2025.M44K
(deferred examination)

2025L025A2EK

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2025

Biology

Section C

Higher Level

3 hours

240 marks

This document must be handed up at the end of the examination.

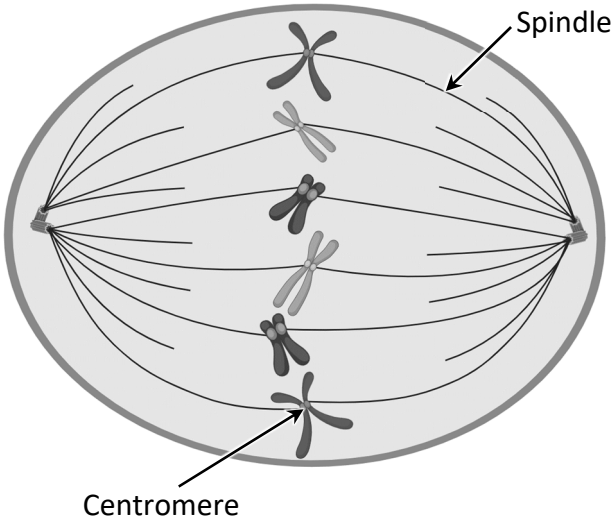
Section C

Answer any four questions.
Write your answers in the answerbook containing Sections A and B.

11. **(a)** **(i)** Write a balanced equation to represent aerobic respiration.
(ii) In which cell organelle does aerobic respiration occur? **(9)**

(b) Aerobic respiration occurs in two stages – stage 1 and stage 2.
(i) Give the name of stage 1.
(ii) State the location in the cell where stage 1 occurs.
(iii) What is the main product of stage 1?
(iv) The product you named at part (b) (iii) above may enter stage 2.
1. Describe in detail the events of stage 2.
2. Under certain conditions, this product may not enter stage 2.
Give a reason why it may not enter stage 2 **and** outline what happens to this product. **(27)**

(c) Mitosis is a type of cell division. The diagram shows a diploid cell during metaphase of mitosis, where the chromosomes line up on the equator of the cell.



(i) Explain the term *diploid*.
(ii) What is the diploid number of this cell?
(iii) Give a role for **each** of the **two** parts labelled in the diagram.
(iv) Name the stage of mitosis that occurs immediately after metaphase **and** draw a diagram to illustrate this stage.

Meiosis is another type of cell division.
(v) **1.** Give a role of meiosis in multicellular organisms.
2. Describe **one** difference between meiosis **and** mitosis. **(24)**

12. **(a)** DNA is a nucleic acid found in all living cells.

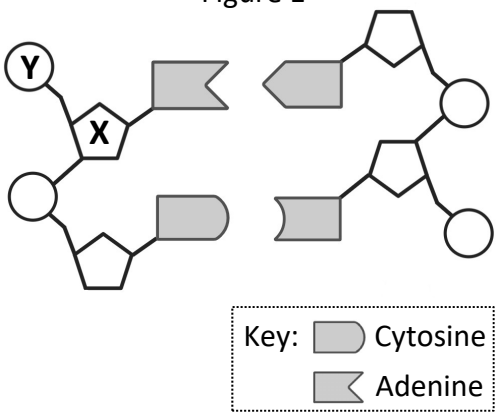
(i) What term describes the shape of a DNA molecule?

(ii) DNA is organised into chromosomes.
What other biomolecule makes up chromosomes?

(iii) How many chromosomes are in a diploid human cell? **(9)**

(b) Figure 1 shows a diagram of a short section of a DNA molecule.
The diagram is incomplete.

Figure 1



(i) Copy the diagram **into your answerbook and** using the key write in the letters **A**, **T**, **C**, **G**, representing the nitrogenous bases (adenine, cytosine, guanine and thymine) in their correct positions **on your diagram**.

(ii) **On your diagram**, draw **and** label the bonds that join the nitrogenous bases together.

(iii) Name the **two** components labelled **X** and **Y** on the diagram.

(iv) The nitrogenous bases in DNA can be classified into two specific groups.
Name these **two** groups **and** state **one** nitrogenous base belonging to **each** group.

(v) DNA is composed of nucleotides.
On your diagram, sketch a rectangle around any **one** nucleotide.

