

NATIONAL EXAMINATIONS COUNCIL
P.O.BOX 3817 KIGALI

Biology I

002

09th Nov 2010 8.30am-11.30am

ORDINARY LEVEL NATIONAL EXAMINATION 2010

SUBJECT : BIOLOGY I

TIME : 3 HOURS

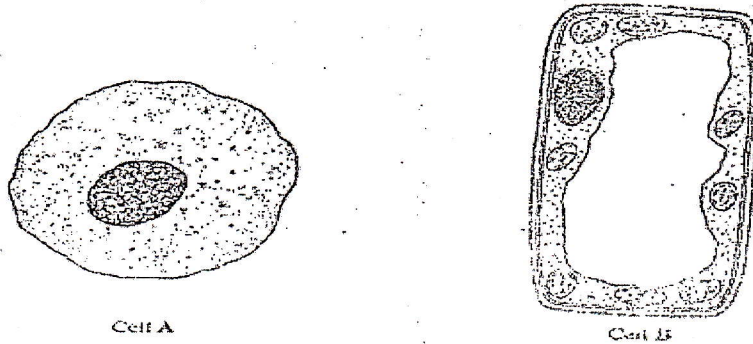
INSTRUCTIONS:

- This paper consists of **THREE** Sections A, B and C.
- Answer **ALL** the questions in section A. **(55 marks)**
- Answer **THREE** questions in section B. **(30 marks)**
- Answer only **ONE** question in section C. **(15 marks)**

SECTION A: Answer all questions.

(55 marks)

1. The diagrams below are of a plant and animal cell.



Using the diagrams, answer the following question:

- a) Name two structures found only in cell B.
 - i..... (1 mark)
 - ii..... (1 mark)
 - b) Name two structures found in cells A and B.
 - i..... (1 mark)
 - ii..... (1 mark)
 - c) i) Which diagram shows a plant cell? (1 mark)
 - ii) Give a reason for your answer in c (i) above. (1 mark)
2. (a) State the region of the leaf which contains most chloroplasts. (2 marks)
- (b) What biological process occurs in the chloroplast? (1 mark)
- (c) Explain the role of air spaces in the leaf. (2 marks)
3. The liver has an important function of maintaining balance in the amounts of nutrients in the blood of humans. It performs this function with the assistance of hormones.
- a) Briefly outline how the liver adjusts the amount of proteins and carbohydrates present in the blood. (2 marks)
 - b) Describe ONE other function of the liver. (1 mark)
4. Proteins help in body building. Starch provided energy.
- (a) Give one reason for a child's diet being rich in proteins. (1 mark)
 - (b) Give one reason for the diet of an elderly person requiring proteins. (1 mark)
 - (c) Would a sugarcane cutter diet require more starch than that of a school teacher? Give a reason for your answer. (1 mark)
5. A student bought a chocolate bar and carried out several food tests on it. The following results were observed.
- | | |
|-----------------|--------------------|
| Benedict's test | an orange color |
| Biuret test | no color change |
| Iodine test | a blue-black color |
- a) What two types of food are present in the chocolate bar? (2 marks)

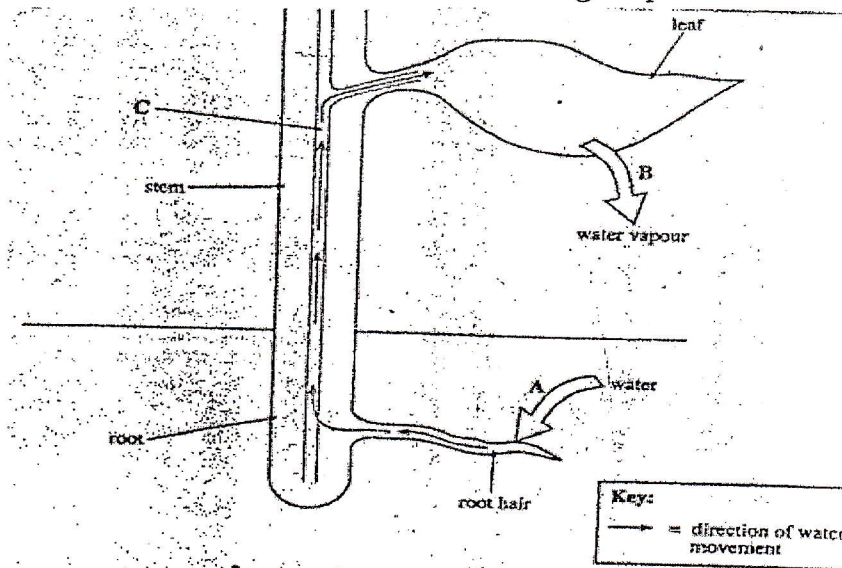
b) Using the results given above, give one reason to explain why a chocolate bar is not a balanced meal. (1 mark)

c) Eating this kind of chocolate bar regularly may lead make someone overweight. Explain why. (2 marks)

