KUSOMA REVISION MATERIALS

BIOLOGY FORM 2 NOTES

www.kusoma.co.ke

This document was downloaded from

www.kusoma.co.ke

1. **a) i) Define transport**

- movement of substances from one part of the body to another

ii) Explain the necessity of transport in plants and animals

- make nutrients move from one point to another
- movement of respiratory gases i.e. oxygen and carbon IV oxide
- elimination of metabolic wastes
- movement of hormones
- movement of water
- movement of salts
- movement of enzymes

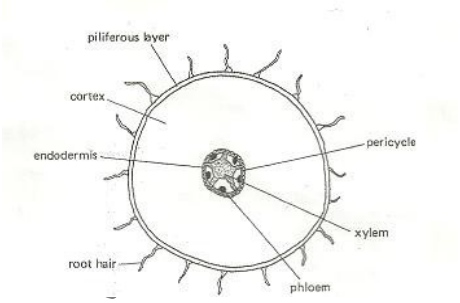
b) i) Describe the structure and function of root hair

- root hairs are found near the root tip
- they are cells with elongated finger-like projections which are in contact with soil particles
- they are permeable to water and mineral salts hence are used to absorb water and mineral salts
- There large number offers a large surface area for absorption of water and mineral salts.

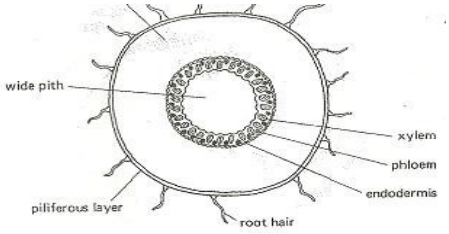
ii) State ways in which the root hairs are adapted to their functions

- the root hair is long/narrow/numerous to increase surface area for absorption of water and mineral salts
- many mitochondria in cytoplasm to supply energy for active transport of mineral salts
- are thin walled to speed up rate of absorption of water and mineral salts

c) i) Compare the internal structure of a dicotyledonous root and a monocotyledonous root
Dicot root



Monocot root



kusoma.co.ke

ii) State the similarities and differences between a dicotyledonous and monocotyledonous root

Similarities

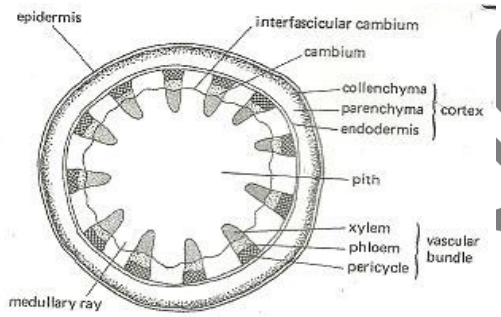
- both used for anchorage and absorption of water and mineral salts
- both have root hairs, epidermis, pericycle, cortex, endodermis and vascular bundles (xylem and phloem)
- both may be used to store food/storage organs
-

Differences

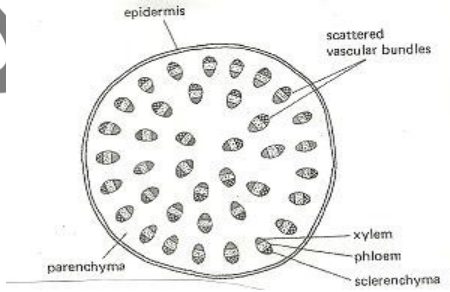
Monocotyledonous	Dicotyledonous
• phloem and xylem are arranged in ring form alternately • pith present	• phloem lies between radial rays of central xylem(star shaped) • pith absent

iii) **Compare the internal structure of a monocotyledonous and dicotyledonous stem**

Monocotyledonous



Dicotyledonous



i) Give the similarities and differences between a monocotyledonous and dicotyledonous stem

Similarities

- both are used for protection
- both conduct water, salts and food
- both have epidermis, cortex, pericycle and vascular bundles

Differences

Monocotyledonous	Dicotyledonous
• vascular bundles are many and scattered • some have hollow pith or pith is absent	• vascular bundles are few and arranged in a concentric ring near the epidermis • pith large and well developed

www.soma.co.ke

• no cambium layer therefore cannot undergo secondary growth • very little cortex	• presence of cambium therefore undergoes secondary growth • cortex has several layers of cells

i) State the differences between the internal structure of a root and a stem.

Root	Stem
• has root hairs • no cuticle • xylem and phloem arranged alternately • in xylem, the small vessels are towards the outside • cortex is the widest tissue	• no root hairs • cuticle present • xylem and phloem arranged on the same radii • in xylem, the smallest vessels are towards the inside • pith is the widest tissue

c**) i) Name the transport structures of a flowering plant**

- xylem vessels and tracheids transport water and mineral salts from the soil
- Phloem vessels translocate manufactured food from leaves to other parts of the body.

ii) State the ways in which xylem vessels are adapted to their function

- lignified/thickened to prevent collapsing
- narrow to facilitate capillary
- no cross walls for continuous flow/column of water
- have bordered pits for lateral movement of water

a) i) Why do flowering plants need water?

- photosynthesis
- transport
- turgidity which helps in plant support
- solvent i.e. medium for chemical reactions
- cooling effect during transpiration
- seed germination

ii) Describe the movement of water from the soil to the leaves of a tall plant

Soil

- water exists as a thin film in the soil, between soil particles

www.kusoma.co.ke

- the concentration of cell sap of root hair is greater than that of the surrounding solution in the soil, thus drawing the water molecules across the cell wall and cell membrane into the root hair by osmosis
- water drawn into the root hair cell dilutes the cell sap making it less concentrated than that in the adjacent cortex cells of the root
- due to osmotic gradient water moves from the root hair cells into the cortex by osmosis, from cell to cell by osmosis, across the endodermis by active transport into xylem vessels of the root that conduct water into xylem vessels of the stem into xylem vessels of the leaves

Stem

- Once in the stem water moves up the plant aided by the narrowness of the xylem vessels (capillary), root pressure, attraction of water molecules to each other (cohesion). Attraction of water molecules to the walls (adhesion)
- from the stem water enters the xylem of leaves
- water moves in the xylem vessels of the stem in a continuous (uninterrupted) water column up to the tree leaves

Leaves

- once in the leaves water moves into the mesophyll cells by osmosis
- as water vaporizes from the spongy mesophyll cells their sap becomes more concentrated than the adjacent cells
- as the result water flows into the cell from other surrounding cells which in turn takes in water from xylem vessels within the leaf veins
- this creates a pull(suction force) called transpiration pull that pulls a stream of water from xylem vessels in the stem and roots
- The transpiration pull maintains a continuous column of water from the roots to the leaves.

iii) Name the process by which mineral salts enter into a plant

- active transport
- diffusion

i) Explain the forces that make water and mineral salts move through a plant mineral

- salts are taken up due to diffusion because of the concentration gradient between the mineral ions in sap and those in soil solution
- active transport involves energy in form of ATP due to respiration which forces mineral salts through a plant against a concentration gradient
- water moves by osmosis through a semi-permeable membrane of root hairs and between cells of stem
- in stem water moves by cohesion(attraction of water molecules to each other)
- it also moves by adhesion(attraction of water molecules to walls)
- capillarity is due to narrowness of xylem vessels
- transpiration pull occurs when water vapour evaporates from sub-stomatal chambers into the air
- root pressure is a force that pushes water up the stem from the roots and causes guttation /exudation

www.kusoma.co.ke

ii) Explain the uptake of mineral salts by plants

- plants require mineral salts for metabolism and proper functioning of their bodies
- mineral salts are taken up from the soil into the root hairs in form of solution by active transport which requires energy
- active transport involves substances called carriers taken up together with water and are then carried to the stems and leaves
- the main process involved in uptake and movement of mineral salts is active transport

b) i) What is transpiration?

- loss of water from plant to the atmosphere

ii) Name the sites through which transpiration takes place in a plant

- stomata (stomatal transpiration)
- lenticels (lenticular transpiration)
- cuticle(cuticular transpiration)

iii) State the importance of transpiration to plants

- cooling the plant
- transport of water
- transport of mineral salts
- excretion of excess water from plants
- excess transpiration causes wilting

i) Explain the structural factors that affect the rate of transpiration in plants

- number of stomata i.e. the more the stomata the higher the rate and vice versa
- turgidity of the guard cells which control the opening and closing of stomata when they are open transpiration rate is high
- size of leaves where the larger the surface area the higher the rate of transpiration
- leaf fall leads to lower rate of transpiration and also drying of leaves reduces rate of transpiration
- Thin cuticle reduces distance through which water vaporizes hence increase transpiration rate. Absence of cuticle also increase rate of transpiration

ii) explain the environmental factors that affect rate of transpiration in plants

- high temperature increases rate of transpiration and low temperature reduces the rate
- humidity when high increases rate and when low reduces the rate

www.kusoma.co.ke

- transpiration rate is higher in moving air (wind) than in still air
- high light intensity increases internal temperature hence higher rate of evaporation leading to higher rate of transpiration
- availability of water in the soil leads to more absorption hence more loss to the atmosphere
- atmospheric pressure when high leads to more evaporation and when low leads to low rate evaporation of water

iii) State the structural differences between xylem vessels and sieve tubes

- sieve tubes have cross wall while xylem vessels have none
- xylem vessels are lignified while sieve tubes are not
- Sieve tubes have cytoplasm elements while xylem vessels have none.

iv) State the adaptations of plants which enable them to reduce water loss

- thick waxy cuticle
- reduced leaf size/thorns/spines
- shedding of leaves
- Sunken stomata. Water vapour accumulates in the depression of stomata lowering the water vapour concentration gradient leading to lower rate of evaporation
- rolling of leaves

v) State the factors that cause increase in the rate of transpiration from leaves

