

LIST OF BIOLOGY ESSAYS (BI)

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CHAPTER 2 - CELL STRUCTURE AND CELL ORGANIZATION

Describe the process of phagocytosis

F1 - pseudopodium is used to trap microorganisms such as bacteria by phagocytosis

P1 - amoeba move towards food by projecting its pseudopodium

P2 - pseudopodium surrounds food which is then packed in food vacuoles or phagosomes

P3 - food vacuoles combine with lysosomes to form phagolysosomes

P4 - food is digested by hydrolytic enzymes in lysosomes secreted by lysosome

P5 - the resulting nutrients will be absorbed into the cytoplasm

P6 - waste products are removed from the amoeba

Explain the process of production of extracellular enzymes

P1 - most of the enzymes produced by specific cells are secreted out of the cell

P2 - for example, pancreatic cells secrete pancreatic juice containing digestive enzymes into the duodenum

P3 - proteins synthesized in ribosomes are transported through the lumen of the coarse endoplasmic reticulum P4 - when it reaches the end of the coarse endoplasmic reticulum, parts of the membrane there form bulging buds to produce transport vesicles

P5 - protein contained in the transport vesicle then moves towards the golgi body and attaches to it

P6 - in the golgi body, the protein is modified

P7 - then the enzyme is secreted into a secretory vesicle formed at the end of the golgi body near the plasma membrane

P8 - secretory vesicles containing modified proteins will move towards the plasma membrane

P9 - these vesicles will coalesce with the plasma membrane before releasing proteins out of the cell

CHAPTER 3: MOVEMENT OF MATERIAL ACROSS PLASMA MEMBRANE

Describe the process of active transportation

F1 - the movement of substances (ions and molecules) across the plasma membrane against the concentration gradient from low concentration to high concentration by using metabolic energy

P1 - this process requires the help of carrier proteins and energy to transport the material across the plasma membrane

P2 - energy for active transport comes from ATP (adenosine triphosphate) molecules generated by mitochondria

P3 - carrier protein has an active site to bind to a particular molecule or ion and another active site to bind to ATP molecules

P4 - ATP energy decomposes into ADP (adenosine diphosphate) and P (phosphate)

P5 - this decomposition process supplies energy to the carrier protein to change shape and move sodium ions across the plasma membrane

P6 - transport causes the accumulation or removal of molecules and ions from the cell

Explain the process of osmosis when an egg cell is put into distilled water

P1 - distilled water is hypotonic compared to egg cells

P2 - water molecules permeate from distilled water into the egg cell through the process of osmosis

P3 - the egg cell will expand to maximum size and break

Describe the process of assisted diffusion transport

F1 - carrier proteins are specific because each one can only combine with certain molecules

P1 - the carrier protein will combine with the corresponding molecule to be transported to a special area called the active site

P2 - after the fusion process, the carrier protein will change shape to move the molecule across the plasma membrane

P3 - the carrier protein returns to its original form and is ready to transport the next protein

P4 - movement of a substance can occur in two directions as long as its movement descends the concentration gradient

Explain the process of osmosis when red blood cells are put into distilled water

P1 - distilled water is hypotonic compared to red cells

P2 - water molecules permeate from distilled water into red blood cells through the process of osmosis

P3 - red blood cells will expand to maximum size and rupture

P4 - hemolysis occurs

Explain the process of osmosis when blood cells are immersed in a 5% solution of sodium chloride

P1 - 5% sodium chloride solution is hypertonic compared to red blood cells

P2 - water molecules permeate out of red blood cells through the process of osmosis

P3 - red blood cells will shrink, crenation is said to occur

Explain the process of osmosis when red blood cells 3% sodium chloride solution

P1 - 3% sodium chloride solution is isotonic to red blood cells

P2 - molecules permeate in and out into red blood cells at the same rate through the process of osmosis

P3 - no deformation of red blood cells

Explain the process of osmosis when onion cells are put into sucrose solution 0.06 M

P1 - 0.06 M sucrose solution is hypertonic compared to onion cells

P2 - molecules permeate out of onion cells into 0.06 M sucrose solution through osmosis process

P3 - onion cells become flaccid (flaccid), vacuoles lose water and shrink, plasma membranes and cytoplasm are attracted away from the cell wall, plasmolysis occurs
P4 - plasmolysis cells are put into distilled water and the distilled water is hypotonic compared to onion cells

P5 - water molecules permeate from distilled water into the onion cell through the process of osmosis

