JUNIOR LYCEUM ANNUAL EXAMINATIONS
Educational Assessment Unit - Education Division
2004

FORM 4 | BIOLOGY | TIME: 1½ Hours

Name: _____ Class: _____ Group: _____

SECTION A: Answer ALL questions in the spaces provided.
This section carries a total of 55 marks.

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1. Read the following passage about respiration in humans. Fill in the blanks using the most suitable word or words to complete the account.

Energy is released in living cells by respiration which is carried out in organelles known as _____ . The chemical reactions in respiration are speeded up by _____ . When _____ . is broken down in the presence of oxygen, the products are _____ , water and energy. This process is known as _____ respiration. The energy is used to form _____ , which acts as a temporary energy store. If the cell does not have enough oxygen it may also carry out some _____ respiration. In this process _____ is formed and this is broken down when oxygen becomes available.

(Total 8 marks)

2. Complete the table below by putting a '✓' in the appropriate column.

Structure / Function	Xylem	Phloem
Dead cylindrical cells without end walls.		
Transports food made in the leaves.		
Transports materials from leaves to other parts of plant.		
Elongated living cells with sieve plates.		
Transports water and minerals.		
Transports materials from roots upwards.		

(Total 6 marks)

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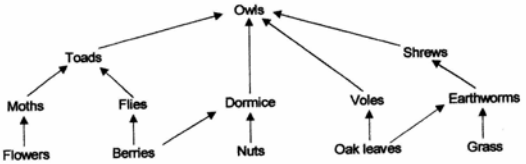
3. Look at this food web and answer the questions below.



a) From the food web name ***one*** producer and ***one*** primary consumer.

_____ **(2)**

b) Which is the top carnivore in this food web? At which trophic level is it found?

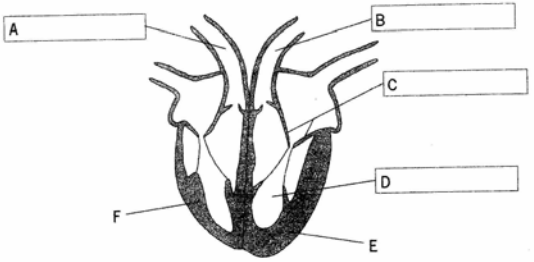
_____ **(2)**

c) What do the arrows indicate in food webs?

_____ **(1)**

(Total 5 marks)

4. The diagram below shows a section through the heart of a mammal.



a) Label the parts A, B, C, and D. **(4)**

b) On the diagram draw an arrow to show the direction of blood flow in part B. **(1)**

c) To or from which organ of the body does blood in part A flow?

_____ **(1)**

d) What is the function of part C?

_____ **(1)**

(continued on next page...)

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e) State whether the blood in part D is oxygenated or deoxygenated.

_____ **(1)**

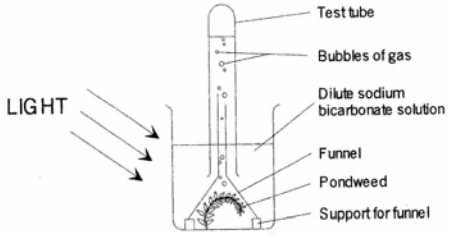
f) Why is part E thicker than part F?

_____

_____ **(1)**

(Total 9 marks)

5. An experiment was carried out to study the effect of light on the rate of photosynthesis in a type of pondweed. The apparatus was set up as shown in the diagram. The student noticed that gas bubbles are released when light shines on the pondweed.



a) Write down an equation, in words or in symbols, to show the process of photosynthesis.

_____ **(3)**

b) Name the gas that you think is being released in this experiment.

_____ **(1)**

c) Why was dilute Sodium bicarbonate solution used instead of water in the beaker?

_____ **(1)**

d) What would happen to the rate at which the gas bubbles are produced if the light intensity is increased? Briefly explain why?

_____ **(2)**

e) Which substance, present in the pondweed's cells, allows it to carry out photosynthesis?

_____ **(1)**

(Total 8 marks)

6. The table below shows the energy and nutrient content of four root vegetables grown in different parts of the world. All values are given for 100g portions.

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Energy or nutrient content	Yam bean	Cassava	Sweet potato	Irish potato
Energy in kJ	231	643	382	365
Water in g	85.1	60.0	70.0	75.8
Protein in g	1.4	0.7	1.2	2.1
Fat in g	0.2	0.2	0.6	0.1
Carbohydrate in g	12.8	37.0	21.5	20.8
Calcium in mg	15	25	22	6
Phosphorus in mg	18	0	47	40

a) Which root vegetable contains the most water?

_____ **(1)**

b) Calculate the ***dry mass*** of a 100g portion of yam bean. Show your working.

_____

_____ **(2)**

c) Calculate the percentage of protein in yam bean, based on its dry mass.

_____

_____ **(2)**

d) In certain parts of Africa, after weaning from being fed on milk, young children are sometimes fed on a diet consisting mainly of cassava.

i) Suggest ***two*** reasons why cassava is good in the diet of young children and in each case ***explain the reason***.

_____

_____

_____

_____ **(2,2)**

ii) Suggest ***one*** disadvantage of feeding young children on a diet of cassava.

