WASSCE JUNE 2015 BIOLOGY 2 — THEORY QUESTIONS

SECTION A — FOR ALL CANDIDATES

QUESTION 1

(a) Explain briefly sexual reproduction in Rhizopus.

(b) A student suddenly stepped on a big snake, he cried for help and ran away.

(i) Name the hormone produced in the body for the reaction.

(ii) In which part of the human body is the hormone named in 1(b)(i) produced?

(iii) State five changes that must have taken place as a result of the hormone named in 1(b)(i).

(c)(i) In a tabular form, state three differences between excretion in flowering plants and excretion in humans.

(ii) List two organelles found in a plant cell that are responsible for the excretion of metabolic wastes.

Answer:

(a) Sexual Reproduction in Rhizopus: Done by conjugation, which involves two strains of hyphae of opposite mating types. The hyphae come in contact and produce small projections on their walls. These develop into progametangia with several nuclei, and the two progametangia enlarge to develop cross walls that later split. The walls later break and their nuclei fuse to form a zygote. The zygote develops a thick wall to form a resistant zygospore, which germinates during favourable damp conditions into hyphae that bear sporangia.

(b)(i) The hormone is Adrenalin.

(ii) Produced in the Adrenal gland (Medulla).

(iii) Changes that occur as a result of the hormone:

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Increase in the rate of respiration.

Increase in heart beat.

Contraction of the arterioles of the skin and alimentary canal.

Increase in muscular tone.

Tension in the voluntary muscles.

Dilation of blood vessels, increasing blood flow to muscles, heart and lungs.

Conversion of glycogen to glucose.

Increase in blood sugar level.

Dilation of pupils of the eye.

Increase in blood pressure.

(c)(i) (SEE DIAGRAM — table)

Flowering Plants	Humans
Excretory products are got from simple organic molecules.	Excretory products are got from complex organic molecules.
There are no definite excretory organs.	There are definite excretory organs like the skin, kidney and liver.
Some excretory products like oxygen, water vapour and carbon dioxide can be reused.	Some excretory products such as urine, urea and uric acid cannot be reused.
Waste products produced include tannins, alkaloids etc.	Waste products here include sweat, urine, urea, mineral salts etc.
Most excretory products like tannins, gums and alkaloids are stored.	Most excretory products are completely removed.
Excretory products are produced in small quantities.	Excretory products are produced in large quantities.
Excretory products are released at a slow rate.	Excretory products are released at a fast rate.

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(ii) Organelles responsible for excretion of metabolic wastes in plant cells:

Mitochondria

Chloroplasts

Question 2

(a) Explain how the leaf of a flowering plant is adapted for photosynthesis.

(b) Describe briefly the mode of feeding in tapeworms.

(c) Name one mineral element each needed for the proper functioning of (i) bones; (ii) red blood cells; (iii) thyroid gland.

(d)(i) State three benefits of including roughage in the diet of humans.

(ii) State three reasons why proteins are important to humans.

Answer:

(a) Adaptations of the leaf for photosynthesis:

i. Broad or flat leaf lamina for maximum absorption of light.

ii. Large intracellular air spaces in the spongy mesophyll allow oxygen and carbon dioxide diffusion.

iii. Guard cells possess chloroplasts for absorption of sunlight.

iv. Bean-shaped structure of guard cells encourages gaseous exchange.

v. Stomata open easily when turgid, allowing diffusion of oxygen and carbon dioxide.

vi. Presence of xylem conducts water and mineral salts into the leaves for photosynthesis.

vii. Presence of phloem transports manufactured food from leaves to other parts of the plant.

viii. Palisade cells arranged at right angle to the upper epidermis aid photosynthesis.

ix. Thin lamina allows light penetration into the mesophyll.

x. Position of leaf relative to stem allows optimum reception of light.

(b) Mode of feeding of Tapeworm:

Exhibits parasitic mode of feeding, living in the guts of man and pigs.

Has suckers/hooks to attach itself to the intestinal lining of the host.

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Has a flattened tape-like/ribbon-like body providing large surface area for easy absorption of digested food.

Has no digestive system or alimentary canal.

(c)

(i) Bones = Calcium, Phosphorus, Fluorine

(ii) Red blood cells = Iron, Copper

(iii) Thyroid gland = Iodine

(d)(i) Benefits of roughage:

Stimulates peristaltic movement and bowel movement.

Reduces blood cholesterol, gall stones, appendicitis, obesity, diabetes mellitus.

Prevents constipation.

Slowly releases glucose.

Reduces high blood sugar and weight gain.

(ii) Importance of proteins:

Helps repair damaged tissues.

Helps replace worn-out tissues.

Supplies necessary amino acids needed by the body.

Helps in formation of hormones, enzymes and antibodies (needed for blood clotting).

Helps in body building and growth.

Question 3

(a)(i) What is sewage? (ii) State five effects of releasing untreated sewage into a stagnant water body.

(b) Explain surface terracing as a soil conservation method.

(c) Explain the term adaptation.

(d) Explain two ways each by which the following organisms adapt to their habitats: (i) hydrophytes; (ii) xerophytes.

Answer:

(a)(i) Sewage: Waste matter such as faeces and urine from humans and other animals, including industrial and domestic waste materials that can dissolve or suspend in water.

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(ii) Effects of releasing untreated sewage into a stagnant water body:

Spread of water-borne diseases.

Poisonous to aquatic life/organisms.

Makes water unfit for consumption.

Increases decomposition rate and concentration of nutrients.

Leads to rapid growth of algae/aquatic plants.

Brings about depletion of oxygen.

Leads to death of aquatic animals.

Leads to air pollution and offensive odour.

Leads to accumulation of nutrients in water body due to breakdown by bacteria.

(b) Surface terracing: Controls soil erosion on sloppy surfaces/hills. It involves constructing flat horizontal areas on which crops are cultivated. Steps like walls are built along the contours, and ploughing is done along the contours — these processes reduce the speed of water running down the slopes.

(c) Adaptation: The possession of certain characteristics/traits/structures/features evolved over time to enable organisms survive and reproduce in response to changes in their habitat/environment.

(d)(i) Adaptations of hydrophytes:

Lack of root hairs/caps or reduced roots.

Large air spaces in leaves and roots for buoyancy support.

Hairs on leaves prevent blockage of stomata.

Stomata only at the upper epidermis to aid transpiration.

Adventitious roots aid absorption of mineral salts and water.

Small plant size for easy floating.

Waxy upper leaf surface prevents clogging by water.

Long petiole/leaf stalk supports the lamina for photosynthesis.

Long flower stalk/pedicel exposes flower for pollination.

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Breathing roots aid gaseous exchange.

(ii) Adaptations of Xerophytes:

Thick waxy cuticle on epidermis reduces water loss/transpiration.

Thick succulent stems and leaves for water storage.

Reduction of leaves to spines reduces transpiration.

Long tap root system obtains water from great soil depth.

Reduced number of stomata for water conservation.

Sunken stomata reduce water loss.

Question 4

(a) Explain the following terms: (i) test cross; (ii) monohybrid cross.

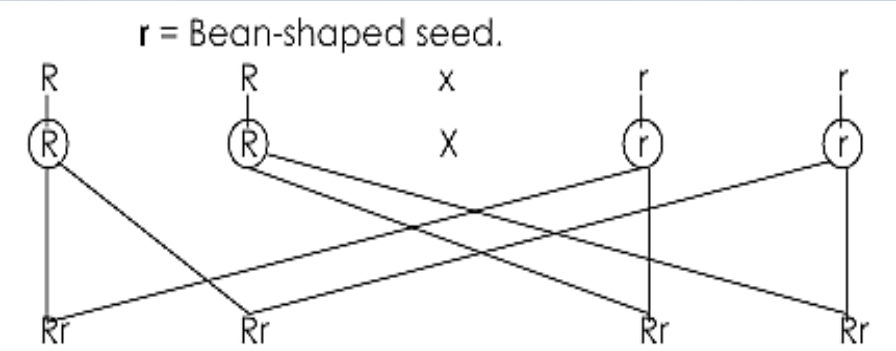
(b) In a mango plant, the allele for bean-shaped seed is r and is recessive to round-shaped seed R. With the aid of a genetic diagram, determine the genotypes of the offspring if: (i) a homozygous bean-shaped parent is crossed with a homozygous round-shaped parent; (ii) a heterozygous bean-shaped parent is crossed with a heterozygous round-shaped parent.

Answer:

(a)(i) Test Cross: The mating/crossing of an organism of unknown genotype with a homozygous recessive organism to determine the genotype of an organism.

(ii) Monohybrid Cross: A cross between parents that differ in the alleles they possess for one particular gene.

(b) (genetic cross) R = Round seed, r = Bean-shaped seed



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Parental genotype (Homozygous): RR × rr

F1 Generation (Genotype): Rr, Rr, Rr, Rr

(ii) Not scorable in source material.

SECTION C — FOR CANDIDATES IN NIGERIA ONLY

Question 6

(a) Copy and complete the table below.

Disease	One Effect	One Remedy
Kidney Stone		
Nephritis		
Diuresis		

(b) Make a labelled diagram of the carbon cycle. (SEE DIAGRAM)

(c)(i) What is an Estuarine habitat? (ii) Construct a food chain typical of an Estuarine habitat.

(d)(i) Name two pests and two diseases that can attack plant crops.

(ii) State three ways of controlling plant diseases.

(e) State four functions of a public health authority.

(f) State four ways of maintaining food hygiene in the community.

Answer:

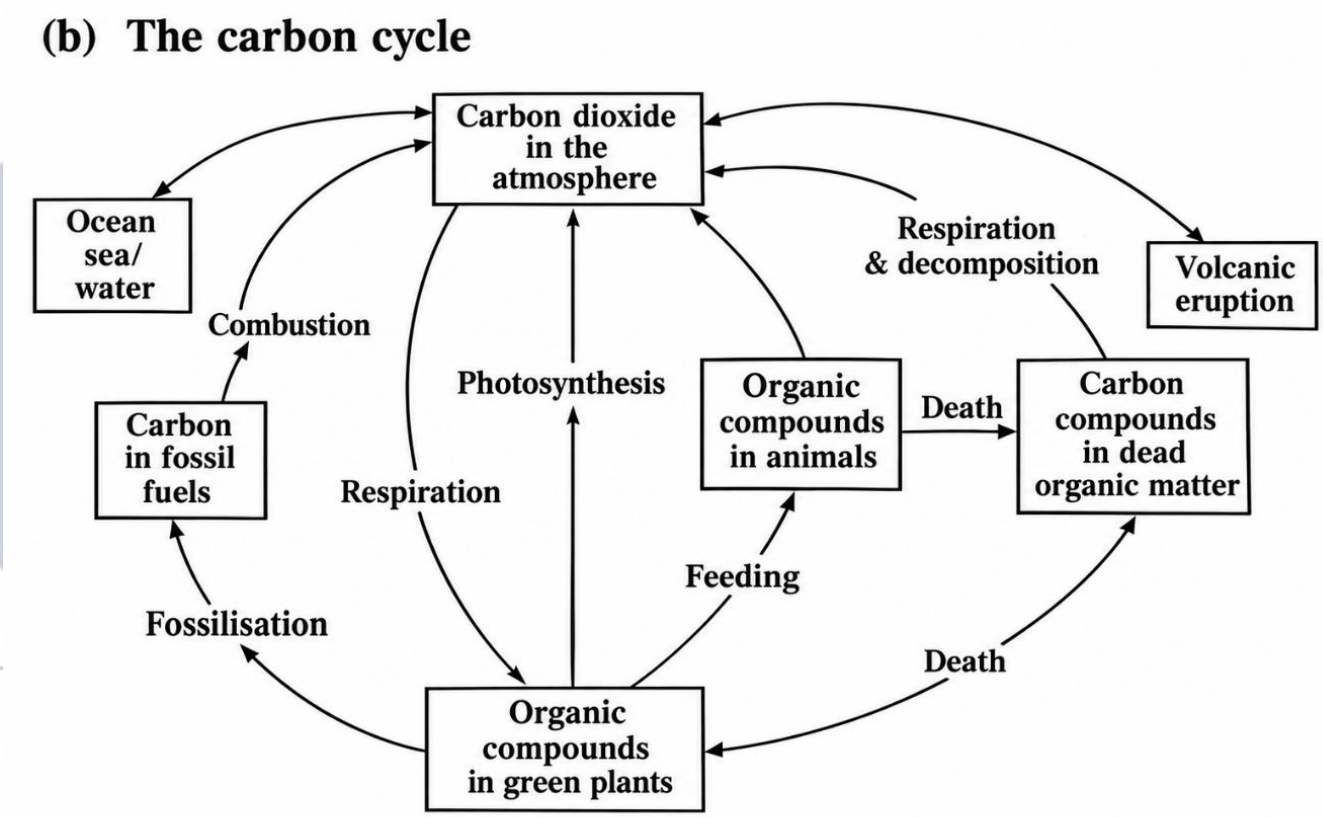
(a) kidney diseases table:

Disease	One Effect	One Remedy
Kidney stones	Decreased rate of urination; pains during urination; abdominal pains; increased blood pressure; presence of blood in urine	Kidney transplant; drink plenty of water; abstain from foods rich in calcium; avoid red meat
Nephritis	Swelling of feet and ankle; high blood pressure; oedema; fatigue/general weakness; blood in urine; back pain; inflammation of the kidney tubules	Kidney transplant; drink boiled water; cook food properly; wash all food items properly; consult a physician; filter boiled water
Diuresis	Loss of serum electrolyte; dehydration occurs; fatigue/weakness; high	Consult a physician; avoid fans/air conditioners in cold

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	blood pressure; loss of appetite; nausea	weather; abstain from alcohol

(b) (carbon cycle: Carbon dioxide in the atmosphere connects via



photosynthesis/respiration/combustion to organic compounds in plants and animals, fossil fuels, dead organic matter, ocean/sea/water, and volcanic eruption)

(c)(i) Estuarine habitat: The habitat that exists where a river enters the sea/ocean, into which tides flow as freshwater mixes with salt water to form brackish (bracket) water.

(ii) Food chain of an Estuarine habitat:

Phytoplanktons → Barnacles → Fish → Bird

Detritus → Worm → Fish → Bird

Detritus → Shrimp → Fish → Bird

(d)(i) Pests that attack plant crops: Stem borer, Army Worm, Weevils, Black tea-thrips, Aphids, Root Mealybugs, Variegated grasshoppers, Beetles, Rodents, Squirrels.

Diseases that attack crops: Rosette,

Swollen shoot of Cocoa, Bacteria Blight, Root Knots, Rice blast, Black pod of Cocoa, Root rot/stem rot, Downy mildew, Frackle, Leaf spots, Cankers, Sigatoka etc.

(ii) Ways of controlling plant diseases:

Use of pesticides, fungicides, nematicides etc.

Breeding resistant varieties of crops.

Use of predators and parasites of insects/pests to keep them in check.

Planting genetically modified crops resistant to bacteria/viruses transmitted by pests.

Destroying infested crops via burning, pruning affected parts, or deep burial.

Destroying the alternate host.

Practising crop rotation.

(e) Functions of Public Health Authority:

Provision of Maternity Clinics/Health centres.

Provision of medical inspection for schools.

Provision of child welfare services.

Registration of births and deaths.

Administration of vaccination/immunization.

Ensure cleanliness of public places.

Ensure adequate provision of clean water to the public.

Provision of quarantine services for man, livestock and plants.

Issuance of health certificates to travellers.

Provide vital information to WHO on outbreak of infectious diseases.

Provision of public health education.

Inspection of slaughterhouses; certify places suitable as abattoirs.

(f) Ways of maintaining food hygiene:

Ensuring proper storage methods for foods.

Ensuring proper disposal of left-over foods.

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Proper washing of cooking utensils before and after use.

Proper personal hygiene for those handling food items.

Ensuring kitchen areas are kept clean always.

Ensuring cooked foods are covered at all times.

Ensuring proper preservation of perishable foods.

WASSCE JUNE 2015 BIOLOGY 3 — PRACTICAL QUESTIONS

SECTION A — FOR ALL CANDIDATES

Question 1

Study specimens A and B carefully and use them to answer questions 1(a) to 1(e). (SEE DIAGRAM — specimens)

(a) Classify specimen B into its division and class.

(b)(i) State the types of leaf arrangements in specimens A and B. (ii) Name the leaf shape of specimens A and B.

(c)(i) State the type of leaf margin in specimen A. (ii) State the types of venation found in the leaves of specimens A and B.

(d)(i) List three observable similarities found in specimens A and B.

(ii) In a tabular form, state four observable differences between specimens A and B.

(e) Make a drawing 8–10 cm long of the leaf of specimen A and label fully. (SEE DIAGRAM)

Answer:

Specimens: A = Twig of Mango plant; B = Twig of Ixora plant

(a) Classification into Division: Angiospermatophyta/Angiospermophyta; Class: Dicotyledonae/Magnolioprida

(b)(i) Leaf arrangement: Specimen A = Alternate or Spiral; Specimen B = Decussate or opposite

(ii) Leaf shape: Specimen A = Sword-like/Lanceolate; Specimen B = Oval/ovate shape

(c)(i) Leaf margin in specimen A = Smooth/Wavy

(ii) Venation: Specimen A = Net or reticulate; Specimen B = Reticulate or Net

(d)(i) Observable similarities between A and B:

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Leaves have pointed apex.

Leaves have prominent midrib.

Leaves are green in colour (contain chlorophyll).

Leaf stalk/petiole are swollen at the base.

(ii) (SEE DIAGRAM — table)

Specimen A (Mango)	**Specimen B (Ixora)**
Leaves are big	Leaves are small
Leaf stalk is long	Leaf stalk is short
Leaf arrangement is alternate/spiral	Leaf arrangement is opposite or decussate
Leaves have elongated apex	Leaves have short apex
Leaves have narrow lamina/leaf blades	Leaves have broad lamina/leaf blades

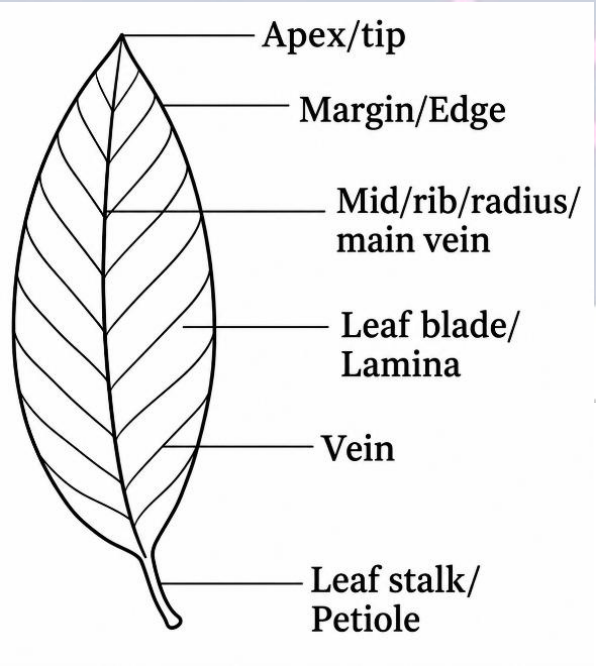
(e) (labelled leaf drawing showing Apex/tip, Margin/Edge, Mid-rib/radius/main vein, Leaf blade/Lamina, Vein, Leaf stalk/Petiole)

Question 2

Study specimens G and H carefully and use them to answer questions 2(a) to 2(c). (SEE DIAGRAM — specimens)

(a)(i) Name the phylum of specimens G and H. (ii) State two reasons for the answer given in 2(a)(i).

(b) Name the structures on specimens G and H that are used for defence.



(c)(i) State the habitat of each of specimens G and H. (ii) State two ways in which each of specimens G and H are of economic importance.

Study specimens M, N and P carefully and use them to answer questions 2(d) and 2(e). (SEE DIAGRAM — specimens)

(d)(i) Name the class of organisms to which each of specimens M, N and P are associated. (ii) State one function common to the specimens named in 2(d)(i). (iii) In a tabular form, state four observable differences between specimens M and P.

(e) Explain three features of biological importance in specimen M.

Answer:

Specimens: G = Bee; H = Termite

(a)(i) Phylum of G and H = Arthropoda

(ii) Reasons:

Presence of chitinous exoskeleton.

Presence of jointed legs.

Possession of segmented body.

Body divided into three layers.

Have bilateral symmetry.

(b) Structures used for defence: Specimen G = Sting/Ovipositor; Specimen H = Strong and biting mandible

(c)(i) Habitat: Specimen H = Termitarium/anthill/termite mound/old logs of tree/timber of wooden buildings; Specimen G = Hive

(ii) Economic importance:

Specimen G: produces wax; pollinates flowers; produces honey; sting causes pain or even death; bee-keeping is a source of income.

Specimen H: destroys wood/timber/furniture/books; destroys plant crops; termitarium used for lawn tennis court; source of protein/food; aids soil aeration via tunneling; enhances water penetration into soil, increasing porosity; increases humus content of soil; mounds form impediments to land use.

(d)(i) Class of organisms: Specimen M = Aves; Specimen N = Osteichthyes; Specimen P = Mammalia

(ii) Common function: Protection of the organisms against mechanical injury.

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(iii) (SEE DIAGRAM — table)

Specimen M (Quill feather)	Specimen P (Mammalian skin)
Absence of fur/hair	Presence of fur/hair
Presence of barbs	Absence of barbs
Presence of inferior umbilicus	Absence of inferior umbilicus
Hard texture	Soft texture when touched
Shafts/radius present	Shafts/radius absent
Quill/Calamus present	Quill/Calamus absent
Superior umbilicus present	Superior umbilicus absent
Barbs found in some parts of the quill	Whole surface covered with hair or fur

(e) Features of biological importance of specimen M:

Quill feather acts as waterproofing.

Flat/broad vane provides surface area for flapping during flight.

Centrally placed shaft/radius provides point of attachment to barbs/strengthens the feather.

Barbs with hooks help provide insulation to the body.

Overlapping arrangement of quill feathers over the body allows smooth movement in flight.

Colouration of the quill feather enhances courtship display.

SECTION B: Only available to Candidates in Ghana (no content provided)

SECTION C — FOR CANDIDATES IN NIGERIA ONLY

Question 4

Study specimens T, V and W carefully and use them to answer questions 4(a) to 4(d). (SEE DIAGRAM — specimens)

(a) Classify specimens T, V and W according to the following criteria: (i) agricultural classification; (ii) life cycle.