- increased light intensity
- low relative humidity
- temperature

vi) Explain how drooping of leaves on a hot sunny day is advantageous to a plant

- reduces surface area exposed to sun reducing cuticular transpiration

c) Explain how aquatic and terrestrial plants are adapted to deal with problems of transpiration

a. Mesophytes

- they grow in soils with enough water
- water loss is perfectly balanced by absorption of more from the soil
- no special adaptations

b. Xerophytes

- they grow in dry conditions
- root grow very deep to absorb water
- succulent/fleshy leaves to store water
- few stomata which are sunken
- thickened waxy cuticle

www.kusoma.co.ke

- leaves are hairy and often folding
- some leaves are needle-like/spines or scales
- leaf surfaces are reduced i.e. small leaves
- all these adaptations are to reduce water loss

c. Hydrophytes

- plants that grow in water
- presence of sclereids
- leaves are broad
- leaves have many stomata on upper side only (none on the lower surface)
- some leaves float on water
- absence or reduced leaf cuticle
- large air spaces
- some leaves are submerged
- poorly developed or reduced vascular bundles

d) i) What is translocation

- transfer of manufactured food substances to the parts where they are required

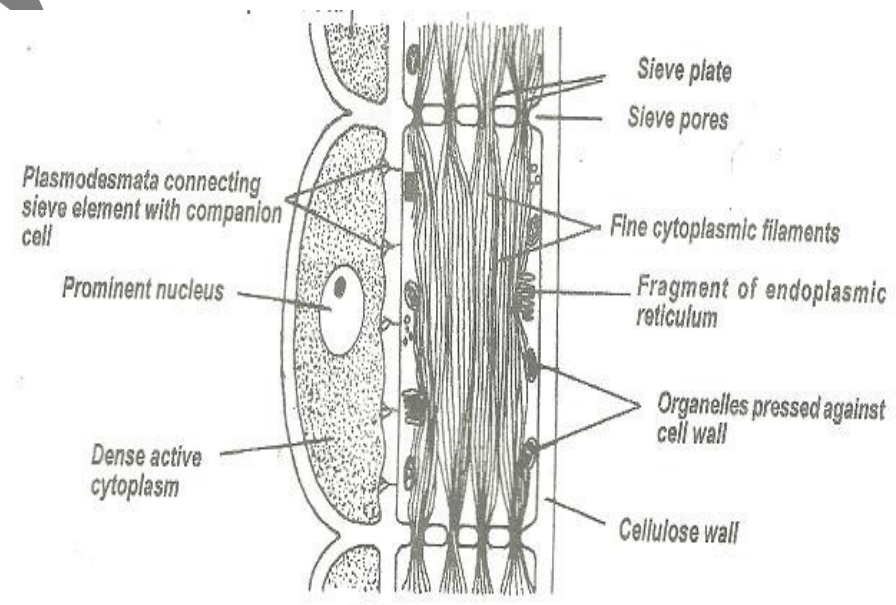
ii) **Name the tissue which is responsible for translocation of manufactured food in flowering plants**

- phloem tissue

iii) Name the processes that bring about the translocation of manufactured food

-active transport
Diffusion
Mass flow
Cytoplasmic streaming

iv) Draw a labeled diagram to represent phloem tissue



Phloem Tissue

www.kusoma.co.ke

ii)State the functions of the labeled structures
cytoplasmic strands

- translocation

Companion cell

- supply nutrients to sieve tube element supply energy for translocation
- regulates activities of tube cells/elements

Sieve tubes element

- conduct food down the stem

iii) name the compounds that are translocated in phloem

- sugars
- amino acids
- hormones e.g
- auxins oils/lipids
- resins vitamins
-

www.kusoma.co.ke

Describe an experiment you would carry out in order to demonstrate that phloem transports manufactured food substances in a plant

a. Ringing experiment

- cut a ring in the bark including the phloem from the stem of a woody plant
- phloem is found next to or just beneath the bark
- observe daily for some time(more than three weeks)
- a swelling of the bark appears above the ring
- this is due to accumulation of food from leaves
- the bark of a second similar plant is removed carefully leaving the phloem intact
- a swelling does not appear

ii) Use the radio-active tracers

- plant is exposed to carbon containing radio-active carbon C14
- C14 is found in the end products of photosynthesis
- It is finally detected in phloem
- C14 is found to move in both directions

iii) Collecting exudate from stylets of aphids

- aphids feed on certain plant phloem using their stylets
- aphid mouthparts are dissected using a sharp razor
- exudates from the mouthparts are collected and then analyzed
- sucrose is found to be a major component of the exudates
- this proves that phloem translocates manufactured food substances

e) Describe an experiment you would carry out to demonstrate that xylem transports water

i. Either

- cut a stem of a young plant or twig of a tree under water
- or else uproot a young herbaceous plant and wash the soil gently
- put some water in a beaker and add a dye i.e. eosin or red ink and place the cut stem or young plant in a beaker
- leave for time e.g. between 20 minutes and one hour
- cut a thin section of stem or leaf
- mount it on a slide and examine under a microscope
- observe and note the distribution of the dye or ink
- the dye appears only in the xylem vessels

ii. OR

- use radio-active tracers, C14 in form of carbon
- ring a plant then put it in a container containing radio-active phosphorous solution
- The radio-active phosphorus is later detected in the leaves.

www.kusoma.co.ke

2. a) i)List the components of animal transport systems

- system of blood vessels in which materials are circulated round the body
- blood, a fluid medium which contains dissolved substances and cells
- the heart, a pumping mechanism which keeps blood in circulation

ii) Distinguish between closed and open circulatory systems

- closed system has blood vessels through which blood moves eg vertebrates
- open system has no blood vessels hence blood is in direct contact with tissues e.g arthropoda

iii) What are the advantages of the closed circulatory system over open circulatory system?

- Closed system has continuous vessels hence able to generate high pressure
- Circulates blood over longer distance
- Circulates blood at a faster rate
- Efficient transport of nutrients and waste products
- Animals are more active

iv) Distinguish between single circulatory system and double circulatory system Single circulatory

- blood passes through the heart once in a complete circuit of the body

Double circulation

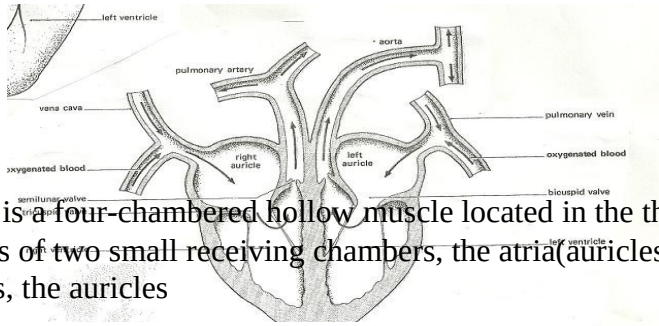
-blood enters the heart twice in a complete circulation
- Pulmonary circulation from the heart to lungs and back
- Systemic circulation from the heart to body systems and back

b) i) describe the general layout of the transport system in mammals

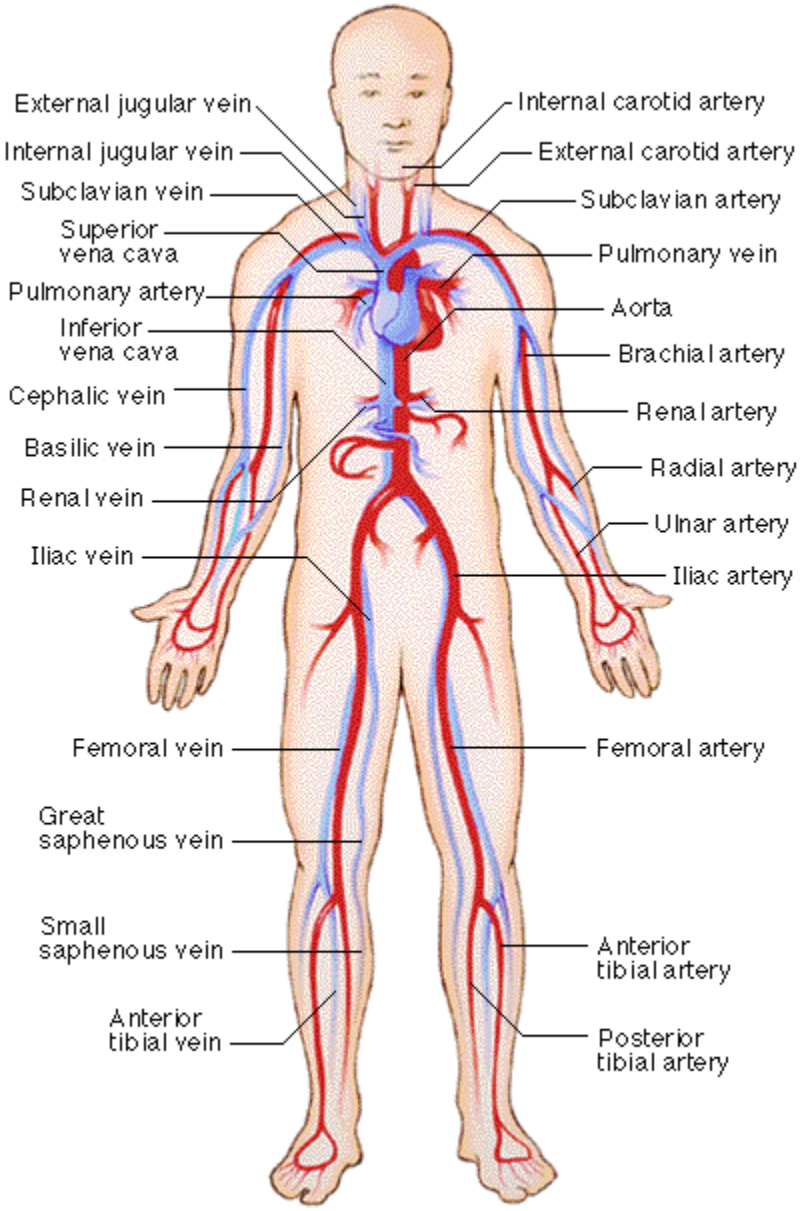
- blood which is a fluid tissue of the body carrying food substances, oxygen, carbon IV oxide and metabolic wastes
- arteries which are elastic tubes carrying blood from the heart to cells
- veins which are blood vessels carrying blood away from the cells to the heart
- capillaries which are extremely numerous and are microscopic channels connecting arteries to veins

ii) Describe the structure and function of the mammalian heart

www.kusoma.co.ke

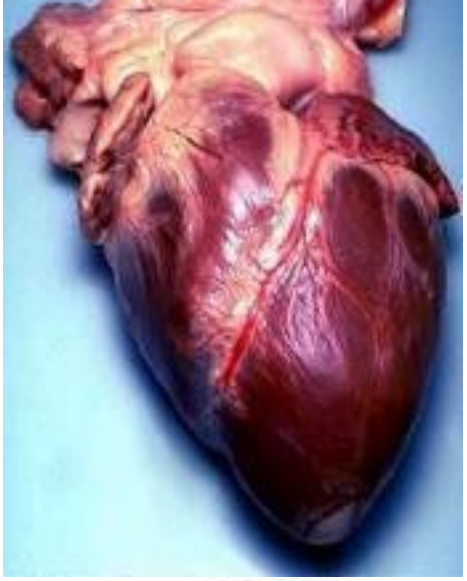


- the heart is a four-chambered hollow muscle located in the thoracic cavity
- it consists of two small receiving chambers, the atria(auricles) and two larger pumping chambers, the auricles



