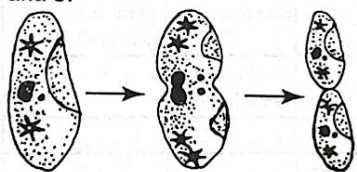


2024 WAEC BIOLOGY

OBJECTIVE TEST QUESTIONS

- Which of the following organisms contains chlorophyll in its cells? A. Canepillar B. Paramecium C. Euglena D. Grasshopper
- Species are groups of organisms that A. are of different origins and are always found together. B. are of common origin but cannot interbreed freely. C. have similar features and can interbreed freely. D. resemble each other and occupy different niches.
- A plant with short, vertical underground stem is a A. bulb. B. corm. C. rhizome. D. tuber.

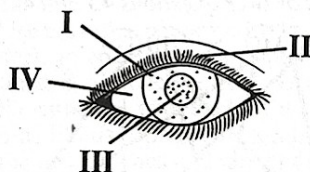
The diagram below is an illustration of a reproductive process in an organism. Study it and answer questions 4 and 5.



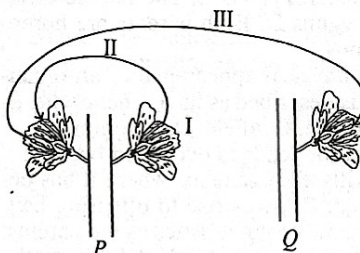
- The type of reproduction illustrated is A. budding. B. binary fission. C. grafting. D. vegetative propagation.
- The illustrated organism is capable of reproducing by A. sexual means only. B. asexual means only. C. vegetative propagation only. D. sexual and asexual means.
- Which of the following organisms consists of unicellular cells joined to form a filament? A. Amoeba B. Spirogyra C. Euglena D. Clamydomonas
- The structure in the cell that controls the movement of substances in and out of the cell is the A. cytoplasmic membrane. B. nuclear membrane. C. protoplasm. D. endoplasm.
- The bursting of a red blood cell placed in a hypotonic solution is called A. crenation. B. haemolysis. C. plasmolysis. D. cytolysis.
- The function of the root hair in plants is to A. absorb soil water by the process of osmosis. B. excrete water and mineral salts by simple diffusion. C. purify the soil for the plant. D. translocate manufactured food.
- If a germinating seed is attached horizontally to a revolving klinostat, what would be the effect on the seedling after three days? The A. plumule will curve vertically upward while the radicle will not show any curvature. B. radicle will curve towards the ground while the plumule will not show any curvature. C. plumule and radicle will not show any curvature. D. plumule will curve vertically upwards while the radicle will curve towards the ground.
- The lumbar vertebra differs from the thoracic vertebra because it possesses a A. longer neural spine. B. wider neural canal. C. thicker centrum. D. shorter transverse process.

- Which of the following blood vessels carries oxygenated blood into the heart? A. Pulmonary artery B. Anterior vena cava C. Pulmonary vein D. Posterior vena cava
- Filtrates in the Bowman's capsule contain vitamins because A. they have low molecular weight. B. most of them are fat soluble. C. they cannot be reabsorbed into the blood. D. little amount is required by the blood.
- The structures that contain grey matter and white matter are found in the A. reproductive system. B. nervous system. C. respiratory system. D. digestive system.

The diagram below is an illustration of sense organ in humans. Study it and answer questions 15 and 16.

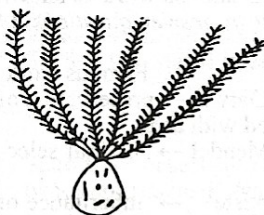


- The part that protects the organ is labelled A. I. B. II. C. III. D. IV.
 - The part labelled III is the A. iris. B. pupil. C. sclera. D. cornea.
- The diagram below is an illustration of two plants P and Q. Arrows I, II and III illustrate the transfer of pollen grains among flowers of plants P and Q. Study it and answer questions 17 and 18.



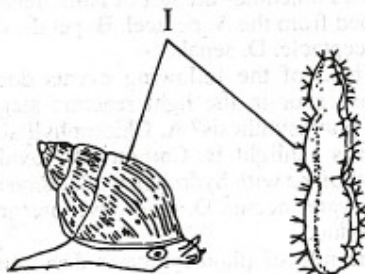
- The types of pollination illustrated as I, II and III, respectively are A. cross, self and cross. B. self, self and cross. C. self, cross and self. D. self, cross and cross.
- The condition necessary for reproduction to occur between plants P and Q after pollination is that plants P and Q should be A. of the same species. B. brightly coloured. C. well scented. D. of different species.

The diagram below illustrates a dry dehiscent fruit. Use it to answer questions 19 and 20.



