CHAPTER #11

HOMEOSTASIS

Q1. Explain homeostasis with the help of examples?

Ans: Homeostasis:

Homeostasis may be defined as the maintenance of the internal conditions of body at equilibrium, despite changes in the external environment

Examples:

i. The core temperature of human body remains at about 37°C despite fluctuations in the surrounding air temperature.

ii. Similarly, the blood glucose level remains about 19 per litre despite eating a meal rich in carbohydrates.

Function of Homeostasis:

Body cells need the internal environment in which conditions do not change much. Stable internal conditions are important for the efficient functioning of enzymes.

Q2 Differentiate between osmoregulation and thermoregulation?

Ans: Difference between osmoregulation and thermoregulation:

Osmoregulation	Thermoregulation
i. Osmoregulation is the active regulation of the osmotic pressure of an organism's fluids to maintain homeostasis of the organism's water content that is it keeps the organism's fluids from becoming too diluted or too concentrated	**i.** Thermoregulation is the ability of organism to keep its body the temperature within certain boundaries, even when the surrounding temperature is very different

ii. It is maintenance of the amounts of water and salts in body fluids i.e. blood and tissue fluids). We know that the relative amounts of water and salts in body fluids and inside oils control the processes of diffusion and Osmosis, which are essential for the functioning of cells.	**ii.** The maintenance of internal body temperature is called thermoregulation. The enzymes of body work best at particular temperatures (optimum temperature) Any change in body temperature may affect the functioning of enzymes.

Q3. Define excretion?

Ans: **Excretion**:

Excretion is a process of homeostasis. In this process, the metabolic wastes are eliminated from body to maintain the internal conditions at equilibrium.

Interesting Information

Metabolic waste means any material that is produced during body metabolism and that may harm the body.

Q4. Suggest why the plants need homeostasis?

Ans: Homeostasis in Plants:

Plants respond to environmental changes and keep their internal conditions constant i.e. homeostasis. They apply different mechanisms for the homeostasis of water and other chemicals (oxygen, carbon dioxide, nitrogenous maternal etc.)

Q5. Suggest why the plants need removal of extra carbon dioxide and oxygen?

Ans: Removal of Extra Carbon dioxide and Oxygen:

In daytime, the carbon dioxide produced during cellular respiration is utilized in photosynthesis and hence it is not a waste product.

At night, it is surplus because there is no utilization of carbon d oxide. It is removed from the tissue cells by diffusion.

In leaves and young stems, carbon dioxide escapes out through stomata.

In young roots, carbon dioxide diffuses through the general root surface especially through root hairs.

Oxygen is produced in mesophyll cells only during daytime, as a by-product of photosynthesis. After its utilization in cellular respiration, the mesophyll cells remove the extra amount of oxygen through stomata.

Interesting Information

Transpiration is the loss of water from plants surface in the form of vapors.

Q6. Suggest why the plants need removal of extra water?

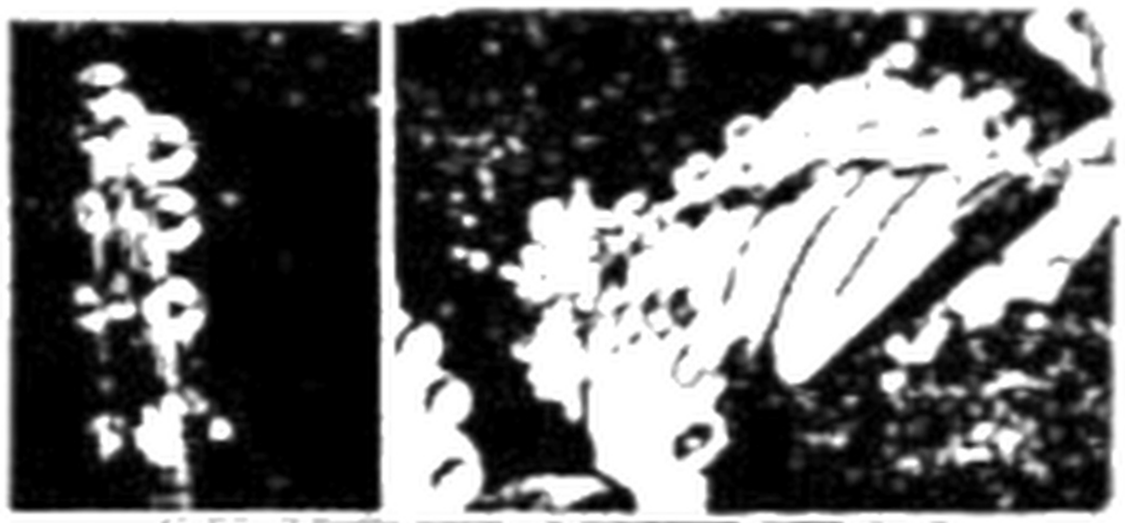
Ans: Removal of Extra Water:

Plants obtain water from soil and it is also produced in the body during cellular respiration. Plants store large amount of water in their cells for transport. Extra water is removed from plant body by transpiration.

