The following processes occur in the nitrogen cycle.
Outline what is occurring during **each** process.

1. **Nitrogen fixation**

2. **Decomposition**

3. **Nitrification**

4. **Denitrification**

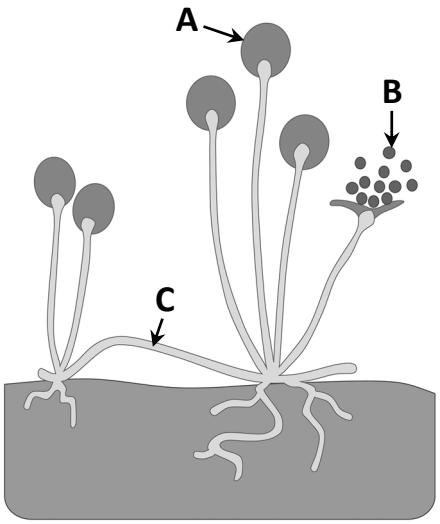
(ii) Pollution can affect the nitrogen cycle. What is pollution?

(iii) Name **and** state the effect of **one** pollutant from **one** of the following areas: agriculture **or** industry **or** domestic.

(iv) Describe how the pollutant you have named in part (iii) above may be controlled. **(24)**

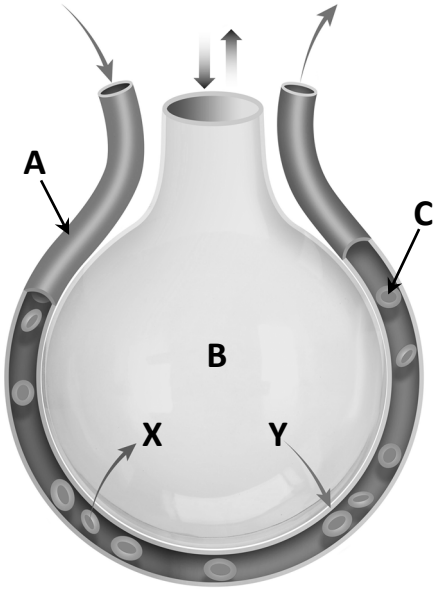
16. Answer any **two** of (a), (b), (c), (d). **(30, 30)**

(a) The diagram shows *Rhizopus*.



- **(i)** Name the structures **A**, **B** and **C**.
- **(ii)** Give **one** function of structure **C**.
- **(iii)** Name the method of nutrition used by *Rhizopus*.
- **(iv)** *Rhizopus* can reproduce sexually **and** asexually.
  - **1.** The *Rhizopus* shown in the diagram is reproducing asexually.
    What evidence is there in the diagram to support this statement?
  - **2.** Describe the process of sexual reproduction in *Rhizopus*.
- **(v)** Name a beneficial use **and** a harmful effect of fungi.

(b) The diagram shows gases **X** and **Y** and their main directions of movement at the site of gas exchange in the lungs.



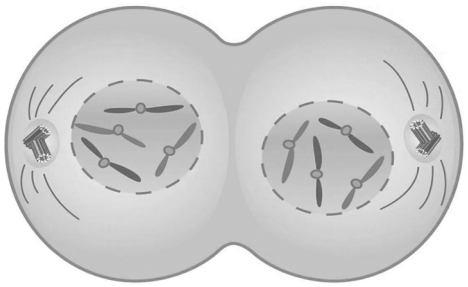
- **(i)** Name the structures **A** and **B**, **and** the type of blood cell labelled **C**, that transports a gas around the body.
- **(ii)** Give **one** way structure **B** is adapted for its function in gas exchange.
- **(iii)**
  - **1.** Oxygen and carbon dioxide are two gases that are exchanged between structures **A** and **B**. Match **each** gas to the letters **X** and **Y**, based on their **main directions** of movement.
  - **2.** What term describes the movement of these gases?
- **(iv)** Name **two** muscles that are directly involved in inhalation.
- **(v)** Describe the changes that occur in the chest during exhalation.
- **(vi)** Give **one** treatment for **one** of the following breathing disorders: bronchitis **or** asthma.
  In your answer, state clearly to which disorder you are referring.

(c) The cell cycle involves interphase and mitosis.

(i) What is interphase?

(ii) Name a cell activity that occurs during interphase.

(iii) The diagram shows a stage of mitosis.