_____

_____ **(1)**

(Total 10 marks)

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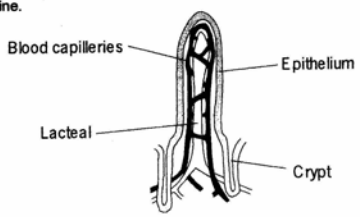
7. The diagram below shows a section through a structure found in the ileum of the human intestine.



a) Name the structure shown in the diagram

_____ **(1)**

b) Name the process by which the gut forces food along the intestine in one direction.

_____ **(1)**

c) Name ***one*** other structure in the digestive system that uses this process.

_____ **(1)**

d) Why can protein and starch not be absorbed directly into the body?

_____ **(1)**

e) What substances are responsible for changing these foodstuffs into forms that can be absorbed?

_____ **(1)**

f) How are the end products of digestion carried to the tissues?

_____ **(1)**

g) State ***one*** way in which amino acids are useful to the body

_____ **(1)**

h) What function associated with digestion is performed by bile?

_____ **(1)**

i) Where is bile stored?

_____ **(1)**

(Total 9 marks)

SECTION B: Answer question ONE and ANY OTHER TWO questions on the papers provided. This section carries a total of 45 marks.

1. Read the following paragraph and answer the questions below:

The chemical process of digestion depends on nearly one hundred different enzymes. Enzymes are ***biological catalysts***. Without them, the nutrients in the food we eat would be broken down so slowly that we would starve to death.

The absence of even one enzyme can cause illness. For example, people who do not produce the enzyme ***lactase*** cannot digest the sugar lactose (milk sugar). They develop cramps and diarrhoea if they consume lactose in milk and milk products, because the sugar builds up in the gut.

The rate at which enzymes work is influenced by various factors, especially ***pH*** (acidity/alkalinity) and ***temperature***. A student carried out an experiment to investigate the effect pH on the activity of the protein-digesting enzyme found in the gut of mammals. She set up seven test tubes, each containing the same amount of enzyme, but with different pHs. The test tubes covered a range of pH from 3 to 9. At the end of the experiment, the student calculated the rate at which a standard amount of protein had been digested in each tube.

During the experiment, the student accidentally knocked over one of the tubes and so could not obtain a full set of results. The table below shows the six results that were recorded.

pH	3	4	5	6	7	8	9
Rate of protein breakdown (in arbitrary units)	100	No result	81	60	5	0	0

a) On the graph paper provided, plot a graph to show the results in the table. Label your horizontal (x) axis 'pH' and label your (y) vertical axis 'Rate of action'. Use as much of the graph paper as possible and join the points with straight lines. **(5)**

b) Use the graph to estimate the following:

i) The rate of action of the enzyme at pH 4. **(1)**

ii) The pH at which a rate of 70 would have been recorded. **(1)**

c) In which conditions does the enzyme used in the experiment work best: ***Acid***, ***neutral*** or ***alkaline***? **(1)**

d) Name ***one*** human digestive enzyme that would behave like the one used in the experiment. **(1)**

e) Where in the human gut would this enzyme be produced? **(1)**

f) Humans cannot digest an important chemical found in plants. Which ***enzyme*** would be needed in order to break down this substance? **(1)**

g) What do you understand by ***biological catalysts*** (Line 2)? **(2)**

h) How does ***temperature*** effect the rate of reaction of enzymes? **(2)**

(Total 15 marks)

2. Some organisms can regulate their body temperature while other cannot.

   a) What are organisms that can maintain a constant body temperature called? Give ***one*** example. **(2)**

   b) What are organisms that cannot maintain a constant body temperature called? Give ***one*** example. **(2)**

   c) ***Blood capillaries***, ***hairs*** and ***sweat glands*** in the skin of humans play and important role in this process. Describe how each of these structures is involved in maintaining a constant body temperature in both cold and warm environments. Present your answer in table form. **(2, 2, 2)**

   d) Describe an experiment you would carry out to show that fur, feathers or body hair are essential for certain animals to keep warm. **(5)**

(Total 15 marks)

3. A balanced diet for a human normally contains ***proteins***, ***carbohydrates*** and ***lipids***.

   a) State ***one*** function for each of these nutrients. **(3)**

   b) Name ***two*** other nutrients, which must be included in a human's diet. **(2)**

   c) A student wants to test for the presence of starch in boiled potatoes. Describe an experiment she would have to perform in order to do this. **(3)**

   d) Food substances must be absorbed into the blood before they can be used by body cells. List ***three*** ways in which the small intestine of a human is adapted for efficient absorption. **(3)**

   e) Flowering plants require certain nutrients to be present in soil. Name ***two*** mineral elements required by flowering plants and in each case state their function. **(2, 2)**

(Total 15 marks)

4. a) Give a definition of ***excretion***. **(2)**

   b) List ***two*** substances that are excreted by the body. State the site from where each substance is excreted. **(2, 2)**

   c) Draw a ***large, well-labelled diagram*** of the human renal tubule (nephron). **(5)**

   d) Describe briefly how the renal tubule (nephron) performs osmoregulation. **(4)**

(Total 15 marks)

5. a) Draw a ***large, well-labelled diagram*** to show the structures through which air passes as it travels from outside the human body to an alveolus in the lungs. **(5)**

   b) Briefly explain how air passing through the breathing system is cleaned before it reaches the lungs. **(2)**

   c) Briefly describe how ***oxygen*** and ***carbon dioxide*** are exchanged in the alveoli. **(3)**

   d) How is food prevented from entering the trachea? **(2)**

   e) State ***three*** characteristics of a good respiratory surface. **(3)**

(Total 15 marks)