(b) State two ways in which specimen W is important to human nutrition.

(c) With a scalpel or knife, make a cross section of specimen T.

(i) What type of placentation is observed in the cut section of

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specimen T?

(ii) Name one example of a fruit with similar placentation as observed in the cut section of specimen T.

(iii) Make a drawing 10 cm – 12 cm long of the transverse section and label fully. (SEE DIAGRAM)

(d) Make a transverse section of specimen V and state: (i) three observable differences; (ii) three observable similarities; between the transverse sections of specimens T and V.

Study specimens X_i and X_{ii} and use them to answer questions 4(e)(i) to 4(e)(iii). (SEE DIAGRAM — specimens)

(e) Carefully remove the bark of specimen X_i to expose the naked part.

(i) State two observable differences between specimens X_i and X_{ii}.

(ii) If X_i and X_{ii} are planted, what difference will be noticed after a month?

(iii) State one reason for the answer in 4(e)(ii).

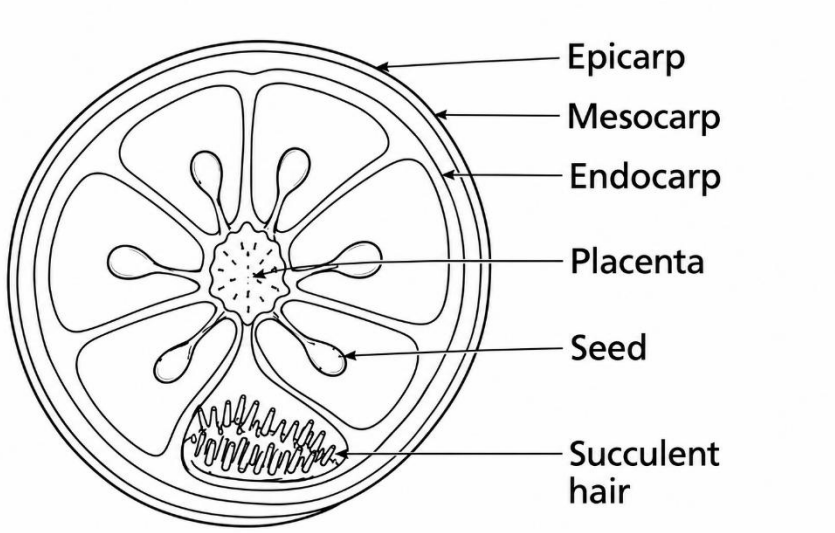
Answer:

(a)(i) Agricultural classification: Specimen T = Fruit Crop; Specimen V = Vegetable Crop; Specimen W = Root tuber

(ii) Life Cycle: Specimen W = Perennial; Specimen T = Annual; Specimen V = Biennial

(b) Importance of Specimen W to man:

Source of carbohydrate/food.



Produces energy for man.

Used for industrial purposes.

Acts as a source of income.

(c)(i) Type of placentation = Axile

(ii) Example of a fruit with similar placentation = Tomato, Pepper, Garden egg

(iii) transverse section labelled: Epicarp, Mesocarp, Endocarp, Placenta, Seed, Succulent hair)

(d)(i) (SEE DIAGRAM — table)

Specimen T (Orange)	**Specimen V (Tomato)**
Few seeds are available	Many seeds are present
It has small placenta	It has large placenta
Epicarp and Mesocarp are hard	Epicarp and Mesocarp are soft
Presence of succulent hair in the endocarp	It has juicy pulp as the endocarp
Larger seeds are seen	Smaller seeds are seen
Epicarp is greenish or yellowish in colour	Epicarp is red in colour

(ii) Observable similarities between T and V:

Both have fused epicarp and mesocarp.

Both have axile placentation.

Both have succulent endocarp.

Both are berries and have seeds.

Both are spherical in shape.

Both are brightly coloured.

(e)(i) (SEE DIAGRAM — table)

Specimen X_i	**Specimen X_{ii}**
Absence of internode	Presence of internode
Absence of scale leaf	Scale leaf present
No node present	Node present
White colour observed	Brown colour seen

(ii) X_{ii} will germinate; X_i will not germinate.

(iii) X_{ii} possesses auxiliary buds responsible for quick germination, but in X_i the auxiliary buds have been removed.

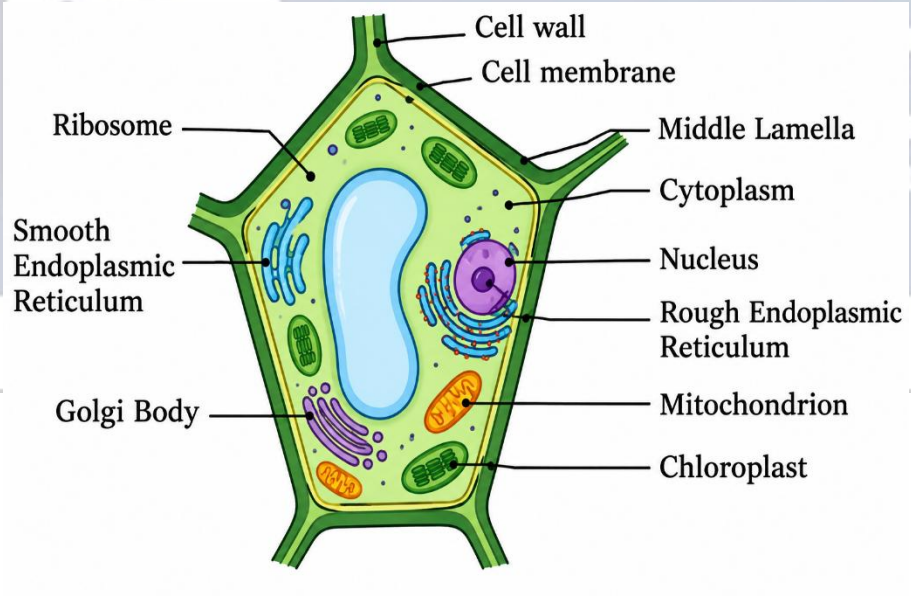
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WASSCE JUNE 2016 BIOLOGY 2 THEORY QUESTIONS

SECTION A — FOR ALL CANDIDATES

1.(a)(i) List three forms in which living cells exist. (ii) Give one example each of the forms listed in 1(a)(i).

(b) Make a diagram, 6 cm – 10 cm long, of a typical plant cell and label fully.



(c)(i) In a tabular form, state three differences between a plant cell and an animal cell. (ii) State three similarities between a plant cell and an animal cell.

2. (a) In sequence, name the organs that constitute the alimentary canal of humans.

(b) State: (i) three structural differences; (ii) three structural similarities; between the alimentary canal of a bird and human.

(c) Explain briefly how the dentition of herbivores is adapted for feeding.

(d) State two roles of the pancreas in digestion.

3.(a)(i) What is a habitat? (ii) Explain briefly three roles of a decomposer in an ecosystem.

(b) Explain briefly energy flow in a freshwater habitat.

(c)(i) State three harmful effects of microorganisms to plants. (ii) State six beneficial effects of microorganisms to humans.

4.(a)(i) Explain the term agglutination as used in blood transfusion. (ii) The table below represents blood transfusion between blood donors and recipients. Copy and complete the table using the keys (+) to represent compatibility and (–) to represent incompatibility.

Donor \ Recipient	A	B	AB	O
A				
B				
AB			-	
O			+	

(b) Explain how each of the following organisms are adapted for obtaining food: (i) Mosquito larva (ii) Dodder plant (iii) Grasshopper

SECTION C — FOR CANDIDATES IN NIGERIA ONLY

6.(a) State two differences between tactic and nastic movements in plants.

(b) Give two examples each of organisms that show: (i) tactic movement (ii) nastic movement

(c)(i) State three ways of caring for the mammalian skin. (ii) List three stimuli to which the mammalian skin is sensitive.

(d) State five effects of high temperature on a terrestrial habitat.

(e)(i) What is courtship behaviour in animals? (ii) List three courtship behaviours in animals.

(f) Name three organisms that carry out holozoic mode of nutrition.

(g) Explain briefly how fingerprinting can be used to detect crime.

ANSWERS TO WASSCE JUNE 2016 BIOLOGY 2 ESSAY

SECTION A

1(a)(i) Three forms of living cells: Single or Free living form; Colony or Colonial living form; Filament or Filamentous living form; Part of a living organism.

(ii) Examples: Single/Free living = Amoeba/Euglena/Paramecium/Chlamydomonas; Colony = Volvox/Sponges/Pandorina/Eudorina; Filament = Spirogyra/Oedogonium/Zygnema/Cladophora; Part of a living organism = Onion cell/Epidermal cell/Parenchyma cell.

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(b) Diagram of a Typical Plant Cell. *SEE DIAGRAM* — labelled: Cell wall, Cell membrane, Middle Lamella, Cytoplasm, Vacuole, Nucleus, Rough Endoplasmic Reticulum, Mitochondrion, Chloroplast, Ribosome, Smooth Endoplasmic Reticulum, Golgi Body.

(c)(i) Differences between Plant and Animal Cell:

Plant Cell	Animal Cell
Rigid cellulose cell wall	No cell wall
Stores lipid as oil	Stores lipid as fat
Contains starch granules	Contains glycogen granules
Has chloroplasts	Lacks chloroplasts
One large central vacuole	Numerous small vacuoles
Cytoplasm less dense	Cytoplasm more dense
No lysosome	Has lysosome
No centrioles/centrosome	Has centrioles/centrosome

(ii) Similarities: Both have Nucleus, Mitochondria, Cytoplasm, Vacuole, Endoplasmic reticulum, Cell membrane, Golgi body, Ribosomes.

2(a) Organs of Alimentary Canal in Sequence: Mouth/buccal cavity, Gullet/Oesophagus, Stomach, Duodenum, Ileum/Small intestine, Colon/Large intestine, Rectum.

(b)(i) Structural Differences (Bird vs Human):

Bird	Human
Beak present	Beak absent
Mouth modified to beak	Mouth present
Teeth absent	Teeth present
Appendix absent	Appendix present
Gizzard present	Gizzard absent
Anal pore modified to cloaca	Anal pore modified into anus
Crop present	Crop absent

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Shorter alimentary canal	Longer alimentary canal

(ii) Similarities: Mouth, Gullet/Oesophagus, Stomach, Duodenum, Small intestine, Large intestine, Caecum, Rectum.

(c) Adaptation of Herbivore Dentition:

1. Curved/Elongated incisors for cutting herbs and grasses.
2. Thick horny pad supporting lower incisors in biting.
3. Broad surfaces of cheek teeth (molars) for chewing and grinding.
4. Furrows/Ridges on cheek teeth for masticating and chewing.
5. Canines absent, substituted with diastema allowing tongue to roll cropped grass.

(d) Roles of Pancreas in Digestion:

1. Produces pancreatic juice containing enzymes.
2. Sodium bicarbonate neutralizes stomach hydrochloric acid to give alkaline solution.
3. Pancreatic amylase digests starch into maltose.
4. Trypsin digests protein into peptones and peptides.
5. Lipase digests fat droplets into glycerol and fatty acids.

3(a)(i) Habitat: The natural dwelling place of an organism.

(ii) Roles of a Decomposer: Decomposers bring about decay of dead plant/animal parts to produce humus/manure; release nutrients absorbed by plant roots for new tissue; play a vital role in nutrient recycling; also release offensive odour polluting the air.

(b) Energy flow in a freshwater habitat: Aquatic plants (Spirogyra/Pistia) use sunlight energy to produce food (photosynthesis). Food is eaten by primary consumers (small aquatic animals), eaten by secondary consumers (bigger animals), then tertiary consumers (much bigger fish). Energy flows from one trophic level to another.

(c)(i) Harmful Effects of Microorganisms to Plants: cause diseases; lead to wastage; reduction in yield; undesirable qualities in plants/products; spoilage.

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(ii) Beneficial Effects to Humans: decompose dead organisms to release nutrients; cleaning up oil spillage; fermentation of foods/cocoa beans/garri/locust beans/vinegar; producing alcoholic beverages; making antibiotics/penicillin; manufacture of insulin; making cheese/yoghurt/bread; producing flax/tanning of leather; producing vitamins; used in sewage treatment.

4(a)(i) Agglutination: The clumping together of antigens of red blood cells with corresponding antibodies in the plasma of incompatible blood groups.

(ii) Completed table:

Donor \ Recipient	A	B	AB	O
A	+	-	+	-
B	-	+	+	-
AB	-	-	+	-
O	+	+	+	+

(b) Adaptation for obtaining food:

(i) Mosquito larva: Pair of ciliated mouth brushes create a water current carrying food particles into the mouth; the mouth brushes filter and sweep food into the mouth.

(ii) Dodder plant: Possesses haustoria for penetrating host plant tissues to obtain food and water.

(iii) Grasshopper: Mandibles for cutting/crushing food; Maxillae for directing food to mandibles/cutting/grinding; Labium for holding food/vegetation and guiding food.

SECTION B: Available for Candidates in Ghana Only.

SECTION C

6(a) Differences between Tactic and Nastic Movements:

Tactic Movement	Nastic Movement
Movement directly towards or away from stimulus	Movement is non-directional
Movement involves the whole parts of the plant	Movement involves some parts of the plant

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Stimuli comprises light, heat and chemical	Stimulus involves touch or turgor pressure

(b) Examples:

(i) Tactic Movement: Euglena, Tilapia, Volvox, Earthworm, Chlamydomonas.

(ii) Nastic Movement: Mimosa, Sunflower, Morning glory, Pride of Barbados, Desmodium.

(c)(i) Ways of Caring for Mammalian Skin: regular exercise; balanced diet; drinking lots of water; moisturizing with cream; avoiding excessive UV exposure; avoiding bleaching creams; avoiding harsh chemicals; wearing clean inner clothes; protecting against injury; eating foods rich in Vitamins A, B2, E.

(ii) Stimuli skin is sensitive to: Pressure, Heat and Cold, Pain, Touch, Chemicals.

(d) Effects of High Temperature on Terrestrial Habitat:

1. High rate of decay of organic matter.
2. High rate of growth, shorter life cycle (toads, housefly).
3. Cold-blooded organisms look for shelter from heat.
4. High rate of water loss in animals through perspiration.
5. High rate of transpiration in plants.
6. Plants wither.
7. High incidences of bush fires.
8. Increased rate of migration of organisms.
9. High rate of metabolism in both plants and animals.

(e)(i) Courtship behaviour: A set of ritual actions animals exhibit to find, attract and choose a mate for reproduction.

(ii) Pairing; seasonal migrating; territoriality; release of attractive sex hormones/odour; display of prominent colour patterns; dancing/attractive movements; vocal display/croaking; mating calls and sound signals.

(f) Organisms with Holozoic Nutrition: Man, Birds, Goat, Frog, Rat.

(g) Uses of Fingerprinting in Crime Detection: No two persons have identical fingerprint patterns, so it's used for crime detection.

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Fingerprints left at a crime scene provide a valuable clue in detecting and arresting a criminal; prints are photographed and compared with the suspect's fingerprints — a match identifies the criminal.

WASSCE JUNE 2016 BIOLOGY 3 PRACTICAL QUESTIONS

SECTION A — FOR ALL CANDIDATES

1.(a)(i) Cut a piece of specimen A. Place it on the white tile. Add a few drops of iodine solution. Record the observation and result in a tabular form.

(ii) Squeeze a few drops of specimen E on another clean white tile provided, add a few drops of iodine solution. Record the observation and result in a tabular form.

(b)(i) State two observable differences between specimens A and B.

(ii) Suggest two factors likely responsible for the state of specimen B.

(iii) With the aid of a hand lens/magnifying lens, observe specimen B and name an organism likely to be growing on it. (iv) State the mode of feeding of the organism growing on specimen B.

(c)(i) Make a drawing 6 cm – 8 cm long of specimen C and label fully.

SEE DIAGRAM

(ii) State one function each of any three parts labelled.

2. Study specimens H, K, L and M and answer questions 2(a) to 2(e).

(a) Name the location of each of specimens H, K and M in the body of a mammal.

(b)(i) Name the fluid in specimen L. (ii) State two functions of the fluid named in 2(b)(i). (iii) Which of the other specimens is specimen L associated with?

(c)(i) State two observable differences between specimens H and K.

(ii) State two observable features of specimen K that adapt it to its function.

(d) State one biological importance each of specimen K and M.

(e) Make a drawing 8 cm – 10 cm long of specimen M and label fully.

SEE DIAGRAM

SECTION C — FOR CANDIDATES IN NIGERIA ONLY

4. Study specimens S, T, U, V and W and answer questions 4(a) to 4(e).

(a)(i) Name the habitats of each of specimens S, U and W. (ii) Name the class to which each of specimens S, U and W belong.

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(b) State: (i) four observable similarities between specimens S and U.

(ii) five observable differences between specimens S and U.

(c)(i) Identify the sex of specimen U. (ii) State two reasons for the answer in 4(c)(i).

(d) State four observable features that adapt specimen S to its habitat.

(e) Construct a food chain using at least three of the given specimens.

ANSWERS TO WASSCE JUNE 2016 BIOLOGY 3 PRACTICAL

SECTION A

1(a) Food Test: Specimen A = Bread; B = Orange juice.

Test	Observation	Result
Specimen "A" + iodine solution	Turns blue-black in colour	Starch is present
Specimen "B" + specimen E + iodine	Turns brownish or yellowish	Starch is absent

(b)(i) Differences between A and B:

Specimen A	Specimen B
Soft in texture	Hard in texture
Absence of mould/fungus/Rhizopus/Mucor	Presence of mould/fungus/Rhizopus/Mucor
White or cream in colour	Dark brown, black or orange in colour
Fresh	Stale

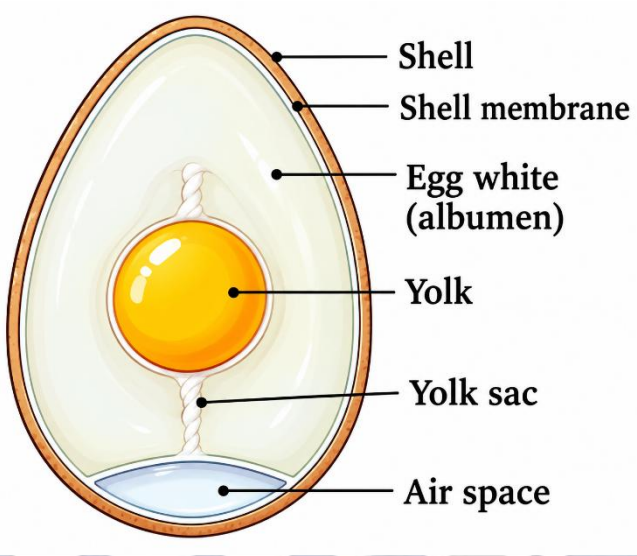
(ii) Factors responsible for the state of B: Moisture/humid air/water; Warmth/temperature; Spores of fungus; Time.

(iii) Organism likely growing on B: Mould/Fungus/Rhizopus/Mucor.

(iv) Mode of feeding: Saprophytic.

(c)(i) Diagram of Specimen C (Boiled egg).

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labelled: Shell, Shell membrane, Yolk sac, Yolk, Egg White (Albumen), Air space.

(c)(ii) Functions of labelled parts:

1. Shell: protection and keeping shape.
2. Shell membrane: creates room for gaseous exchange.
3. Yolk: provision of food for embryonic growth.
4. Albumen (Egg White): supplies protein.
5. Air Space: allows exchange of gases.
6. Yolk Sac: protection of the embryo.

2(a) Specimen H = Liver; Specimen K = Lung; Specimen M = Kidney. Location: Specimen H below the diaphragm/upper abdominal cavity; Specimen K at the thoracic cavity/chest region; Specimen M at the dorsal wall of the abdominal cavity.

(b)(i) Specimen L = Bile.

(ii) Functions: emulsifies fats/oils into fat droplets; provides alkaline medium for pancreatic juice to act; prevents food decay in the small intestine; gives brownish/yellowish colouration of faeces; inorganic salts neutralize the acid in chyme.

(iii) Other specimen associated: Specimen H (Liver).

(c)(i) Differences between H and K:

Specimen H (Liver)	Specimen K (Lung)
Dark red in colour	Brighter and pink in colour
Smoother on the surface	Has a convoluted surface
Thick and turgid	Soft and spongy or fluffy

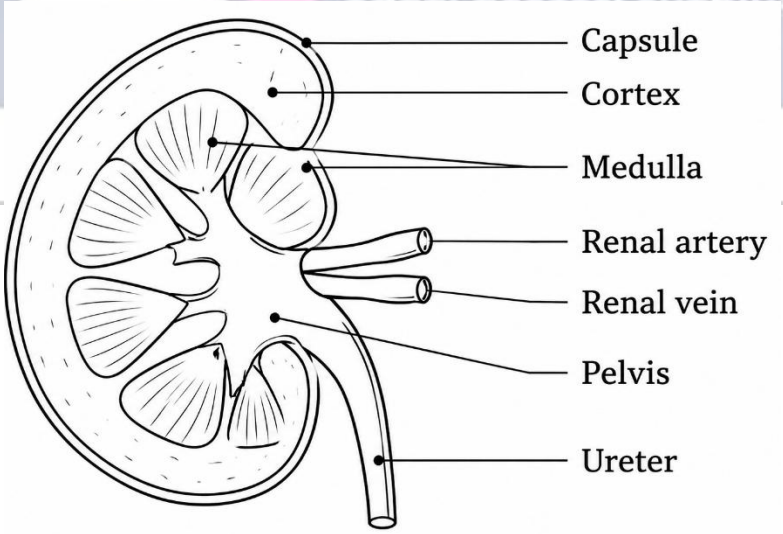
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(ii) Features adapting K to its function: moist surface for dissolution of gases; thin surface membrane for easy diffusion; presence of many blood vessels for transportation of gases and dissolved substances.

(d) Biological importance:

- Specimen K (Lung): surface for inspiration and expiration/exchange of gases.
- Specimen M (Kidney): acts as an osmoregulator, controlling liquid contents in the body; aids urine production and excretion of metabolic waste; maintains acid-base balance.

(e) Diagram of Longitudinal Section of Specimen M (Kidney).



labelled: Capsule, Cortex, Medulla, Renal artery, Renal Vein, Pelvis, Ureter.

SECTION C

4(a) Specimen S = Toad; Specimen U = Lizard; Specimen W = Locust.

