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Write Your Examination Number here

**AN ROINN OIDEACHAIS**

**LEAVING CERTIFICATE EXAMINATION, 1992**

BIOLOGY — HIGHER LEVEL

WEDNESDAY, 17 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.**

1. Answer the following by placing a tick (✓) in the appropriate box.

   (*a*) At which stage of mitosis are chromatids found on the equatorial region of the nuclear spindle?

   metaphase ☐ telophase ☐ prophase ☐ anaphase ☐

   (*b*) To which group of organisms does the organism responsible for potato blight belong?

   viruses ☐ protozoa ☐ bacteria ☐ fungi ☐

   (*c*) In which of the following organelles does the storage of starch take place in plant cells?

   ribosome ☐ mitochondrion ☐ nucleus ☐ leucoplast ☐

   (*d*) Which of the following is an enzyme?

   prolactin ☐ insulin ☐ trypsin ☐ adrenaline ☐

   (*e*) Which of the following metals forms part of the chlorophyll molecule?

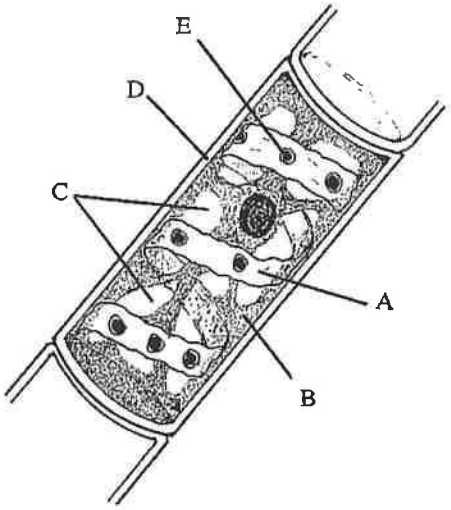
   potassium ☐ magnesium ☐ zinc ☐ calcium ☐

2. Complete the table below by selecting *one* example in each case from the following list of organisms:

   spider, *Rhizopus*, snail, man, earthworm, yeast, *Fucus*, cactus, *Fasciola hepatica*, sheep, mushroom, planarian.

| | | | |
|---|---|---|---|
| Omnivore | ..... | Predator | ..... |
| Xerophyte | ..... | Invertebrate | ..... |
| Producer | ..... | Endoparasite | ..... |
| Primary consumer | ..... | | |

3. The diagram shows a cell from a filament of *Spirogyra*.




(i) Name the parts labelled.

A .....

B .....

C .....

D .....

E .....

(ii) Name the carbohydrate present in D. .....

(iii) Is D permeable or selectively (semi-) permeable? .....

(iv) State the natural habitat in which this organism may be found.....

(v) Give *one* way in which other organisms living in the same habitat as *Spirogyra* might benefit from its presence.

.....

(vi) How does *Spirogyra* survive under adverse environmental conditions?

.....

4. In each of the following cases state *two* features that show the named structure is adapted to carry out the function indicated.

(*a*) The ileum for the absorption of food.

(i) .....

(ii) .....

(*b*) Alveoli for the exchange of gases.

(i) .....

(ii) .....

(*c*) A wind-pollinated flower for pollination.

(i) .....

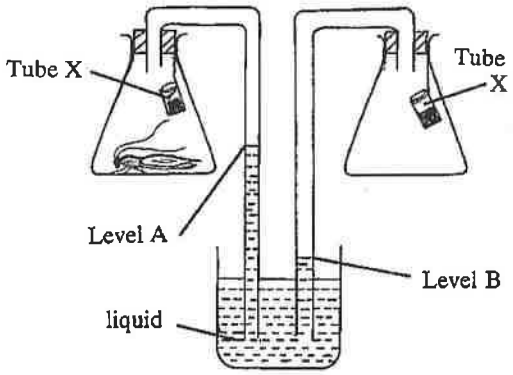
(ii) .....

(*d*) A root for the uptake of water.

(i) .....

(ii) .....

5. In an experiment, apparatus was set up as shown in the diagram.




(i) What is being demonstrated in this experiment?

.....

.....

(ii) What chemical is in the two small tubes labelled X?

.....

(iii) Why is the liquid at level A much higher than the liquid at level B?

.....

.....

(iv) What would happen if, at the start of this experiment, the two tubes labelled X were empty?

.....

Explain your answer. .....

.....

(v) For a similar investigation using a green plant, what modification of the apparatus would be required?

.....

State the reason for this modification.

.....

6. Give a concise explanation for each of the following observations.

(*a*) During hot weather the leaves of plants in greenhouses are sometimes seen to wilt.

.....

.....

(*b*) Endocrine glands contain large numbers of capillaries.

.....

.....

(*c*) Grass covered for a few days by a light-proof covering turns yellow.

.....

.....

(*d*) Shrubs eventually appear on a neglected farm.

.....

.....

(*e*) When Fehling's (or Benedict's) solution is mixed with a sample of urine and then heated a positive result is obtained for the test.

.....

.....

