Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2020

Biology

Section C
Higher Level

240 marks

Do not hand this question paper up

Section C

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

10. (a) (i) Why is it necessary for an organism to possess an adaptation to its habitat?
(ii) Name **two** types of adaptation that an organism can exhibit. **(9)**

(b) Gunnera (*Gunnera tinctoria*), known as giant rhubarb is a ornamental plant native to Chile. It has umbrella-like leaf blades up to two metres high and great numbers of tiny flowers.

This huge plant has been recorded at 1,168 locations on Achill Island and creeps invasively along cliffs, streamsides, roadsides and damp meadows, shading out native vegetation and building up huge seed banks which crowd out everything else.
Gunnera spreads largely by its creeping surface rhizomes (horizontal stems) and the scatter of plant fragments, rather than by birds eating the seeds.
Eradication schemes by county councils have proved difficult, as fresh leaves sprout from rhizomes that have been partially poisoned with glyphosate herbicide and the layered seed banks wait their turn to take over.
Gunnera is one of the few flowering plants to fix its own nitrogen through hosting a toxic cyanobacteria in its cells. The plant's need for water, humidity and frost-free winters has kept it largely to the west coast of Ireland and its hinterland.
(Adapted from 'Gunning for Gunnera: ornamental wonder or ecological menace?', The Irish Times, 15th March, 2013.)

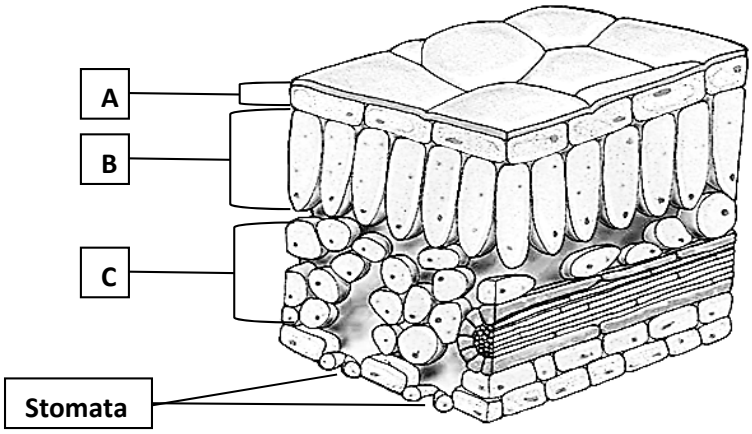
(i) Give **two** methods by which *Gunnera* outcompetes native Irish plants.
(ii) What method is usually used to control the population of *Gunnera*?
(iii) Suggest **one** reason why *Gunnera* is so successful at growing in poor quality soil.
(iv) Biological control, using herbivores, might not be successful at controlling the population of *Gunnera*. Suggest **one** reason why.
(v) Suggest **two** ways how *Gunnera* may invade and colonise new areas.
(vi) Name **two** abiotic factors that have limited the spread of *Gunnera* in Ireland. **(27)**

(c) (i) State **one** reason why ecological surveying is important.
(ii) Organisms' roles in energy transfer in an ecosystem can be represented using different methods.
1. Name the ecosystem you studied.
2. Draw a food chain from this named ecosystem containing four members (trophic levels).
3. Why are food chains mostly limited to four or five members?
4. Draw a pyramid of numbers to represent this food chain.
5. Indicate on your pyramid of numbers, the position of
   1. the producer **and** 2. the secondary consumer.
6. Give **one** limitation of the use of pyramids of numbers. **(24)**

11. (a) (i) Name the type of nutrition exhibited by organisms that carry out photosynthesis.
(ii) Write a balanced chemical equation to summarise photosynthesis.

(9)

(b) The diagram is that of a transverse section (T.S.) of a leaf growing in a sunny area.