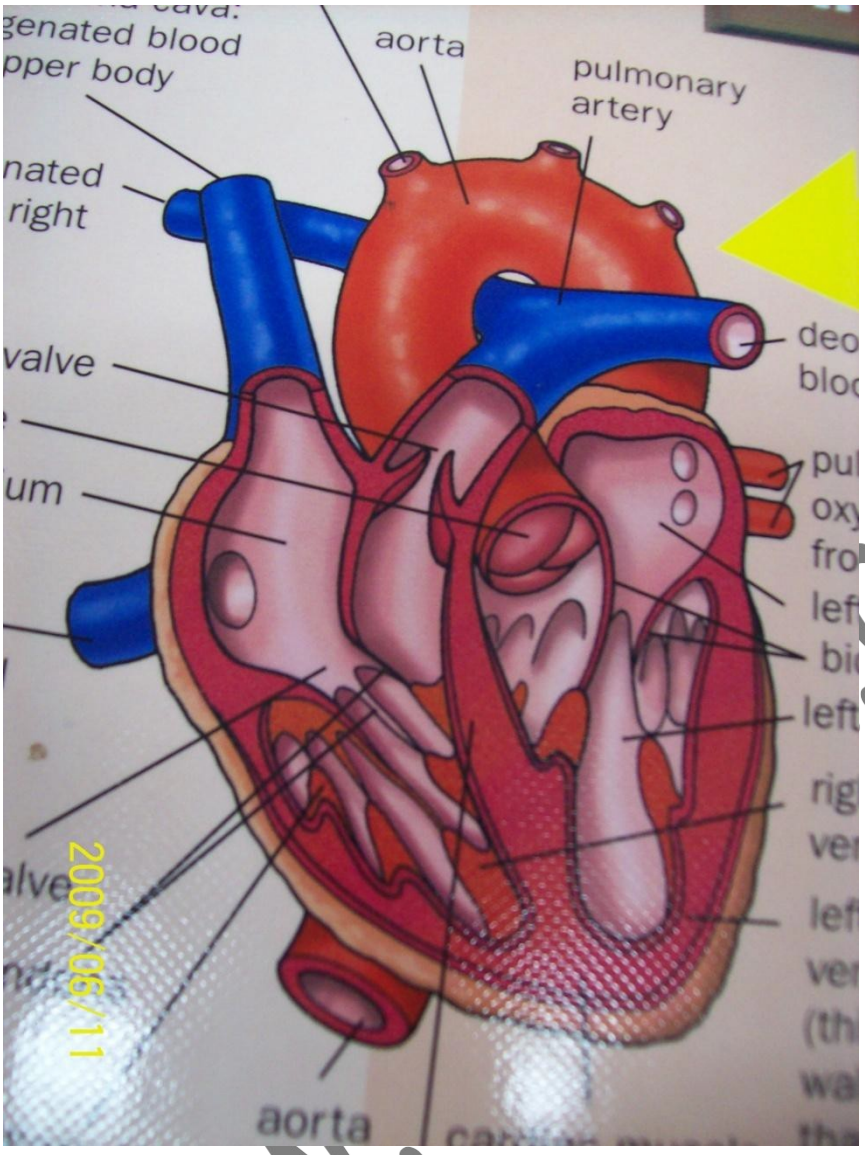
www.kusoma.co







www.[illegible]oma.co.ke



www.co.ke

- the left ventricles is the most powerful and has the thickest walls
- this is because it is the chamber which pumps blood throughout the body
- each time it contracts, blood is forced out into the elastic arteries(aorta)
- blood moves on to the capillaries
- from capillaries blood moves to veins and back to the heart through the vena cava
- from vena cava it enters into right auricle which contracts and pumps blood into the right ventricle
- right ventricle pumps blood into the lungs through the pulmonary artery
- blood releases carbon IV oxide to lungs and picks oxygen then returns to left auricle
- left auricle pumps blood into left ventricle

- left ventricle then pumps blood into the aorta and into arteries, starting the process all over again
- both auricles contract simultaneously while both

iii) Explain how the mammalian heart is adapted to performing its functions

- the heart is made of muscles that contract and relax synchronously without requiring nervous stimulation
- nerve supply however, determine contraction strength and frequency
- the heart is divided into four chambers
- The right atrium is connected to the right auricle. It receives blood from the whole body.
- The blood is pumped from the left atrium to the right ventricle
- To avoid flow back into the right atrium, a valve is present between the two chambers – the tricuspid valve
- The right ventricle pumps blood to the lungs
- This is facilitated by the presence of pulmonary artery
- A valve is also present to avoid blood flowing back from the pulmonary artery to the right ventricle
- Blood from the lungs enters the heart through the pulmonary vein into the left atrium.
- When the left atrium contracts, blood flows into the left ventricle
- Blood will not flow back into the left atrium because of the presence of bicuspid valve(mitral)
- The left ventricle is connected with the aorta and when it contracts, blood flows into the aorta for distribution into the whole body
- The heart muscle surrounding the left ventricle is thicker than that surrounding the right ventricle to be able to generate enough pressure to push blood to the whole body
- A pace-maker is present in the heart muscle to initiate and synchronise contractions.
- For the heart muscle to be well nourished and be provided with enough oxygen and carbon IV oxide removal, it is supplied with blood by the coronary arteries and drained by the coronary veins

iv) Explain why blood leaving the lungs may not be fully oxygenated

- under ventilation of the lungs
- blockage of alveoli (air sacs)
- high cardiac frequency i.e. high rate of pumping of blood in the heart

e) Describe the structure and functions of the blood vessels

i. Arteries

- carry away blood from the heart
- carry oxygenated blood except pulmonary artery which takes blood from the heart to lungs for oxygen

www.kusoma.co.ke

- have thick, muscular walls
- are elastic
- have narrow lumen
- all these adaptations are required to withstand high pressure caused by heartbeat

ii. Capillaries

- link arterioles and venules to arteries and veins
- small in diameter to increase pressure resistance for materials to filter out
- thin walled as they consist of a single layer of cells to allow diffusion of substances e.g leucocytes to tissues
- thin walled to allow presence of intercellular spaces
- large number i.e. numerous to provide a large surface area for exchange of materials
- have sphincter muscles at the junction of the arterioles and capillaries to control movement of blood into them
- lie close to the body for easy exchange of materials

iii. Veins

- carry blood back to the heart
- all carry deoxygenated blood except pulmonary vein that carries blood from the heart to lungs
- have thinner walls than arteries
- have valves to prevent backflow of blood
- have wide lumen

b) i) State the ways in which the composition of blood in the pulmonary arterioles differs from that in the pulmonary venules

Pulmonary arterioles	Pulmonary venules
• deoxygenated • high carbon IV oxide • low oxygen • more nutrients	• oxygenated • low carbon IV oxide • high oxygen • less nutrients

ii) Give the reasons why pressure of blood is greater in the arterioles than I the veins of mammals

- blood is pumped to the arteries by the heart at high pressure
- blood pressure in veins is reduced by capillary resistance
- arteries have narrow lumen which maintains high pressure/veins have wide lumen which reduces pressure
- arteries have more/thicker muscular walls which generate pressure/veins have less/thinner muscular walls which reduce pressure

iii) Name the common heart diseases in humans

- thrombosis
- antheroma

www.kusoma.co.ke

- arteriosclerosis
- varicose veins
- cerebral vascular thrombosis
-

c) i) State the functions of mammalian blood

- transport of substances
- defense against diseases
- clotting
- temperature regulation

ii) Describe how mammalian blood components carry out their functions Plasma

- transport dissolved food substances like glucose, amino acids, fatty acids and glycerol from small intestines to liver and other body tissues
- transports hormones, enzymes from secretory glands to tissues when required
- transports carbon IV oxide to lungs and urea from tissues to the kidneys
- distributes heat
- bathes the tissues allowing for exchange of materials
- contains protein fibrinogen and pro-thrombin which take part in blood clotting

Red blood cells (Erythrocytes)

- transports oxygen from the lungs to body tissues in form of haemoglobin
- transport carbon IV oxide from body tissues to the lungs in form of bicarbonates

White blood cells (leucocytes)

- engulf foreign bodies
- produce antibodies for defense against disease
- produce antitoxins which neutralize bacterial toxins

Blood platelets (thrombocytes)

- produce an enzyme called thrombokinase/thromboplastin necessary for blood clotting
- prevents loss of blood, water and mineral salts

iii) State the ways in which the red blood cells are adapted to their functions

- many per unit volume hence carry more oxygen and carbon IV oxide
- biconcave in shape to provide large surface area for absorption of oxygen and carbon IV oxide

www.kusoma.co.ke

- absence of nucleolus hence more haemoglobin to carry sufficient oxygen and carbon IV oxide
- alter shape to be able to pass through the narrow lumen of capillaries to deliver or supply oxygen and carry away carbon IV oxide
- have haemoglobin with high affinity for uptake of oxygen and carbon IV oxide

iv) State the structural differences between a red blood cell and a white blood cell.

