



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination

Biology

Section C

Higher Level

3 hours

180 marks

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Section C

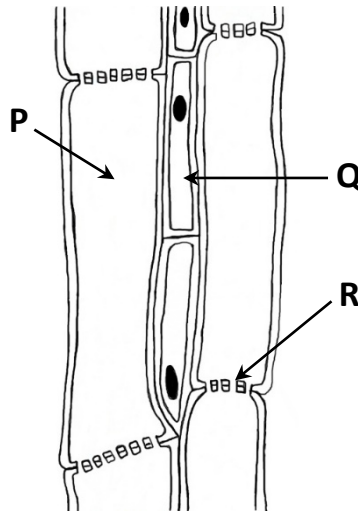
Answer any three questions.

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

11. (a) Organs in some plants are modified for food storage.
- Name a food storage polysaccharide found in plants.
 - Name a type of modified stem that functions in food storage.
 - Name a plant in which the leaves are modified for food storage.

(9)

- (b) The diagram shows the structure of phloem.



- Identify the parts **P**, **Q** and **R**.
- Draw a diagram of the longitudinal section of a stem.
On your diagram, label the following **three** plant tissues:
phloem; xylem; dermal.
- Xylem transports water upwards through plants.
Give **two** structural features of xylem that allow this upward movement of water.
- Distinguish between monocotyledonous **and** dicotyledonous plants, by writing a sentence on **each**, using the following headings:
 - Leaf vein type
 - Organisation of vascular bundles in the stem.

(27)

- (c) (i) Explain the term *tropism*.
- Name **two** examples of tropisms in plants.
 - Describe in detail the mechanism of any **one** plant tropism.
 - Give **two** uses of commercial plant growth regulators.

(24)

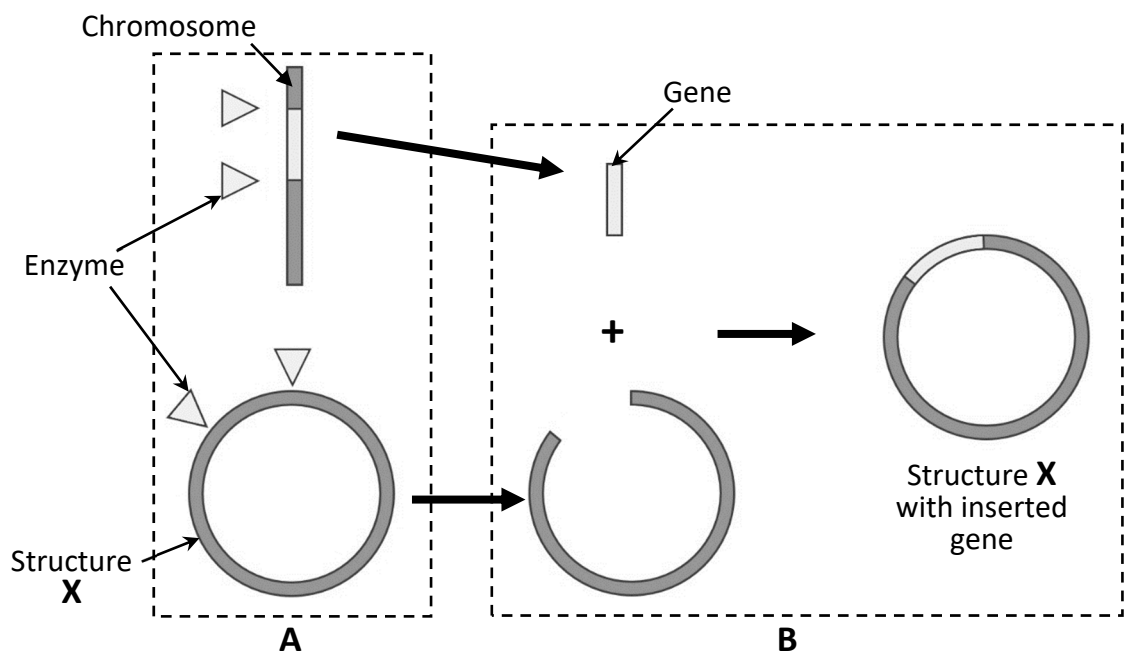
12. (a) Explain the following terms that are used in genetics:
- (i) *Heterozygous*
 - (ii) *Genotype*
 - (iii) *Recessive*.
- (9)

- (b) In dogs the allele for dark coat colour (**D**) is dominant to the allele for light coat colour (**d**) and the allele for short coat (**H**) is dominant to the allele for long coat (**h**). These genes are not linked.