P6 - vacuole expands but does not rupture due to the presence of cell wall

P7 - deplasmolysis occurs

Explain the process of osmosis when onion cells are put into sucrose solution 0.01M

P1 - 0.01M solution is isotonic compared to onion cells

P2 - water molecules permeate in and out into the onion cell at the same rate through the process of osmosis

P3 - onion cells do not change shape or size and vacuoles remain at norm size

Describe the process when onion cells are put into distilled water

P1 - distilled water is hypotonic compared to onion cells

P2 - water molecules permeate from distilled water into onion cells through the process of osmosis

P3 - onion cells become fresh, vacuoles expand but do not rupture due to the existence of cell walls

Explain how salt solution is effective in preserving fish

P1 - salt solution is hypertonic compared to fish cells

P2 - water is absorbed out of fish cells through osmosis

P3 - fish becomes dehydrated

P4 - inhibits bacterial reproduction in fish cells

P5 - plasmolysis bacterial cells

P6 - prevents cells from rotting and lasts longer

Explain how vinegar is effective in preserving vegetables

P1 - vinegar is acid

P2 - vinegar is absorbed into vegetable cells

P3 - vegetable cells become acidic

P4 - low pH value inhibits the growth of bacteria

P5 - prevents cells from decaying and lasts longer

CHAPTER 4: CHEMICAL COMPOSITION IN CELLS

Temperature affects enzyme activity

- P1 - at low temperatures, the rate of the reaction catalyzed by the enzyme is low
- P2 - as the temperature rises, the substrate molecules move faster
- P3 - the rapid movement of the substrate molecules increases the chance for the molecules to collide with each other and with the active sites of the enzyme molecules
- P4 - the rate of reaction between the enzyme and the substrate is accelerated
- P5 - this condition occurs only until the optimum temperature is reached
- P6 - the optimum temperature is the temperature at which the rate of catalysis of the reaction by the enzyme is maximum
- P7 - after the optimum temperature, the next increase in temperature will not further increase the reaction rate
- P8 - because the bonds holding the enzyme molecules begin to break at high temperatures, thus changing the three-dimensional shape of the enzyme and eventually destroying the active site of the enzyme
- P9 - the substrate molecule can no longer complete the active site of the enzyme
- P10 - the enzyme loses its activity and is said to be degraded

pH affects enzyme activity

- P1 - each enzyme can only function optimally at a certain pH
- P2 - the optimum pH is the pH at which the reaction rate is maximal
- P3 - changes in pH can change the charge of the active site of the enzyme and the surface of the substrate
- P4 - this reduces the ability of the two molecules to combine
- P5 - when the pH of the environment returns to optimum, the charge on the enzyme returns to its original state and the enzyme returns to function

The concentration of the substrate affects the activity of the enzyme

- P1 - as the substrate concentration increases, there are more substrates to combine with the active site of the enzyme
- P2 - more results obtained
- P3 - more chance for a collision between the substrate molecule and the enzyme molecule to allow the reaction to take place
- P4 - an increase in the concentration of the substrate will only accelerate the reaction if there are enough enzyme molecules to catalyze the excess substrate molecules
- P5 - the rate of the enzyme reaction is directly proportional to the concentration of the substrate until the reaction reaches its maximum rate
- P6 - after reaching the maximum rate, all active sites of the enzyme molecule have been filled and are involved in the catalytic reaction
- P7 - the enzyme is said to be saturated with the substrate
- P8 - the concentration of the enzyme becomes a limiting factor
- P9 - the rate of the reaction can only be increased by increasing the concentration of the enzyme

Enzyme concentration affects enzyme activity

P1 - when the enzyme concentration is increased, there are more enzymes

P2 - the reaction rate increases only if the supply of substrate molecules is unlimited and other factors such as pH, temperature and pressure are constant

P3 - this is because there are more active sites for the catalytic action

P4 - the rate of the enzyme reaction is directly proportional to the concentration of the enzyme present until the maximum rate is reached

P5 - after the maximum rate, the substrate concentration becomes a limiting factor

The nature of the enzyme

P1 - enzyme remains unchanged at the end of the reaction
P2 - enzyme can be used repeatedly

P3 - enzyme has an active site for a specific substrate

P4 - enzyme is specific to each substrate

P5 - the enzyme has an active site to combine with a specific substrate

P6 - the enzyme cannot be destroyed by the reaction it catalyzes

P7 - the enzyme reaction is reversed

Explain the four differences between monosaccharides and polysaccharides.