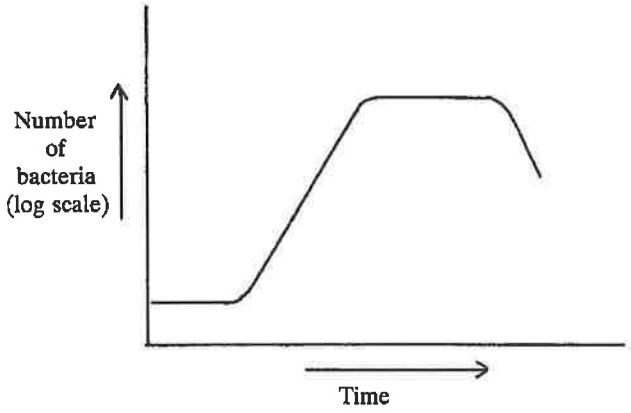
(*f*) Proteins are normally absent from glomerular filtrate.

.....

.....

**P.T.O.**

7. The graph shows the number of bacteria growing in a culture in nutrient medium over a period of time at a temperature of 20 °C.




(i) After an initial period, the number of bacteria in the culture increases rapidly. Suggest an explanation for this increase.

.....

.....

.....

(ii) Give *two* factors which eventually limit the size of the bacterial population in the culture.

(*a*) .....

(*b*) .....

(iii) What will be the eventual fate of the bacteria in the culture if the experiment is allowed continue under the same conditions?

.....

(iv) What would be the effect on the rate of increase in the number of bacteria in a culture grown under the same conditions but at a temperature of 30 °C?

.....

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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*) Explain each of the following terms: decomposer, habitat, pyramid of numbers, biosphere.

Roadside grass verges and hedgerows are sprayed annually, often in the spring, with a herbicide designed to kill a range of monocotyledonous and dicotyledonous plants.
Describe how you would investigate the effects of this measure on the plant and animal life. (50)

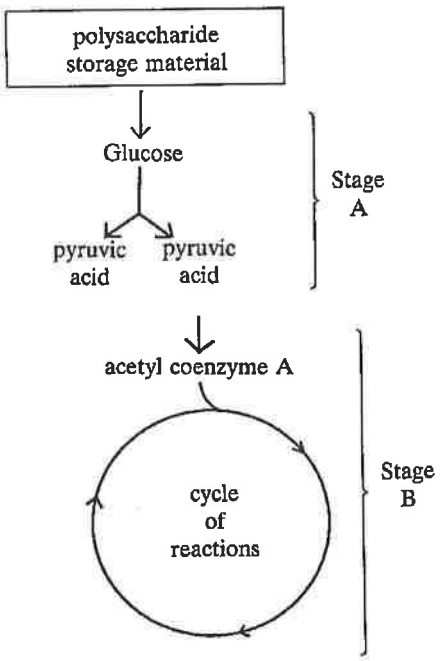
(*b*) Describe an experiment to find the amount of (i) water, (ii) humus, in a sample of soil. (20)

**9.** The diagram shows an outline of some of the events in the complete aerobic respiration of glucose in a cell.

(*a*) (i) Give a balanced chemical equation to summarise the process of aerobic respiration.

(ii) Name the polysaccharide storage material in mammals from which the glucose is produced for respiration and give one major storage location in the body.

(iii) Give the term used in each case to describe the series of reactions in stage A *and* in stage B on the diagram. State where in the cell each of these stages takes place. (28)




(*b*) (i) Outline the main features of stage B to show the completion of the process of aerobic respiration; refer in your answer to oxidative phosphorylation.

(ii) The blood is unable to deliver an adequate supply of oxygen to the muscles during short intensive periods of exercise e.g. an athlete running a 100 m race. The athlete is said to have an oxygen debt and may suffer muscle pain and cramps as a result.

Indicate how the absence of oxygen modifies the process shown in the diagram and suggest why the athlete's pain and cramp disappear a short time after the race. (42)

**10.** (*a*) The body of organism A is divided into three distinct regions, head, thorax and abdomen. The thorax and abdomen are segmented. Chitin is found in the outer part of the body as are spiracles. Ecdysis and metamorphosis are processes associated with the organism's life cycle.

(i) Name an organism which fits the above description.

(ii) Name the phylum to which A belongs and give *two* reasons for its inclusion in this phylum.

(iii) To which class of the phylum does A belong? Give two reasons for its inclusion in this class.

(iv) Explain each of the underlined terms.

(v) List four ways in which named members of the class to which A belongs are of benefit to humans.

(38)

(*b*) Organism B is tripoblastic and has a coelom. It is hermaphrodite and has chaetae (setae), nephridia and a crop. The body is segmented along its length.

(i) Name an organism which fits the above description.

(ii) Name the phylum to which B belongs.

(iii) Explain each of the underlined terms.

(iv) Outline the significance of the triploblastic condition.

(32)

**11.** In a species of flowering plant flower colour is determined by a single pair of allelic genes. The texture of the plant's leaves is also determined by a single pair of allelic genes. These genes are not linked.