A dog heterozygous in respect of coat colour and coat length was crossed with a dog with a light, long coat.

- (i) State the genotypes of **both** parents.
 - (ii) Determine the genotypes **and** matching phenotypes of all the possible offspring of the above cross.
 - (iii) What is meant by the statement that the genes are not linked?
 - (iv) How would the results of the cross be different if the genes were linked? Explain your answer.
- (27)

- (c) The diagram shows two processes (labelled **A** and **B**) that are carried out during genetic engineering. Structure **X** is used to carry a gene of interest.

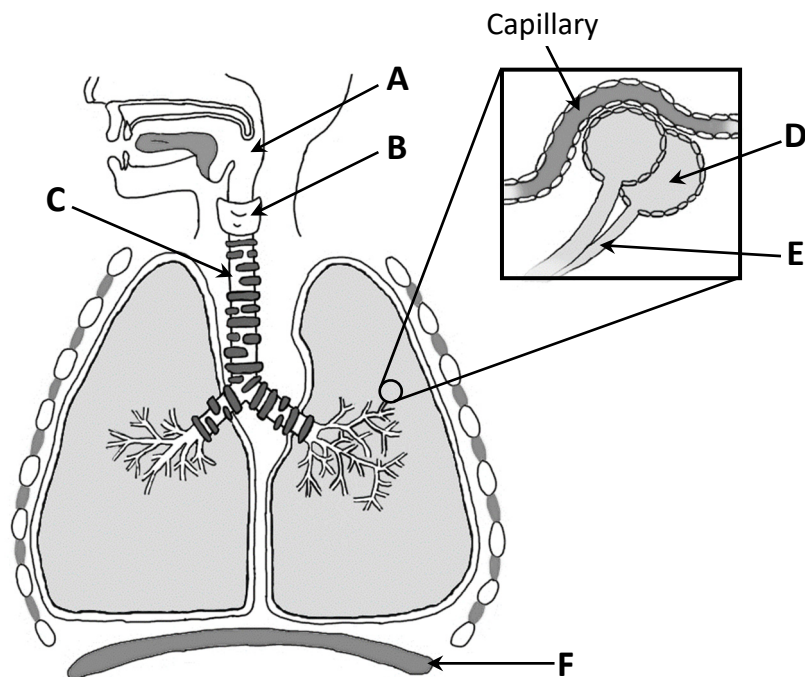


- (i) What is genetic engineering?
 - (ii) Name processes **A** and **B**.
 - (iii) Name structure **X** that is used during both processes **A** and **B**.
 - (iv) Briefly describe what happens to structure **X** after process **B**.
 - (v) Give **one** application of genetic engineering in **each** of the following:
 1. Plants
 2. Animals
 3. Microorganisms.
- (24)

13. (a) (i) What is homeostasis?
 (ii) Distinguish between an ectotherm **and** an endotherm by writing a brief sentence on **each**.

(9)

- (b) The diagram shows the structure of the human breathing system.



- (i) Name structures **A, B, C, D, E** and **F**.
 (ii) Describe in detail the process of inhalation.
 (iii) In relation to the breathing system answer the following:
1. Name **one** disorder.
 2. Name **one** possible cause of the named disorder.
 3. Name **one** possible treatment for the named disorder.

(27)

- (c) Answer the following questions in relation to the human urinary system.

- (i) Draw a diagram to show the structure of the human urinary system, labelling each of the following:
- kidney; ureter; bladder.**
- (ii) The nephron is the functional unit of the kidney.
 Explain, with reference to parts of the nephron, why glucose is not normally found in urine.
- (iii) In certain situations, the kidney excretes lower than normal volumes of urine.
 Suggest **two** situations in which urine volume is likely to be low.
- (iv) Name the hormone involved in lowering the volume of urine.
- (v) Name **one** part of the nephron affected by the hormone named at part (c) (iv) above.

(24)

14. (a) (i) Explain the term *nutrient recycling*.
(ii) Name **two** nutrient cycles found in nature. (9)
- (b) Read the passage below and answer the questions that follow.

Trout population under threat

According to research by the Environmental Research Institute (ERI), trout in freshwaters in Ireland could be under threat due to changes in water temperature and food levels.