At night, transpiration usually does not occur because most plants have their stomata closed. If there is a high water content in soil, water enters the roots and is accumulated in xylem vessels. Some plants such as grasses force this water through special pores, present at leaf tips or edges, and form drops.

Guttation:

The appearance of drop of water on the tips or edges of leaves is called guttation,



Guttation in Different plants

Note: Guttation is not to be confused with draw which ... atmosphere onto the plant surface.

Q7. Suggest why the plants need removal of the following metabolic wastes

i. Calcium oxalate ii. Leaf fall iii. Resins

iv. Gums v. latex vi. Mucilage

Ans: i. Removal of Calcium oxalate:

Plants deposit many metabolic wastes in their bodies as harmless insoluble maternal. For example, calcium oxalate is deposited in the form of crystals in the leaves and stems of many plants e.g. tomato

Cacium oxalate needles in a leaf cell

i. **Removal of Metabolic waste by leaf fall:**

In trees which shed their leaves yearly, the excretory products are removed from body during leaf fall

ii. **Removal of Risns:**

Other waste materials that are removed by some plants are resins (by coniferous trees)

iii. **Removal of Gums:**

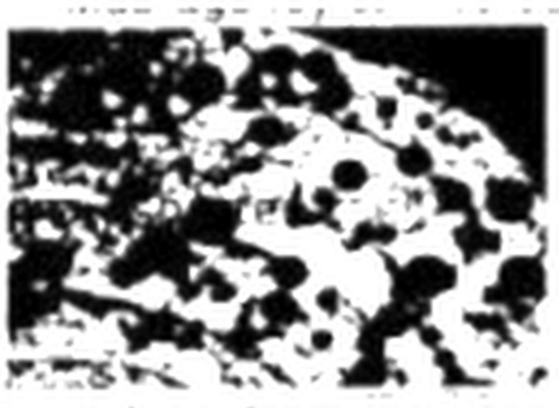
Gums (by keekar)

iv. **Removal of Latex:**

Latex (by rubber plant)

v. **Removal of Mucilage:**

Mucilage (by carnivorous plants and ladyfinger)



Resin drops from a cut tree

Latex being extracted from a tree

Mucilage drops on a carnivorous plants

Interesting Information

The removal of excretory products is a secondary function of leaf fall. If the leaves are not shed, the calcium oxalate just remains as natural catalyst in the leaves.

Q8. Describe the process of osmotic adjustments in plants?

Ans: Osmotic Adjustments in Plants:

Osmosis:

Osmosis is the movement of water from hypotonic solutions (less solute concentration), to hypertonic solutions (higher solute concentration), through semi permeable membrane.

i. On the basis of the available amount of water and salts, plants are divided into three groups

i. Hydrophytes:

Hydrophytes are the plants which live completely or partially submerged in freshwater. Such plants do not face the problem of water shortage. They have developed mechanisms for the removal of extra water from their cells.

Hydrophytes have broad leaves with a large number of stomata on their upper surfaces This characteristic helps them to remove the extra amount of water. The most common example of such plants is water lily.

Hydrophytes

ii. Xerophytes:

Xerophytes live in dry environments. They possess thick waxy cuticle over their epidermis to reduce water loss from internal tissues. They have a smaller number of stomata to reduce the rate of transpiration. Such plant has deep roots to absorb maximum water from soil.

Some xerophytes have special parenchyma cells in stems or roots in which they store large quantities of water. This makes their stems or roots wet and juicy called succulent organs. Cacti (Singular Cactus) are the common examples of such plants.

Xerophytes

iii. Halophytes:

Halophytes live in sea waters and are adapted to salty environments Salts enter in the bodies of such plants due to their higher concentration in sea water.

On the other hand, water tends to move out of their cells into the hypertonic sea water When salts enter into cells, plants carry out active transport to move and hold large amount of salts in vacuoles.