(vi) How many nucleotides are visible on the diagram? **(27)**

(c) The second type of nucleic acid found in cells is called RNA.
RNA is complementary to a DNA sequence. Figure 2 shows a section of DNA containing a number of nitrogenous bases.

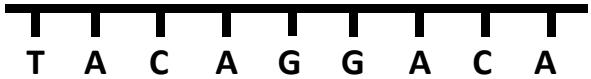


Figure 2

(i) Copy out the section of DNA **into your answerbook and on your diagram**, write down the complementary sequence of RNA from the DNA template.

(ii) This piece of RNA is produced during the first stage of protein synthesis.
What is the name given to this piece of RNA?

(iii) What is the name given to this first stage of protein synthesis?

(iv) Where in the cell does this first stage of protein synthesis occur?

(v) The type of RNA produced in the first stage of protein synthesis is used in the second stage. Describe the second stage of protein synthesis. **(24)**

13. **(a)** **(i)** Give **one** example of waste management from **one** of the following areas: agriculture **or** fisheries **or** forestry.

(ii) Give **two** problems associated with waste disposal. **(9)**

(b) Farms around the country are striving to reduce their carbon footprint by changing their farming practices. In addition to reducing carbon, farms are also looking to improve factors such as water quality, air quality and biodiversity.
One practice being changed is that farmers are wiring off corners of their fields to improve biodiversity within the habitat. These areas develop into new hedgerows full of plants (such as clover and mixed grasses), maximising sequestration – capturing carbon dioxide. These new areas also increase the diversity of fauna.

Adapted from "*Inside a climate neutral dairy farm*", The Irish Times, 5th August 2024

(i) Explain the underlined terms.

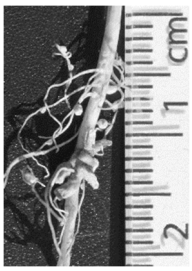
(ii) From information in the passage, or otherwise, give **one** practice that can increase biodiversity on farms around the country.

(iii) Sequestration is the capturing of carbon dioxide.

1. Name a biological process involved in the capturing of carbon dioxide by living organisms.

2. Name a biological process that releases carbon dioxide into the atmosphere.

(iv) Clover contains bacteria in root nodules. The clover and the bacteria live in close association with both species benefitting. These bacteria are involved in a process of capturing nitrogen gas from the atmosphere and converting it to usable compounds.



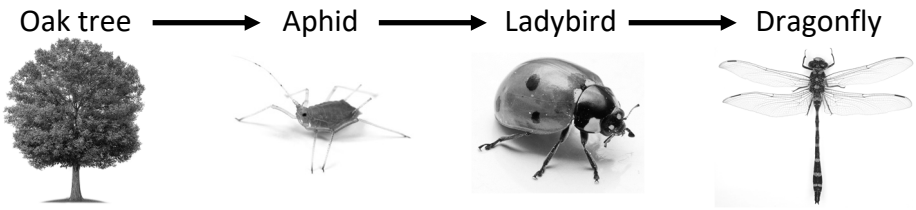
1. What term describes this process?

2. Name a compound produced by this process.

3. What term describes the process of converting the compound named in part (iv) 2. above into nitrogen gas?

4. What term describes the close association between clover and bacteria? **(27)**

(c) A food chain from an ecosystem is shown below.



(i) Explain the term *ecosystem*.

(ii) Name the secondary consumer in the food chain above.

(iii) Draw a pyramid of numbers to represent the food chain shown above.

(iv) Suggest what might happen to the population of aphids if the population of producers decreased **and** give a reason for your answer.

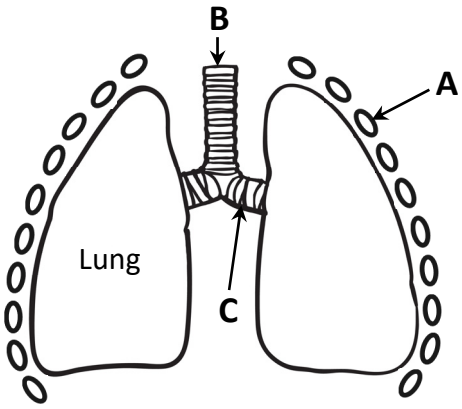
(v) Construct a food web by using the food chain above **or** another food chain you have studied. **(24)**

14. **(a)** The lung is an organ involved in homeostasis.

