Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination

Biology

Section C

Higher Level

3 hours

240 marks

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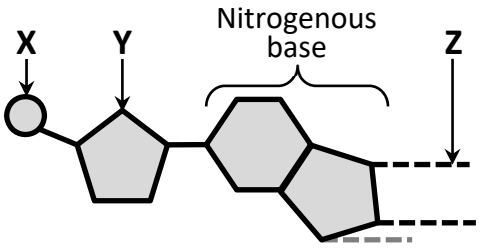
Section C

Answer any four questions.

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

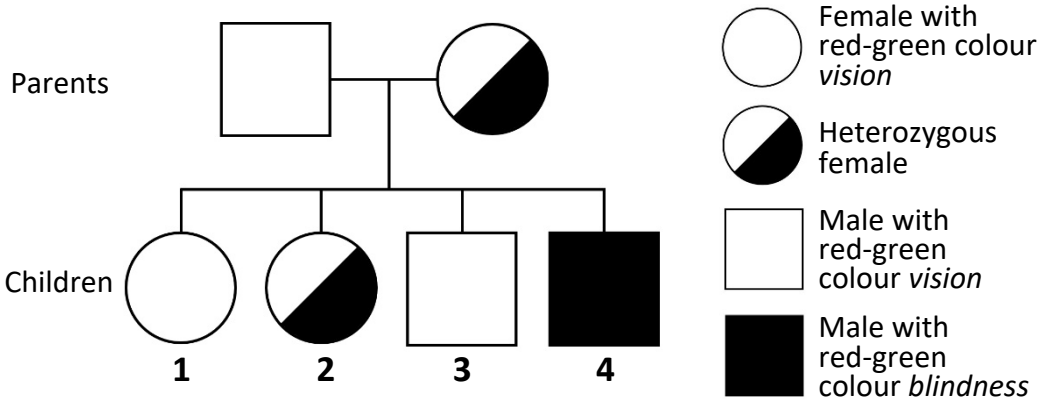
11. (a) DNA is a long, double-stranded and helical-shaped molecule made of nucleotides. The diagram shows the structure of a nucleotide.



(i) Name the component parts **X and Y**.

(ii) Name the type of bonding (**Z**) that links the base pairs in the DNA molecule. **(9)**

(b) Red-green colour *blindness* is a recessive characteristic in humans. It is a sex-linked trait and caused by an allele present on the X chromosome. There is no corresponding allele on the Y chromosome. The allele (**N**) for red-green colour *vision* is dominant. The recessive allele (**n**) contributes to red-green colour *blindness*.
The pedigree chart shows parents and their four children – two females and two males. Males are represented by squares and females are represented by circles.



(i) Explain the underlined term.

(ii) Using the letters described in the paragraph, write down the genotypes of the parents.

(iii) Write down the genotypes of all **four** children.

(iv) Explain why males are more likely than females to be red-green *colour-blind*.

(v) Name **one** other common sex-linked trait. **(27)**

(c) The cell cycle describes the cell's activities in the state of non-division and division (mitosis).

(i) What term is used to describe the state of non-division of a cell?

(ii) Draw a labelled diagram (e.g. a pie chart) to illustrate the relative lengths of time of non-division and division during the cell cycle.

(iii) DNA replication occurs towards the end of non-division.
Describe the main events of DNA replication.

(iv) Is DNA replication an anabolic or a catabolic process? Explain your answer.

(v) Mitosis is one type of division. Name **and** briefly describe the other type. **(24)**

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

(ii) Describe **one** effect of a **named** pollutant **and one** way it may be controlled. **(9)**

(b) Read the following passage and answer the questions that follow.

The introduction of invasive alien species into aquatic environments is impacting on many Irish habitats, changing many aquatic environmental factors.

Species such as the killer shrimp (that feeds on phytoplankton and seaweed detritus), the European Chub (that feeds on killer and native shrimp) and Japanese wireweed (that outcompetes many native seaweeds) have all appeared in Ireland.

To limit the introduction of non-native species, awareness and implementation of biosecurity measures (cleaning, drying and disinfecting) is required.

Adapted from: *Ireland's Invasive Alien Species…, www.invasives.ie*.