Trout usually feed on insects (e.g. mayflies) that live in and around waterways. In turn, young insects obtain nutrition from algae. Trout also usually migrate to the sea to feed more and grow. This allows them to eventually return to the rivers and lakes to spawn (reproduce).

The team found that reduced freshwater food levels causes an increase in the numbers of migrating trout, but warmer water temperatures have the opposite effect, where fewer trout choose to migrate to sea. Instead, they remain resident in freshwater despite there being less food.

Striking a balance between seeking more food for growth and reproduction and remaining in warmer waters is the challenge facing trout, and is likely to be made much worse by climate change. Reduced trout numbers also have implications for organisms that feed on trout, such as otters.

(Adapted from "Sea trout population under threat...", Irish Examiner, 19 March 2020)



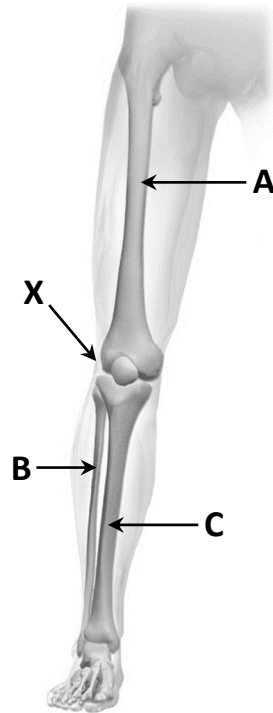
- (i) From the information in the passage, name **one** abiotic factor **and one** biotic factor that could be causing a reduction in trout numbers. Indicate clearly which is the abiotic factor and which is the biotic factor.
- (ii) What type of nutrition do trout demonstrate?
- (iii) What type of ecological relationship exists between trout and otters?
- (iv) Suggest **one** effect that fewer numbers of trout may have on otters.
- (v) Using the information from the passage, draw a pyramid of numbers to include four trophic levels.
- (vi) From the text, or otherwise, suggest **one** behavioural adaptation that trout possess. (27)
- (c) The size of the human population has increased dramatically over the last one hundred years. This has caused increased pollution of the Earth's ecosystems. As a result, conservation practices have also increased.
- (i) Explain the underlined terms.
- (ii) Describe the effect of a **named** pollutant from **one** of the following areas: domestic; agricultural; industrial.
- (iii) Give **one** example of conservation practised in agriculture **or** fisheries **or** forestry.
- (iv) Suggest **two** factors that influence the size of the human population.
- (v) For **one** of the factors named at part (c) (iv) above, state the effect it has on the human population. (24)

15. (a) (i) Explain the term *antagonistic muscle pair*.
(ii) Give **one** example of an antagonistic pair of muscles in the human body.
(iii) Name the connective tissue that joins muscles to bones.

(9)

- (b) (i) State **two** functions of the skeleton.
(ii) Name the type of bone cell that lays down new bone.
(iii) Other than diet, give **two** factors that affect bone renewal.

The diagram shows the bones of a human leg.



- (iv) Name bones **A**, **B** and **C**.
(v) Synovial joints are one type of joint found in the human body. Identify the type of synovial joint indicated by the letter '**X**'.
(vi) Name **one** other type of joint found in the human body **and** give its location.

(27)

- (c) (i) What is the chemical nature of most hormones?
(ii) Distinguish between an endocrine gland **and** an exocrine gland, by writing a brief sentence on **each**.
(iii) Name a gland in the human body that has **both** an endocrine and exocrine function.
(iv) Give **two** examples of the use of hormone supplements.
(v) Describe the feedback mechanism of any **one** named hormone in the human body.

(24)

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

(30, 30)

- (a) (i) Draw a large diagram of the internal structure of the heart and its associated blood vessels.

