Write your Examination Number here ⇨ [ ]

Coimisiún na Scrúduithe Stáit
State Examinations Commission

LEAVING CERTIFICATE EXAMINATION, 2017

BIOLOGY – HIGHER LEVEL

Tuesday, 13 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**.

Total: 400 marks.

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.

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) Name a protein that has a fibrous structure.

_____

(b) Where in the human body would you expect to find the fibrous protein referred to above?

_____

(c) Give a role of a named mineral, other than calcium, which is required by plants.

Mineral: _____

Role in plants: _____

(d) State **two** reasons why water is required by living organisms.

(i) _____

(ii) _____

(e) Name the metallic element present in haemoglobin.

_____

(f) Which type of food biomolecule may be identified by the use of Benedict's or Fehling's solution?

_____

2. (a) Why is it important that nutrients are recycled in nature?

_____

(b) During the nitrogen cycle, nitrogen from the air is converted to nitrates.
Of what benefit is this?

_____

(c) Nitrates are formed directly from other molecules in the soil.
Name **one** of these molecules.

_____

(d) Mention **one** role of animals, other than as consumers, in the nitrogen cycle.

_____

(e) Name the family of plants which have a symbiotic relationship with nitrogen-fixing bacteria.

_____

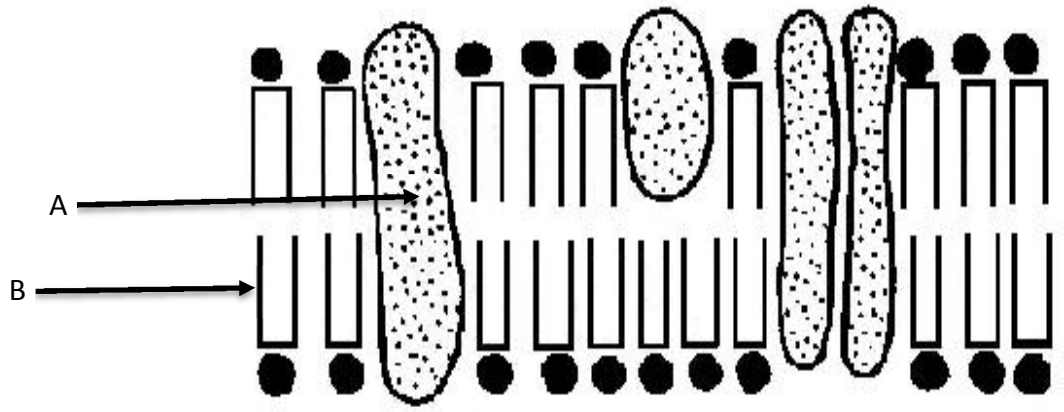
(f) The nitrogen in the air is converted to nitrates but the percentage of nitrogen in the air does not change. What process is responsible for this?

_____

(g) What is the role of modern fertilisers in the nitrogen cycle?

_____

3. The diagram below shows part of the ultrastructure of a cell membrane.



(a) Name the molecules labelled A and B.

A _____ B _____

(b) Molecules can move through cell membranes by various processes.
Name **two** such processes.

(i) _____ (ii) _____

(c) Suggest a reason why the organelle involved in aerobic respiration is found in different amounts in different cells.

_____

(d) What term is used to describe organisms whose cells contain a nucleus?

_____

(e) What term is used to describe organisms that do not have nuclei?

_____

(f) Name an organelle other than the nucleus which contains genetic material.

_____

4. From your knowledge of microorganisms, explain what is meant by **each** of the following terms.

(a) Pathogen.

_____

(b) Saprophyte.

_____

(c) Heterotroph.

_____

(d) Antibiotic.

_____

(e) Asepsis.

_____

(f) Bioprocessing.

_____

(g) Bioreactor.

_____

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

	True	False
(a) Aerobic respiration occurs entirely in the cytosol.		
(b) Glycolysis is an anaerobic process.		
(c) None of the energy released in respiration is lost as heat.		
(d) In respiration, all of the ATP molecules are produced in the Krebs cycle.		
(e) ADP requires an input of energy to produce ATP.		
(f) When glucose is fermented by yeast, ethanol and water are formed.		
(g) Fermentation releases more energy than aerobic respiration.		

6. The following questions refer to sexual reproduction in both flowering plants and humans.

(a) Which types of cell division occur during production of the female gametes in flowering plants and in humans? If more than one type occurs in either case, write them in the order in which they occur.

In flowering plants: _____

In humans: _____

(b) Give the precise location of the production of the female gametes.

In flowering plants: _____

In humans: _____

(c) Give the precise location of fertilisation under normal circumstances.

In flowering plants: _____

In humans: _____

(d) Name the next stage of development following formation of the zygote.

In flowering plants: _____

In humans: _____

(e) Give an advantage **and** a disadvantage of sexual reproduction in organisms.

Advantage: _____

Disadvantage: _____

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) Answer the following questions by reference to a **named** ecosystem which you have investigated.

Name of ecosystem: _____

(i) Give **one** example of a possible error in ecological surveying.

_____

(ii) Suggest how this error might be minimised or eliminated.