- The agent of dispersal of the fruit is A. animal. B. explosive mechanism. C. water. D. wind.
 - The Parachute-like tuft of hairs developed from the A. pedicel. B. petals. C. receptacle. D. sepals.
 - Which of the following events does *not* occur in the light reaction stage of photosynthesis? A. Chlorophyll absorbs sunlight B. Carbon (IV) oxide combines with hydrogen C. Photolysis of water occurs D. Hydroxyl ions are produced
 - The rate of photosynthesis decreases in a wilted herbaceous plant because the A. enzymes in the leaf were denatured. B. chlorophyll in the leaves was not broken down. C. amount of light reaching the plant was reduced. D. amount of carbon dioxide entering the leaf decrease.
 - The element required for chlorophyll formation in plants is A. Iron. B. calcium. C. phosphorus. D. sulphur.
 - The process of food digestion in mammals would A. make energy immediately available to the body. B. promote growth and repair of tissues. C. provide sufficient food materials within the body. D. render food substances soluble and absorbable.
 - Which of the following food substances would give a **negative** reaction with Benedict's reagent? A. Fructose B. Glucose C. Galactose D. Sucrose
 - Sunlight is the major source of A. vitamin D. B. vitamin C. C. vitamin B. D. vitamin A.
 - Discouraging the use of poison to kill fish in a large water body is a way of A. impoverishing the people. B. conserving the fish species. C. allowing the fittest organism to survive. D. making the fish adapt to their environment.
 - The pathway through which nutrients are replenished and circulated in an ecosystem is called a A. cycle. B. pyramid of energy. C. pyramid of numbers. D. food chain.
- The illustration below is a food chain. Study it and answer questions 29 and 30.
- Grasses → Grasshoppers → Lizards → Hawks
- Which of the following statements is not correct about the food chain? The number of A. grasses eaten by grasshoppers is greater than the number of grasshoppers. B. grasses eaten by grasshoppers is fewer than the number of grasshoppers. C. grasshoppers eaten by lizards is greater than the number of lizards. D. lizards eaten by hawks is greater than the number of hawks.
 - If the individual species of organisms in the food chain are counted and arranged as a pyramid, the result would be a pyramid of A. numbers. B. energy. C. biomass. D. biomes.

31. Which of the following gases is released during the decomposition of organic matter? A. Carbon (II) oxide B. Sulphur (IV) oxide C. Hydrogen sulphide D. Nitrous oxide
- The diagrams below are illustrations of organisms from different habitats. Study them and answer questions 32 and 33.

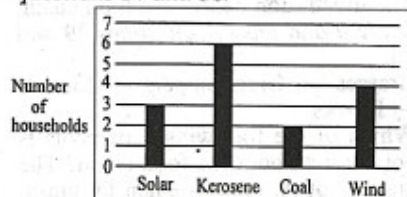


32. The structures labelled I are for A. camouflage. B. chemical offence. C. physical defence. D. mimicry.
33. Habitats of the organisms respectively, are A. river and stream. B. rainforest and stream. C. pond and leaf litter. D. garden and desert.
34. An environmental problem caused by Sulphur (IV) oxide is A. acid rain. B. deforestation. C. global warming. D. erosion.
35. The phenomenon by which a farmland that is left to fallow for several years develops into a forest is called A. succession. B. afforestation. C. population. D. colonization.
36. A farmer planted many seeds on a small piece of land. The plants that germinated are as shown below.



Which of the following effects would not be observed among the population of the plants? A. Rise in disease condition B. Death C. Mutualistic relationship D. Competition

The bar chart below shows the data of sources of energy used for cooking in a community. Study it and answer questions 37 and 38.



37. The source of energy that is mostly community is A. solar. B. kerosene. C. coal. D. wind.
38. The two sources of energy that would mostly lead to pollution in the community are A. solar and kerosene. B. coal and wind. C. kerosene and coal. D. solar and wind.
39. An individual found a strange bird that is tagged as an endangered species. What should the individual do? A. Kill

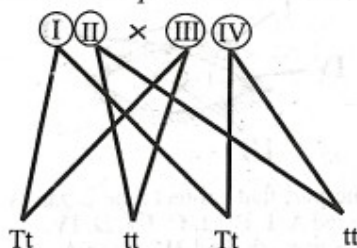
it B. Take it to an aquatic environment C. Return it to its natural habitat D. Sell it at a very high price

40. Which of the following traits is not inheritable? A. taste P.T.C. B. roll the tongue. C. move the ear. D. roll the eyeball.

