Biology ACSEE

Past Paper Questions and Answers By Topic

Contents

Form V

1.0 CYTOLOGY

2014 Paper 1

8. (a) Describe the tertiary structure of protein?

(b) Elaborate six categories of protein basing on their functions.

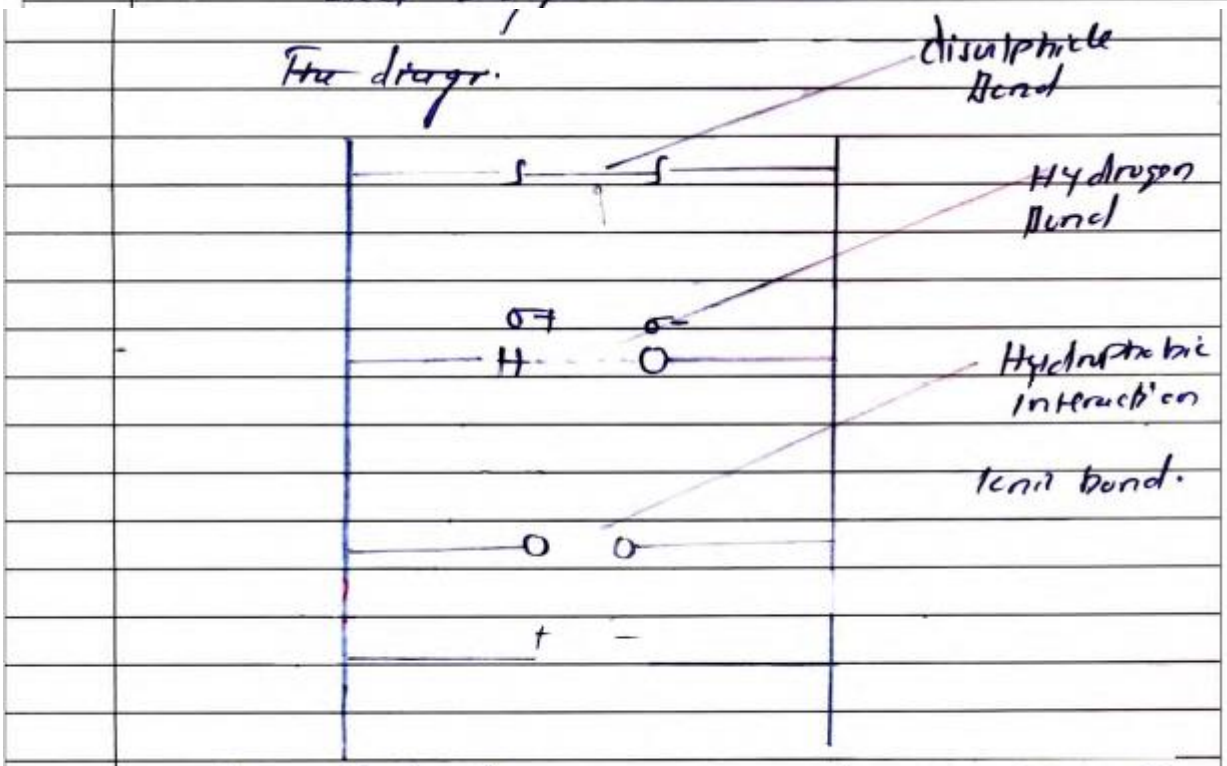
8 (a) The description of tertiary ~~protein~~ structure of protein

Tertiary proteins are these proteins which are consists folded polypeptide chains and of which they are associated with the following bonds

i Hydrogen bonding
ii Ionic bonding
iii disulphide bonding
iv Hydrophobic interaction

Examples Tertiary proteins are Hormones and Enzymes.

The diagram.



Simplified diagram showing the structure of Tertiary protein (Tertiary structure)

(b) Elaboration of six categories of protein having on their function.

1. Structural proteins
These are Keratin and Elastic protein.
Example of keratin are hair, horn and Elastic are those in bone tendons.

2. Storage protein
Function of storage Example is Egg white Albumen.

3. Protective protein
These are proteins whose their function is to protect especially body organisms against diseases
Example of protective protein are Antibodies

4. Respiratory (Respiration) protein.
These are proteins which are involved in the whole process of respiration.
Examples are
Myosin and Haemoglobin for carrying respiratory gases (CO_2 and O_2) produced and used during respiration.

5. Toxin (Toxin proteins)
These proteins produced by some animals or plant which are toxic whether and mostly used in defense mechanism
Examples are Snake venom.

6. (Catalytic function / catalysing) protein.
These are proteins which are important in catalysing several metabolic activities such as digestion.
Example of these are
Enzymes such as pepsins, Amylase and Trypsin.

The candidate had good knowledge on the topic, good understanding of the question demand as all the responses were correct.

2014 Paper 1

5. (a) By using examples classify cells into two major groups. Give four features for each group to justify your answers.

(b) Outline three advantages of the presence of membranes in cell organelles.

5. (a) – The cells are Divided into two Major Groups.
(i) Eukaryotic cells – Examples: plants cells and the Animal cells.

(ii) Prokaryotic cells – Example the Bacteria
– The Following are the Features that are given to Distinguish between the two (2) Groups.

(i) Features of the Eukaryotic cells.
(i) They have got the true Nucleus Example cell.

(ii) They contain the 80's Ribosomes
(iii) They have the Linear Nuclear material (DNA) surrounded by the Membrane.
(iv) They have large size.

5. (a) (i) Features for prokaryotic cells.
(i) They have 70's Ribosomes.
(ii) They Nuclear material is Not bound with Membranes.

(iii) They do not have the true Nucleus.

(iv) They lack some of the cell organelles such as Mitochondria.

(b) The Advantages of the cell Membranes in cell. Organelles.

(i) They form Separately compartment for, which each cell specialized a particular Function For Example Chloroplast for photosynthesis.

(ii) They contain Receptor sites which can receive hormones and other materials for uses.

(iii) They contain Enzymes that catalyse various Chemical Reactions.

The candidate who did well in this question. The candidate had sufficient knowledge on the topic of Cytology, good understanding of the question demand and good English grammar. Thus, all his/her responses were correct.

2015 Paper 1

9. Describe categories of proteins based on their structures and functions.

iii) Adaptation of sperm cell.

- The acrosome consists of enzymes (such as protease and hyaluronidase enzymes) which are responsible for digesting the walls of the ovum for fertilization.
- It has many Mitochondria so as to ensure maximum supply of energy for the propulsion of the sperm.
- It has a long tail which enables propulsion during fertilization so as to reach the ovum cell.
- The cell is also adapted to specifying chemicals secreted by the ovum so as to move towards it (chemotactic movement).
- It has a tapered end which enables it to fuse to the ovum receptor cells.

The following are the category of protein based on function.

PROTEIN and examples.	FUNCTION.
i) Hormones example insulin and glucagon	These are proteins which regulate blood glucose level in the body.
ii) Enzymes example trypsin.	These are proteins which catalyse the metabolic reaction example trypsin catalyse the breakdown of protein.
iii) Protection example Fibrinogen.	This used to prevent outflow of blood. Responsible for clotting of blood.
iv) Respiratory pigment. Example haemoglobin	This is involved in the transportation of respiratory gases.
myoglobin	This stores oxygen in muscle.

The candidate had enough knowledge on the topic and good understanding of the demand of the question. Thus, he/she was able to describe categories of proteins based on their structures and functions.

2015 Paper 1

1. (a) Differentiate between eukaryotic and prokaryotic cells basing on the following criteria:

(i) Cell division
(ii) Genetic material
(iii) Cell wall
(iv) Flagella
(v) Respiration
(vi) Photosynthesis
(vii) Nitrogen fixation.

Tabulate your answer as shown below.

Criteria	Prokaryotic cells	Eukaryotic cells

(b) What is cell differentiation?

1A	CRITERIA	Prokaryotic cell	Eukaryotic cell
I	Cell division	- Binary Fission	- Mitosis and meiosis
II		- No Spindle fibre formation	- Involve formation of spindle fibre
III	Genetic material	- Circular DNA	- Linear DNA and RNA
		- DNA is naked not associated with protein to form chromosome	- DNA associated with protein called Histones to form chromosome
IV	Cell wall	- Made up peptidoglycan or Murein	Either chitin (Fungus) or cellulose (in plant cell) as a main component.

iv	Flagella	- Lack microtubule arrangement 9+2	- Made of microtubule which has ~~9+2 arrange~~ ~~ment~~. 9+2 arrangement.	

	Criteria	Prokaryotic	Eukaryotic	
1.A				
v	Respiration	Aerobic respiration take place in ~~meso~~ mesosome	Aerobic respiration take place in mitochondrion	
vi	Photosynthesis	~~Photo~~ Takes in photosynthetic membrane laying in cytoplasm which do not clustered ~~in~~ to form grana	Takes in a ~~mitochond~~ chloroplast which contain thylakoid and Stroma.	
vii	~~Nitrogen~~	- Involve only cyclic photophorylation for the Light reaction stage	- Involve both cyclic and non-cyclic photophosphorylation for Light reaction Stage	
	Nitrogen fixation	some have ability	- None have ability.	

1.B	Cell differentiation:
	- Is the ~~te~~ development of cell, which acquire features enabling them to perform a specific function and get ~~d~~ distinguished from other cells ~~for~~ for ~~ea~~ case of multicellular organism.

The candidate had good knowledge about the topic of Cytology. Thus, he/she managed to differentiate between eukaryotic and prokaryotic cells and define the term cell differentiation.

2015 Paper 1

2. (a) What are the chemical compositions of proteins?

(b) State supporting and storage functions of carbohydrates using one example in each case.

2(a) chemical Composition of Proteins are

i/ Nitrogen.

ii/ Carbon.

iii/ Oxygen.

iv/ Hydrogen.

Hence all they form an amino acid which consist of Amine group and Carboxylate group.

2(b) Supporting functions of Carbohydrate.

(i) Supporting function of Carbohydrate it is about the formation of the cell wall in plants. cell.

The carbohydrate which is involved in formation of the cell wall is called Cellulose.

Thus cellulose is among of the components of the cell wall which protects the cell wall by rendering rigidity.

(ii) Carbohydrate such as chitin is among of the components of the exoskeleton of some Insects.

Thus chitin makes contribution in formation of the exoskeleton which provides support such as protection to the insects.

Storage function of Carbohydrate.

Carbohydrate act as a store of energy in different forms. as follows.

(i) In plants.

Carbohydrate stores energy in form of Starch.

(ii) In Animals.

Carbohydrate stores energy in form of glycogen.

The candidate had sufficient knowledge on the topic of Cytology. He/she managed to state the chemical compositions of proteins and to state the supporting and storage functions of carbohydrates using one example in each case.

2016 Paper 1

11. (a) Name the chemical composition of proteins.

(b) Explain six categories of protein based on their functions.

11. (a) Chemically protein is composed of :-

(i) Hydrogen

(ii) Carbon

(iii) Oxygen

(iv) Nitrogen and

(v) sulphur

(vi) It has chemical bonds such as peptide bonds, disulphide bridge, hydrophobic interaction and hydrogen bonding.

(b) Protein are polymers of amino acids which is formed when amino acids join up by peptide bonds through condensation polymerization which involve the release of water.

Besides, the following are categories of proteins based on their functions.

Enzymes, these are globular proteins which are highly specific to their subst

11 (b) rates, they can catalyse a reversible reaction, since they are protein in nature they are coded for by DNA, they are affected by temperature, substrate concentration, pH of the medium. Enzymes are biological catalyst they speed up the rate of reactions and also catalyse the substrates.

Poison proteins, these are proteins that are mainly found in some insects and reptiles, such as spider, snake and also centipede. These proteins are for defence against enemies.

Messenger proteins, they includes hormones which transmit or stimulate organ or gland to secrete another hormone. Hormones are chemical substances secreted by glands and have effect far away from where they are made.

Contractile proteins, these are proteins which are specialized for contraction and relaxation purpose and hence bring about movement of the body or part of the body - e-g actin and myosin

Food storage proteins, these are proteins which are purposely made for storage of food they includes albumin in egg yolk.

Structural proteins, these are proteins which are used to make parts of the body for example hair, nails are made up of proteins - Thus is the one of the categories of proteins in terms of their functions

11 (b) Immuno-proteins, these are proteins which aid body defense against disease and infections that is they make more antibodies against diseases.

In brief, categories of protein based on their functions includes enzymes, contractile proteins, poison proteins, messenger proteins, food storage protein, structural proteins as well as Immuno-proteins.

The candidate correctly named the chemical composition of protein such as carbon, hydrogen, oxygen, and nitrogen. Also, he/she explained six categories of protein based on their functions.

2016 Paper 1

9. (a) Study Figure 2 and answer the questions which follow.

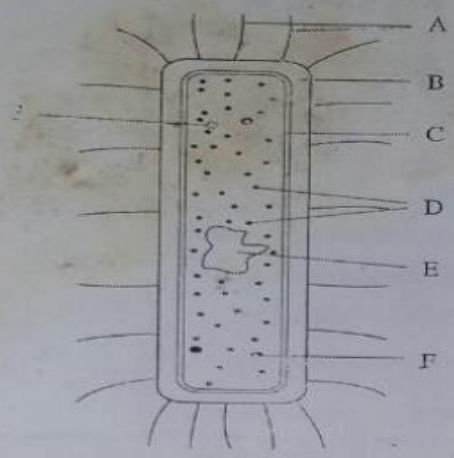


Figure 2

(i) Identify the cell.
(ii) Name the parts labeled A, B, C, D, E, F and G.

(b) Outline five differences between the cell in 9(a) above and a trypanosome cell?

9a i) The cell is a prokaryotic cell, typically a bacterial cell.

ii) A = Pili
B = Cell wall
C = Cell Surface membrane
D = 70's ribosomes
E = Circular DNA
F = Food reserve
G = Plasmid

9b

Bacteria cell	Trypanosome cell
Has circular, naked DNA	Contains DNA enclosed by histone protein
Respiration occurs through mesosomes	Respiration occurs in mitochondria
Contains small 70's ribosome	Contains large 80's ribosomes
Has no cell organelles like Golgi apparatus and mitochondria which are bounded by membrane	Contains many membrane bounded cell organelles
Contains cell wall made by murein	Has no cell wall.
Contains plasmid	Has no plasmid

The candidate who was able to identify the cell as bacterial cell and correctly named the required labels. He/she also correctly differentiated a given cell from a trypanosome cell.

2016 Paper 1

3. (a) Discuss the effect of temperature on the rate of enzymic controlled reaction.

(b) Draw the structure of ATP molecule and explain how it is formed.

3(a) The effect of temperature on enzymic controlled reaction

- Low temperature.

At low temperature, less than 5°C the enzymes are inactivated and hence they fail to catalyze the reaction, this result into fall of the rate of reaction. The active site of an enzyme fail to bind with the substrate, hence no formation of substrate/enzyme complex

3(a)

- Optimum temperature.

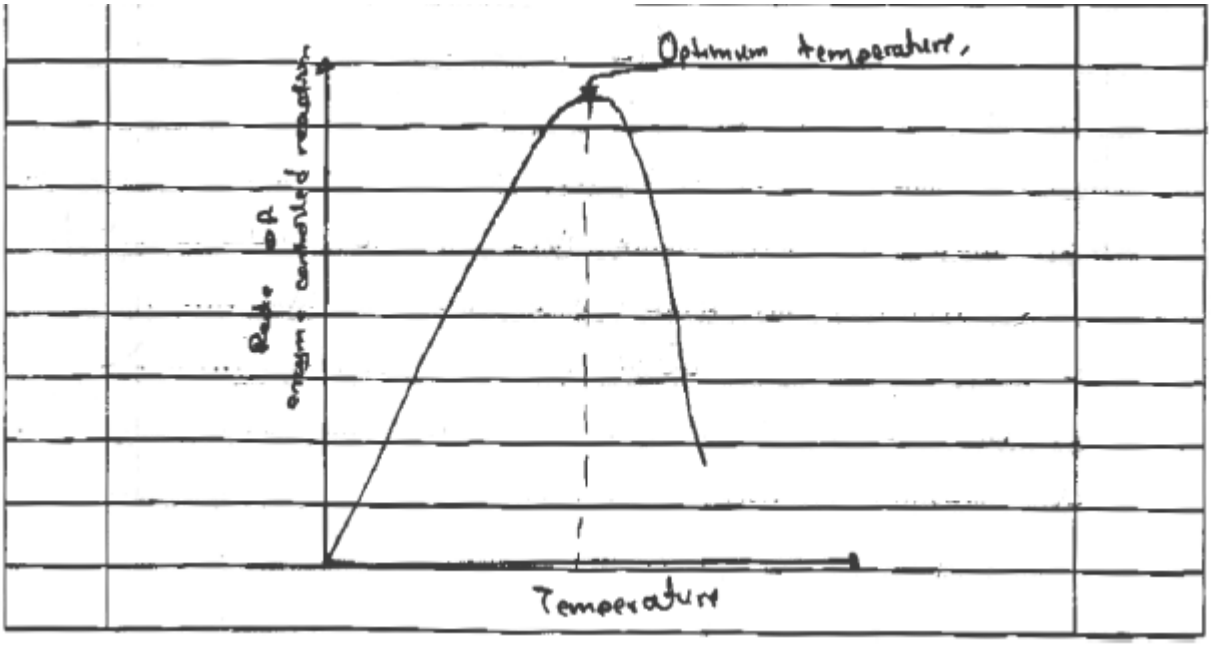
At optimum temperature, the rate of reaction is high, this is due to the enzymes are at its best medium and have high chance of colliding of enzymes and substrate to form substrate/enzyme complex due to their vibration motion.

- High temperature

Temperature above the optimum temperature decrease the rate of chemical reaction due to denaturation of enzymes by loosing their three dimension shape. The denaturation is due to high vibration of atoms of enzymes which result to break of bonds like ionic bond and disulphide bond

In short,

Increase of temperature result into the increase of rate of enzyme controlled reaction upto the optimum temperature, above this the reaction rate decreases as shown below:-



30. ATP is formed by adding phosphate groups to the Adenosine

Addition of phosphate group to a adenosine molecule is called phosphorylation. This process need energy either from the sun as in photosynthesis (photophosphorylation) or from respiration (oxidative phosphorylation)

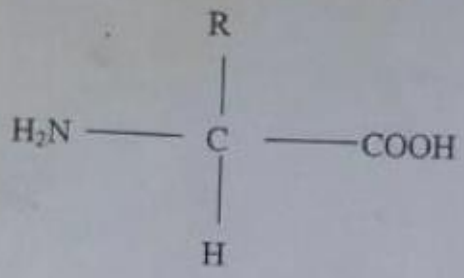
Addition of the last two phosphate group require about 30.6 kJ/mol energy while that of the first just require are half - of it.

The addition of phosphate molecule to Adenosine dephosphate (ADP) is catalyzed by an enzyme called ATPase

All of these reactions are condensation reaction which involve removal of water molecule

The candidate who was able to correctly discuss the effect of temperature on the rate of enzymic controlled reaction. He/she was also able to explain ATP formation using ATP as enzyme and 30.6kJmol-1

2. Study the molecular formula below and answer questions that follow.



(a) (i) What is the general name given to the molecular formula above?

(ii) What is the simplest form of R?

(b) State six properties of enzymes.

2. (a)(i) The name is Amino acid.
(ii) The simplest form of R is Hydrogen (H) which form an amine acid called Glycine.

(b) Properties of enzymes.
- Enzymes are globular proteins.
- Enzymes Catalyse reaction in a reversible reaction that is reactant may react to form product and product react to form reactant.
- Enzyme they tend to react by lowering the activation energy of the reaction.
- Enzymes are highly specific in such a way that a single enzyme can only catalyse only a single reaction.
- Enzymes are highly efficient; That is only a small amount of it can bring about a vast number of products.
- Enzymes controlled reaction are affected by changes in pH, temperature but also presence of inhibitors.

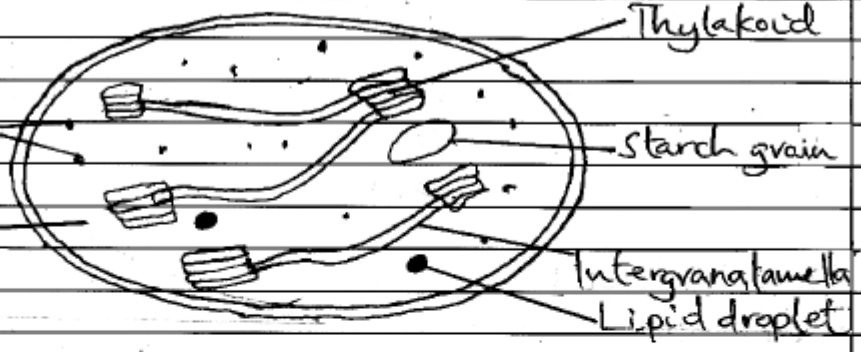
The candidate who was able to give the correct general name of the given molecular formula. He/she also stated the correct properties of enzymes such as enzymes are globular in shape and they are highly efficient.

1. (a) Draw a structure of chloroplast and label any six parts.

(b) State three structural adaptations shown by the chloroplast to its role.

SECTION A.

1. (a)



A well labelled diagram of chloroplast.

(b) Structural adaptations of chloroplast

(i) Chloroplast possess a bundle of thylakoids which form granna for absorption of light

(ii) Membranes of chloroplast are permeable to allow the respiratory gases to enter and leave chloroplast

(iii) Granna are held in position by lamella for maximum absorption of light

The candidate who was able to draw a well labelled diagram of chloroplast and correctly state its structural adaptions to its role, such as, possession of thylakoids for light absorption.