(i) What other term in the passage is used to describe '*invasive alien species*'?

(ii) Give **two** examples of aquatic environmental factors.

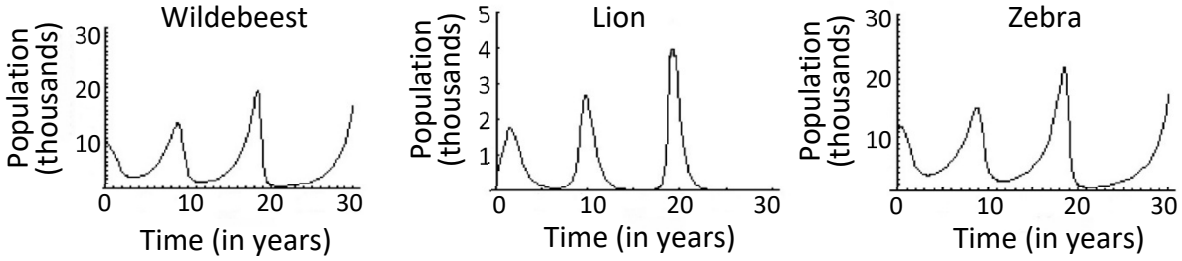
(iii) Conservation is an important aspect of ecology. Define the term *conservation* **and** describe **one** part of the passage that is promoting conservation.

(iv) Suggest **one** effect of not implementing conservation measures in Ireland.

(v) Using the organisms named in the passage, write down a food chain containing three trophic levels.

(vi) Draw a pyramid of numbers for the food chain you described above. **(27)**

(c) Wildebeest and zebras are herbivores. The lion is a carnivore and preys on wildebeest and zebra. The graphs below show the populations (in thousands) of wildebeest, lion and zebra over a 30-year period in a particular habitat.



(i) Explain the term *habitat*.

(ii) In relation to the herbivores, suggest **two** reasons for their fluctuating populations as shown in each graph.

(iii) Estimate the mean maximum population of lion over the first 20 years.

(iv) Suggest a reason for the population of lions in the habitat being lower than the population of their prey.

(v) **Copy the middle graph into your answerbook** and continue the graph to illustrate the population of lions over the next 10 years based on the corresponding numbers of their prey.

(vi) Explain why wildebeest and zebra are in competition with each other in this habitat.

(vii) Predation and competition are examples of ecological relationships that affect organisms in a habitat.
Name **one** other ecological relationship. **(24)**

13. (a) Viruses are obligate parasites.

(i) Explain the term *obligate parasite*.

(ii) Give **one** way in which viruses are economically important to humans. **(9)**

(b) Bacterial cells can be autotrophic or heterotrophic.

(i) Distinguish between the terms *autotrophic* **and** *heterotrophic* by writing a brief sentence on each.

(ii) Give **one** example of an autotrophic bacterium **and one** example of a heterotrophic bacterium.

(iii) State **two** factors that affect the growth of bacteria.

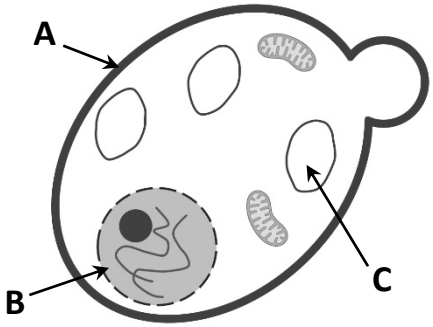
Bacterial infections can often be treated with antibiotics.

(iv) What is an antibiotic?

(v) Describe how antibiotic resistance develops in bacterial populations.

(vi) Explain why antibiotics are not effective against the common cold. **(27)**

(c) The diagram shows a yeast cell during asexual reproduction.



(i) Name the structures labelled **A**, **B** and **C**.

(ii) To which kingdom does yeast belong?

(iii) Name another organism that belongs to the kingdom you named at part (c) (ii) above.

(iv) What name is given to asexual reproduction in yeast cells?

(v) Describe in detail the process of asexual reproduction in yeast cells.