41. Which of the following statements is correct about the ABO blood group system? A. Antigens are located on the surface of white blood cells B. Antibodies are located in the blood plasma C. Antibodies are located on the surface of red blood cells D. Antigens are located in the blood plasma

42. A woman with blood group A gives birth to a child with blood group O. Which of the following blood groups cannot belong to the father? A. B B. A C. AB D. O

The diagram below is an illustration of the genetic cross between two parents. The parental gametes I, II, III and IV gave rise to the offspring below. Study it and answer questions 43 and 44.



43. Gametes I, II, III and IV, respectively are A. T, T, T and t. B. T, t, t and t. C. T, T, t and t. D. T, t, T and t.

44. Which of the following statements is correct about the cross? A. Both parents are heterozygous B. The male is not heterozygous C. The female is homozygous D. Both parents are homozygous

45. The physical appearance of an organism is described as its A. phenotype. B. genotype. C. allele. D. chromosome.

46. Mutation leads to evolution because it A. kills all organisms where it has occurred. B. gives rise to offspring having same characteristics as the parents. C. does not confer adaptability to the offspring. D. gives rise to new individuals that differ from their parents.

47. The male and female gametes which bear genes for inheritance in plants are located in the A. anthers and petals. B. sepals and petals. C. stamens and pistils. D. stamens and petals.

48. Which type of breeding is represented by industrial melanism in peppered moths? A. Artificial selection B. Natural selection C. Inbreeding D. Outbreeding

In a test, a student paired some scientists with their famous work as shown below. Use it to answer questions 49 and 50.

- | Scientist | Famous work |
|--------------------|---------------------------------------|
| I. Charles Darwin | → preservation of some food with heat |
| II. Gregor Mendel | → natural selection |
| III. Jean Baptiste | → inheritance of |

Lamarck acquired characteristics

IV. Louis Pasteur → independent assortment of genes

49. The scientists that are not correctly paired with their famous work are A. I and II only. B. II and III only. C. I, II and IV. D. II, III and IV.
50. Which of the scientists were involved in the study of evolution? A. I and III B. II and III C. I, II and IV D. II, III and IV

2024 WAEC BIOLOGY THEORY QUESTIONS SECTION A

- 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.

- (b) Complete the table below.

Organism	Structure for excretion	Form in which waste is excreted by organism
	Contractile vacuole	
Flatworm		
Earthworm		
Cockroach		
Human		Liquid
	Stomata pore	

- (c) List five excretory products of plants

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.

- (b) Name three of the organs listed in 2(a) that contain enzymes needed to breakdown the food

- (c) Name three digestive enzymes that would be involved in the digestion of the meal.

- (d) Name two end products of the meal after digestion.

- e(i) State one effect that the excess salt in the meal might have on the individual.

- (ii) State three advantages that the individual would derive from the meal.

- 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).

- (i) State four likely changes that would be observed in the meat.

- (ii) Name the biological process that led to the changes that are observed in the meat.

- (iii) On the table below, list four methods of preserving meat to prevent it from the changes stated in 3a(i) and mention the principle involved in the methods.

Four methods of preserving the meat	One principle involved in the preservation method

- (iv) Name **two** environmental factors that may be responsible for the changes in 3a(i)
- (b) name **one** method of preserving the following food items:
 (i) dried maize grains; (ii) fresh tomatoes; (iii) vegetables; (iv) beans; (v) milk.

4a(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		
Check cell		diploid

- (ii) What is *mitosis*?
- (b) Explain **briefly** how parents with blood groups A or B could have an offspring with blood group O.
- (c) Explain briefly how genes are involved in the process of evolution.

SECTION B

- 5a(i) What is *competition*?
- (ii) List **two** types of competition.
- (iii) List **four** factors that organisms compete for in a habitat.
- (iv) Explain briefly the relationship between *competition* and *succession*.
- b(i) What is *structural adaptation*?
- (ii) State **four** types of structural adaptations in animals.
- (c) List **four** features of variation in humans that are used in crime detection
- (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 show the type of colouration

- (c) Give **three** examples of plants found in a tropical Rainforest.

2024 WAEC BIOLOGY PRACTICAL QUESTIONS SECTION A

1. Study specimens B, D and E and answer questions 1(a) to 1(f).
- (a) Name the Phylum and Class of the organism that possesses specimen D.
 Phylum:
 Class:
- (b) State **three** observable features of specimen B.
- c(i) Give **three** functions of specimen B to the organism from which it was obtained.
- (ii) State **one** function **each** of specimens D and E to the organism from which they were obtained
 D:
 E:
- (iii) Mention **one** adaptation **each** of specimens D and E to the function stated in 1c(ii)
 D:
 E:
- d(i) Use the office pin provided to prick the dark green structure attached to specimen B. Touch the fluid oozing from the structure with **each** of the red and blue litmus papers at intervals. Record the observations and inferences on the table below.