Red blood cells	white blood cells
• has haemoglobin • smaller size • lacks nucleus	- not pigmented - larger size - nucleated

v) State the functional differences between a red blood cell and a white blood cell

Red blood cell	**White blood cell**
- Transports oxygen and carbon IV oxide	- protects body against harmful pathogens

ii) How does the heart increase blood flow to some parts of the body during exercise

- stronger contractions
- faster contractions/heartbeat

Explain how oxygen and carbon Iv oxide are transported in the blood

<u>Oxygen</u>

- oxygen concentration is higher in lungs(alveoli) that in blood
- oxygen in the alveoli dissolves in the film of moisture and diffuses through thin epithelial and capillary walls into plasma and red blood cells
- the oxygen combines with haemoglobin to form oxyhaemoglobin
- blood then becomes oxygenated
- blood from lungs then travels to all body tissues where the oxyhaemoglobin breaks down to form oxygen and haemoglobin
- haemoglobin is transported back to the lungs to collect more oxygen while the oxygen in capillaries diffuses into body cells for respiration
- respiration produces carbon IV oxide

www.kusoma.co.ke

Carbon IV oxide

- carbon IV oxide produced during respiration diffuses out of cells into blood plasma and red blood cells due to concentration gradient
- carbon IV oxide and water form carbonic acid carbamino compounds with haemoglobin
- in the presence of carboxyl anhydrase enzyme, hydrogen carbonate is carried in blood to the lungs
- in the lungs the hydrogen carbonate dissociates to liberate carbon IV oxide which diffuses into alveolar cavity due to concentration gradient
- from alveolar space carbon IV oxide is expelled during expiration

Most carbon IV oxide is transported from tissues to lungs within the red blood cells and not in the blood plasma. Give the advantages of this mode of transport.

- PH of blood is not altered/homeostasis is maintained
- Within the red blood cell is an enzyme, carbonic anhyrase which helps in fast loading(combining) and offloading of carbon Iv oxide

d) i) what is blood clotting?

- process in which blood components clump together to prevent loss of blood from an injured/cut vessel

ii) Name a protein, vitamin, an enzyme and a mineral element involved in blood clotting

Protein – fibrinogen/prothrombin
Vitamin - k/quinine
Enzyme – thrombokinase/thromboplatin/thrombin
Mineral element – calcium

www.kusoma.co.ke

iii) describe the blood clotting process

- enzyme thromboplastin produced in the platelets of damaged tissues converts plasma protein prothrombin into thrombin in the presence of calcium ions

- thrombin converts another plasma protein fibrogen into fibrin in the presence of vitamin K
- fibrin is insoluble
- fibrin forms fibres which form a meshwork that forms a clot
- prothrombin thromboplastin thrombin
  calcium ion

Fibrinogen thrombin fibrin clot
vitamin K

iv) State the role of blood clotting on wounds

- prevents blood/body fluids from being lost
- conserves water and salts
- prevents entry of microorganisms/pathogens
- regulates body temperature
- enables wound to heal faster

v) Explain why blood flowing in blood vessels does not normally clot

- Presence of anticoagulant in blood

e) i. list the major types of human blood groups

- O, with neither B nor A antigen
- AB, with both A and B
- antigens A, with type A antigen
- B, with type B antigen

iii. explain the meaning of :

Universal donor

- a person who can donate blood to any other blood group without agglutination/clumping
- this is usually blood group O
- however this person cannot receive blood from other blood groups except group O

Universal recipient

- can receive blood from all blood groups without agglutination
- this is usually blood group AB
- however, can only donate blood to group AB

iii) What is the difference between rhesus positive and Rhesus negative blood samples?

- rhesus positive blood has the Rhesus (Rh) antigen
- rhesus negative lacks the Rhesus antigen

www.kusoma.co.ke

vi) What is blood transfusion?
- Introduction of blood from one person to another

v) Under what conditions would blood transfusion be necessary in people?
- during accidents
- during surgery in hospitals
- bleeding mothers when giving birth

vi) How can low blood volume be brought back to normal?
- transfusion
- taking fluids
- eating iron rich food/taking iron tablets

How may excessive bleeding result in death?

Anaemia/low blood volume/loss of iron/low red blood cells count/low haemoglobin leading to low oxygen, loss of nutrients and dehydration.

State the precautions that must be taken before blood transfusion
- blood must be disease free
- sterilized equipment must be used
- blood of the recipient and that of the donor must b compatible to both ABO and rhesus factor
- Fresh blood must be used.

j) i) What is immunity?
- Resistance to disease by organisms

ii) Distinguish between natural and acquired immunity
- natural immunity is inherited/transmitted from parent to offspring/inborn/innate
- Acquired immunity is developed after suffering from a disease or through vaccination.

iii) What are allergic reactions?

Excessive sensitivity and reaction of an individual to certain substances in environment e.g. dust, pollen, perfumes, smoke etc.

vi) How does an allergic reaction occur?
- the substances act as antigens
- an antigen-antibody reaction occurs on surface of cells
- the cells release a substance called histamine
- the histamine causes irritation, itching and may stimulate nasal discharge

v

ii) State the role of vaccination against certain diseases
- protect body against infectious diseases

www.kusoma.co.ke

- prevent spread/transmission of certain diseases
- diseases for which vaccination is given include tuberculosis, poliomylitis,measles, whooping cough, diphtheria

3. a) i) What is gaseous exchange?

- The continous exchange of oxygen and carbon Iv oxide between the organism and environment.

ii) Why is gaseous exchange important to organisms?

- to supply oxygen necessary for energy production
- to remove carbon IV oxide produced during respiration
- To remove water vapour.

b) i) name the structure used for gaseous exchange by plants

- stomatal pores/stomata
- lenticels
- cuticle
- pneumatophores

ii) Briefly describe the structure of stomata

- are minute pores found in leaf epidermis
- each consists of a slit-like opening
- Each is bordered by two large, bean-shaped guard cells.
- Guard cells contain chloroplasts, unlike the other epidermal cells which enable photosynthesis to occur.
- Inner walls of guard cells are thicker than the outer cells

iii) State the factors which affect stomatal opening

- water which when low stomata close and when high stomata keeps open
- light as stomata open in bright light and close in darkness
- temperature

iv) Name the theories suggesting the mechanism of opening and closing of stomata

- interconversion of starch and sugar
- pH theory
- mineral ion concentration

v) Describe the mechanism of opening and closing of stomata

www.kisoma.co.ke

- stomata close at night and open during daytime
- This comes about due to changes in turgidity as a result of pH changes in guard cells.
- In the dark carbon Iv oxide accumulates in the intercellular spaces
- This raises concentration of carbonic acid
- The pH drops (pH lowered)
- Enzymes convert sugar into starch in guard cells
- Osmotic pressure in guard cells is lowered
- Water moves out of guard cells by osmosis making cells lose turgidity hence become flaccid
- The stomata close
- During day time there is photosynthesis hence the production of sugar, carbon IV oxide concentration is lowered, pH increases, guard cells become turgid causing stomata to open.

- During the day potassium ions concentrate in guard cells, raising their osmotic pressure and causes then to open
- In the night the concentration of potassium ions decreases increasing osmotic pressure in guard cells therefore causes stomata to open.

i) What is the advantage of having stomata open during daytime and having them closed at night?

- opening in the daytime allows diffusion of carbon IV into the leaf for photosynthesis to take place and allows diffusion of oxygen out of the leaf
- transpiration also takes place, thus cooling the leaf and facilitating uptake of water and mineral slats
- Closing in the night is to conserve water in the plant especially when there is not enough water available in the soil.

c) i) State the ways in which leaves of plants are adapted to gaseous exchange

- presence of stomata for faster gaseous exchange
- intercellular spaces/air spaces in the leaf for movement/circulation of air
- film of moisture around the surface of cells for easy diffusion
- broad/flattened shape to increase surface area
- thin lamina to reduce distance of diffusion
- exposed to air for easy diffusion

ii) Describe how gaseous exchange takes place in terrestrial plants

- Gaseous exchange takes place in spongy mesophyll
- During the day air diffuses into large air spaces of spongy mesophyll through stomata
- The carbon iv oxide in the air diffuses into the photosynthesis oxygen is produced
- Some of the oxygen diffuses out of the leaf through stomata

www.kisoma.co.ke

- During the night air diffuses out of air spaces of spongy mesophyll
- The air dissolves into film of moisture
- The oxygen in the air diffuses into cells and is used in respiration during which carbon iv oxide is produced
- The carbon iv oxide diffuses out of the leaf through stomata due to diffusion/concentration gradient
- At night carbon iv oxide accumulates in the leaf since photosynthesis does not take place
- Some gaseous exchange also takes place through cuticle
- Gaseous exchange occurs through epidermis of young leaves and stems
- The cork cells at lenticels are loosely packed
- Gaseous exchange takes place between cork and atmosphere within the loosely packed cells

iii) State the ways in which floating leaves of aquatic plants are adapted to gaseous exchange

- stomata found only on upper dermis to allow efficient gaseous exchange
- presence to aerenchyma tissues/large air spaces to enable it float/buoyancy/storage of air
- absence of cuticle to enhance gaseous exchange

iv) How is aerenchyma tissue adapted to its function?