Monosaccharides	Polysaccharides
Known as simple sugar	Known as polymers for monosaccharides and disaccharides
The molecular formula is $C_6H_{12}O_6$	The molecular formula is $(C_6H_{10}O_5)_n$
Sweet taste	Has no taste
Soluble in water	<ul style="list-style-type: none"> ○ May be water soluble or not soluble in water ○ Glycogen and cellulose are insoluble, while starch is soluble in water

CHAPTER 5: CELL DIVISION

Comparison between mitosis and meiosis

Meiosis	Mitosis
Occurs in the reproductive organs	Occurs in all somatic cells (body cells)
The goal is to produce gametes (sperm/ovary)	The goal is to replace the cell which is damaged and dead
The number of child cells produced was four	The number of child cells produced is two
Child cells have a number of chromosomes haploid (n)	Child cells have a number of chromosomes diploid (2n)
Child cells are genetically different with stem cells	Child cells are genetically identical with stem cells

Tissue culture

P1 - tissue culture is a technique of culturing tissue fragments of living organisms in a solution of sterile culture medium containing nutrients and growth hormones.

P2 - plants can be cultured asexually using small pieces of tissue known as explants taken from the parent plant

P3 - sterilized explants are placed in culture medium to divide mitotically and form callus, which is a group of undifferentiated tissue

P4 - the cells in the callus grow into embryos and then into seedlings

P5 - the seedlings are then transferred to the soil and become adult plants

P6 - various types of plant cells and animal cells can be extracted outside the cell

P7 - plant parts that can be cultured include

Describe the cloning process for a goat

P1 - first donor donates milk sac cells

P2 - milk sac cells are cultured for 6 days

P3 - second donor donates egg cells

P4 - infertile egg cells are taken from ovaries

P5 - egg cell nuclei are removed

P6 - the nucleus of the milk sac cell is inserted into the egg cell using the method of electric shock

P7 - the cell has a cytoplasm from the second donor and a nucleus from the first donor

P8 - cells are allowed to grow in culture by mitosis to form embryos

P9 - embryos

are inserted into the uterus of the third goat (surrogate mother)

P10 - the embryo grows and gives birth to a goat that has the same chromosomes as the chromosomes in the milk sac cells from the first donor

Cytokinesis

P1 - for animal cells, cytokinesis occurs when the plasma membrane shrinks in the center of the cell between two nuclei

P2 - microfilaments found at the site of contraction shrink causing the cells to shrink and break into two child cells

P3 - cytokinesis in plants begins when vesicles gather in the center of the cell between two nuclei

P4 - these vesicles will coalesce and form a large sac called a cell plate

P5 - the cell plate is surrounded by a new plasma membrane and new cell wall material accumulates in the space between the cell plates

P6 - cell plate expands outwards until it joins the original plasma membrane and divides into two daughter cells

P7 - at the end of cytokinesis, cellulose fibers are produced by cells to strengthen new cell walls

CHAPTER 6: NUTRITION

Explain the mechanism of photosynthesis

- P1 - during the light reaction, chlorophyll traps light energy and this excites the electrons of the chlorophyll molecule to a higher energy level
- P2 - in the excited state, electrons will leave the chlorophyll molecule
- P3 - activated chlorophyll molecules attract electrons from water molecules so that they return to stability
- P4 - loss of electrons will cause water molecules to decompose into hydrogen ions and hydroxyl ions
- P5 - this reaction is called water photolysis
- P6 - water ions accept electrons from chlorophyll and form hydrogen atoms
- P7 - energy released during electron conduction is used to form adenosine triphosphate (ATP)
- P8 - at the same time, hydroxyl ions lose electrons to form oxygen gas and water
- P9 - oxygen gas is released into the atmosphere. Water molecules are reused for
- P10 photolysis - part of the electrons are transferred and re-accepted by chlorophyll molecule
- P11 - the reaction of light converts light energy into chemical energy
- P12 - then, the result of the light reaction is water, oxygen gas and ATP
- P13 - hydrogen atoms and ATP are used in the dark reaction
- P14 - dark reaction occurs in the chloroplast stroma and the energy for this reaction is supplied by ATP
- P15 - during the dark reaction, the hydrogen atom releases carbon dioxide gas that does not permeate into the chloroplast stroma
- P16 - the dark reaction involves several small reactions in succession and ends in the production of glucose
- P17 - this reaction is catalyzed by several enzymes found in the stroma
- P18 - glucose monomers condensed to form starch molecules
- P19 - starch is stored in the form of starch grains in the chloroplast stroma for a while