Test	Observation	Inference
Red litmus paper + fluid		
Blue litmus paper + fluid		

- (ii) Give **three** functions of the fluid tested in 1d(i) to the organism that possesses it.
- e(i) Name the biological system in the body of vertebrates that specimens D and E belongs to.
- (ii) Which of specimens B, D or E is absent in humans?
- f(i) Name the mode of feeding of the organism that possesses specimen E.
- (ii) Name **one** type of food that the organism that possesses specimen D consumes.

2. Study specimens F, H and K and answer questions 2(a) to 2(d).

- (a) State **four** functions of specimen H to the plant from which it was obtained.
- b(i) State **one** function **each** of specimen F and K to the plants from which they were obtained.
 F:
 K:
- (ii) Give **one** reason for the answers in 2b(i)
 F:
 K:
- (iii) What part of the plant is modified for the function stated in 2b(i)?
 F:
 K:
- c(i) State **four** observable differences between specimens F and K.

F	K

- (ii) State **one** similarity between specimens F and K.
- (d) Make a drawing; 6 cm to 8 cm long of specimen H and label fully.

SECTION B

Answer all the questions in this section

3. Study specimens L, M, P and answer questions 3(a) to 3(d).

- (a) Name the region of the human body where **each** of specimens L and Q are located.

L:

Q:

- b(i) State **four** observable differences between specimens L and Q.

L	Q

- (ii) State **Four** observable similarities between specimens L and Q.
- c(i) Name **two** bones **each** that articulate with specimens M and P.
- (ii) Name **one** vertebra **each** that is located and after **each** of specimens L and Q in the vertebral column.

Before After

L:

Q:

- (d) Complete the table below by using tick (✓) to indicate *presence* and cross (X) to indicate *absence* of the following features in **each** of specimens L, M, P and Q.

Specimen	Features			
	Neural canal	Rounded head	Neural spine	Long shaft
L				
M	X			
P				
Q				

2024 WASSCE BIOLOGY (OBJECTIVE SOLUTIONS)

1. C: Euglena contains chlorophyll in its cell. Euglena is a type of single-celled organism that has characteristics of both plants and animals. It has chloroplasts, which contain chlorophyll, allowing it to perform photosynthesis and produce its own food when light is available. It should be noted that Euglena can switch between autotrophic and heterotrophic nutrition.
2. C: The species is a group of organisms that can interbreed freely to produce fertile offspring. Members of the same

- species share common characteristics and genetic similarity.
3. **B:** A corn is a short, vertical, swollen underground plant stem that serves as a storage organ to help the plant survive adverse conditions such as winter or drought.
 4. **B:** The diagram illustrates binary fission. Binary fission is a form of asexual reproduction commonly found in prokaryotic organism like bacteria and archaea, as well as in some single-celled eukaryotes. In binary fission, a single organism divides into two identical daughter cells.
 5. **D:** The organism presented in paramecium. Paramecium reproduces both asexually and sexually.
Asexual Reproduction: the asexual reproduction in paramecium is through binary fission as explained on question 4.
Sexual Reproduction: This occurs through conjugation genetic material, leading to genetic recombination and diversity.
 6. **B:** Spirogyra consists of unicellular cells that join end to end to form a filament. Each cell in the filament contains a characteristic spiral chloroplast, giving it its name **spirogyra**.
 7. **A:** The cytoplasmic membrane plays a crucial role in controlling the movement of substances into and out of the cell. It acts as a selectively permeable barrier, regulating the passage of molecules and ions.
 8. **B:** When a red blood cell is placed in a hypotonic solution, water moves into the red blood cell through osmosis, causing it to swell and eventually burst if the influx of water is excessive. This process is known as haemolysis.
 9. **A:** The primary function of root hairs in plants is to absorb water and nutrient from the soil. This absorption occurs primarily through the process of osmosis. Root hairs are tiny extensions of root epidermal cells that increase the surface area of the root.
 10. **C:** If a germinating seed is attached horizontally to a revolving klinostat, the plumule (embryonic root) will not show any curvature. This is because the klinostat which rotates slowly neutralizes the effects of gravity by constantly changing the orientation of the seed. The plumule and radicle will grow in a more or less straight manner without curving in response to gravity.
 11. **C:** Lumbar vertebrae possess larger and thicker centra (plural of centrum). This robust structure is essential for supporting the body's weight and facilitating greater flexibility and range of motion in the lower back.
 12. **C:**
 - All arteries carry oxygenated blood except the pulmonary artery which carries deoxygenated blood.
 - All veins carry deoxygenated blood except the pulmonary vein which carries oxygenated blood.
 13. **A:** Vitamins are included in the filtrate in the Bowman's capsule because they are small in size. During glomerular filtration, the filtration barrier in the glomerulus allows water and small molecules such as vitamins to pass through while larger molecules like blood cells are retained in the blood stream.
 14. **B:** The structures that contain grey and white matter are the brain and the spinal cord. Grey matter is made up of cell bodies while white matter is composed of nerve fibres.
 15. **D:** The part labelled 'IV' is the sclera. The sclera (white part of the eye) is a strong tissue that wraps around your eyeball. It helps maintain your eye's shape and protect it from injury.
 16. **B:**
 - I \Rightarrow Iris
 - II \Rightarrow Eye lashes
 - III \Rightarrow Pupil
 17. **B:**
 - Self-pollination occurs when pollen from the anther of a flower lands on the stigma of the same flower or another flower on the same plant.
 - Cross-pollination involves the transfer of pollen from the anther of one flower to the stigma of a flower on a different plant of the same species.

