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Biology Paper 2, WASSCE (SC), 2023

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QUESTION 1

1. What is *classification of living things*? [2 marks]
2. State **four** ways **each** by which the following groups of organisms are of economic importance in their habitats:
3. fungi;
4. plants. [8 marks]
5. Complete the table below by stating **five major** phyla of the Kingdom Animalia and give **one** example of **each**.

Phyla of Kingdom Animalia	*Example*

[10 marks]

This question was popular among the candidates. Many who attempted the question gave correct answers but few could not define classification of living things except as a means of identification. Few candidates correctly defined it as grouping of living things based on their genetics/structural similarities.

In question 1*(b),* some candidates were only listing the beneficial importance of fungi but were able to state the economic importance of plants to their habitat.

Many candidates who attempted to list the Phyla of Kingdom Animalia with correct examples gave wrong spellings which led to loss of marks. Some candidates also gave wrong examples for the classes mentioned.

The expected answers are as follows:

(a) Classification of living things
is the grouping/arrangement of organisms; with similar characteristics based on structural/genetic/cellular/evolutionary trends; for easy identification.

(b) Ways by which the groups of organisms are of economic importance in their habitats

(i) Fungi

- cause various plants/animal diseases;
- act as decomposers;
- recycle nutrients;
- bring about fermentation in breweries;
- used in baking industries;
- serve as sources of food;
- are used in pharmaceutical industries/production of antibiotics/vitamins;
- destroy various substances/cloth/paper/wood/food

(ii) Plants

- are involved in nutrient recycling;
- purify the environment/reduce greenhouse effects;
- provide shade/shelter;
- provide food;
- provide oxygen;
- prevent erosion;
- are sources of timber for building/construction;
- provide materials for pharmaceuticals/production of drugs.

(c) Table of major phyla of the kingdom Animalia and examples

Phyla of Kingdom Animalia	**Examples**
Porifera	Sponges/Venus flower basket
Cnidaria/Coelenterata	Hydra/*Obelia*/sea anemone/jelly fish/*Aurelia*/coral
Platyhelminthes	Liver fluke/tapeworm/*Schistosoma*/planaria
Nematoda	*Wuchereria*/whipworm/*Ascaris*/Guinea worm/hookworm
Annelida	Marine worm/leech/earthworm/lugworm/seaworm/ bobbit worm/fireworm
Mollusca	Snail/bivalve/slug/octopus/clam/oyster/squid
Arthropoda	Scorpion/spider/cockroach/crab/crayfish/grasshopper/centipede/millipede/ant/any other correctly named Arthropod
Echinodermata	Starfish/sea lily/sea urchin/sea cucumber/brittle star/sea star
Chordata	Fish/frog/toad/bird/man/human/cat/lion/tiger/dog/salamander/alligator/snake/giraffe/ar other correctly named chordate

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QUESTION 2

a.Complete the table below.

Element	*Function in plants*	*Effects of deficiency in plants*
Iron		
Molybdenum		
Potassium		
Copper		
Nitrogen		

[10 marks]

b. Name **three** classes of organic foods which are essential constituents in the diet of a mammal. [3 marks]

c. State **two** roles **each** of the following structures of the digestive system in humans:

- buccal cavity;
- duodenum;
- stomach. [6 marks]

d. Name the end product of adding dilute hydrochloric acid to sucrose. [1 mark]

Few candidates attempted this question.

In question 2*(a),* Some candidates gave correct response to the functions and deficiency effects of the listed mineral elements. The function of molybdenum i.e. converts nitrogen to amino acids, could not be correctly stated by many candidates.

Most candidates gave correct answers in question 2*(b).*

Some candidates wrote wrong answers in question 2*(c)*(i), (ii) and (iii). They mention the function of the buccal cavity as helping to mix food with saliva and in swallowing and the function of duodenum as site for digestion of all food.

Many candidates on

The expected answers include:

(a) Table

Element	**Functions in plants**	**Effect of deficiency in plants**

Iron	Necessary for the synthesis of chlorophyll/protein	Chlorosis/yellowing of leaves/poor growth;
Molybdenum	Converts nitrogen to amino acids	Stunted growth/pale leaves;
Potassium	Protein synthesis/formation of cell membrane/crop maturation/activates respiration/ photosynthesis	Premature death of plant/leaf margin turns yellow/brown;
Copper	Activates enzymes for respiration/carbohydrate metabolism/photosynthesis	Pale/wilted/spotted leaves;
Nitrogen	Necessary for the formation of chlorophyll/amino acids/protein	Poor/stunted growth/yellowing of leaves/poor flower formation.

(b) Classes of organic food in diet of mammals

- Carbohydrate;
- Protein;
- Lipids/fats and oil;
- Vitamin.

(c) Roles of structures of digestion in humans

(i) Buccal cavity

- Takes in/receives food;
- Contains the teeth that chew/masticate the food; to increase the surface area of food particles;
- Contains salivary gland that secretes saliva that moistens the food; it also secretes the enzyme ptyalin which breaks down starch to maltose;
- Contains the tongue which tastes /rolls the food into bolus for swallowing.