(i) What is meant by the term *homeostasis*?

(ii) Name **two other** organs that also help with homeostasis in the body. **(9)**

(b) The diagram shows parts of the human breathing system. The muscles involved in breathing have not been included.



(i) Name bone **A and** tubes **B** and **C**.

(ii) Name the **two** muscles, not shown on the diagram, that are essential for inhalation.

(iii) Copy the diagram **into your answerbook and** draw in the location of the **two** muscles involved in breathing **and** label **both** clearly.

(iv) Describe the process of inhalation.
Include in your answer the roles of the two muscles you named in (b) (ii) above.

(v) Tube **B** has rings of cartilage present in its walls.
Explain the importance of these rings of cartilage. **(27)**

(c) The function of the alveolus is the exchange of gases (oxygen and carbon dioxide) between the atmosphere and the bloodstream.

(i) By what process are oxygen and carbon dioxide exchanged in the alveolus?

(ii) Carbon dioxide dissolves in the blood reducing the pH.
What effect does this have on the breathing rate?

(iii) State the name of the red pigment that transports oxygen in the bloodstream.

(iv) **1.** Draw a diagram of an alveolus **and** its associated blood supply.

2. State **two** features of the alveolus that allow for efficient gas exchange.

(v) In relation to asthma **or** bronchitis, give **one** cause **and one** treatment.

(24)

15. **(a)** Plants are critical to life on Earth.

(i) Name the structures found on leaves of plants that function in gas exchange.

(ii) Name the corresponding structures found on the stems of plants.

(iii) Name **one** factor that affects the opening and closing of the structures you named in part (a) (i) above. **(9)**

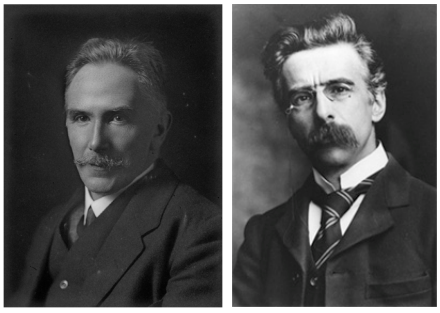
(b) **(i)** Draw a diagram of a transverse section of a dicotyledonous **stem** to show the distribution of vascular tissues.
Label the following: *vascular tissue*, *ground tissue*, *dermal tissue*.

(ii) Describe the structural difference between a monocotyledonous stem and a dicotyledonous stem.

(iii) Vascular tissue is involved in transport of water up the plant. In the early 1900s, two Irish scientists, shown in the pictures, proposed a model of transport of water.

1. Name **both** scientists.

2. Describe in detail the model they proposed.



(27)

(c) Answer the following questions in relation to vegetative propagation and artificial propagation.

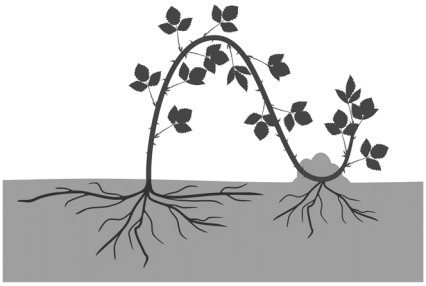
(i) Name any **two** methods of vegetative propagation used by plants **and** for **each** named method, give **one** example of a plant that carries out that method of vegetative propagation.

(ii) Artificial propagation is used by horticulturists.

1. What is meant by the term *artificial propagation*?

2. Layering is one method of artificial propagation, as shown in the diagram. Name any **two** other methods.

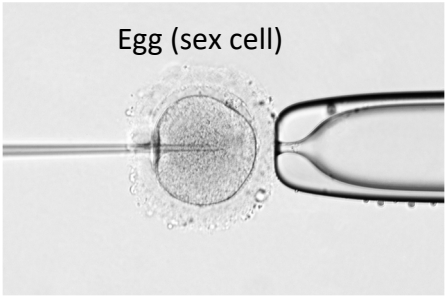
3. Suggest a reason horticulturists use artificial propagation.