6. a) Where in the digestive system is hydrochloric acid produced? (1 mark)

b) What is the function of hydrochloric acid in the digestion of food? (3 marks)

7. The diagram below shows the movement of water through a plant.



a) Name the process occurring at:
 i) A.....
 ii) B.....

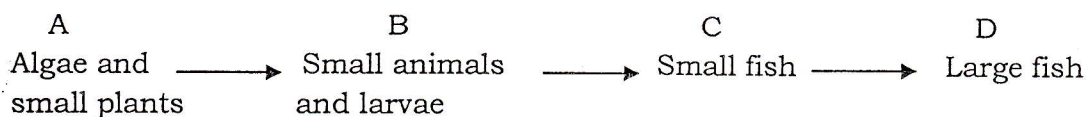
(2 marks)

b) Name the tube labeled C. (1 mark)

c) State one feature of root hairs that helps the process occurring at A. (1 mark)

d) State TWO functions of water in a plant. (2 marks)

8. The figure below represents a food chain in the marine environment.



a) How would you call organisms labeled A and D? (2 marks)

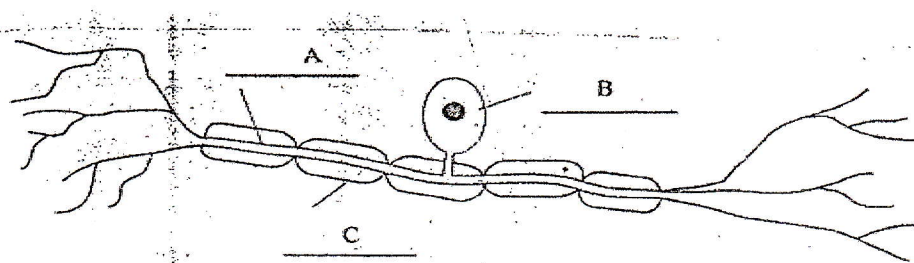
b) Discuss THREE possible effects on this food chain if the small fish at C are removed from it. (3 marks)

9. In humans, primordial germ cells undergo a process called Meiosis to produce egg cells and sperm cells. These cells have only half the normal number of chromosomes.

a) What is the name given to a cell with only half the number of chromosomes? (1 mark)

b) Sometimes two eggs are fertilized at the same time, producing non-identical twins. Explain why the off springs from this fertilization will not look exactly alike. (2 marks)

10. The diagram below shows a neuron (nerve cell).



a) Name the parts labeled A, B and C.

A.....

B.....

C.....

(3 marks)

b) There are three types of neurons: Sensory, Motor and Relay. Describe the function of each type of neuron.

Sensory.....

Motor.....

Relay.....

11. a) How do plants and animals differ in the way they obtain their food?

(2 marks)

b) Write a balanced chemical equation to represent the process by which plants obtain their food.

(1 mark)

12. a) What is the essential difference between mitosis and meiosis?

(2 marks)

b) Predict what is likely to happen to the chromosome numbers in successive generation if zygotic formation occurred from fusion of gametes formed by mitosis rather than meiosis.

(1 mark)

c) The four blood groups found in man are A, B, AB and O. Consider the case of two parents who both belong to blood group A. what will be the possible genotypes and blood groups of their children?

(3 marks)

SECTION B: Answer only THREE questions.

(30 marks)

13. a) Name two foods which are good sources of proteins.

(2 marks)

b) Explain briefly why the human body needs proteins.

(2 marks)

c) Describe the experiment you would carry out to test for proteins in a piece of food.

Say what you would expect to see if protein was present.

(3 marks)

d) Human saliva can change a 1% starch solution into a Maltose solution. Explain why digestive juice from the human stomach would not have this effect.

(3 marks)

14. Cholera is a highly dangerous disease which is spread by bacteria.

It is spread by eating or drinking food or water which is contaminated with the bacteria.

a) Which parts of the body are likely to be infected first when someone drinks water containing the cholera bacteria?