(i) Habitats: Specimen S (Toad) = Moist/damp land or grass/vegetation near fresh water pond. Specimen U (Lizard) = Walls/cracks/garden/farm land. Specimen W (Locust) = Vegetation/trees/leaves or grassland.

(ii) Class: Toad = Amphibia; Lizard = Reptilia; Locust = Insecta.

(b)(i) Similarities between S and U: wide terminal mouth; two pairs of limbs (fore and hind); nostrils; trunk; eyes; head; tympanic membrane/ear drum.

(ii) Differences between S and U:

Specimen S (Toad)	Specimen U (Lizard)
Body short and wide	Body long and narrow
Has poison gland	No poison gland

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No claws on digits	Has claws on digits
Fore limbs end in four digits	Fore limbs end in five digits
Gular fold absent	Gular fold present
Bulging eyes	No bulging eyes
No scales	Has scales
Streamlined body	Body not streamlined
Warty skin	No warty skin
No tail	Has tail
No nuchal crest	Has nuchal crest
No neck	Has neck

Digits of hind limbs webbed	Digits of hind limbs not webbed

(c)(i) Sex of U: Male (implied by reasons).

(ii) Reasons: blue and orange tail; prominent nuchal crest; hemi-penis; gular fold; brightly coloured trunk.

(d) Features adapting S to its habitat: poison gland for protection; warty skin for camouflage; webbed hind digits for swimming; bulging eyes for wide vision; muscular fore limbs for absorbing shock; long muscular hind limbs for hopping/jumping; cryptic colouration for camouflage; moist skin for easy respiration; pads on fore limbs for absorbing shock during landing.

(e) Food chain:

Specimen T (Grass) → Specimen W (Locust) → Specimen S (Toad)

Specimen T (Grass) → Specimen W (Locust) → Specimen U (Lizard)

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WASSCE JUNE 2017 BIOLOGY 2 THEORY QUESTIONS

SECTION A — FOR ALL CANDIDATES

1. (a)(i) What is classification of living things? (ii) Name the scientist that developed the Binomial system of classification. (iii) State three reasons why it is necessary to classify living things. (iv) List seven major groups into which Taxonomists classify living things in order of hierarchy.
(b) State two features each which viruses have in common with: (i) living things; (ii) non-living things.
(c) Name two viral diseases each of: (i) plants; (ii) humans.

2. (a) State four characteristics of enzymes.
(b)(i) List two digestive enzymes produced in the duodenum of humans. (ii) Name the substrate that each enzyme listed in 2(b)(i) acts on. (iii) State the products of each enzyme activity in 2(b)(ii).
(c)(i) State one way in which chlorophyll is important in plants. (ii) Name two macroelements that are required for the formation of chlorophyll in plants. (iii) State one deficiency symptom of each macroelement named in 2(c)(ii).
(d) Outline the procedure used for testing for starch in a leaf.

3. (a) Name one instrument used for collecting: (i) soil organisms from a soil sample; (ii) tiny insects from a leaf or a stem.
(b) Make a diagram 6cm – 8cm long of the instrument named in 3(a)(ii) and label fully.
(c) Explain briefly the relationship between three examples of symbiotic organisms.

4. (a) A child belongs to blood group O and the mother belongs to group B. With the aid of a genetic cross, state the possible blood groups of the father.
(b)(i) Name two forms of adaptive communication in animals. (ii) State two reasons why organisms communicate with one another.

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SECTION C — FOR CANDIDATES IN NIGERIA ONLY

6. (a) Explain briefly the process of perceiving smell in humans.

(b) State the adaptive features of the egg of a domestic fowl.

(c)(i) What are autotrophs? (ii) Name two unicellular organisms that are autotrophs.

(d) State five functions of the World Health Organization.

(e) Name two examples each of plants and animals that live in a freshwater pond.

(f) State five differences between the skin of a mammal and the epidermis of a leaf.

(g) A farmer has two plots of land; plots A and B. On plot A, the farmer planted several seeds of maize. On plot B the farmer planted several seeds of maize and pepper in a small area. What type of competition would be observed on: (i) plot A; (ii) plot B?

ANSWERS TO WASSCE JUNE 2017 BIOLOGY 2 ESSAY

SECTION A

1.(a)(i) Classification of living things: The grouping or arrangement of living things according to their common characteristics or features.

(ii) Scientist: Carolus Linnaeus.

(iii) Reasons for classification:

To put every living organism into specific order.

To make for easy reference.

To enable easy research works.

To trace the geographical distribution of living organisms.

To indicate relationships between different categories of living organisms.

To make room for easy identification of similar living organisms.

To show evolutionary trends in different groups of living things.

(iv) Order of hierarchy: Phylum/Division, Class, Order, Family, Genus, Species.

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(b) Features Viruses have in common:

(i) With Living things: Possession of protoplasm (protein membrane); Possession of DNA/RNA/nucleic acid.

(ii) With Non-living things: Appearance as crystals; Absence of organelles.

(c) Viral diseases:

(i) Plants: Cassava mosaic disease, Cacao swollen shoot disease, Groundnut rosette, Maize streak, Cucumber mosaic, Bean mosaic.

(ii) Humans: Poliomyelitis (Polio), Chicken pox, Measles, AIDS, Ebola disease, Lassa fever, Influenza/flu, Avian Influenza, Rabies, Swine flu, Infective Hepatitis.

2. (a) Characteristics of Enzymes:

Enzymes are biological catalysts which speed up the rate of biological reactions.

Required in small quantities.

Protein in nature.

Specific in action.

Actions are reversible.

Remain chemically unchanged at the end of a reaction.

Act best at optimum temperatures.

Sensitive to pH.

Actions retarded by poisons or inhibitors.

Some enzymes require co-enzymes to function normally.

(b)(i) Digestive enzymes in the duodenum: Amylase, Trypsin, Lipase.

(ii) Substrates: Amylase = Starch; Trypsin = Protein; Lipase = Fats and oils.

(iii) Products: Amylase = Maltose; Trypsin = Peptones/peptides; Lipase = glycerol and fatty acid.

2.(c)(i) Importance of chlorophyll: Aids absorption of sunlight for photosynthesis.

(ii) Macro-elements: Nitrogen, Magnesium, Iron.

(iii) Deficiency symptoms:

Nitrogen: chlorosis/yellowing of leaves; stunted growth; poor

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flower development; poor fruit development.

Magnesium: yellowing of leaves/chlorosis; poor growth of plants.

Iron: stunted growth; yellowing of leaves; poor growth of plants.

(d) Procedure for testing Starch in a leaf:

Detach the leaf from the parent plant after four to six hours of sun exposure to enable starch formation.

Put the leaf in boiling water for about thirty seconds to kill the living cells.

Put the boiled leaf in 70% warm alcohol or ethylated spirit in a water bath to decolorize.

Rinse the decolorized leaf in running cold water to soften tissues and remove alcohol.

Spread on white tiles or watch glass and add a few drops of iodine solution.

Allow to stand for a few minutes.

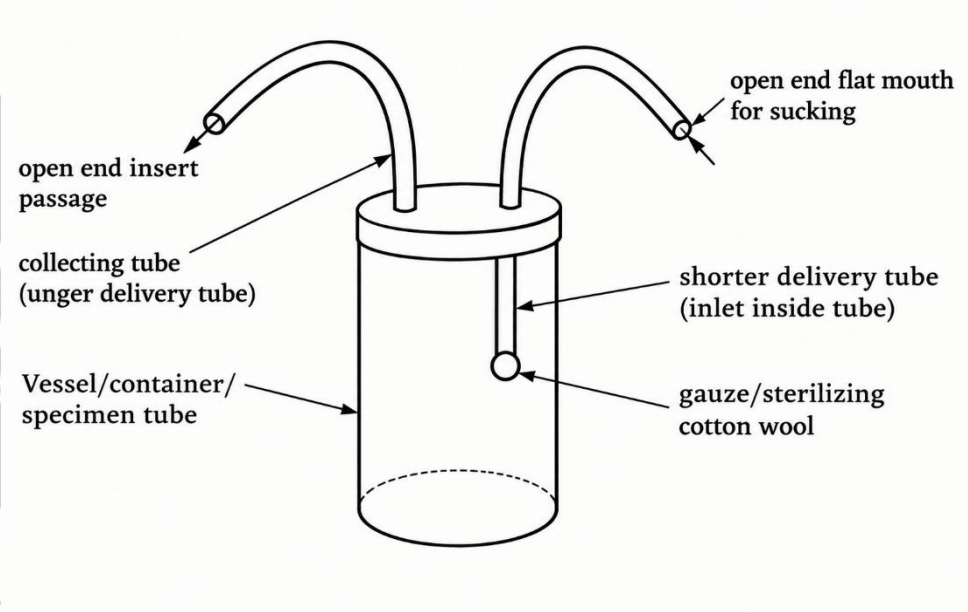
It turns blue-black indicating the presence of starch.

3. (a) Instruments for Collecting:

(i) Soil organisms: Sieve and Tullgren funnel.

(ii) Tiny insects: Pooter.

(b) Diagram of Pooter. labelled: stopper/bung/cork, open end to



mouth for sucking, shorter delivery tube/suction tube, gauze/netting/cotton wool, open end insect passage, collecting tube/longer delivery tube/Vessel/container/specimen tube.

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(c) Symbiotic relationships:

(i) Trichonympha: A protozoa living in the gut of a termite. It helps the termite digest cellulose while the protozoa derives protection.

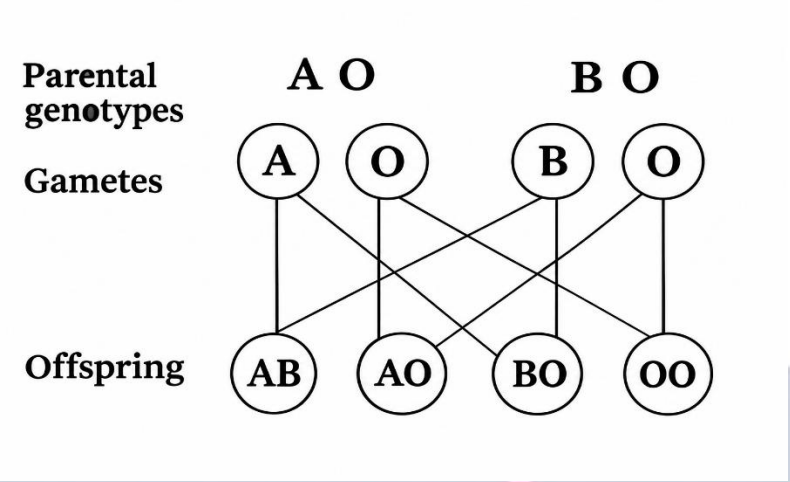
(ii) Sea anemone: Attaches to the shell of a hermit crab, feeding on leftover food. The hermit crab derives protection from predators via the sea anemone's stings.

(iii) Algae and fungi in a lichen: The lichen is made of a fungus and a unicellular alga. The alga produces food via photosynthesis; the fungus protects the alga and absorbs water.

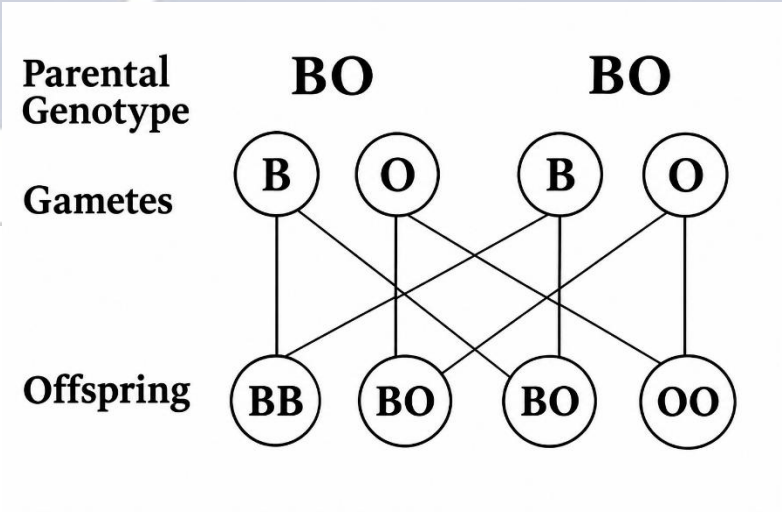
(iv) Rhizobium Sp: A nitrogen-fixing bacteria in root nodules of leguminous plants. Rhizobium fixes atmospheric nitrogen for the plant while deriving nutrients from the plant.

4.(a) Genetic Cross: For a child (Group O) and Mother (Group B):

If the father is group A: Parental genotype AO × BO → Offspring: AB, BO, AO, OO.

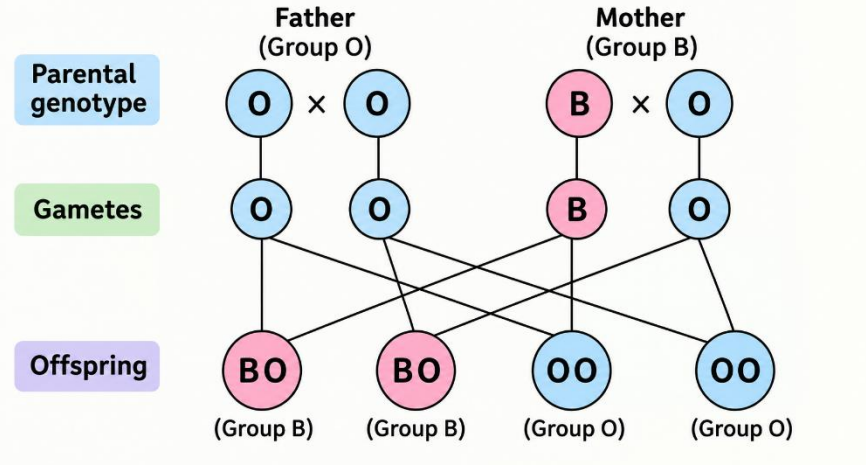


If the father is group B: Parental genotype BO × BO → Offspring: BB, BO, BO, OO.



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If the father is group O: Parental genotype OO × BO → Offspring: BO, BO, OO, OO.



(b)(i) Forms of adaptive communication: Sound/Acoustic; Visual/sight; Smell; Chemical/Electrical/display; Pheromones/Tactile.

(ii) Reasons organisms communicate: In respect of food; For mating; In respect of territorial defence; In times of danger/threats.

SECTION C

6. (a) Process of perceiving smell in humans:

Chemical substances/odour carried in air pass through the nasal cavity.

The molecules dissolve in the moist membrane of the nasal cavity.

The sensory cells are stimulated.

Impulses are transported/conveyed.

Impulses pass through nerve endings to the olfactory nerves.

From the olfactory nerves, impulses move into the Cerebrum.

The brain interprets the impulses.

The sensation of smell is then produced/perceived.

(b) Adaptive features of a domestic fowl egg:

Porous shell for gaseous exchange and protection of the embryo.

Shell membrane protects the embryo and aids gaseous exchange.

Yolk contains high levels of proteins and fats for embryonic growth.

Egg white/albumen contains water to absorb shock and proteins.

Air space provides surface for gaseous exchange.

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Chalaza holds the yolk and embryo in position.

(c)(i) Autotrophs: Organisms that do not rely on others for food manufacture; they manufacture food using simple inorganic compounds in the presence of sunlight energy via photosynthesis.

(ii) Examples: Euglena, Chlamydomonas, Blue-green algae, Nitrosomonas (Nitrobacter), Chemosynthetic bacteria.

(d) Functions of WHO:

– Provision of grants for medical research.

– Provision of vaccines and drugs in emergencies.

– Assistance sending medical personnel to countries in need.

– Training of medical personnel.

– Promotion of nutritional and sanitary products.

– Keeping health statistics of various parts of the world.

– Provision of information about research findings and disease outbreaks.

– Improvement in public health and environmental health promotion.

– Prevention of the spread of diseases.

(e) Plants and animals in a freshwater pond:

(i) Plants: Diatoms, Water arum, Water fern.

(ii) Animals: Water flea, water snails, Hippopotamus, Crocodile, Water snake, water scorpions, Tadpole, mosquito larvae, Pond skaters, Water bugs, Catfish, Tilapia etc.

(f) Differences between mammalian skin and leaf epidermis:

Skin of Mammal	**Epidermis of leaf**
Erector muscle present	Absent
Hair follicle present	Absent
Sweat gland present	Absent
Many layers/cells	Single layer of cells
Sweat pore present	Absent
Cuticle absent	Cuticle present
It is a sensory organ	Not a sensory organ
Fatty cells present	Absent

(g) Types of Competition:

(i) Plot A: Intraspecific Competition.

(ii) Plot B: Interspecific Competition.

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WASSCE JUNE 2017 BIOLOGY 3 PRACTICAL QUESTIONS

SECTION A — FOR ALL CANDIDATES

1. Study specimens C, D and E carefully and answer questions 1(a) to 1(e).

(a)(i) Name the phylum to which specimens C and E belong. (ii) State two reasons for the answer in 1(a)(i).

(b) State three observable structural differences between the following specimens: (i) C and D (ii) C and E.

(c) What is the relationship between specimens C and D?

(d)(i) Name the habitat of specimen D. (ii) State two ways in which specimen D is adapted to its habitat.

(e) Make a drawing, 8cm – 10cm long of the dorsal view of specimen C and label fully.

2. Study specimens F and G carefully and answer questions 2(a) and 2(b).

(a) State three observable features of biological importance in: (i) specimen F; (ii) Specimen G.

(b)(i) Classify specimens F and G as either stem tuber or root tuber.

(ii) Give two reasons each for the answer in 2(b)(i).

Study specimens H and J and answer questions 2(c) to 2(e).

(c) Classify specimens H and J into the class to which both belong.

(d)(i) State four observable differences between specimens H and J. (ii) State four observable similarities between specimens H and J.

(e)(i) State the feeding habits of each of specimens H and J. (ii) Name two observable features used for feeding in specimen J.

4. Study specimen R and answer questions 4(a) to 4(c).

(a)(i) Name the phylum of specimen R. (ii) State two reasons for the answer in 4(a)(i). (iii) State the habitat of specimen R.

(b)(i) State two structural features that adapt specimen R to its habitat. (ii) State three ways in which specimen R is of economic importance.

(c) Make a drawing, 8cm – 10cm long of the dorsal view of specimen R and label fully.

Study specimens S and T and answer questions 4(d) to 4(e).

(d) What type of fruits are specimens S and T?

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(e)(i) State four observable differences between specimens S and T.

(ii) State three observable similarities between specimens S and T.

ANSWERS TO WASSCE JUNE 2017 BIOLOGY 3 PRACTICAL

SECTION A

1. Specimen C = Butterfly; Specimen D = Caterpillar; Specimen E = Grasshopper.

1(a)(i) Phylum of C and E = Arthropoda.

(ii) Reasons: Body is segmented; possession of jointed appendages; presence of chitinous exoskeleton; bilateral symmetry.

(b)(i) Differences between C and D:

Specimen C (Butterfly)	Specimen D (Caterpillar)
Possession of wings	Absence of wings
Presence of antennae	Absence of antennae
Absence of claspers	Presence of claspers
Proboscis present	Mandibles present
Proleg absent	Proleg present
Legs are longer	Legs are shorter
Pair of compound eyes	Simple eyes
Absence of Osmeterium	Presence of Osmeterium

(ii) Differences between C and E:

Specimen C (Butterfly)	Specimen E (Grasshopper)
Hairy abdomen	Smooth abdomen
Wings pigmented and colourful	Wings uniform colour green/brown
Presence of proboscis	Presence of mandibles
Wing soft and membranous	Wing hard, forewings leathery
Clubbed/rounded antennae	Non-clubbed/rounded antennae
Eye spots and scales	Absence of eye spots and scales
Hind limbs smaller, less muscular	Hind limbs larger, more muscular

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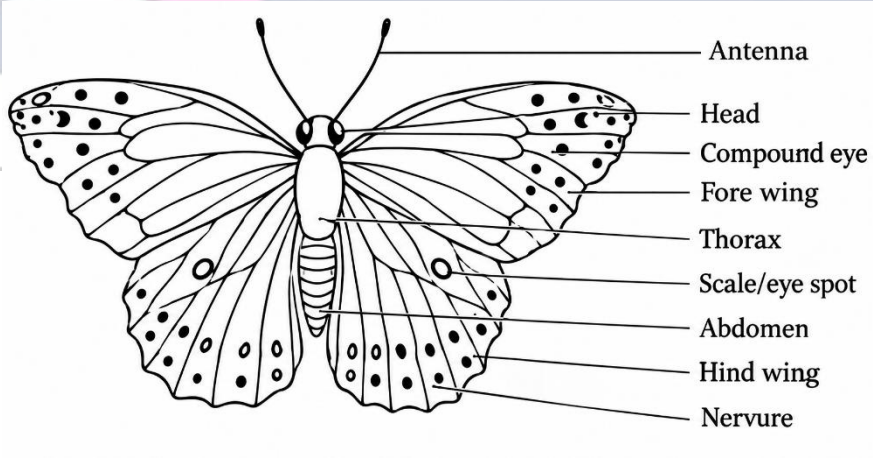
(c) Relationship between C and D: Specimen C (Butterfly) is the adult (Imago) of Specimen D (Caterpillar); Specimen D is the larva of Specimen C.

(d)(i) Habitat of D: Green plants/leaves; Vegetables; Garden leaves; Citrus leaves.

(ii) Adaptations of D: Mandibles; simple eyes; Osmeterium for defence; spiracles for respiration; claspers for attachment; four pairs of prolegs for climbing; coloured pattern for camouflage.

(e) Diagram of dorsal view of Specimen

C. — labelled: Antenna, Head, Compound eye, Fore wing, Thorax, Scale/eye spot, Abdomen, Hind wing, Nervure.



2(a) Observable features of biological importance:

(i) Specimen F (Carrot): tap root, swollen root tuber; lateral roots; short stem; foliage leaves; tapering main root.

(ii) Specimen G (Irish potato): swollen stem/stem tuber; eye/buds; lenticels; scale leaf; adventitious roots.

(b)(i) Specimen F = Root tuber; Specimen G = Stem tuber.

(ii) Reasons:

F (Carrot): swollen tap root; lateral roots; reduced stem.

G (Irish potato): buds/eyes; scale leaves; lenticels; swollen stem/tuber.

(c) Specimen H = Adult mosquito; Specimen J = Adult Cockroach. Class = Insecta.

