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Coimisiún na Scrúduithe Stáit
State Examinations Commission

LEAVING CERTIFICATE EXAMINATION, 2015

BIOLOGY – HIGHER LEVEL

TUESDAY, 9 JUNE – AFTERNOON, 2.00 – 5.00

Section A Answer any **five** questions from this section.
Each question carries 20 marks.
Write your answers in the spaces provided on **this examination paper**.

Section B Answer any **two** questions from this section.
Each question carries 30 marks.
Write your answers in the spaces provided on **this examination paper**.

Section C Answer any **four** questions from this section.
Each question carries 60 marks.
Write your answers in the **answer book**.

It is recommended that you spend not more than 30 minutes on Section A and 30 minutes on Section B, leaving 120 minutes for Section C.

You must return this examination paper with your answer book at the end of the examination.

[OVER]

Section A

Answer any five questions.
Write your answers in the spaces provided.

1. Answer any **five** of the following parts (a) to (f):

(a) What name is given to the simplest units of carbohydrates? _____

(b) Name a catabolic process that produces these simplest units. _____

(c) The general formula of carbohydrates is $C_x(H_2O)_y$.
What is the most common value of y in the carbohydrates used for energy by human cells?

_____

(d) Name a structural polysaccharide found in plants. _____

(e) Name a polysaccharide, other than the one referred to in part (d), commonly found in plants.

_____

(f) Which carbohydrate is always found in DNA? _____

2. (a) What do ecologists mean by the term *scramble competition*? _____

_____

(b) Give **one** example of a factor, other than light, which may be a source of competition among plants.

_____

(c) Give **one** example of a factor, other than food, which may be a source of competition among animals.

_____

(d) Caterpillars have mouth parts that are suitable for chewing on leaves, whereas the adult form, the butterfly, has long sucking mouth parts. Suggest how having different types of mouth parts reduces competition between the adults and the young of such species.

_____

_____

(e) Answer the following questions in relation to a quantitative survey of a species of small herbaceous plant.

(i) Name the method that you would employ. _____

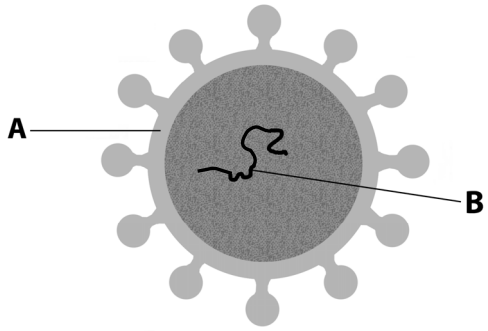
(ii) How would you ensure that your sampling was random? _____

_____

(iii) Name **one** edaphic factor that could affect the distribution of this plant in the ecosystem.

_____

3. The diagram shows the structure of a type of virus.



(a) What is the main chemical constituent of part A? _____

(b) Viruses are *obligate parasites*. What does this mean in relation to viruses?

_____

(c) **B** is one of two possible biomolecules. Name **one** of these.

_____

(d) Name **one** virus that causes disease in plants. _____

(e) How do scientists distinguish between different viruses?

_____

(f) Viruses are difficult to classify into a kingdom. Why is this so?

_____

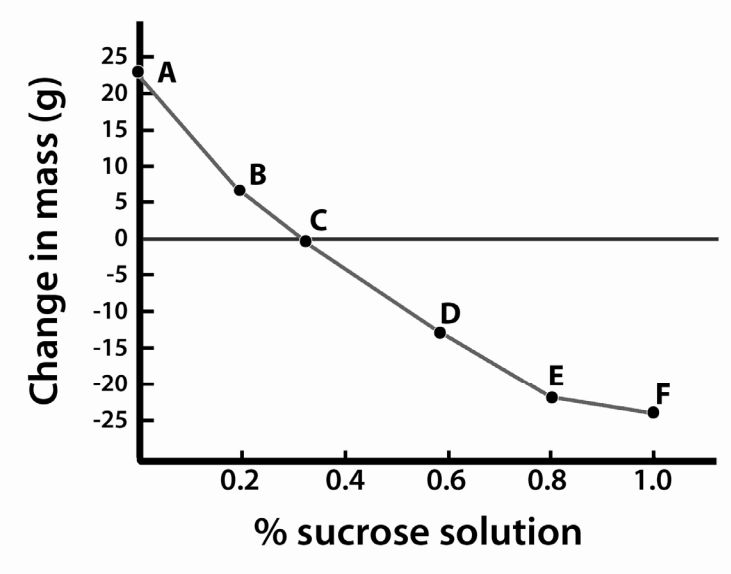
(g) Give **one** way in which viruses are economically important to humans.