Contrast the digestive system of herbivorous animals with the digestive system of humans

Herbivorous digestive system	The human digestive system
<ul style="list-style-type: none"> ○ Able to digest cellulose because it has bacteria/protozoa that secrete cellulase enzymes ○ Cellulase enzymes digest cellulose into glucose 	<ul style="list-style-type: none"> ○ Unable to digest cellulose
<ul style="list-style-type: none"> ○ The stomach has <i>four</i> spaces called the rumen, reticulum, omasum and abomasum 	<ul style="list-style-type: none"> ○ The stomach has only one space

On Thursday morning, Syahirah ate paprika meat rice. What will happen to the meat along Syahirah's digestion if she undergoes bile removal surgery?

- P1 - paprika meat rice food is a protein and carbohydrate food
- P2 - during digestion in the mouth, rice starch will be hydrolyzed by salivary amylase enzyme and convert starch to maltose
- P3 - paprika meat i.e. protein does not experience any reaction during digestion in the mouth
- P4 - food that has been chewed into balls called bolus that enters the esophagus
- P5 - the action of peristalsis that moves the bolus along the esophagus
- P6 - during digestion in the stomach, secreted gastric juice contains the enzymes pepsin hydrochloric acid and renin
- P7 - acidic hydrochloric acid can destroy most bacteria in the body, stop the action of salivary amylase and is the optimal medium for the action of enzymes in the stomach

- P8 - pepsin enzyme hydrolyzes large molecules of meat protein into smaller polypeptide chains
- P9 - renin will thicken milk, which converts caseinogen into casein
- P10 - meat and rice are mixed and mixed with gastric juice and turned into a semi -liquid substance called kim
- P11 - kim will slowly enter the duodenum
- P12 - partially digested rice and meat will be digested by the enzyme amylase, pancreas and trypsin
- P13 - pancreatic amylase will complete the digestion of starch to maltose and trypsin completes the digestion of polypeptides to peptides
- P14 - Syahirah who has undergone bile removal surgery will not give effect on it because the food eaten does not contain lipids
- P15 - when food enters the ileum, maltose is digested by maltase and becomes glucose while peptides are digested by erepsin and become amino acids

Give advice on healthy eating habits to a group of teenagers who often consume fast food.

- P1 - Avoid unbalanced fast food
- F1 - high in fat and cholesterol
- F2 - high in carbohydrates and sugar
- F3 - high in salt
- F4 - less salt and preservatives
- F5 - contains dyes and preservatives
- P2 - Replace fast food with a balanced diet
- F6 - consume more carbohydrates to meet energy needs for growth activities
- F7 - take milk for healthy bone growth
- F8 - consume foods high in iron to produce more red blood cells during menstruation
- P3 - food is taken according to time, at least three times a day, i.e. breakfast, lunch and dinner

Factors affecting photosynthesis

1. Light intensity

- P1 - light energy decomposes water molecules during photolysis of water in light reaction
- P2 - the higher the light intensity, the higher the light reaction rate and the higher the photosynthesis rate
- P3 - after this stage, the increase in light intensity no longer increases the rate of photosynthesis because the concentration of carbon dioxide and temperature become limiting factors
- P4 - if the limiting factor is increased, for example increasing the concentration of carbon dioxide, then the rate of photosynthesis becomes higher

2. Temperature

- P1 - affects the rate of the enzyme reaction involved during the dark reaction
- P2 - each increase in temperature of 10 ° C will increase the rate of photosynthesis by a factor of two until it reaches the optimum temperature
- P3 - the optimum temperature for most plants is between 25 ° C -30 ° C
- P4 - if the temperature is too high, the enzyme will be released and the dark reaction stops causing the process of photosynthesis also stops

3. Carbon dioxide concentration

- P1 - carbon dioxide is the raw material in the dark reaction to synthesize glucose
- P2 - if there are no limiting factors such as light intensity and temperature, an increase in carbon dioxide concentration will increase the rate of photosynthesis (directly proportional)

Explain the process of digesting BBQ meat eaten by Atikah after she underwent surgery to remove the pancreas