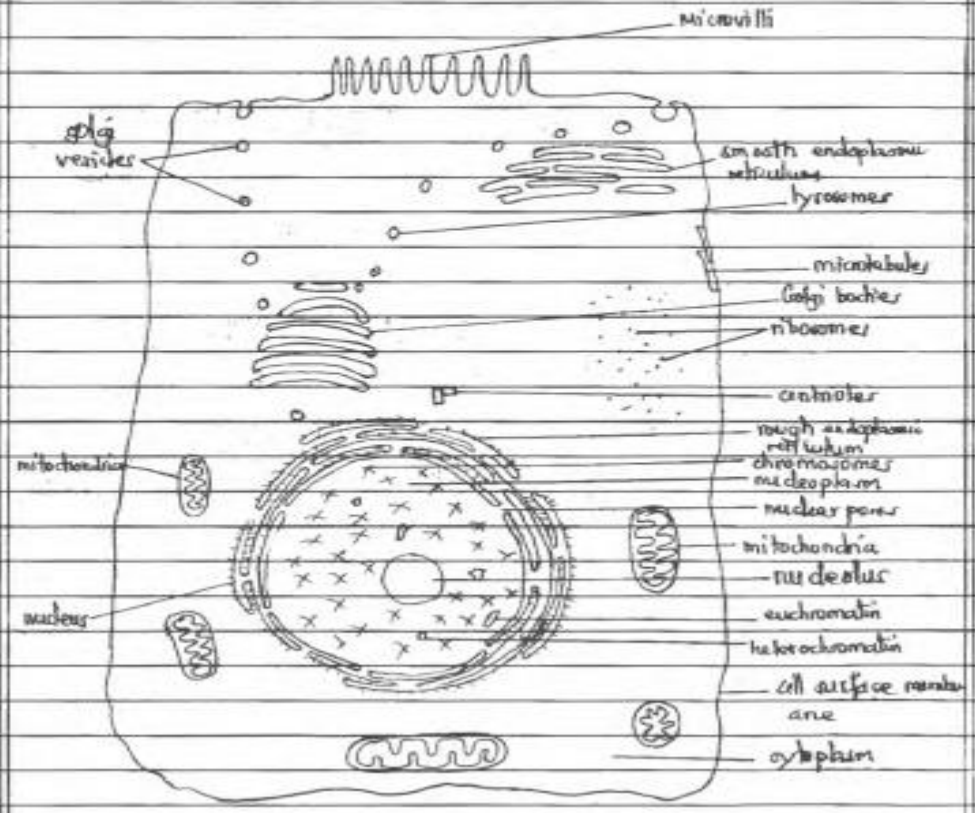
6. (a) Draw the structure of animal cell as seen under electron microscope.

(b) (i) Name a double membrane organelle found in plant cells only.

(ii) How is the organelle adapted to its role?

DG: (a)

THE DIAGRAM TO SHOW THE STRUCTURE OF ANIMAL CELL AS SEEN UNDER ELECTRON MICROSCOPE:



OG: (b)(i) Double membrane organelle found in plant cells only is the chloroplast.

(ii) Its role is photosynthesis

The organelle is adapted to its function/role as follows:

1: It has a double membrane system which separate its reaction from those of the cytoplasm.

2: It has enzymes to facilitate the photosynthesis process. Example RUBISCO.

3: It has a stroma which acts as a site of all the chemical reactions of chloroplast.

4: It has structures called thylakoid to facilitate absorption of light from the sun.

5: It has chlorophyll which is essential requirement for photosynthesis to occur.

6: It has starch grains and lipid droplets for the food reserve.

7: It has it's own DNA molecule which makes it able to self-replication.

8: It has ribosomes in its stroma for the synthesis of proteins and enzymes.

9: It has carbondioxide acceptors, the Ribolose biphosphate and Phosphoenol pyruvate to enable the succession of photosynthetic reactions.

The candidate who correctly drew the structure of animal cell and named the double membrane organelle found in plant cells only. He/she also explained how the organelle is adapted to its role.

2017 Paper 1

1. (a) Study Figure 1 and answer questions which follow.

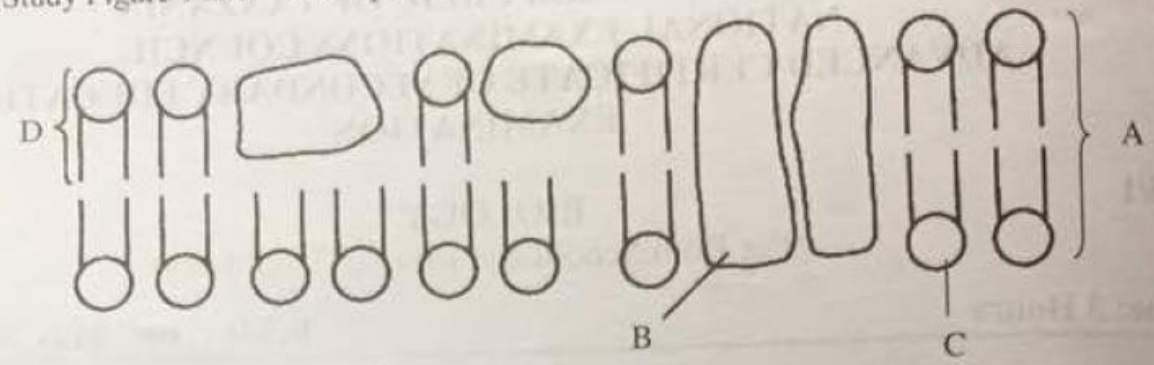


Figure 1

(i) What structure does Figure 1 represents?
(ii) Identify the parts labeled A, B, C and D.
(iii) State four functions of the structure labeled B.

(b) Describe three functions of microtubules.

1 (a)i	The fluid mosaic model of the cell membrane.	
ii	A – Phospholipid bilayer	
	B – Protein molecule	
	C – Polar head of Phospholipid	
	D – Phospholipid layer	
iii	- It acts as a channel through which non polar molecules are able to pass in and out of the cell.	
	- In some cells they serve as enzymes such as in epithelial cells of the microvilli in the small intestine	
	- They act as reaptor sites for attachment of specific molecules	
	- They combine with ~~glucose~~ Carbohydrate molecules to form glycoproteins that are essential in cell to cell recognition for tissue formation.	
(b)	Functions of microtubules	
	- They are useful in spindle formation during cell division in animals	
	- They give mechanical strength and support to the cell and give the cell its structure.	
	They are useful in formation of flagella for movement in some cells such as sperms	

The candidate who correctly identified all the labelled parts in figure 1 and managed to state the functions of structure B. Furthermore, the candidate well described the functions of microtubules.

2017 Paper 1

2. (a) Analyze the differences between cyanobacteria and yeast cells based on the following criteria:
   (i) Cell division.
   (ii) Respiration.
   (iii) Photosynthesis.
   (iv) Protein synthesis.

   (b) Enumerate five similarities between mitochondria and chloroplast.

2a ii) Differences according to respiration
- Respiration in cynobacteria occurs in mesosomes and other respiratory membranes while respiration in yeast occurs in mitochondria.

- Yeast can undergo aneorobic respiration to produce alcoholic facultative anerobe while cynobacteria rarely undergo anaerobic respiration.

iii) Difference according to photosynthesis
- Cynobacteria undergoe photosynthesis through photosynthetic membranes that contain photo-synthetic pigments while Yeast does not undergoe photosynthesis since it has no photosynthetic mem. pigments.

iv) Differences according to protein synthesis
- Cynobacteria undergoe protein synthesis using smaller 70s ribosomes while Yeast possess 80's ribosome
- Yeast have ribosome bounded to endoplasmic reticulum to form Rough endoplasmic rectriculum while the ribosomes in cynobacteria are ~~bounded~~ non bounded.

2 b) Similarities of mitochondria and chloroplast
i) Both are bounded by a double membrane forming an envelope
ii) Both contain smaller 70's ribosomes for protein synthesis
iii) Both contain a small piece of circular DNA in their structure

2b iv) Both contain internal medium copartmentalized from the external cytoplasm. ie stroma for chloroplast and mitochondria contains matrix.
v) Both divide independently of other organelles hence act as cells within the cell.

The candidate was able to give the correct differences between cyanobacteria and yeast cells according to the given criteria. He/she also managed to correctly state the similarities between mitochondria and chloroplast.

2017 Paper 1

3. (a) (i) Briefly explain how to test for the protein in a given solution using Biuret test.
(ii) What is the basis of protein test?

(b) Explain how each of the following factors cause protein denaturation:
(i) Heat
(ii) Acid
(iv) Alkalis
(v) Mechanical force.

3(b): The factors for protein denaturation are described as follows:-

i Heat, heat denature protein due to the fact that atoms of molecules in protein get energy which make hydrogen bonds to break and leads the protein to be denatured.

ii Acid, presence of acid adds H^+ ions which combine with COO^- group to form COOH which are now broken, hence leads to protein denaturation.

iii Alkalis, the addition of alkali released the NH_3^+ since alkali react with NH_4^+ result to the formation of NH_2 and result to the broken of the bond in protein

iv. Mechanical force, the movement of protein example keratin found in hair lead to protein denaturation since if hair is stretched it reach the extent that the keratin break. hence lead to denaturation of protein

3(a) i. To test for protein, first $2cm^3$ of a sample solution was placed in a clean test tube. Adds $2cm^3$ of sodium hydroxide, followed by two drops of 1% copper (II) sulphate solution and then the mixture was shaken gently.

The presence of protein is indicated when the solution becomes purple in colour but if is not present the solution retain the pale blue colour of copper sulphate solution.

The candidate who was able to correctly explain how to test for protein in each solution using Biuret test. The candidate was also able to explain the effect of heat, acid, alkalis, and mechanical force on denaturation of protein.

2018 Paper 1

5. (a) Identify two categories of carbohydrate.

(b) Using one example in each case, describe six functions of carbohydrates in organisms.

5. a/ Two categories of carbohydrate.
i/ Monosaccharides, (single sugar carbohydrate).
ii/ polysaccharides
like starch and glycogen.

b/ Functions of carbohydrates in organisms.

i/ Used as substrate in respiration to produce energy in form of ATP. Example glucose.

ii/ Some Carbohydrates are used as storage like starch and glycogen.

iii/ Some carbohydrates are used as structural components like cellulose and chitin in cell walls.

iv/ Some are used in formation of nucleic acids example ribose forms RNA and Deoxyribose forms DNA.

v/ Some also are used in synthesis of coenzymes such as ribose is used in synthesis of NAD and NADP which are hydrogen carriers in the bodies of organisms.

vi/ Some used in formation of ATP such as ribose sugar is used in synthesis of ATP molecule which is the energy carrier in organisms.

The candidate who had adequate knowledge of the topic of Cytology, specifically on categories and roles of carbohydrates in the body. He/she correctly identified the categories of carbohydrates and described the functions of carbohydrates in organisms, with examples in each case.

2018 Paper 1

1. (a) Describe the features of cell membrane.

(b) Assess the suitability of the structure of a mitochondrion to its function. Give five points.

1(a) Features of the cell membrane.

The cell membrane has got the following features

(i) Glycoprotein layer, one of the membrane component is the glycoprotein this is a protein combined with glycogen

(ii) The phospholipid layer
- Also the large part of the membrane is composed of the layer of the phospholipid which protein layer float over the lipid layer

(iii) The protein layer.
- Also membrane consist of the protein layer which is float over the lipid layer.

(iv) Also membrane has a glycolipid layer
- This is the layer of the lipid combined with the glycogen to form glycolipid layer

(v) Cholesterol
- This provide the flexibility of the membrane and prevent solidification of the membrane.

16. Suitability of structure of mitochondria to its function

(i) It consist of double membrane that isolate the enzymatic reaction that occur in the cytoplasm from these which occur in mitochondria.

(ii) It has the matrix which is cytoplasm like where various processes such as Krebs cycle take place.

(iii) It posses the cristae which is the site for the electron transport chain. this is formed due to the infolding of the inner membrane of the mitochondria.

(iv) It has a circular DNA which carries the genetic material and control the process taking place in the mitochondria.

(v) It posses ribosomes of 70's. These aid in the protein synthesis in the mitochondria and this make the mitochondria to be known as a producer of ~~prote~~ its own substrate like protein.

The candidate who correctly described the features of the cell membrane such as possession of glycolipids, glycoprotein, and cholesterol. He/she also correctly assessed the suitability of the structure of a mitochondrion to its function.

2018 Paper 1

2. (a) State three importance of each of the following groups of carbohydrates in living things:
   (i) Pentose
   (ii) Hexose
   (iii) Disaccharide.

   (b) Explain the role of the following chemical reagents in testing carbohydrates:
   (i) Dilute hydrochloric acid.
   (ii) Dilute sodium hydroxide.

02.	(a) Importance of the following groups of carbohydrates	
	(i) Pentose.	
	- It is important in the synthesis of Ribonucleic	
	and Deoxyribonucleic acids (RNA and DNA).	
	Ribose and Deoxyribose pentose sugars are the	
	components of RNA and DNA respectively.	
	- It is important in the synthesis of Adenosine	
	triphosphate molecule (ATP) which is the universal	
	energy carrier. Pentose sugar is a component.	
	- It is important in the physiological processes like	
	photosynthesis. Ribulose combines with phosphate	
	molecules to form ribulose biphosphate which	
	is the carbondioxide acceptor in photosynthesis	

02.(a) (ii) Hexose

- It is a major energy source in the bodies of living organisms. Glucose is the main respiratory substrate which is oxidized to release energy. Other hexoses like fructose and galactose are also important.

- It is important in forming disaccharides like sucrose formed from fructose and glucose and maltose from two glucose molecules. These are important in living organisms.

- It is important in forming polysaccharides like cellulose which is the major component of the plants.

(iii) Disaccharide

- It is important in plants as it is a means of food transport to various parts of the plants. After photosynthesis, sucrose (disaccharide) is transfered to other parts.

- It also acts as source of energy as its hydrolysis results to monosaccharide constituents which can be oxidized to produce energy.

- It is important in forming polysaccharides like starch and which is the stored form of food in plants.

02. (b) (i) Dilute hydrochloric acid hydrolyses non-reducing sugar (disaccharide often) into its corresponding reducing sugar (monosaccharide component).

(ii) Dilute sodium hydroxide is used to neutralize the acidity of initially added dilute hydrochloric acid.

The candidate who was able to state the importance of pentose, hexose, and disaccharide. The candidate also explained the role of dilute hydrochloric acid and sodium hydroxide in testing carbohydrates correctly.

2019 Paper 1

1. Study the structure represented by Figure 1 and then answer the questions that follow:

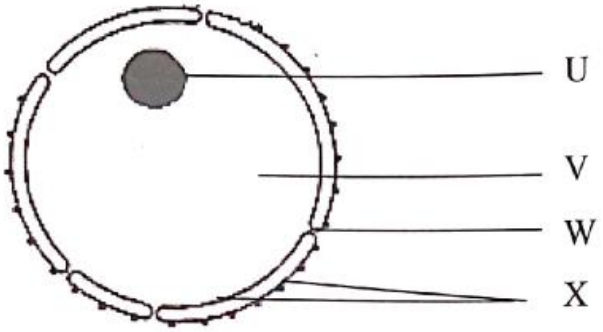


Figure 1

(a) (i) Name the structure represented by Figure 1.
(ii) Identify the parts labeled U, V, W and X.
(iii) What role does each of the parts labeled U, V and X plays?

(b) Enumerate four roles played by the structure represented by the Figure 1.

1. (a)

(i) The structure is nucleus.

(ii) U – nucleolus
V – nucleoplasm
W – nuclear pore
X – nuclear envelope (two membranes).

(iii).

U- NUCLEOLUS:
- This contains DNA which are used during protein synthesis to make messenger RNA.
- It synthesises ribosomal RNA in a region called nucleolar organiser in the nucleolus.

V- NUCLEOPLASM
- This contains chromatin molecules which carry genetic information
- It is the site for nucleus activities, such as nuclear division processes.

W- NUCLEAR PORE
- This helps the movement of materials between the cytoplasm and the nucleoplasm.
- It provides the path for messenger RNA (mRNA) from the DNA to the cytoplasm after transcription in the process of making protein.
- Also, food materials, such as amino acids are passed from the cytoplasm to nucleus through nuclear pore.

X- Nuclear envelope.
- this separates the metabolic activities of the nucleus to those in the cytoplasm of a cell.
- It is associated with ribosomes which help in protein synthesis.

5). Roles played by the nucleus:

i) It stores genetic information from both parents after fertilisation process.
ii). It controls all activities of the cell, such as respiration
iii). It helps in protein synthesis, where DNA produces ribonucleic acid, messenger RNA.
iv). Nucleus helps to control cell division, and distribution of organelles.

The candidate gave a correct name of the nucleus, labelled the given parts and stated the role of each part. The candidate also managed to enumerate the roles played by the nucleus.

2019 Paper 1

2. (a) Explain the procedure for testing non-reducing sugar in a given solution.

(b) Analyze the chemical composition of the following food substances:
(i) Lipids
(ii) Proteins.

2(a) Procedures for testing non reducing sugar:

(i) 2cm³ of the sample to be tested is put in a test tube.

(ii) 1cm³ of hydrochloric acid is added, then it is added to it to break disaccharides into their constituent monomers which show positive test with benedicts solution.

(iii) The mixture is then heated for two minutes and cooled

(iv) a 1 cm³ solution of NaOH is then added. This is added to neutralize the acidity and make the contents right basic as benedicts solution does not react in acidic conditions.

(v) To the mixture 2cm³ of benedicts solution is then added and the mixture is heated for two minutes

(vi) If the sample contains non-reducing sugar there would be colour change from blue-green yellow - orange - brick red

(vii) If the sample does not contain non-reducing sugar the blue colour of copper (II) sulphate is returned

(b)(i) Lipids are chemically computed of fatty acids and glycerol

(ii) Proteins are chemically computed of amino acids

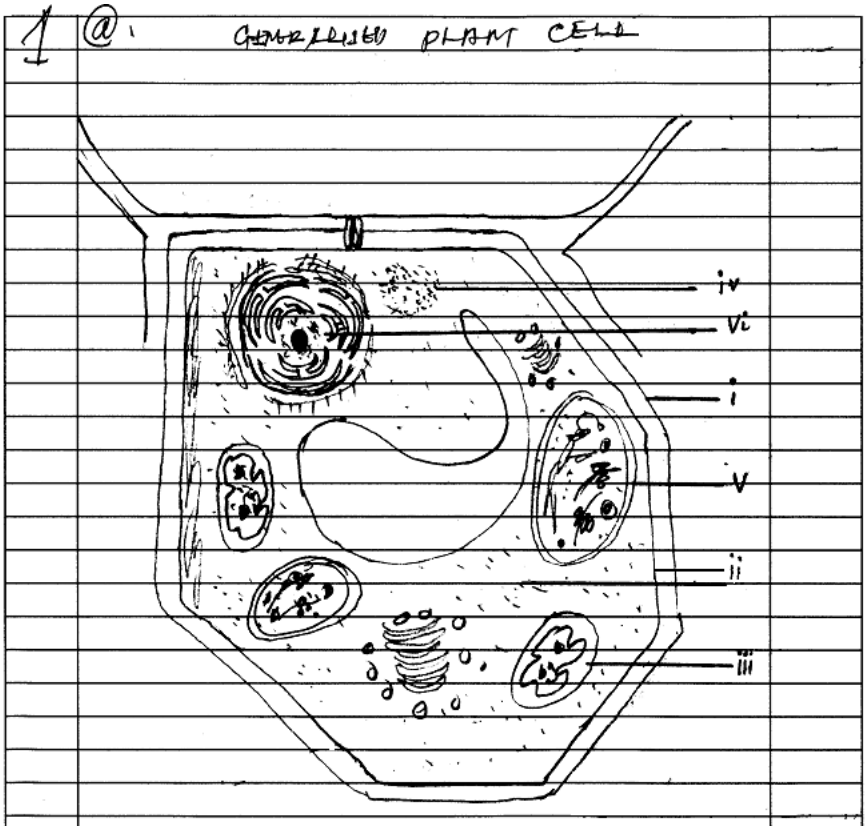
The candidate was able to explain the procedure for testing non-reducing sugar. The candidate also analysed properly the chemical composition of lipids and proteins.

2020 Paper 1

1. (a) Draw the structure of a generalised plant cell as seen under electron microscope and use roman numbers to label only the parts which are associated with the following roles:
   (i) Strengthening of the cell
   (ii) Controlling the exchange between the cell and its environment
   (iii) Provision of energy
   (iv) Protein synthesis
   (v) Manufacture of food
   (vi) Controlling of cell activities.

   (b) Identify four structures which are found in plant cells but not in animal cells.

   (c) How are the following processes important to a cell?
   (i) Phagocytosis
   (ii) Pinocytosis
   (iii) Exocytosis.



(b) - chloroplasts

- Plasmodesmata

- Cell wall

- tonoplast

(c) (i) - Phagocytosis helps the cell to take some useful materials in solid form and degrading them easily to usable end products which can be utilised in the cells.

- Pinocytosis helps the cell to take water and other materials in liquid form more efficiently.

- Exocytosis helps in the removal of unuseful materials away from the cell also it aids in extracellular digestion conducted by the cell.

The candidate drew a correct diagram of plant cell and labelled the parts which perform the stated roles such as mitochondrion for provision of energy. The candidate also correctly identified structures which are found in plant cells but not in animal cells such as chloroplasts. Moreover, he/she was able to explain the importance of transport processes to cell.

2020 Paper 1

4. (a) Giving reason, state a part in the body of a mammal where large number of the following organelles are found:
   (i) Lysosomes
   (ii) Microbodies.

   (b) What will happen if each of the following organelles is severely damaged? Give four points in each.
   (i) Nucleus
   (ii) Lysosome
   (iii) Vacuole
   (iv) Endoplasmic reticulum.

4 a)(i) Lysosomes

- This are organelles which may act as suicide garbage and disposal bags which generally involves killing of cell or unwanted organelles.
- In the liver, there is a high concentration of lysosomes since it is the part responsible for detoxification.
- Forexample, In the liver there is a breakdown of red blood cells hence lysosomes is required.
- Toxic body substances are also made in the liver such as Urea.

4 a)(i) Microbodies

(i) Detoxification of harmful substances such as hydrogen peroxide take place in the liver in special cells known as kupffer cells.

(b)(i) If the nucleus is damaged;

(i) Protein synthesis will cease since no production of messenger RNA found in the gene of DNA in chromosomes found in the nucleus

(ii) Cell replication will also stop hence there will be constant number of cells. The mitosis take place in the nucleus by the chromosomes hence no cell replication.

(iii) Cellular metabolic activities such as aerobic respiration will cease hence Energy production will be low and inactivity of all.