(vi) Give **one** way yeast cells differ from bacterial cells. **(24)**

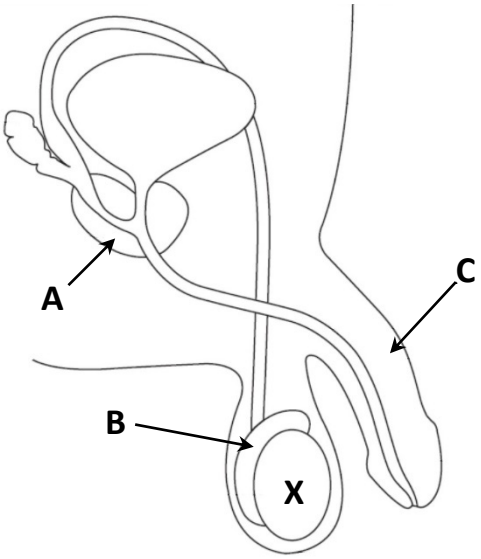
14. (a) Fibroids and endometriosis are two menstrual disorders which may contribute to infertility in females.

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

(ii) Choosing either fibroids **or** endometriosis, give **one** cause **and one** treatment.

(9)

(b) The diagram shows the male reproductive system and part of the urinary system.



(i) Name the parts labelled **A**, **B** and **C**.

(ii) Give a function for the parts labelled **B and C**.

(iii) Name the male sex hormone produced by the part labelled **X**.

(iv) Part **X** produces sperm.
Draw **and** label the structure of a sperm cell.

(v) State the approximate survival time of sperm within the female reproductive tract.

(vi) Name the structure through which both urine and sperm travel.

(27)

(c) (i) Draw a labelled diagram of the human female reproductive system.

On your labelled diagram, indicate where each of the following occur:

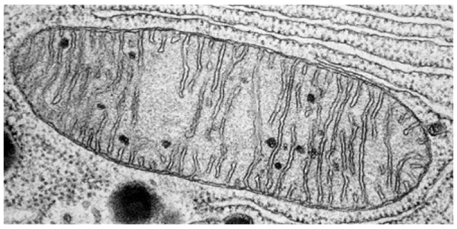
1. Egg production
2. Fertilisation
3. Implantation.

(ii) In relation to human reproduction, give the names of **two** structures that are formed in the days following fertilisation up to the point of implantation.

(24)

15. (a) (i) Distinguish between aerobic respiration **and** anaerobic respiration, by writing a brief sentence on each.

(ii) Identify the organelle shown in the transmission electron microscope image that is responsible for aerobic respiration.



(9)

(b) Respiration occurs in two stages.

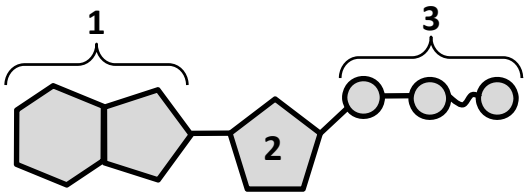
(i) Name stage 1 **and** state where in a cell it occurs.

(ii) The main product of stage 1 is pyruvate.
How many carbon atoms are present in pyruvate?

(iii) Pyruvate enters stage 2 and loses a molecule of carbon dioxide.
What name is given to this new molecule?

(iv) ATP is a product of stage 1 and stage 2.
Comment on the relative amounts of ATP produced by both of these stages.

(v) The diagram shows the structure of ATP.
Name the parts labelled **1**, **2** and **3**.



(vi) NAD is also involved in respiration.
What does NAD stand for?

(vii) Describe, in detail, the roles NAD **and** oxygen play in aerobic respiration.

(27)

(c) Enzymes are involved in many different metabolic reactions.

(i) What is an enzyme?

(ii) Name **one** anabolic **and one** catabolic enzyme you have studied.

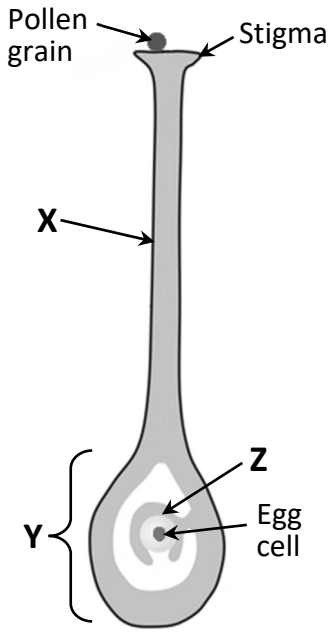
(iii) Enzyme activity is specific.
What is meant by the term *specificity* in relation to enzyme function?