_____

4. Indicate whether the following statements are true or false by placing a tick (✓) in the appropriate box in **each** case.

		True	False
(a)	Meiosis is an important source of variation.		
(b)	Mitosis occurs in mature red blood cells in humans.		
(c)	During mitosis the nuclear membrane temporarily disappears.		
(d)	Meiosis gives rise to the haploid condition.		
(e)	In multicellular organisms mitosis functions primarily in growth.		
(f)	In plants, a cell plate forms during telophase of mitosis.		
(g)	The human zygote divides by meiosis.		

5. In an experiment, a student cut some potatoes into small, evenly-shaped pieces. She divided them into groups of 10, weighed each group and placed them in sucrose solutions of different concentration, labelled A to F. Two hours later, she removed the potato pieces from the sucrose solutions, dried them and reweighed them. She plotted her results on a graph (change in mass versus % sucrose solution). The graph is shown below.



(a) From the graph, determine the concentration of the contents of the potato cells.

_____

(b) Explain in detail why the pieces in solutions D to F lost mass.

_____

_____

(c) Give **one** example of the use of the mechanism(s) described in (b) in food preservation.

_____

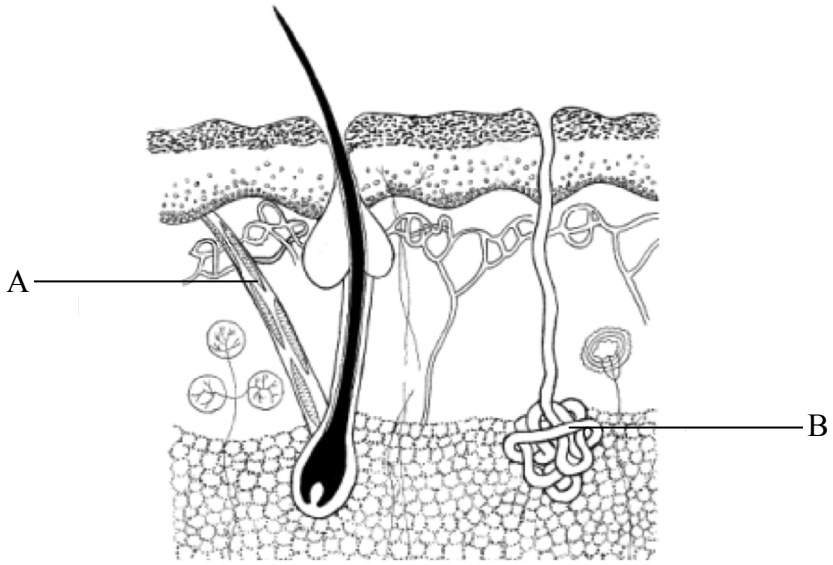
(d) Explain how plant cells remain turgid.

_____

_____

_____

6. The diagram shows a vertical section through human skin.



(a) Place an X on the adipose tissue.

(b) Name A and B.

A. _____ B. _____

(c) Define each of the following words **and** explain how each process keeps the human body warm.

(i) Piloerection. _____

_____

_____

_____

(ii) Vasoconstriction. _____

_____

_____

_____

[OVER]

Section B

Answer any <u>two</u> questions.
Write your answers in the spaces provided.
Part (a) carries 6 marks and part (b) carries 24 marks in each question in this section.