(d)(i) Differences between H and J:

Specimen H	**Specimen J**
A pair of wings	Two pairs of wings
Absence of hard hind wings	Presence of hard hind wings
Shorter antennae	Longer antennae
Presence of proboscis	Presence of mandibles

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Absence of maxillary palp	Presence of maxillary palp
Cylindrical body	Dorso-ventrally flattened body
Thin legs	Thick large legs
No spines on legs	Presence of spines on legs
Smaller in size	Bigger in size

(ii) Similarities: pair of compound eyes; joined appendages; pair of membranous wings; pair of antennae; chitinous skeleton; three pairs of walking legs; body divided into three parts.

(e)(i) Feeding habit: Specimen H = Piercing and Sucking; Specimen J = Biting and Chewing.

(ii) Features used for feeding in J: Mandible; Labrum; Maxillae.

SECTION C

4(a) Specimen R = Earthworm; Specimen T = Tomato fruit; Specimen S = Unripe Mango fruit.

(i) Phylum of R = Annelida.

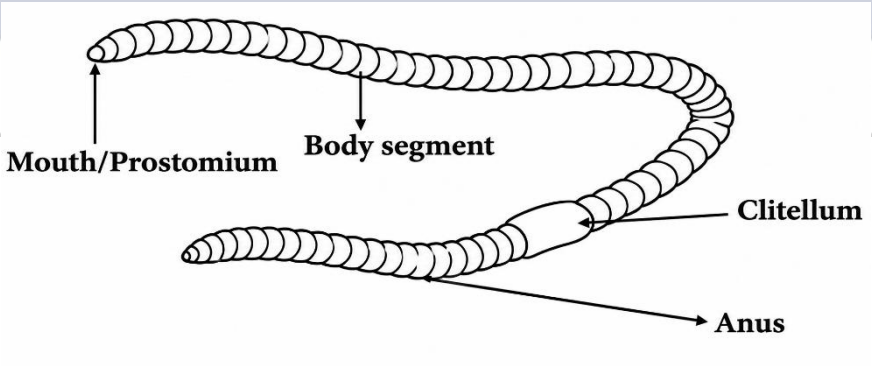
(ii) Reasons: metameric segmentation; bilaterally symmetrical body; separation of segments; presence of chaetae; body covered by thin collagen cuticle; long and cylindrical body.

(iii) Habitat of R: Under decaying leaves; open savannah beneath tall trees; forest decaying tree stumps; wet or moist soil.

(b) Features of adaptation of R: bristle-like chaetae for locomotion; pointed anterior for burrowing; slim body reduces friction; clitellum for attachment during spermatozoa exchange; moist skin for respiration.

(ii) Economic Importance of R: aids soil aeration; used as food for some birds; secretions neutralize acidic soil; enriches soil and improves fertility; used as bait for fishing.

(c) Diagram of the dorsal view of Earthworm. SEE DIAGRAM —



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labelled: Mouth/Prostomium, Body segment, Clitellum, Anus.

(d) Type of fruit: Specimen S (Unripe Mango) = Drupe; Specimen T (Tomato) = Berry.

(e)(i) Differences between S and T:

Specimen S	**Specimen T**
Has one seed	Has many seeds
Green in colour	Red/yellow in colour
Hard endocarp	Fleshy/soft endocarp
Fibrous mesocarp	Succulent mesocarp
Large seed	Small seeds
Mesocarp/endocarp not fused	Mesocarp/endocarp fused
Basal placentation	Axile placentation

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(ii) Similarities: Both are succulent fruits; have three layers (epicarp, mesocarp, endocarp); have placenta; have fleshy mesocarp; have thin epicarp; have seeds.

WASSCE JUNE 2018 BIOLOGY 2 THEORY QUESTIONS

SECTION A — FOR ALL CANDIDATES

1. (a) Explain briefly how the structure of each of the following cells relates to their functions: (i) sperm cell; (ii) palisade cell.

(b) Make a drawing 8 cm – 10 cm long of the front view of the female reproductive system in humans and label fully.

(c) State two differences between reproduction in mammals and in amphibians.

(d) State two methods of birth control in humans.

2. (a) Name the gases involved in the photosynthesis of a plant.

(b) State one role each of the gases named in 2(a).

(c) (i) What is a variegated leaf? (ii) Which part of the variegated leaf would test positive when treated with iodine solution? (iii) State two reasons for the answer in 2(c)(ii). (iv) Name one mineral element required by plants for the formation of the part that would test positive in 2(c)(ii).

(d) The table below indicates different methods by which organisms obtain food. Place the following organisms under the headings in the table below: Human, Mushroom, Venus flytrap, Waterleaf plant, Tapeworm, Elephant grass, Housefly, Lichen, Spirogyra, Rhizopus.

Holozoic	Parasitic	Symbiotic	Saprophytic	Autotrophic

3. (a) Explain briefly the following terms: (i) renewable natural resources; (ii) non-renewable natural resources.

(b) Give two examples each of: (i) renewable natural resources; (ii) non-renewable natural resources.

(c) State five ways of conserving forests.

(d) State four effects of adding animal manure to garden soil.

(e) Give the possible genotypes in humans.

4. (a) Explain briefly the following terms: (i) gene; (ii) hybrid; (iii) trait.

(b) Two heterozygous yellow flowers are crossed. Using a genetic diagram, state the phenotypic and genotypic ratios of the first filial

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generation.

(c) State four transmittable characters in plants.

SECTION C — FOR CANDIDATES IN NIGERIA ONLY

6. (a) (i) Explain briefly chemosynthesis as a mode of nutrition. (ii) Give two examples of organisms that carry out chemosynthesis.

(b) List three gases in the atmosphere with their percentage composition.

Gases in the atmosphere Percentage composition

(c)(i) State four characteristics of a salt marsh habitat. (ii) Explain briefly how plants are modified for anchorage in a salt marsh habitat.

(d)(i) List four bacterial diseases associated with poor food hygiene. (ii) State three effects of poor food hygiene.

(e) A person was involved in a car accident and became unconscious due to excessive blood loss. Explain briefly how the blood lost could be restored.

(f) State three differences between tillage and bush burning as farming practices.

ANSWERS TO WASSCE JUNE 2018 BIOLOGY 2 ESSAY

SECTION A

1(a) Structure of Cell in respect to its function:

(i) Sperm Cell:

Possession of long flagellum for swimming.

Possession of a head with acrosome for digesting and penetrating egg membrane.

Possession of nucleus which fuses with the nucleus of the egg cell (ovum) during fertilization to form zygote.

Possession of mitochondria for supply of energy / ATP.

(ii) Palisade Cell:

It has a thin wall for easy penetration of light.

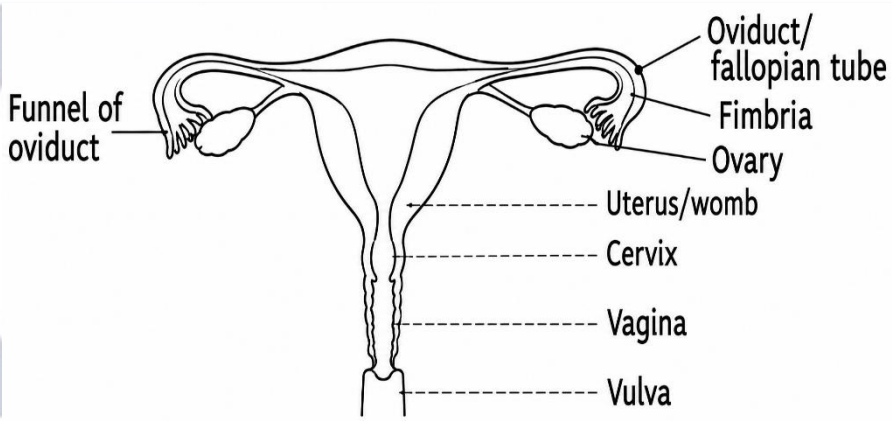
It has numerous chloroplasts for maximum absorption of sunlight.

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It possesses large vacuole containing cell saps for temporary storage of products of photosynthesis.

(b) Diagram of the Front View of the Female Reproductive System in humans.

labelled: Funnel of oviduct, Oviduct/fallopian tube, Fimbria, Ovary,



Uterus/womb, Cervix, Vagina, Vulva.

(c) Differences between Reproduction in Mammals and Amphibians:

Mammals	Amphibians
Few eggs and offspring are produced	Numerous eggs and offspring are produced
Exhibits parental care	Does not show parental care
Possesses placenta	Does not have placenta
Development of offspring is internal	Development of offspring is external
Exhibits viviparous form of reproduction	Exhibits oviparous type of reproduction

(d) Methods of Birth Control in Humans:

Abstinence which involves use of contraceptives / pills / injection of hormonal drugs.

Coitus interruptus / withdrawal method.

Safe period / rhythm method.

Sterilization of men / vasectomy.

Sterilization of women / tubal ligation.

Use of condoms.

Use of spermicide / foam.

Use of implant / norplant.

Use of diaphragm.

Use of intrauterine devices (IUDs).

2(a) Gases involved in the photosynthesis of a plant: Carbon dioxide, Oxygen.

(b) Role of Gases involved in Photosynthesis:

Carbon (IV) oxide acts as a raw material for photosynthesis to produce glucose.

Oxygen is a by-product that is given off during photosynthesis.

(c)(i) Variegated leaf: A leaf with different colour parts or patches, usually green and non-green parts.

(ii) Part positive with iodine = the green part/patch.

(iii) Reasons: Presence of chlorophyll/chloroplast for trapping solar energy to manufacture starch, which turns blue-black with iodine solution.

(iv) Mineral elements required to produce chlorophyll = Magnesium, Iron or Nitrogen.

(d)

Holozoic	**Parasitic**	**Symbiotic**	**Saprophytic**	**Autotrophic**
Human	Tapeworm	Lichen	Mushroom	Waterleaf plant
Housefly			Rhizopus	Elephant grass
Venus fly trap				Spirogyra
				Venus flytrap

3(a)(i) Renewable Natural Resources: Materials that can be recycled after they have been used.

(ii) Non-renewable Natural Resources: Materials that cannot be recycled after being exhausted.

(b)(i) Examples of renewable resources: Soil, air, Water, Vegetation, wildlife.

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(ii) Examples of non-renewable resources: Coal, rocks, Crude oil, Limestone etc.

(c) Ways of Conserving Forest:

Discourage bush burning.

Avoid indiscriminate felling of trees.

Practise selective cutting of trees.

Enact laws to control excessive clearing of forest.

Practise afforestation (plant new trees).

Employ forest guards to discourage intruders.

Embark on public education on the dangers of deforestation.

Apply pesticides to kill pests and control plant diseases.

(d) Effects of Adding Animal Manure to Garden Soil:

It improves soil fertility / adds nutrients.

It improves the water-holding properties of the soil by binding soil particles, improving soil structure.

Animal manure is acted upon by nitrifying bacteria.

It prevents soil from being blown away by wind / erosion.

(e) Possible Genotypes in Human = AA, AS and SS.

4(a) Explanation of Terms:

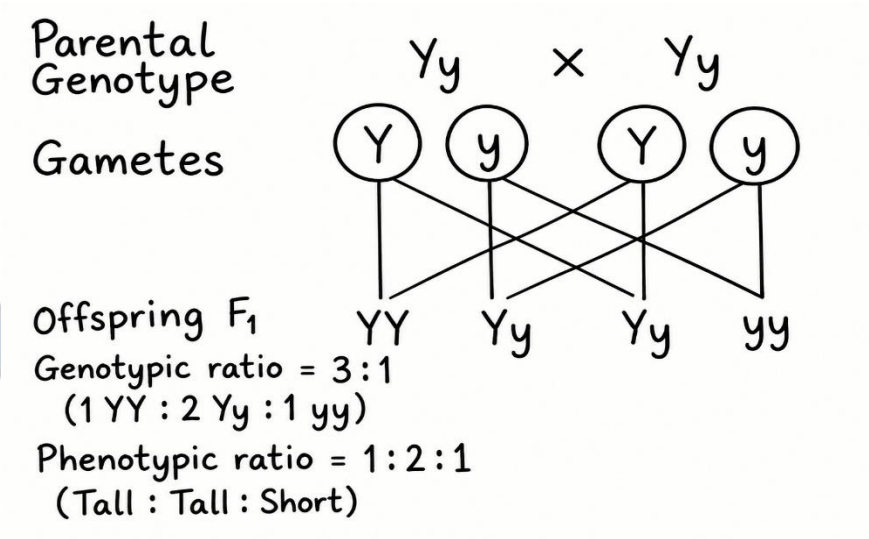
(i) Gene: A unit of heredity of living organisms; composed of DNA and located on the chromosome.

(ii) Hybrid: An offspring formed from a cross between parents that are genetically different but of same species.

(iii) Trait: A feature or character possessed by an organism that can be transferred from parent to offspring.

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(b) Genetic Cross: Parental genotype Yy × Yy; Gametes Y, y × Y, y;



Offspring F1: YY, Yy, Yy, yy; Phenotypic ratio = 3:1; Genotypic ratio = 1:2:1.

(c) Transmittable Characters in Plants:

Type of seed, Type of leaf, Size of plant, Height of plant, Colour of flower, Colour of leaf

Texture of seed coat

(c)(i) Characteristics of Salt Marsh Habitat:

SECTION C

6(a)(i) Chemosynthesis: The process by which some organisms manufacture their food by converting carbon molecules into organic substances, using the oxidation of inorganic substances like ammonia, hydrogen sulphide or methane as a source of energy without sunlight.

(ii) Examples: Sulphur Bacteria, Nitrosomonas, Nitrobacter, Blue-green algae, Nitrococcus.

(b) Percentage Composition of Gases in the Atmosphere:

Gas	Percentage Composition
Oxygen	20.5 – 21.5
Nitrogen	78.0 – 79.0
Rare gases	0.9 – 1.0
Carbon (IV) oxide	0.03 – 0.05

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Presence of low oxygen levels.

High salinity.

Soft, muddy environment.

Presence of changing water levels.

Flat low land.

Swampy / water-logged area.

Low light penetration.

(ii) Modification of Plants: Plants grow for a long time; numerous roots to hold to the substrate; stilt roots for anchorage.

(d)(i) Bacterial Diseases from Poor Food Hygiene: Staphylococcal food poisoning, Cholera, Typhoid, Dysentery, Gastritis, Botulism, Tuberculosis.

(ii) Effects of bad food hygiene: frequent stooling; severe food poisoning; loss in economic value; intestinal ulcer; death; diarrhoea.

(e) Restoring Blood Loss after an Accident:

Rush the victim to a nearby hospital.

Perform an agglutination test to determine the blood group.

A blood sample should be taken immediately at the hospital.

Compatible blood should be transfused to the victim.

(f) Differences Between Tillage and Bush Burning:

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Tillage	Bush Burning
Loosens the soil	Compacts the soil
Does not lead to soil or air pollution	Burning leads to air and soil pollution
Aerates the soil	Leads to poor aeration of the soil
Enhances activities of micro-organisms	Kills microfauna and soil organisms
Mixes organic matter to improve nutrients	Depletes/destroys soil nutrients through leaching

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WASSCE JUNE 2018 BIOLOGY 3 PRACTICAL QUESTIONS

SECTION A — FOR ALL CANDIDATES

1. Study Specimens A and B and answer questions 1(a) to 1(c).

(a)(i) Name the habitat of each of Specimens A and B.

(ii) Name the adult stage into which each of Specimens A and B would develop.

(iii) Name the phylum and class common to the adult stages of Specimens A and B.

(b) State three observable features of biological significance in: (i) Specimen A (ii) Specimen B

(c)(i) State four observable structural differences between Specimens A and B. (ii) State three observable similarities between Specimens A and B.

2. Study Specimens C, D and E and answer questions 2(a) to 2(c).

(a)(i) Name the organism from which each of Specimens C, D and E are obtained. (ii) State the function common to Specimens C, D and E. (iii) State three observable features which adapt Specimen C to its function.

(b)(i) State two observable structural similarities in Specimens C and D. (ii) State three observable structural differences between Specimens C and D.

(c) Make a drawing, 6 cm to 8 cm long of Specimen C and label fully. SEE DIAGRAM

4. Study Specimens K and L and answer questions 4(a) to 4(f).

(a)(i) Name the floral parts of Specimen K. (ii) Indicate the number of floral parts in each whorl of Specimen K.

(b)(i) Name the sex of Specimen K. (ii) Give one reason for the answer in 4(b)(i).

(c)(i) What is the symmetry of Specimen K? (ii) Give one reason for the answer in 4(c)(i).

(d) Name one pollinating agent of each of Specimens K and L.

(e) State four observable differences between Specimens K and L.

(f) Make a drawing 8 cm – 10 cm long of the longitudinal section of Specimen K and label fully. SEE DIAGRAM

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ANSWERS TO WASSCE JUNE 2018 BIOLOGY 3 PRACTICAL

SECTION A

1(a)(i) Habitat of Specimen A (Larva of Mosquito) = Stagnant water, pond, pool, swampy area or edge of streams.

(ii) Adult stage of Specimen A = Mosquito. Specimen B (Maggot) = Housefly.

(iii) Phylum = Arthropoda; Class = Insecta.

(b)(i) Specimen A (Larva of Mosquito) features:

Presence of spiracles for gaseous exchange or breathing.

Presence of siphon (breathing tube) for breathing.

Presence of eyes for vision.

Possession of long/cylindrical body for wriggling movement.

Possession of feather-like hair for defence.

Presence of bristles to aid buoyancy in water.

Possession of horny jaw for chewing solid food.

Possession of mouth brushes for sweeping food into its mouth.

(ii) Specimen B (Maggot) features:

Possession of two pairs of spiracles for breathing.

Possession of spiny pad for movement.

Presence of hook at the mouth for tearing food particles.

(c)(i) Differences between Specimens A and B:

Specimen A (Mosquito larva)	**Specimen B (Maggot)**
Body divided into three (head, thorax, abdomen)	Body divided into two (head and trunk)
Has one pair of spiracle	Has two pairs of spiracles
Hook at the mouth absent	Hook present at the mouth
Siphon/breathing tube present	Siphon/breathing tube absent
Eye present	Eye absent
Pad absent	Pad present
Antennae present	Antennae absent
Bristles present	Bristles absent
Mouth brushes present	Mouth brushes absent

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Anal gills present	Anal gills absent
Anterior end not pointed	Anterior end is pointed

(ii) Similarities: Spiracles; cylindrical/elongated body; segmented body; mouth.

2(a) Specimen C = Gill; Specimen D = Lung; Specimen E = Leaf.

(i) Organisms: Specimen C (Gill) = Catfish, Tilapia; Specimen D (Lung) = Cow, Goat; Specimen E (Leaf) = Orange plant, Mango plant.

(ii) Function common to C, D, E = "Gaseous exchange."

(iii) Features adapting Specimen C: large surface area for diffusion; moist nature aids diffusion; thin-walled membrane aids diffusion; blood capillaries/vessels serve as diffusion medium.

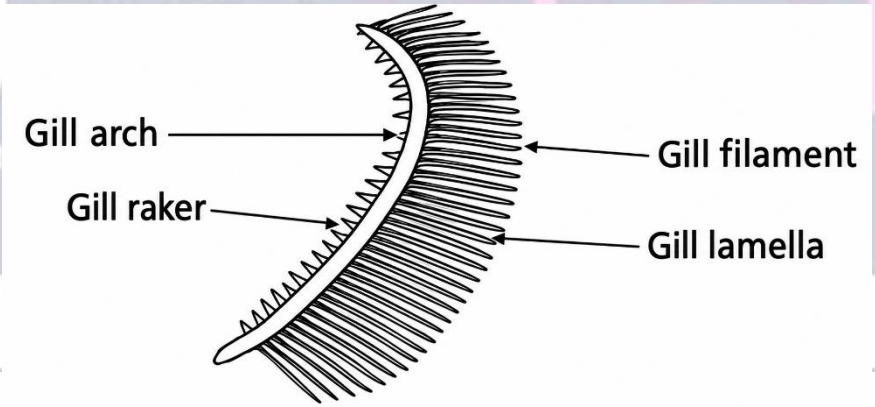
(b)(i) Similarities between C and D: both have network of capillaries; pink/red colour; moist surfaces; large surface area; thin-walled membrane.

(ii) Differences:

Specimen C (Gill)	**Specimen D (Lung)**
Gill filaments present	Gill filaments absent
Pleural membrane/cavity absent	Pleural membrane/cavity present
Gill rakers present	Gill rakers absent
Gill arch/bar present	Gill arch/bar absent
Gill lamellae present	Gill lamellae absent
Gill is not fluffy	Lung is soft and fluffy

(c) Diagram of Specimen C (Gill).

labelled: Gill arch/bar, Gill raker, Gill Filament, Gill Lamella.



SECTION B: Only available for Candidates in Ghana.

SECTION C

4(a) Specimen K = Pride of Barbados flower; Specimen L = Elephant grass.

Floral parts of Specimen K: Sepal (Calyx), Petal (Corolla), Stamen (Androecium), Pistil (Gynoecium/Carpel).

(ii) Numbers: Sepals = 5/4+1; Petals = 5/4+1; Stamen = 10; Pistil = 1.

(b)(i) Sex of Specimen K: Hermaphrodite.

(ii) Reason: It has both stamen and pistil, the male and female reproductive organs, respectively.

(c)(i) Symmetry of Specimen K: Bilateral (Symmetrical).

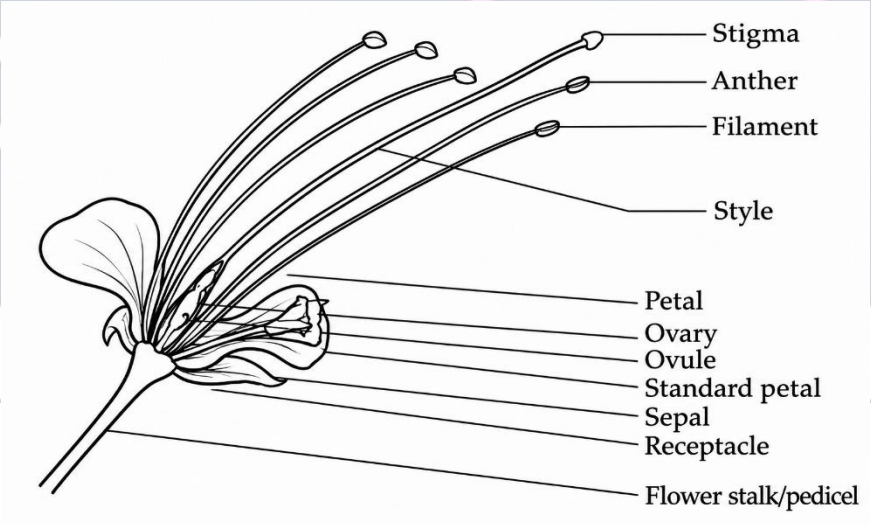
(ii) Reason: It can be cut into two equal halves along only one plane.

