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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

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Section C

Answer any four questions.

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

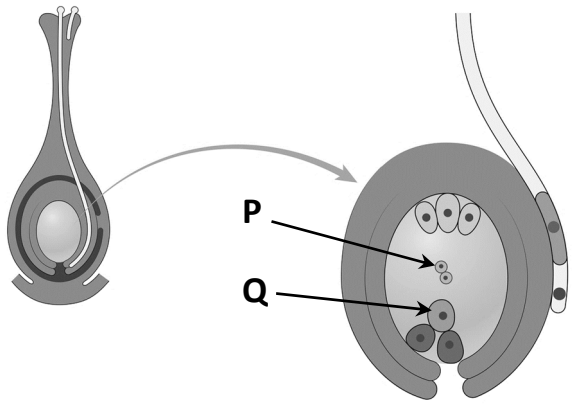
11. **(a)** Tropisms are important for plants.

(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**.

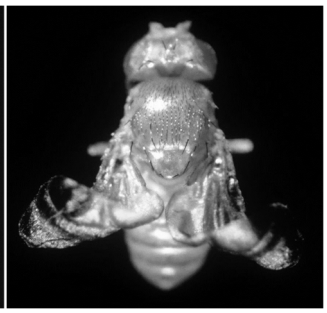
2. Give **one** example of a plant that reproduces asexually using **buds**. **(24)**

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.

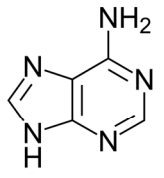
2. Give the genotype of a fruit fly with a **black** body and **curly** wings.

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.

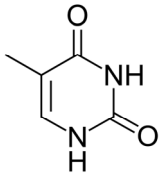
(iii) What term is used for genes found on the **same** chromosome? **(27)**

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

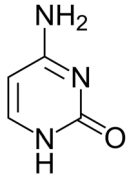
(ii) Adenine, thymine, cytosine and guanine are the four DNA bases shown in the diagram.
State which **two** are purines **and** which **two** are pyrimidines.



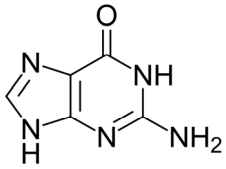
Adenine (A)



Thymine (T)



Cytosine (C)



Guanine (G)

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

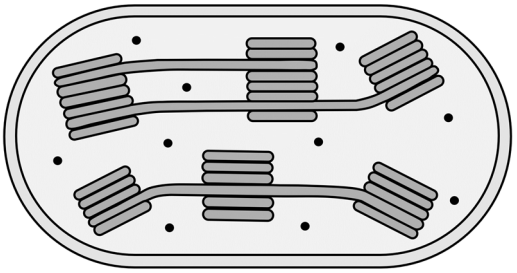
(iv) DNA profiling can be used to identify DNA left behind at a crime scene.
Describe the **four** main steps in creating a DNA profile. **(24)**

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.

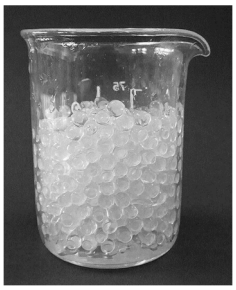
(v) Name the **two** products of the light-independent stage that are regenerated and used in the light-dependent stage. **(27)**

(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:

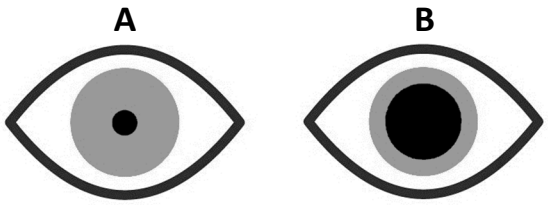
1. Cornea

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.

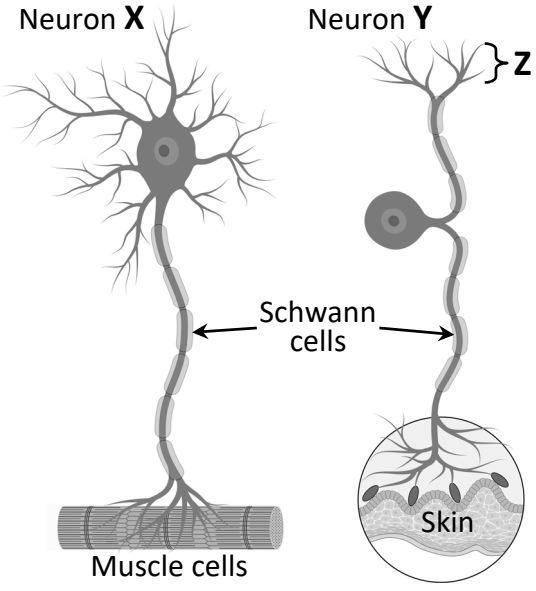
(iv) Describe **one** corrective measure for **one** of the following: long sightedness **or** short sightedness **or** a hearing defect.
In your answer, state clearly to which disorder you are referring. **(27)**

(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.