Thus, I and II denote self pollination while III denotes cross pollination.
 18. **A:** The plants must be of the same species. This is because for successful fertilization to occur, the pollen must contain genetic material that is compatible with the reproductive structures of the receiving flower.
 19. **D:** The agent of tridax (*Tridax procumbens*) is the wind. *Tridax* produces fruits that are hard achenes covered with hair and have a feathery plume like white pappus at one end. The pappus of the fruit allows it to disperse through the wind.
 20. **D:** The parachute-like tuft of hairs found in *Tridax* develops from the modified sepals (persistent calyx). This structure called pappus plays a crucial role in seed dispersal by wind, enabling the seeds to be carried over long distances to new locations where they can germinate and grow.
 21. **B:** CO_2 does not combine with hydrogen during the light reaction stage. It is during the light-independent reactions (dark reactions or Calvin cycle) that this occurs.
 22. **D:** When a plant wilts, its stomata close to prevent further water loss through transpiration. However, stomatal closure also limits the entry of carbon dioxide with reduced CO_2 uptake, the Calvin cycle of photosynthesis slows down.
 23. **A:** The main elements needed for the formation of chlorophyll are magnesium, iron and nitrogen.
 24. **D:** Digestion breaks down food into smaller molecules that can be absorbed and utilized by the body for energy, growth and repair.
 25. **D:** Benedict's reagent is primarily used to test for the presence of reducing sugars sucrose is a non-reducing sugar. Thus, when sucrose is tested with Benedict's reagent, there is no reaction.
 26. **A:** Vitamin D can be synthesized by the human body upon exposure to sunlight. When ultraviolet rays from the sun hit the skin, they trigger a chemical reaction that produces vitamin D. This process occurs in the epidermis and is facilitated by the presence of 7-dehydrocholesterol, a compound found in skin cells.
 27. **B:** Discouraging the use of poison to kill fish in a large water body is crucial for conserving fish species. Poison indiscriminately kills targeted and non-targeted organisms leading to a significant loss of biodiversity.
 28. **A:** The nutrient cycle, also known as the biogeochemical cycle, is the process by which essential elements and compounds move through the earth's ecosystems, including the atmosphere, hydrosphere, lithosphere and biosphere. These cycles ensure the continuous availability and recycling of nutrients required by living organisms.
 29. **B:** The number of organisms typically decreases as we move up the trophic levels. Thus, grasses will be more numerous than grasshoppers, grasshoppers more numerous than lizards and lizards more numerous than hawks.
 30. **A:** A pyramid of numbers shows the number of individual organisms at each trophic level in an ecosystem. It illustrates the population size of each trophic level, starting with producers at the bases and moving up through various levels of consumers.
 31. **C:** The main gases released during the decomposition of organic matter include hydrogen sulphide, ammonia, carbon (IV) oxide and methane.
 32. **C:** The shell of a snail and the spines of a cactus both serve as physical defenses. The snail's shell protects it from predators and physical harm while cactus spines deter herbivores and reduce water loss. These adaptations help each organism survive in their environments.
 33. **D:** Snails inhabit moist environments such as gardens, forests and wetlands, where they can find shelter and food. Cacti inhabit arid and semi-arid regions such as deserts, where they are adapted to survive with minimal water.
 34. **A:** Sulphur (IV) oxide (SO_2) is a major contributor to acid rain. When SO_2 is released into the atmosphere through

processes like volcanic eruptions or human activities such as burning fossil fuels, it reacts with oxygen and water in the atmosphere to form sulphuric acid. This acid then falls to the ground with the rain. Acid rain has harmful effects on the environment and human health.

35. **A:** Ecological succession is the process of change in the species composition of a biological community over time, resulting in a new community that is different from the original one. In the case of a farmland being left to fallow for several years and developing into a forest, it is an example of secondary succession, where a previously occupied area is recolonized by new species.