(iv) Genetic Variation among organisms will not take place hence constant characteristics since no meiosis will occur.

ii) Lysosomes.

i) There will be accumulation of unwanted organelles hence the cell will be inefficient in performing its activities

4b) ii) Lysosomes

ii) Also there will be failure of loss of some structures in some animals during their life cycle for example tadpole tail hence frog would be having tail.

iii) Vacuole

i) The cells will lack turgor pressure to prevent the cell from bursting in hypotonic solution hence cells would easily burst.

ii) Osmoregulation would fail to take places in contractile vacuole hence abnormal accumulation of water and salt

iii) Also symplast water pathway in plant cells will fail if vacuole is damaged in a plant cell.

iv) Endoplasmic reticulum.

i) Protein synthesis would be inhibited and cease due to the ability of Rough Endoplasmic reticulum to synthesize protein with ribosomes

ii) Synthesis of steroids in the cells will fail to occur which form important components such as cholesterol for the cell membrane.

iii) There will be no formation of Golgi bodies if they are damaged.

iv) The cellular transporting system between different organelles would be difficult due to damage of tubules vesicles and cisternae of Endoplasmic Reticulum. Endoplasmic reticulum provide the transporting system.

The candidate correctly stated that lysosomes and microbodies are found in large number in the body part where there is high degree of degradation and detoxification such as in the liver. Also, she/he stated the problems which would arise if each of the organelle's nucleus, lysosome, vacuole, and endoplasmic reticulum organelles was severely damaged.

2.0 PRINCIPLES OF CLASSIFICATION

2014 Paper 1

6. (a) What do you understand by the term Taxonomic Key as used in Biology?

(b) Explain how to construct and use a Dichotomous Key.

6 a) Taxonomic key is a method used in identifying organism baring on observable features such as wings, legs, scales and leaf morphology.

b) The way used to construct a dichotomous key are :

i) Analysing all observable features such as wings, legs, scales, and leaf morphology of an organisms

ii) Analysing all distinctive observable features of an organisms

iii) Use two observable features to group or identify organisms

Example: Presence of scales — snake

Absence of scales — Earthworm

iv) To observe features which complete the identification of an organisms.

The way how to use a dichotomous key are :

i) To observe the features which present to the organisms with respect to constructed dichotomous key.

ii) If it is numbered dichotomous key to follow the direction required by number up to appropriate organism name.

iii) The organisms observed should be identified by taking reading with respect to observable features.

The candidate who had sufficient knowledge on the topic. He/she managed also to identify the demand of the questions and used clear English language to answer them.

2015 Paper 1

3. Identify:
   (a) Steps used to construct simple taxonomic keys.
   (b) Rules used in binomial nomenclature.

3(a) The following are the steps for construction of of taxonomic keys

i/ The first step is to tabulate the table of similarities and differences of the given organism. example suppose we have given the organism like cockroach, spider and Grasshopper.

ii/ The second step is to separate the given organisms into two groups basing on their similarities

iii/ The third step is to group the organism in a manner that, in each branch the number of organisms given decrease in (n-1) for each branch.

(b) The following are the rules of binomial nomenclature.

i/ Every organism is composed of only one scientific name.

ii/ The scientific name should poises two parts which is generic name and specific name.

iii/ The scientific name should be latinized and underlined separately.

iv/ If an organism is given names from different scientists, the first name is given priority.

v/ Only the commission is responsible to change the scientific name if there is the need to do so.

The candidate who demonstrated adequate knowledge in this question. He/she was able to identify the steps used to construct simple taxonomic keys and to identify the rules used in binomial nomenclature.

4. (a) (i) Define the term taxonomic hierarchy.
(ii) Using man as an example, illustrate the concept of taxonomic hierarchy.
(b) Explain four advantages of using artificial system of classification.

4. a/ i/ Taxonomic hierarchy - is the sequential arrangment in taxonomic ranks from highest to lowest taxon.

ii/ to show the concept of taxonomic hierarchy using Man

Man - Homo sapiens

- Kingdom – Animalia
- Phylum – Chordata
- Class – Mammalia
- Order – Primates
- Family – Hominidae
- Genus – Homo
- Species – sapiens

4 b/ Artificial system of classification is the one which based on few observable features considered at a time.

Advantages of Artificial system of classification are

i/ it is stable, as it is not subjected to changes

ii/ it does not need experties.

iii/ it is not time consuming process because it consider observable features only.

iv/ it is not expensive, since it does not base on many features such as Biochemical, Ecological, evolutional thus it based on observable features only which their information are easy to gather them.

The candidate who correctly stated the advantages of the artificial system of classification such as stability and less time consuming.

2017 Paper 1

7. (a) What is meant by natural system of classification?

(b) Why is it difficult to achieve a complete natural system of classification?

07: (a) Natural system of classification is the system of classifiction in which organisms are classified basing on their true evolutionary relationship, it never use few observable features.

(b) It is difficult to achieve complete natural system of classification because;

1: Natural system of classification is time consuming process

2: It needs skilled personnel, and biases the unskilled ones.

3: It is expensive in terms of cost and equipments

4: It uses true evolutionary relationship which can not be observed externally.

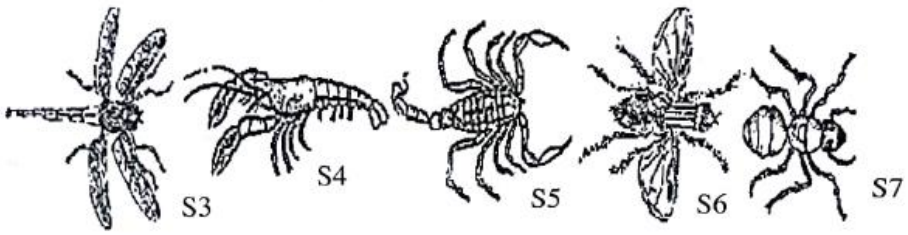
5: It is not flexible to allow discovery of new organisms.

6. For those unknown organisms, it does not allow their classification easily.

7: It requires the history of an organism to trace the ancestral origin of features.

The candidate who correctly explained the meaning of natural system of classification and explained why it is difficult to achieve a complete natural system of classification.

7. Study the labeled organisms below and then answer the question that follows:



(a) For each organism, identify the observable features only and put a tick (√) if the characteristic is present or a cross (X) if the characteristic is absent in Table 1.

Table 1

Organism	Wings two pair	Antennae present	Legs three pair	Legs four pair
S3				
S4				
S5				
S6				
S7				

(b) Use the characteristics you have filled in Table 1 to construct a simple bracketed key.

7. (a)

Organism	Wings two pair	Antennae present	Legs three pair	Legs four pair
S3	✓	✓	✓	X
S4	X	✓	X	X
S5	X	X	X	✓
S6	X	✓	✓	X
S7	X	✓	✓	X

(b) A simple bracketed key.

1. (a) presence of antennae ..... go to 2
   (b) Absence of antennae ..... organism S5

2. (a) three pairs of walking legs ..... go to 3
   (b) four pairs of walking legs ..... organism S4.

3. (a) presence of wings ..... go to 4.
   (b) Absence of wings ..... organism S7.

4. (a) Two pairs of wings ..... organism S3
   (b) One pair of wings present ..... organism S6.

The candidate who correctly identified the observable features of the given organisms and correctly constructed a simple bracketed key.

3. (a) (i) Identify the lowest taxon.
(ii) Illustrate the taxonomic hierarchy of human being.

(b) (i) Why classification of organisms is needed? Give three points.
(ii) Analyze three differences between natural and artificial systems of classification.

3a) i) The lowest taxon is Species

ii) Taxonomic hierarchy of human being
Kingdom : Animalia
Phylum : Chordata
Class : Mammalia
Order : Primates
Family : Hominidae
Genus : Homo
Species : Sapiens

b) i) Why classification of organisms is needed.
Classification of organisms is needed because classification has some advantages such as;

> Provides an organized system into which newly discovered organism can be placed in the future.
∴ Through classification, newly discovered organisms in the future can be easily studied and placed in its appropriate group by studying its characteristics and comparing with the characteristics of a particular group of organisms.

3b i) - to come up with conclusion about the characteristics of the studied organism

> Simplifies communication among biologists throughout the world
Classification involves assigning of scientific names to an organism. These scientific names are universal unlike common names hence biologists can be able to understand each other well

ii) Differences between natural and artificial systems of classification

	Natural system of classification	Artificial system of classification
i	Is the type of classification in which organisms are placed in to their natural groups based on many characteristics they have in common, both internal and external	Is the type of classification in which organisms are placed into their ~~natural~~ groups based on few observable external features
ii	It concidere evolutionary relationship of organisms	Does not concider evolutionary relationship of organisms
iii	It is expensive, time consuming and requires much knowledge	It is cheap, fast and requires minimal knowledge

The candidate misspelt a Class and Species of human being as *mamal* and *sapianse* instead of Mammalia and sapiens respectively. The candidate also interchanged the differences between natural and artificial systems of classification.

2020 Paper 1

3. (a) (i) What is the scientific name of human being?
(ii) List hierarchically the major classification taxa.

(b) (i) Why are Animal, Plant, Protoctista and Fungi considered to be Eukaryote Kingdoms while bacteria are considered to be Kingdom Prokaryotae?
(ii) State five rules that a biologist should follow in binomial nomenclature.

3(a) (i) Homo sapiens

(ii) Major classification ~~taxa~~ are
i) Kingdom
ii) Phylum
iii) Class
iv) Order
v) Family
vi) Genus
vii) Species

3(b)(i) - Both Animal, Plant, Protoctista and Fungi have nuclear membrane that encloses nuclear material while bacteria lack nuclear membrane that encloses nuclear material.

3(b)(i) - Both Animal, Plant, Protoctista and Fungi have linear DNA structure while bacteria have circular DNA structure

- Also both Animal, Plant, Protoctista and Fungi have ribosomes of 80's size while bacteria have ribosomes of 70's size.

- Respiration in Animal, Plant, Protoctista and Fungi takes place in mitochondrion while respiration in bacteria takes place in mesosome

3(b)(v) Rules of binomial nomenclature are :-

i) All living organism should have scientific name

ii) Scientific name of living organism has two part, the generic name and specific name

iii) The first name should be start with Capital letter while the second name should start up with the small initial letter

iv) The name should be latinized

v) The name should be separate underline if it is written in hand form

The candidate demonstrated mastery of competencies in Classification Systems and Categories of Classification by correctly writing the scientific name of human being based on the rules of assigning scientific names to organisms. The candidate correctly listed and spelt the major classification taxa in hierarchical order from Kingdom to Species. In addition, the candidate clearly differentiated the Eukaryote Kingdoms from Kingdom Prokaryote by providing unique features of each group.

3.0 NATURAL GROUPS OF ORGANISMS

2014 Paper 2

2. (a) Account for the general characteristics of the Phylum Apicomplexa.

(b) Describe the life cycle of *Plasmodium falciparum* and the effects it causes to its host.

Q2 (a) phylum apicomplexa is among the phylum of the kingdom protoctista in which the plasmodium is present and the phylum has the following characteristics and these are

Non-Motile, Most of the organisms of which are found in the phylum are non Motile example plasmodia can not move by themselves in the body instead it is always been carried into body tissues such as blood during its life cycle.

Endo-parasite, the members of the phylum such as plasmodium they tend to live and feed on the digested food within the body of the hosts

have high reproduction potential, the members of phylum apicomplexa are able to reproduce very large amount of young and this helps them in perpetuation of the generation

Asexual and sexual life cycle, the members of phylum apicomplexa have the double life that is in the mosquito they have the sexual life cycle and in the human body they tend to have the asexual life cycle

they are unicellular, that means they are made up of the single cell so their body tend to be like a cell

02 (b) plasmodium falaparum tend to have the two types of life cycles and these include the sexual life cycle taking place in the body of the Mosquito and the sexual reproduction that takes place in the human body

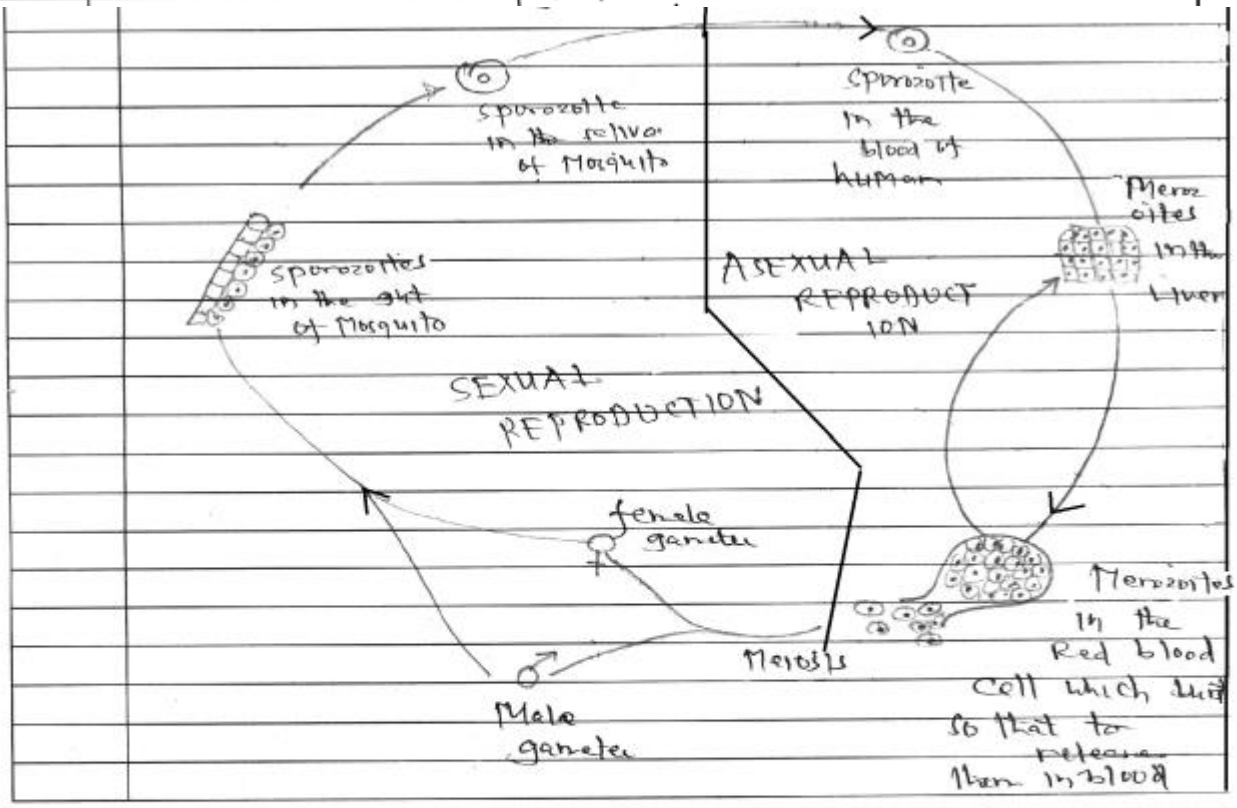
In Mosquito the plasmodium falaparum sporozoites always been attached to the gut walls and from the gut walls the sporozoites are always moved by the body fluids to the saliva of the Mosquito and once the Mosquito comes to a human body for taking meal it tends to introduce its saliva that contains also the plasmodium sporozoites.

Once the plasmodium sporozoites are been introduced into the body they always be incorporated into the blood and then been moved to the liver at the stage the plasmodium is known as the sporozoites of which after reaching to the liver the sporozoites tend to undergo the asexual reproduction to produce many other called Merozoite.

Some of the Merozoites been produced are been moved to the blood and enter to the red blood cells while other remain in the liver so that to continue undergoing the asexual reproduction so that to produce as many Merozoites as possible the Merozoites in the red blood cells tend to divide by asexual reproduction and produce many other Merozoites and these Merozoites tend to produce the male gametes and female gam

b2|b) etes of which are been sucked by the Mosquito Once it comes to take Meal once again and once they ~~reach~~ reach into the gut of Mosquito the gametes tend to combine (fertilization) by Sexual reproduction and produce the other plasmodium ~~sporozoites~~ of which will be introduced once again to the human body so that to make the continuation of its life cycle.

⇒ Diagram for Life cycle of plasmodium falciparum.



b2|b) effects that falciparum causes are
- destruction of the Liver
- destruction / bursting of the red blood cells
- cause disease called malaria to the human body

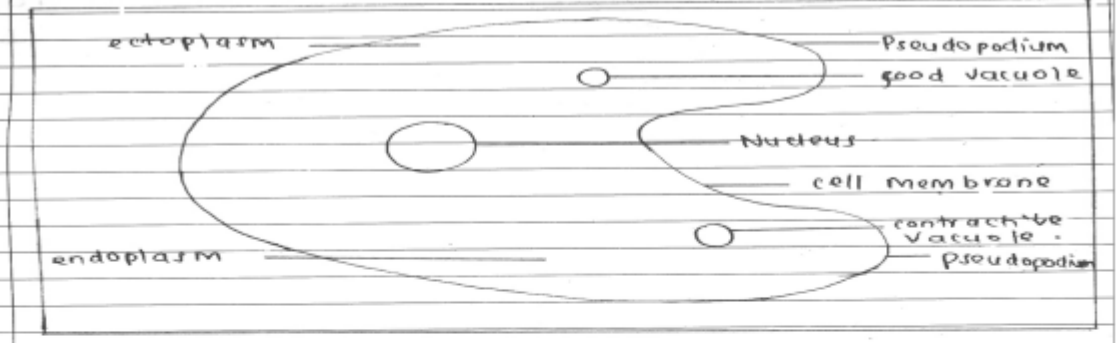
The candidate had enough knowledge about the topic, good understanding of the demand of the question and good command of English language.

2014 Paper 2

1. (a) Describe the structural adaptations of *Entamoeba spp.*

(b) Explain the advantages of algae to human being and other living things.

1 (a) DIAGRAM OF ENTAMOEBA SPP.



The structural adaptations of Entamoeba spp

i). Entamoeba spp possesses pseudopodium/a which is used for locomotion from one locality to another. The movement is achieved through pseudopodium.

ii). Entamoeba spp has ectoplasm and endoplasm; possesion of two layers of cytoplasm regulates the entry and exit of food materials and other materials.

iii). Entamoeba spp possess food vacuole. This helps an organism to store food which is used in times of lack of nutrientic contents

iv). The cytoplasm is mobile; The mobility of the cytoplasm leads to net motion of entamoeba spp which is called CYTOPLASMIC STREAMING motility.

v)	It posseses cell membrane which regulates the entry and exit of materials from the cell and also conducts intracellular impulses.
vi)	It has the nucleus which carries its genetic information and it is involved in reproduction i.e it divides to give two daughter cells by the process called binary fission.
1 (b)	Advantages of Algae to human beings.
(i)	Algae are used in culturing of other organisms such as bacteria, viruses and protozoans for example red algae.
(ii)	Algae are used to manufacture alginic acid which is a chemical constituent used industrially to form products such as paints and hence they are industrially valuable for example brown algae.
(iii)	Algar gel is produced from Algae and it is a good constituent used in chemical laboratories and industrial use to manufacture products for example salt bridges in laboratories. Algar is manufactured by blue algae.
(iv)	Green algae are photosynthetic and therefore they are used to balance levels of carbondioxide gas and oxygen gas in the air and to release oxygen gas to be used

The candidate had enough knowledge on the topic and good command in English Language. In addition, the candidate was systematic and precise in answering the question.

2015 Paper 2

1. (a) Give five reasons to justify the kingdom to which *Agaricus* belongs.

(b) With examples, explain five advantages of kingdom Plantae to human being.

It has the characteristics as explained below

(i) It has cell wall made up of chitinous material not of the cellulose. This present in kingdom fungi

(ii) It has hyphae for absorption of nutrients

(iii) It reproduces by means of spores produced in the sporangia

(iv) It undergoes heterotrophic mode of nutrition by feeding saprophytically on dead or decaying living things such as plants and animals.

(v) It store food such as glucose in form of glycogen.

1. (b) Kingdom plantae has various advantages to human being. Plants being the primary producer they convert light energy to more usable form for human being, they reduce amount of carbon-dioxide in the atmosphere by photosynthesis. Kingdom plantae has these advantages as explained here below,

Plants provide food for human being. Plants manufacture food by the process of photosynthesis by using light energy from the sun and chlorophyl with, carbondioxide and water as raw materals. For example maize plants, wheat plant

Plant provide medicine when they are extracted by human being. Medicines from plants are used to cure diseases such as quinine from qinchona tree used to cure Malaria

Plants are used in production of papers and clothes in industries by providing raw materials used to manufacture the products. For example pine plant is used for production of papers and cotton plant for manufacture of clothes in fabrics industries.

Also they are used in construction activities since they produce timber for poles used in construction of houses. For example cyprus plants (trees) mango trees.

Plant act as wind breaker also this helps to prevent strong winds to cause soil erosion and blowing of roofs. For example cover crops are grown on the soil to prevent

1 soil erosion.

Generally kingdom plantae is advantageous to human being due to the above facts and also they increase soil fertility due to their decomposition in the soil which produce humus content in the soil.

The candidate had enough knowledge on the topic as he/she managed to give reasons to justify the kingdom to which *Agarics* belongs and to explain with examples, the advantages of kingdom Plantae to human being.

2015 Paper 2

2. (a) (i) Identify divisions of the kingdom Plantae.
(ii) State three general characteristics of each division identified in 2(a) (i).

(b) Draw the structure of a moss plant and show sporophyte and gametophyte generations.

2.

(a) (i) The divisions of the kingdom plantae are

(a) Division Bryophyta.
(b) Division Filicinophyta.
(c) Division Coniferophyta.
(d) Division Angiospermophyta.

General characteristics of each division.

(a) Division Bryophyta.

(i) The gametophyte generation is dominant over the sporophyte generation.

(ii) It has no vascular tissues thus transport is by diffusion through out the body.

(iii) It has biflagellated sperm called anther ozoids which require a water as a medium for its transportation to the female gamete.

2 (a) (ii)

(b) Division Filicinophyta.

(i) The gametophyte is reduced and form a heart shaped structure called Prothallus.

(ii) It has large leaves called fronds.

(iii) The spores are in sporangia which are in clusters called sori.

(c) Division Coniferophyte.

(i) It has naked seed, that is its seed are not enclosed in the ovary.

(ii) It does not produces fruit since it lacks ovary.