- has large airspaces which store gases/for gaseous exchange/buoyancy

v) Explain stomatal distribution in plants of different habitats

- land plants have their stomata mainly on the lower side to reduce water loss but if on both sides then upper side has very few
- water plants, floaters, have stomata on upper side to enhance water loss
- in dry areas, plants have leaves with sunken stomata to reduce water loss by transpiration
- Plants in wet areas have stomata equally distributed on both sides.

d) i) List the types of respiratory surfaces of animals

- cell membrane in unicellular organisms e.g. amoeba
- gills in fish
- tracheal system
- skin, buccal cavity and lungs in amphibians
- lings in mammals

ii) State the characteristics of respiratory surfaces in animals

- moist
- thin walled/thin membrane/thin surface

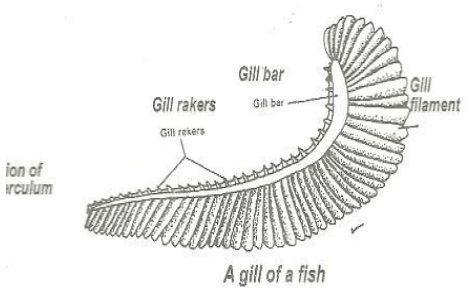
www.kusoma.co.ke

- Highly/richly vascularised/numerous blood vessels/well supplied with blood vessels.
- Large surface area

iii) Describe gaseous exchange in protozoa

- example is amoeba
- small and have large surface area
- oxygen diffuses into the organism and carbon IV oxide diffuses out into water
- simple diffusion of gases is enough to meet its respiratory requirements

e) i) Make a labeled drawing of a fish gill



A gill of a fish

ii) How is a fish gill adapted to its function?

- large surface area due to many filaments
- extensive vascularisation due to capillaries, for gaseous exchange
- thin filaments to facilitate diffusion of gases
- presence of rakers to filter solid particles
- gill bar is bony, hard and firm to support the filaments and rakers and for attachment of filaments and rakers

iii) Discuss gaseous exchange in bony fish

- example is tilapia
- the mouth opens and the floor of the mouth is lowered so that the volume in the mouth is increased and pressure is lowered
- water then enters into the mouth cavity
- the mouth is closed and the floor of the mouth raised so that the volume is reduced
- this raises the pressure, forcing water over gills and out through the operculum
- As water passes over the gills oxygen diffuses due to concentration gradient (partial pressure) into the blood stream.
- In the body tissues, carbon IV oxide diffuses into the blood (due to concentration gradient, and is transported to the gills and diffuses out into the water.

iv) What is counter-flow system?

- Where water in which the fish lives flows in opposite direction across the gill.

www.kusoma.co.ke

vi) What is the advantage of counter-flow system?

- maintains a diffusion gradient so that there is maximum uptake of oxygen
- oxygen continues diffusing into blood and carbon iv oxide into water

f) i) Describe the mechanism of gaseous exchange in terrestrial insects

- example is cockroach
- air in the atmosphere contains oxygen
- air is drawn into the body of the insect through the spiracles due to movement of abdominal muscles
- these movements cause the opening of spiracles
- air moves through the trachea to tracheoles
- oxygen moves from the tracheoles into body cells by diffusion due to concentration gradient
- carbon iv oxide in the tissues diffuses into tracheoles due to concentration gradient
- From tracheoles carbon IV oxide moves into trachea and out through the spiracles into the air.

ii) State how traceholes are adapted to gaseous exchange

- thin walls of tracheoles
- moist surface
- large surface area due to numerous tracheoles

g) i) What is breathing?

- Any process which speeds up the rate of gaseous exchange between an animal and its surrounding.

www.kusoma.co.ke

ii) Name the structures in humans that are used in gaseous exchange

- nose
- larynx
- epiglottis
- trachea
- lungs

- pleural membrane
- pleural cavity
- diaphragm muscles

iii) Describe the mechanism of gaseous exchange in a mammal

Breathing in

- external intercostals muscles contract while internal intercostals muscles relax, raising the ribcage upwards and outwards
- muscles of the diaphragm contract hence it flattens
- the volume of the thoracic cavity increases while pressure decreases
- higher air pressure in the atmosphere forces air into lungs through the nose

Breathing out

- external intercostals muscles relax while internal intercostals muscles contract, moving the ribcage downwards and inwards
- muscles of the diaphragm relax hence the diaphragm assumes dome shape
- the volume of the thoracic cavity decreases while pressure increases
- the higher pressure forces air out of the lungs through the nose

iv) Explain how mammalian lungs are adapted to gaseous exchange

- large number of alveoli that increase surface area
- moist inner surface of alveoli for dissolving oxygen/gases to facilitate exchange of gases through alveolar cavities and blood
- thin walls of alveoli to allow efficient/faster diffusion of gases
- rich capillary/blood supply on alveolar surface to transport oxygen away from the lungs and carbon IV oxide to the lungs

v) Name the features of alveoli that adapt them to their function

- have large surface area/spherical shaped
- numerous/many to increase surface area
- one cell thick
- moist surface for air to diffuse
- highly vascularised/numerous capillaries

vii) How is the trachea of a mammal suited to its function?

- has a ring of cartilage which keeps it open at all times
- cilia that move mucus/particles to the top of the trachea i.e. into larynx for removal
- mucus to trap dust, solid particles and microorganisms
- hollow for passage of air

viii) **State the advantages of breathing through the nose rather than through the mouth**

- nose has hairs to filter solid particles
- it has mucus lining to trap dust particles
- the nose has cells sensitive to smell for survival
- it warms the air before it reaches the lungs

www.kusoma.co.ke

ix) Give the conditions under which the carbon iv oxide level rises above normal in mammalian blood

- vigorous exercise
- emotions/stress
- disease infection

x) Explain the physiological changes that occur in the body to lower the carbon iv oxide level back to normal when it rises

- heartbeat/cardiac frequency increases to pump blood faster carbon iv oxide from the tissues and supply more oxygen
- ventilation rate/rate and depth of breathing increases to take more oxygen and remove carbon iv oxide from the lungs
- arterioles to take in more oxygen and remove carbon iv oxide from the lungs
- arterioles dilate leading to faster flow of blood to and from body tissues

h) i)Describe the factors which control the rate of breathing in humans

- breathing movements usually occur unconsciously
- it is controlled by the medulla oblongata part of the brain situated at the breathing centre
- medullar oblongata is in the brain
- respiratory centre transmits impulses to the diaphragm through phrenic nerves
- carbon iv oxide concentration in the blood determines the breathing rate
- if carbon iv oxide is less, the brain is triggered to decrease breathing rate
- cardiac frequency decreases and the arterioles constrict
- therefore carbon iv oxide level is raised
- this brings back to normal level of breathing and carbon iv oxide level increases/is more the brain is triggered to increase breathing rate
- cardiac frequency is increased
- there is vasodilation of arterioles
- carbon iv oxide level falls
- therefore the normal level is attained and carbon iv oxide is removed faster

ii) Name the respirator diseases

- asthma
- bronchitis
- whooping cough
- pneumonia
- tuberculosis

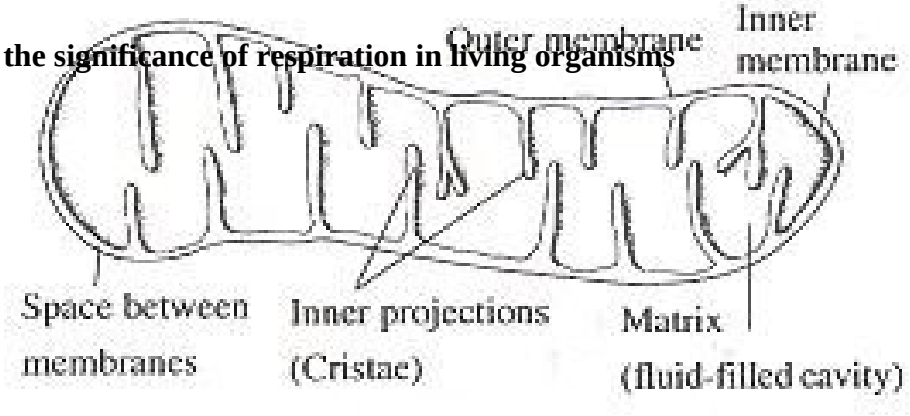
4. a) i) Define respiration

- the oxidation/breakdown of food within cells to release energy

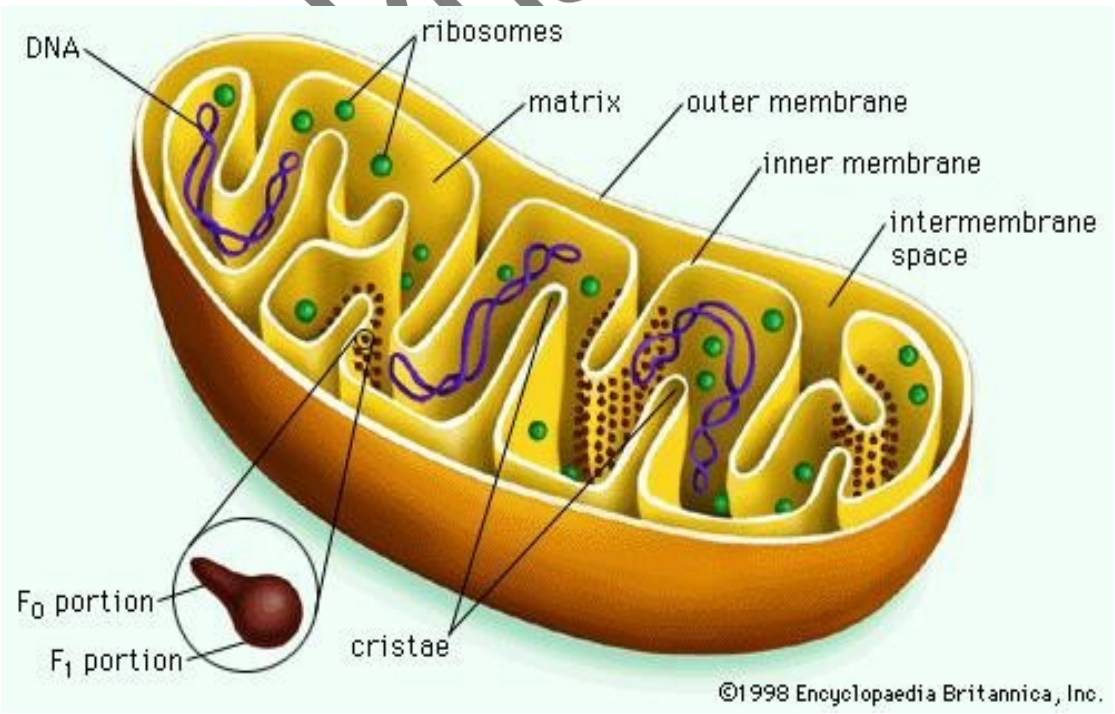
www.klsoma.co.ke

it yields energy (ATP)
this energy enables organisms to move, grow, excrete and reproduce
iii) Where does respiration take place? in the mitochondria

b) i) Draw and label a mitochondrion



ii) Explain the significance of respiration in living organisms



ii) State the most important function of mitochondria

- to produce Adenosine triphosphate (ATP) which is the energy source of the whole cell

iii) Give the functions of the labeled parts

Outer membrane

- controls what enters and what leaves mitochondrion

Cristae

- also called inner membrane
- increase surface are for attachment of enzymes
- this is where cellular oxidation reactions occur

Matrix

- enzymes are located here
- other reactions occur here

c) explain the roles of enzymes in respiration

- they catalyse reactions i.e. speed up respiration

d) i) What is aerobic respiration

- respiration in the presence of oxygen

ii) Give a word equation for aerobic respiration

- glucose + oxygen - water + carbon iv oxide + energy

iii) What are the end products of aerobic respiration?