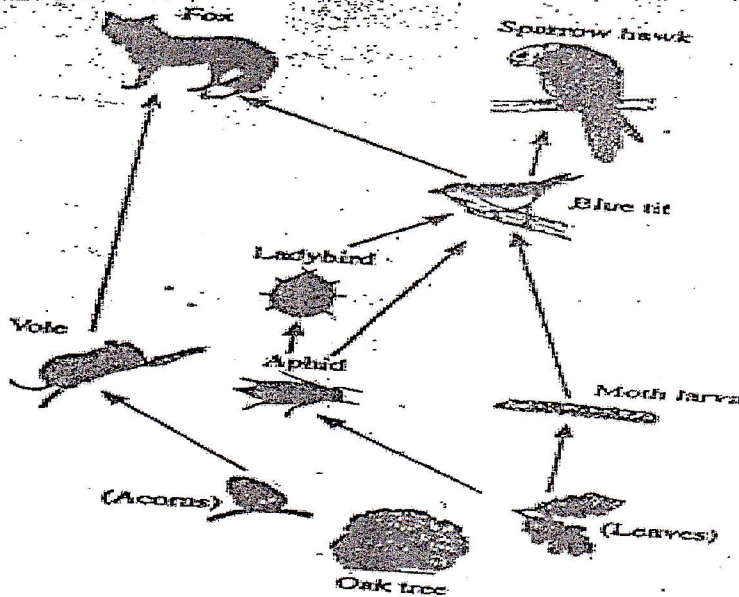
(1 mark)

b) Explain how the cholera bacteria inside the body may cause disease.

(2 marks)

- c) Name one other group of microbes that may cause diseases. (1 mark)
- d) Cholera is very common in refugee camps where people live in crowded rudimentary accommodation. Explain why these people are likely to catch this disease. (1 mark)
- e) Explain how the body defends itself against bacteria. (3 marks)

15. The diagram below shows a woodland food web.



- a) Using the information in the food web, construct a food chain in the space below. (in your answer sheet)

The producer has been included for you.

Oak tree leaves → → → →

(2 marks)

- b) What do arrows in the food chain indicate? (1 mark)
- c) Why is the oak tree called a producer? (1 mark)
- d) From the diagram:
 - i) Name one herbivore
 - ii) Name one carnivore. (2 marks)
- e) List four effects that a large increase in the lady bird population would have on the food web as a whole. (4 marks)

16. In Labrador dogs, the hair color is controlled by a single gene which exists in the two forms (alleles): black and yellow. A male dog with black hair is mated with a female dog with yellow hair. All the F1 offspring (puppies) have black hair. When the puppies are old enough, two of them are mated together.

- a) Complete the key to show the allele for yellow hair.

Key: B = Allele for black hair

..... = Allele for yellow hair

(1 mark)

b) Complete the following to show the two matings:

1st mating

Parents	Male	X	Female
Phenotype
Genotype

F1

Gametes
.....
.....

2nd mating (F1 puppy X F1 puppy)
F2

Gametes
.....
.....

(2 marks)
(2 marks)

c) If eight puppies were born in the second mating, how many are likely to have yellow hair?

(1 mark)

d) Using the information given above, state:

i) The heterozygous genotype.

ii) The dominant allele.

(2 marks)

17. a) Define the term "Enzyme"

(2 marks)

b) Describe the characteristics of enzymes.

(8 marks)

SECTION C: Answer only ONE question. (15 marks)

18. a) Define the following biological terms:

i) Osmosis

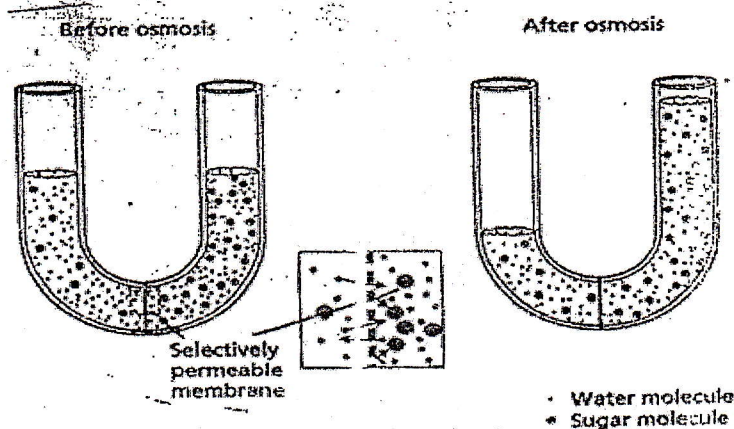
ii) Diffusion

(4 marks)

b) Give two processes where osmosis is used in living things.