36. **C:** Competition, rise in spread of diseases and eventual death are probable effects of over population.

37. **B:** In the bar chart, we can see that 3 households use solar, 6 use kerosene, 2 use coal and 4 use wind.
So, the source of energy that is mostly used in the community is kerosene.

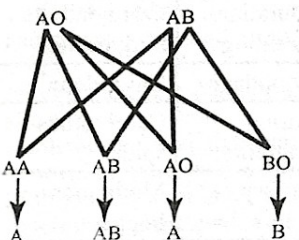
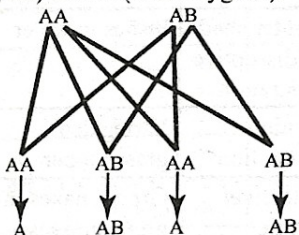
38. **C:** Burning kerosene and coal releases harmful pollutants into the environment. These pollutants include particulate matter, carbon monoxide, nitrogen oxides, sulphur dioxide and volatile organic compounds.

39. **C:** The individual should return it to its natural habitat. Returning endangered species to their natural habitat is crucial for conservation as it helps restore populations, preserve ecosystem balance and allows species to thrive.

40. **D:** Rolling the eyes is a common facial expression that is not typically considered a heritable trait. Eye-rolling is a voluntary action. It is not a characteristic that is passed down through genetics.

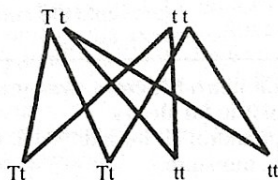
41. **B:** Antigens are found on the surface of red blood cells and they determine an individual's blood type (A, B, AB or O). Antibodies are in the blood plasma.

42. **C:** A woman with blood group A and a man with blood group AB cannot produce a child with blood group O. Blood group A may be AA (homozygous) or AO (heterozygous).



So, a woman with blood group A and a man with blood group AB can produce a child with blood group A, B or AB but never group O.

43. **B:**



44. **C:** In the diagram given, the first organism is heterozygous while the second organism is homozygous. In genetic diagrams, some conventions put the male parent first.

45. **A:** The physical appearance of an organism, which includes its observable traits such as colour, shape, size and other characteristics influenced by both genetics and the environment, is known as its phenotype.

46. **D:** Mutation contributes to evolution primarily because it introduces genetic variation within population. This variation can lead to new traits or characteristics that may be advantageous, neutral or disadvantageous in different environmental conditions.

47. **C:** The stamen is the male reproductive organ of a flower while the pistil is the female reproductive organ. The stamen consists of an anther and a filament. The pistil consists of three main parts: the stigma, the style and the ovary.

48. **B:** Industrial melanism in peppered moths is a classical example of natural selection. This phenomenon occurred during the Industrial Revolution when pollution darkened the tree trunks with soot, making lighter-coloured moths more visible to predators. As a result, darker moths, which were better camouflaged against the darkened background had higher survival rates and passed on their genes, leading to an increase in the proportion of dark-coloured moths in the population over time.

49. **C:** The matching of Jean Lamarck with the inheritance of acquired traits/characteristics is the only correct one.

50. **A:** Charles Darwin proposed natural selection as the main mechanism of evolution.

Jean-Baptiste Lamarck suggested acquired traits could be inherited, contributing to early evolutionary theory but later supplanted by Darwin's ideas

THEORY SOLUTIONS

SECTION A

I(a) Function of the parts of a nephron

- Glomerulus** carries out ultrafiltration/ filters the blood passing through it.
- Bowman's capsule** collects filtrate from glomerulus.
- Proximal convoluted tubules** carry-out selective reabsorption: reabsorbs certain nutrients/materials/substances/ amino acids, vitamins.

- (iv) **Distal convoluted tubule** causes tubular secretion/secretion of molecules/ions; reabsorbs water.

(b) Table

Organism	Structure for excretion	Form in which waste is excreted by organism
Amoeba/Paramecium	Contractile vacuole	Gaseous/Liquid
Flatworm	Flame cell	Liquid
Earth-worm	Nephridium/Nephridia	Liquid
Cockroach	Malpighian tubule	Solid
Human	Skin/Kidney/lung	Liquid
(Green) Plant	Stomata/pore	Gaseous/gas

(c) Excretory products of plants

- Oxygen; II. gum;
- carbon (IV) oxide;
- oxalic acid;
- alkaloids/quinine/morphine;
- cocaine; VII. tannin(s).

