WARNING: You must return this section with your answer book otherwise marks will be lost.

Write Your Examination Number here

AN ROINN OIDEACHAIS

LEAVING CERTIFICATE EXAMINATION, 1993

BIOLOGY — HIGHER LEVEL

WEDNESDAY, 16 JUNE — MORNING, 9.30 to 12.30

Answer **six** questions from Part I and **four** questions from Part II.

You should not spend more than 45 minutes on Part I, leaving about 135 minutes for Part II.

PART I (120 marks)

Answer **six** questions. Each question carries 20 marks.
Write your answers in the spaces provided.
Keep your answers short.
Write your examination number at top.
Be sure to return this part of the examination paper; enclose it in the answer book you use for answering Part II.

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1. Answer *five* of the following:

(*a*) The ..... joins the kidney and the bladder.

(*b*) The Eustachian canal joins the pharnyx and the .....

(*c*) The hepatic portal vein joins the ..... and the liver.

(*d*) The pancreatic duct joins the pancreas and the .....

(*e*) The vas deferens (sperm duct) joins the urethra and the .....

(*f*) The umbilical cord joins the foetus and the .....

2. (i) Which antibody is present in a person of blood group A? .....

(ii) Name the substrate for the enzyme thromboplastin (thrombokinase). .....

(iii) Name the substance in erythrocytes which is involved in the transport of oxygen. .....

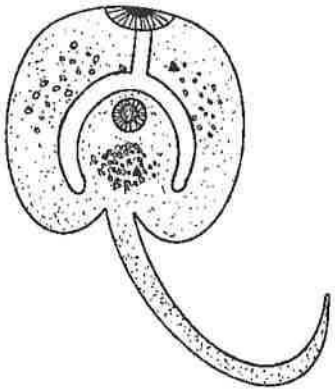
(iv) State the function of leucocytes. .....

(v) Give one location in the body where erythrocytes are formed. .....

(vi) Name two substances, other than foods and gases, which are transported by the blood.

(*a*) ..... (*b*) .....

3. (*a*) The diagram shows a stage in the life cycle of an acoelomate animal.



(i) Explain the term acoelomate.

.....

.....

.....

(ii) Name this stage of the life cycle.

.....

(iii) Name the host organism within which this stage develops.

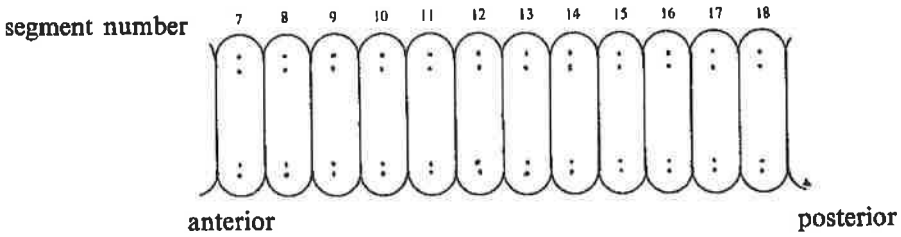
.....

(iv) State a possible fate of this life cycle stage.

.....

(*b*) Insert the letters W, X, Y, on the diagram of a part of the ventral surface of an earthworm to show each of the following:

a male opening (W), a spermothecal opening (X), a female opening (Y).



4. Answer the items (ii)–(v) below by reference to the organisms normally present in the ecosystem you name in item (i).

(i) Name an ecosystem you have studied. .....

(ii) Give an example of

(*a*) a predator: ..... (*b*) an autotroph: .....

(iii) Give an example to illustrate the meaning of the term competition.

.....

(iv) Give a four-member food chain which does not include the organisms named in (ii).

.....

(v) State *two* ways in which a *named* organism is adapted to life in this ecosystem.

Name.....

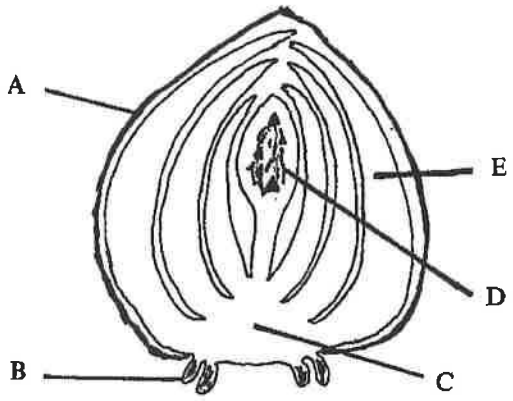
(1) .....

.....

(2) .....

.....

5. The diagram shows a vertical section through a bulb.



(i) Name the parts labelled.

A .....

B .....

C .....

D .....

E .....

(ii) Name a plant which forms a bulb. .....

Tick (√) the appropriate box to indicate the group to which the plant belongs.