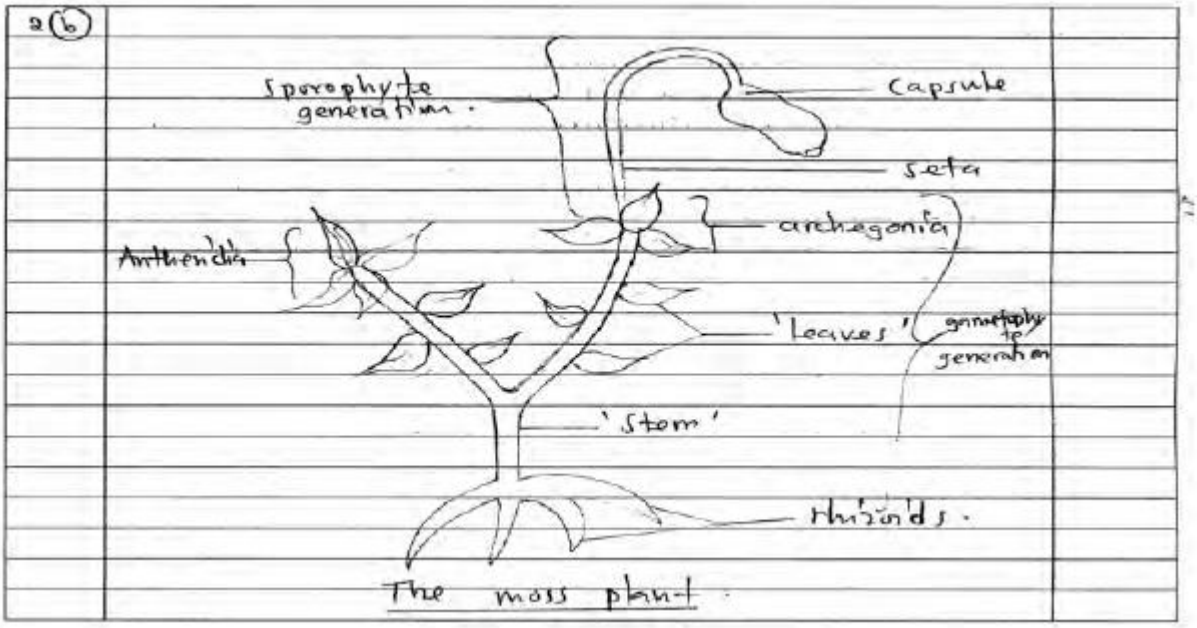
(iii) The reproductive structure is called cones

(d) Division Angiospermophyta.

(i) It has double fertilization which result into embryo and endosperms.

(ii) Its seed are enclosed in the ovary.

(iii) It produce fruit since it has ovary which during development it grows into a fruit.



The candidate was able to identify divisions of the kingdom Plantae, state three general characteristics of each division and to draw the structure of a moss plant and show sporophyte and gametophyte generations.

2016 Paper 2

2. Using diagrams and one example in each case, classify bacteria on the basis of their morphology.

2. The following is the classification of bacteria on the basis of their morphology (shape) as explained below with diagrams and examples

(i) Cocci bacteria (Singular Coccus bacteria).
- These are spherical shaped bacteria example Staphylococcus bacteria. They can occur in groups or single one depending on the type of bacteria concerned.

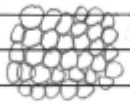
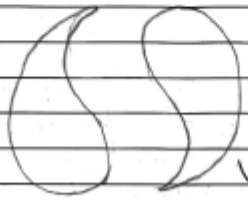


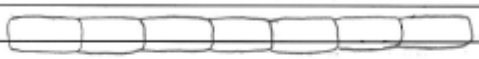
diagram showing the cocci bacteria

(ii) Comma shaped bacteria example Vibrio cholerae bacteria. These are type of bacteria which have comma shaped as shown below in more details



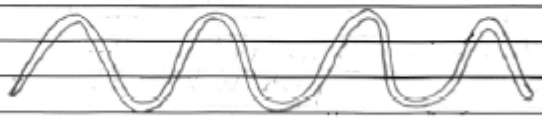
Vibrio bacteria

(iii) Bacilli bacteria (Singular bacillus bacteria). Example Salmonella typhi which causes typhoid fever. These are type of bacteria which have rod shaped morphology.



Bacilli bacteria

(iv) Spirilla bacteria. Example Treponema pallidum. These are type of bacteria which are found in our environment. They have spiral shape (morphology) as shown below



Spirilla bacteria.

The candidate was able to classify bacteria based on their morphology. He/she was also able to use diagrams and one example to illustrate the answers. In addition, he/she had good drawing skills.

2016 Paper 2

1. (a) Give five reasons to justify the class to which cockroach belongs.

   (b) Using examples, explain seven advantages of insects to human being.

1(a) cock roach

Cockroach belong to class insecta

This is due to the following reasons:

(i) The body of cockroach is divided into three parts that is head, thorax and abdomen like other member of class insecta.

(ii) Cockroach has three pairs of walking legs therefore it has six legs like other member of class insecta.

(iii) cockroach has compound eyes which contain simple eyes inside like other members of class insecta.

(iv) cockroach has simple wings for flight like most members of class insecta.

(v) cockroach has one pair of antennae like other members of class insecta.

(b) Advantages of insects to human being include the following.

(i) Insects are source of food to human being like locust. human being obtain nutrients from insects also obtain nutrients from insects products like honey which is produced by bee.

(ii) Insects produce useful products such as honey as raw materials in industries for making various products like cosmetics.

b. (iii) Insects are agents of pollination like bee and butterfly. They aid human being in the process of pollination hence insuaring the fertilination of crop plant this may lead into high productivity and also may improve living standard of human being

(iv) Some insects are used for decoration example butterfly. The dried butterfly can be used in various places like home for decoration also they can be used in offices for decoration hence making our environment beautiful.

(v) Insects provide employment opportunity to the people example keeping bees which prod uce honey. People who engage themselves in keeping bees and production of honey from bees they earn income when they sell products like honey which come from bee hence employ themselves and this lead to improvement of their living standard.

(vi) Some of insects act like scavengers they help to clean our environment and makes our environment clean and bouhful like ants, they facilitate the decomposition of dead bodies and they feed on dead body hence assisting in the process of cleaning environment

(vii) Insects are used in biological study and research example grass hopper, butterfly and cockroach also they can be used in fishing activities or hunting activities example grass hopper.

The candidate gave correct justification as to why the cockroach belongs to Class Insect. In addition, the advantages of insects to human beings, and examples such as provision of honey by honeybee were also correct.

2017 Paper 2

1. (a) Classify the following organisms to the class level.
   (i) Bean
   (ii) Crab
   (iii) Elephant grass
   (iv) Mouse.

   (b) Giving six reasons, justify the:
   (i) Phylum to which mouse belongs.
   (ii) Class to which bean plant belongs.

1(a) (i) Bean

KINGDOM - Plantae

DIVISION - Angiospermophyta.

CLASS - Dicotyledonae.

(ii) Crab

KINGDOM - Animalia

PHYLUM - Arthropoda.

CLASS - Crustacea.

1(a) (iii) Elephant grass

KINGDOM - Plantae.

DIVISION - Angiospermophyta.

CLASS - Monocotyledonae.

(iv) Mouse

KINGDOM - Animalia.

PHYLUM - Chordata.

CLASS - Mammalia.

(b)(i) six reasons to justify the phylum to which mouse belongs are:

(i) They have a notochord in atleast one stage of their life history.

(ii) They have a post-anal tail.

(iii) They have a visceral clefts

(iv) They have a dorsal-ventrally hypognyx

(v) Limbs are formed from more than one body segment.

(vi) They posses endoskeleton.

3 (b)(ii) six reasons to justify the class to which bean plant belongs

(i) They have two cotyledons.

(ii) They have net-like venation leaves.

(iii) They have a tap root.

(iv) They have a ring shape vascular bundle in stem.

(v) They have a star-shaped vascular bundle in roots.

(vi) They have ~~three~~ four/five or their multiples floral parts.

1. c) Liverworts and mosses are organism found in kingdom plantae, phylum/division bryophyta.

Amphibians are organism that are capable to live in both terrestrial and aquatic environment.

Liverworts and mosses have sometimes been described as the amphibians of the plant world because

i) Their habitats are on moist land and shady, damp places. similary to amphibian needs water and the terrestrial habitats

ii) Their fertilization needs water though they live on land. This is because they posses motile male gametes with flagella. So water help fertilization to take place that is the reason as to why liverworts and mosses are described as amphibians

iii) They have no true roots and no xylem and phloem tissues responsible for transporting water so they have to stay near water source for ensuring constant water supply.

The candidate who correctly classified the given organisms to appropriate class level and gave correct justifications as to why mouse belongs to phylum Chordata and bean plant belong to the class Dicotyledonae. They also correctly explained why liverworts and mosses are described as amphibians of the plant world.

2017 Paper 2

2. (a) Study Figure 1 and answer questions which follow.

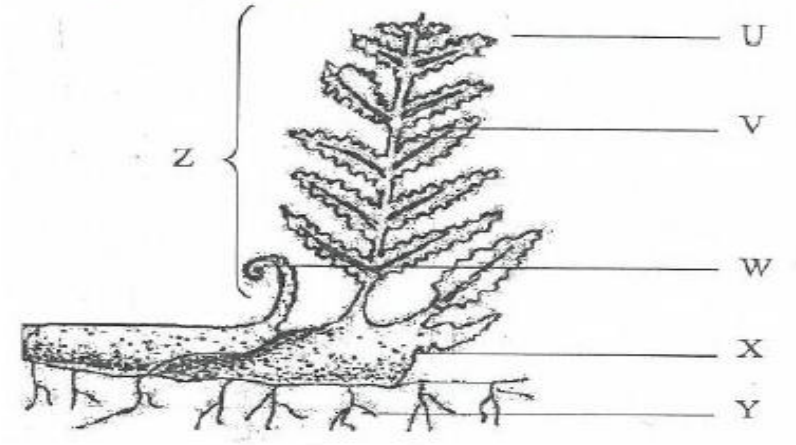


Figure 1

(i) Name the organism.
(ii) Classify the organism to division level.
(iii) Explain four general and three distinctive feature of the kingdom to which the organism belongs.

(b) (i) Identify the parts labeled U, V, W, X, Y and Z.
(ii) State three roles played by the part labeled Y.
(iii) Give five ways in which the organism structurally adapts to its mode of life.

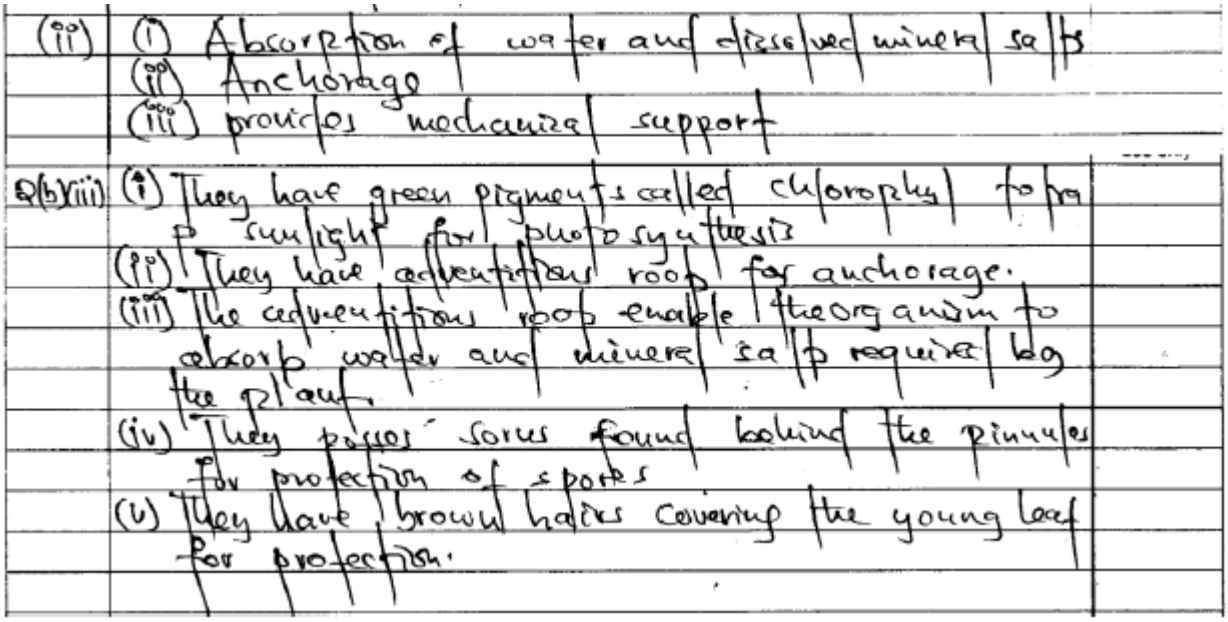
2(a)(i) fern plant

(ii) Kingdom — Plantae
Division — Bryophyta

(iii) General features
(i) They are autotrophs
(ii) Store food in form of starch
(iii) Reproduce both sexually and asexually
(iv) They do not locomote

Distinctive features
(i) Their cell wall made up of cellulose
(ii) Store food in form of starch
(iii) They show alternation of generation in which the gametophyte generation alternate with the sporophyte generation.

(b)(i) U — Pinna
V — Branch
W — Young leaf
X — Underground rhizome
Y — Adventitious roots
Z — frond



The candidate who was able to name and classify the organism in Figure 1 to division level and explain general and distinctive features of kingdom of the organisms. He/she also identified the labelled parts in the given figure and correctly stated the roles played by part Y.

1. ° (a) Give six reasons to justify that, human being belongs to phylum Chordata.

(b) Using examples, explain seven advantages of the Kingdom Animalia to human being.

1. (a) Reasons that justify, Human being belongs to Phylum Chordata.

(i) Human being have/ posesses a hollow dorsal nerve cord. All chordates posses a dorsal hollow nerve cord.

(ii) Human being have a notochord during it earlier stages of life. All chordates have a notochord, ~~either~~ rather in human it is replaced by a Vertebral Column in adult life.

(iii) Human being posses a post-anal tail. as a characteristics of all chordates human being have a post-anal tail.

(iv) Human being have pharyngeal slits. All chordates posses pharyngeal slits.

(v) Human being has a Closed circulatory system. All chordates have Closed Circulatory system.

(vi) Human being has segmented muscles. all chordates have segmented muscles.

1. (b) Advantages of Kingdom animalia to human being.

(i) Some organisms are used as source of food to man (human being). for example, locust, cows, domesticated animal (goat, sheeps) poultry are consumed by man providing man with nutrients.

(ii) Some organism are used as source of power to human being. for example horses, bulls are used to drive cart and carry people and laggages from place to place. And also Camels which are widely used as source of transport in desert areas.

(iii) Some organisms are used by human being for providing security. for example dogs are reared by man to offer security and also there are kinds of rats which are used in military to detect bombs.

(iv) The dug produced by animals including cows they increase soil fertility and hence led to increased Crop production by man.

(v) Some organism are sources of raw materials required by industries. for example wool from sheeps, skin of cows are required by industries to produce other useful products such as belts, shoes and jackets.

(vi) Some animals are used in biological Control of pests which are disease causing agent. for example by employing ducks to feed on locust in farms

vii) Some animals are used by ~~many~~ human for decoration purpose. for example, Some Coloured fishes are reared in houses for decoration purpose.

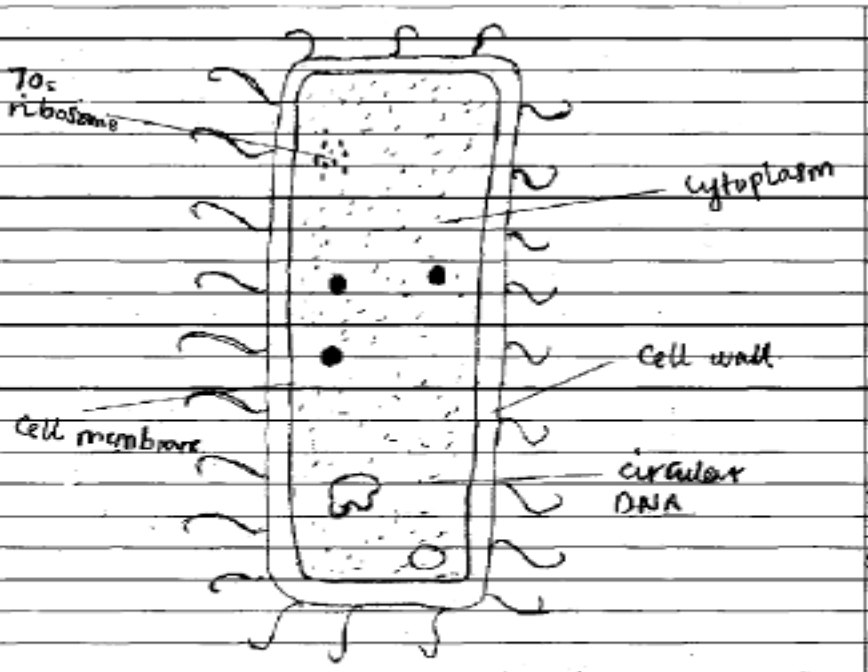
The candidate who in part (a) gave correct reasons to justify that human being belong to the phylum Chordata. In part (b), he/she gave correct advantages of Kingdom Animalia to human being.

2018 Paper 2

2. (a) (i) Draw the structure of *Escherichia coli* and label five parts.
(ii) State the role played by each part labeled in 2 (a) (i).

(b) Explain how the reproduction of bacteria takes place.

2a i



Structure of escherichia coli

ii- cytoplasm; Provide medium for other organelles to suspend in the organism like

2aii	Circular DNA	
–	70s ribosome; It Synthesize protein for the purpose of bacteria its self	
–	Cell membrane; It allow exchange of material in and out examples food substance water molecules etc	
–	Cell wall; Used to maintain its rod shape (bacilli) and provide support to them.	
–	Circular DNA; This is the genetic materials used for carrying and transmission of hereditary materials when it conjugate its self.	
b	Reproduction of bacteria is by sexual and asexual form Sexual form of reproduction (conjugation): This involve the joining of bacteria by using their pili or flagellum when a bacteria conjugate to each other one produce male gametes and another produce female gametes their conjugation result of fusion of male and female gamete form a new bacteria but this form is in small percent as compared to asexual form Asexual form of reproduction (binary fission); most of bacterias can be reproduce by binary fission in which two daughter cell are formed from one parent.	

The candidate who correctly responded to all parts of the question. He/she demonstrated enough competence in the topic of Comparative Studies of Natural Groups of Organisms and good drawing skills.

2019 Paper 2

1. Using examples, explain five advantages and disadvantages of Kingdom Fungi to human being.

1. Advantages of kingdom fungi to human beings.

a) Source of food to man.

→ Some fungi are eaten by man and hence source of protein in the body. Example the Agaricus compestris.

Helps in

b) Manufacturing of Medicines.

→ Some fungi help in manufacturing of medicines that treat bacterial diseases. For example Penicillium leads to the manufacture of Penicilin that treat bacterial diseases.

c) They are used for biological Studies or Research. For example the Neurospora.

d) They lead to bakery and alcohol production.

→ Fungi assist in fermentation process where breads and alcohols are made. Example yeast helps in bakery and Saprophytic fungi in alcohol production.

e) They Improve the Soil fertility.

→ Fungi decompose Organic matter hence leading to humus formation which adds nutrients to the Soil making the Soil fertile. For example the Saprophytic fungi.

Disadvantages of kingdom fungi to human beings

a) They Cause death, Some fungi are poisonous when eaten and hence when eaten they Cause death. For example Amanita Species of Mushroom.

1. b) They cause diseases to man.
⇒ This diseases affects the human being's health for example Candida albicans causes Candidiasis.

c) Destruction of Crops.
⇒ These is where by some Crops especially maize are destroyed by fungi making them rot. Example Puccinia fungi.

d) Destruction of Organic materials such as leather and timber and other natural fabrics by fungi and hence this brings loss to man. for example Rhizopus and Mucor.

e) Destruction of food substances.
⇒ These is where by the food substances go bad that is they rot and hence food shortage and wastage to man. for example the saprophytic fungi that make the food go bad and rot.

The candidate used correct examples to explain the advantages of the Kingdom Fungi such as the source of food to man and disadvantages such as the cause of diseases.

2019 Paper 2

2. (a) Draw a diagram of a bacteriophage and label six parts.

(b) Viruses pose problem in identification as they possess characteristics of both living and non-living things. Justify this statement by stating four living and three non-living characteristics of the viruses.

Q2: (a)

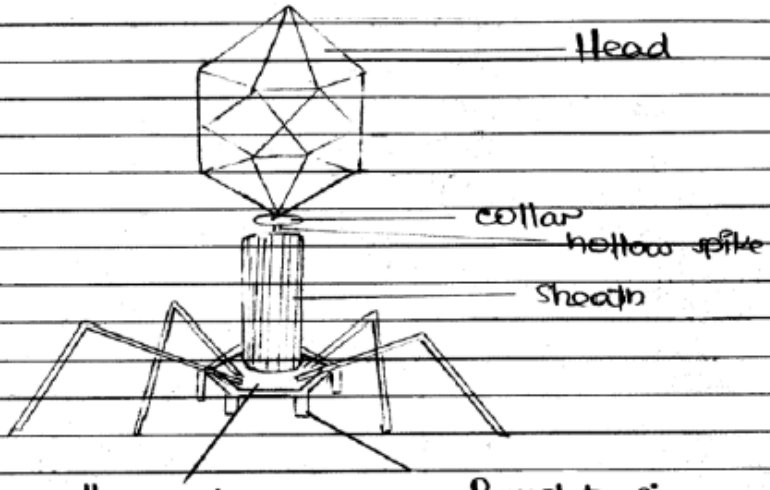


Fig: Bacteriophage

(b) Living things characteristics of Viruses

(i) They contain/poses Genetic Materials Example DNA and RNA. thus it justify that also viruses are Living things

(ii) They have ability to Replicate (self replication) since they contained with those genetic material that DNA and RNA

(iii) They can reproduce when they are inside in to other Organism, only inside of the body of another Organism hence suggest that they are Living things

(iv) They can cause diseases to human (host), that suggest that they are Living Organism.

2 (b) Non-Living characteristics of Viruses

(i) They have no Cellular structure, this justify that viruses are also non-living organisms

(ii) They are Unable to undergo multiplication when they are outside from another organism

(iii) They are ~~Cystal~~ crystal (crystalline) in nature, also

2020 Paper 2

1. (a) Euglena has both plant and animal characteristics. Explain its three plant and animal characteristics.

(b) In seven points, describe the structural adaptations of *Euglena* to its mode of life.

1. (a) Euglena refers to the organism found in Kingdom protoctista as it shew characteristics of different taxa, and posses both plant and animal characteristics.