(2 marks)

c) Study the experiment below and answer the questions that follow.



i) Why did the number of water bubbles on each side of the membrane change, whereas the number of sugar molecules remained the same? (5 marks)

ii) How does the plasma membrane of a cell compare with the membrane in the U-shaped tubes? (4 marks)

19. Describe an experiment you would carry out to test solutions suspected to contain

i) Glucose

ii) Sucrose

In your description, name the reagents you would use and mention the results you expect.

(15 marks)

END.

MARKING GUIDE FOR 2010

SECTION A

Answer to Question 1

(a) (i) Plant cell wall

(ii) Chloroplasts

(b) (i) Cell membrane

(ii) Nucleus, Mitochondria

(c) (i) Cell B

(ii) It has a regular shape. It has a cell wall and also has a large vacuole.

Answer to Question 2

(a) The palisade mesophyll layer (or mesophyll layer)

(b) Photosynthesis

(c) - To temporarily store gases such as carbon dioxide that is used in photosynthesis.

- It also keeps the air vapour briefly before it moves out through transpiration.

Answer to Question 3

(a) It regulates the amount of proteins through deamination by removing the amino group from the amino acid. It regulates carbohydrates by converting excess glucose into glycogen with help from insulin hormone and the reverse with help from glucagon hormone.

(b) - It stores nutrients such as vitamins.

- It produces bile which helps in emulsification of fats.

Answer to Question 4

(a) Being young, the child needs to grow (form new body parts), hence needs proteins.

(b) Being old, that person needs to repair the damaged tissues and also form white blood cells that fight foreign bodies.

(c) Sugarcane cutter uses more energy in his/her work compared to a teacher hence will need more energy giving food of starch.

Answer to Question 5

- (a) Reducing sugars and starch.
- (b) It is because it contains only carbohydrates and no proteins.
- (c) It is because that excessive intake will result in more glucose being converted into fats and stored under the skin. The result will be overweight.

Answer to Question 6

- (a) Stomach
- (b) - To kill the germs that come along with food.
 - To stop the action of salivary amylase (breakdown of starch)
 - To activate pepsinogen into the enzyme pepsin.

Answer to Question 7

- (a) (i) Osmosis
(ii) Transpiration
- (b) Xylem
- (c) Are cell thick to minimise water resistance. Also they have more salts to lower the concentration.
- (d) - To form sugars through photosynthesis.
 - To cool the plant through transpiration.

Answer to Question 8

- (a) A – Producer D – Tertiary consumer
- (b) - All the large fish would die off.
 - The numbers of B would increase greatly for some time.
 - The numbers of A would eventually die off hence causing the collapse of the chain.

Answer to Question 9

- (a) It is called a haploid
- (b) It is because the two come from completely different eggs. The other reason is that the sperms that fertilize are completely different.

Answer to Question 10

- (a) A- Dendron B – Cell body C – Myelin sheath
- (b) *Sensory*: To transmit impulses from the receptors to the central nervous system.
Motor: To transmit impulses from the central nervous system to the effectors.
Relay: To connect the motor neuron to the sensory neuron.

Answer to Question 11

- (a) Plants make their own food through photosynthesis while animals cannot make their own food hence rely on food made by plants.
- (b) $6\text{CO}_2 + 6\text{H}_2\text{O} \longrightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$.

Answer to Question 12

- (a) Difference between mitosis and meiosis

Mitosis	Meiosis
Produces two identical daughter cells	Produces four different daughter cells

- (b) The number of chromosomes in the future generation will keep on doubling over time.

(c) Let I^A represent the allele for blood group A
 Let I^O represent the allele for blood group O.
 1st instance

Parents are homozygous blood group A

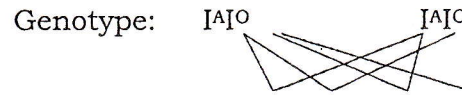


F1 genotype: $I^A I^A I^A I^A I^A I^A$

Blood group: A, A, A, A

2nd Instance

Parents are heterozygous blood group A



F1 genotype: $I^A I^A I^A I^O I^A I^O I^O I^O$

Blood group: A, A, A, O

SECTION B

Answer to Question 13

- Eggs, meat, chicken, fish.
- To repair worn out body tissues
- Test for proteins

Test	Observation	Conclusion
To 2cm ³ of a solution suspected to contain proteins in a test tube, add 3 drops of dilute NaOH _(aq) followed by 3 drops of dilute CuSO _{4(aq)} drop wise. Leave to stand.	If a violet colour forms slowly	Proteins present
	If the blue colour of CuSO ₄ persists	Proteins absent

- (d) It is because the acidity in the stomach would stop the breakdown of starch into maltose by salivary amylase.