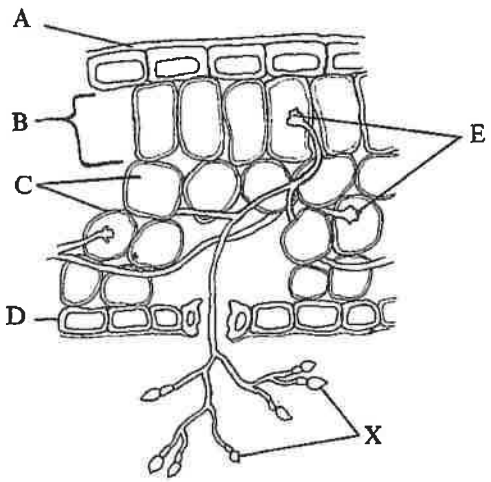
monocotyledons ☐ dicotyledons ☐

(iii) State the function of E. .....

(iv) Give the meaning of the term perennation.

.....

6. The diagram shows a vertical section through the leaf of a potato plant which is infected with the organism that causes the disease known as potato blight.



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

A .....

B .....

C .....

D .....

E .....

(ii) Name the cell organelle which is particularly associated with the cells of B. .....

(iii) Name the organism which causes potato blight. .....

(iv) State the function of E.

.....

(v) Name the part of the organism labelled X and state its function.

Name ..... Function .....

7. (*a*) (i) Name the implement shown in the diagram. .....

(ii) For what purpose is this implement normally used in the biology laboratory?

.....

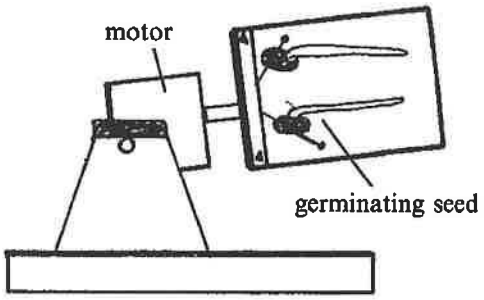
(iii) Outline how you would use this implement for the purpose you gave in (ii).

.....

.....

(*b*) (i) Name the apparatus shown in the diagram.

.....



(ii) For what purpose is this apparatus normally used in the biology laboratory?

.....

.....

(iii) Outline how you would use this apparatus for the purpose you gave in (ii).

.....

.....

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Part I is on a separate sheet which provides spaces for your answers. The completed sheet should be enclosed in your answer book.

PART II (280 marks)

Write your answers to this part in your answer book.

Answer **four** questions. Each question carries 70 marks.

8. (*a*) (i) Replication occurs between mitoses. What is replication and what is its significance?

(ii) Meiosis is sometimes termed 'reduction division'. Suggest why it is given this alternative name. (18)

(*b*) In the human red-green colour blindness is a sex-linked character. A boy with red-green colour blindness has a brother with normal colour vision.

(i) Give the genotype of the mother of these boys in respect of colour vision.

(ii) The boys' father had normal colour vision. Which of the following represents the chance that the boys' sister would have the same genotype as her mother in respect of colour vision?

0% 25% 50% 75% 100% (16)

(*c*) (i) What are homologous structures? Briefly assess the value of homologous structures as evidence for evolution.

(ii) Define the term mutation. How do mutations arise? (36)

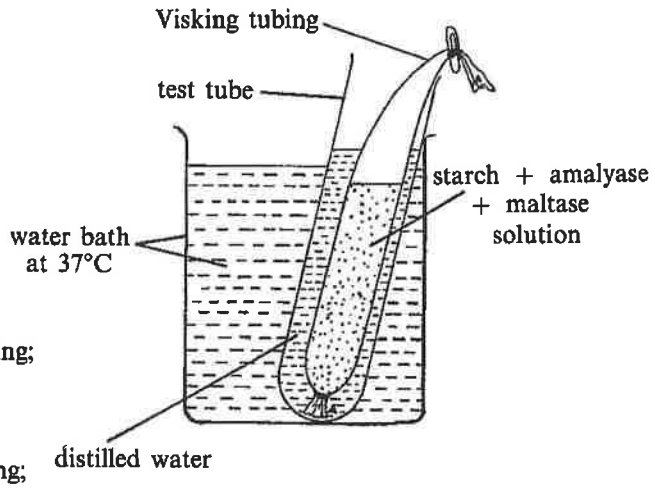
9. (*a*) (i) What are carbohydrates? Outline four functions of carbohydrates in living organisms.

(ii) Describe how you would carry out Fehling's (or Benedict's) test in the laboratory to detect the presence of reducing sugars.

(iii) Name a reagent used to test for the presence of starch. When testing green leaves for the presence of starch certain preliminary treatment of the leaves is necessary. Describe this preliminary treatment and explain why it is necessary. (46)

(*b*) A length of Visking tubing, which is partially permeable, was tied tightly at one end. The tubing was then three quarters filled with a 1% starch solution.