(ii) Duodenum

- Receives the food as chyme from the stomach;
- Receives pancreatic juice from pancreas;
- Receives bile from the liver which reduces surface tension/emulsifies fats and oil;
- Contains amylase in pancreatic juice which hydrolyses starch to maltose;
- Contains trypsin which breaks down proteins to polypeptides;
- Contains lipase which breaks down fats and oil to carboxyl acid and glycerol;
- Provides large surface area for absorption of some digested food/vitamins and nutrients

(iii) Stomach

- Temporarily stores food;
- Secretes dilute HCl/hydrochloric acid which destroys bacteria;
- Churns food;
- Contains enzymes which start the digestion of protein.

(d) End product of adding dilute hydrochloric acid to sucrose

Glucose and fructose are produced.

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QUESTION 3

Relationships **I, II, III, IV** and **V** exist among some organisms in an ecosystem. *Use them to answer questions* **3***(a)* to **3***(e).*

I: Organism **A** grows on dead organism **B**.
II: Organism **C** feeds on the remnants of food left by organism **D** without affecting organism **D** negatively or positively.
III: Organism **E** provides shelter for organism **F** while organism **F** transports organism **E** towards food.
IV: Organism **G** kills organism **B** for food.
V: Organism **H** feeds on organism **J**, causing **J** a disease.

a. Name the type of relationship in **I, II, III, IV** and **V** [5 marks]

b. In relationship **IV**, what is the biological term for **each** of organisms **B** and **G**?

- **B;**
- **G:** [2 marks]

c. Name **one** example **each** of organisms **B** to **J**. [8 marks]

d .(i) Name the relationship that is **most** beneficial to the ecosystem. [1 mark]

(ii) Give **one** reason for the answer in **3***(d)*(i). [1 mark]

e. (i) Give **two** examples of organism **A**. [2 marks]

(ii) Name the group to which organism **A** belongs. [1 mark]

This question was popular among candidates and many did well in it. Some candidates however gave wrong responses to the feeding relationship **I** and **V** in question 3*(a)* by writing Saprophytic, Parasitic etc. instead of Saprophytism and Parasitism respectively.

The biological term for organisms **B** and **G** as well as their examples as required in questions 3*(b)*(i) and (ii) was correctly given by most candidates.

Many candidates could not give the correct name for organisms **C**, **D**, **E** and **F** in question 3*(c)*.

Spelling mistakes made some candidates perform poorly in this question.

The expected answers are as follows:

(a) Types of relationship

I: Saprophytism
II: Commensalism
III: Mutualism
IV: Predation
V: Parasitism

(b) Biological term for organisms **B** and **G**

B - prey
G - predator

(c) Example of organisms **B** to **J**

B: Antelope/goat/sheep/cow/rabbit/guinea pig/rat/any other correctly named prey.
C: Remora fish
D: Shark
E: Hermit crab
F: Sea anemone
G: Lion/tiger/leopard/cat/dog/snake /hawk/eagle/any other correctly named predator.
H: Tapeworm/tick/louse/*Plasmodium*/*Ascaris*
J: Human/pig/cattle/cow/sheep/dog/cat

(d) (i) Most beneficial relationship to the ecosystem

Saprophytism

(ii) Reason for answer

It is involved in nutrient recycling/replenishment of nutrients in the ecosystem.

(e) (i) Examples of organism **A**

- Mushroom/Mucor/Rhizopus/Yeast;
- *Pseudomonas*/*Bacillus*/*Clostridium*/*Enterobacter*/*Escherichia* spp./*E. coli*/*Salmonella* spp.

(ii) Group to which organism A belongs

Fungi/Bacteria/mold/mould

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QUESTION 4

a. Complete the following Punnett squares of a dihybrid cross between **two** rats. One has black fur **(BB)** and short tail **(tt)**, the other has brown fur **(bb)** and long tail **(TT).**

X		**Bt**		
bT				

[12 marks]

b. How many of the offspring will have:
- black fur and short tail;
- brown fur and long tail;
- black fur and long tail;
- brown fur and short tail? [4 marks]

c. If there were twenty (20) chromosomes in the leaf cell of a plant, how many chromosomes would be in **each** of the following cells of the plant?
- pollen grain
- guard cell
- ovule
- root cell [4 marks]

The question was not popular among candidates.

Many candidates could not give the correct Parental gamete horizontal (PGH) and Parental game vertical (PGV) thereby getting wrong answers in Offspring (F1) in the punnett square.

In question 4(b), many wrote 9:3:3:1 or 1:3:3:9 as the number of offspring that would have the required phenotypic characters.

Most candidates could not differentiate somatic from reproductive cells and so gave wrong number of chromosomes in question 4(c).

Many candidates loss marks in this question due to poor knowledge of genetics and poor interpretation of the question.