- P1 - meat is a protein
- P2 - mouth chews meat to increase surface area per volume
- P3 - no reaction occurs in mouth
- P4 - the epithelial layer in the stomach contains gastric glands that secrete gastric juice
- P5 - gastric juice contains mucus, hydrochloric acid as well as pepsin and renin enzymes
- P6 - pepsin enzymes hydrolyze large protein molecules into smaller polypeptide chains
- P7 - food is mixed with gastric juice and mixed by the process of peristalsis of the muscles in the abdominal wall
- P8 - the contents in the stomach turn into a semi -liquid substance called kim
- P9 - kim enters the duodenum
- P10 - the duodenum receives kim from the stomach and secretions from the gallbladder and pancreas
- P11 - no response from the pancreas because the pancreas has been removed
- P12 - ileum secretes the enzyme erepsin to break down peptides into amino acids
- P13 - no reaction occurs
- P14 - as a result, Atikah will not get enough amino acid nutrients
- P15 - Atikah will get kwasyiokor due to lack of amino acids

Describe the absorption process in villus

- P1 - adaptation of the small intestine for effective absorption of food
 - The length of the small intestine is about 6m
 - has many folds
 - there is a radial -shaped projection known as a villus
 - there is a fine, microvilli projection on the surface of the villus epithelium
- P2 - each villus has a network of blood capillaries
- P3 - in the center of the villus has a white lacteal connected to the lymphatic ducts
- P4 - the process of absorption of food occurs by diffusion and active transport
- P5 - simple sugars, mineral salts, amino acids, vitamins B and C soluble in water are absorbed into the blood capillaries (villus)
- P6 - all blood capillaries from the villus unite into the hepatic portal vein
- P7 - the hepatic portal vein carries digested food to the liver
- P8 - fatty acids and glycerol are absorbed into the villus epithelium, merging into fatty droplets. Droplets of fat are deposited into the lacteal
- P9 - vitamins A, D, E and K are soluble in fat and absorbed into the lacteal
- P10 - from the lacteal, fatty droplets are transported to the lymphatic vessels and finally to the left subclavicular vein
- P11 - digested food is transported from the hepatic portal vein to the liver

Explain the process of assimilation of digested food

- P1 - glucose is converted into glycogen and stored in the liver
- P2 - when blood sugar levels drop and a substance needs energy, stored glycogen is converted back to glucose
- P3 - glucose is distributed throughout the body by the circulatory system
- P4 - when glucose arrives in the cell, glucose is oxidized to release energy through cell respiration
- P5 - when glycogen stores in the liver become full, excess glucose is converted to lipids
- P6 - amino acids need to pass through the liver before being received by the circulatory system
- P7 - liver synthesizes plasma proteins using amino acids
- P8 - the liver will convert amino acids to glucose if there is a lack of glucose and glycogen
- P9 - amino acids that enter the cell are used to synthesize new protoplasm and repair damaged tissue
- P10 - amino acids are the basic unit for the synthesis of enzymes, coenzymes and hormones

- P11 - excess amino acids cannot be stored in the body and broken down by the liver through the dehydration process to produce urea
- P12 - urea is a waste product Urea is the most common waste product and is transported from the liver
- P13 - lipids such as fat are the body's main source of energy
- P14 - excess lipids are stored in adipose tissue
- P15 - some other lipids such as phospholipids and cholesterol are major components of the plasma membrane
- P16 - an important function of the liver is detoxification
- P17 - liver cells get rid of less toxic substances
- P18 - harmful substances such as alcohol, drugs and pesticides can enter the body through food
- P19 - detoxification products are eliminated through bile or urine

Explain the adaptation of plants from various habitats to undergo the process photosynthesis

- P1 - terrestrial plants such as hibiscus have a large number of stomas on the bottom surface for maximum absorption of carbon dioxide
- P2 - chloroplasts are more present in palisade mesophyll cells than sponge mesophyll cells
- P3 - for floating plants such as lotus, the leaves are larger and flatter
- P4 - the stoma is mostly on the surface of the leaves
- P5 - chloroplasts are in palisade mesophyll cells
- P6 - plants that are submerged in water such as aquatic weeds usually do not have
- P7 - and chloroplasts are found on the leaves and stems of these plants
- P8 - desert plants such as cactus have small leaves or no leaves at all
- P9 - the stoma is embedded in the surface of the epidermis
- P10 - desert plant chloroplasts are found on plant stems