A solution of amylase and maltase was then added to the starch solution and the tubing twisted at the top and secured using a paper clip. The contents of the tubing were mixed by shaking and the tubing then placed in a test-tube of distilled water as shown in the diagram.



After a period of time tests were carried out on samples as follows:

(i) Fehling's test on the contents of the Visking tubing;

(ii) Fehling's test on the contents of the test-tube;

(iii) a starch test on the contents of the Visking tubing;

(iv) a starch test on the contents of the test-tube.

For each of the tests (i)–(iv) state the result you would expect and the reason for your answer. (24)

10. (*a*) Compare and contrast *Fucus* and *Spirogyra* under the following headings:

(i) habitat, (ii) structure, (iii) methods of reproduction. (40)

(*b*) How is *Fucus* adapted to life in the inter-tidal zone in respect of (i) its structure, (ii) its life cycle. (30)

11. Read the following passage and then answer the questions below.

Later in the 1960's Dr Crick and others postulated that DNA's bases were so organised as to represent a code to specify the assembly of amino acids into proteins. By 1970 this theory was proved. The codes for all 20 amino acids used to make proteins were found to be different groups of three of DNA's bases in sequence; these trinities were called codons. A stretch of codons together formed the instructions for the building of a protein; each stretch was in effect a gene.

Genetic engineering is founded on this understanding of DNA. It was soon realised that if the genetic instructions for the manufacture of a desirable protein could be identified and inserted into the DNA of a living cell, then that cell would be able not only to manufacture the protein but also to pass on that ability to future generations of cells. Practical applications e.g. mass production of rare but desirable proteins were obvious.

Turning microbes into "factories" has proved a realistic proposition. Bacteria were natural candidates for the job; they are simple single-celled creatures, whose biochemistry is reasonably well understood; they reproduce quickly; and they carry plasmids, small loops of self replicating DNA which float around the cell and are therefore ideal for the insertion of new genes. The techniques for transferring genes from other organisms into bacteria were first developed in the early 1970's. By the end of the decade the first commercial drug, Genentech's human insulin, was made in bacteria.

What Genentech did was isolate the gene coding for human insulin, and insert this gene into plasmids of the bacterium *Escherichia coli.* First they cut the gene sequence for human insulin out of its surrounding DNA with a "restriction" enzyme. These useful enzymes had been seen to attack the DNA of invading viruses by cutting it at specific sites, wherever the enzyme found a certain sequence of bases.

(Adapted from "The Genetic Alternative, A Survey of Biotechnology", The Economist, 30 April 1988)

(i) Name the bases present in DNA.

(ii) What is a codon? How do codons relate to genes?

(iii) Draw sufficient of the DNA molecule to show one complete codon within the molecule and label the parts.

(iv) Why are bacteria suitable organisms for conversion into "factories"?

(v) The hormone insulin is used to treat a certain human condition. Name this condition. Where is insulin produced in the human body?

(vi) What feature of "restriction" enzymes makes them suitable for use in genetic engineering?

(vii) Name the three types of bacterial cell. (70)

12. (*a*) (i) Explain what is meant by reflex action and give a brief account of the importance of this form of response.

(ii) Draw a large diagram of a transverse section through the spinal cord to show a reflex arc and label *six* parts. Show by means of arrows on your diagram the direction of impulse transmission for this spinal reflex. (40)

(*b*) In relation to the function of a motor neuron explain the role of each of the following: axon, synaptic knobs, myelin sheath, Schwann cell.

What is meant by threshold in relation to a stimulus? (30)

P.T.O.

K6

13. (i) Describe a laboratory experiment to show that the rate of photosynthesis varies with light intensity. Outline a graph of the results you would expect to obtain. (30)

(ii) Draw a labelled diagram of a chloroplast as seen using the electron microscope. Indicate on your diagram the site of (*a*) the light stage, (*b*) the dark stage of photosynthesis.
Outline the main features of the dark phase of photosynthesis. (40)

14. (i) Describe an experiment which you would carry out to determine the relationship between exercise level and the rate of breathing. (22)

(ii) Give a brief explanation of each of the following terms:
(*a*) tidal volume, (*b*) inspiratory reserve volume, (*c*) vital capacity. (18)

(iii) Outline how inhalation and exhalation occur during normal breathing. (30)

15. Answer *two* of the following. (35,35)

(*a*) In order to quantify and monitor animal and plant populations ecologists have developed a number of procedures for use in fieldwork.

Name *three* of these procedures, at least one of which must be suitable for studying animals, and describe the steps involved in using each procedure.

(*b*) In each of the following cases explain how the event indicated is brought about:

(i) The control of light entering the eye;

(ii) The focusing of light rays on to the retina when a person commences reading;

(iii) The detection, by binocular vision, that an object is three-dimensional.

(*c*) Write short explanatory notes on *four* of the following:

auxin, diffusion, active transport, villi, ribosome.

(*d*) Write an essay entitled

'Problems associated with the destruction of tropical rain forests.'