- energy
- carbon iv oxide
- water

e) i) What is anaerobic respiration

- occurs in the absence of oxygen
- e.g. yeast and certain bacteria release energy in the absence of oxygen

ii) What are obligate anaerobes?

www.kusoma.co.ke

- are completely independent of oxygen

iii) What are facultative anaerobes?
- can survive both in the presence and absence of oxygen
- also called partial anaerobes

iv) State the word equation representing anaerobic respiration in plants
- Glucose ethanol + carbon iv oxide + energy

v) Name the end products of anaerobic respiration in plants
- alcohol/ethanol
- carbon iv oxide
- energy

g) i) Give a word equation of anaerobic respiration in animals
- Glucose lactic acid + energy

ii) Name the end products of respiration in animals when there is insufficient oxygen supply
- lactic acid
- energy

iii) Why is there a high rate of lactic acid production during exercise?
- the demand for oxygen is more than supply leading to anaerobic respiration

iv) Why does lactic acid level reduce after exercise?
- lactic acid is oxidized to form carbon iv oxide and water
- some is converted to glucose
- some is converted into glycogen

v) State why accumulation of lactic acid during vigorous exercise lead to an increase in heartbeat
- lactic acid is poisonous to tissues and must be removed
- to increase supply of oxygen to tissues

State the economic importance of anaerobic respiration
- brewing of alcohol
- biogas production
- compost manure formation
- silage formation
- baking bread
- production of dairy products

www.kusoma.co.ke

- fermentation of milk
- sewage treatment
- Fermentation of tea in industries.

What is oxygen debt?

- amount of oxygen required to convert accumulated lactic acid to water, carbon IV oxide and energy

h) i) What is respiratory quotient(RQ)?

- ration of carbon IV oxide produced to oxygen consumed

$$RQ = \frac{\text{volume of } CO_2 \text{ produced}}{\text{Volume of oxygen consumed}}$$

ii) Why are respiratory quotient important

- their calculation assists in identifying the kind of substrate being used in respiration

iii) Name the respiratory substrates

- carbohydrates
- fats
- proteins

iv) Why does anaerobic respiration of a given substrate yield a smaller amount of energy than aerobic respiration?

- Some energy locked up in intermediate products like ethanol in plants and lactic acid in
  - animals substrate is completely oxidized in aerobic respiration

iv) Explain the disadvantages of anaerobic respiration

- Less energy produced in anaerobic respiration since food is partially oxidized while in aerobic respiration food is completely oxidized.
- Some metabolic wastes accumulate in cells affecting cellular functions
- Ethanol produced in plants poisons the tissues while lactic acid produced in animals causes muscle fatigue/muscle cramp and may stop muscle contraction
- Such intermediate wastes are not produced in aerobic respiration

v) Mention the types of experiments carried out for

- **respiration** germinating seeds which yield energy in form
- of heat animals produced heat when they respire
- yeast cells respire to produce heat

5. a) i) Define the following

terms Excretion

www.kusoma.co.ke

- the process by which organisms get rid of waste products which result from chemical process which occur in living cells

Secretion

- the process by which organisms produce substances which are useful to the body, by glands

Egestion

- removal of indigestive materials from the body

Homeostasis

- maintenance of constant internal environment

ii) Explain why excretion is necessary in plants and animals

-products of excretion are usually harmful while some are toxic
- if allowed to accumulate in the cells they would destroy tissues and interfere with normal metabolism
- They are therefore removed through excretion

b) i) Describe how excretion takes place in green plants

- carbon IV oxide, oxygen and water diffuse through the stomata, lenticels and hydathodes
- some toxic wastes are converted into non-toxic substances
- these are deposited in certain tissues of the plant or stored in aging structures
- resins and tannins are exuded through the bark of stem or lost during leaf fall

www.kusoma.co.ke

ii) Why do plants lack complex excretory structures like those of animals?

- plants have lower rates of metabolism
- plants excrete non-poisonous products derived from carbohydrate metabolism unlike animals which produce toxic wastes derived from protein metabolism
- plants re-use some of their wastes like nitrogenous wastes used in protein synthesis
- plants store waste products in roots, fruits and leaves

ii) State the excretory products of plants and some of their uses to humans

- **caffeine** from tea and coffee is used in medicine and as a stimulant which is harmful to humans
- **quinine** used for treating malaria

- **cocaine** derived from leaves of cocoa plant used as a stimulant by addicts or as a local anesthesia, also causes damage to the brain, may cause addiction if not well used and is an illegal drug
- **Tannins** derived from barks of acacia (wattle bark) trees are used to make ink and tanning (softening) of leather.
- **Nicotine** got from leaves of tobacco plant stimulates the central nervous, may cause addiction if much is used or consumed. It is used to make cigarettes, cigars and is poisonous. It is a precursor of lung cancer
- **Cannabis sative(**bhang) is used to make drugs
- **Gum** derived from glues is used for sticking substances and making certain jellies
- ***Rubber***, a product of latex, got from rubber plant is sued to make tyres and synthetic fibres
- **Morphine** from opium poppy plant is a narcotic and illegal drug as it causes addiction
- **Khat and miraa** are used as stimulants
- **Colchicines** used in inducing polyploidy, cancer therapy, treatment of gouts in small quantities
- **Papain** used as meat tenderizer

c) i) Describe excretion in unicellular organisms

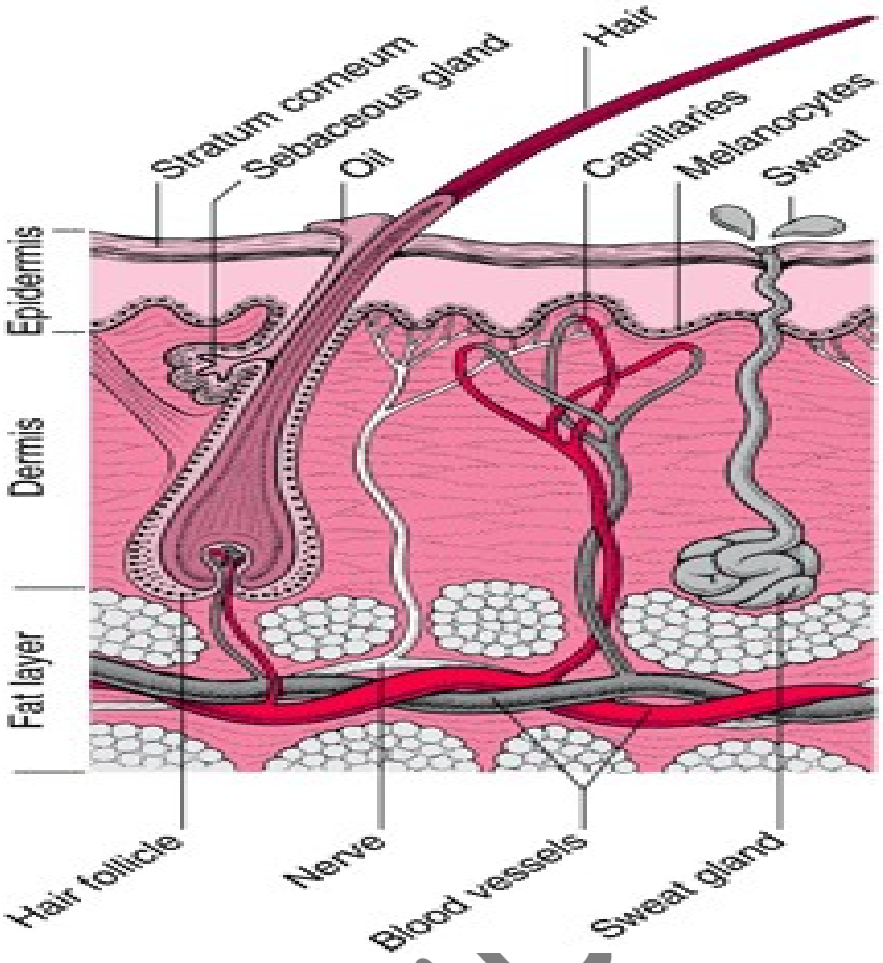
-examples are amoeba and paramecium
-They have to remove waste products such as carbon IV oxide and nitrogenous substances e.g urea and ammonia
- These diffuse from the body surface into the surrounding water
- Diffusion is due to large surface area

ii) List excretory organs and products of mammals

- kidney excretes urea, water and salts
- skin excretes water, slats and urea
- lungs excrete carbon IV oxide and water
- liver excretes bile salts

www.kusoma.co.ke

d)i) Draw and label a mammalian skin



ii) Explain how the mammalian skin is adapted to its functions

- the skin is made up of dermis and epidermis

Epidermis

- it is made up of three layers
- the outermost layer, cornified layer is made up of dead cells that prevent entry of microorganisms, prevent physical damage and dessication
- granular layer made of living cells gives rise to cornified layer
- malpighian layer is made up of actively dividing cells that give rise to new epidermal cells/granular layer it contains melanin that protects the body against ultra violet rays(radiations)

www.ku-.co.ke

Dermis

- has several components
- Has sweat gland which produce sweat through sweat pores on the skin and the sweat evaporates cooling the body by lowering body temperature. When it is cold, no sweat is produced, conserving water
- sweat contains water, sodium chloride, uric acid and urea hence the skin acts as an excretory organ
- Has hair. The hair stands erect to trap air when temperature is low to reduce loss/insulation. It lies flat to allow heat loss when temperature is high.
- Has nerve endings which are sensitive to stimuli such as heat, cold, pain, pressure and touch
- Has subcutaneous fat/adipose fat that insulates the body against heat loss
- Has arteries and capillaries (blood vessels) that supply food and oxygen and remove excretory products. Arterioles vasodilate when temperatures are high to lose heat by radiation, and convention. Arterioles constrict when temperatures are low to conserve heat i.e. reduce heat loss
- Has sebaceous glands which secrete sebum, and antiseptic and water repellant that prevents drying and cracking the skin by making the skin supple

e) What is the role of lungs in excretion?