CHAPTER 7: RESPIRATION

Oxygen uptake by plants for the process of respiration

- P1 - the stoma pores connect the outside air with the air space between the cells in the leaf
- P2 - the air space between the leaf cells forms a continuous system of spatial interweaving in the plant
- P3 - oxygen from the atmosphere permeates into the intercellular air space and dissolves in a layer of moisture that covers the cell surface characteristic of leaf palisade mesophyll
- P4 - when oxygen is used for the respiration process, the oxygen concentration in the cell becomes lower than the oxygen concentration in the intercellular air space
- P5 - the concentration gradient difference allows dissolved oxygen in the moisture layer to permeate directly from the intercellular space is now lower than the air outside stoma
- P6 - the oxygen concentration in the intercellular space is now lower than in the air outside the stoma
- P7 - this promotes the diffusion of oxygen gas from the atmosphere into the intercellular space through the stoma pores

Comparison and difference between aerobic respiration and anaerobic respiration

- F1 - both aerobic respiration and anaerobic respiration are for cellular respiration and glucose oxidation
- F2 - both of these respiration always occur producing ATP
- F3 - both of these respiration are also catalyzed by enzymes and this respiration occurs in animals and plants
- P1 - aerobic respiration is performed by almost all cells while anaerobic respiration is performed by some plant cells, yeast, bacteria and muscle cells
- P2 - oxygen requirement for aerobic respiration is essential while anaerobic respiration does not require oxygen
- P3 - glucose oxidation in aerobic respiration is complete while anaerobic respiration is incomplete
- P4 - aerobic respiration produces carbon dioxide, energy and water while anaerobic respiration produces ethanol, energy, carbon dioxide for yeast and carbon dioxide, lactic acid and energy for animals
- P5 - energy production for aerobic respiration is 2898kJ compared to anaerobic respiration which produces only a small amount of energy which is 150kJ for muscle and 210kJ for yeast
- P6 - aerobic respiration occurs in the mitochondria while anaerobic respiration occurs in the cytoplasm

Anaerobic respiration in human muscles

- P1 - respiration rate and heart rate increase to transport more oxygen to muscle cells
- P2 - although respiratory rate and heart rate increase, the blood is unable to supply oxygen quickly to meet the energy requirements of ATP
- P3 - the rate of oxygen consumption by muscle cells exceeds the quantity of oxygen supplied by the circulatory system
- P4 - muscles are in a state of oxygen deficiency and are said to have oxygen debt
- P5 - in this condition, the muscle is forced to breathe anaerobically to produce the extra energy needed
- P6 - during anaerobic respiration, glucose molecules are partially broken down to lactic acid P7 - because glucose is broken down incompletely and some of the energy is still bound

Describe the mechanism of pulling and exhaling

P1 - during inhalation, the outer intercostal muscles contract while the rib cage rises up and forward

P2 - at the same time, the diaphragm muscles contract and the diaphragm descends to become flat and horizontal

P3 - these two movements cause the volume of the thoracic cavity to increase and the pressure of the thoracic cavity to decrease

P4 - higher atmospheric pressure outside pushes air into the lungs

P5 - during exhalation, the inner intercostal muscles contract while the outer intercostal muscles relax

P6 - this action causes the rib cage to move down and in

P7 - at the same time, the diaphragm muscles relax and the diaphragm curves upward, dome-shaped

P8 - both of these movements cause the volume of the thoracic cavity to decrease and the pressure of the thoracic cavity to increase

P9 - air is forced out of the lungs

CHAPTER 8: DYNAMIC ECOSYSTEMS

Colonization and Displacement In Ponds

- F1- the process of colonization and displacement can be seen in abandoned ponds due to tin mining activities
- F2 - examples of plants involved in the colonization process are submerged (pioneer) plants, floating plants, amphibious and terrestrial plants
- P1 - colonization by pioneer species begins with idle ponds that are infertile and unsuitable for life
- P2 - the pioneer species that began to colonize ponds were phytoplankton (art algae) and submerged plants (*Hydrilla sp.*, *Elodea sp.* and *Utricularia sp.*)
- P3-submerged plants and phytoplankton carry out photosynthesis and supply food to other organisms
- P4 - when the pioneer plants die and rot, the resulting organic matter will settle to the bottom of the pond. As a result the pond becomes increasingly shallow and unsuitable for submerged plants and phytoplankton
- P5 -in increasingly shallow pond conditions, floating plants that act as displacing species replace the pioneer plants and the first displacement occurs
- P6 - floating plants such as (*Lemna sp.*), kiambang (*Pistia sp.*), pregnant yams (*Eichornia sp.*) and lotus (*Nelumbium sp.*) will grow quickly and cover the surface of the water. This prevents sunlight from reaching the pool. Eventually the pioneer plants cannot carry out photosynthesis and die
- P7 - organic matter from submerged plants as well as floating plants continue to settle at the bottom of the pond. Eventually the pond became too shallow for
- P8 floating plants - floating plants were replaced by amphibious plants such as purun and rusiga that lived in swamps
- P9 - amphibious plants as a displacing species begin to grow at the edge of the pond and spread to the middle of the pond
- P10 - when the plant dies and rots, more and more organic matter accumulates at the bottom of the pond
- P11 - therefore, the pond becomes dry and shallow and more suitable for other plant species
- P12 - amphibious plants are replaced by terrestrial plants such as shrubs and woody plants
- P13 - displacement in the pond continues to occur until the formation of a climax community, which is a tropical rainforest