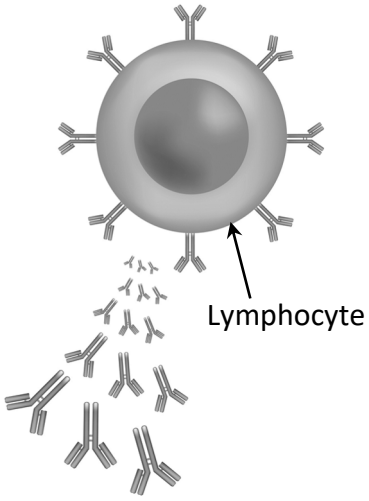
1. Name the stage shown.

2. What is the diploid number of this cell?

3. Draw a series of labelled diagrams of this cell as it would appear during the **other three** stages of mitosis.

(iv) Meiosis is another type of cell division.
Give **two** ways in which meiosis is different to mitosis.

(d) **(i)** Lymphocytes, such as the one shown in the diagram, mature in the lymphatic system, which is part of the human defence system.



1. Name **two** organs of the lymphatic system.

2. Other than maturation of lymphocytes, give **two** functions of the lymphatic system.

(ii) Lymphocytes play a role in the specific defence system.
State the precise location in the body where lymphocytes are produced.

(iii) Name **two** types of lymphocyte **and** describe the role of **each**.

(iv) Explain the term *vaccination*.

17. Answer any **two** of (a), (b), (c), (d). **(30, 30)**

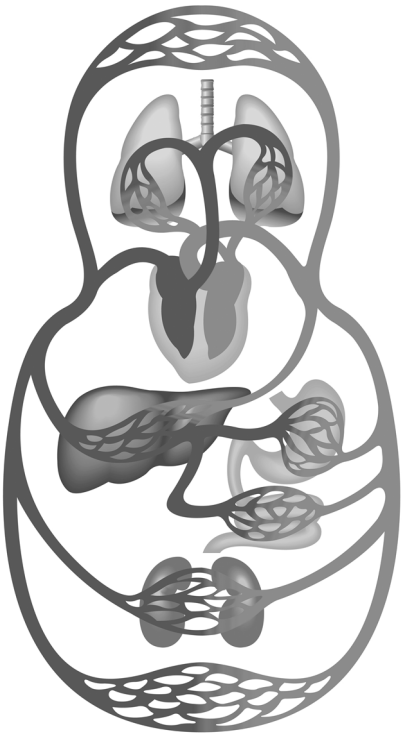
(a) **(i)** Using the diagram as an aid, answer the following questions:

1. The human circulatory system has two circuits. Name **both** circuits.

2. Which of these circuits receives blood from the left ventricle?

3. Name the blood vessel that is carrying blood highest in oxygen.

4. Name the blood vessel that is carrying blood highest in nutrients.



(ii) State the precise function of the following in the heart:

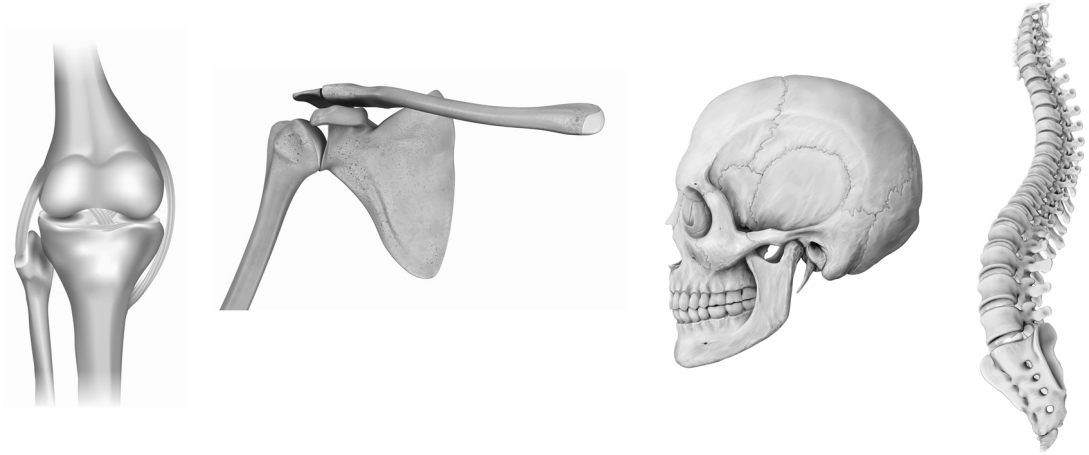
1. Sino-atrial (SA) node

2. Septum

(iii) What term is used to describe the period of time during which the heart muscle is contracting?

(iv) Give **two** structural differences between arteries and veins.

(b) The diagrams show some types of joints of the human skeleton.



(i) Name **any three** types of joint found in the human skeleton **and** give a **matching** precise location for **each** type.