(iv) Enzymes can be immobilised.

1. What is an immobilised enzyme?
2. Give **one** advantage of immobilised enzymes.
3. Describe how enzymes may be immobilised. **(24)**

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

(a) The diagram shows the carpel of a flower.
A pollen grain is trapped on the stigma.



(i) Name the parts labelled **X**, **Y and Z**.

(ii) The pollen grain can be carried to the stigma by animals.
Give **one** other way in which pollen can be carried to the stigma of a flower.

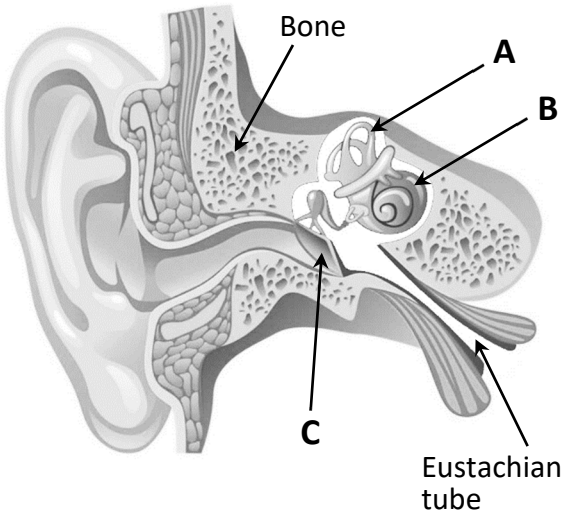
(iii) **Copy the diagram into your answerbook and** draw in a pollen tube to show the path taken by the male gametes.

(iv) The pollen grain has a generative nucleus. Describe how this nucleus gives rise to the male gametes.

(v) Give an account of the development of the egg cell within structure **Z**.

(vi) Two fertilisations occur during sexual reproduction in flowering plants.
Describe what happens during **each** fertilisation.

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



(i) Name the parts labelled **A**, **B and C**.

(ii) Give the functions of the parts labelled **A and B**.

(iii) What is the name of the bone that helps to protect the internal parts of the ear?

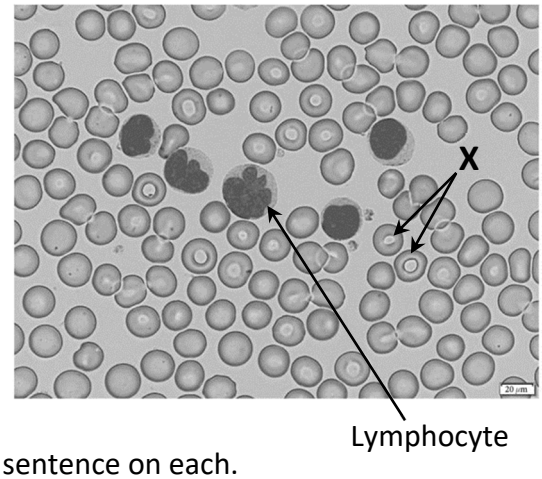
(iv) The function of **C** is to transfer sound vibrations to three small bones.
What is the collective terms for these three bones?

(v) The Eustachian tube connects the middle ear to another structure.
Name this other structure.

(vi) Name any **two** sense organs, other than the eye and the ear.

(vii) Name **one** disorder of the eye **or** the ear **and** suggest **one** treatment.

(c) The picture shows blood cells under a light microscope.



(i) State the precise location in the body where blood cells are made.

(ii) Name the blood cells labelled **X**.