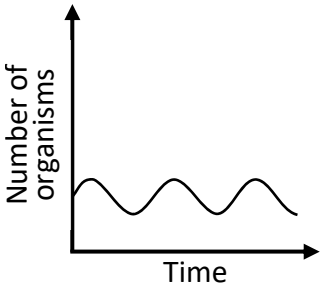
Adapted from *White-tailed eagles breed….*, breakingnews.ie 27 Sept 2024

(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**

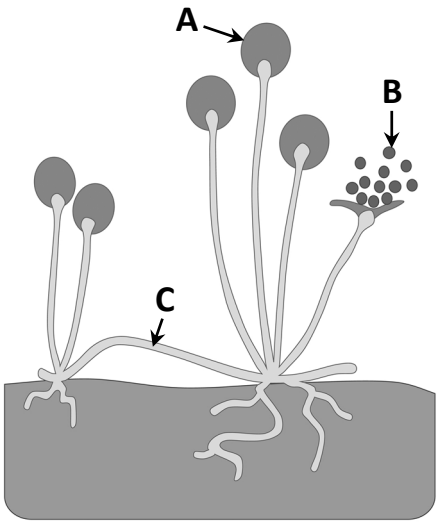
(ii) Pollution can affect the nitrogen cycle. What is pollution?

(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)**

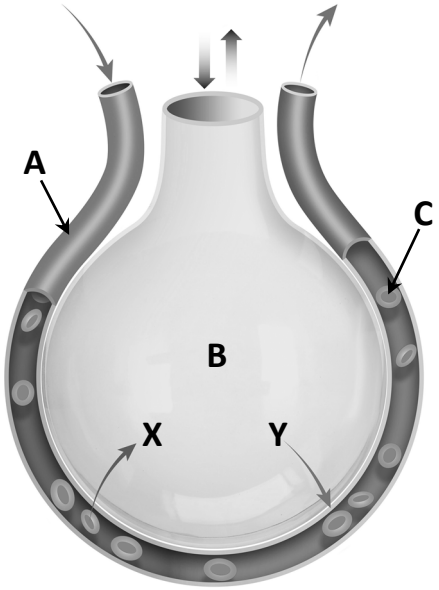
16. Answer any **two** of (a), (b), (c), (d). **(30, 30)**

(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.



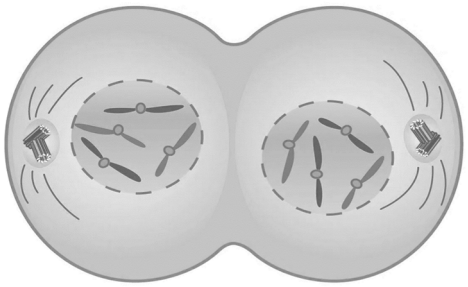
- **(i)** Name the structures **A** and **B**, **and** the type of blood cell labelled **C**, that transports a gas around the body.
- **(ii)** Give **one** way structure **B** is adapted for its function in gas exchange.
- **(iii)**
  - **1.** Oxygen and carbon dioxide are two gases that are exchanged 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.



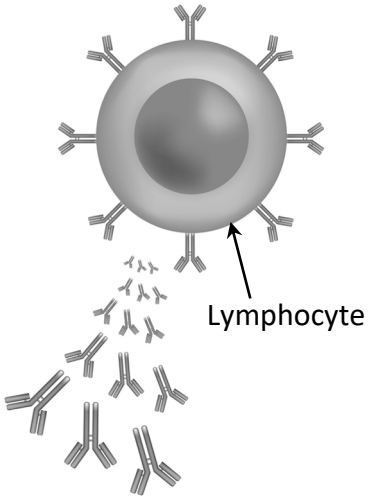
1. Name the stage shown.