Euglena as plant:

(i) Have chloroplast which help to undergo photosynthesis as many plants do. hence has to be considered as plants.

Q1 (ii) Has vacuole euglena have vacuole which is used for osmoregulation just like other plants.

(iii) Store food in the form of paramylon granule. euglena also store starch in the form of paramylon granule just like plant do.

(iv) Have ability to use nitrate and ammonia. also euglena can use nitrates and ammonia for its own usage just like plants who use nitrate and ammonia present in the soil for growth process.

Euglena as animal.

(i) Has myonemes which contract like muscles of animal

(ii) Have gullet which act as a mouth for heterotrophic feeding just like other animal, which use mouth for eating food hence euglena has to be considered as animal.

(iii) Have flagella which arise from base of body also euglena posses flagella which is used for Movement just like cell of animal which tend to move by using flagella.

(b) Structural adaptation of Euglena to its mode of life.

(i) Have chloroplast. Which tend to undergo photosynthesis process so as to

21 make energy available for use in the physiological process of process example respiration.

(ii) Has vacuole both food vacuole and Contractile vacuole, food vacuole is used for storage of food while Contractile vacuole is used for osmoregulation (maintainance of fluid content or osmotic pressure of the body).

(iii) Euglena has flagella which is used for Movement that is moving from one place to another, and hence enable euglena to exhibit wide variety of habitat.

(iv) Has stigma (eyespot) these is used for detecting light intensity, and so euglena is able to detect if sunlight intensity have been increased or decreased.

(v) Has pellicle, also euglen has pellicle which help to change shape and protecting inner content of euglena body.

(vi) Have gullet which act as mouth for heterotrophic feeding. euglena posses gullet for feeding when autotrophic mode of life is limited.

(vii) Has ability to store food in form of paramylam granule for use during starvation, hence ensure their survival. When environmental stress became rampat to them.

The candidate gave correct plant characteristics of euglena, such as possession of chloroplast and animal characteristics such as possession of gullet. She/he also gave correct adaptations of euglena to its environment such as ability to store food for use during adverse conditions.

4.0 COORDINATION

2014 Paper 1

9. Explain the seven roles of synapse.

9

Synapse is the link between two adjacent neurones. A synapse consists of a tiny gap known as the synaptic cleft. The synapse is a link between the axon of one neurone and the dendrites of another neurone.

Roles of synapse

(i) Unidirectionality

The presence release of the neurotransmitter substance at the pre-synaptic membrane and the presence of receptor sites at the post-synaptic membrane ensures that nerve impulses flow or pass in only one direction along a given pathway. These ensures that the nerve impulses reach their particular destination.

(ii) Adaptation and fatigue

The amount of neurotransmitter substance released at the synapse continuously falls in response to a constant stimulation. This is known as adaptation. The neurotransmitter substance may be exhausted in which case the synapse is said to be fatigue. Fatigue prevents the damage of the nerve cell as a result of constant stimulation

(iii) Amplification

Sufficient amount of neurotransmitter substance are released at the synapse. Therefore the weaker nerve impulses arriving at the synapse may cause a response as they are amplified by the sufficient release of the neurotransmitter substance.

9

(iv) Facilitation.
Each nerve impulse passed at the synapse leaves the synapse responsive to the successive/coming nerve impulse. This increases the sensitivity of the system and helps the successive/coming nerve impulse to be able to cause a response.

(v) Filter out low level stimuli
For the neurotransmitter substance to be released there is a threshold frequency of stimulation below which no release of neurotransmitter substance. Thus low level stimuli which have not attained threshold frequency will not cause the release of neurotransmitter substance hence they are not carried any further. They end at the synapse

(vi) Transmission of nerve impulses.
This is the major role of the synapse. The synapse passes nerve impulse from one neurone to another. Because the two adjacent neurones have no physical contact, the synapse plays a role of transmitting nerve impulses from one neurone to another.

(vii) Convergence, integration and summation
The synapse receives a number of both inhibitory and excitatory presynaptic potentials and then adds or combines them to give a response. The combination of these excitatory presynaptic potentials is very helpful as it allows a synapse to give a coordinated response.

The candidate's responses indicate that he/she had enough knowledge on the topic, good understanding of the demand of the question and used correct English language in his/her explanations.

2014 Paper 1

7. (a) Distinguish nastic movements from tactic movements in living organisms. Give one example in each case.

(b) Explain the importance of tropic movement in plants.

7 (a) NASTIC Movement is a non-direction movement of an organism or part of an organism in response to diffuse stimulus. Example Movement of Mimosa pudica leaves in response to touch

WHILE

TACTIC movement is the movement of whole body or a cell of an organism in response to unilateral source of stimulus Example Movement of Sperm towards an egg is chemotaxes

(b) Importance of tropical Movement in plants are

i) Exposure of plant leaves to sunlight wh

7(b) ich they trap it and use for the process of photosynthesis. This is PHOTOTROPISM

ii/ Helps plant to anchor well in the soil and hence facilitate proper growth. This is GEOTROPISM where roots grow towards the soil

iii/ Helps plant to get water necessary for different chemical reactions in their bodies such as respiration and photosynthesis. This is HYDROTROPISM where plant grow towards the water

iv/ Helps to give support to non-wood plants by coiling themselves around the wood plants. This is THIGMOTROPISM where movement is in response to touch

v/ It ensures that during germination shoot always grows upwards and root always grows downwards into the soil.

vi/ It exposes leaves to the air for proper gaseous exchange. This is PHOTOTROPISM where shoot grows upwards

vii/ Plagiogeotropism ensures Maximum colonization of an area by a plant because in this case plant grows horizontally

viii/ It helps plant to escape from direct heating from the sun by bending opposite to the sun. This is AEROTROPISM and occur in the sunflower

The candidate had sufficient knowledge on the topic of Coordination and managed to adhere to the question demand. The candidate's responses were also clear in terms of English language and straight to the point.

2015 Paper 1

10. Explain the process of nerve impulse along the axon and across the synapse of the neuron.

10: MECHANISM OF NERVE IMPULSE ACROSS THE AXON

① When the Axon membrane is stimulated by an impulse, it becomes depolarized such that the potential across the axon changes from negative to positive inside with respect to the outside.

The depolarization of the axon membrane causes the influx of Sodium ions in the membrane, this increases the permiability of membrane to Sodium ions again.

The localized circuits are established along the membrane as the impulse progresses forward the membrane however these circuits take place behind the impulse.

As the impulse progresses, the permiability of the axon membrane decreases and this causes the out-flux of potassium

10. Ions which goes to balance the charge outside.

When an impulse has fully passed the membrane, the Sodium ions are actively expelled out such that the membrane is Repolarized to allow the conduction of another impulse

10: MECHANISM OF IMPULSE CONDUCTION ACROSS THE SYNAPSE

A Synapse is the point at which the axon of One neuron meet the body of another neurone but without physical contact.

When an impulse arrives at the Synapse, it causes the depolarization of Presynaptic membrane causes the influx of Calcium ions in the pre-synaptic membrane.

The influx of calcium ions causes the presynaptic membrane to fuse with the Synaptic vesicle thereby releasing the acetyl choline neurotransmitter to the Synaptic cleft.

10: The Acetyl choline diffuse across the Synaptic cleft ~~and~~ to the receptor sites on the Post-Synaptic membrane. ~~This~~ an

The Post-synaptic membrane is depolarized by the influx of Sodium ions thus initiating the generator potentials which form the action potential

The acetyl choline is hydrolysed by the Acetyl choline Sterase enzyme from the post-Synaptic membrane to Acetyl and choline.

The two components diffuse via the Synaptic cleft to the Synaptic knob where the energy in form of ATP from the mitochondria recombines the Acetyl to Choline to form acetyl choline.

The acetyl choline is restored in the Synaptic Vesicle for further use.

The responses indicate that, the candidate was knowledgeable as he/she managed to explain the process of nerve impulse along the axon and across the synapse of a neuron.

2015 Paper 1

4. (a) Explain three characteristics of nerve impulse.

(b) Why do myelinated axons of frog having a diameter of 3.5 micro-meter conduct impulse at 30 m s^{-1} whereas axons of the same diameter in cat conduct impulses at 90 m s^{-1}?

(d) The following are three characteristics of Nerve Impulse:-

(i) Speed of conduction / transmission.

Nerve impulse transmission occurs at high speed. The speed of transmission of nerve impulse can depend on the following factors;

- Temperature of the body, the higher the temperature, the higher the speed of transmission.
- Axon diameter, the larger the axon diameter, the low the resistance hence the higher the speed of nerve impulse
- Myline sheath, Presence of myline sheath makes the transmission to be fast since there is jumping of impulse from node of Ranvier to another, the process called Saltatory conduction.

(ii) Refractory period.

This is the time between transmission of one nerve impulse to another. Refractory period can be absolute by which however the intensity of stimulus is, transmission can not occur. This lasts for about 1 millisecond. Also it can be relative, whereby if the intensity of stimulus is high, nerve impulse transmission can occur. This lasts for about 5 milli seconds.

- Refractory period helps in unidirectional transmission of nerve impulse as well as separates one impulse from the other.

(iii) All-or-nothing law

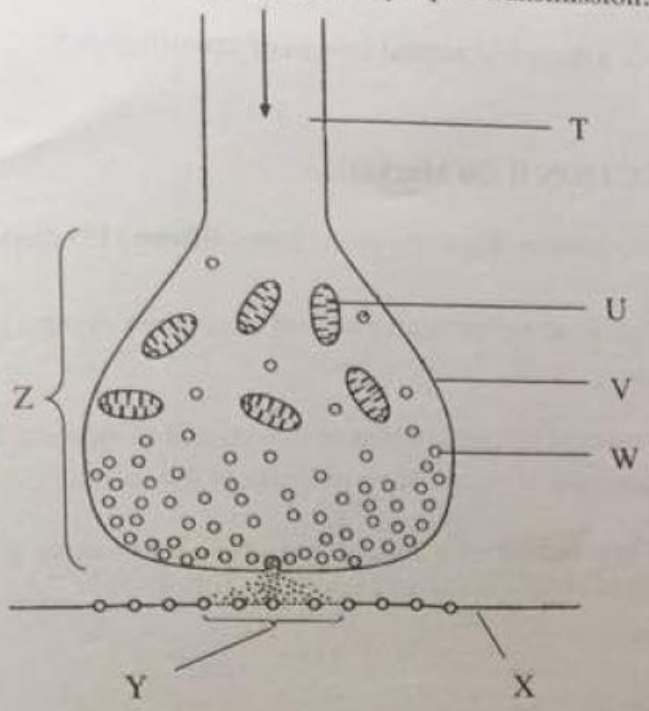
This law demands that "The intensity of stimulus can not affect the extent to which an impulse is transmitted". Transmission occurs only when the stimulus reaches threshold frequency. Above the threshold frequency, there is no further generation of nerve impulse.

01f	(b) This is because the cat is a warm blooded animal whereas the frog is a cold blooded animal. Therefore, ~~cat~~ speed of conduction of nerve impulse in cat is contributed by its high body temperature, frog being with low body temperature has low speed of transmission of nerve impulse.

The candidate had adequate knowledge on the topic of Coordination, good understanding of the question demand and good mastery of English Language. Thus, he/she managed to respond to the question accordingly.

2017 Paper 1

4. (a) Figure 2 shows a certain stage of synaptic transmission.



(i) Identify each of the parts labeled T, U, V, W, X and Z.

(ii) What is the state of the region shown by letter Y?

(iii) State the role played by structure labeled U and W respectively.

(b) Why do some impulses arriving at the pre-synaptic membrane fail to produce an action potential in the post synaptic neuron whereas several impulses arriving in succession can do so?

4a. i) T - Axon

U - Mitochondrion

V - Pre-synaptic membrane.

W - Synaptic vesicles

X - Post-synaptic membrane.

Z - Synaptic knob

ii) State of the region Y is Depolarisation.

iii) Role played by part U.

- Provide energy required by the synaptic vesicles during recombination of acetyl and choline to form the transmitter substance Acetylcholine.

Acetyl + Choline $\xrightarrow{ATP}$ Acetylcholine.

Role played by part W.

- They contain neurotransmitter substance which is responsible in transfer of impulse. Example of neurotransmitter substance is Acetylcholine (Ach).

4b. Several impulse arriving in succession produce an action potential as a result of additive or cumulative effect brought about by each. This is SUMMATION.

Summation involves adding up the effect of individual weak impulse to produce an action potential. Weak impulses fail to produce an action potential by being below the threshold frequency. Simultaneous arrival of stimulus impulse is then added to increase strength of the impulse and hence produce an action potential.

The candidate who correctly identified the labelled parts and named the state of the region labelled Y. He/she also stated the roles of parts labelled U and W. He/she gave the correct reason as to why some impulses arriving at the pre-synaptic membrane fail to produce an action potential in the post synaptic neuron.

2018 Paper 1

6. (a) What is phytohormone?

(b) Outline three roles of each of the following phytohormones:

(i) Auxins

(ii) Gibberellins

(iii) Cytokinins.

Ans 6. (a) Phytohormone: Are chemical substance produced by plant which bring about psychological effect ie growth in plant such as auxin, cytokinin, ethene, abscessic acid (ABA)

(b) (i) The roles of Auxins are.

→ It promote cell elongation in plant
→ It promote fruit development and induce palthenpcarpy.
→ It promote root growth and development on cutting

(ii) The role of Gibberellins

→ It promote cell growth and diveision
→ It enhance palthenocarpy.
→ It promote flower development.

(iii) The role of cytokinins are.

→ It break seed and bud dormancy.
→ It delay leaf senescence
→ It promote palthenocarpic fruit development.

The candidate who knew the concepts of phytohormone. He/she correctly explained the meaning of phytohormone and outlined the roles of auxins, gibberellins and cytokinin's.

2018 Paper 1

3. (a) Distinguish between the following:
   (i) nervous and hormonal coordination. Give four points.
   (ii) positive and negative feedback of body temperature regulation process. Give two points.

   (b) Examine four properties of a hormone which enable it to accomplish its function.

3 (a) (i)	Nervous coordination	Hormonal coordination
	- Involve both chemical and electrical traimission of information.	- Involve the chemical tranimission of information.
	- Rapid traimission and response	- Slower traimission and slower response except adrenaline.
	- Short term changes	- Cause long term changes example growth
	- Pathway specific through nerve cells	- Pathway not specific as it travel in blood.
(ii)	Positive feeback of body temperature regulation	Negative feedback of body temperature regulation
	- This ~~ea~~ lead to further increase of body temperature in the body or further dencrease of body temperature from the optimum or reference point.	- This cause the temperature of the body to return to its optimum level in the body by preventing further deviation from optimum point.
	- This increase unstability of the system.	- This increase the stability of the system.

2	(b) - Hormones are specific to their target organ. This enable hormones to carry information to the specific location or organ in the body. - Hormones travel in blood from the gland to target organ - Hormones have effect in region different from where they are produced. - Hormones are soluble. This enable them to travel through blood.	

The candidate who correctly distinguished the terms: nervous and hormonal coordination, and positive and negative feedback of body temperature regulation process. He/she correctly examined the properties of a hormone which enables it to accomplish its function.

2019 Paper 1

4. (a) Identify four main types of receptors and state the role of each.

(b) Describe the effect of the following factor in transmission of nerve impulse:
(i) Axon diameter.
(ii) Myelin sheath.

4 iii) PHOTORECEPTORS.
- These are receptors which play a role of detecting light stimuli.

iv) MECHANO RECEPTORS
- These are receptors which play a role of detecting mechanical stimuli such as touch.

b) i) AXON DIAMETER.
- Axon diameter affects the transmission of nerve impulse in the following way :-
- Axon with greater diameter usually speedsup the transmission of nerve impulses this is because in larger axons having great diameter the resistance offered by the axoplasm is usually less and due to this nerve impulses tend to travel at a faster rate.
- Also to the axon with smaller diameter the rate of nerve impulse transmission is usually too low this is because there will be greater resistance offered by the axoplasm which will tend to slower the speed of the nerve impulse.

ii) MYELIN SHEATH.
- To the axon with myelin sheath usually the nerve impulses are propagated at a faster rate compared to the non-myelinated axon.
- Between one myelin sheath to the other there is a space known as node of Ranvier. Myelin sheath dont conduct the nerve impulse but instead the impulses will be moving / jumping from one node of ranvier to another and this movement is known as saltatory movement. This movement is actually the reason to the faster speed of nerve impulses along the axon.

The candidate described the effect of large axon diameter as to lower transmission speed and myelin sheath to hinder nerve impulse transmission which are incorrect responses.

2019 Paper 1

6. (a) State the function of each of the following neurons;
   (i) Motor
   (ii) Sensory
   (iii) Relay.

   (b) (i) Explain how the receptors of nervous system communicate with effectors.
   (ii) Briefly describe how the structure of the synapse ensures that the signals can only pass through it in only one direction.

6(a)(i) Motor Neurone.
This links the central nervous system and the effector where the response is to be initiated. Dendrites carry information towards the cell body that directs it to the axon and towards the synapse.

(ii) Sensory Neurone.
This links the outside invironment and the Central nervous system. This detect the stimuli. They are mainly found in the receptors

(iii) Relay neurone.
This act as an intermediate, it links the motor neurone and sensory neurone.

b.(i) The receptors of the nervous system have the sensory neurone which detect the stimuli from the enviroment. The stimuli is detected and the impulse is generated which is sent to the Central nervous System.
The central Nervous system is composed of the Brain and the Spinal cord. This interpret the required stimuli and gives off the appropiate response through the motor Neurone of the specific effector.
The dendrites of the motor neurone will conduct the impulse towards the cell body and directed to the axon that is towards the synapse and the response is then achieved. The relay neurone act as an intermediate between motor neurone and sensory neurone.

Receptor	→	Brain / Spinal cord	→	Effector
Sensory neurone		Central Nervous System		Motor Neurone

(ii) • Presence of receptors on the post-synaptic membrane that will only detect impulse from the before neurone that are on the cleft.

• Presence of presynatic membranous vesicle that will release neuro transmitter on the cleft and not other wise.

The candidate was able to state the function of nerve and explain well how communication occurs in the nervous system.

2020 Paper 1

2. (a) (i) Identify three types of nerve cells.
(ii) State the role(s) of each nerve cell identified in 2 (a) (i).

(b) Give a reason to support the fact that giant axons conduct impulses at greater velocities than thin axons.

2. (a) (i) (a) Sensory neurone
(b) Motor neurone
(c) Relay neurone

(ii) (a) Sensory neuron
- It conduct impulse from the sensory organ and and transmit to the central nervous system for interpretation. (brain and spinal cord)

(b) Motor neurone
- It conduct impulse from the central nervous system (brain and spinal cord) to the effector organ.

(c) Relay neurone
- It act as link between one neurone and another ie it connect motor neurone and sensory neurone to perform their function effectively.

(b) Resistance of axoplasm decrease as diameter of the axon increase. As the resistence decrease the length of the membrane increase by local circuit increase, these lead to increase in transmision of nerve impulse at a greater velocity. ie In giant axon the diameter of the axon is large hence conduct impulse at greater velocity compared to thin axon which have smaller diameter.

The candidate correctly identified the types of nerve cells and stated their roles.
The candidate also correctly gave the reason for the giant axons to conduct impulses at greater velocities than thin axons.

5.0 NUTRITION

2014 Paper 1

2. (a) Define the following terms:
   (i) Photoautotrophs
   (ii) Chemoheterotrophs

   (b) What would be the effect of lowering oxygen concentration on the following:
   (i) C3 photosynthesis
   (ii) C4 photosynthesis

   (c) (i) Why is it an advantage that bundle sheath chloroplasts lack grana?
   (ii) What would happen to the activities of intestinal enzymes if the pH in intestine remains at 2?

Q2.

(a)(i) Photo autrophs
- There are the organisms which are able to use the light energy to synthesize their own food substances due to presence of Chlorophyl example green plants and grasses.

(ii) Chemoheterotrophs
- There are the organisms which are not able to synthesize their own food substances but use the chemical substance of the already synthesized food for their body activities
Example are the sulphur bacteria which use the chemical to synthesize their own food.

Q2

(b) i/ The lowering of Oxygen Concentration in the C_3 plants will help them increasing the process of synthesizing food because C_3 plants have affected by effect of O_2 Concentration due to photorespiration in which their cells of RuBp Carbondioxide acceptor have competetive effect with O_2 hence the reduction of Oxygen to C_3 plant will favour the photosynthesis process and reduce the photo-respiration effect

ii) The lowering of oxygen concentration have no effect on the C_4 photosynthesis plant because their enzyme of Carbondioxide acceptor PEP (carboxylase have no competetive effect of Oxygen ~~but he~~

2(c)(i) The advantage of bundle sheath & lack grana is that it reduces the competetive effect of carbondioxide receptor RuBp as their enzyme have high affinity to oxygen and favour the Photorespiration instead of Photosynthesis

(ii) if the pH in the Intestine will remain 2 it will cause the denature of the enzyme.

The candidate had sufficient knowledge on the topic of Nutrition.

2015 Paper 1

11. Study Figure 3 and answer questions which follow:

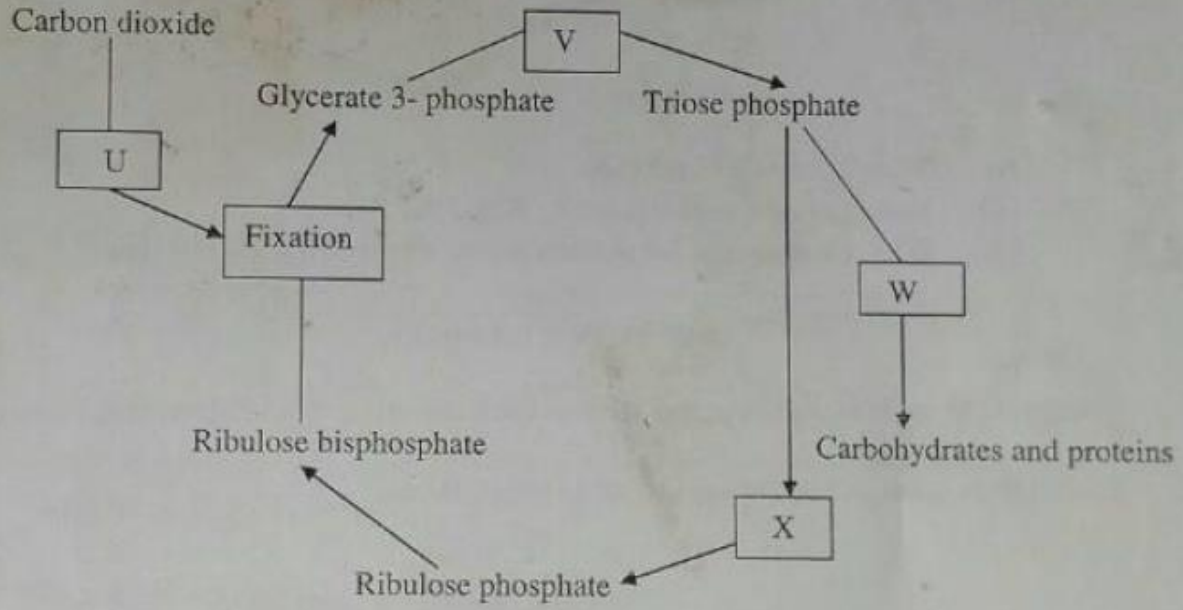


Figure 3

(a) (i) Name the process illustrated by Figure 3.