Explain the interaction between prey and predator (dynamic balance)

- F1 - rats are prey while eagles are predators
- F2 - an eagle or predator has keen eyesight to track the position of prey
- F3 - sharp and curved nails to grip the victim
- F4 - long and pointed canine teeth to kill the victim. The eagle has a beak that is bent to tear the flesh of its prey
- F5 - the victim has the characteristics of running speed and camouflage to avoid being caught
- F6 - under appropriate conditions, when food resources are sufficient,
- F7 - an increase in the total victim population followed by an increase in the victim population
- F8 - when the total victim population increases, the number of predators also increases due to insufficient supply so that the number of victims decreases
- F9 - the number of prey can also decrease as the number of predators increases. However, when the total prey population decreases due to either the process of predation or the spread of disease, the predator population can also decrease
- F10 - this interaction can occur in cycles until both populations of the organism reach dynamic equilibrium

Describe the process of displacement in a mangrove swamp

- F1 - mangrove swamps have soft soils with high salt concentrations and low oxygen content
 F2 - mangrove swamps are also exposed to high light intensity
 F3 - the pioneer species in mangrove swamps are *Avicennia sp.* and *Sonneratia sp.*
 F4 - extensive root system on *Avicennia sp.* and *Sonneratia sp.* helps the tree trap mud and organic parts carried by the tide
 F5 - the gradual accumulation of mud in this area causes the soil to become higher and denser
 F6 - this situation becomes more suitable for *Rhizophora sp.* and is no longer suitable for the growth of pioneer trees
 F7 - over time *Rhizophora sp.* replacing the pioneer species
 F8 - *Rhizophora sp.* has tangled taproots that can trap twigs and drifting mud and block the flow of water
 F9 - more mud trapping causes sedimentation to occur more quickly. Over time the cliffs become higher and drier due to less overflowing sea water during high tide
 F10 - soil structure becomes harder and denser. These environmental changes cause the soil to become less suitable for *Rhizophora sp.* but instead becomes more suitable for other types of mangrove trees viz *Bruguiera sp.* which replaces *Rhizophora sp.*
 F11 - principal *Bruguiera sp.* grows well in areas of high, hard soil and only overflowing with high tides
 F12 - *Bruguiera sp.* has a banir root. Banir roots form a spiral that comes out of the soil and can trap a lot of mud and silt. This changes the structure of the soil gradually
 F13 - a continuous sedimentation process causes the formation of new swamps that project into the sea while the old shores move further away from the sea
 F14 - environmental changes occur continuously causing the soil on the coast to resemble land that is more suitable for terrestrial trees such as *Nypa Fruticans* and *Pandanus*
 F15 - over time other terrestrial trees will grow and displacement occurs
 F16 - eventually tropical rainforests form and resemble climax communities

Explain how nitrogen gas is absorbed in plants

- F1 - nitrogen is an important element for synthesizing animal and plant proteins
 F2 - nitrogen gas cannot be absorbed by plants
 F3 - plants can only absorb nitrogen in the form of ammonia ions and nitrate ions
 F4 - nitrate ions are also added to the soil in the form of fertilizer and through lightning (atmospheric binders)
 F5 - nitrogen -fixing bacteria will convert nitrogen gas into a form that can be used by plants
 F6 - an example of nitrogen fixing bacteria is *Nostoc sp.* Which is abundant in nut tree nodules
 F7 - they bind nitrogen and convert it to ammonia ion form
 F8 - trees can only take nitrogen in the form of nitrate ion
 F9 - when animals eat plants, organic matter nitrogen is transferred into the body animals
 F10 - when animals and plants die, the decomposition process produces ammonia to be converted into nitrate and nitrite by nitrifying bacteria
 P11 - ammonia is converted to nitrite ions by *Nitrosomonas sp.*
 P12 - while nitrite is converted to nitrate by *Nitrobacter sp.*
 P13 - nitrifying bacteria convert nitrate back to nitrogen in the atmosphere to complete the nitrogen cycle