Specimen K	Specimen L
Possession of sticky stigma	Stigma is not sticky
Has large pollen grains	Has small and light pollen grains
Flowers are large and conspicuous	Flowers are small and not conspicuous
Flowers are brightly coloured	Flowers are dull coloured
Flowers are red / yellow	Flowers are green
Has scented flowers	Flowers are not scented

(d) Pollination agents: Specimen K = Bees, Butterfly; Specimen L = Wind.

(e) Differences between K and L:

(f) Diagram of the Longitudinal Section of Pride of Barbados Flower. labelled: Stigma, Anther, Filament, Style, Petal, Ovary, Ovule, Standard petal, Sepal, Receptacle, Flower stalk/pedicel.



WASSCE JUNE 2019 BIOLOGY 2 THEORY (QUESTIONS)

SECTION A — FOR ALL CANDIDATES

1.(a)(i) Complete the table below with the respiratory surface of each of the listed organisms.

Organism	Respiratory surface
Tadpole (2 days old)	
Cockroach	
Domestic fowl	
Talinum	
Earthworm	
Amoeba	

(ii) State five characteristic features of respiratory surfaces in organisms.

(b) Make a drawing, 4 cm – 6 cm long, of the respiratory organ in Tilapia and label fully.

2. The table below shows the percentage composition of fat and protein in six different meat types.

Meat type	Fat (%)	Protein (%)
A	07.2	21.3
B	25.3	10.6
C	20.0	22.5
D	03.1	28.2
E	12.6	17.3
F	13.2	14.3

(a)(i) Which two of the meat types may be recommended for an obese patient? (ii) State one reason for the answer in 2(a)(i).

(b)(i) Which two of the meat types would provide the most energy? (ii) State two reasons for the answer in 2(b)(i).

(c)(i) Which three of the meat types could be recommended for a child suffering from kwashiorkor? (ii) State one reason for the answer in 2(c)(i).

(d) Which of the meat types would most likely be suitable for: (i) an active teenager; (ii) a 70-year-old human?

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(e) Which other class of food provides energy?

(f) State three uses of fat in the human body.

(g) Describe briefly the procedure for testing for fat in a meat sample using a piece of white paper.

3.(a) Classify the following biological associations under the headings in the table below: (i) Remora and shark; (ii) Lichen; (iii) Cattle and white Egret; (iv) Tapeworm in the gut of humans; (v) Flowers and Honeybees; (vi) Mistletoe and Cacao plant.

Parasitism	Mutualism	Commensalism

(b)(i) State three adaptive features of parasites. (ii) State two effects of parasites on their hosts.

(c)(i) What are saprophytes? (ii) Give four examples of saprophytes.

4. Use the information below to answer questions 4(a)(i) and 4(a)(ii). HbA represents normal haemoglobin, HbS represents sickled haemoglobin.

(a) A female heterozygote for sickle cell married a sickler. With the aid of a genetic diagram, determine the: (i) possible genotypes of their offspring; (ii) phenotypic ratio of the offspring. SEE DIAGRAM

(b) Explain briefly the reason why a Rhesus negative woman married to a Rhesus positive man might lose her second pregnancy.

(c) Name two examples of features in animals that support the theory of use and disuse of body parts as used by Lamarck.

(d) List three structures in mammals that are vestigial.

SECTION B — FOR CANDIDATES IN GHANA ONLY

5. (a) State three secondary sexual characteristics each in: (i) males; (ii) females.

(b)(i) Describe how vegetatively reproducing stems serve their purposes. (ii) Give two examples of vegetatively reproducing stems.

(c) State five differences between DNA and an RNA molecule.

(d)(i) Outline the process of biogas production. (ii) Name three crops that could be used to produce biogas.

(e)(i) State three advantages of rendering First Aid treatment to an

accident victim. (ii) State five procedures involved in administering mouth-to-mouth ventilation to an accident victim.

SECTION C — FOR CANDIDATES IN NIGERIA AND THE GAMBIA

6. (a) Explain briefly the importance of the following factor and organisms in the nitrogen cycle: (i) lightning; (ii) Nitrosomonas; (iii) Azotobacter.

(b) Name the excretory organ in: (i) insects; (ii) earthworm.

(c) Explain briefly the following diseases: (i) hepatitis; (ii) kidney stones.

(d)(i) State three effects of lack of sense receptors in the skin to humans. (ii) List three layers of the epidermis in the skin of humans.

(e)(i) What is metamorphosis? (ii) State the type of metamorphosis exhibited by each of the following insects listed in the table below.

Insect	Type of Metamorphosis
Grasshopper	
Cockroach	
Butterfly	
Mosquito	
Housefly	

ANSWERS TO WASSCE JUNE 2019 BIOLOGY 2 ESSAY

SECTION A

1(a)(i)

Organism	Respiratory Surface
Tadpole (2 days old)	Gill (External)
Cockroach	Trachea / Tracheoles
Domestic fowl	Lung / Lungs
Talinum	Stoma / Stomata
Earthworm	(Moist) skin surface / body surface
Amoeba	Cell membrane / Plasmalemma/body surface

(ii) Characteristic features of respiratory surfaces:

Large surface area

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Thin-walled or body surface

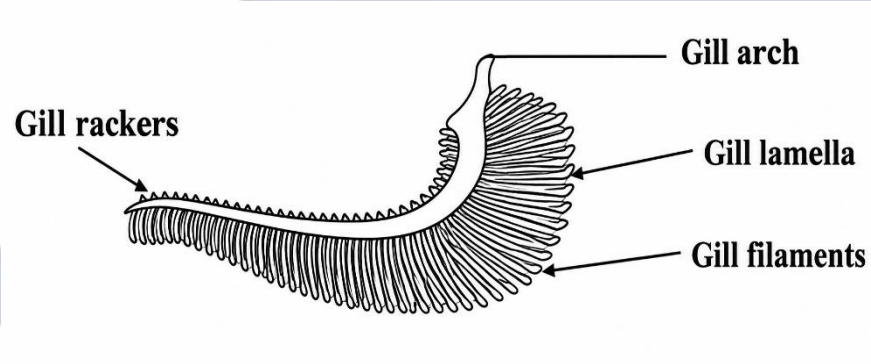
Moist surface

Well-ventilated surface

Permeable surface

Highly vascularized or a network of capillaries present

(b) Diagram of respiratory organ of Tilapia. labelled: Gill arch/bar,



Gill lamella, Gill rackers (rakers), Gill filaments.

2(a)(i) Meat types recommended for an obese patient: A and D.

(ii) Reason: A and D have lower fat content compared to the others.

(b)(i) Meat types providing most energy: B and C.

(ii) Reason: They have the highest fat composition; when oxidized, they release much energy.

(c)(i) Meat types recommended for a child with kwashiorkor: A, C, D and E.

(ii) Reason: A child with kwashiorkor is deficient in protein; meat types A, C, D and E have high protein contents.

(d) Meat types suitable for an active teenager: A, B, C, D, E and F (all meat types).

(ii) Meat types for a 70-year-old human: A and D.

(e) Other class of food providing energy: carbohydrate.

(f) Uses of fat in the human body:

Provision of insulation

Protection of vital organs

Generation of heat

Provision of energy

Formation of part of the cell membrane

Smoothening of the skin

Formation of solvent for fat-soluble vitamins (A, D, E and K)

(g) Procedure for testing fat using white paper:

Rub the meat sample against a piece of white paper.

Allow to dry.

A translucent spot appears.

This confirms the presence of fat.

3(a)

Parasitism	Mutualism	Commensalism
Tapeworm in the gut of human	Lichen	Remora and shark
Mistletoe and Cacao plant	Flowers and honey bee	Cattle and white egret

(b)(i) Adaptive features of parasites:

Possession of specialized organs like suckers and hooks for attachment.

Possession of specialized piercing mouth parts for fluids/plant juices.

They are hermaphrodites, reproducing rapidly in large numbers.

Large surface area for absorption of digested food.

Possess special features like cuticle to withstand harsh environments.

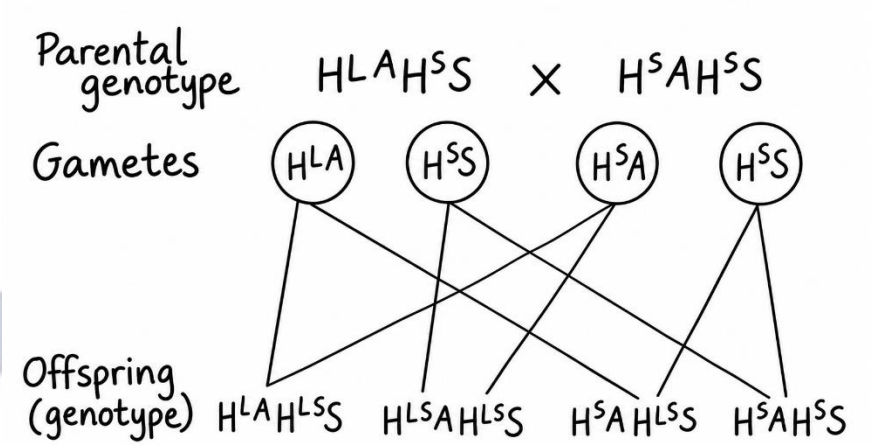
(ii) Effects of parasites on host: stunted growth; low resistance to disease; loss of blood; loss of weight; de-valuing of farm animals; septicemia; death in some cases.

(c)(i) Saprophytes are organisms that feed on dead or decayed organic matter.

(ii) Examples: Fungi — Rhizopus, Mucor, Mushroom, Yeast, Penicillium, Mould, Aspergillus, Saccharomyces, Toadstool.
Bacteria — Azobacter, Clostridium, Streptomycetes.

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4(a)(i) Genetic crossing diagram. Parental genotype HbAHbS ×



HbSHbS; Gametes HbA, HbS × HbS, HbS; Offspring F1: HbAHbS, HbSHbS, HbAHbS, HbSHbS.

(ii) Phenotypic ratio: 2:2 or 1:1 (sickler to non-sickler).

(b) Reasons for loss of second pregnancy (Rh incompatibility):

Rhesus negative mother has no antigen on the surface of her red blood cells.

The husband has antigen on his red blood cells.

During her first pregnancy, the child carries positive Rhesus factor.

The Rhesus factor enters the mother's bloodstream.

Rupture of the placenta lets blood seep into the mother's blood, causing anti-Rhesus antibody development.

It can cause agglutination in a small proportion of foetal blood cells.

In the second pregnancy, the child might be Rhesus positive.

The Rhesus positive child suffers massive destruction of red blood cells.

This may cause miscarriage of the second child.

(c) Examples supporting use and disuse theory (Lamarck):

– Long neck in giraffe

– Smaller wings in penguins

– Lost legs of snakes

– Long legs of heron

– Webbed feet of ducks/frogs

(d) Vestigial organs in mammals:

Appendix in humans

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Pelvic and leg bones in whale

Reduced coccyx in man

Pyramidalis nasi muscles of the forehead

Hairs on the chest

Posterior auricular muscles to move the ear

Nipples in males, etc.

SECTION C

6(a) Importance in the nitrogen cycle:

Lightning: Nitrogen reacts with oxygen in air to form nitrogen oxides, which further oxidize to nitrogen(IV) oxide. This dissolves in rainwater to form nitric and nitrous acids, which reach the soil and combine with bases and mineral salts that plants absorb.

Nitrosomonas: A nitrifying bacterium that converts ammonia to nitrites in the soil.

Azotobacter: A nitrogen-fixing bacterium that converts nitrites to nitrates in the soil.

(b) Excretory organs: (i) Insects — Malpighian tubules. (ii) Earthworm — Nephridium.

(c)(i) Hepatitis: An inflammation or destruction of the liver cells, caused by bacteria, virus, or excess alcohol consumption. Symptoms: fatigue, loss of appetite, muscle aches and pains, fever, flu, nausea, jaundice, etc.

(ii) Kidney stones: Small solid crystals of concentrated minerals/uric acid found in urine, formed when there is excessive water loss reducing mineral solubility, or high levels of uric acid/amino acids. Bacteria may be trapped in kidney tubules as stones grow. Impact: frequent urination, excessive sweating, nausea. Treated with medication, dietary change, drinking water, or surgery.

(d)(i) Effects of lack of skin sense receptors:

Cannot perceive external stimuli.

Pain.

Temperature change.

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Change in pressure.

(ii) Layers of the Epidermis: Cornified layer, Granular layer, Malpighian layer.

(e)(i) Metamorphosis: The developmental stages some organisms undergo from egg to adult stage; may involve three or four stages (incomplete or complete).

(ii) Types of metamorphosis:

Insect	Type of Metamorphosis
Grasshopper	Incomplete
Cockroach	Incomplete
Butterfly	Complete
Mosquito	Complete
Housefly	Complete

WASSCE JUNE 2019 BIOLOGY 3 PRACTICAL QUESTIONS

SECTION A — FOR ALL CANDIDATES

1. Study Specimens A, B, C, E and F and answer questions 1(a) to 1(e).

(a) Name one branch of Biology which involves the use of specimens A, B, C, D, E and F.

(b) State one function each of specimens A, B, C, D, E and F.

(c) Describe briefly how each of specimens B and D could be used.

(d) Make a drawing, 10 cm to 12 cm long, of specimen D and label fully. SEE DIAGRAM

(e) Name two organisms each associated with the use of specimens D and F.

2. Study specimens H and J and answer questions 2(a) to 2(d).

(a)(i) Name the Kingdom and Class of organisms from which specimen H could be obtained.

(ii) Name the specific location on the body of the organism from which specimen H could be obtained.

(iii) Name one example of organism from which specimen H could be obtained.

(b)(i) State six observable structural differences between specimens H and J (six-row comparison table).

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(ii) State three observable structural similarities between specimens H and J.

(c) State one function each of specimens H and J to the organisms that possess them.

(d) Mention: (i) three observable features that adapt specimen H to the function stated in 2(c); (ii) two observable features that adapt specimen J to the function stated in 2(c).

SECTION C — FOR CANDIDATES IN NIGERIA ONLY

4. Study Specimens P and Q and answer questions 4(a) to 4(e).

(a)(i) State the sex of specimen P. (ii) Give one reason for the answer in 4(a)(i).

(b)(i) Name the habitats of each of specimens P and Q. (ii) State three adaptations each of specimens P and Q to their habitats.

(c)(i) State one observable structural difference between specimens P and Q. (ii) State three observable structural similarities between specimens P and Q.

(d)(i) Observe the mouthpart of specimen Q and state its feeding mechanism. (ii) List one food which specimen Q feeds on.

(e) Remove carefully one of the legs on the right side of the metathorax of specimen P. Make a drawing, 6 cm to 8 cm long, of the removed leg and label fully. SEE DIAGRAM

ANSWERS TO WASSCE JUNE 2019 BIOLOGY 3 PRACTICAL

SECTION A

1(a) Branch of Biology involved: Ecology.

(b) Functions of specimens:

Specimen A (Thermometer) — measures temperature of a body/object.

Specimen B (Rain gauge) — measures quantity of rainfall/precipitation.

Specimen C (Metre rule) — determines distance between two points.

Specimen D (Sweep net) — collects flying insects in a habitat.

Specimen E (Wind vane) — determines wind direction.

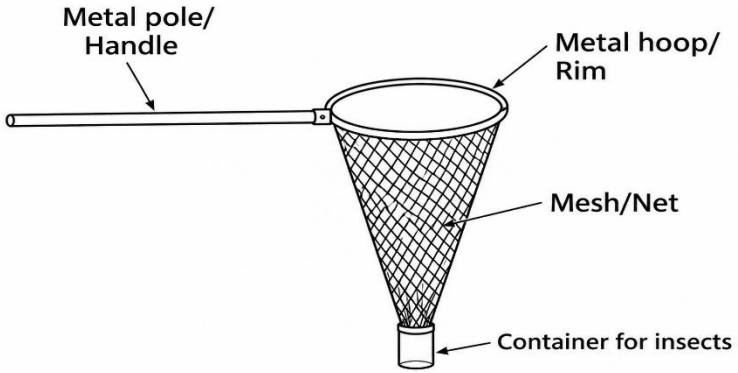
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Specimen F (Quadrat) — determines population of small organisms in a habitat.

(c) Description of use:

Specimen B (Raingauge): Placed in an open area without vegetation, not under any building, on an elevated platform about 7 cm high. After each rainfall, water collected is noted and recorded over time. Rainfall is calculated using: Rainfall(cm)/Time(period) = $(D^2/d^2) \times h$, where D = diameter of cylinder used, d = diameter of funnel mouth, h = height of rain water in the cylinder.

Specimen D (Sweep net): Held by the handle and swung in air to catch organisms/insects. Trapped insects are counted and recorded.



(d) Diagram/Drawing of Specimen D (Sweep Net). labelled: Metal pole/Handle, Metal hoop/Rim, Mesh/Net, Container for Insects.

(e) Organisms associated with D and F:

Specimen D (Sweep net): Butterfly, Dragonfly, Grasshopper, Praying mantis.

Specimen F (Quadrat): Millipede, Water leaf, Garden snail, Ant, Beetle, Spear grass, etc.

2(a) Specimen H = Quill feather; Specimen J = Palm frond.

(i) Kingdom = Animalia; Class = Aves.

(ii) Location: Wing or Tail.

(iii) Examples: Chicken, Duck, Ostrich, Domestic fowl, Cock/hen, Pigeon.

(b)(i) Differences between H and J:

Specimen H	**Specimen J**
Doesn't have sharp apex	Has sharp apex
Has short barbs	Has long leaflet
Vanes present	Vanes absent

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Midrib absent	Midrib present
Has petiole	Petiole absent
Smaller in size	Larger in size
Non-green in colour	Green in colour
Shaft present	Shaft absent
Has blunt end	Tapers at the end

(ii) Similarities: Possession of Apex; Possession of Margin; Possession of Glossy Surface.

(c) Functions:

Specimen H (Quill feather): Flying; Protection and giving shape; Insulation; Camouflaging; Sexual courtship display; Identification; Waterproofing.

Specimen J (Palm frond): Transpiration; Photosynthesis; Gaseous exchange; Manufacture of food.

(d) Adapting features:

Specimen H: Glossy surface for waterproofing; Hollow shaft for buoyancy; Interlocking barbules for upthrust; Colour for camouflage; Strong feather texture for protection.

Specimen J: Green colour to aid photosynthesis; Veins to transport water and nutrients; Waxy surface to make it waterproof.

SECTION C

4(a) Specimen P = Cockroach; Specimen Q = Grasshopper.

(i) Sex of P = Male.

(ii) Reason: Presence of the anal style.

(b)(i) Habitats:

Specimen P: pit toilet/soak-away; dark boxes/wardrobes; shelves/cupboards; cracks/crevices.

Specimen Q: garden; vegetation/grassland; farmland.

(ii) Adaptations:

Specimen P: flattened body for movement between cracks/crevices; jointed legs for fast movement; tiny legs for crawling; wings for flight; compound eyes for vision; long antennae for sensitivity/feeding; mandibles for feeding; dark brown colour for camouflage; spiracles for respiration.

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Specimen Q: jointed legs for fast movement to escape predators; green colour for camouflage; pair of antennae to detect vibrations; spiracles for gaseous exchange; mandibles for feeding/tearing food; wings for flight.

(c)(i) Differences between P and Q:

Specimen P	Specimen Q
Has two pairs of wings	Has one pair of wings
Has spines on every side of hind legs	Has row of spines on inner side of hind leg
Has a dorsoventrally flattened body	Cylindrical in nature (body)
Has short hind limb	Has elongated hind limb

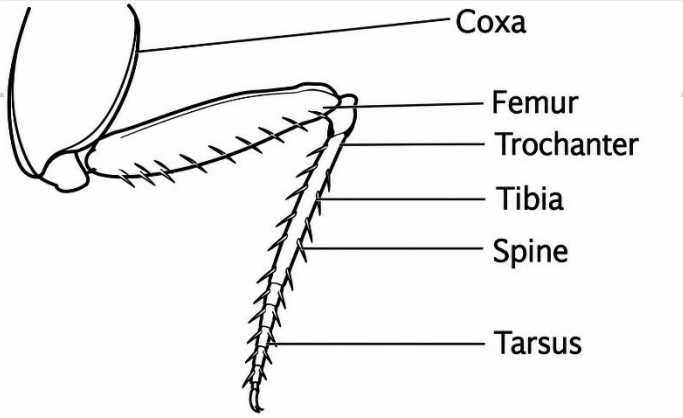
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(ii) Similarities: Segmented body; wings; body divided into three (head, thorax, abdomen); three pairs of walking legs; jointed appendages; mandible/mouthparts; compound eyes; exoskeleton of chitin; antennae.

(d)(i) Feeding mechanism of Q: biting and chewing.

(ii) Food item: feeds on foliage leaves, young tender stem and grass.

(e) Diagram of leg of Specimen P. labelled: Coxa, Femur, Trochanter, Tibia, Spine, Tarsus.



WAEC BIOLOGY (SC)

PAPER 2: ESSAY — 2020

Answer three questions in all: two questions from Section A and one compulsory question in either Section B or Section C. No marks will be awarded for answering questions not peculiar to your own country.

Write your answers in ink in this booklet. Large, labelled diagrams should be used where they make an answer clearer. The names given for chosen species must be English or Scientific and not vernacular. Credit will be given for clarity of expression and orderly presentation of answers.

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SECTION A — FOR ALL CANDIDATES

Answer two questions only from this section.

1.(a) Explain briefly how the human ear carries out its balancing function. [4 marks]

(b) (i) Make a drawing 8 cm – 10 cm long of the structure of the human ear and label fully. [11 marks]

(ii) Describe briefly the structure of the middle ear in humans. [5 marks]

2.(a) (i) What is a *deficiency disease*? [2 marks]

(ii) Complete the table below by naming five nutrient deficiency diseases in humans and stating one remedy each for the diseases.