(ii) Name the steps in the process indicated by letter U, V, W and X.

(b) Explain Hatch-Slack pathway in C_4 plants.

11. a) i) The process illustrated is Light Independent reaction (Calvin cycle)

ii) steps:-

U - The step is carbondioxide fixation, as the carbondioxide is fixed by Ribulose biphosphate Carboxylase enzyme.

V - Is reduction step, at which glycerate 3-phosphate is reduced by $NADPH_2$ and acted by ATP to form Triose phosphate.

W - Is the step showing Fate of Triose phosphate in synthesizing other food materials like carbohydrates and protein.

X - Is the step showing Regeneration of Ribulose phosphate later forming Ribulose biphosphate.

11 b). Hatch-slack pathway in C_4 plants is the pathway which shows the transportation of carbondioxide gas and hydrogen from Mesophyll cells to bundle sheath cells. The process do occur in C_4 plants whose first product is a 4 carbon compound, it occurs in chloroplast which have Kranzy anatomy that is two rings of chloroplast a Mesophyll ring cell and bundle sheath cells, the process occur as follows:-

Carbondioxide fixation, In this case in C_4 plant Phosphoenolpyruvate (PEP) do accept or fix carbondioxide gas in presence of an enzyme Phosphoenol pyruvate carboxylase, to form a 4 carbon compound called oxaloacetate which later break form malic acid as shown below.

Phosphoenolpyruvate + CO_2 —(Phosphoenol pyruvate carboxylase.)→ Oxaloacetic acid.

Then.

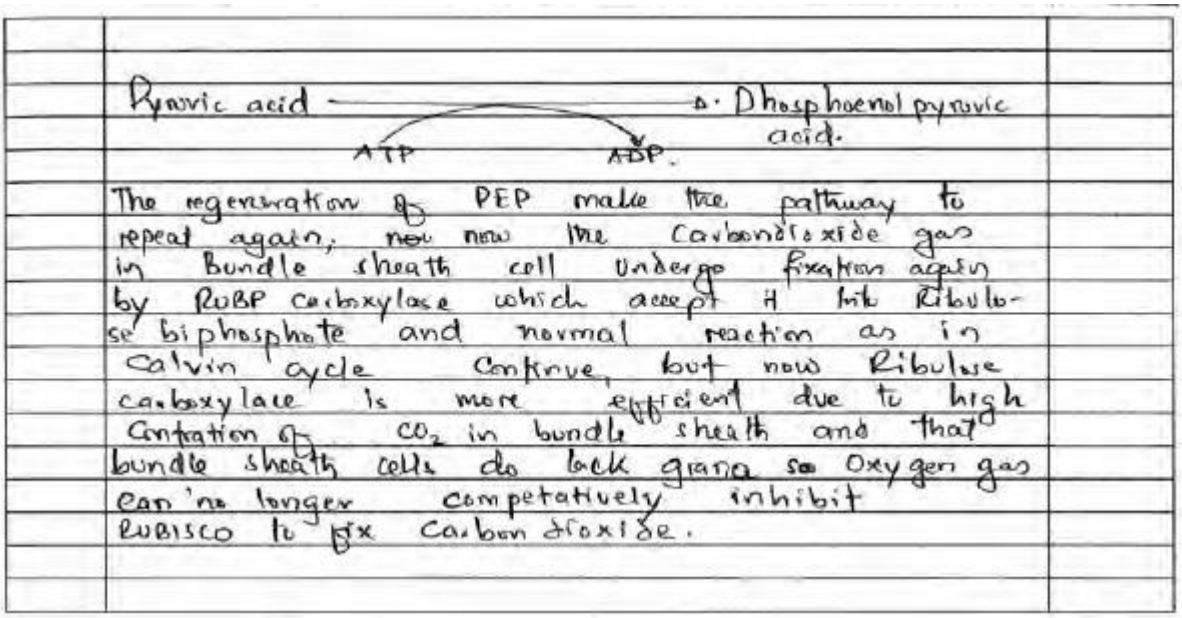
Oxaloacetic acid —($NADPH_2$ → $NADP + H_2O$.)→ Malic acid.

All this process do occur in Mesophyll cells.

Malate shunt in this case the malic acid formed is shunted into Bundle sheath cells through plasmodesmata, where now further reaction do occur, at which the Malic acid is reduced into CO_2 and Pyruvic acid Molecule as shown below

Malic acid —($NADPH_2$ → $NADP + H_2O$.)→ CO_2 + Pyruvic acid

Regeneration of Phosphoenolpyruvate, now the formed pyruvic acid is shunted back again into Mesophyll cells where it is Converted into Phosphoenolpyruvate again by ATP Molecule as Shown below.



The candidate had enough knowledge as he/she managed to name the required process, the steps shown by the process and explain the Hatch-Slack pathway in C_4 plants.

2015 Paper 1

5. (a) Write a balanced equation of photosynthesis and from the equation, state which factors and conditions are likely to affect the rate of photosynthesis.

(b) Explain events which take place during dark reaction.

5 a/ $6CO_2 + 12H_2O \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} C_6H_{12}O_6 + 6O_2 + 6H_2O$

- The factors which may affects the rate of photosynthesis are Carbondioxide and water.
- And conditions are Sunlight and chlorophyll.

b/ Events which takes place in dark reaction.

1. Carbondioxide fixation

In dark reaction carbondioxide is fixed by (RUBP) rubitose biphosphate in presence of enzyme called ~~Rubisco~~ RUBP carboxylase and form 6C carbon compound which is intermediate and soon after formation disomb gives to three carbon compound called Phosphoglyceric acid PGA. $RUBP + CO_2 \xrightarrow[\text{carboxylase}]{\text{RUBP}} 3C\ (PGA)$

2. Reduction phase

The three carbon compound formed PGA is reduced to phosphoglyceraldehyde (PGAL) which contain more chemical energy than PGA. The reduction is done by NADPH2 and in this process ATP is used.

PGA $\xrightarrow{ATP \rightarrow ADP+P_i;\ NADPH \rightarrow NADP^+ + H}$ PGAL

3. Regeneration of RUBP

Some molecule of PGAL is converted through series of reaction to RUBP and the process use ATP this is done in order for the process to continue that means it ensures the availabilities of RUBP, carbondioxide acceptor to accept more carbondioxide. But some are converted to starch, lipid and protein.

The candidate had good understanding of the question demand and sufficient knowledge on plant nutrition. Thus, the candidates managed to write a balanced equation of photosynthesis, to state factors and conditions which are likely to affect the rate of photosynthesis and to explain the events which take place during dark reaction.

2017 Paper1

5. (a) Briefly explain the roles of the following in photosynthesis:
   (i) NADP.
   (ii) Ribulose diphoshate.
   (iii) Photosytems I and II (PSI and PSII).

   (b) Giving reason, explain the effect of lowering oxygen concentrations on:
   (ii) C3 photosynthesis.
   (iii) C4 photosynthesis.

   (c) Why the rate of photosynthesis decreases at high temperatures?

5. @ (i) NADP is an electron acceptor hence hydrogen acceptor, it combine with electron and hydrogen to form NADPH and this NADPH is used as a hydrogen carrier which is used in the dark reaction in photosynthesis for making sugar carbohydrate. Hence, NADP is reduced to NADPH for carriage of hydrogen hence electron and hydrogen carrier.

(ii) Ribulose diphosphate act as a carbondioxide gas acceptor in dark reaction during photosynthesis reaction hence leading to the production of food molecules which are locked in chemical bond as a phosphoglycerate molecule which is a 3C-compound. Therefore Ribulose diphosphate accept/combine with carbondioxide hence leading to the making of phosphoglyceric acid as the primary intermidiate food.

(iii) Both photosystems I and photosystem II (PSI and PSII) help much in the release of electron which act as the means of ~~p~~ in photosynthesis process which combine with NADP and hydrogen to form NADPH.
—Also these photosystems ~~act as the~~ absorb sunlight from the sun thus leading to the excitation of electrons to high energy which on the result they involve in energy synthesis when they tend to come to the lower energy level.

(5) (iii) Lowering Oxygen concentration on C_4 photosynthesis does not affect C_4 photosynthesis since in C_4 plants there are two cell involved in the fixation of carbondioxide that is mesop bundle sheath cell and mesophyll cell also there is an enzyme called phosphoenol pyruvate carboxylase (PEPcase) which is has high affinity to carbondioxide as the result there will be normal photosynthesis as usual and no effect with Oxygen to C_4 photosynthesis will affect.

(ii) Lowering Oxygen concentration on C_3 photosynthesis favours photosynthesis in C_3 plant since in C_3 plant there is their chloroplast there is an enzyme which is Ribulose bisphate Carboxylase (RUBISCO) which has high affinity to Oxygen than carbondioxide as the result when Oxygen is lowered in C_3 plant then phot normal and high yields of photosynthesis will attain since Ribulose bisphate carboxylase (RUBISCO) will fix Carbondioxide normal and at high rate.

(c) The rate of photosynthesis decreases at high temperature since at high temperatures enzyme which are involved in photosynthesis are denatured by being destroyed their active site for the substrate to bind hence lowering in photosynthesis rate for example Ribulose bisphate carboxylase and phosphoenol pyruvate Carboxylase (PEPcase) will be denatured hence Carbondioxide fixation will fail hence lowering in photosynthesis rate.

The candidate who correctly explained the roles of NADP, Ribulose diphosphate and Photosystem I and II. He/she managed to explain the effect of lowering Oxygen concentrations on C3 and C4 photosynthesis and gave correct reasons to support the decrease of the rate of photosynthesis at high temperatures.

2018 Paper1

4. (a) Study the photosynthesis equation given below and answer the questions which follow:

$$6CO_2 + 6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$$

(i) Give two reasons to justify the fact that, this equation is not correct although it is balanced.

(ii) Identify two types of reaction that take place in photosynthesis process and state specifically where in the cell does each reaction takes place.

(b) Explain how each of the following factors affects the rate of photosynthesis:

(i) Temperature

(ii) Inorganic ions.

4 (a) (i)

$6CO_2 + 6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$.

The equation above is not correct although its balanced because:-

- Equation show that oxygen released comes from carbondicxide, but the radioactive reveals that the oxygen released come from photosplitting of water molecules.

$$H_2O \xrightarrow{\text{Light}} 2e^- + 2H^+ + \frac{1}{2}O_2$$

- Also the equation does not show water (H_2O) molecules as end product, but its clear that during photosynthesis water molecules are released.

hence

$$6CO_2 + 12H_2O \longrightarrow C_6H_{12}O_6 + 6O_2 + 6H_2O$$

(ii) Types of reactions that take place in photosynthesis process are:-

- light dependent photosynthesis also known as light reaction
- take place in grana and thylakoids.

- light independent phase, also know as dark reaction
- take place in stroma.

4 (b) (i) Temperature affect the rate of photosynthesis in three ways: since we know that photosynthesis is an enzymatic reaction example ribulose carboxylase. Hence:-

- When temperature increase the rate of photosynthesis also increase due to activation of enzymes but more increase in temperature denature the enzymes.
- But also ~~att~~ at low temperature the rate of photosynthesis is low because the enzymes are in inactive.
- Now the high rate of photosynthesis is favoured by moderate or optimum temperatures.

(ii) Inorganic ions example Mg^{2+}, K^{+}, Ca^{2+}

- The rate of photosynthesis increase with the increase in required organic ions, As the required organic ions facilitate health and maintain leaf greenish and thus support the increase in rate of photosynthesis

The candidate with adequate knowledge of the topic of Nutrition as he/she managed to respond to all parts of the question correctly. In addition, the candidate had a good command of English Language.

2019 Paper 1

5. (a) Study Figure 2 which represent a certain tissue and answer the questions that follow.

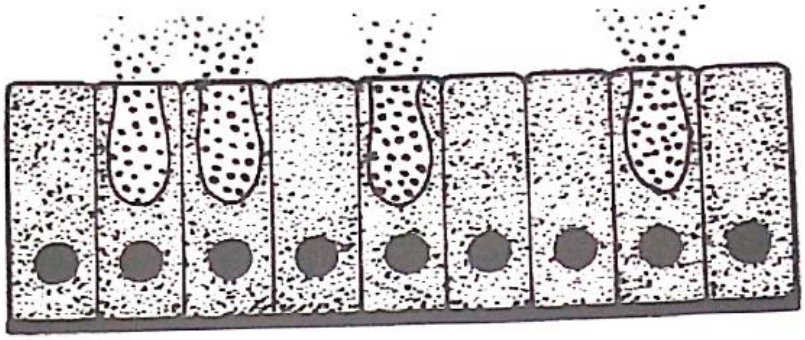


Figure 2

(i) Identify the type of tissue represented by the Figure 2.
(ii) Examine the digestion role played by the tissue.
(iii) Elaborate how the structure of the tissue relates to its function.

(b) (i) Examine three features of the ileum which increases its surface area.
(ii) Why is it an advantage for the ileum to have large surface area? Give two reasons.

05 (a) (i) Glandular tissue

(ii) To secrete mucus that have various roles such as lubricating the food as well as trapping the dusts and microorganisms taken mistakenly into the body

(iii) – It consists of numerous secretory cells that ensures that the mucus are secreted

05. (b) (i) – It is highly coiled to increase the surface area

– It is made up of numerous finger – like projections called villi to increase the surface area.

– It is too long so as to increase its surface area.

(ii) – To increase the rate at which the diffusion takes place through it.

– To allows for the efficient absorption of the digested food substances

The candidate in item (b) (i) named some parts of the alimentary canal instead of stating features of ileum that increase its surface area. These responses imply that the candidate failed to identify the demand of the question.

2019 Paper 1

7. Evaluate the importance of light and dark reaction processes of photosynthesis to life.

7. Importance of light and dark reaction processes of photosynthesis to life.

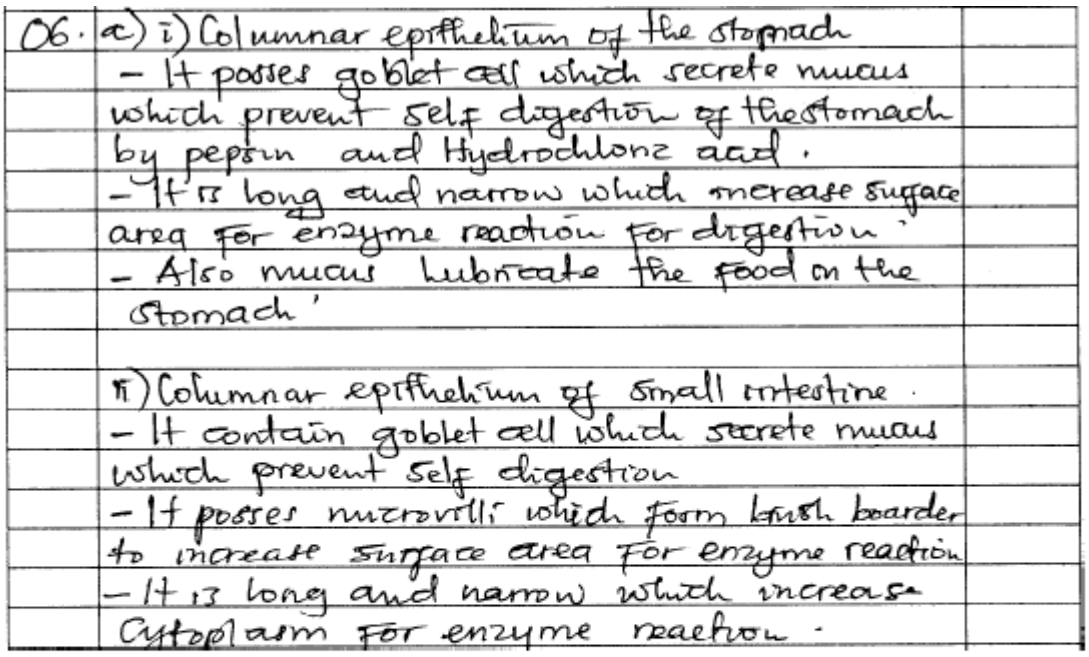
1. Light reaction processes convert sunlight into chemical energy that can be used by plants and other organisms after consumption.
2. Light reaction processes produce oxygen gas which adds up to the oxygen content in the atmosphere that can be used for respiration.
3. Dark reaction processes uses or fix up carbondioxide hence reducing carbondioxide content in the atmosphere that helps to prevents global warming.
4. Dark reaction processes produce carbohydrate which acts as a source of food to other organisms and hence production of energy after respiration.
5. Dark reaction processes produce water vapour as a product which adds up to the content of atmospheric vapour that helps in rain formation.

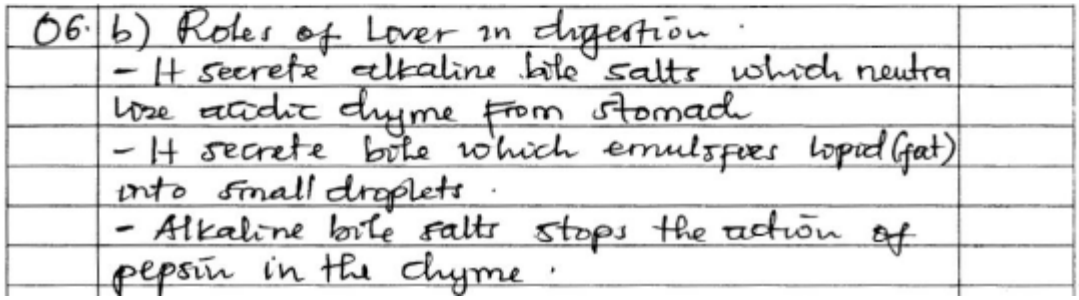
The candidate correctly stated the importance of light reaction and dark reaction to life as result merited to score high marks allotted to this question.

2020 PAPER 1

6. (a) How do the following structures relate to their digestive role?
   (i) Columnar epithelium of the stomach.
   (ii) Columnar epithelium of the small intestine.

   (b) Giving two points, briefly describe the role of liver in digestion.





The candidate correctly explained the presence of goblet cells in the columnar epithelial cells of the stomach and small intestine as one of their adaptations to digestion. She/he also recognized secretion of bile as one of the role of the liver in digestion.

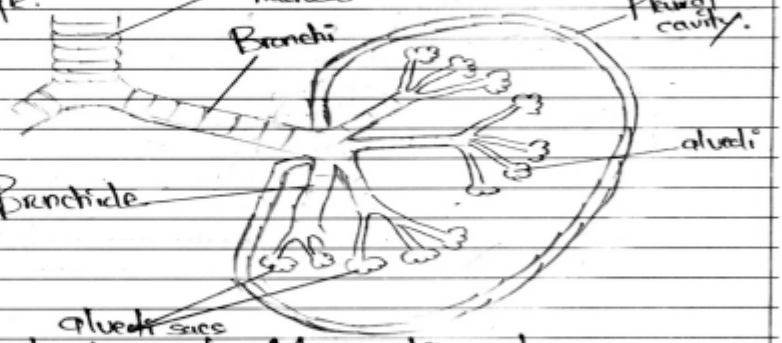
6.0 GASEOUS EXCHANGE AND RESPIRATION

2014 Paper 1

10. (a) Describe the internal structure of the mammalian lung. Illustrate your answer.

(b) Why it is **not** advisable to warm the room at night by using charcoals while people are sleeping in the house and both door and windows are closed?

10.(a) There are two lungs in mammals one is in the right side and other in the left side. Lungs are found in the abdominal cavity below the Thoracic cavity. Lung consist of a system of trachea runing from the mouth and nose from the bucal cavity and the trachea branches into two ~~brochi~~ branchi and each one enters into either of the lungs. In the lung the brunchi brenches again to form brunchioles, and the branchioles enters the alveoli sacs that contains billions of alveoli for gaseous exchange. Alveoli are well supplied with the network of blood capillaries to enable efficient gaseous exchange.



Internal structure of Mammalian lung.