(ii) Antagonistic muscle pairs are associated with the skeleton.
Name **any one** antagonistic muscle pair **and** describe how it functions in creating movement.

(iii) Sketch the internal structure of a long bone **and** label at least **three** parts.

(c) Homeostasis is an important process in living organisms.

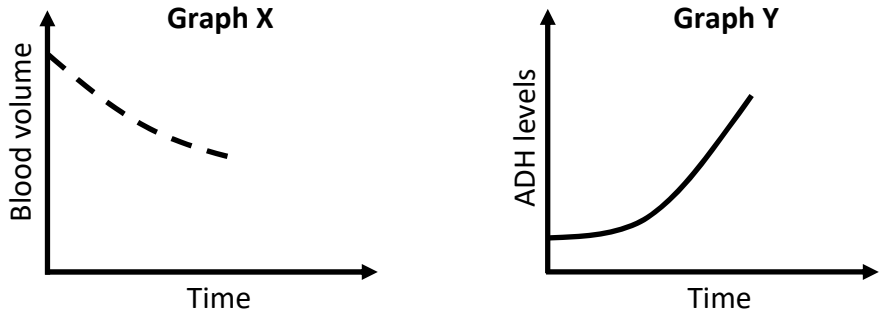
(i) Explain the underlined term.

(ii) ADH (anti-diuretic hormone) is an important hormone in homeostasis. Name the endocrine gland that secretes ADH.

(iii) Name **one** specific part of the nephron (functional unit of the kidney) that ADH affects.

(iv) What effect does increased ADH have on the volume of urine produced by the kidneys?

The graphs (**X** and **Y**) show the relationship between blood volume and ADH levels in an athlete's body over the **same** period of time. The athlete is exercising vigourously.



(v) Using the information given in the description above **and** from analysing the graphs, answer the following questions.

1. State the relationship between blood volume **and** ADH levels in this case.

2. Suggest how the athlete might increase their blood volume back to normal.

3. Copy graph **Y into your answerbook and** continue the line to show how ADH levels would change if the athlete brought their blood volume back to normal after exercising.

The skin of the athlete is also involved in homeostasis during vigourous exercise.

(vi) State **two** ways the skin can help the athlete's homeostasis.

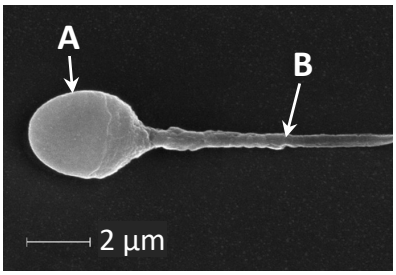
(d) **(i)** Draw the structure of the human male reproductive system **and** label at least **three** parts. **On your diagram**, write the letters **X**, **Y** and **Z** to indicate where **each** of the following occurs:

1. Sperm production (**X**)

2. Sperm storage (**Y**)

3. Seminal fluid production (**Z**)

(ii) The image shows an electron micrograph of a sperm cell. Name parts **A** and **B and** give **one** role for **each** part.



(iii) What is the approximate survival time for sperm cells following copulation?

(iv) Where does fertilisation usually occur in the female?

(v) Give **one** cause of infertility **and** describe a corrective measure.

Acknowledgements:

Images/graphs/diagrams/pictures:

Diagram on page 2:	dreamstime.com
Images of fruit flies on page 3:	alamy.com
Diagram of DNA bases on page 3:	alamy.com
Diagram on page 4:	State Examinations Commission
Image in Q13 (c) on page 4:	Tess Watson, flickr.com
Diagram in Q14 (b) on page 5:	Adapted from nei.nih.gov
Diagrams of neurons on page 5:	alamy.com
Image of sea eagle on page 6:	christophmueller.org
Graph on page 6:	State Examinations Commission
Diagram in Q16 (a) on page 7:	shutterstock.com
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Diagram in Q16 (d) on page 8:	dreamstime.com
Diagram in Q17 (a) on page 9:	shutterstock.com
Pictures in Q17 (b) on page 9:	dreamstime.com; alamy.com
Graphs in Q17 (c) on page 10:	State Examinations Commission
Image in Q17 (d) on page 10:	Zhu, WJ. (2020). Atlas of Human Sperm Ultrastructural Morphology. Springer, Singapore. https://doi.org/10.1007/978-981-15-5325-7_2

Text:

Text on page 6:	Adapted from *White-tailed eagles breed in Northern Ireland for first time in 150 years*, by Rebecca Black, PA Media, published by breakingnews.ie 27 September 2024

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Leaving Certificate – Higher Level

Biology Section C

Tuesday 10 June

Afternoon 2:00 - 5:00