Nutrient deficiency disease	Remedy

[10 marks]

(b) Outline a chemical test for:

(i) starch in a tuber of yam; [4 marks]

(ii) glucose in orange fruit. [4 marks]

3.(a) Complete the table below:

Disease	Causative organism	Vector	Control
Cholera			
	Trypanosome		
		Female Anopheles mosquito	
Ringworm		None	

[11 marks]

(b) Explain briefly the biological basis of preserving foods using each of the following methods:

(i) salting; [3 marks]

(ii) irradiation; [3 marks]

(iii) smoking. [3 marks]

4.(a) Explain briefly:

(i) independent assortment of genes; [5 marks]

(ii) the reason blood group O in humans can only exist in homozygous form while blood groups A and B can exist both in homozygous and heterozygous forms. [5 marks]

(b) Complete the table below by naming the Classes of vertebrates in their evolutionary trend and giving one example each of the Classes.

Classes of vertebrate	One example

[10 marks]

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SECTION C

FOR CANDIDATES IN NIGERIA, SIERRA LEONE, THE GAMBIA AND LIBERIA

Answer the questions in this section.

6.(a) Explain the following types of fertilisation briefly in animals:

(i) external fertilization; [2 marks]

(ii) internal fertilization. [2 marks]

(b) Name two groups of animals each that exhibit the types of fertilization in 6(a):

(i) external fertilization; [2 marks]

(ii) internal fertilization. [2 marks]

(c)(i) If the placenta in a pregnant woman is detached from the uterine wall, give three effects this would have on the foetus. [3 marks]

(ii) Name three other features in the uterus of a pregnant woman that are useful for the development of the foetus. [3 marks]

Explain briefly how the activities of organisms bring about dynamic equilibrium in the habitat. [4 marks]

(e) State four problems that organisms in the intertidal zone of a marine habitat could encounter. [4 marks]

(f) Explain briefly the reason the following factors are necessary for germination:

(i) moisture; [2 marks]

(ii) viable seed. [2 marks]

(g) Explain briefly the reason light energy is considered a limiting factor in the production of food by autotrophs. [4 marks]

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WAEC FINAL MARKING SCHEME
BIOLOGY 2 (ESSAY) 2020

MAXIMUM OBTAINABLE MARK [70 MARKS]

SECTION A — FOR ALL CANDIDATES

Answer two questions only from this section.

Question 1

(a) How the human ear carries out its function of balance.

Answer:

Head movement in any direction affects the fluid/endolymph;

In the semicircular canals;

Which are at right angles to each other;

The movement forces the sensory/hair cells in the ampulla to set up impulses;

Which travel through the auditory nerve to the brain;

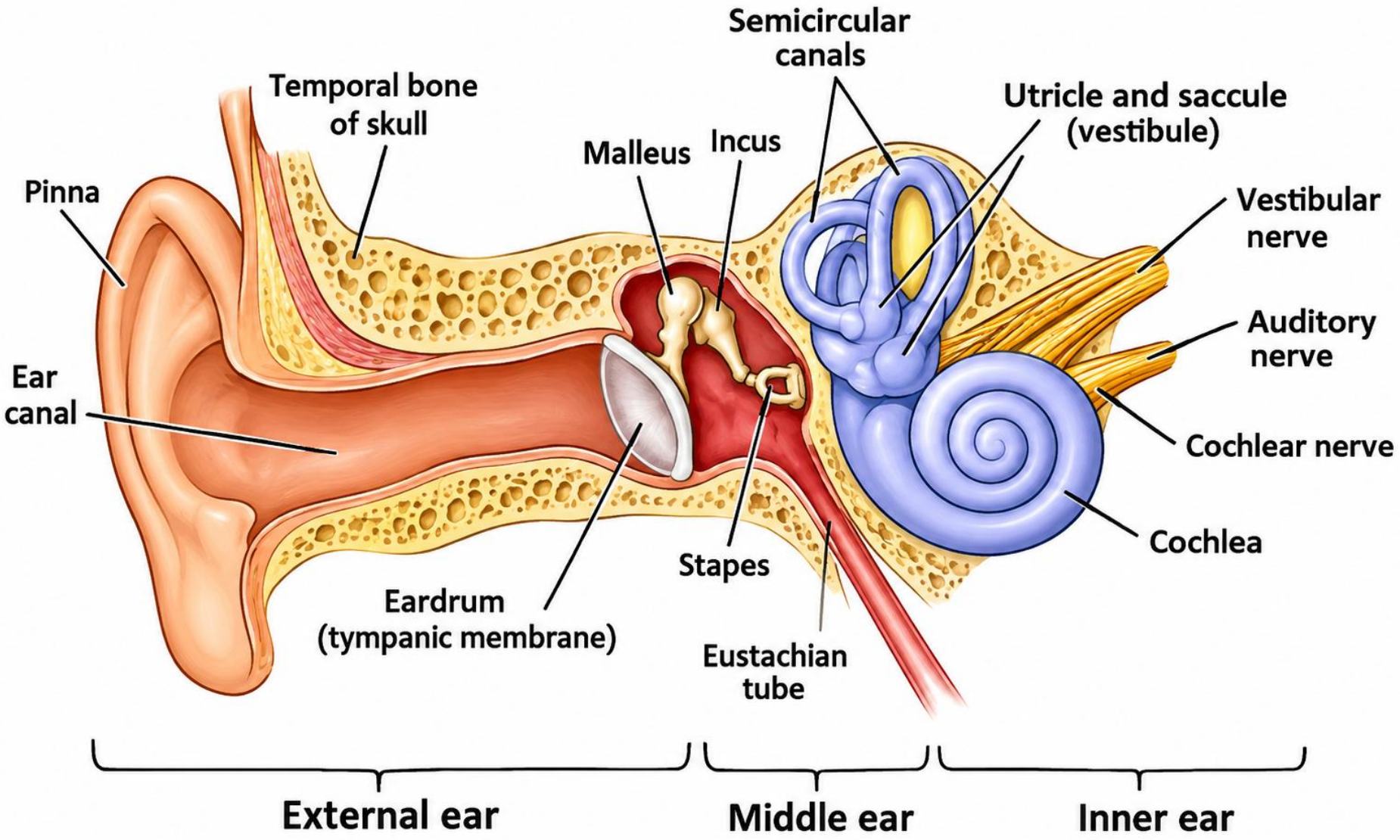
The brain interprets the impulses;

And relays the impulses to the body muscles for balancing.

Any 4 × 1 [4 marks]

(b)(i) **DIAGRAM OF THE HUMAN EAR**

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Semicircular canals
Temporal bone of skull
Utricle and saccule (vestibule)
Malleus
Incus
Pinna
Vestibular nerve
Auditory nerve
Ear canal
Cochlear nerve
Cochlea
Stapes
Eardrum (tympanic membrane)
Eustachian tube
External ear
Middle ear
Inner ear

ear, and internal ear, including pinna, temporal bone of skull, tympanic cavity, tympanum, malleus, incus, stapes, oval window/fenestra ovalis, round window/fenestra rotunda, semicircular ducts, membranous labyrinth, ampulla, utriculus, sacculus, cochlea, cochlear nerve, vestibular nerve, auditory nerve, external auditory meatus, eustachian tube)

Marking scheme scoring criteria:

Title (TL) × 1

Quality (Q) × 1

Clarity of lines (CL) × 1

Size (Sz) (8cm to 10cm across/horizontal) × 1

Neatness of labels (NL) × 1

Details (D):

Pinna shown (PS) × 1

Three ossicles in chain sequence shown (OS) × 1

Coiled cochlea shown (CC) × 1

Three sections of ear shown (SS) × 1

Eustachian tube shown (ET) × 1

Any 3 × 1 [3 marks]

Labels (L):

Pinna, auditory canal/meatus, ear drum/tympanum/tympanic membrane, ossicles/hammer/malleus, anvil/incus, and stapes/stirrup, oval window/fenestra ovalis, round window/fenestra rotunda, Eustachian tube, semi-circular canal, sacculus, utriculus, outer ear, middle ear, inner ear, cochlea.

Any 8 × ½ [4 marks]

Note: Spellings must be correct to score.

(ii) Description of the structure of the middle ear in humans

The middle ear is an air-filled chamber;

It connects the ear drum to the oval window/fenestra ovalis;

It contains three bones/hammer/malleus, anvil/incus and stapes/stirrup/ear ossicles;

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The malleus is attached to the tympanic membrane/tympanum/ear drum;

Each of the bones has direct contact with the one next to it;

The round window/fenestra rotunda connects the middle ear to the inner ear;

The Eustachian tube is found at the base of the middle ear;

The Eustachian tube links the ear to the throat/pharynx.

Any 5 × 1 [5 marks]

TOTAL [20 MARKS]

Question 2

(a)(i) What is a deficiency disease?

Answer:

A deficiency disease is a disease caused by lack of/insufficient/inadequate supply of a specific vitamin or other nutrients/food substances.

2 × 1 [2 marks]

(ii) Table (SEE DIAGRAM — table)

Nutrient deficiency disease	Remedy
Goitre/Goiter	Consumption of iodized salt/seafood
Rickets	Consumption of a diet rich in calcium/phosphorus/vitamin D
Anaemia/Anemia	Eating a diet rich in iron
Kwashiorkor	Diet of infants should contain protein
Scurvy	Consumption of foods/fruits rich in vitamin C
Pellagra	Addition of niacin/vitamin K to diet
Night blindness	Consumption of foods rich in vitamin A
Beriberi	Consumption of foods rich in vitamin B
Stunted growth/cretinism	Consumption of food rich in iodine
Marasmus	Consumption of protein and carbohydrate

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Any 10 × 1 [10 marks]

Note: Diseases must correspond with remedies to score; diseases alone can score one mark; spellings must be correct to score.

Question 3

(a) Table (SEE DIAGRAM — table)

Disease	**Causative organism**	**Vector**	**Control**
(Cholera)	Vibrio cholerae	Housefly/cockroach	Good sanitation/good personal hygiene/any other method of good sanitation/inoculation/vaccination
Trypanosomiasis/Sleeping sickness		Tsetse fly/Glossina	Destroying habitat of vector/clearing the vegetation; killing vector/eradicate flies
Malaria	Plasmodium sp		Proper sanitation/using/spraying recommended insecticide/fumigation; clearing of bushes/drainages of breeding sites/sleeping under nets
(Ringworm)		Tinea Sp./Fungi/Microsporium	Good personal hygiene; avoid contact with infected persons/materials/use of drugs/griseofulvin

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11 × 1 [11 marks]

Note: Scientific names of vectors could be accepted. Spellings must be correct to score.

(b) Biological basis of preserving food by:

(i) Salting

Removes water/moisture from food;

By osmosis;

Therefore prevents microorganisms from growing on food;

By dehydrating and killing them.

Any 3 × 1 [3 marks]

(ii) Irradiation

Involves the exposure of food to high energy gamma rays/X-rays radiation;

To destroy enzymes that cause spoilage;

Delay ripening of fruits;

Sprouting of vegetables;

Therefore allowing long storage periods.

Any 3 × 1 [3 marks]

(iii) Smoking

Reduces the water content of food;

Thereby creating unfavourable conditions for microbial growth and survival, also called curing;

Smoke contains phenols/carbon;

That kill microbes on the surface of food.

Any 3 × 1 [3 marks]

TOTAL [20 MARKS]

Question 4

(a)(i) Independent assortment of genes

Answer:

Is the random selection of genes;

During meiosis;

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To produce gametes;

Where the genes separate/segregate;

So that only one of a pair is found in any one gamete;

In the dihybrid inheritance in heterozygote;

The pairs of alleles are found on different pairs of chromosomes;

Only four types of gametes are produced in approximately equal numbers.

Any 5 × 1 [5 marks]

(ii) Blood grouping in humans

Is determined by three alternative genes/alleles A, B and O;

A person can only possess two alleles of the genes on a pair of homologous chromosomes;

Gene O is recessive to both genes A and B, which are dominant/co-dominant/possess antigen A and B in the red blood cells;

Hence it is possible to have blood group A as AA (homozygous) or AO (heterozygous);

And blood group B as BB or BO;

Blood group O can only exist genotypically as OO/does not possess antigen A or B in the red blood cells;

In the homozygous recessive state.

Any 5 × 1 [5 marks]

(b) Classes of vertebrates in their evolutionary trend (SEE DIAGRAM — table)

Class of vertebrates	**One example**
Pisces/Osteichthyes/Chondrichthyes	Tilapia; Tuna; Salmon; Shark; Dogfish; Catfish; Skate; Ray
Amphibia	Frog/Toad
Reptilia	Snake; Crocodile; Tortoise; Turtle; Lizard; Wall gecko
Aves	Dove; Pigeon; Parrot; Weaver Bird; Hawk; Eagle; domestic fowl

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Mammalia	Human; Monkeys; Rat; Rabbit/Guinea pig

10 × 1 [10 marks]

Note: Evolutionary trend must be reflected to score for classes of vertebrates; spellings of classes and examples must be correct to score.

TOTAL [20 MARKS]

SECTION C — FOR CANDIDATES IN NIGERIA AND THE GAMBIA

Answer all the questions in this section.

Question 6

(a)(i) External fertilisation

Answer:

Involves the release of eggs

By the female to the outside/environment;

Where a male sheds its sperms on them for fertilization outside the body of the female.

Any 2 × 1 [2 marks]

(ii) Internal fertilization

Involves the release of eggs;

Inside the body of a female;

They deposit sperms inside the female, where fertilization occurs.

Any 2 × 1 [2 marks]

(b)(i) Groups of animals that exhibit external fertilization

Fish/Pisces

Amphibians

2 × 1 [2 marks]

(ii) Groups of animals that exhibit internal fertilization

Reptiles

Birds/Aves

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Mammals

Any 2 × 1 [2 marks]

Note: Spellings must be correct to score.

(c)(i) Effect of detached placenta to a foetus

The exchange of dissolved food substances/oxygen/antibodies between a foetus and the mother will cease;

Removal of waste products from foetus will cease;

Production of progesterone/hormone will cease;

Might lead to the death of foetus/miscarriage/abortion/stillbirth;

Certain molecules may pass into the body of foetus.

Any 3 × 1 [3 marks]

(ii) Other features present in the uterus of a pregnant woman

Umbilical cord;

Amnion;

Amniotic fluid;

Allantois;

Chorion.

Any 3 × 1 [3 marks]

Note: Spellings must be correct to score.

(d) Dynamic equilibrium

Nature does not encourage any population exceeding the carrying capacity of the habitat;

Living organisms play a role in the regulation of the abundance of organisms/population in the habitat;

Interactions among various populations lead to competition;

Which may result in the elimination of one species or its restriction to a non-competitive position;

Plants sometimes compete by producing toxic chemicals;

That inhibit neighbouring species;

There also exists predator-prey relationship/association between animals;

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All these forces act together to achieve dynamic equilibrium in the habitat.

Any 4 × 1 [4 marks]

(e) Problems that organisms in intertidal zones of marine habitats could encounter

Tendency of being carried away by waves;

Drying up/desiccation/exposure to air;

Varied osmotic balance;

Oxygen deficiency;

Low light intensity for producers;

Reduced visibility in animals;

Fluctuation of water temperature.

Any 4 × 1 [4 marks]

(f) Reasons the following factors are necessary for germination:

(i) Moisture

A seed imbibes/absorbs moisture causing the seed to swell;

And the testa becomes more permeable to oxygen and carbon (IV) oxide;

This swelling will rupture the testa before germination starts;

The moisture/water activates the enzymes for metabolism leading to germination.

Any 2 × 1 [2 marks]

(ii) Viable seed

Has a living/healthy embryo;

Intact/healthy cotyledon/endosperm;

Whole without boring from insect.

Any 2 × 1 [2 marks]

(g) Reason light energy is considered a limiting factor in the production of food by autotrophs

Light energy is obtained from the sun;

Which is an important factor for photosynthesis/photolysis of water;

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That is a process of manufacturing/producing food by autotrophs;

At optimum temperature/sunlight/solar/light energy;

Green plants/autotrophs will manufacture food.

Any 4 × 1 [4 marks]

TOTAL [30 MARKS]

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WAEC BIOLOGY (SC)

PAPER 2: ESSAY — 2021

Answer three questions in all: ***two questions from Section A and one compulsory question in either Section B or Section C. No marks will be awarded for answering questions not peculiar to your own country. Write your answers in ink in this booklet.***

Large, labelled diagrams should be used where they make an answer clearer. The names given for chosen species must be English or Scientific and ***not*** *vernacular.*

Credit will be given for clarity of expression and orderly presentation of answers.

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SECTION A — FOR ALL CANDIDATES

Answer two questions only from this section.

1. A sample of human blood was put in a test tube and allowed to spin in a centrifuge. The components of the blood sample were clearly separated.

(a) List the **four** main components of blood that would be in the test tube.

[4 marks]

(b) Name the component of the blood that:

(i) would form the top layer in the test tube;

(ii) destroys pathogens;

(iii) is biconcave in shape;

(iv) would be relatively low in a haemophilic condition;

(v) is produced in the bone marrow;

(vi) is a thrombocyte;

(vii) is nucleated.

[7 marks]

(c) Mention **three** chemical substances transported by the blood component named in 1(b)(i).

[3 marks]

(d) List **four** diseases associated with blood.

[4 marks]

(e) Explain **briefly** why a disease of the blood could be dangerous.

[2 marks]

(b) Describe **briefly** the generalised structure of a tooth in animals.

[6 marks]

(c) List **three** food substances that plants manufacture from glucose.

[3 marks]

(d) Make a diagram, 6 cm to 8 cm long, of an experimental set-up to show that oxygen is produced during photosynthesis.

[9 marks]

[Diagram required: a labelled illustration of the classic "aquatic plant + inverted funnel/test tube collecting gas bubbles under light" set-up demonstrating oxygen production during photosynthesis — e.g. Canadian pondweed (Elodea) submerged in water under a beaker, with a test tube inverted over the cut stem to collect gas bubbles.]

2.(a) What is *dentition* in animals?

[2 marks]

3. (a) Complete the table below by placing **each** of the following organisms under the appropriate heading:

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Algae, Bacteria, Dog, Water lettuce, Tadpole, Cat, Lemna, Waterleaf, Mucor, Mushroom

Animal	One body part that makes the animal endangered

Decomposer	Producer	Consumer
Bacteria	Algae	Dog
Mucor	Water lettuce	Tadpole
Mushroom	Lemna	Cat
	Waterleaf	

[10 marks]

(b) (i) Name **four** products of decomposition.

[4 marks]

(ii) Mention **three** roles of decomposers on a refuse dump.

[3 marks]

(c) List **three** materials found in a refuse dump which would **not** be affected by the action of decomposers.

[3 marks]

4.(a) Complete the table below by naming **five** wildlife animals in West Africa and **one** body part each that makes them endangered because of the activities of humans.

[10 marks]

(b) State **three** effects each of the following factors on conservation of natural resources:

(i) poor economy of a nation;

[3 marks]

(ii) poaching.

[3 marks]

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(c) State **four** roles played by the Government in conservation of natural resources.

[4 marks]

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WASSCE FOR SCHOOL CANDIDATES, 2021

BIOLOGY 2 (ESSAY) FINAL MARKING SCHEME (NIGERIA AND THE GAMBIA)

SECTION A

FOR ALL CANDIDATES

Answer two questions only from this section.

1. (a) Components of blood

- (Blood) plasma;
- Platelets (thrombocytes);
- White blood cells/leucocytes;
- Red blood cells/erythrocytes.

Note: Spellings must be correct to score. — 4 x 1 [4 marks]

(b) Name of blood component that:

(i) forms the top layer in the test tube

(Blood) plasma — 1 x 1 [1 mark]

(ii) destroys pathogens

White blood cells/leucocytes — 1 x 1 [1 mark]

(iii) is biconcave in shape

Red blood cells/erythrocytes — 1 x 1 [1 mark]

(iv) would be relatively low in a haemophilic condition

Platelets (thrombocytes) — 1 x 1 [1 mark]

(v) is produced in the bone marrow

- Platelets (thrombocytes);
- White blood cells/leucocytes;

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- Red blood cells/erythrocytes.

  Any 1 x 1 [1 mark]

(vi) is a thrombocyte

Platelets — 1 x 1 [1 mark]

(vii) is nucleated

White blood cells/leucocytes — 1 x 1 [1 mark]

(c) Chemical substances transported by the blood component named 1(b)(i)/blood plasma

- Thyroxine/adrenaline/insulin/progesterone/hormones; vitamins; water;
- (digested) food substances/nutrients/glucose/amino acids/any correctly named digested food substances;
- Antibodies/antigens;
- Oxygen/carbon (IV) oxide/dissolved gases;
- Toxins;
- Mineral salts/salt/magnesium/copper/potassium/zinc;
- Urea/uric acid;
- Water;
- Vitamins.

  Any 3 x 1 [3 marks]

(d) Diseases associated with blood

- Anaemia/Anemia; — Haemophilia;
- Hepatitis; — AIDS;
- Sickle cell anaemia; — Malaria.
- Leukemia/Leukaemia/blood cancer;

  Note: Spellings must be correct to score. — Any 3 x 1 [3 marks]

(e) Reason a disease that attacks the blood is deadly

- Blood circulates throughout the body/it is a medium of transportation in the body;
- It contacts major organs of the body and makes it easy for a disease to be deadly.

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- Blood disease could attack any component of blood and threaten life.

  Any 2 x 1 [2 marks]

TOTAL [20 MARKS]

2. (a) Dentition in animals

Is the type/shapes, number, and arrangement of teeth in the mouth/jaws of animals.

Any 2 x 1 [2 marks]

(b) Description of the generalized structure of a tooth in animals

- The tooth is made up of crown, neck and root;
- The visible part of the tooth is the crown;
- And is covered by the hardest substances/enamel;
- The neck of the tooth is surrounded by the gum;
- While the root is embedded in the jaw bone;
- Beneath the enamel is the hard dentine;
- Which forms the bulk of the tooth in the pulp cavity;
- Containing sensory endings of nerves/blood capillaries;
- The cement/periodontal membrane covers the root of the tooth in the jaw bone.