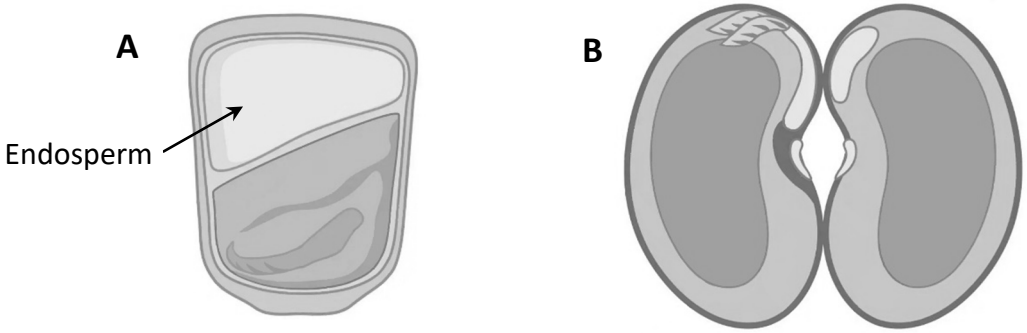
(iii) Give **one** function of the cells labelled **X and** give **one** adaptation that enables them to carry out this role.

(iv) Lymphocytes are involved in immunity. Distinguish between active immunity **and** passive immunity by writing a brief sentence on each.

(v) Lymphocytes can be classified as B and T cells.

1. Each B cell produces one type of antibody to bind to one type of antigen. What is an antigen?
2. T cells can be further classified based on their functions. Name any **three** types of T cell.

(d) The diagrams show two types of seed.



(i) Is the seed in diagram **A** classified as monocotyledonous or dicotyledonous? Give **one** reason for your answer.

(ii) **Copy either seed into your answerbook and** label the following parts:

testa; **cotyledon**; **embryo**

(iii) Name **one** example of a monocotyledonous seed **and one** example of a dicotyledenous seed.

(iv) Which part of the embryo in a germinating seed gives rise to each of the following parts of the seedling?

1. The root
2. The shoot.

(v) Answer the following questions in relation to seed dispersal:

1. What is meant by the term *dispersal*?
2. Name **two** methods used by plants to disperse seeds.
3. State **one** advantage of dispersal to the plant.

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

(a) Excretion is an important part of homeostasis. Organs involved in excretion include the kidney, lungs and skin.

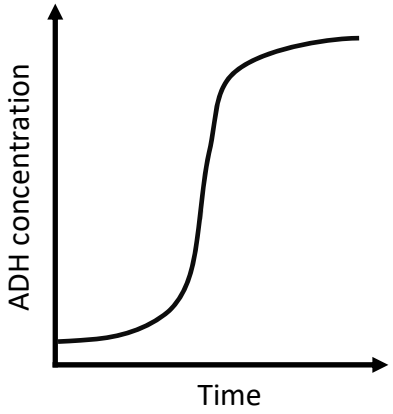
(i) Explain the term *homeostasis*.

(ii) Name an excretory product common to all three organs involved in excretion.

(iii) The nephron is the functional unit of the kidney, which is involved in the formation of urine through the processes of filtration, reabsorption and secretion.

1. Draw a labelled diagram of the nephron, including its blood supply.
2. **On your diagram**, place the letter **X** on the location where filtration occurs **and** place the letter **Y** on the location where reabsorption occurs.

(iv) ADH (anti-diuretic hormone) is produced by the pituitary gland. The graph shows ADH concentration in the blood increasing over time. What might cause this increase?



(v) Where in the nephron does ADH act?

(vi) What is the effect on the nephron of increased ADH levels?

(b) The brain is part of the central nervous system.

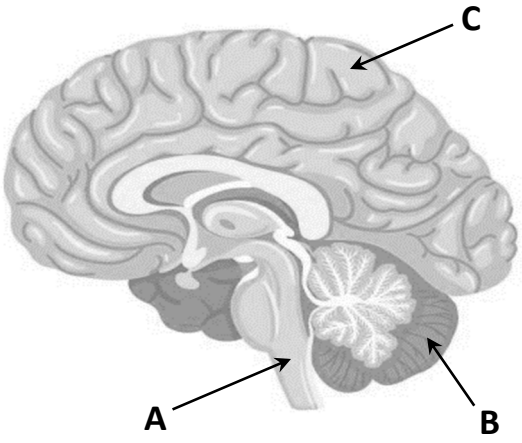
(i) Name **one** other part of the central nervous system.