(i) What is the role of the stomata in photosynthesis?
(ii) Which of the labelled part (A, B or C) would you expect to contain the most chloroplasts?
(iii) Chloroplasts contain chlorophyll molecules. What is the role of the chlorophyll molecules in photosynthesis?
(iv) What particles are released from chlorophyll during the light dependent stage of photosynthesis.
(v) These particles enter one of two pathways.
Give an account of the events of **pathway 2**.

(27)

(c) Answer the following questions in relation to the second stage of aerobic respiration.

(i) Name the 3-carbon molecule which enters the mitochondrion.
(ii) Name the **two** carbon containing molecules produced when the 3-carbon molecule at (i) above is broken down.
(iii) One of these carbon containing molecules formed at (ii) above enters a series of reactions. Name this series of reactions.
(iv) Outline the events that take place in the electron transport chain (system).

(24)

12. (a) (i) What is meant by the term *heredity*?

(ii) State Mendel's Law of Independent Assortment (2nd Law).

(9)

(b) The series of images below represents the four main stages of the DNA profiling technique invented by Sir Alec Jeffreys in 1984.

Sample used to create a DNA profile

A DNA profile

(i) Distinguish between *DNA profiling* and *genetic screening*.

(ii) Explain **each** of the Stages, **1 to 4**, of DNA profiling shown above.

(iii) Give any **two** applications of DNA profiling.

(iv) Identical twins have the same DNA profile. Explain why this is so.

(27)

(c) In Andalusian chickens the allele for black feathers (B) exhibits incomplete dominance over the allele for white feathers (b). When a black, homozygous rooster (male) is crossed with a white, homozygous hen (female) all the newly hatched chicks will have an intermediate phenotype of speckled colour (Bb) known as "blue".

(i) Explain the terms underlined in the passage above.

(ii) Determine all the possible genotypes and phenotypes of the offspring of a cross between the following chickens:

"blue" rooster **X** "blue" hen

Include in your answer the ratio of the resulting phenotypes.

(iii) What would be the effect on the offspring phenotype ratio, in the genetic cross at (ii) above, if there was **no** incomplete dominance between the two alleles for feather colour, and if black feather was the dominant trait and white feather was the recessive trait?

(24)

13. (a) (i) Explain what is meant by the term *homeostasis*.

(ii) Give **one** reason why homeostasis is important in organisms.

(iii) Explain what is meant by the term *excretion*.

(9)

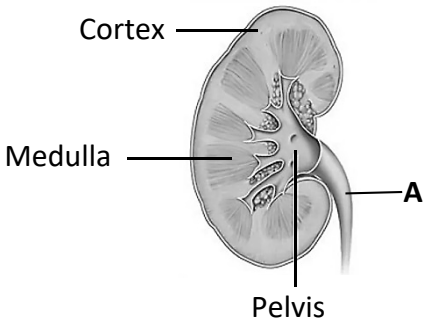
(b) Urine produced by the kidney contains water, salts and urea.

(i) State the precise location in the body where urea is made.

(ii) Name the food biomolecule from which urea is derived.

(iii) A diagram of a human kidney is shown on the right.

1. In which part of the kidney is the Bowman's capsule located?
2. In which part of the kidney is the Loop of Henle located?
3. Name the part labelled 'A'.



(iv) Draw a large diagram of a nephron and its associated blood supply from a human kidney. Label the following parts:

Bowman's capsule	**Loop of Henle**	**Proximal convoluted tubule**
Collecting duct	**Distal convoluted tubule**	**Glomerulus**

(27)

(c) The following table shows the representative composition of blood plasma, glomerular filtrate and urine from a typical adult, (each in g/100 cm^3 of fluid).

	Blood Plasma	**Glomerular filtrate**	**Urine**
Urea	0.03	0.03	1.8
Glucose	0.1	0.1	0
Proteins	7	0	0

(i) Using the data from the table above, what is the main difference between the composition of blood plasma and glomerular filtrate? Explain why this is so.