7. (a) (i) What is the chemical composition of a chromosome?

_____

(ii) What is meant by the term *junk DNA*? _____

(b) (i) In relation to the isolation of DNA from a plant tissue, explain why you used each of the following:

1. Washing-up or similar liquid.

_____

2. Sodium chloride.

_____

3. Protease.

_____

4. Freezer-cold ethanol.

_____

(c) (i) In relation to an investigation you carried out into heat denaturation of an enzyme, answer the following:

1. Name the enzyme you used. _____

2. Name the enzyme's substrate. _____

3. Name the product(s) formed. _____

(ii) How did you denature the enzyme? _____

(iii) How did you know that the enzyme had been denatured? _____

_____

(iv) Why are buffers needed when carrying out experiments with enzymes in school?

_____

8. (a) (i) Fungi may be classified into two groups on the basis of their nutrition. One of these groups is the parasitic fungi. What is the other group?

_____

(ii) Draw a labelled diagram of a reproducing yeast cell.

(b) Answer the questions below in relation to the growth of leaf yeast in the laboratory.

(i) What principal nutrient was added to the agar for the yeast?

_____

(ii) How did you introduce the yeast into the Petri dishes?

_____

_____

_____

(iii) What did the yeast look like when it had grown on the agar?

_____

(c) (i) Describe how you carried out the investigation into the effect of IAA on plant tissue.

_____

_____

_____

_____

_____

(ii) What were the results of your investigation?

_____

_____

9. (a) (i) What is the purpose of a hypothesis in the scientific method?

_____

(ii) Explain what is meant by double-blind testing in scientific experimentation.

_____

_____

(b) A scientist wished to investigate the effect of the concentration of iodine on the rate of growth of tadpoles (young frogs). He acquired 100 tadpoles of the same age, all of which had hatched from the fertilised eggs of one female. He used water from the pond in which the tadpoles had hatched, and a stock solution of iodine.

(i) Why do you think that it was important that all the tadpoles came from the same mother?

_____

(ii) At the start of the investigation the scientist divided the tadpoles into four groups of 25, one of which was to be the control.

1. Why is a control essential in scientific experiments?

_____

2. Suggest why he used 25 tadpoles in each group.

_____

3. Suggest how this investigation would have been carried out.

_____

_____

_____

_____

_____

(iii) Suggest **two** factors that the scientist would have kept constant during the investigation.

_____

_____

Section C

Answer any <u>four</u> questions.
Write your answers in the answer book.

10. (a) (i) Which famous 19th century biologist is regarded as 'the father of genetics'?

(ii) In genetics, what is meant by segregation?

(iii) Give an example of a sex-linked characteristic in humans. **(9)**

(b) Write notes on each of the following topics in relation to nucleic acids. In each case your notes should contain three points. Do not give diagrams in your answers.

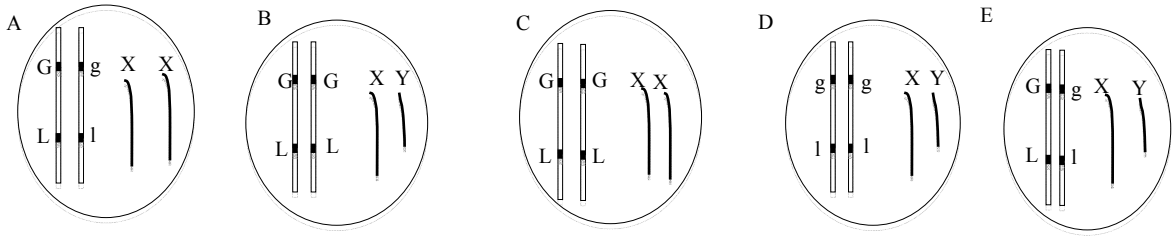
(i) Complementary base pairs.

(ii) Codons.

(iii) Transcription. **(27)**

(c) Unlike the situation in humans, maleness in birds results from the presence of the XX chromosome pair in the fertilised egg and femaleness results from the XY pair. In a particular bird species, green plumage (G) is dominant to yellow plumage (g) and long tail (L) is dominant to short tail (l). The gene for plumage colour is linked to the gene for tail length.