The expected answer is as follows:

(a) Punnett squares of a dihybrid cross

X	**Bt**	**Bt**	**Bt**	**Bt**
bT	BbTt	BbTt	BbTt	BbTt
bT	BbTt	BbTt	BbTt	BbTt
bT	BbTt	BbTt	BbTt	BbTt
bT	BbTt	BbTt	BbTt	BbTt

Parental gametes horizontal (PGH): Bt 4x½ [2 marks]
Parental gametes vertical (PGV): bT 4x½ [2 marks]
Offspring (F1) 16x½ [8 marks]

(b) Offspring with:
(i) black fur and short tail – 0
(ii) brown fur and long tail – 0
(iii) black fur and long tail – 16
(iv) brown fur and short tail – 0

(c) Number of Chromosomes in
(i) Pollen grain: 10
(ii) Guard cell: 20
(iii) Ovule: 10
(iv) Root cell: 20

QUESTION 5

- (i) What are *sense organs*? [3 marks]

(ii) Name **three** sense organs that respond to the stimulus of chemicals. [3 marks]

- List **three** animals **each** that exhibit the following courtship behaviours.
- territoriality
- pairing [6 marks]
- (i) State **one** similarity between the *eggs of toads* and the *eggs of birds*. [1 mark]

(ii) State **three** differences between the *eggs of toads* and the *eggs of birds*. [3 marks]

- Complete the table below by listing **four** organisms involved in the nitrogen cycle and state **one** role **each** of the organisms.

Four *organisms involved in the nitrogen cycle*	**One** *role of each organism*

[8 marks]

- Complete the table below by naming **two** types of heterotrophic modes of nutrition in animals and give **two** examples **each** of the organisms that carry out the modes of nutrition.

Two *modes of heterotrophic nutrition*	**Two** *examples of organisms that carry out mode of nutrition*

[6 marks]

This question was attempted by many candidates.

Most candidates were able to define sense organs with examples.

Poor spellings made some candidates to lose marks for example spelling tongue as *tounge*, *yoke* instead of yolk etc.

In question 5*(b)*(i), many candidates could not give correct examples of animals that exhibit territoriality some instead were mentioning animals like Zebra, Elephant, Antelope etc.

Many candidates gave wrong responses in question 5*(c)*(iii). They wrote it is *hydrated/it is not hydrated*; *absence of amniotic fluid/presence of amniotic fluid*; *cannot survive on land/can survive on land* etc.

The organisms involved in nitrogen fixation and their roles were wrongly answered by many candidates.

Many candidates gave correct answers in question 5(e) Few however could not give correct examples for the mode of nutrition mentioned.

The expected answers are as follows:

(a) (i) Sense organs

Organs with sensory receptors; that detect changes from the environment; and relay the impulses to the nervous system; for interpretation and appropriate response sent to the effector organ.

(ii) Sense organs that respond to the stimulus of chemicals

- Tongue;
- Nose;
- Skin;
- Eye.

(b) (i) Animals that exhibit territoriality

- Agama lizard/lizard;
- Leopard/tiger;
- Jaguar;
- Lion;
- Monkey;
- Chimpanzee/baboon;
- Dog;
- Cat;
- Male Tilapia.

(ii) Animals that exhibit pairing

- Termite;
- Human;
- Gibbon;
- Domestic fowl/duck/pigeon;
- Fish;
- Spider;
- Monkey;
- Toad.

(c) (i) Similarities between eggs of toads and eggs of birds

Both have yolk; embryo; vitelline membrane.

(ii) Differences between eggs of toads and eggs of birds

Eggs of toads	**Eggs of birds**
Surrounded by jelly coat	surrounded by calcareous shell;
Relatively smaller	relatively larger;
Shell membrane absent	shell membrane present;

Presence of black part	no black part;
Eggs are laid in chains	eggs are laid in single piece;
Many/numerous eggs	one egg at a time;
Transparent	opaque;
Airspace absent	airspace present;
Yolk not suspended by chalaza	Yolk suspended by chalaza.

(d) Organisms involved in Nitrogen Cycle

Organisms involved in the nitrogen cycle	**One role of organism**
Animals	Excrete nitrogenous compounds/ Eat proteins in plant/ Die/decay to form ammonium compound;
Plants	Absorbs nitrate from soil/ Die/decay to form ammonium compound;
Putrefying bacteria	Break down dead plants/animals;
Azotobacter	Converts atmospheric nitrogen to nitrate;
Rhizobium	Converts atmospheric nitrogen to nitrates;
Nitrobacter	Converts nitrite to nitrates;
Nitrosomonas	Converts ammonium compound to nitrite;
Pseudomonas	Converts amino compound to ammonium compounds.

(e) Types of heterotrophic nutrition

Two modes of heterotrophic Nutrition	**Two** examples of organisms that carry out mode of Nutrition
Holozoic	Human; domestic fowl; dog; cat; goat; sheep; cow; snake; lion; rabbit; *Amoeba*; Any 2x1 [2 marks]
Parasitic	Lice; tick; tapeworm; liver fluke; Guinea worm; hookworm; Any 2x1[2 marks]
Saprophytic	Fungi; mushroom; soil bacteria; yeast; Rhizopus; Mucor. Any 2x1 [2 marks]

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Weakness/Remedies

Candidate's Strength

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