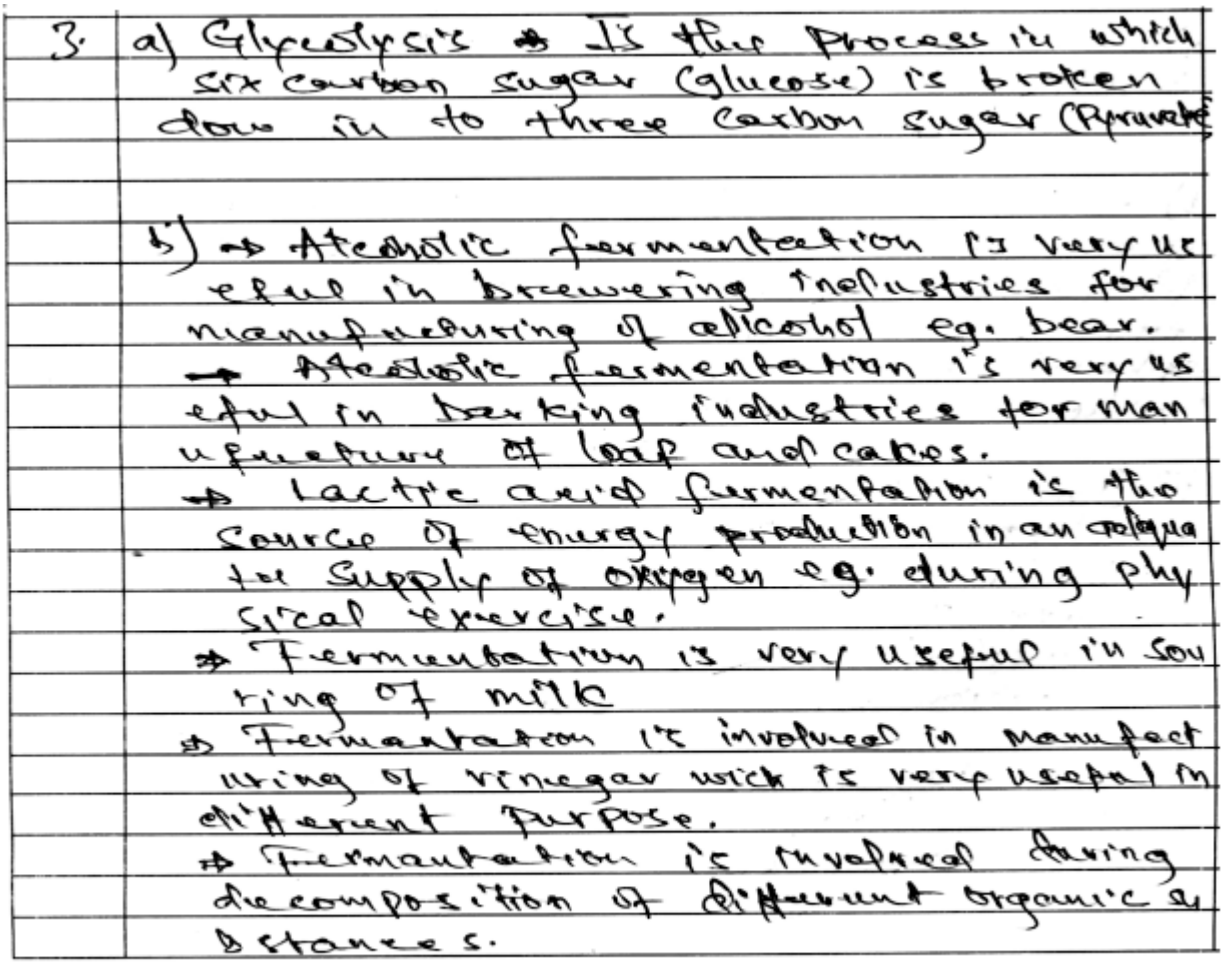
10.(b) It is not advisable to warm the room at night by using charcoals while people are sleeping in the house because the charcoal produces carbon-monoxide when burnt. And hence carbonmonoxide will combine with the haemoglobin to form carbumine-haemoglobin and prevents haemoglobin from transporting oxygen around the body. And haemoglobin affinity to carbon monoxide is greater than that of oxygen and this would results into death of an individual.

The responses provided indicate that, the candidate was knowledgeable and managed to identify the question demand. In addition, the candidate had good drawing skill.

2014 Paper 1

3. (a) What is glycolysis?

(b) In what ways are fermentation processes useful to human beings?



3. a) Glycolysis ⇒ It is the process in which six carbon sugar (glucose) is broken down in to three carbon sugar (Pyruvate

b) ⇒ Alcoholic fermentation is very useful in brewering industries for manufacturing of alcohol eg. bear.
⇒ Alcoholic fermentation is very useful in baking industries for manufacture of bread and cakes.
⇒ Lactic acid fermentation is the source of energy production in an organism for supply of oxygen eg. during physical exercise.
⇒ Fermentation is very useful in souring of milk
⇒ Fermentation is involved in manufacturing of vinegar which is very useful in different purpose.
⇒ Fermentation is involved during decomposition of different organic substances.

Extract 3.1 shows a sample of the candidate who performed well in this question.

2015 Paper 1

6. (a) Give the meaning of basal metabolic rate.

(b) Describe the fate of pyruvic acid under anaerobic respiration.

6 (a) Basal metabolic rate is the minimum amount of energy required by an organism during ~~total rest~~ complete rest of an organism

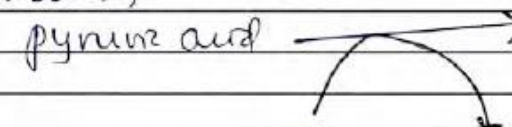
6 (b) The fate of pyruvic acid under anaerobic respiration ~~are~~ is fermentation

(i) There are two types of fermentation which are

(i) Lactic acid fermentation

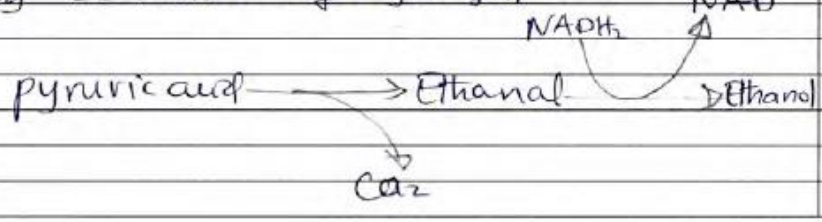
(ii) Alcoholic fermentation.

6 (b) (i) Lactic acid fermentation take place in animal. where by by the pyruvic acid is converted to lactic acid. by addition of hydrogen (reduction)



6 (b) (ii) Alcoholic fermentation occur in small organism example Bacteria and yeast and Also occur in plants

- during alcoholic fermentation. the pyruvic acid is change into aldehyde (ethanal) by decarboxylation of pyruvic acid Then the ethanal is reduced to alcohol by addition of hydrogen.



The candidates who had sufficient knowledge on the topic and ability to identify the demand of the question. The candidate managed to give the meaning of basal metabolic rate and to describe the fate of pyruvic acid under anaerobic respiration.

2016 Paper 1

5. (a) State three similarities between respiration and photosynthesis.

(b) What will happen to the rate of respiration if:
(i) temperature is raised above optimal point.
(ii) health of an organism is impaired.

5. Similarities between respiration and photosynthesis.

- Both respiration and photosynthesis involve process of the electron transport.
- Both are metabolic process aiming at producing energy in the cell
- Both take place in membrane closed system.

(b) Rate of respiration of temperature is Raised above normal.

i/ Because respiration is an enzyme controlled reaction, enzymes in the different phases of respiration will be denatured by the high temperature. This denaturing causes the enzymes to lose their three dimensional structure and change the active site. Therefore the rate of respiration will be lowered by the high temperature.

ii/ When health of an organism is impaired the rate of respiration will increase so as to remove the toxic substance from body of organisms and fights against the new pathogens which entered in the body. The energy is released and help the white blood cells to kill all pathogens in the body. This is why the rate of respiration increases.

The candidate who had sufficient knowledge on respiration and photosynthesis. For example, the candidate gave correct similarities of respiration and photosynthesis, such as involvement of electron transfer in both processes.

2018 Paper 1

10. (a) (i) Define the term respiratory quotient.

(ii) For each metabolic pathway listed in Table 2, name the specific location in the cell it occurs, substrates used and products formed under each.

Table 2

Metabolic pathway	Precise location	Substrates	Products
Glycolysis			
Krebs cycle			
Alcoholic fermentation			

(b) Briefly explain how each of the following factors affect the rate of respiration:
(i) Temperature
(ii) Size of an organism.

10 a/(i) Respiratory quotient is the ratio of volume of carbondioxide produced to the volume of oxygen used in respiration of food.

(ii)

Metabolic Pathway	Precise location	Substrates	Products
Glycolysis	Cytoplasm	Glucose	- 2ATP - $2NADH_2$ - Pyruvate
Krebs Cycle	Matrix of Mitochondria	Acetyl CoA	- 2ATP - Carbon dioxide - $6NADH_2$ - $2FADH_2$
Alcoholic fermentation	- Cytoplasm	- Pyruvate $NADH_2$	- Ethanol - Carbondioxide (CO_2)

b) How do factors affect respiration

① Temperature

- Respiration is an enzyme controlled reaction. Enzymes are affected by temperature. At low temperature the enzymes become deactive deactivated hence the respiration rate is low.
- The rate of respiration increase as the temperature increases until an optimum temperature is

10 b) ① is reached. The rate increase as temperature provide kinetic energy for the substrate to collide with enzymes.

- At high temperature above the optimum temperature, the enzyme become denatured hence the rate of respiration begin to fall.

② Size of an organism.

- Small organisms have large surface area to volume ratio. Hence lose heat rapidly. Therefore the rate of respiration is greater in small organisms to compensate the heat losses to the environment. The rate of respiration increase to provide energy for production of heat.

- Large organisms have small surface area to the volume ratio. Hence organism have low rate of respiration compared to the small organism as the lose little heat to their environment.

The candidates who had enough knowledge about the metabolic pathways and the factors that affect it.

2020 PAPER 1

7. (a) What is respiratory quotient?

(b) What information does each of the following respiratory quotients (RQ) carry? Give two points.
(i) RQ = 1.0
(ii) RQ = 0.9
(iii) RQ = 0.7

(c) A baby was born with its lungs lacking surfactant. In three points, briefly describe the respiratory problem that the baby will experience.

7. a) Refers to the ratio of volume of carbon dioxide produced to the volume of oxygen consumed under similar conditions of pressure and temperature for respiration purposes.

b) i) a) Carbohydrate is being respired only.
b) Aerobic respiration is taking place.

7. b) ii) a) Protein is the only food substance being respired.
b) Aerobic respiration is taking place.

iii) a) Lipid is the only food substance being respired.
b) Aerobic respiration is taking place.

c.) a.) The baby will have difficulties in inhaling and exhaling air since surfactant is responsible for lubricating pleular lung membranes thus reducing friction between them and cause easier ventilation. This is also possible by reducing surface tension inside the alveolus.

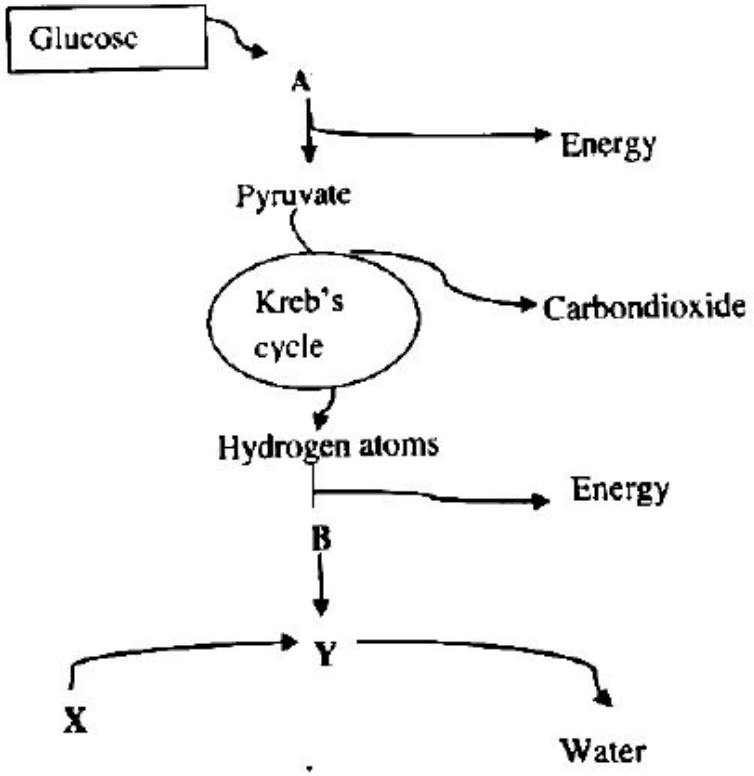
b.) The baby will have higher risk of suffering lung infection since surfactant helps in killing of microorganisms such as bacteria.

c.) The lungs of the baby will be less efficient and less permeable to diffusion of air. This is because surfactant helps to capture the dust particles inside the cell and trap air making it easier to diffuse.

The candidate correctly gave the meaning of Respiratory quotient and relates the RQ values with the respired substrate and type of respiration. Also, she/he was aware of the roles of surfactant in the alveoli. Therefore, He/she pointed out reduction of surface tension and lack of protection against harmful microorganism as the problems which may arise if a baby lacks surfactant.

2020 PAPER 1

8. Study the following Figure and answer the questions that follow.



(a) (i) Name the processes represented by letters **A** and **B** respectively.
(ii) What does each of the letters **X** and **Y** represent?
(iii) In two points, explain what will happen if each of the processes labeled **A** and **B** is impaired.

(b) In seven points, explain the importance of fermentation processes to human beings.

8 a i. A - Glycolysis.

B - Electron Transport Chain (ETC)

ii. X - Oxygen.

Y - Hydrogen.

(iii) If process A is impaired.

- "If glycolysis is impaired means there will no more synthesis of pyruvate from glucose hence pyruvate cannot enter krebs cycle so no respiration
- Accumulation of glucose on cytoplasm of cell.

8 a/iii. If process B ie Electron Transport Chain is impaired Means.

- No oxidative phosphorylation hence there will be no process of ATP formation and respiration yield only ATP from glycolysis and Krebs cycle not from ETC.
- No formation of water at end of respiration since Oxygen doesn't allowed to react with Hydrogen at end of ETC which is impaired.

b/ Importance of Fermentation.

Fermentation is process by which carbohydrate molecule is respired in total absence of oxygen. ie respired anaerobically. When in plant it is called Alcohol fermentation and in Animal it called Lactic acid fermentation. The following are importances of fermentation to human being.

(i) Used in breweries to produce beers where in absense of oxygen maltose is respired into alcohol particularly ethanol which is used as beer.

(ii) In production of cheese and Yoghurt. Bacteria on fresh milk tends to undergo lactic acid fermentation on milk without use of oxygen and produce useful goods such as yoghurt.

(iii) Provision of energy to body during physical exercise when oxygen supply is low lactic acid fermentation help to produce energy anaerobically.

8 b) (i) Used in bakery where yeast are allowed to perform fermentation of baking dough which help it to rise into their desirable size by making bakery products posses carbondioxide.

(ii) In agricultural activities: Here the nutrients from dead bodies of animals are undergoing lactic acid fermentation by bacterias which leads to addition of nutrients to soil hence improve soil fertility for agriculture

(iii) Used in industrial manufacture of disinfectants. Since most disinfectants and sanitizers have ethanol as integral component so alcoholic fermentation help to produce ethanol used in production of disinfectants and sanitizers.

(iv) Source of lactic acid which can further oxidized by cardiac muscles to produce energy. Therefore the process of fermentation produce raw material for oxidation in cardiac muscles. NB: Lactic is produced by skeletal muscles.

The candidate had good mastery of respiration and its stages which are glycolysis, Krebs cycle and Electron transport chain. Therefore, he/she responded correctly to this question.

7.0 REGULATION (HOMEOSTASIS)

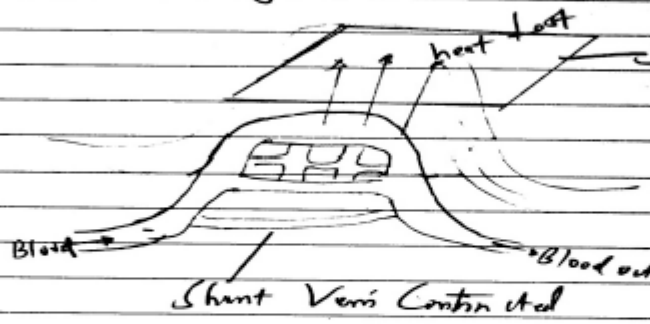
2014 Paper 2

6. Describe how mammals are adapted to warm environment.

6 How mammals adapted to warm environment

Mammals adapted to warm environment as follows:

i) Vasodilation this is the situation where by superficial arterioles dilates so as to have more contact with skin and much heat is lossed through the skin easily as radiation.



ii) Sweating this is the situation where heat is lost thrugh the skin as or in form of water vapour this is common in mammals with sweating land throughout the body.

iii) Relaxation of erector pili muscle when erector pili muscle relax hairs are pulled down as cover the skin allowing air to passes or flow over the skin and carries heat away.

6 iv) Panting and Licking
This is the best mechanism for mammals with fur in all parts of their body or mammals with few sweat gland where to Example dogs tend to hang out their Tongue so as to allow heat to get lost
- for such mammal (dogs) sweating occurs in fully parts with no fur example in pads.

v) Larger Surface area to volume ratio
- Organism in warm environment have long extremities compared to those of cold environment, this is so as to allow much heat to get lost
- Example European counterparts have larger or longer ears than fennec foxes.

vi) Variation of body temperature.
Some Organism in warm environment are able to vary their body temperature so as to reduce temperature difference between inside and outside their body.
- Example Camel are able to fluctuate their body temperature between 34°C to 41°C.

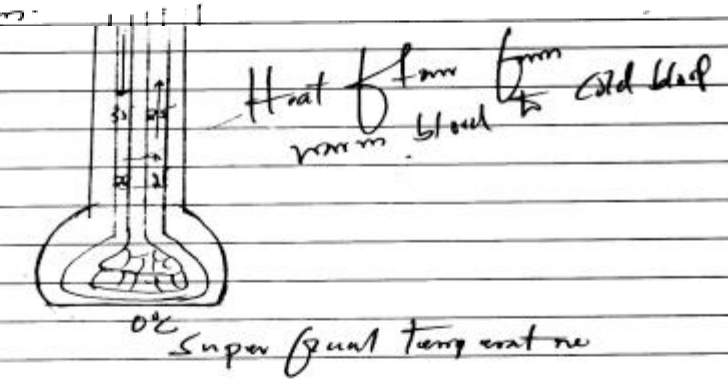
VI) Behavioral mechanisms.
Some of Organism in warm environment tend to perform some behavioral mechanisms so as to avoid period of heat stress in warm environment Example Some of them tend to hibernate so as to prevent heat

6 gain in their bodies
The Hibernation in warm environment is called Aestivation.

- Other Organism tend to shelter themselves in burrows or rocks so as to prevent heat gain.

vii) Taking (Ingest) cold meals (water)
- This is common to human being at adults when environment temperature is high to the cooling of the body is by taking cold meals such as water so as to cool the body.

viii) Variation between Superficial and Core temperature.
- When temperature of body of Organism is ~~warm~~ is high organism tend to vary between core temperature and superficial temperature so as to loose heat.
- this is possible since some of mammal contains counter current heat exchanger system.



ix) Insulation.
- Some mammals are insulated by fur that is thick fur, those furs are lighter being lighter assist on reflecting sunlight radiation thus preventing heat gain.

The candidate had enough knowledge about the topic and used clear English language to describe the adaptations of mammals to warm environment.

2015 Paper 2

3. Explain four common disorders of the urinary system in human, their causes and symptoms.

3. The four common disorders of the Urinary system in human.

(i) Polynephritis.

This is a urinary disorder caused by the inflammation of the nephrons in the kidney. It is caused by bacteria i'e bacterial infection.

Causes and symptoms of Polynephritis:

Polynephritis is caused by bacterial infection

Symptoms:

- Pain during urination.
- Abdominal pains
- Presence of pus in the female sexual organs and burning feeling while urination in men.

3. (ii) Glomerulonephritis.

This is a urinary disorder caused by bacterial infection in the glomeruli of the nephron in the kidney.

Causes of Glomerulonephritis.

It is caused by bacterial infection.

Symptoms of Glomerulonephritis.

- Body fatigue
- Pain sensation during urination.
- Presence of tips of blood in the urine.
- Burning sensation during urination.

(iii) Renal stones / Kidney stones.

This is a urinary disorder caused by blockage of the urinary tract or urinary pathway by the solid substances of fats and other elements hence the name "stones".

Causes of kidney stones.

It is caused by blockage of the urinary pathway by the solid substances ie fats and other elements.

Symptoms of the kidney stones.

- Abdominal pains.
- Little or no urine produced depending on the intensity of the problem.
- Stomach problems i.e stomach acidity.
- Pain during urination

The candidate had good knowledge about the topic. Thus, he/she managed to explain common disorders of the urinary system in human, their causes and symptoms.

2015 Paper 2

4. (a) Describe five general roles of liver in mammalian body.

(b) Explain how urea is formed in the mammalian liver.

SECTION B.

4. a) ROLES OF LIVER IN MAMMALIAN BODY

The Liver is an essential organ in Mammals as it performs More than 500 roles in the body

Generally Liver Performs the following functions in Mammalia body.

1 DEAMINATION.

Refers to the formation of Ammonia due to the breakdown of excess Amino acid in the body.

When Amino Acids is in excess amount it cannot be stored in the body thus it has to be eliminated.

The excess Amino acid in the liver is broken down to give out Ammonia and Keto-group (energy rich compound-Molecule). Ammonia being toxic cannot be accumulated in the body thus it is converted into Urea by reacting it with Carbon dioxide from respiration.

Excess Amino Acid ⟶ Ammonia + Keto Group.

CO_2

Urea.

ie $NH_3 + CO_2 \longrightarrow NH_2-C(=O)-NH_2$ (urea).

Urea is Soluble and Less toxic thus can be easily transported and filtered.

2. DETOXIFICATION

Also some Toxins or poisonous substance May enter the body through drugs Taken orally, chemicals or food eaten may contain toxins.

When these Toxins are passed through to Liver, Liver detoxifies them into less harmful substances which May not interfere the body metabolism. The Assimilated food absorbed from

4. a) Small intestine (Ileum) may contain toxins but when they enter the Liver through hepatic portal vein the toxins are removed.

Detoxification helps to maintain the constant internal environmental condition for enzymes and metabolic activities of the body.

3. SYNTHESIS AND STORAGE OF VITAMINS.

Also the Liver of a Mammal is able to synthesize Vitamins forexample Vitamin K are synthesized in the body.

Some Lipid Soluble Vitamins such as Vitamin A, D and E are stored in the Liver, also although the Liver can store Water Soluble Vitamins such as B and C. The Vitamins are very important for the normal growth of the Mammalian body, some do activate the metabolic activities of the body.

4. CARBOHYDRATE METABOLISM

Also the Liver of Mammal is responsible for the metabolism of protein. Carbohydrate is stored in the body as Glycogen.

Excess Carbohydrate end product — Glucose is converted into Glycogen in the Liver by the hormone called Glucagon through the process called Glucogeonesis. Glycogen is stored in the Liver for all the time until when it is required by the body.

Rise in high demand of Glucose, the Insulin hormone is stimulated — secreted to catalyse the conversion of Glycogen into Glucose through the process which is called Glycogenesis.

4. a). 5. SYNTHESIS OF BILE.

Also the worn out red blood cells (RBCs) are called in the Liver. The Liver break down the old worn out red Blood cells to produce a green pigment called Bile which is used in digestion.