In a cross between a plant with red flowers and smooth leaves and a plant with white flowers and rough leaves, the progeny all had pink flowers and smooth leaves.

In a second cross one of the progeny from the above cross was itself crossed with a plant with white flowers and rough leaves. The progeny of this cross were of the following four types:

pink flower and smooth leaf; pink flower and rough leaf;
white flower and smooth leaf; white flower and rough leaf.

(i) State Mendel's Law of Segregation. Explain segregation by reference to flower colour *or* leaf texture.

Briefly relate segregation to the behaviour of chromosomes during meiosis.

(22)

(ii) What is dominance? How is dominance illustrated in the above crosses?

These genes are not linked. State what this means.

If pink-flowered plants of this species were allowed to self-pollinate which of the following percentages of the progeny would you expect to bear pink flowers? Briefly account for your choice.

0% 25% 50% 75% 100%

(24)

(iii) State the genotypes of the parents in the second cross and show how the four progeny phenotypes resulted from the cross.

(24)

**12.** (*a*) In the case of each of the following give a precise explanation for the experimental procedure given.

(i) Cutting a leafy twig under water in preparation for its use in a potometer.

(ii) Removing the stamens from the flower of a pea plant that is to be used in an experimental cross.

(iii) Placing a bone in dilute hydrochloric acid for several days.

(iv) Quickly opening and closing an agar petri dish when inoculating the agar with a bacterial or fungal culture.

(v) Pinning out a dissected earthworm under water. (35)

(*b*) State the meaning of the term tropism.

In an experiment oat coleoptiles were treated as follows.

Batch 1: No treatment given. Acts as control.

Batch 2: Coleoptile tip cut off and then immediately replaced on the cut surface of the coleoptile.

Batch 3: Coleoptile tip cut off and discarded.

Batch 4: Coleoptile tip cut off, a thin block of agar placed on the cut surface of the coleoptile and the coleoptile tip then placed on the block of agar.

Batch 5: Coleoptile tip cut off, a thin piece of mica (which is impermeable) was placed on top of the cut surface and the coleoptile tip then placed on top of the mica.

All five batches of coleoptiles were then grown in light from one side only for a period of time. Give the results you would expect to observe for *each* batch of coleoptiles at the end of the growing period. Using your biological knowledge explain these results. (35)

**13.** (*a*) Outline the stages of the human heart beat. (16)

(*b*) In an experiment the effect of each of three different chemicals on the rate of heart beat of the water flea (*Daphnia pulex*) was investigated. Dilute solutions of each of the chemicals were used and were of equal concentration. A different water flea was used for each chemical.
The results are shown below.

| Time (minutes) | Rate of heart beat (beats/min.) | | |
|---|---|---|---|
| | ethanol | adrenaline | chlorpromazine |
| 0 | 180 | 184 | 180 |
| 2 | 130 | 215 | 100 |
| 4 | 120 | 230 | 70 |
| 6 | 130 | 245 | 43 |
| 8 | 145 | 250 | 36 |

(i) On the graph paper provided draw graphs on the same axes to show the above results. Put heart rate on the vertical axis.

(ii) State briefly in each case the overall effect of the chemical on the rate of heart beat in *Daphnia*.

(iii) Draw on the axes a graph to show what you think would be the heart beat rate of *Daphnia* placed in pond water only as a control during the above investigation.

(iv) Outline the basic steps you would take in carrying out this experiment using, say, the pond water.

A point of criticism regarding the experimental procedure is that a different *Daphnia* was used in each trial. Suggest how, other than using the one *Daphnia* in all trials, this criticism could be overcome. (54)

**14.** (*a*) Draw a diagram of a human sperm and label four major features.

Outline the path taken by a sperm from the time of ejaculation in the vagina until it meets the ovum.

Give the events that then take place leading to fertilization.

(24)

(*b*) Make an outline diagram of a mature Graafian follicle and label its parts.

Briefly describe what happens to the Graafian follicle at ovulation. What changes take place in the Graafian follicle after ovulation (i) in a normal menstrual cycle, (ii) when fertilization and implantation take place.

(28)

(*c*) Hormonal control is an important feature of human reproduction. Give two functions in each case for the following hormones in the female: oestrogen, luteinizing hormone (LH), progesterone.

(18)

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

(*a*) Define the term enzyme? Explain briefly how an enzyme works.

Describe a laboratory experiment to show that the rate of enzyme action varies with substrate concentration.

(*b*) Draw a labelled diagram of a chloroplast as seen using the electron microscope and indicate on it the site of the light phase of photosynthesis.

Given a leaf describe how you would (i) extract and (ii) separate the chloroplast pigments using chromatography.

(*c*) 'Xylem is both a vascular tissue and a support tissue.'

Explain what is meant by this statement and describe how the tissue is adapted for its dual role.

Describe an experiment you would carry out to show root pressure.

(*d*) Define osmoregulation. Explain how the osmoregulatory problems of man differ from those of *Amoeba*. Outline the osmoregulatory processes which takes place in man and *Amoeba*.