On your diagram label the following parts:

Right atrium	Left ventricle	Septum	Aorta	Vena cava	Semilunar valve
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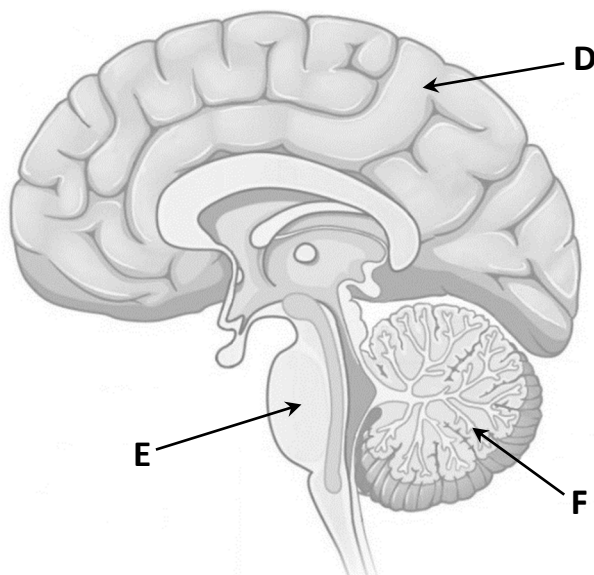
- (ii) Use your diagram to show the following:

1. Place the letter **X** to label the blood vessel that carries blood to the lungs;
2. Place the letter **Y** to label the blood vessel that carries blood into the heart from the lungs.

- (iii) The sequence of events in the heart cycle is carefully co-ordinated.

Give a detailed account of the heart cycle, to include the functions of the sino-atrial (SA) **and** the atrio-ventricular (AV) nodes in your answer.

- (b) The diagram shows the internal structure of the human brain.

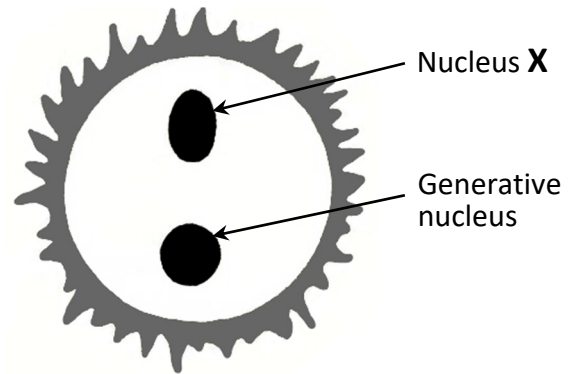


- (i) Name structures **D**, **E** and **F**.
- (ii) Give **one** function for **each** structure **D**, **E** and **F**.
- (iii) What is the name given to neurons that carry impulses only within the central nervous system?
- (iv) Name the type of neuron that carries impulses from the central nervous system to muscles and glands.
- (v) Describe how a nerve impulse is transmitted from one neuron to the next.

- (c) Answer the following questions based on sexual reproduction in flowering plants.
- Draw and label the structure of the stamen of a flower.
Indicate, with the letter **P**, the location where pollen is made.
 - What is meant by the term *pollination*?
 - Distinguish between cross-pollination **and** self-pollination, by writing a sentence on **each**.
 - Name **two** ways in which cross-pollination can occur in flowering plants.

The diagram shows a pollen grain.

- State the function of the nucleus labelled **X**.
- Describe what happens to the generative nucleus following pollination.
- The human defence system can react against pollen causing respiratory symptoms such as sneezing and watery eyes.
What is this reaction commonly known as?



- (d) The picture shows an electron microscope image of a typical bacterial cell.

- What shape is the bacterium in the photograph?
- Name another **two** shapes of bacteria.
- Bacteria reproduce asexually.
 - What term describes asexual reproduction in bacteria?
 - Describe in detail the steps involved in bacterial asexual reproduction.
- Some bacteria are pathogenic.
Explain the underlined term.
- Give **one** example of beneficial bacteria **and** **one** example of harmful bacteria.



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

(30, 30)

(a) Photosynthesis takes place in plants in two stages: the light stage and the dark stage.

(i) Write a balanced chemical equation to summarise photosynthesis.

(ii) Chlorophyll traps energy in sunlight. Electrons from chlorophyll travel along one of two pathways.

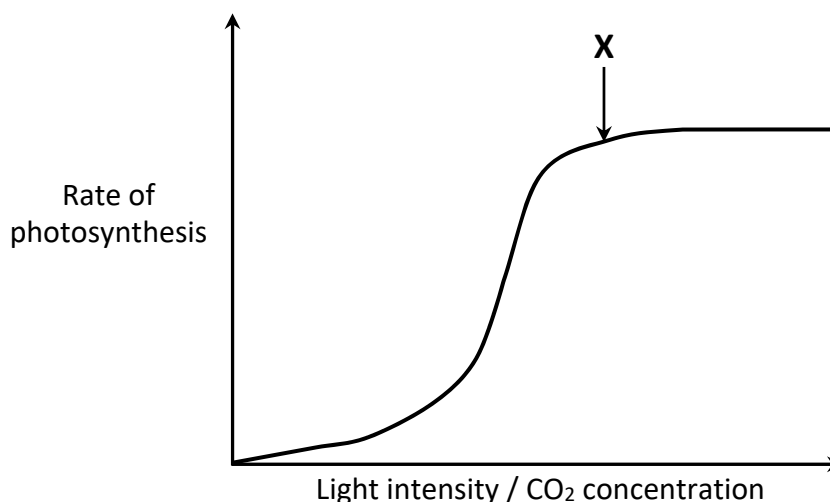
In relation to these electrons, describe in detail the main events of **each** pathway in the light stage.