Study the genotypes of the above bird species shown in the diagrams below and **in your answer book** match the correct genotype to each of the descriptions (i) to (vi).
A diagram may match more than one of the descriptions.



(i) A female that is heterozygous in respect of plumage colour and tail length.

(ii) A male that can produce only one type of gamete.

(iii) The individual that can produce the greatest number of different gametes.

(iv) A male, **all** of whose offspring will have long tails.

(v) A female, **all** of whose offspring will have green plumage.

(vi) A male that is homozygous in respect of plumage colour and tail length.

(vii) **In your answer book**, write out the genotypes of the gametes that bird D can produce.

(24)

11. (a) (i) Humans are *heterotrophic* and *omnivorous*. Explain **each** of these terms.

(ii) What is meant by a balanced diet?

(9)

(b) (i) Draw a large diagram of the human alimentary canal and its associated glands.
On your diagram label all of the following:

1. **Two** associated glands. Name each gland labelled and put the letter ***G*** in brackets after each name to indicate it is a gland.

2. **Two** parts of the small intestine. Name each part labelled and put the letter ***S*** in brackets after each name to indicate it is part of the small intestine.

3. **Two** parts of the large intestine. Name each part labelled and put the letter ***L*** in brackets after each name to indicate it is part of the large intestine.

(ii) Answer the following questions in relation to lipase.

1. What is lipase?

2. Give **one** part of the alimentary canal that secretes lipase.

3. What is the approximate pH at the site of lipase action? **(27)**

(c) (i) 1. Write the dental formula for an adult human with a full set of teeth.

2. Give **one** difference between the dental formula referred to above and the tooth arrangement of the mammal in the photograph below.

3. What type of food do you think is mainly consumed by the mammal in the photograph? Explain your answer.

(ii) Give **two** functions of the large intestine.

(iii) Outline **two** beneficial functions of the bacteria that live in the digestive tract.

(24)

12. (a) (i) Write a balanced chemical equation for photosynthesis.

(ii) Where precisely in a plant cell does photosynthesis occur? **(9)**

(b) Researchers have taken an important step towards enhancing photosynthesis by creating genetically modified plants. These plants now contain genes from blue-green algae that code for a more efficient form of Rubisco, an enzyme used in the dark stage of photosynthesis. Rubisco can account for up to half of all the soluble protein found in a leaf.

(i) What is the energy source for the dark stage?

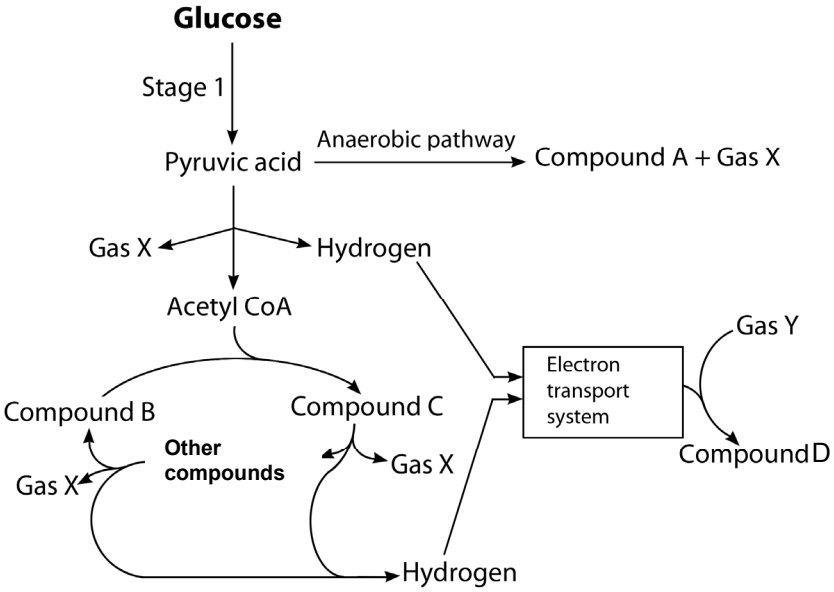
(ii) Give the details of the dark stage of photosynthesis. Marks will not be given for a word diagram alone.