- during respiration oxygen is used up in the body cells to produce energy
- carbon IV oxide is produced as a by-product
- the carbon IV oxide must be eliminated from the body
- elimination is through the lungs
- also, water vapour is formed and must be removed
- this removal is through the lungs
- the lung is therefore considered as an excretory organ as it removes carbon IV oxide and water vapour which are by-products of respiration

f) State the functions of the liver

i. Excretion

- in this function the liver is aided by the kidney
- deamination i.e. excess amino acids converted into urea and uric acid which is transported to skin and kidney for removal
- detoxification where harmful substances are converted into harmless ones in the liver and transported to kidneys for removal

www.kisomo.co.ke

- breakdown of worn out blood cells and haemoglobin and the residue excreted through the kidney to give urine a yellow tinge
- Breakdown of sex hormones after they have performed their function and the wasted are released through the kidney and bile.

ii) Homeostasis

- regulation of blood glucose
- the normal amount of glucose in blood is about 90mg/100
- increase in blood sugar is detected by cells of the pancreas which secrete insulin
- insulin stimulates the liver to convert excess glucose to glycogen
- further excess glucose is converted to fats until the normal blood sugar level is attained
- Excess glucose is oxidized to carbon IV oxide, water and energy. Excess glucose is also used in respiration
- decrease in blood sugar level below normal level is detected by the pancreas, which secretes glucagon which stimulates the liver to convert glycogen to glucose until the normal sugar level is attained
- fats, amino acids are converted to glucose
- it also leads to reduced oxidation of glucose

Deamination

- excess amino acids are deaminated by the removal of amino group
- the amino group is converted to ammonia
- ammonia combines with carbon IV oxide to form urea
- urea is excreted in urine through the kidney

Detoxification

- poisonous substances are converted to less harmful compounds

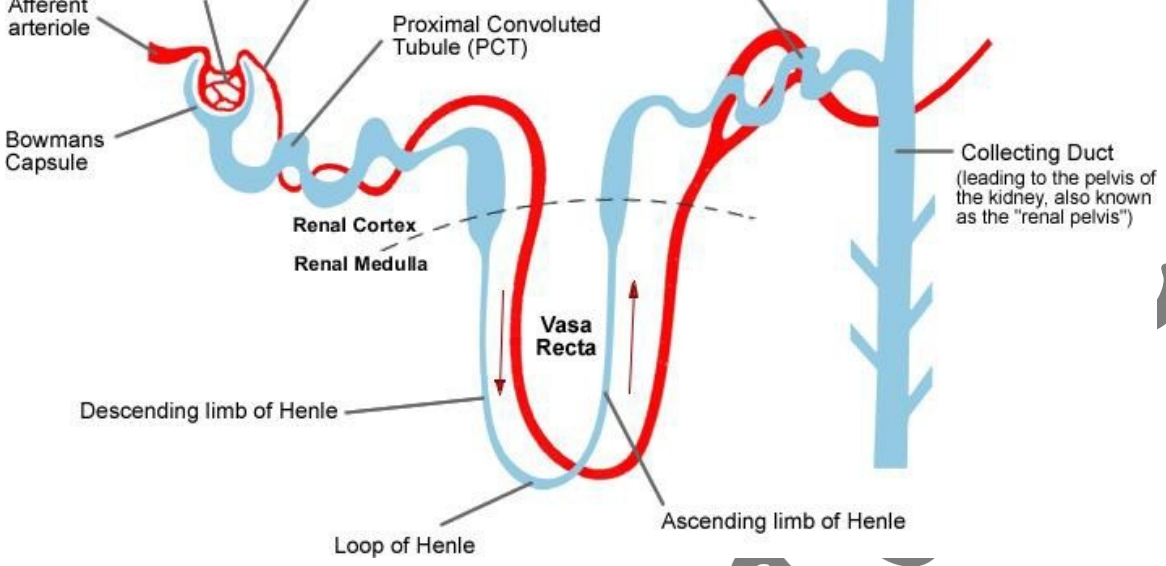
Thermal regulation

- maintenance of body temperature
- heat is generated in the liver by chemical activities
- the heat is distributed

g) i) Draw a labeled diagram of mammalian nephrone

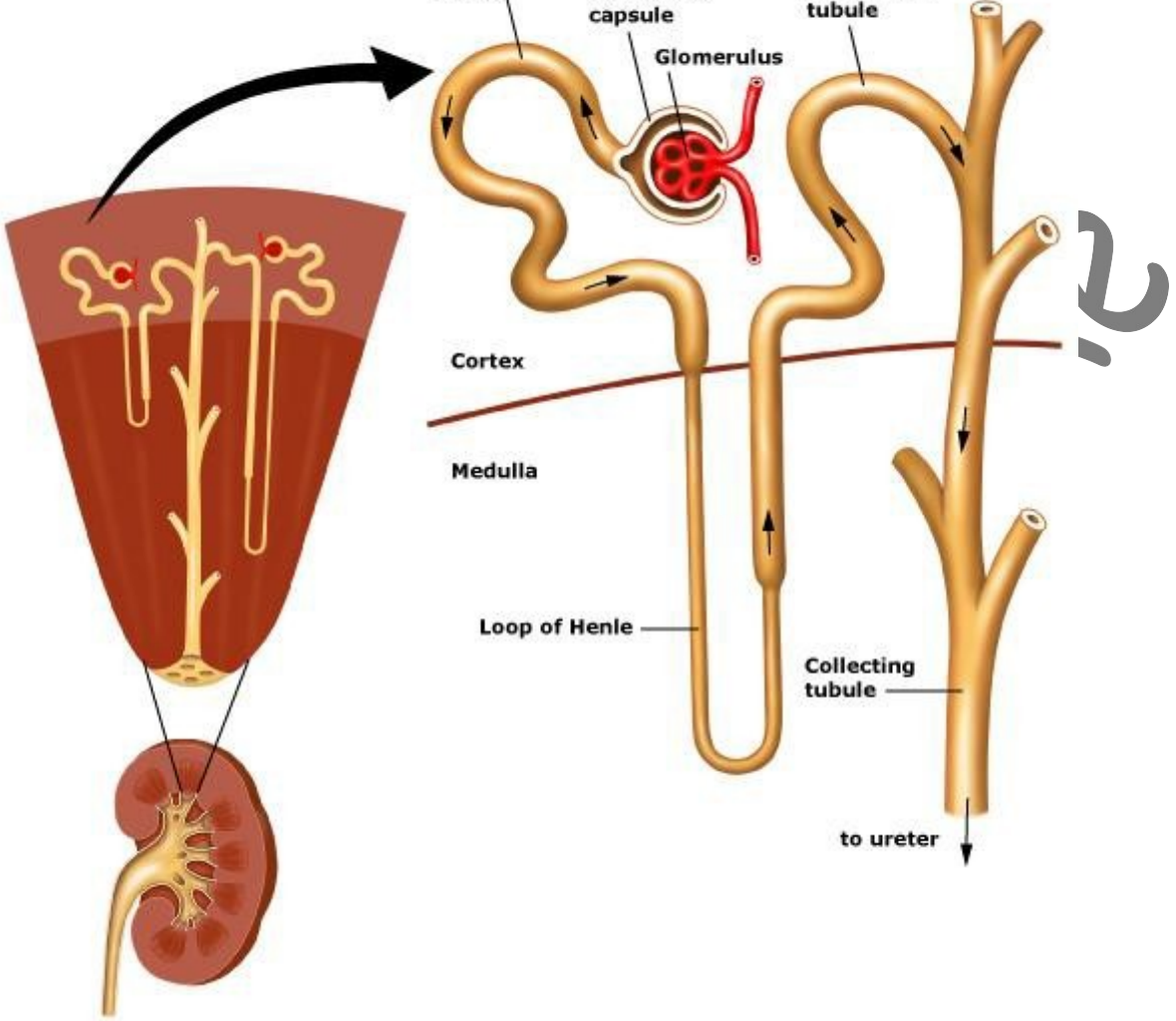


www.kusoma.co.ke



www.kusoma.