Halophytes

Salts are not allowed to move out through the semi-permeable membranes of vacuoles. So, the sap of vacuoles remains even more hypertonic than sea water. In this way, water does not move out of cells. Many sea grasses are included in this group of plants.

Q9. What are the major organs involved in homeostasis in human body? State the roles of each of these organs.

Ans: Homeostasis in Humans:

Like other complex animals, humans have highly developed systems for homeostasis. The following are the main organs which work for homeostasis

Major organs involved in homeostasis in human body:

i. **Lungs:**

Lungs remove excess carbon dioxide and keep it in balance

ii. **Skin:**

Skin performs role in the maintenance of body temperature and also removes excess water and salts

iii. **Kidney:**

The kidney filters excess water, salts, urea, uric acid etc. from the blood and forms urine.

Q10. Skin is the major organ involved in homeostasis in human body state the role of skin in homeostasis?

Ans: Skin:

Our skin consists of two layers

Epidermis:

Epidermis is the outer protective layer without blood vessels

Dermis:

Dermis is the inner layer containing blood vessels, sensory nerve endings, sweat and oil glands, hairs and fat cells.

Function of skin:

Skin performs important role in the regulation of body temperature. The thin layer of fat cells in the dermis insulates the body.

Goosebumps:

Contraction of small muscles attached to hairs forms "Goosebumps". It creates an insulating blanket of warm air.

Goosebumps

Similarly, skin helps in providing cooling effect when sweat is produced by sweat glands and excess escapes through evaporation.

Metabolic wastes such as excess water, salts, urea and uric acid are also removed in sweat.

Q11. Hypothesize why the dogs body heat hang their tongues out and pant?

Ans: Dogs have a high body temperature and they hang their tongues out to let heat out through their tongues. Salivating (producing spit or saliva) helps cool the dog when its tongue is hanging out.

It's like their way of sweating. They have no sweat glands except for on their tongues so they poke their tongue out to cool off by the process of evaporation.

Q12. Lungs are the major organ involved in homeostasis in human body state the role of lungs in homeostasis?

Ans: Lungs:

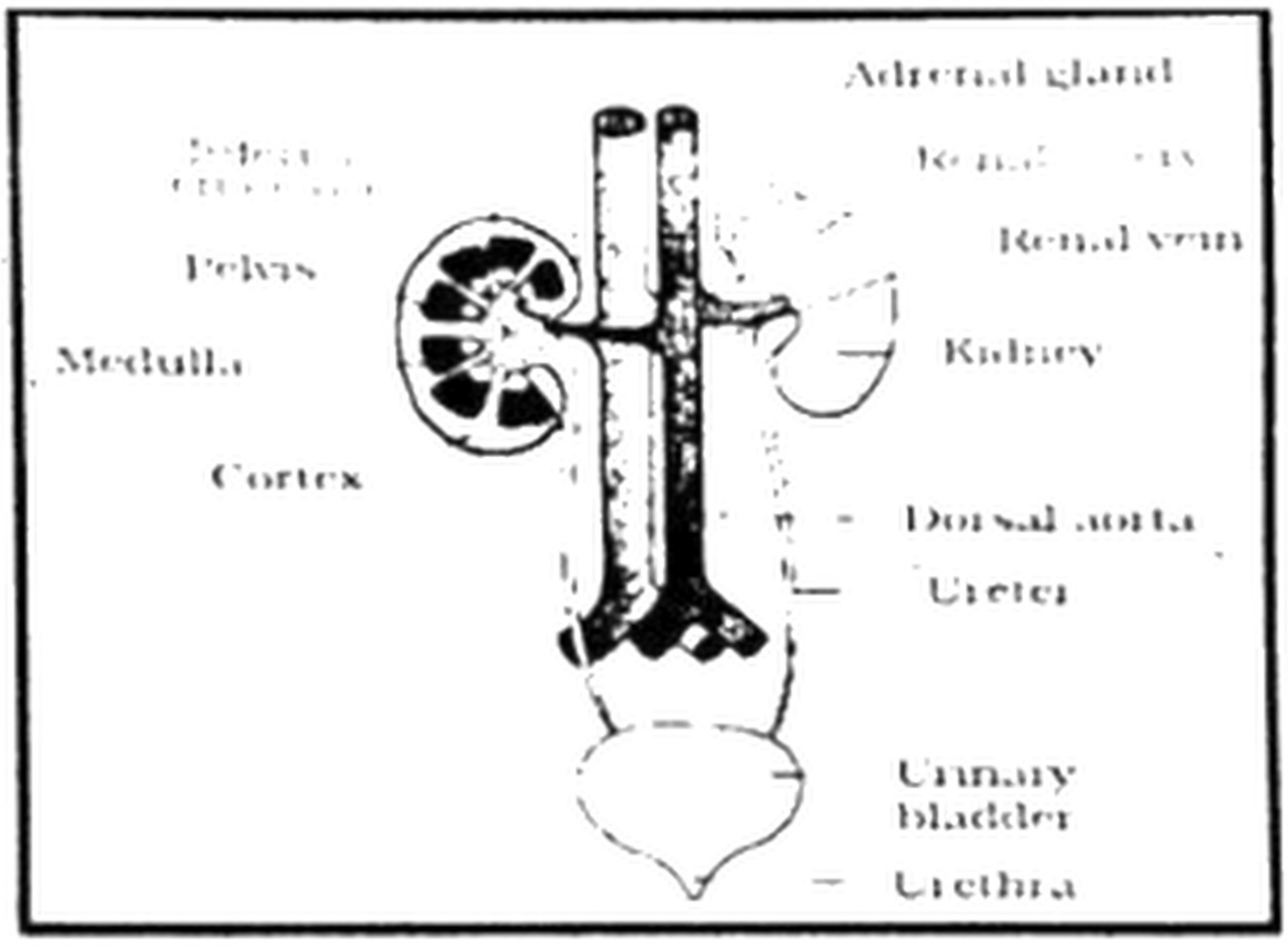
Lungs maintain the concentration of carbon dioxide in the blood. Our cells produce carbon dioxide when they perform cellular respiration. From cells, carbon dioxide diffuses into tissue fluid and from there into blood. Blood carries carbon dioxide to lungs from where it is removed in air.