(iii) Give **two** uses of the main product of the dark stage.

(iv) Name **two** environmental factors on which the rate of photosynthesis depends.

(v) Suggest **one** advantage of using genetically modified crops. **(27)**

(c) The diagram below represents stages in respiration in yeast cells.



(i) Name Stage 1 **and** state its location in yeast cells.

(ii) **Copy the table below into your answer book** and complete it by inserting a letter or name, from the diagram above, to identify a compound which has the number of carbon atoms shown.

Number of carbon atoms	Compound
6	
3	
2	

(iii) Name Gas X and Gas Y.

(iv) Name the compound D **and** give **two** functions of this compound in yeast cells.

(24)

[OVER]

13. (a) Explain the following words as used in ecology:

(i) Ecosystem.
(ii) Community.
(iii) Fauna. **(9)**

(b) Answer the following questions in relation to the ecosystem you have studied.

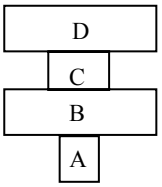
(i) All organisms have adaptations that help them survive and thrive. Some adaptations are structural, other adaptations are behavioural.
Behavioural adaptations are the **techniques** by which organisms enhance their survival.

Name **one** predator from a **named** ecosystem that you have studied **and** give **one** adaptive **technique** of the predator.

(ii) 1. What is meant by the term *variation*?

2. Give a reason why there might be variation in the height of a mature plant species in the ecosystem.

(iii) In relation to this diagram of a pyramid of numbers,
1. name appropriate organisms at A, B, C and D.
2. indicate which organism is most likely to be a herbivore.



(iv) What is the significance of energy loss at each stage in a food chain in relation to:
1. the length of the food chain?
2. the number of organisms at the final trophic level?

(v) If a niche becomes vacant in an ecosystem for a decomposer species, suggest why some other decomposer species may not be able to occupy the vacant niche.

(27)

(c) Using your knowledge of ecology, suggest why caution is advised regarding each of the following practices.

(i) The release of non-native animals into the Irish countryside.

(ii) Using fishing nets of very small mesh size.

(iii) Hedgerow cutting in spring and summer.

(iv) Spreading slurry on farmland. **(24)**

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

(a) (i) Outline how any **one** named feature of the human general defence system works.

(ii) Name **two** organs in the human body that are specific to the immune system.

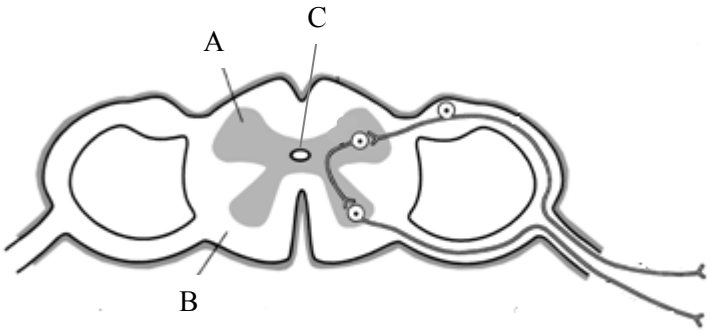
(iii) Distinguish clearly between an antigen and an antibody.

(iv) T cells are a type of lymphocyte, with different sub-types having different roles in our immune system.

1. Describe the specific roles of both killer T cells **and** helper T cells in an immune response.

2. Name the T cells that stop the immune response.

(b)



(i) Name the parts labelled A, B and C in the diagram of the cross section of the spinal cord.

(ii) What is the main structural difference between A and B?

(iii) 1. What is the function of the meninges?
2. How many layers are present in the meninges?

(iv) Reflex actions are very important in animals.