  Any 6 x 1 [6 marks]

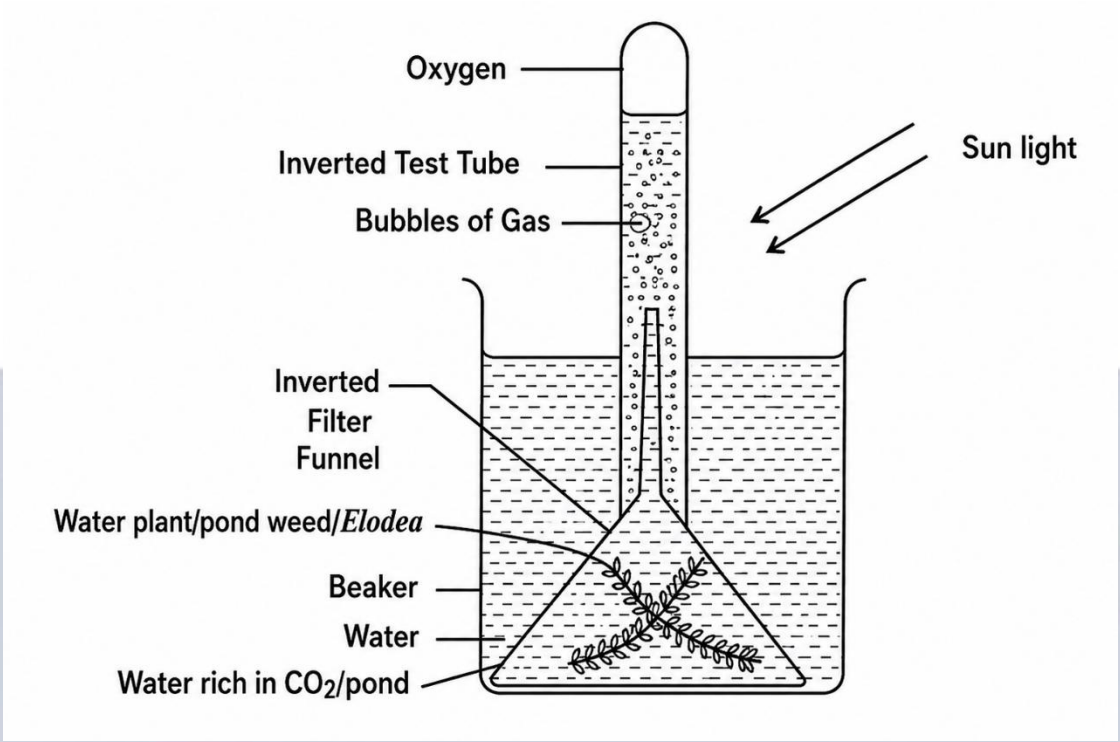
(c) Food substances that plants manufacture from glucose

- Sucrose/maltose;
- Starch;
- Cellulose;
- Oil;
- Proteins.

  Note: Spellings must be correct to score. — Any 3 x 1 [3 marks]

(d) Diagram of an experiment that shows that oxygen is produced during photosynthesis

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(Labelled diagram of an inverted test tube collecting bubbles of gas over an inverted funnel, sitting over a water plant/pond weed (Elodea), in a beaker of water rich in CO_2; sunlight arrows shown striking the setup; "Oxygen" labelled at the top of the collected gas in the test tube.)

Title (TL) — x 1

Quality (Q) — x 1

Size (Sz) 6cm to 8cm long — x 1

Clarity of lines (CL) — x 1

Neatness of labels (NL) — x 1

Details (D):

- Water plant shown (WP) — x 1
- Bubbles shown (BS) — x 1
- Inverted test tube on inverted funnel shown (IT) — x 1

Labels (L):

Inverted funnel; Inverted test tube, water plant/pond weed/Elodea, pond water/water rich in CO_2; beaker.

Any 4 x ½ [2 marks]

Note: Spellings must be correct to score.

TOTAL [20 MARKS]

3. (a) Table

Decomposer	Producer	Consumer
Mucor	Algae	Dog
Bacteria	Waterleaf	Cat
Mushroom	Water lettuce	Tadpole
	Lemna	

10 x 1 [10 marks]

(b)(i) Products of decomposition

- Hydrogen sulphide;
- Carbon (IV) oxide;
- Methane;
- Ammonia;
- Water vapour/water;
- Mineral salt/plant nutrients;
- Heat/energy;
- Humus.

  Any 4 x 1 [4 marks]

(ii) Roles of decomposers on a refuse dump

- They feed on dead/decaying organisms;
- They form a link in a food chain;
- They form a link between biotic and abiotic factors in an ecosystem;
- They release inorganic components from organic materials;
- They facilitate the recycling of nutrients in the ecosystem;
- They reduce the bulky nature of the debris/dump.

  Any 3 x 1 [3 marks]

(c) Materials in a refuse dump that would not be affected by the action of decomposers

- Plastics;
- Metals/iron/tin/zinc/aluminium;

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- Glass/bottle;
- Nylon/polythene;
- Rubber/tyres;
- Stones;
- Ceramics.

Note: Spellings must be correct to score. — Any 3 x 1 [3 marks]

TOTAL [20 MARKS]

4. (a) Table

Animal	One body part that makes animal endangered
Lion	Canine tooth/teeth/skin/mane/fur/claws/bones
Peacock	Feather
Crocodile	Skin/flesh/meat/teeth
Zebra	Skin/flesh
Elephant	Tusk/flesh
Rhinoceros	Horn/flesh
Tiger	Skin/teeth
Parrot	Red feather
Snake	Skin/flesh
Pangolene	Skin

Note: Name of body part must correspond with animal to score. Spelling must be correct to score. — Any 5 x 2 [10 marks]

(b) Effects of the following factors on the conservation of natural resources:

(i) Poor economy of a nation

- It leads to lack of funding in creating awareness/educating people on the importance of conservation;

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- It leads to increase in poaching/forest encroachment/overfishing/illegal mining by locals;
- It leads to inability to execute/enforce policies/strategies;
- It leads to poor implementation/enforcement of laws;
- It leads to inability to setup forest/game reserves;
- It leads to inability to employ guards;
- It affects the feeding of animal species in game reserves;
- It affects the habitat of species;
- It affects the maintenance/acquisition of enough land for game reserves.

  Any 3 x 1 [3 marks]

(ii) Poaching

- Leads to the death of endangered species;
- Leads to reduced population/extinction of species;
- It affects tourism/economy of a nation;
- It disrupts the natural food chain;
- Leads to spread of disease from wildlife animals to humans.

  Any 3 x 1 [3 marks]

(c) Roles played by the Government in conservation of natural resources

- Enactment/enforcement of laws for conservation;
- Formulating policies against poaching/overgrazing/over fishing/for tree planting campaign/protecting soil from erosion;
- Creating ranches to avoid overgrazing;
- Training officials to guard game reserves/fish ponds;
- Educating the general public on conservation of resources;
- Setting up surveillance equipment for security officers in game reserves;
- Setting up forest/game reserves/fish ponds;

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- Encouraging regeneration of endangered species.

  Any 4 x 1 [4 marks]

TOTAL [20 MARKS]

SECTION C

FOR CANDIDATES IN NIGERIA AND THE GAMBIA

Answer all the questions in this section.

6. (a) Table

Process	Nutrient cycle	Three other processes involved in the named nutrient cycle
Combustion	Carbon cycle (1x1) [1mark]	Photosynthesis; decomposition/decay; respiration; fossilization; burning; volcanic eruption. — Any 3x1 [3marks]
Precipitation	Water cycle (1x1) [1mark]	Condensation/clouds gathering; evaporation; perspiration; transpiration. — Any 3x1 [3marks]
Lightning	Nitrogen cycle (1x1) [1mark]	Denitrifying; nitrifying; decay/decomposition; ammonification; putrefaction. — Any 3x1 [3marks]

Note: Spellings must be correct to score.

TOTAL [12 MARKS]

(b)(i) Irritability

This is the response/sensitivity to changes; in stimulus/stimuli; in the environment.

Any 2 x 1 [2 marks]

(ii) Table

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Action	Type of response
Euglena moving towards source of light	Positive phototaxism/Nastism/phototactic
Opening and closing of Mimosa plant leaves	Nastic movement/Nastism/Nastic
Mosquitoes avoiding repellants	Negative chemotaxism/chemotactic
Earthworm moving away from light	Negative phototaxism/phototactic
Sperm cell moving towards chemical substances of an ovum	Positive chemotaxism/chemotactic
Four O' Clock plant opening at 4.00pm	Nastic movement/Nastism
Shoot of bean seedling growing towards sunlight	Positive phototropism/phototropic

Note: Spellings must be correct to score. — 7 x 1 [7 marks]

(c) Examples of animals that exhibit:

(i) Territoriality

- Male fish/Tilapia;
- Male Agama lizard/crocodiles;
- Birds;
- Man/dogs/monkeys/hippopotamus/apes/wolves/antelopes/baboons/lions.

Any 3 x 1 [3 marks]

(ii) Seasonal migration

- Catfish/mudfish;
- Swallow;
- Wildebeest;

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- White egret;
- White stock bird;
- Salmon;
- Desert locust;
- Quelea;
- Eel.

Any 3 x 1 [3 marks]

(iii) Display

- Peacock;
- Domestic fowl;
- Pigeon;
- Dove;
- Penguins;
- Humans;
- Ostrich;
- Turkey;
- Lizard.

Note: Spellings in 4(c)(i), (ii) and (iii) must be correct to score. — Any 3 x 1 [3 marks]

TOTAL [30 MARKS]

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WAEC BIOLOGY (SC)

PAPER 2: ESSAY — 2022

Answer three questions in all: ***two questions from Section A and one compulsory question in Section B. No marks will be awarded for answering questions not peculiar to your own country.***

Write your answers in ink in this booklet.

Large, labelled diagrams should be used where they make an answer clearer. The names given for chosen species must be English or Scientific and ***not*** *vernacular.*

Credit will be given for clarity of expression and orderly presentation of answers.

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SECTION A — FOR ALL CANDIDATES

Answer two questions only from this section.

1.(a)(i) What is a *cell*? **[2 marks]**

(ii) Name **three** scientists that are associated with the discovery of the cell. **[3 marks]**

(b) (i) Make a diagram, 6 cm to 8 cm long, of a plant cell and label **only** the organelle responsible for cell reproduction. **[7 marks]**

(ii) Name **one** blood cell in humans that does **not** have the organelle labelled in 1(b)(i). **[1 mark]**

(iii) What is the biological implication of the cell named in 1(b)(ii) not possessing the organelle responsible for cell reproduction? **[1 mark]**

(c) List **six** organelles found in a plant cell. **[6 marks]**

2.(a) Complete the table below by ticking (✓) the **appropriate** group to which each of the listed elements required by plants belongs.

Element	Microelement	Microelement
Hydrogen		✓
Copper	✓	
Magnesium		✓
Zinc	✓	
Phosphorus		✓
Manganese	✓	
Boron	✓	
Nitrogen		✓
Carbon		✓
Oxygen		✓

[10 marks]

(b) State:

(i) **three** differences between the dentition of a *herbivore* and a *carnivore*;

Herbivore Carnivore

[3 marks]

(ii) **four** differences between the dentition of a *human* and a *goat*.

Human Goat

[4 marks]

(c) What are *milk teeth*? **[3 marks]**

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3.(a)

(i) What is an *ecological niche*? **[2 marks]**

(ii) State **five** roles played by a mango tree in its ecological niche. **[5 marks]**

(b)

(i) State **two** reasons why ecologists use sampling techniques in population studies. **[2 marks]**

(ii) State **four** examples of sampling techniques used in population studies. **[4 marks]**

(c) Name **four** types of fingerprints in humans. **[4 marks]**

(d)

(i) Name the plant used by Gregor Mendel in his experiment. **[1 mark]**

(ii) State **two** reasons why the plant named in 3(d)(i) was used. **[2 marks]**

4.(a) (i) What are *conservation laws*? **[2 marks]**

(ii) State **three** conservation laws. **[3 marks]**

(b)

(i) State **two** reasons why animals are poached. **[2 marks]**

(ii) Name **five** animals that are commonly poached. **[5 marks]**

(c) State **four** effects of excessive use of the forest. **[4 marks — implied]**

(d) Explain **briefly** the following terms:

(i) *blood transfusion*;

(ii) *antigen*.

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SECTION B

Answer all the questions in this section.

5.(a)

(i) State **three** differences between the alimentary canals of *earthworm* and *cockroach*.

Earthworm	**Cockroach**

(ii) State **three** similarities between the alimentary canals of *earthworm* and *cockroach*.

(b) The diagram below is an illustration of a biological cycle. Study it and answer questions 5(b)(i)–

(iii). **Diagram — The Water Cycle**

(i) Name the biological cycle. **[1 mark]**

(ii) Explain **briefly three** roles played by plants and animals in the cycle. **[3 marks]**

(iii) Name the processes that occur in X, Y and Z.

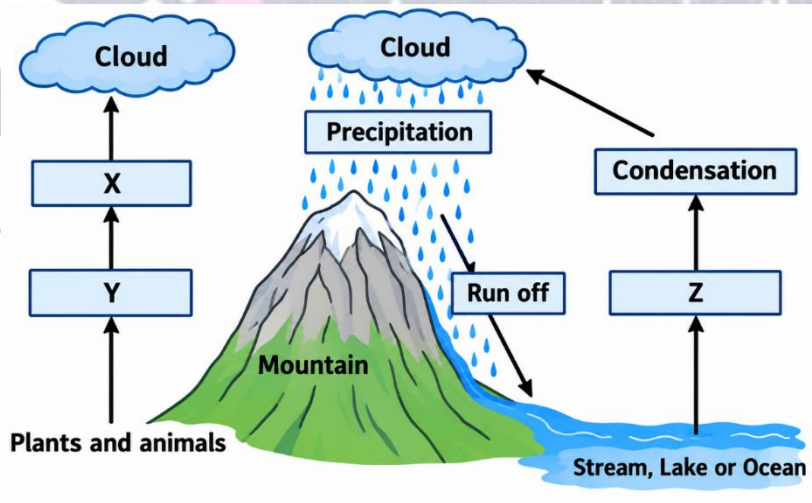
X: _____

Y: _____

Z: _____

[3 marks]

(c) Complete the table below.



	Organs associated with excretion in humans	Three diseases each that affect the organ
(i)		
(ii)		

[8 marks]

(d) (i) What is decay of organic matter? **[2 marks]**

(ii) Name **two** groups of organisms that cause decay of organic matter. **[2 marks]**

(iii) State **one** other factor that causes decay. **[1 mark]**

(iv) Name the biological cycle that involves decay. **[1 mark]**

(e) Explain **briefly** the mode of nutrition in carnivorous plants. **[3 marks]**

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WASSCE BIOLOGY 2 (ESSAY) JUNE 2022

SECTION A — Answer two questions only from this section

QUESTION 1

(a)(i) Define a cell. (2 marks)

Is the basic/smallest structural/building block, and functional unit, of life.

(ii) Name scientists associated with the discovery of the cell. (3 marks — any 3)

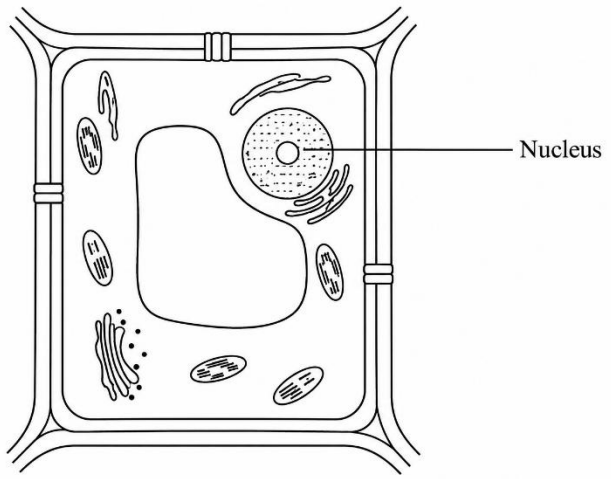
Robert Hooke; Matthias Schleiden; Theodor Schwann; Rudolf Virchow; Felix Dujardin

(Note: full names must be spelled correctly to score)

(b)(i) Draw and label a diagram of a plant cell, showing the nucleus.

(Scored on: Title; Quality; Size 6–8cm; Clarity of lines; Neatness/label guideline; Rectangular/regular shape; Central vacuole shown; Label — Nucleus)

(b) (i) Diagram of a plant cell



(ii) Name a blood cell in humans that does not possess a nucleus. (1 mark)

Red blood cell/erythrocyte

(iii) State the biological implication of this cell not possessing a nucleus. (1 mark)

It has a short life span; unable to reproduce;

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gives room for carriage of more oxygen.

(c) Name organelles found in a plant cell. (6 marks — any 6)

Nucleus; Chloroplast; Rough Endoplasmic Reticulum; Smooth Endoplasmic Reticulum; Vacuole; Lysosome; Ribosome; Golgi body; Mitochondrion.

QUESTION 2 (20 marks)

(a) Complete a table classifying the following elements as microelement or macroelement: Hydrogen, Copper, Magnesium, Zinc, Phosphorus, Manganese, Boron, Nitrogen, Carbon, Oxygen. (10 marks)

Element	Microelement	Macroelement
Hydrogen		✓
Copper	✓	
Magnesium	✓	✓
Zinc	✓	
Phosphorus		✓
Manganese	✓	
Boron	✓	
Nitrogen		✓
Carbon		✓
Oxygen		✓

(b)(i) State the differences in dentition between a herbivore and a carnivore. (3 marks)

Herbivore	Carnivore
Presence of diastema	Absence of diastema
Absence of canine	Presence of canine
Absence of carnassial teeth	Presence of carnassial teeth
Ridged molar	Cusped molar

(ii) State the differences in dentition between a human and a goat. (4 marks)

Human	Goat
Absence of diastema	Presence of diastema
Presence of canine	Absence of canine
Presence of upper incisor	Absence of upper incisor

Absence of dental pad	Presence of dental pad
Presence of eight premolars	Presence of twelve premolars
Equal number of incisors in upper and lower jaw	Presence of more incisors on lower jaw

(c) Describe milk teeth. (3 marks — any 3)

Are the first set of teeth grown by infants of a human; twenty in number; made up of incisors, canines and molars; premolars are absent; dental formula is I2/2 C1/1 M2/2; also known as primary/temporal/deciduous teeth — shed and replaced by permanent teeth.

QUESTION 3 (20 marks)

(a)(i) Define ecological niche. (2 marks)

Where an organism normally lives, and the role it plays in an ecosystem/community.

(ii) State the roles of a mangrove tree in its ecological niche. (5 marks — any 5)

Absorbs sunlight for photosynthesis; absorbs water/mineral salts from the soil; provides shelter for animals/other plants; acts as support for creepers; produces fruits/food/serves as food; serves as fuel, source for animals; covers the ground with dead leaves that enrich the soil.

(b)(i) State reasons why ecologists use sampling techniques in population studies. (2 marks)

Counting individuals could be impossible/difficult in fast-moving animals; counting could be tedious; counting could be time-consuming (technique saves time); the terrain/habitat could be difficult to reach.

(ii) Give examples of sampling techniques used in population studies. (4 marks — any 4)

Quadrat method; Line transects method; Sweep net method; Pitfall trap method; Tullgren funnel method; Light trap method;

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Random sampling method; Systematic sampling method; Convenience sampling; Cluster sampling; Stratified sampling.

(c) State the types of fingerprints. (4 marks)

Arch/tented arch; Loops (double/central pocket/ulnar/radial loop); Whorls (accidental/plain whorl); Compound.

(d)(i) Name the plant used by Gregor Mendel in his genetics experiments. (1 mark)

Pea plant/Garden pea plant/Pisum sativum

(ii) State reasons why this plant was used. (2 marks — any 2)

It is self-pollinated/flowers are bisexual; has a short life cycle; produces many offspring in one cross; presence of distinct physical characters that are easily recognizable.

QUESTION 4 (20 marks)

(a)(i) Define conservation laws. (2 marks)

Are set-down rules/legislations, with sanctions/punishments for offenders/perpetrators, which regulate/protect the usage of natural resources/endangered species.

(ii) Give examples of conservation laws. (3 marks — any 3)

No unauthorised exploration of minerals/coal/gold/petroleum/bauxite by individuals without permit; no killing of endangered species; no use of poisonous chemicals/Gammalin 20 for fishing; observing closed season for hunting/fishing; no trading of body parts of endangered species.

(b)(i) State reasons why animals are poached. (2 marks — any 2)

For their unique body parts/tusks/skin/fin; for sport/game; for money/trade/business; for food; for trado-medicinal purposes.

(ii) Give examples of animals that are commonly poached. (5 marks — any 5)

Elephant; crocodile; deer; hippopotamus; birds; leopard; pangolin/porcupine; snake; lion; tiger; shark; any correctly named animal; whale; zebra; rhinoceros; ape/gorilla.

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(c) State the effects of excessive use of the forest. (4 marks — any 4)

Shortage of trees; shortage of timber over time for the furniture industry; natural habitat of organisms will be destroyed; foreign exchange from timber export will reduce; useful herbs/medicinal plants will be destroyed; research sites will be destroyed; succession will occur; soils exposed to flooding/erosion; carbon(IV) oxide emission leading to global warming; desert encroachment/desertification.

(d)(i) Define blood transfusion. (2 marks)

Is the process of administering blood, from a healthy person/donor, to an individual/patient/recipient who requires/needs it.

(ii) Define antigen. (2 marks)

A substance/protein found on the surface of red blood cells that could stimulate/trigger the production of antibodies in the body/blood plasma.

SECTION B — Answer all the questions in this section

QUESTION 5 (30 marks)

(a)(i) State the differences between the alimentary canals of an earthworm and a cockroach. (3 marks)

Earthworm	**Cockroach**
Simple sucking mouthparts	Elaborate biting/chewing mouthparts
Alimentary canal not divided/simple	Alimentary canal divided into foregut, midgut and hindgut
Absence of mesenteric caecum	Presence of mesenteric caecum
No Malpighian tubules attached	Malpighian tubules attached to canals

(ii) State the similarities between them. (3 marks — any 3)

Both have: Mouth; Crop; Gizzard; (Small) intestines; Oesophagus; Anus.

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(b)(i) Name the biological cycle referred to in the diagram. SEE DIAGRAM (1 mark)

Water (cycle)

(ii) State the roles of plants and animals in the cycle. (3 marks — any 3)

Plants and animals produce water as a by-product of respiration; plants give off water through transpiration; animals give off water by perspiration/sweating/urinating/excretion; plants absorb water/animals drink water for body metabolism.