_____

(b) (i) As part of your study you constructed a food web. In the space below or in your answer book, draw a food web from the ecosystem you named above, containing:
1. At least three food chains, **and**
2. At least four trophic levels.

(ii) Many animals must be captured for identification and counting in ecological surveying. Some of these animals have adaptive features that may help them escape capture. Give an example of **one** such adaptive feature.

_____

(iii) Explain how this adaptation helps the animal escape capture.

_____

(iv) Suggest why ecological surveying is important.

_____

(v) Describe how you carried out a quantitative survey of a plant species named in your food web above.

_____

_____

_____

[OVER]

8. (a) Answer the following in relation to enzymes.

(i) Give a factor, other than pH, which affects enzyme activity.

_____

(ii) Explain the term *optimum activity*.

_____

(b) Answer the following in relation to an investigation you carried out into the effect of pH on the rate of enzyme activity.

(i) Name the enzyme that you used in this investigation.

_____

(ii) State:

1. The source of this enzyme. _____

2. The substrate of this enzyme. _____

(iii) Explain why changing the pH would have an effect on enzyme activity.

_____

_____

(iv) How did you measure the rate of enzyme activity?

_____

_____

(v) Label the axes **and** sketch a graph to show the effect of pH on enzyme activity.

9. (a) (i) What is the purpose of replicates in scientific experimentation?

_____

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

_____

(b) (i) When investigating the conditions necessary for seed germination, describe how you:

1. Provided an oxygen-free environment.

_____

2. Determined that germination had taken place.

_____

(ii) In relation to an investigation you carried out to prepare and examine with a microscope a transverse section of a dicotyledonous stem, answer the following.

1. How did you prepare the section?

_____

2. Why is a coverslip used?

_____

(iii) When demonstrating osmosis:

1. What did you use as a selectively-permeable membrane?

_____

2. What led you to conclude that osmosis had occurred?

_____

(iv) When isolating DNA from plant tissue:

1. Give a reason for adding salt (NaCl) to the chopped plant tissue.

_____

2. Why was the mixture containing the chopped plant tissue, salt and washing-up liquid kept at 60 °C for a period of time?

_____

Section C
Answer any four questions.
Write your answers in the answer book.

10. (a) Explain the following terms as used in ecology.

(i) Scramble competition.

(ii) Ecosystem.

(iii) Conservation. **(9)**

(b) A new waste-to-energy incinerator is currently being built in Poolbeg, Dublin. The facility will generate energy from domestic waste that cannot be reused or recycled.

(i) Suggest **two** reasons why this new incinerator is located in Dublin.

(ii) Give **one** advantage **and one** disadvantage of incineration in waste disposal.

(iii) What is the main role of microorganisms in waste disposal?

(iv) What is meant by the term *pollutant*?

(v) Give an account of the effect of a **named** pollutant from one of the following areas: domestic, agriculture, industry.

(vi) Describe how the pollutant referred to in (v) is controlled.

(27)

(c) (i) List **two** species from an ecosystem you have studied, which are involved in a predator-prey relationship.

(ii) Draw a graph, appropriately labelling axes and curves, to show how population numbers fluctuate in a predator-prey relationship.

(iii) Explain the fluctuations shown in the graph.

(iv) Outline a role in nature of such a predator-prey relationship.

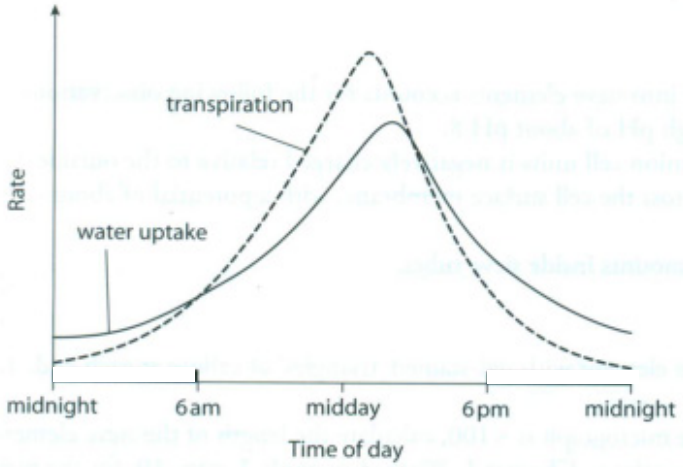
(24)

11. (a) (i) Name the vascular tissue through which the products of photosynthesis are transported in plants.

(ii) Give two structural features of the tissue referred to in (i).

(9)

(b) The graph shows the relationship between the rate of transpiration and the rate of water uptake for a particular plant on a fine summer day.



(i) Describe the relationship between the rate of transpiration and the rate of water uptake during the day. Suggest a reason for this relationship.

(ii) Under what **two** conditions does the highest rate of transpiration occur on that day?

(iii) Name the cells which control the opening and closing of stomata.

(iv) What is the advantage to plants of having most of their stomata on the underside of the leaves?

(v) Give a disadvantage to plants of a high rate of transpiration.

(vi) What do plants do in response to the disadvantage referred to in (v)?

(vii) Name **both** Irish scientists who proposed the theory of water movement in plants.