2(a) Roles played by the organs involved;

- mouth**
contains salivary glands in the mouth/ secrete saliva which contains ptyalin/salivary;
contains saliva that moistens/softens the food.
 - skin**
excretes sweat/controls body temperature;
excretes excess salt/eliminates excretory wastes.
 - tongue**
tastes the food;
rolls the food into bolus.
 - kidney**
excretes excess salt/excess water;
carryout osmoregulation.
 - stomach**
temporary storage of the food;
churning of food and turning it into chyme.
 - small intestine**
maltase converts maltose to glucose;
lipase converts fats and oil to glycerol and fatty acids.
 - large intestine**
absorbs water from undigested food;
moves waste to the rectum as faeces for expulsion through the anus.
 - liver**
deaminates excess amino acid;
converts excess glucose to glycogen for storage.
- (b) **Organs that would contain enzymes needed to break down the food**
mouth
small intestine
stomach
- (c) **Digestive enzymes that would be involved in the digestion**

- ptyalin/salivary amylase;
 - amylase/pancreatic amylase;
 - lipase.
- (d) **End-products of the meal after digestion**
- glucose;
 - fatty acid glycerol;
 - amino acids.

- (e) **Effect of the excess salt osteoporosis**
- enlarges heart muscle;
 - stomach cancer;
 - headache;
 - dehydration;
 - heart failure;
 - high blood pressure;
 - stroke;
 - kidney disease/kidney stone;
 - derives from the meal.

- (ii) **Advantages that the individual derives**
- prevents cardiovascular diseases;
 - improves energy and mood;
 - manages diabetes;
 - promotes skin, nail and hair health;
 - improves digestion;
 - strengthens the immune system.

3a(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;
- there will be presence of water around the meat;
- there will be microbial growth;
- presence of maggot.

- (ii) **Biological process**
Decay/decomposition/putrefaction.

(ii) Table

methods of preserving 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 the microorganisms by increasing the osmotic pressure in the meat;
Frying	Involve the immersion of foods in boiling oils / dehydrates the items and decreases microbial growth
Canning	Involves heating to kill microorganisms

Smoking	Reduces the water content of the meat; kills the microorganisms / prevents the entry of new ones
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- (iv) **Environmental factors that may be responsible for decay**

I. temperature; II. humidity; III. Oxygen; IV. moisture.

- (b) **Methods of preserving;**

- (i) **dried maize grains**

I. sun drying; II. storage chemical treatment; III. pack in low-humid containers/silos/bags; IV. store in jute bags/sacks/airtight container.

- (ii) **fresh tomatoes**

I. canning; II. drying; III. freezing

- (iii) **vegetables**

I. refrigeration/freezing; II. drying; III. curing

- (iv) **beans**

I. sun drying; II. storage chemical treatment; III. pack in low humid containers/silos/airtight containers.

- (v) **milk**

I. pasteurization; II. drying; III. canning

4a(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
Check cell	Mitosis	diploid

- (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 same number of chromosomes as the parent cell.

- (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.

- (c) **Explanation of how genes are involved in the process of evolution**

- Genes are inherited by next generations;
- 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.

SECTION B

- 5a(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.

- (ii) **Types of competition**

- intra-specific competition
- inter-specific competition

- (iii) **Factors that compete for in a habitat**

- space/territory/shelter
- water; light;
- food;
- mate;
- inorganic substances.

- (iv) **Relationship between competition and Succession**

- succession is the changes that occurs; in population of organism in a habitat; until a climax is reached;
- for this changes to occur there must be competition;
- between the old population and the new one;

- (b) **Structural adaptation**

- it is the possession of special structure; which allows the organism; to survive and reproduce successfully; in its habitat.

- (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.

- (c) **Features of variation in humans used in crime detection**

- fingerprint; - blood group; - DNA; - Peculiar body features; - Eye colour; - Skin colour; - Facial expression

- (d) **Table**

Three types of adaptive colouration in animals	One example of animal that show 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; grass-hopper

- Example of plants found in a tropical Rainforest**
- Iroko;
 - Umbrella tree;
 - African walnut;
 - Mahogany;
 - Oil palm;
 - Orchids;
 - Obecche;
 - Opepe.

SECTION A PRACTICAL SOLUTIONS

- 1(a) Phylum and Class of the organism that possesses specimen D/gizzard

Phylum

Chordata/Vertebrata

Class

Aves

- (b) Observable features of specimen B/ whole liver from a domestic fowl
- reddish/dark red in colour;
 - soft but firm/spongy to touch;
 - has a greenish sac attached to it/gall bladder present

- (c(i) Functions of specimen B/ liver to the organism from which it was obtained

- stores glycogen/regulation of blood sugar level;
- deamination of proteins; in the body/excretion of nitrogenous wastes/Ammonium conversion;
- formation of fibrinogen (for blood clotting purposes);
- produce heat: for maintenance of constant body temperature;
- stores vitamins AD/B/B₁/E;

- (ii) Function of specimen D/gizzard and E/intestine to the functions

- D** - has thick muscular walls/contracts/relaxes; to grind food;
- contains small stones/gastrolith/chitinous plates/teeth; for grinding
- E** - for digestion/absorption of food/nutrients/production of enzymes
- (iii) Adaptation of specimen D/gizzard and E/intestine to the functions
- D** - has thick muscular walls/contracts/relaxes; to grind food;
- contains small stones/gastrolith/chitinous plates/teeth: for grinding
- E** - very long/has villi; to create a large surface area (for the absorption of food).