(24)

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

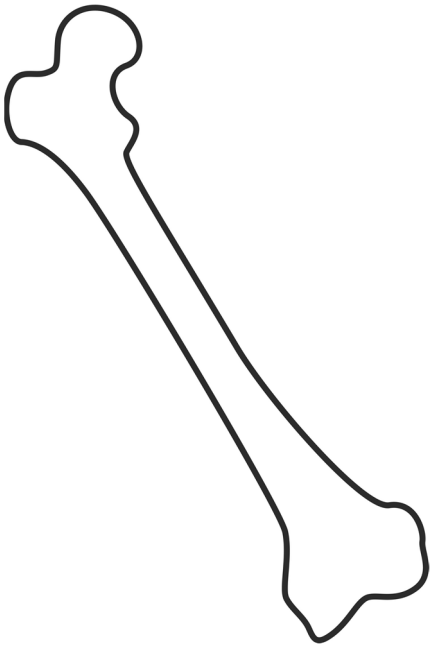
(a) The image shows one step involved in *in vitro* fertilisation (IVF). Other steps involve the administration of hormones to encourage super-ovulation, where a number of eggs are produced and retrieved. Embryos are then transferred to a part of the female reproductive system.



- **(i)** Explain the underlined terms.
- **(ii)** Suggest a reason for more than one egg being retrieved at the same time.
- **(iii)** Draw a labelled diagram of the **other** sex cell involved in IVF.
- **(iv)** Draw a labelled diagram of the female reproductive system **and on your diagram** indicate clearly where **each** of the following IVF steps occur:
  1. Egg retrieval (where ovulation occurs)
  2. Embryo transfer (or embryo implantation)

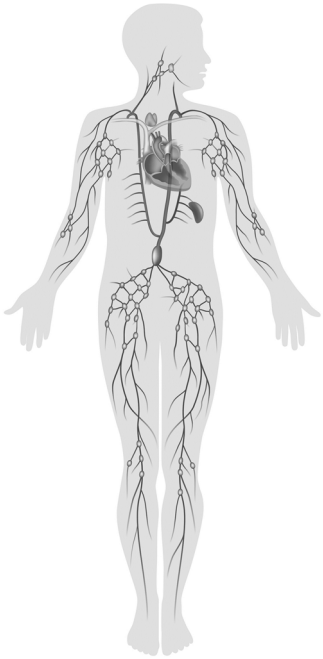
(b) The human musculoskeletal system is an important body system.

- **(i)** The skeleton can be categorised into the appendicular skeleton and axial skeleton.
  Distinguish between the terms *appendicular skeleton* **and** *axial skeleton*, by writing a sentence on **each** term.
- **(ii)** The diagram shows the outline of a long bone.



  1. Name any **one** long bone that is found in the human body.
  2. Copy the outline of the long bone **into your answerbook and on it** draw **and** label the following parts:
     bone marrow, **compact bone**, **cartilage**.
  3. Give **one** function of **each** part named above.
- **(iii)** Bone is continually being broken down and replaced. The continued renewal of bone is dependent upon certain factors.
  1. Name any **one** factor that affects the renewal of bone.
  2. Name the type of cell involved in breaking down bone.
  3. Name the type of cell involved in formation of new bone.

(c) Answer the following questions based on the lymphatic and blood circulatory systems.



(i) Give **two** structural similarities between lymph vessels **and** veins.

(ii) Other than lymph vessels, name any **one** structure **or** organ that is part of the lymphatic system.

(iii) State **two** functions of the lymphatic system.

(iv) Give **two** differences between the composition of lymph **and** the composition of blood.

(v) Comment on the effect of **each** of the following on the blood circulatory system:

1. Smoking

2. Diet

3. Exercise.

(d) Some external factors that regulate the growth of plants are light intensity, gravity and temperature. Plants respond to these external factors through tropisms.

(i) Name any **two** tropisms.

(ii) Growth regulators control tropisms.
IAA (indole acetic acid) is an example of a growth regulator.
Give a specific location in a plant where IAA is produced.

(iii) A botanist investigated the effect of using different concentrations of IAA on the growth of roots and shoots of germinating cress seeds. They obtained the data below.