(iii) Name the processes that occur at X, Y and Z in the diagram. (3 marks)

X — Condensation

Y — Evaporation/Evapotranspiration

Z — Evaporation

(c) Complete a table naming the organ associated with excretion in humans and three diseases affecting each organ (Kidneys, Liver, Skin, Lungs). (8 marks total)

Organ	Three diseases that affect the organ
Kidneys	Nephritis; kidney stones; diuresis; kidney cancer; polycystic kidney disease; diabetes insipidus; any correctly named disease
Liver	Cirrhosis; hepatitis; jaundice; dropsy; gall stones; diabetes mellitus; cancer; any correctly named disease
Skin	Scabies; ringworm; acne; eczema; boil; leprosy; cancer; dermatitis; any correctly named disease
Lungs	Bronchitis; cancer; asthma; tuberculosis; pulmonary fibrosis; any correctly named disease

(Note: organ + spelling must be correct to score; max 3 diseases per organ counted)

(d)(i) Define decay. (2 marks)

Is the breakdown of complex organic matter into small/simple compounds, so that their nutrients can be absorbed.

(ii) Name groups of organisms that bring about decay. (2 marks — any 2)

Saprophytes/fungi; bacteria; detritivores/decomposers.

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(iii) State a factor that brings about decay. (1 mark)

Temperature/heat/warmth; osmotic pressure; amount of water; amount of oxygen.

(iv) Name a biological cycle that involves decay. (1 mark)

Carbon; Nitrogen

(e) Describe the mode of nutrition in carnivorous plants. (3 marks — any 3)

They obtain nutrients from trapped insects and other small animals; the trapped insects are digested; the amino acids are absorbed; carnivorous plants grow on soils poor in nitrogen; animal proteins supplement the nitrogenous compounds.

(iii) State a factor that brings about decay. (1 mark)

Temperature/heat/warmth; osmotic pressure; amount of water; amount of oxygen.

(iv) Name a biological cycle that involves decay. (1 mark)

Carbon; Nitrogen

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WAEC BIOLOGY (SC)

PAPER 2: ESSAY — 2023

1 hour 40 minutes

Answer three questions in all: *two questions from Section A and one compulsory question in Section B.*

Write your answers in ink in this booklet. Large, labelled diagrams should be used where they make an answer clearer. The names given for chosen species must be English or Scientific and ***not*** *vernacular. Credit will be given for clarity of expression and orderly presentation of answers.*

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SECTION A — FOR ALL CANDIDATES

Answer two questions only from this section.

1.(a) What is the *classification of living things*? **[2 marks]**

(b) State **four** ways by which the following groups of organisms are of economic importance in their habitats:

(i) fungi;

[8 marks]

(ii) plants.

[8 marks]

(c) 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]

2.(a) Complete the table below.

Element	Function in plants	Effect 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:

(i) buccal cavity;

(ii) duodenum;

(iii) stomach.

[6 marks]

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

---

3. Relationships I, II, III, IV and V exist among some organisms in an ecosystem.

Use them to answer the 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 organism J a disease.

(a) Name the type of relationship in:

I: _____

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II: _____

III: _____

IV: _____

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:

B: _____

C: _____

D: _____

E: _____

F: _____

G: _____

H: _____

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. **[2 marks]**

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).

×		**Bt**		

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bT				

[12 marks]

(b) How many of the offspring will have:

(i) black fur and short tail: _____

(ii) brown fur and long tail: _____

(iii) black fur and long tail: _____

(iv) 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?

(i) pollen grain: _____

(ii) guard cell: _____

(iii) ovule: _____

(iv) root cell: _____

[4 marks]

SECTION B

Answer the questions in this section.

5.

(a)

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

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

(b) List **three** animals each that exhibit the following courtship behaviours.

(i) territoriality

(ii) pairing

[6 marks]

(c)

(i) State **one** similarity between the eggs of a toad and the eggs of birds. **[1 mark]**

(ii) State **three** differences between the eggs of toads and the eggs of birds.

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Eggs of toads	Eggs of birds

[3 marks]

(d) 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 organism

[8 marks]

(e) 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]

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THE WEST AFRICAN EXAMINATIONS COUNCIL

FINAL MARKING SCHEME

BIOLOGY 2 (ESSAY) 2023

MAXIMUM OBTAINABLE MARK [70 MARKS]

SECTION A

Answer two questions only from this section.

1. (a) Classification of living things

Is the grouping/arrangement of organisms with similar characteristics based on structural/genetic/cellular evolutionary trends, for easy identification. *Any 2×1 [2marks]*

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

(i) Fungi

- Cause various plant/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.

Any 4×1 [4marks]

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(ii) Plants

- Are involved in nutrient recycling;
- Purify the environment/reduce greenhouse effects;
- Provide shade/shelter;
- ;
- Provide materials for pharmaceuticals/production of drugs.

Any 4×1 [4marks]

- Provide food;
- Provide oxygen;
- Prevent erosion;
- Are sources of timber for building/construction

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

Phyla of Kingdom Animalia	**Examples**
Porifera	Sponges
Cnidaria/Coelenterata	Hydra/Obelia/sea anemone/jelly fish/Aurelia/coral
Platyhelminthes	Liver fluke/tapeworm/Schistosoma/planaria
Nematoda	Wuchereria/whipworm/Ascaris/Guinea worm/hookworm

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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

Any 4×1 [4marks]

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/any other correctly named chordate |

Any 5×1 [5marks]

Note: Spelling must be correct to score. Phyla must correspond with example to score.

TOTAL [20 MARKS]

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2. (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.

5×1 [5marks] / 5×1 [5marks]

(b) Classes of organic food in diet of mammals

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

Note: Spelling must be correct to score. *Any 3×1 [3marks]*

(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;

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- 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.

  Any 2×1 [2marks]

(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.

  Any 2×1 [2 marks]

(iii) Stomach

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

  Any 2×1 [2 marks]

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

Glucose and fructose are produced.

Note: Both must be mentioned to score. *1×1 [1 mark]*

TOTAL [20 MARKS]

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3. (a) Types of relationship

I. Saprophytism

II. Commensalism

III. Mutualism

IV. Predation

V. Parasitism

Note: Spelling must be correct to score. *5×1 [5marks]*

(b) Biological term for organisms B and G

B – prey

G – predator

2×1 [2marks]

(c) Example of organisms B, C, D, E, F, G, H, and 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

Note: Spelling must be correct to score. *8×1 [8marks]*

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

Saprophytism

1×1 [1mark]

(ii) Reason for answer

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

1×1 [1mark]

(e)(i) Examples of organism A

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

2×1 [2marks]

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(ii) Group to which organism A belongs

Fungi/Bacteria/mould

1×1 [1mark]

TOTAL [20 MARKS]

4. (a) Punnett square of a dihybrid cross

Parental gametes horizontal (PGH): Bt 4×½ [2 marks]

Parental gametes vertical (PGV): bT 4×½ [2 marks]

Offspring (F_1): 16×½ [8 marks]

[12 marks]

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

(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

4×1 [4marks]

(c) Number of Chromosomes in

(i) Pollen grain: 10

(ii) Guard cell: 20

(iii) Ovule: 10

(iv) Root cell: 20

4×1 [4marks]

TOTAL [20 MARKS]

SECTION B

Answer all the questions in this section.

5. (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

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organ.

Any 3×1 [3 marks]

(ii) Sense organs that respond to the stimulus of

[touch/heat/cold — heading partially cut off]

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

Note: Spelling must be correct to score. *Any 3×1 [3marks]*

(b)(i) Animals that exhibit territoriality

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

Any 3×1 [3marks]

(ii) Animals that exhibit pairing

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

Note: Spelling must be correct to score in (b)(i) and (ii).

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Accept only one example from the same class in (b)(i) and (ii). *Any 3×1 [3marks]*

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

Both have yolk; embryo; vitelline membrane.

Any 1×1 [1mark]

(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.

Note: Answers must correspond to score. *Any 3×1 [3marks]*

(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 compounds;
Plants	Absorb 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 nitrate;
Nitrosomonas	Converts ammonium compounds to nitrite;
Pseudomonas	Converts amino compounds to ammonium compounds.

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Any 4×1 [4 marks] / Any 4×1 [4 marks]

Note: Spelling must be correct to score. Answer must correspond to the role of the organism to score.

(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 2×1
Parasitic	Lice; tick; tapeworm; liver fluke; Guinea worm; hookworm; Any 2×1
Saprophytic	Fungi; mushroom; soil bacteria; yeast; Rhizopus; Mucor. Any 2×1

Any 2×1 [2 marks] / Any 2 examples for each [4 marks]

TOTAL [30 MARKS]

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WAEC BIOLOGY (SC)

PAPER 2: ESSAY — 2024

1 hour 40 minutes

Answer three questions in all: *two questions from Section A and the compulsory question in Section B.*

Write your answers in ink in this booklet.

Large, labelled diagrams should be used where they make an answer clearer. The names given for chosen species must be English or Scientific and ***not*** *vernacular. Credit will be given for clarity of expression and orderly presentation of answers.*

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SECTION A — FOR ALL CANDIDATES

Answer two questions only from this section.

1.(a) State **one** function each of the following parts of the nephron:

(i) glomerulus;

(ii) Bowman's capsule;

(iii) proximal convoluted tubule;

(iv) distal convoluted tubule.

[4 marks]

(b) Complete the table below.

Organism	**Structure for excretion**	**Form in which waste is excreted by organism**
	Contractile vacuole	
Flatworm		

Earthworm		
Cockroach		
Human		Liquid
	Stomatal pore	

[11 marks]

(c) List **five** excretory products of plants. **[5 marks]**

2. An individual ate a hot and large meal of cassava with salty groundnut soup. The individual was sweating profusely and did not drink water after the meal.

(a) State **one** role each played by the following organs involved in the activity above:

(i) mouth;

(ii) skin;

(iii) tongue;

(iv) kidney;

(v) stomach;

(vi) small intestine;

(vii) large intestine;

(viii) liver.

[8 marks]

(b) Name **three** of the organs listed in 2(a) that contain enzymes needed to breakdown the food. **[3 marks]**

(c) Name **three** digestive enzymes that would be involved in the digestion of the meal. **[3 marks]**

(d) Name **two** end products of the meal after digestion. **[2 marks]**

(e)

(i) State **one** effect that the excess salt in the meal might have on the individual. **[1 mark]**

(ii) State **three** advantages that the individual would derive from the meal. **[3 marks]**

3.(a) A piece of raw meat was left in an uncovered bowl for seven days. Use the information to answer questions 3(a) and 3(b).

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(i) State **four** likely changes that would be observed in the meat. **[4 marks]**

(ii) Name the biological process that led to the changes that are observed in the meat. **[1 mark]**

(iii) On the table below, list **four** methods of preserving meat to prevent it from the changes stated in 3(a)(i) and mention the principle involved in the methods.

Four methods of preserving the meat	**One principle involved in the preservation method**

[8 marks]

(iv) Name **two** environmental factors that may be responsible for the changes in 3(a)(i). **[2 marks]**

(b) Name **one** method of preserving the following food items:

(i) dried maize grains;

(ii) fresh tomatoes;

(iii) vegetables;

(iv) beans;

(v) milk.

[5 marks]

4.(a) (i) Complete the table below by stating the type of cell division and the type of set of chromosomes for the listed cells.

Cell	**Type of cell division**	**Set of chromosomes**
Onion cell	mitosis	
Sperm cell		
Pollen grain		
Ovum		
Guard cell		
Cheek cell		diploid

[10 marks]

(ii) What is *mitosis*? **[2 marks]**

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(b) Explain **briefly** how parents with blood groups A or B could have an offspring with blood group O. **[4 marks]**

(c) Explain **briefly** how genes are involved in the process of evolution. **[4 marks]**

SECTION B

Answer all the questions in this section.

5.(a)

(i) What is *competition*? **[3 marks]**

(ii) List **two** types of competition. **[2 marks]**

(iii) List **four** factors that organisms compete for in a habitat. **[4 marks]**

(iv) Explain **briefly** the relationship between *competition* and *succession*. **[2 marks]**

(b) (i) What is *structural adaptation*? **[2 marks]**

(ii) State **four** types of structural adaptations in animals. **[4 marks]**

(c) List **four** features of variation in humans that are used in crime detection. **[4 marks]**

(d) Complete the table below by listing **three** types of adaptive colouration in animals and give **one** example each of animals that show the colourations.

Three types of adaptive colouration in animals	One example of animal that shows the type of colouration

[6 marks]

(e) Give **three** examples of plants found in a tropical Rainforest. **[3 marks]**

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WAEC 2024 FINAL MARKING SCHEME

BIOLOGY 2 (ESSAY) — NIGERIA AND THE GAMBIA

MAXIMUM OBTAINABLE MARK [70 MARKS]

SECTION A

Answer two questions only from this section.

Question 1

(a) Function of the parts of a nephron:

Organism	**Structure for excretion**	**Form in which waste is excreted by organism**
Amoeba/Paramecium	Contractile vacuole	Gaseous/Liquid
Flatworm	Flame cell	Liquid
Earthworm	Nephridium/Nephridia	Liquid
Cockroach	Malpighian tubule	Solid
Human	Skin/Kidney/lung	Liquid
(Green) Plant	Stomatal pore	Gaseous/gas

(i) Glomerulus — carries out ultrafiltration/filters the blood passing through it.

(ii) Bowman's capsule — collects filtrate from the glomerulus.

(iii) Proximal convoluted tubules — carry out selective reabsorption; reabsorb certain nutrients/materials/substances/amino acids, vitamins.

(iv) Distal convoluted tubule — causes tubular secretion/secretion of molecules/ions; reabsorbs water.

4×1 [4 marks]

(b) Table:

Note: Spelling must be correct to score. 11×1 [11 marks]

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(c) Excretory products of plants:

oxygen; carbon (IV) oxide; oxalic acid; alkaloids/quinine/morphine; cocaine; tannin(s); gum; latex; resin; oils; water.
Any 5×1 [5 marks]

TOTAL [20 MARKS]

Question 2

(a) Roles played by the organs involved:

(i) Mouth — contains salivary glands in the mouth that secrete saliva which contains ptyalin/salivary amylase for the digestion of the cassava meal; contains teeth for mastication/grinding of the food; contains saliva that moistens/softens the food; contains tongue for rolling food. Any 1×1 [1 mark]

(ii) Skin — excretes sweat/controls body temperature; excretes excess salt/eliminates excretory wastes. Any 1×1 [1 mark]

(iii) Tongue — tastes the food; rolls the food into bolus; pushes the food into the gullet. Any 1×1 [1 mark]

(iv) Kidney — excretes excess salt/excess water; carries out osmoregulation; reabsorbs water. Any 1×1 [1 mark]

(v) Stomach — temporary storage of the food; churning of food and turning it into chyme; secretes dilute hydrochloric acid which kills bacteria/neutralises action of ptyalin; gastric juice contains the enzyme pepsin that converts proteins to peptones. Any 1×1 [1 mark]

(vi) Small intestine — digestion is completed; maltase converts maltose to glucose; erepsin converts polypeptides to amino acids; lipase converts fats and oil to glycerol and fatty acids; end products are absorbed into the blood, through the villi of intestinal walls. Any 1×1 [1 mark]

(vii) Large intestine — receives undigested food; absorbs water from undigested food; moves waste to the rectum as faeces for expulsion through the anus. Any 1×1 [1 mark]

(viii) Liver — deaminates excess amino acid; produces bile for emulsification of fat; converts excess glucose to glycogen for storage; detoxifies toxic substances. Any 1×1 [1 mark]

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(b) Organs that would contain enzymes needed to break down the food:

mouth; small intestine; stomach.
3×1 [3 marks]

(c) Digestive enzymes that would be involved in digestion:

ptyalin/salivary amylase; amylase/pancreatic amylase; lipase; protease.
Any 3×1 [3 marks]

(d) End-products of the meal after digestion:

glucose; fatty acid/glycerol; amino acids.
Any 2×1 [2 marks]

(e)(i) Effect of the excess salt:

enlarges heart muscle; headache; heart failure; high blood pressure; kidney disease/kidney stone; osteoporosis; stomach cancer; dehydration; stroke.
Any 1×1 [1 mark]

(ii) Advantages that the individual derives from the meal:

prevents cardiovascular diseases; improves energy and mood; manages diabetes; promotes skin, nail and hair health; improves digestion; strengthens the immune system; weight loss; prevents cancer; growth/repair/replacement of worn-out tissues; maintenance of good health.
Any 3×1 [3 marks]

TOTAL [20 MARKS]

Question 3

(a)(i) Likely changes that would be observed in the meat:

bad odour/offensive smell; change in texture/slimy texture; change in colour/greenish colour/rot; presence of maggot; microbial growth.
Any 4×1 [4 marks]

(ii) Biological process: Decay/decomposition/putrefaction.
1×1 [1 mark]

(iii) Table:

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Methods of preservation of the meat	Principle involved in the preservation method
Freezing	Reducing the growth of microorganisms
Drying	Removal of moisture/water content to prevent growth/multiplication of microbes
Salting	Salt kills microorganisms by increasing the osmotic pressure in the meat
Frying	Involves the immersion of foods in boiling oils/dehydrates the items and decreases microbial growth
Canning	Involves heating to kill microorganisms in a vacuum under pressure
Smoking	Reduces the water content of the meat; kills the microorganisms/prevents the entry of new ones

Any 4×1, Any 4×1 [8 marks]. Note: Method of preservation alone can score, but principle alone cannot score.

(iv) Environmental factors that may be responsible for decay:

temperature; humidity; oxygen; moisture.

Any 2×1 [2 marks]

(b) Methods of preserving:

(i) dried maize grains — sun drying; storage chemical treatment; pack in low-humidity containers/silos/barns; store in jute bags/sacks/airtight containers. Any 1×1 [1 mark]

(ii) fresh tomatoes — canning; drying; freezing/refrigeration. Any 1×1 [1 mark]

(iii) vegetables — refrigeration/freezing; drying; curing. Any 1×1 [1 mark]

(iv) beans — sun drying; storage chemical treatment; pack in low-humidity containers/silos/airtight containers. Any 1×1 [1 mark]

(v) milk — pasteurization; drying; canning. Any 1×1 [1 mark]

Note: Spelling must be correct to score.

TOTAL [20 MARKS]

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Question 4

(a)(i) Table:

Cell	Type of cell division	Set of chromosomes
Onion cell	Mitosis	Diploid
Sperm cell	Meiosis	Haploid
Pollen grain	Meiosis	Haploid
Ovum	Meiosis	Haploid
Guard cell	Mitosis	Diploid
Cheek cell	Mitosis	Diploid

Note: Spellings must be correct to score. 10×1 [10 marks]

(ii) Mitosis — is a type of cell division, in which a cell replicates its chromosomes and segregates them; thereby producing two identical daughter cells with the same number of chromosomes as the parent cell. Any 2×1 [2 marks]

OR — is the process of cell duplication, in which one cell duplicates to produce two genetically identical cells. Any 2×1 [2 marks]

Note: Only one definition of Mitosis should be marked.

(b) Explanation of how parents with blood groups A or B could have an offspring with blood group O:

Parents with blood group A would have genotype AO while the parent with blood group B would have genotype BO; when an individual with blood group AO mates with an individual with blood group BO; the offspring could be AB, BO, AO and OO; OO is the recessive genotype of blood group O. 4×1 [4 marks]

OR — both parents could be B; with blood group genotypes BO and BO; when an individual with blood group BO mates with an individual with blood group BO; the offspring could be BB, BO and OO; OO is the recessive genotype of blood group O. Any 4×1 [4 marks]

OR — both parents could be A; with blood group genotypes AO and AO; when an individual with blood group AO mates with an individual with blood group AO; the offspring could be AA, AO and OO; OO is the recessive genotype of blood group O. Any 4×1 [4 marks]

Note: Only one explanation should be marked.

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(c) Explanation of how genes are involved in the process of evolution:

Genes are inherited by the next generation through reproduction; sometimes a mutation may cause a change in the gene, which alters the expression of a trait or produces a different characteristic; some of the newly acquired traits make an organism better adapted to its environment; the traits may be passed on to offspring of different generations.
Any 4×1 [4 marks]

TOTAL [20 MARKS]

SECTION B

Answer all the questions in this section.

Question 5

(a)(i) Competition is the struggle for resources by organisms living in the same habitat, especially when the resources are limited; it could be between organisms of the same species or of different species. Any 3×1 [3 marks]

(ii) Types of competition: intra-specific competition; inter-specific competition. 2×1 [2 marks]

(iii) Factors that organisms compete for in a habitat: space/territory/shelter; water; light; food; mate; inorganic substances. Any 4×1 [4 marks]

(iv) Relationship between competition and Succession:

Succession is the changes that occur in a population of organisms in a habitat until a climax is reached; for these changes to occur there must be competition between the old population and the new one; the new population is established when it takes the resources from the old population, thereby leading to their death and disappearance from the habitat. Any 2×1 [2 marks]

(b)(i) Structural adaptation — is the possession of a special structure which allows the organism to survive and reproduce successfully in its habitat. Any 2×1 [2 marks]

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(ii) Types of structural adaptation in animals: adaptation for obtaining food; adaptation for securing mate; adaptation for water conservation; adaptation for offence and defence; adaptation for controlling temperature. Any 4×1 [4 marks]

(c) Features of variation in humans used in crime detection:

fingerprint; blood group; DNA; peculiar body features; eye colour; skin colour; facial expression; sex difference; voice detection; shape of foot; hair colour.

Any 4×1 [4 marks]

(d) Table:

Types of adaptive colouration in animals	Example of animal that shows the type of colouration
Counter shading/disruptive colouration	Fishes in water
Warning colouration	Variegated grasshopper
Protective/Cryptic colouration/concealing	Green snakes in green grasses; lizard; lady bird; beetle
Camouflage	Chameleon
Alluring colouration	Carnivorous spider
Mimicry	Moth; grasshopper

Any 3×1, Any 3×1 [6 marks]. Note: Spellings must be correct to score.

(e) Example of plants found in a tropical Rainforest:

Iroko; Umbrella tree; African walnut; Mahogany; Oil palm; Orchids; Obeche; Opepe; Chromolaena; Bamboo; Rubber; Ebony tree; (any correctly named example).

Note: Spelling must be correct to score. Any 3×1 [3 marks]

TOTAL [30 MARKS]

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