(ii) The brain and the part you named at part (b) (i) above are surrounded by a protective tissue composed of multiple layers.

1. What is the name of this tissue?
2. How many layers are present in this tissue?
3. Name an infection associated with this tissue.

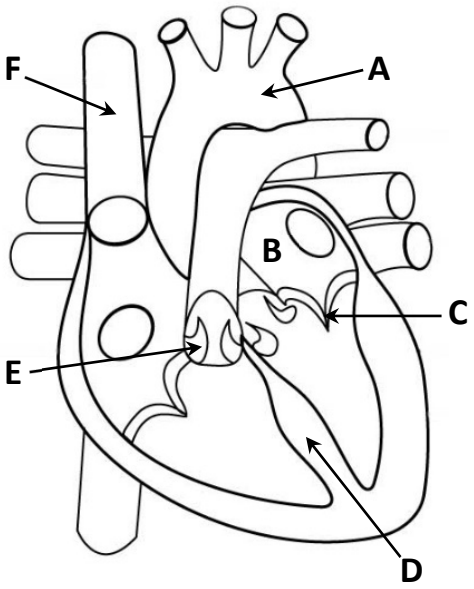
(iii) The diagram shows the internal structure of the human brain.

1. Name the parts of the brain labelled **A**, **B and C**.
2. Give **one** function of **each** labelled part.



(iv) In relation to **one** of the following nervous system disorders: *paralysis* or *Parkinson's disease*, give **one** possible cause **and one** possible treatment.

(c) The diagram shows a sketch of the internal parts of the human heart.



(i) Name the parts labelled **A**, **B**, **C**, **D**, **E and F**.

(ii) The function of the part labelled **D** is to separate the two sides of the heart.
State **one** reason why this is important.

(iii) The heart is composed of specialised muscle tissue.
Name this type of muscle **and** give **one** characteristic of this specialised muscle tissue.

(iv) The wall of the left ventricle is thicker than the wall of the right ventricle.
Explain why this is necessary.

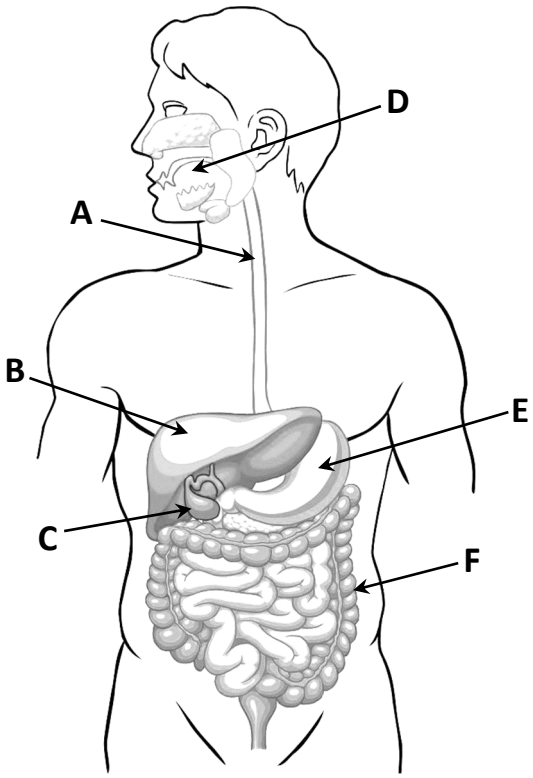
(v) The SA (sinoatrial) and AV (atrioventricular) nodes are involved in the control of the heart cycle. State their respective locations in the heart **and** describe how each carries out their role in heartbeat control.

(d) Digestion can be mechanical or chemical in nature.

(i) Distinguish between mechanical **and** chemical digestion by writing a brief sentence on **each**.

(ii) Digestion and absorption are two of the four stages of nutrition.
Name the other **two** stages.

The diagram shows the human digestive system.



(iii) Name the parts labelled **A**, **B**, **C**, **D**, **E and F**.

(iv) Give **two** functions of the structure labelled **B**.

(v) State **one** benefit of having fibre in the diet.

(vi) Give **one** benefit of bacteria living in the digestive tract.

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