Answer to Question 14

- Stomach, small intestines and colon.
- Cholera produces toxic substances which prevent absorption of sodium and chloride ions. The result is that the person loses a lot of water in form of diarrhoea.
- Salmonella typhi bacteria
- It is due to the low standards of living and disposal of wastes that will easily cause cholera.
- It produces white blood cells which can either ingest the bacteria or produce antigens to stop bacteria from reproducing.

Answer to Question 15

- Oak tree leaves → Aphid → Ladybird → Blue tit → Fox
- They indicate what is eating what or being eaten by.
- Because it makes its own food using sunlight energy.
- (i) Vole or Aphid or Moth larva.
(ii) Fox or Blue tit
- It would cause an increase in the number of sparrow hawks
- It would cause an increase in the number of foxes.
- It would cause a decrease in the number of lady birds.
- It would cause a decrease in the number of moth larva.

Answer to Question 16

(a) b = Allele for yellow hair

(b) 1st mating

Parents: Male x Female

Phenotype : Black yellow

Genotype : BB bb

F1

Gametes	(B)	(B)
(b)	Bb	Bb
(b)	Bb	Bb

2nd mating (F1 puppy X F1 puppy)

F2

Gametes	(B)	(b)
(B)	BB	Bb
(b)	Bb	bb

(c) Number of yellow = $\frac{1}{4} \times 8 = 2$ puppies

(d) (i) Bb.

(ii) B

Answer to Question 17

(a) Enzyme is an organic compound protein in nature which alters the rate of metabolic reaction.

(b) - They work best at particular temperatures. High temperatures denature them while low temperatures slow their rate.

- They are specific to substrates e.g. sucrose will only breakdown maltose.

- They work best even at low concentrations i.e. have high turnover numbers.

- They work at optimum P^H e.g. Pepsin works only in acidic conditions.

- They are protein in nature hence can be broken down protein digesting enzymes.

- Their processes are very fast e.g. catalase is the fastest enzyme.

SECTION C

Answer to Question 18

(a) (i) Osmosis is the movement of water from the region of its high concentration to a region of its lower concentration across a semi permeable membrane.

(ii) Diffusion is the movement of ions, atoms, molecules from a region of their high concentration to a region of their low concentration.

(b) Root hairs absorbing water.

Movement of water in leaf cells

Entry of water into a seed during germination

(c) (i) This is because water being a small molecule, moves easily across the selectively permeable membrane thus it is more on the right than left side. However Sugar has large molecules thus it cannot cross the selective permeable membrane.

- (ii) The cell membrane is also selectively permeable hence it can allow some substances to cross while others not. In that case, water will easily cross into the cell, while some solutes like sugar would not easily cross the membrane. The result is that the cell can control what goes in and out.

Answer to Question 19

- (i) Tasting for glucose

Title: *An experiment to determine glucose*

Apparatus:

- Test tubes
- Heat source
- Benedict's solution
- Dropper
- Solution suspected to contain glucose

Procedure:

Add 2cm³ of a solution suspected to contain glucose in a clean test tube. Add 2 cm³ of benedict's solution and heat for 1 minute.

Observation:

Either: The blue colour changes to green to yellow and finally brown.

Or: The blue colour of benedict's solution persists.

Conclusion:

For either: Glucose present

For or: Glucose absent

- (ii) Tasting for sucrose

Title: *Tasting for sucrose*

Apparatus:

- Solution suspected to contain sucrose, Test tubes, Test tube holder, Benedict's solution, Dilute Hydrochloric acid solution [HCl_(aq)], Dilute sodium hydroxide solution [NaOH_(aq)]

Procedure:

Add 2cm³ of a solution suspected to contain sucrose solution in a test tube followed by 1cm³ of dilute HCl_(aq) and heat for 1 minute. Cool and add 1 cm³ of dilute NaOH_(aq) followed by 2cm³ of benedict's solution and heat for 1 minute.

Observation:

Either: The blue colour changes to green to yellow and finally to brown.

Or: The blue colour of benedict's solution persists

Conclusion:

For either: Sucrose present

For or: Sucrose absent

END