- d(i) Table

Test	Observation	Inference
Red litmus paper + Fluid	Fluid turns litmus paper blue	is a base / alkaline / basic
Blue litmus paper + Fluid	Blue litmus paper remains unchanged	Base/Alkaline/ not acidic

- (ii) Functions of bile

- neutralizes acid food from the stomach;
- provides alkaline medium for pancreatic enzymes to work
- emulsifies fat, and glycogen;
- removal of toxins/waste products

- e(i) Biological system in vertebrates that specimens D/gizzard and E/ intestine

belong to

Digestive system

- (ii) The specimen that is absent in humans
- D/Gizzard
- f(i) Mode of feeding of the organism that possesses specimen E/ intestine
- Holozoic/heterotrophic/omnivorous
- (ii) Type of food that the organism that possesses specimen D/gizzard consumes
- Grains/seeds/crops/plant materials/insects/worms.

- 2(a) Functions of specimen H/Leaf of Bolytium to the plant from which it was obtained
- photosynthesis/manufactures food
 - vegetative propagation/Asexual reproduction
 - storage of water
 - for transpiration
 - for exchange of gases

- b(i) Function of specimens F/Ginger rhizome and K/Cassava tuber to the plants from which they were obtained

F - Vegetative propagation/storage of food/anchorage

K - Storage of food/anchorage

- (ii) Reasons for the answers

E - presence of buds/stored food/water

- rhizome located underground

K - presence of swollen root

- is a root/presence of lateral root

- (iii) Part of the plant modified for the function stated

F - stem

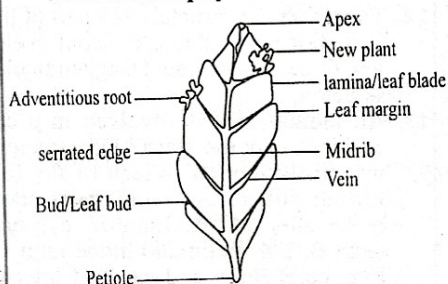
K - root

- c(i) Observable differences between specimens F/Ginger rhizome and K/Cassava tuber

F/Ginger rhizome	K/Cassava tuber
nodes present	nodes absent;
internodes present	internodes absent;
scale leaves present	scale leaves absent;
buds present	buds absent;
presence of adventitious roots	presence of lateral roots;
smaller in size	bigger in size.

- (ii) Similarity between specimens F/Ginger rhizome and K/Cassava tuber
- both are swollen;
 - both are storage organs/store food;
 - both are carbohydrates.

- d(i) Drawing/Diagram of specimen H/ Leaf of Paraphylum



SECTION B

Answer all the questions in this section

- 3a(i) Region of the human body where specimens L/Thoracic vertebra and Q/Lumbar vertebra are located
- L- chest/thorax/thoracic region
- Q- abdominal region/between thoracic and sacral vertebrae
- b(i) Observable differences between specimens L/Thoracic vertebra and Q/Lumbar vertebra

L/Thoracic vertebra	Q/Lumbar vertebra
The neural spine is long	the neural spine is short;
The transverse process is long	the transverse process is short;
Demifacets are present	demifacets absent;
Metapophysis absent	metapophysis present;
Anapophysis absent	anapophysis present;
Centrum small	large centrum.

- (ii) Observable similarities between specimens L/Thoracic vertebra and Q/Lumbar vertebra

Presence of:

- neural spine; facets; - centrum; - transverse process; - neural canal; - Zygapophysis; - neural arch: marks]

- c(i) Bones that articulate with specimens

M/Humerus bone and P/Femur bone

M - scapula, clavicle, ulna

P - Pelvis/pelvic girdle, tibia

- (ii) Vertebra located before and after specimens L/Thoracic vertebra and Q/Lumbar vertebra.

L - Before- cervical vertebra

Q - After - lumbar vertebra

Before - thoracic vertebra

After - sacral vertebra

- (d) Table

Specimen	Features			
	Neural canal	Rounded head	Neural spine	Long shaft
L/Thoracic vertebra	✓	X	(✓)	
M/Humerus bone	(X)	✓	X	✓
P/Femur bone		(✓)	X	✓
Q/Lumbar vertebra	✓	X	✓	(X)