Proximal


capsule
Glomerulus
tubule
Cortex
Medulla
Loop of Henle
Collecting tubule
to ureter

www.

ii) Describe how the human kidney functions

- the afferent arterioles, which is a branch of the renal artery, supplies blood to the glomerulus
- the afferent arteriole has a wider diameter than the efferent arteriole
- this difference in diameter of afferent and efferent vessels causes high pressure leading to ultra filtration
- the walls of the blood capillaries are one cell thick hence glucose, amino acids, vitamins, hormones, salts, cratinine, urea and water filter into Bowman's capsule to form glomerular filtrate
- white blood cells, red blood cells, plasma proteins (such as globulin) and platelets are too large to pass through the capillary walls hence remain in blood capillary
- the filtrate flows into proximal convoluted tubule where amino acids, vitamins and all glucose are selectively reabsorbed back into the blood stream
- many mitochondria provide energy for reabsorption of these substances against a concentration gradient by active transport
- the glomerular filtrate flows into the loop of Henle
- water in the descending loop moves by osmosis into the blood capillaries
- sodium chloride is actively pumped from the ascending arm of the loop of Henle into the blood capillaries
- the glomerular filatrate flows into the distal convoluted tubule
- water and salts are reabsorbed from distal convoluted tubule into blood capillaries
- the glomerular filtrate flows into collecting tubule (duct) from where more water is reabsorbed into blood stream
- antiduretic hormone influences the amount of water reabsorbed depending on osmotic pressure of blood
- the glomerular filtrate from collecting duct, now referred to as urine, is emptied into pelvis and ureter into bladder and out of body through urethra
- urine consists of excess water, slats and nitrogenous wastes

iii) State the adaptations of proximal convoluted tubule to its function

- folded to increase surface area for absorption
- thin epithelium to reduce distance of diffusion
- micro-villi on inner lining to increase surface area for absorption
- folded to reduce speed of flow for efficient absorption
- numerous mitochondira to provide energy for reabsorption
- dense capillary network to transport reabsorbed products

www.kusoma.co.ke

iv) Name the common kidney diseases

- nephritis
- kidney stones(renal calculi
- cystitis
- oedema
- kidney failure

6. a) i) Why is homeostatic control necessary?

- this provides a constant internal environment so that the cells of the body have the optimum (best) condition for their survival

ii) What is internal environment?

- immediate surrounding of body cells
- refers to tissue fluid within an organism

b) i) Why is constant body temperature maintained by mammals?

- most enzymes in the body function within a narrow range of temperature
- high temperature denatures enzymes
- low temperature inactivates and inhibits enzymes

i**i) Explain the advantage gained by possessing a constant body temperature**

- animals remain active despite fluctuations in environmental temperature
- higher chances of survival in various environments ie they colonize various environments
- chemical processes in their body continues at an optimum rate

iii) How do mammals regulate body temperature?

- the body temperature of a mammal is kept constant
- to maintain this temperature the mammal must be able to balance its heat loss against the heat gain
- body temperature is controlled by the hypothalamus, a specialized part of the brain
- changes in the temperature within the body and the surrounding are detected by the hypothalamus
- it transmits impulses to the skin and the blood stream in response to temperature changes
- hypothalamus acts as a thermostat for the body
- a mammal loses heat by breathing out, urine, feaces, skin by radiation and by evaporation of sweat.
- A mammal generates heat by the activity of its muscles, by general metabolism in respiration, or chemical activities

www.kusoma.co.ke

- In hot conditions the hypothalamus stimulates responses that increase heat loss from the body hence lowering the body temperature
- Such responses include sweating, vasodilation, keeping its hair flat on the surface of skin and reduction of metabolic rate
- In cold conditions the hypothalamus stimulates responses that generate heat gain in the body and reduce heat loss to the environment
- Such responses include shivering, vasoconstriction, raising its hair to trap a layer of air around the skin because still air is a good insulator of heat and by generation of heat by increasing metabolic rate.

iv) Why does body temperature of a healthy person rise up to 37^{o}C on a hot humid day?

- sweat evaporation is reduced hence cooling is less therefore more heat is retained in the body causing temperature to rise

v) Name the structures in the human body that detect external temperature changes

- temperature receptors (end bulb corpuscles e.g. bulb of Krause (warmth) and organ of Ruffinni (cold)
- heat (thermal) receptors

vi) State the advantages that organisms with small surface area to volume ratio experience over those with larger

- heat loss slow hence their body temperature can increase to intolerable levels
- Heat gain from surrounding slower hence may remain inactive for a long time.
- Need specialized and complex transport system and also gaseous exchange system

Explain why individuals with smaller sizes require more energy per unit body weight than those with larger sizes.

- surface area to volume ratio is higher in smaller individuals than larger ones, therefore smaller heat is lost faster by smaller ones than larger ones
- they therefore require more energy per unit body weight to maintain body temperature

c) i) What is the meaning of osmoregulation?

- mechanism which regulates osmotic pressure of internal environment of an organism
- the regulation/maintenance of salt/solute-water balance of an internal environment

ii) State the importance of osmoregulation

- Maintenance of constant level of water and slats (osmotic pressure) for optimum/suitable conditions for metabolism suitable for cellular functions

iii) State the ways by which desert mammals conserve water

- fewer glomeruli

www.kusoma.co.ke

- longer loop of Henle
- excretion of dry feaces or concentrated urine
- hump for fat to be metabolized to give metabolic water for use
- nocturnal, burrowing, aestivate or hibernate
- sweat glands few or absent
- more ADH (vasopressin)

iv) **Explain why some desert animals excrete uric acid rather than water**

- uric acid is less toxic than ammonia, hence elimination of uric acid requires less water than ammonia therefore more water conserved
- uric acid being less toxic is safer to excrete where there is less water/desert

v) **Explain why eating a meal with too much salt leads to production of a small volume of concentrated urine**

- the concentration of salts in the blood rises leading to production of more ADH hence higher rate of water reabsorption by kidney tubules

vi) Explain how marine fish regulate their osmotic pressure

- swallow plenty of sea water to increase amount of water in the body
- have chloride excretory cells in their gills to remove excess salts
- eliminate nitrogenous wastes in form of trimethalamine oxide which requires little water for elimination
- few/small glomeruli thus slow filtration rate in the kidneys
- retain nitrogenous wastes in form of urea to raise osmotic pressure of body fluids

d) i) What is the biological significance of maintaining a relatively constant sugar level in a human body?

- body cells are surrounded by tissue fluids that are isotonic/same osmotic pressure as cytoplasm
- if sugar level is high/hypertonic, cell will lose water by osmosis to the surrounding, thus increasing the concentration of the contents
- this changes the physiology of the cell
- if the blood sugar is lower than the normal, the cytoplasm gains water by osmosis, diluting the cell contents, thus altering the physiology of the cell

ii) Discuss the role of the following hormones in blood sugar control

Insulin

- insulin is produced when there is increase in blood sugar concentration

www.kusoma.co.ke

- it converts glucose to glycogen which is in the liver or muscle thus lowering sugar level

Glucagon

- when glucose level decreases glucagon is produced, which causes the breakdown of glycogen to glucose thus raising blood sugar level

e) Explain the part played by antidiuretic hormone in homeostasis

- Produced when there is less water (high osmotic pressure above normal level of salt concentration) in the blood.
- It acts on kidney tubules (nephron) thus increasing water reabsorption from tubules to the blood stream, thus restoring osmotic pressure
- When there is more water(lower osmotic pressure) or decreased salt concentration in blood, little or no ADH is produced, less water reabsorbed hence water loss in urine (more dilute urine) hence raising the osmotic pressure in body fluids/blood

f) What is the role of blood clotting in homeostasis?

- when a blood vessel is cut, there is exposure of blood platelets to the air
- this triggers fibrinogen to be converted to fibrin
- the fibrin forms a clot that prevents body fluids e.g. blood from being lost
- therefore the clot conserves water and salts in the body

www.kusoma.co.ke

g) Describe the role of the following hormones in homeostasis

i. Aldosterone

- concerned with regulation of ionic balance
- secreted by the cortex of adrenal glands
- it increases sodium ion uptake by the gut and promotes the reabsorption of sodium ions (and therefore water) in the kidneys)
- this is accompanied by elimination of potassium ions
- this raises the overall level of sodium and lowers the overall level of potassium in the blood
- as sodium ions are absorbed in the blood, chlorine ions follow so as to neutralize the effect of sodium ions
- the production of aldosterone is regulated by the concentration of sodium ions which has an inhibiting effect, and a fall in sodium ions has a stimulating effect on the adrenal cortex
- the flow of aldosterone is stimulated by the adreno-cortic-tropic hormone (ACTH) produced in the anterior of the pituitary gland

- however, the main method of control is dependent on the fact that adrenal cortex itself is somehow sensitive to the relative concentration of potassium and sodium in the blood

ii. Adrenaline

- produced by adrenal glands
- in high concentrations, it increases hydrolysis of glycogen and increases blood sugar
- it is usually released in emergency cases to increase glucose level for respiration this
- releases energy for the emergency

h) i) Distinguish between diabetes mellitus and diabetes insipidus

- diabetes mellitus is a condition resulting from insufficient production of insulin causing hyperglucaemia and presence of glucose in urine
- diabetes insipidus is a condition whereby less or no antidiuretic hormone is secreted hence a high volume of water is passed out in urine in a condition called diuresis

ii) How can high blood sugar level in a person be controlled?

- administer insulin

iii) Why does glucose not normally appear in urine even though it is filtered in the mammalian Bowman's capsule?

- glucose molecules are actively reabsorbed in the proximal convoluted tubules

iv) When is glycogen which is stored in the liver converted into glucose and released into the blood?

- after activity/when blood sugar (glucose) falls below normal
- when glucagon
- stimulates the liver/when glucagon is produced
- after strenuous/vigorous activity
- during starvation

v) How would one find out from a sample of urine whether a person is suffering from diabetes mellitus?

- test or react urine in Benedict's solution
- positive result i.e. orange or red precipitate

Positive result is an indication of diabetes mellitus

www.kusoma.co.ke

This document was downloaded from;

www.kusoma.co.ke

The other documents available on this website include;

- All secondary school schemes of work.
- Form 1-form 4 revision papers in all subjects.
- Marking schemes to most of the revision papers.
- K.C.S.E past papers.
- University past papers.
- K.A.S.N.E.B past papers e.g. C.P.A
- Primary school schemes of work.
- Primary school revision papers to all classes.
- Marking schemes to primary school past papers.
- K.C.P.E past papers.

www.kusoma.co.ke