(iii) Explain why the second stage of photosynthesis is called the dark stage.

(iv) Explain why the dark stage is an anabolic process.

(v) Light intensity and carbon dioxide (CO₂) concentration affect the rate of photosynthesis as shown in the graph.

Explain why the graph levels off at **X**.



(b) Diffusion and osmosis are processes that have particular significance for cell shape and activity.

(i) Explain the underlined terms.

(ii) Describe in detail what happens to a plant cell that is placed in a solution with less dissolved solutes than its cytoplasm.

(iii) Describe what would happen to an animal cell if it was exposed to the same conditions as the plant cell at part (b) (ii) above. Explain your answer.

(iv) Describe the biological basis **and** the advantage of having a high salt or sugar concentration in foods (e.g. jam).

(v) Living cells can be classified into two major types based on the presence or absence of cell organelles.

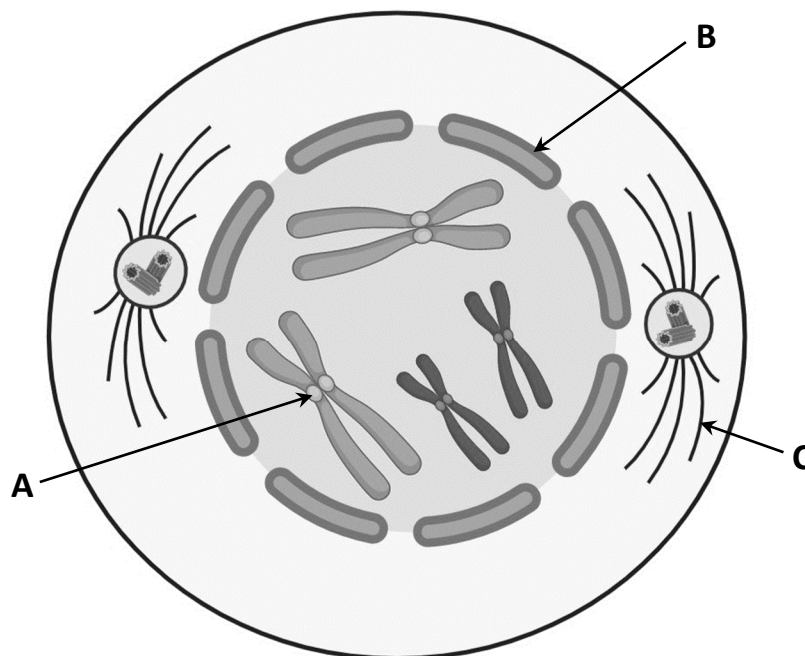
What are the names of these **two** major types of cells?

- (c) COVID-19 is a new virus that can cause harmful disease in humans. In 2021, vaccination against this virus was rolled out.
- Explain in detail the underlined term.
 - Name **any** other harmful disease **or** illness in humans caused by viruses.
 - Viruses can be classified based on their shape. Name any **two** shapes of viruses.
 - Name **one** organ specific to the immune system.
 - Name any **two** types of T lymphocytes.
 - State **one** function for **each** of the T lymphocytes named at part (c) (v) above.

- (d) The cell cycle consists of interphase and mitosis.

- Explain the underlined terms.

The diagram shows one of the four stages of mitosis in a diploid cell.



- Name the stage of mitosis shown in the diagram.
- Name the stage of mitosis that immediately follows the stage shown in the diagram.
- Name structures **A**, **B** and **C**.
- Give the function of structure **C**.
- What is the diploid number of this cell?
- Name a group of disorders in which cells lose control of the rate of mitosis and cell division.
- Give **two** possible causes of the group of disorders you named at part (d) (vii) above.

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