Explain how eutrophication occurs

- P1 - due to excessive use of inorganic fertilizers
- P2 - containing nitrates and phosphates
- P3 - the fertilizer will leach and flow into rivers or lakes
- P4 - add nutrients in rivers or lakes
- P5 - causes sudden algal growth
- P6 - covers the surface of the water so that the light intensity in the water source becomes less
- P7 - submerged plants will die
- P8 - decomposing bacteria will break it down
- P9 - decomposition process using oxygen, causing oxygen in the water to decrease
- P10 - aquatic animals and plants will die
- P11 - increasing growth of microorganisms (aerobic bacteria)
- P12 - increasing this *Biochemical Oxygen Demand*(BOD)

Colonization and displacement in barren lands

- P1 - only some species can survive in an environment consisting of rocks and sand because this type of soil stores little water and less nutrients
- P2 - a species that begins to conquer and occupy an area that has never been occupied by other species (pioneer)
- P3 - pioneer species usually have special adaptive properties that allow them to survive in new environments that are usually dry and less fertile
- P4 - pioneer species have a root system that can trap humus and water sand grains
- P5 - this pioneer has a short life cycle
- P6 - when the pioneer species dies, the result of its decay becomes humus content in the soil and the soil gradually becomes more fertile
- P7 - the environment becomes more suitable for a surrogate species or a displacement species
- P8 - pioneer species alter the environment and create conditions that are less suitable for and themselves but more suitable for the growth of displacing species
- P9 - the displacing species grows taller than the pioneer species to prevent sunlight from reaching the pioneer plants
- P10 - the number of new displacing species will increase and displacement or replace the pioneer species
- P11 - displacing species usually have small seeds that are easily dispersed by wind and are able to fall down and grow quickly
- P12 - displacer species alter the structure and quality of the soil to make it more suitable for the growth of large trees
- P13 - large trees became the dominant species because they grew faster and successfully displaced slower-growing displacing species
- P14 - over time, the dominant species modifies the environment and allows other larger and taller trees to grow
- P15 - large trees displacing shrubs replaced by plant species on the forest floor that do not require high light intensity
- P16 - the process of habitat change and displacement by new species will continue
- P17 - the process of gradual and successive replacement of one species by another is called displacement
- P18 - displacement produces a community that is relatively stable and in balance with the environment and this community is called a climax community

CHAPTER 9: THREATENED ECOSYSTEMS

Explain how you can determine the level of water pollution in X (river near the factory), Y (river near the garden) and Z (river near the area livestock)

- P1 - water samples at X, Y and Z are taken and brought to the laboratory
- P2 - 100 ml of water in X, Y and Z is put into three bottles of reagent (250ml)
- P3 - using a 1ml syringe, methylene blue is put into all three reagent bottles simultaneously at the same time
- P4 - time recorded
- P5 - the bottle is closed and stored in a dark cupboard
- P6 - methylene blue bleaching time was recorded and recorded
- P7 - the fastest blue bleaching indicates the most contaminated water sample or vice versa

Deforestation for the continued progress and development of industry is now leading to ozone depletion and greenhouse effects. Describe how this phenomenon occurs

1. Thinning of the ozone layer

- P1 - increased use of CFCs as a result of the manufacture of polystyrene, refrigerators, aerosols and solvents in industry
- P2 - when exposed to UV radiation, high energy causes CFCs to release chlorine atoms
- P3 - free chlorine breaks down ozone to form chlorine monoxide and oxygen
- P4 - chlorine monoxide reacts with oxygen atoms to produce chlorine and oxygen molecules
- P5 - free chlorine repeats the cycle
- P6 - causes the ozone layer to become thin and a lot of UV rays to reach the earth

2. Greenhouse effect

- P1 - as a result of widespread deforestation, forest fires, vehicle and factory smoke fuels
- P2 - a lot of carbon dioxide gas is released into the atmosphere
- P3 - high carbon dioxide traps heat
- P4 - this heat is supposed to go out or be reflected into outer space
- P5 - as a result, the earth's temperature will rise