(ii) Using the data from the table above, in relation to glucose, explain the findings in the composition of the fluids between:

1. Blood plasma and glomerular filtrate.
2. Glomerular filtrate and urine.

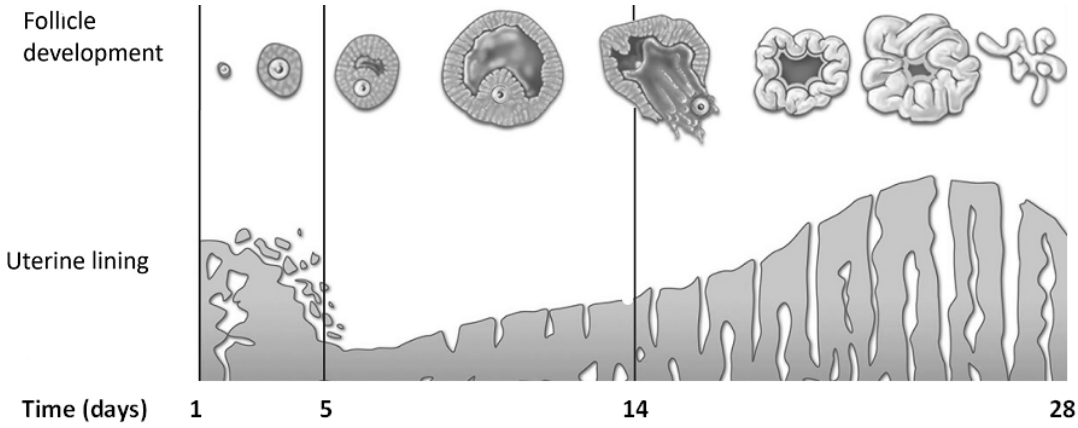
(iii) Using your knowledge of homeostasis and excretion:

1. State the **effect** on the volume of urine produced by a high salt intake.
2. Explain your answer to part 1.

(24)

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

(a) The diagram below summarises some of the changes that take place in a typical human female during the menstrual cycle. Answer the questions that follow, based on this diagram.



(i) What is the role of the menstrual cycle?
(ii) Name the event that occurs between days 1-5 of the cycle.
(iii) The event you have named at (ii) is triggered by a large drop in a certain hormone. Name the hormone.
(iv) Where is the hormone oestrogen produced?
(v) Using the time axis from the graph above, sketch a graph in your answer book, to indicate the changes in oestrogen levels during the cycle.
(vi) Name the event that occurs at day 14 **and** name the hormone which causes this to happen.
(vii) Name the structure that the Graafian follicle develops into after day 14.
(viii) Does the graph indicate that the woman became pregnant during this menstrual cycle? Explain your answer.

(b) Answer the following questions from your knowledge of sexual reproduction in flowering plants.

(i) Describe in detail:
1. The development of the pollen grain from a microspore mother cell.
2. The events that happen to a mature pollen grain following pollination up to double fertilisation.

(ii) Give **two** adaptations of wind-pollinated flowers that increase their chance of successful pollination.

(iii) State **two** advantages of sexual reproduction versus asexual reproduction in plants.

(c) Multi-antibiotic (drug) resistant *Clostridium difficile* (C.diff) is a species of bacteria, which can form endospores in response to adverse environmental conditions.

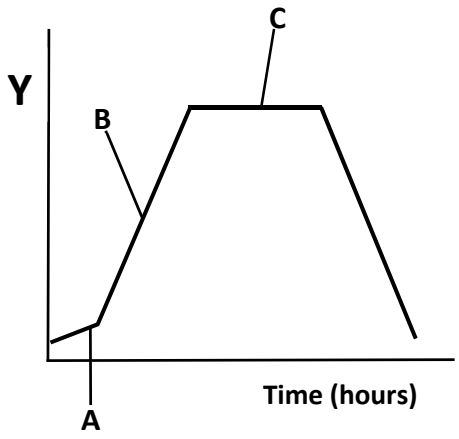
(i) Draw a large labelled diagram of a typical bacterial cell.