(27)

(c) (i) Some plants can reproduce by means of vegetative propagation.
Explain the term *vegetative propagation*.

(ii) Give **two** features of vegetative propagation.

(iii) Give **one** example of natural vegetative propagation from a leaf **and** one example from a bud.

(iv) Artificial vegetative propagation is widely used in horticulture.
Give **two** examples of artificial vegetative propagation.

(v) Suggest a benefit of artificial vegetative propagation.

(24)

12. (a) Give a brief account of how you would produce a DNA profile. **(9)**

(b) (i) In the context of natural selection, explain how numbers in a population remain relatively constant despite the production of many offspring.

(ii) The son of a haemophiliac father was not haemophiliac.
Explain in detail how this situation might have arisen.

(27)

(c) DNA contains the genetic code for the formation of all proteins.

(i) Name the **two** purine bases in DNA.

(ii) Describe fully the roles played in protein synthesis by the three different types of RNA.

(iii) Once a protein has been synthesised, a final step is required for it to become fully functional. What is this step?

(24)

13. (a) The photograph below shows a system of promoting grass growth on a football pitch by shining very bright light on the pitch when it is not in use, in order to accelerate photosynthesis.

(i) Give **two** ways, other than the method shown in the photograph, by which photosynthesis could be accelerated in horticulture.

(ii) Explain how **one** of the methods referred to in part (i) could accelerate photosynthesis.

(9)

(b) Answer the following questions about photosynthesis.

(i) In relation to electrons, describe the main events of **each** pathway in the light stage.

(ii) Is the dark stage of photosynthesis anabolic or catabolic? Explain your answer.

(iii) What happens to **both** ADP and $NADP^+$ at the end of the dark stage?

(iv) Name the **two** types of particle transferred from NADPH to CO_2 in the dark stage.

(27)

(c) Answer the following questions in relation to the cell cycle.

(i) Explain the term *diploid*.

(ii) Draw a labelled diagram to show the position of the chromosomes during anaphase of mitosis in a diploid nucleus in which 2n = 4.

(iii) After telophase of mitosis, how do 1. animal cells; 2. plant cells, split in two?

(iv) What is the function of mitosis in 1. single-celled organisms; 2. multi-celled organisms?

(24)

[OVER]

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

(a) Read the passage below and answer the questions that follow.

Zika virus is a mosquito-borne virus. Mosquitoes usually bite during the day, peaking during early morning and late afternoon or evening. Researchers are studying a potential link between Zika virus infection and a surge in microcephaly cases. Microcephaly is a condition in which a baby is born with a small head or the head stops growing after birth. Rio de Janeiro, was an area with ongoing Zika virus transmission during the 2016 summer Olympic Games.

(i) Suggest a reason why the World Health Organisation (WHO) advised women of childbearing age or those who were pregnant not to travel to areas where a Zika virus outbreak was occurring.
(ii) Give **two** precautions people could take to prevent Zika virus transmission if they did travel to affected areas.
(iii) Although the Zika virus can cause harm, other viruses can be beneficial. Give **one** example of a beneficial virus.
(iv) Describe how a virus replicates.
(v) Discuss the statement "Viruses are not considered to be living organisms".

(b) (i) An outbreak of measles occurred in Ireland during the summer of 2016. Name a group of people who would be most at risk if exposed to such an outbreak.
(ii) What is a vaccine **and** how does it result in immunity?
(iii) List any **three** types of T lymphocyte active in the human immune response.
(iv) Describe the role of **each** of the T cells referred to in part (iii) above.

(c) In each of the following, state **two** features that show how the named structure is adapted to carry out the named function.
(i) The lens of the eye for focusing light.
(ii) A neuron for transmitting impulses.
(iii) An intestinal villus for absorbing soluble food.
(iv) A glomerulus for filtering blood.
(v) A wind-pollinated flower for pollination.

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

(a) (i) Explain the term *homeostasis*.
(ii) Why is homeostasis important in the human body?
(iii) Describe in detail the process of inhalation.
(iv) Name a human breathing disorder.
(v) State a cause **and** a treatment for the breathing disorder referred to in part (iv).

(b) The vertebral column is part of the human axial skeleton and is composed of bones called vertebrae, with intervertebral discs.

(i) There are five regions in the vertebral column. Name any **two** of these regions **and** state how many bones are found in **each** named region.
(ii) What are the intervertebral discs made of **and** what is their function?
(iii) Bone tissue is continually broken down and reformed during life.
1. Name the cells that break down bone.
2. Name the cells that build bone.
(iv) Give **two** factors on which the continued renewal of bone depends.

(c) Answer the following questions in relation to human sexual reproduction.
(i) During *in vitro* fertilisation treatment (IVF) several eggs are removed from the woman.
1. Explain the term *in vitro fertilisation*.
2. Suggest a reason for the removal of **several** eggs.
(ii) Identify the germ layer from which the skin of the developing embryo arises.
(iii) From which tissues does the placenta form?
(iv) One function of the placenta is to stop the blood of the mother and foetus mixing. Give **two** reasons why such mixing must not occur.
(v) State **two** other functions of the placenta.

Blank Page