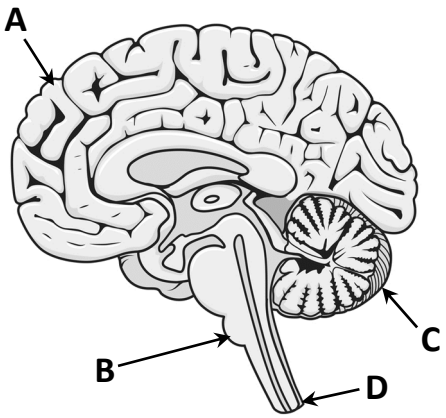
Relative IAA concentration	Root length (mm)	Shoot length (mm)
0	10	2
10^{-1}	18	10
10^{0}	8	20
10^{1}	3	30
10^{2}	0	15

1. **On the graph paper in your answerbook**, plot line graphs to illustrate the data obtained by the botanist. Put the relative IAA concentrations (0, 10^{-1}, 10^{0}, 10^{1}, 10^{2}) on the horizontal axis.

2. Suggest what the botanist may have concluded from these results.

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

(a) The diagram shows the internal structure of the human brain, which is part of the central nervous system.



(i) Name the parts of the brain labelled **A**, **B** and **C and** give **one** function of **each** labelled part.

(ii) There is a layered tissue surrounding the brain.

1. What name is given to this layered tissue?

2. How many layers are present in this tissue?

3. What is the function of this tissue?

(iii) Part **D** continues down the body.
What name is given to this part of the central nervous system?

(iv) There are millions of neurons in the central nervous system.
Draw **and** label a neuron.

(v) Give **one** cause for **one** of the following nervous system disorders:
Parkinson's **or** paralysis.
In your answer, state clearly to which disorder you are referring.

(b) Answer the following questions in relation to evolution **and** genetic engineering.

(i) Explain the term *evolution*.

(ii) Give **one** source of evidence for evolution.

(iii) Explain the term *genetic engineering*.

(iv) Describe the steps involved in genetic engineering.

(v) Give **one** application of genetic engineering for **each** of the following:

1. Plant

2. Animal

3. Micro-organism

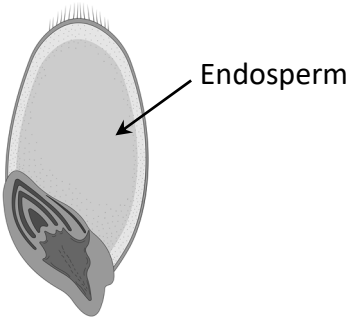
(c) Answer the following questions in relation to enzymes.

(i) What is an enzyme?

(ii) Name **two** factors that affect the rate of enzyme activity.

(iii) **In your answerbook**, sketch a graph showing the effect of any **one** factor named above on the rate of enzyme activity. Clearly label **both** axes.

(iv) The diagram shows the structure of a seed.



The endosperm contains the substrates starch, protein and lipid.

Enzymes digest these substrates converting them into product(s).

Copy the table into your answerbook and complete it for **any two** of the substrates.

Substrate	Enzyme	Product(s)
Starch		
Protein		
Lipid		

(v) Describe in detail the active site theory to explain enzyme function.

(d) Answer the following questions in relation to the Kingdom Fungi.
Fungi can be classified as saprophytic or parasitic.

(i) Describe the difference between **each** of the underlined terms.

(ii) Give **one** example of a parasitic fungus.

Rhizopus is an example of a saprophytic fungus.

(iii) **1.** Draw a diagram of the structure of *Rhizopus*.

2. **On your diagram**, label the following parts: *sporangiophore*, *stolon*, *rhizoid*.

3. Give a function for **any one** of the above-labelled parts.

(iv) Give an account of sexual reproduction in *Rhizopus*.

Acknowledgements:

Images/Pictures/Graphs/Diagrams:

Diagram on page 2:	Created on biorender.com
Diagrams on page 3:	State Examinations Commission
Image in Q13 (b) on page 4:	wikipedia.org
Images in Q13 (c) on page 4:	shutterstock.com; dreamstime.com
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Texts/data:

Text on page 4:	Adapted from "*Inside a climate neutral dairy farm*" The Irish Times, 5th August 2024
Data in Q16 (d) on page 8:	State Examinations Commission

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Leaving Certificate – Higher Level

Biology Section C

3 hours