(ii) Name the method of asexual reproduction exhibited by bacteria.

(iii) Describe the process of this asexual reproduction in bacteria.

(iv) The diagram below is that of a typical growth curve for microorganisms;

1. Name each of the stages of the growth curve labelled A, B and C.
2. What is a suitable label for axis Y?



(v) Copy the growth curve in your answer book and indicate on your diagram when endospore formation is most likely to occur.

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

(a) Plants produce chemicals called growth regulators such as auxin to regulate tropisms.

(i) What is a tropism?

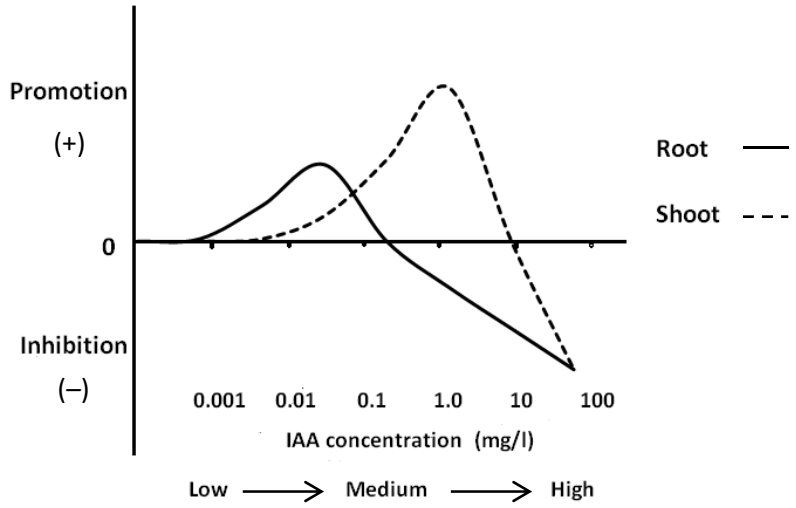
(ii) Where precisely in plants are auxins produced?

(iii) What is the precise benefit to the plant that the shoot is positively phototropic?

(iv) Give **two** uses in agriculture or horticulture of plant growth regulators.

(v) The graph below shows the result of a student's investigation on the effect of different concentrations of IAA on the growth of plant roots and shoots.

Compare the effects the different concentrations of IAA have on the growth of the roots and the shoots.



(vi) State **two** reasons why the action of an auxin is considered to be similar to the action of a hormone in the human body.

(b) Human papilloma virus (HPV) is a virus that can infect cells and cause some cancers in males and females. A vaccine has been produced to prevent infection by the human papilloma virus and is now available to all first year students attending Irish second-level schools. The vaccine contains particles from the coat of the virus only, in a saline solution, and stimulates induced immunity in humans.

(i) From which biochemical component are viral coats made?

(ii) Name the other main chemical component of a virus.

(iii) Why can viruses be described as obligate parasites?

(iv) Describe how virus particles can infect and replicate in host cells.

(v) Immunity is the ability to resist infection. Name the **two** types of induced immunity.

(vi) Which of these types of immunity that you have named at (v), occurs after a vaccination with the HPV vaccine?

(vii) Give **one** difference between the types of induced immunity that you have named at (v).

(c) Answer the following questions about a plant root.

(i) Draw a diagram of the longitudal section (L.S.) of a typical root.

(ii) Label any **three** zones on your diagram.

(iii) In which zone is water absorbed from the soil?

(iv) Name the process through which water is absorbed from the soil.

(v) Name the tissue that transports water in roots.

(vi) Give **two** ways in which this tissue is adapted to transporting water.

(vii) Two Irish scientists, Dixon and Joly, first proposed the theory of water movement in plants. Using this theory, describe the mechanism by which water moves through this tissue to the leaves in a plant.

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Leaving Certificate – Higher Level

BIOLOGY

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