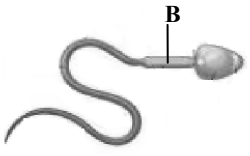
1. What is a reflex action?
2. Outline the mechanism of a reflex action.

(c) (i) Draw a labelled diagram of the human male reproductive system and its associated glands.

(ii) Put X on the diagram where meiosis occurs.

(iii) Give a function of **one** named gland.

(iv) The diagram shows the structure of a human sperm cell. Part B contains many mitochondria.



1. Suggest why a sperm cell needs so many mitochondria.

2. Mitochondria are inherited exclusively from the mother. Suggest why this is the case.

(v) State the survival times of the egg and sperm in the female body.

[OVER]

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

(a) Seeds may be classified as either endospermic or non-endospermic, based on whether food is stored in endosperm or cotyledon tissue. Seeds may also be either monocotyledonous or dicotyledonous.

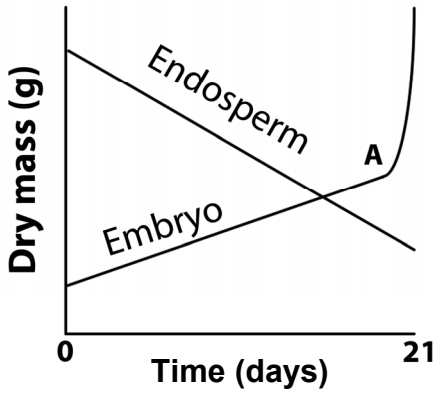
(i) Following fertilisation, from precisely which part of the flower is the seed formed?

(ii) What is meant by the term *monocotyledonous*?

(iii) Name **two** biomolecules stored in endosperm or cotyledon tissue.

(iv) Give **one** way knowledge of seed dormancy has been useful to humans.

(v) The graph below shows the changes in dry mass of both endosperm and embryo tissue of a germinating endospermic seed over a three-week period after sowing. (Dry mass is the mass of a tissue with its water content removed.)



1. Suggest why the measurement of dry mass is preferred in these investigations.

2. Explain why the dry mass of the endosperm tissue decreases over the three weeks.

3. What process begins at A?

4. Would you expect the total dry mass of the seed (embryo plus endosperm) to have remained the same up to A?
Explain your answer.

(b) (i) Draw a large labelled diagram to show the structure of *Rhizopus*.

(ii) 1. What is the role of fungi such as *Rhizopus* in nature?

2. Why is this role vital?

(iii) Give **one** structural difference between Fungi and Plantae.

(iv) Name the method of asexual reproduction in *Rhizopus*.

(v) Describe in detail the process of sexual reproduction in *Rhizopus*.

(c) (i) Name the **three** general shapes of bacterial cells.

(ii) What is meant by the term *pathogen*?

(iii) What is the difference between 'asepsis' and 'sterility'?

(iv) Give **one** way in which bacteria cope with unfavourable environments.

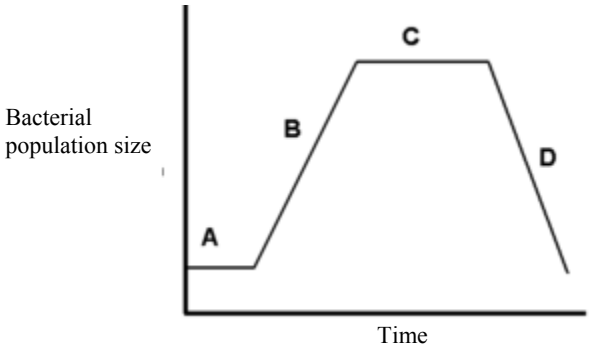
(v) When growing bacteria in the laboratory, samples are taken regularly from the growth medium and the number of cells per millilitre is counted. A graph of the results is drawn and is similar to the one shown below.

Answer the following questions in relation to this graph.

1. Name the stages B, C and D.

2. Explain what is happening during stage C.

3. Distinguish between batch processing and continuous flow in food processing. Refer to the stages labelled in the graph in your answer.



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