The Yellowish substance — bile is essential for providing the basic medium in the duodenum, also for coagulating Milk, fats, to breakdown large fats molecules into small molecules for easy digestion.

b). FORMATION OF UREA IN MAMMALIAN LIVER.

Urea is formed in Mammalia Liver through the breakdown of excess Amino Acids.

It involves two major stages/processes called Deamination and Detoxification. The cycle in which urea is formed is called ORNITHINE CYCLE.

DEAMMINATION.

Excess Amino Acids are broken down to release Ammonia and Keto Group. Keto-Group is energy rich Molecule which is used in respiration to produce energy.

DETOXIFICATION.

The Ammonia produced can not be allowed to accumulate thus it is converted into a less toxic and soluble substance Urea by reaction with Carbon dioxide from respiration.

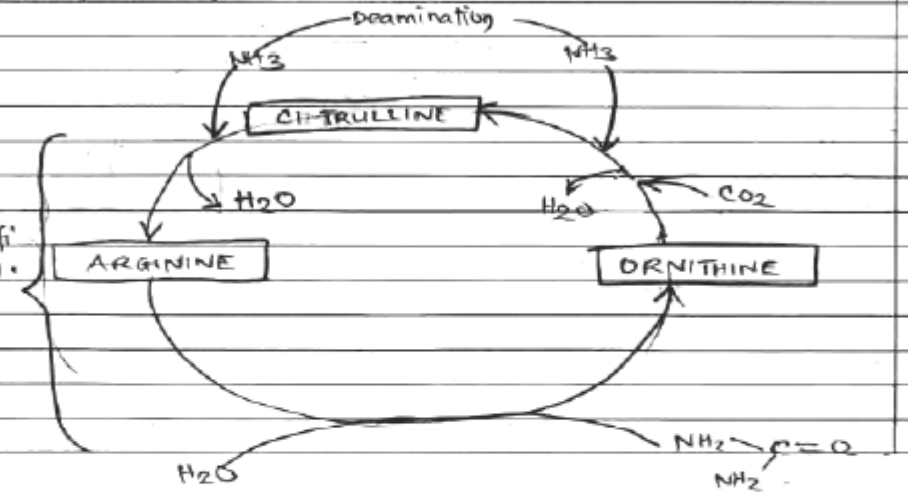
$NH_3 + CO_2 \longrightarrow (NH_2)_2CO$

Ammonia. Urea

$NH_3 + CO_2 \longrightarrow (NH_2)_2CO$

Ammonia. Urea

The whole process of urea formation can be summarised in an ORNITHINE CYCLE.



4. b) Ammonia from deamination enters a Citrulline compound through condensation reaction to produce Arginine. Then Arginine reacts with water to produce Urea and Ornithine Molecule.

The Ornithine Molecules combine with CO_2 to produce H_2O and Citrulline, then Ammonia is added to them the cycle repeats.

The candidate had sufficient knowledge on the topic and managed to give general roles of liver in mammalian body and explain how urea is formed in the mammalian liver.

2016 Paper 2

4. Explain different ways used by endotherms to keep their body temperature constant.

Qn4 Endotherms Are those organisms that are able to regulate their body temperature either in high Temperature condition or low temperature Condition Example Human being.

Way used by endotherms to keep their body temperature constanta it devide into two condition

A: High temperature condition: Organism may do the following

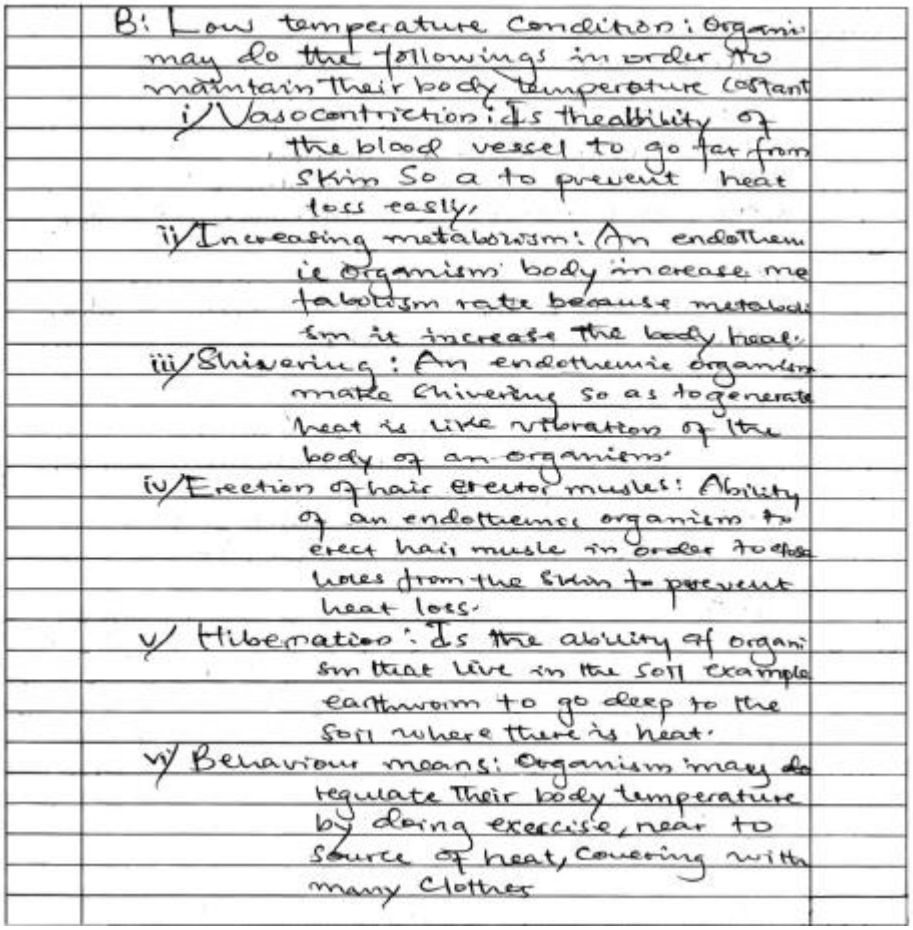
i/ Sweating: Is the ability of an organism to release heat body through the skin which is mixture of water, electrolytes, salts.

ii/ Vasodilation: Is the ability of an organism's body to adjust blood capillary or vessel more close to skin so as to easy to radiate heat.

iii/ Decrease in metabolism: In high temperature an endotherms decrease metabolism because metabolism it leads to the production heat

iv/ Relaxation hair erector musles: When hair erector muscle is relaxed it leads to easly radiation of heat out side the body of an organism.

v/ Panting: An endothermic organism like dog they loose heat through the mouth by opening their mouth because their body are covered with hair and is impermiable to heat loss.



B: Low temperature condition: Organism may do the followings in order to maintain their body temperature constant

i/ Vasocontriction: Is the ability of the blood vessel to go far from skin so a to prevent heat loss easly.

ii/ Increasing metabolism: An endothermic organism body increase metabolism rate because metabolism it increase the body heat.

iii/ Shivering: An endothermic organism make shivering so as to generate heat is like vibration of the body of an organism.

iv/ Erection of hair erector musles: Ability of an endotherms organism to erect hair musle in order to close holes from the skin to prevent heat loss.

v/ Hiberation: Is the ability of organism that live in the soil example earthworm to go deep to the soil where there is heat.

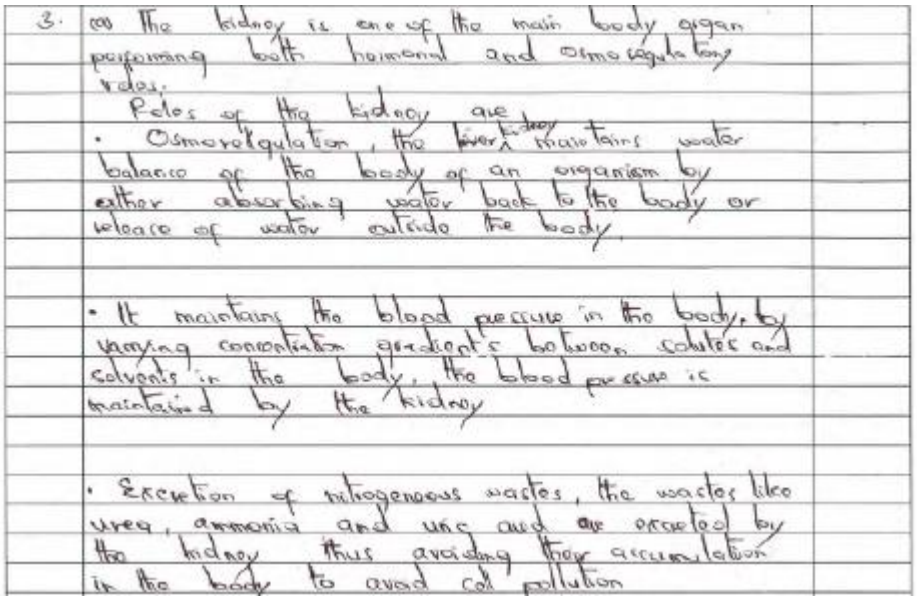
vi/ Behaviour means: Organism may do regulate their body temperature by doing exercise, near to source of heat, covering with many clothes

The candidate gave precise explanations of different ways used by endotherms to keep their body temperature constant such as erection of hair erector muscle in cold and sweating in hot environment.

2016 Paper 2

3. (a) Explain four major roles of the kidney.

(b) Describe the structure of mammalian nephron.



3. (a) The kidney is one of the main body organ performing both hormonal and osmoregulatory roles.

Roles of the kidney are

- Osmoregulation, the kidney maintains water balance of the body of an organism by either absorbing water back to the body or release of water outside the body.

- It maintains the blood pressure in the body, by varying concentration gradients between solutes and solvents in the body, the blood pressure is maintained by the kidney

- Excretion of nitrogenous wastes, the wastes like urea, ammonia and uric acid are excreted by the kidney thus avoiding their accumulation in the body to avoid cell pollution

- Maintaining pH of the body fluids, this is done by eliminating ions like CO_2, H^+, OH^- that may cause any slight change in body fluid pH which can slow down the body metabolism

3. b) • Bowman's capsule
It is the cup shaped organelle that is like a ball which has been pressed on on side. It holds the Glomerulus for filtration of the blood coming from the body tissues

• Glomerulus
It the network of blood capillaries that is essential for filtration of blood coming from the body tissue. Large sized molecules like protein, plasma cells are not allowed to pass through the glomerulus.

• Proximal convulted tubule
The tube in which selective reabsorption of essential molecule begins. The amino acids, glucose are absorbed here.

• Loop of henle
Both ~~descending~~ descending and ascending loops are responsible for absorption. The descending is permeable to water and less permeable to salt (NaCl) while the ascending limb is large since body fluid flow at high pressure and is permeable to salt (NaCl) but less permeable to water

• Distal convulted tubule
This is the tubule in which selective reabsorption continues and is permeable to water. Under

8. b) Vasopressin hormone, the permeability of the Distal Convoluted tubule can be varied.

• Collecting duct
The tube linked to a million of nephrons in which the unabsorbed molecules are poured to be eliminated out as urine

• Blood vessels
Afferent vessel carry blood rich in materials from the body tissues to the nephron while the efferent blood vessels carry blood rich in larger materials back to the body tissue

The candidate managed to explain four major roles of the kidney such as removal of waste products. He/she also gave the correct descriptions of the structure of the mammalian nephron such as Loop of Henle and convoluted distal tubule.

2017 Paper 2

4. (a) (i) State two main roles played by the kidney.

(ii) Table 2 summarizes the relationship between excretory product and the habitat of the representative animal group. Complete the table.

Table 2

Animal	Excretory product	Habitat
Protozoan		
Terrestrial insect		
Freshwater bony fish		
Marine bony fish		
Bird		
Mammal		

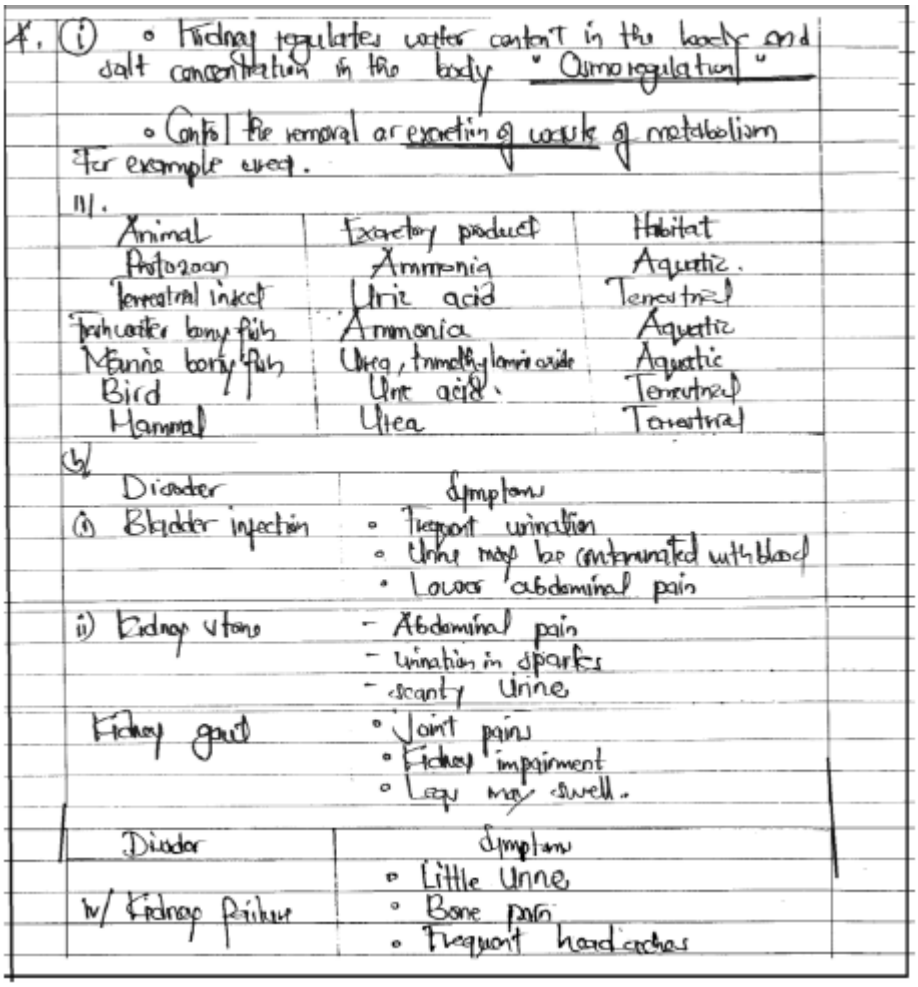
(b) Enumerate three symptoms of each of the following disorders of urinary system in human:

(i) Bladder infection.

(ii) Kidney stone.

(iii) Kidney gout.

(iv) Kidney failure.



4. (i) • Kidney regulates water content in the body and salt concentration in the body "Osmoregulation"
• Controls the removal or excretion of waste of metabolism for example urea.

ii).

Animal	Excretory product	Habitat
Protozoan	Ammonia	Aquatic.
Terrestrial insect	Uric acid	Terrestrial
Freshwater bony fish	Ammonia	Aquatic
Marine bony fish	Urea, trimethylamine oxide	Aquatic
Bird	Uric acid.	Terrestrial
Mammal	Urea	Terrestrial

b)

Disorder	Symptoms
(i) Bladder infection	• Frequent urination • Urine may be contaminated with blood • Lower abdominal pain
ii) Kidney stone	- Abdominal pain - Urination in sparks - Scanty Urine
Kidney gout	• Joint pains • Kidney impairment • Legs may swell.

Disorder	Symptoms
iv/ Kidney failure	• Little Urine • Bone pain • Frequent headaches

The candidate precisely stated the main role of the kidney and correctly completed the table by indicating the excretory product and the habitant of the respective group of animal. He/she was able to correctly enumerate the symptoms of each of the given urinary disorders.

2018 Paper 2

3. (a) (i) Identify three major nitrogenous excretory wastes in animals.

(ii) Identify which animals excrete each identified type of nitrogenous wastes in (a) (i) and give three reasons for your answer. Tabulate your answer as shown in the following table:

S/N	Nitrogenous wastes	Animals excreting it	Reasons

(b) Enumerate five responses which occur in the body when the body temperature is lower than normal.

03 (i) - Urea
- Uric acid
- Ammonia.

S/N	Nitrogenous waste	Animals excreting it	Reasons.
1	Ammonia	Aquatic animals like - Fish	Ammonia is toxic and soluble, thus it needs alot of water to be excreted. Since fish lives in water it can excrete ammonia easily.
2	Urea	Terrestrial animals like, - human being - goat - cow.	Urea is less soluble compared to ammonia and less toxic, it needs relatively less water to be excreted which terrestrial animals can have.

	3	Uric acid	Insects, such as cockroach and grasshoper	It is insoluble and low toxicity. It needs very little water to be excreted. Since water is a problem to insects, They are only able to excrete Uric acid.	

03	(b) Responses to animals body when temperature is below normal
	- Vasoconstriction
	This prevents heat loss by conduction and convection.
	- Contraction of hair erector muscle.
	This helps to trap air which is a bad conductor since hair become erect.
	- Increase in metabolic rate
	This helps to produce heat.
	- Shivering
	It involves contraction of skeletal muscles to raise temperature
	- Decrease in sweat production by sweat glands.
	This prevents loss of heat by evaporation of sweat.

The candidate who responded to all items of question 3 correctly. He correctly identified the excretory products secreted by different animals and gave correct responses shown by animals when temperature is below normal.

2019 Paper 2

3. (a) With the help of a diagram, describe the formation and removal of urea in mammalian liver.

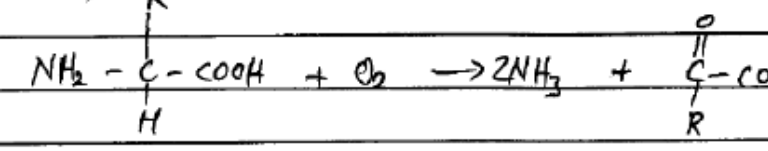
(b) (i) Identify the major excretory products in the vertebrates.
(ii) For each excretory product identified in 3 (b) (i), state their nature and give one example of an organism which excretes it.

3. (a) FORMATION AND REMOVAL OF UREA.

- Urea is formed in mammalian liver by aid of two process namely, (i) Deamination of Amino acids and
(ii) Detoxification

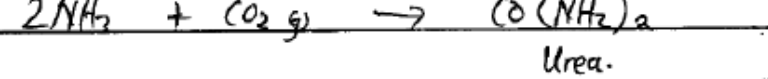
(i) Deamination of Amino acids.

- The process involves removal of amino group from amino acids through oxidizing aminoacids.



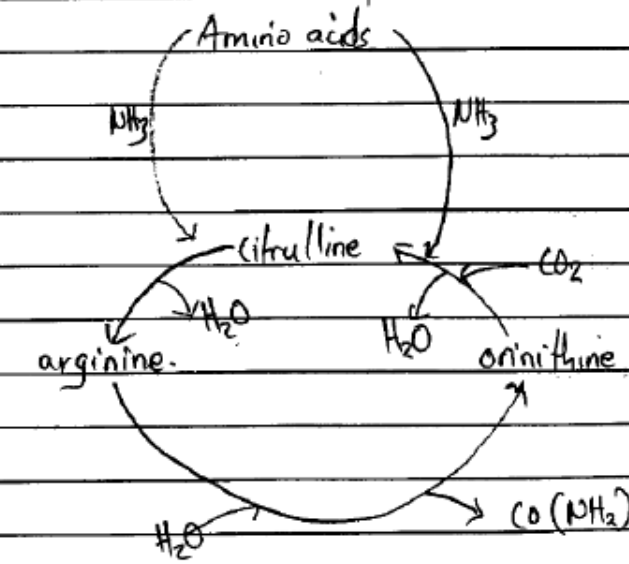
(ii) Detoxification.

- Due to formation of ammonia which is a harmful product, detoxification takes place it converts harmful product to harmless product. Ammonia reacts with carbondioxide produced from respiration and leads to formation of urea.



Urea.

ORNITHINE CYCLE.



3. (a) Urea is transported to kidney and excreted away, therefore the following are pathway of urea from liver to kidney so that it can be removed.

Liver → hepatic vein → Posterior Vena cava → right autrium of heart → right ventricle of heart → Pulmonary artery → Lungs → Pulmonary vein → left autrium of heart → left ventricle of heart → dorsal aorta → Renal artery → kidney.

(b) (i) The major excretory products in the vertebrates are,

(i) Uric acid

(ii) Urea.

(iii) Ammonia

(ii)

Excretory product	Nature	Example of organism
Ammonia	- It is very toxic - Requires alot of water for its excretion.	Fish.
Urea	- It is less toxic compared to ammonia - Less water is required for its excretion - It is soluble molecule, can be easily filtered with kidney	Human being
Uric Acid	- It is non-toxic - Less water or no water is required for its excretion	Reptiles example Lizard.

The candidate managed to describe the process of formation and removal of urea in mammalian liver. These responses imply that the candidate had adequate knowledge to respond the demand of the question.

2020 PAPER 2

2. Describe any six processes which are impared when mammalian liver is severely damaged.

02

Liver is the largest organ within the body of the organism and it has most fundamental functions after the brain.

When the liver is severely damaged the following processes will stop.

Carbohydrate Metabolism stops

The liver acts as interconversion centre between glycogen and glucose.

When the liver is severely damaged excess glucose will not be Metabolized — leading to diabetes Mellitus

02

Bile formation

The liver corresponds to the formation of bile, the later helps in during degestion

once damaged bile will not be formed and hence the digestion of fats will occur by difficult, and enzymes actions will be reduced.

Deamination process

The liver is involved in the deamination of the excess amino acids for elimination

When the liver is severely damaged the the deamination process will not occur and the excess amino acids will never be eliminated.

Lipids Metabolism

The liver carryout the Conversion of lipids to carbohydrates and also it stores lipids through its cells.

When the liver is severely damaged the lipid metabolism will not occur and excess lipids will accumulate and cause the blockage of many blood capillaries and so then leads to death of the organism.

Storage of vitamins and Mineral ions

Fat soluble vitamins and Minerals such as K^+ and M^+ are stored in the liver

When the lever is severely damaged the vitamins and Minerals will not be stored for the use of the body this lead to decrease in various metabolic activities when these are in absence.

The candidate correctly described the processes of the liver that will be impaired if the liver is severely damaged. These include regulation, digestion, storage and detoxification.