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)**

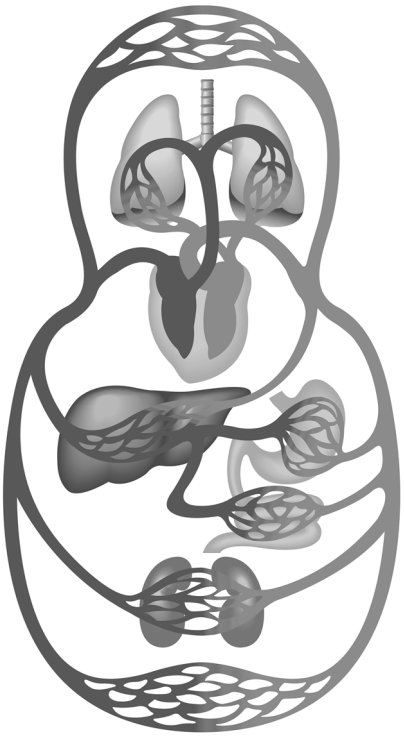
(a) **(i)** Using the diagram as an aid, answer the following questions:

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:

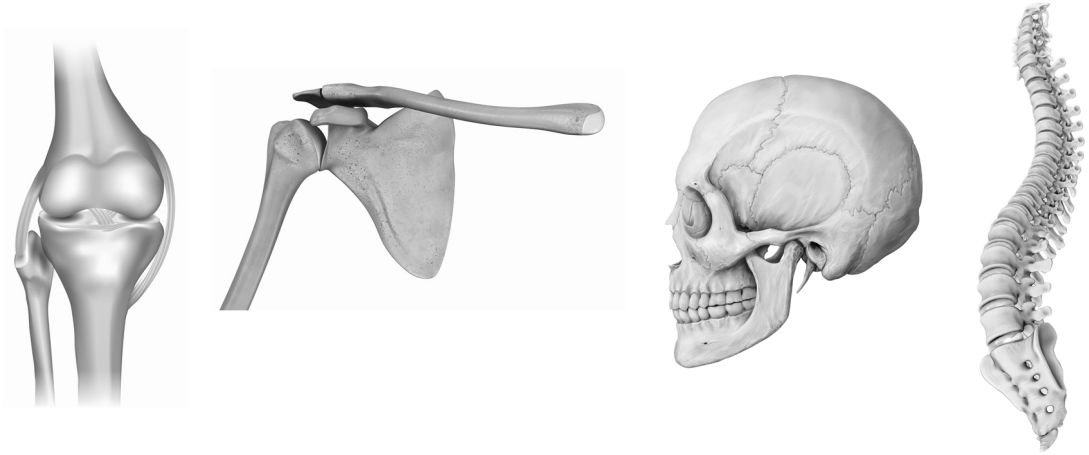
1. Sino-atrial (SA) node

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.

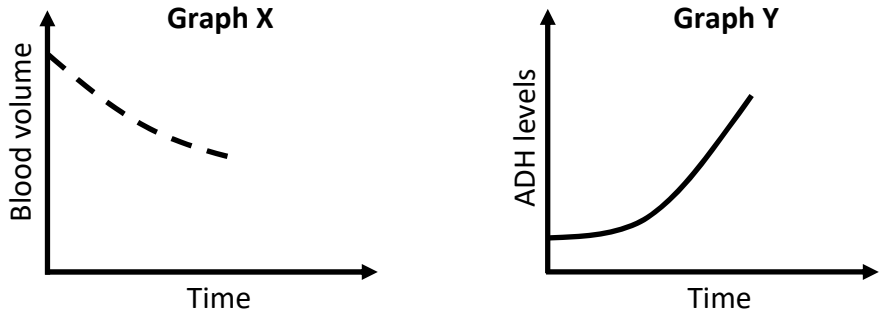
(i) Explain the underlined term.

(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.

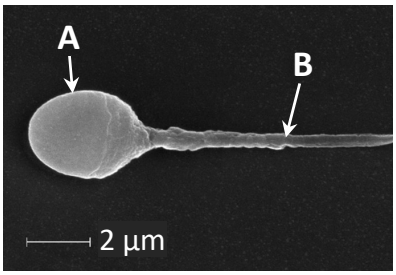
(d) **(i)** Draw the structure of the human male reproductive system **and** label at least **three** parts. **On your diagram**, write the letters **X**, **Y** and **Z** to indicate where **each** of the following occurs:

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
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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