Q13. The urinary system of humans is the major organ involved in homeostasis in human body state the role of the urinary system of humans in homeostasis?

Ans: The Urinary System of Humans:

The excretory system of humans is also called the urinary system. It is formed of one pair of kidneys, a pair of ureters, a urinary bladder and a urethra Kidneys filter blood to produce urine and the ureters carry urine from kidneys to

urinary bladder. The bladder temporarily stores urine until it is released from body Urethra is the tube that carries urine from urinary bladder to the outside of body.



The Urinary System of Humans

Q14. Describe the structure and labelled diagram of kidney?

Ans: Structure of Kidney:

Colour, shape, size and weight of kidney:

Kidneys are dark-red bean shaped organs Each kidney is 10 cm long, 5 cm wide and 4 cm thick and weighs about 27 grams.

Location of kidneys:

Kidneys are placed against the back wall of abdominal cavity just below diaphragm one on either side of vertebral column They are protected by the last 2 ribs. The left kidney is a little higher than then right.

Hilus:

The concave side of kidney faces vertebral column. There is a depression called hilus, near the center of the concave area of kidney This is the area of

kidney through which ureter leaves kidney and other structures including blood vessels, lymphatic vessels and nerves enter and leave kidney.

Longitudinal section of the kidney:

The longitudinal section of the kidney shows two regions.

Renal Cortex:

Renal cortex is the outer part of kidney and it is dark red in colour.

Renal medulla:

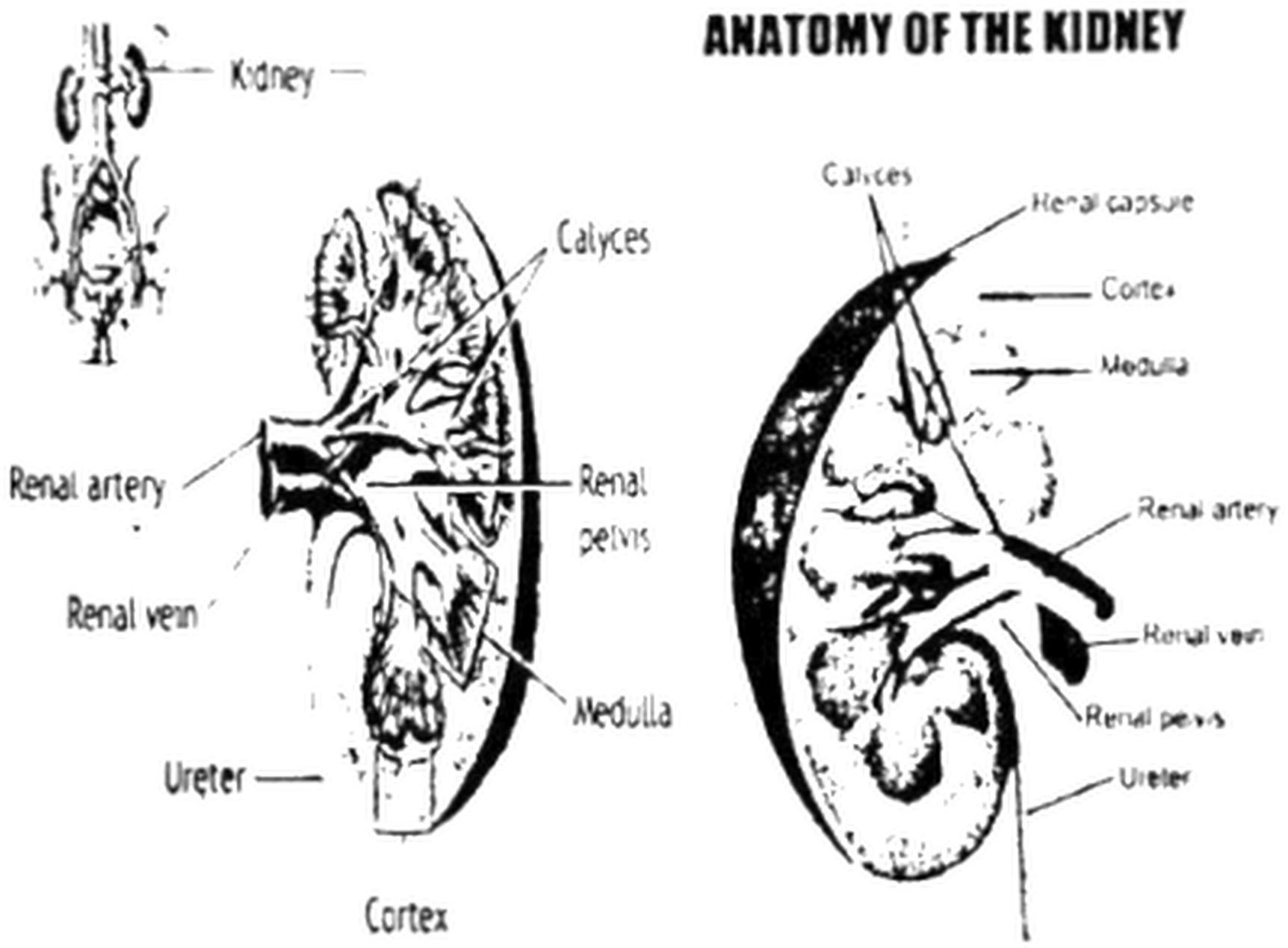
Renal medulla is the inner part of kidney and is pale red in colour.

Pyramids:

Renal medulla consists of several cone shaped areas called renal pyramids.

Renal pelvis:

Renal pyramids project into a funnel-shaped cavity called renal pelvis, which is the base of ureter.



The anatomy of a kidney

Nephron:

The functional unit of the kidneys is called nephron. There are over one million nephrons in each kidney

Parts of nephron:

There are two parts of a nephron i.e. renal corpuscle and renal tubule

i. **renal corpuscle:**

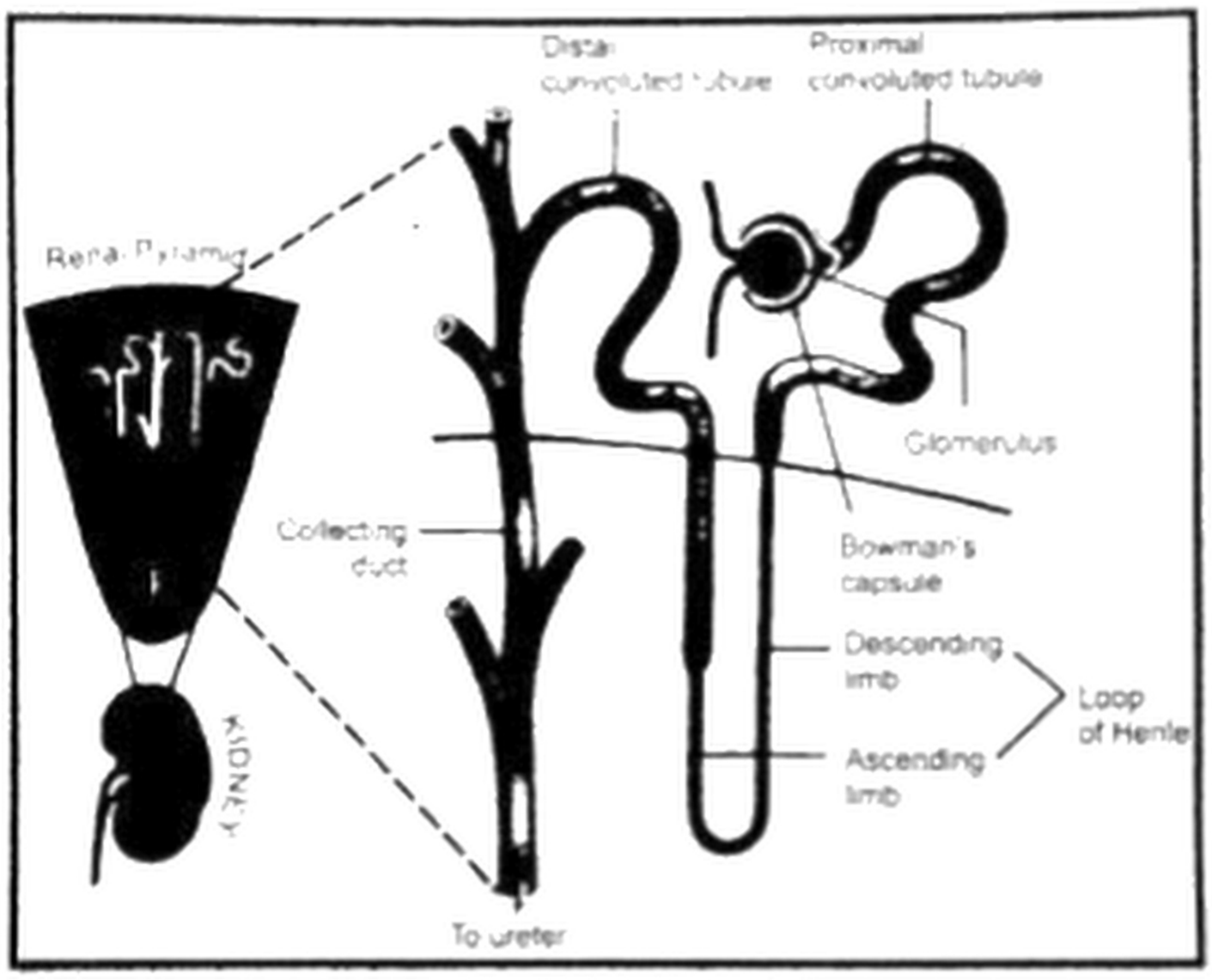
The renal corpuscle is not tubular and has two parts le glomerulus and Bowman's capsule Glomerulus is a network of capillaries while Bowman's capsule is a cup-shaped structure that encloses glomerulus.

The capillaries of the glomerulus anise from the afferent artenole and join to form the efferent arteriole.

ii. Renal tubule:

The renal tubule is the part of nephron which starts after Bowman's capsule its first portion is called the proximal convoluted tubule. Next portion is U-shaped and is called the Loop of Henle. The last portion of renal tubule is the distal convoluted tubule.

The distal convoluted tubules of many nephrons open in a single collecting duct. Many collecting ducts join together to form several hundred papillary ducts which drain into renal pelvis.



Structure of a nephron

Interesting Information

Blood cells and proteins are not filtered through the glomerular capillaries because they are relatively larger in size.

Interesting Information

At the final stage urine is only 1 % of the originally filtered volume. The typical volume of urine produced by an average adult is around 1.4 liters per day.

Q15. Explain how a kidney helps in the formation of urine in the human body?

OR

Explain the functioning of kidney?

OR

What steps are involved in the formation of urine in the kidneys?

Ans: Functioning of Kidney:

The main function of kidney is urine formation, which takes place in three steps

Formation of urine:

i. Pressure filtration:

The first step is pressure filtration. When blood enters the kidney via the renal artery. it goes to many arterioles, and then to the glomerulus. The pressure of blood is very high and so most of the water, salts, glucose and urea of blood is forced out of glomerular capillaries. This material passes into the Bowman's capsule and is now called glomerular filtrate.

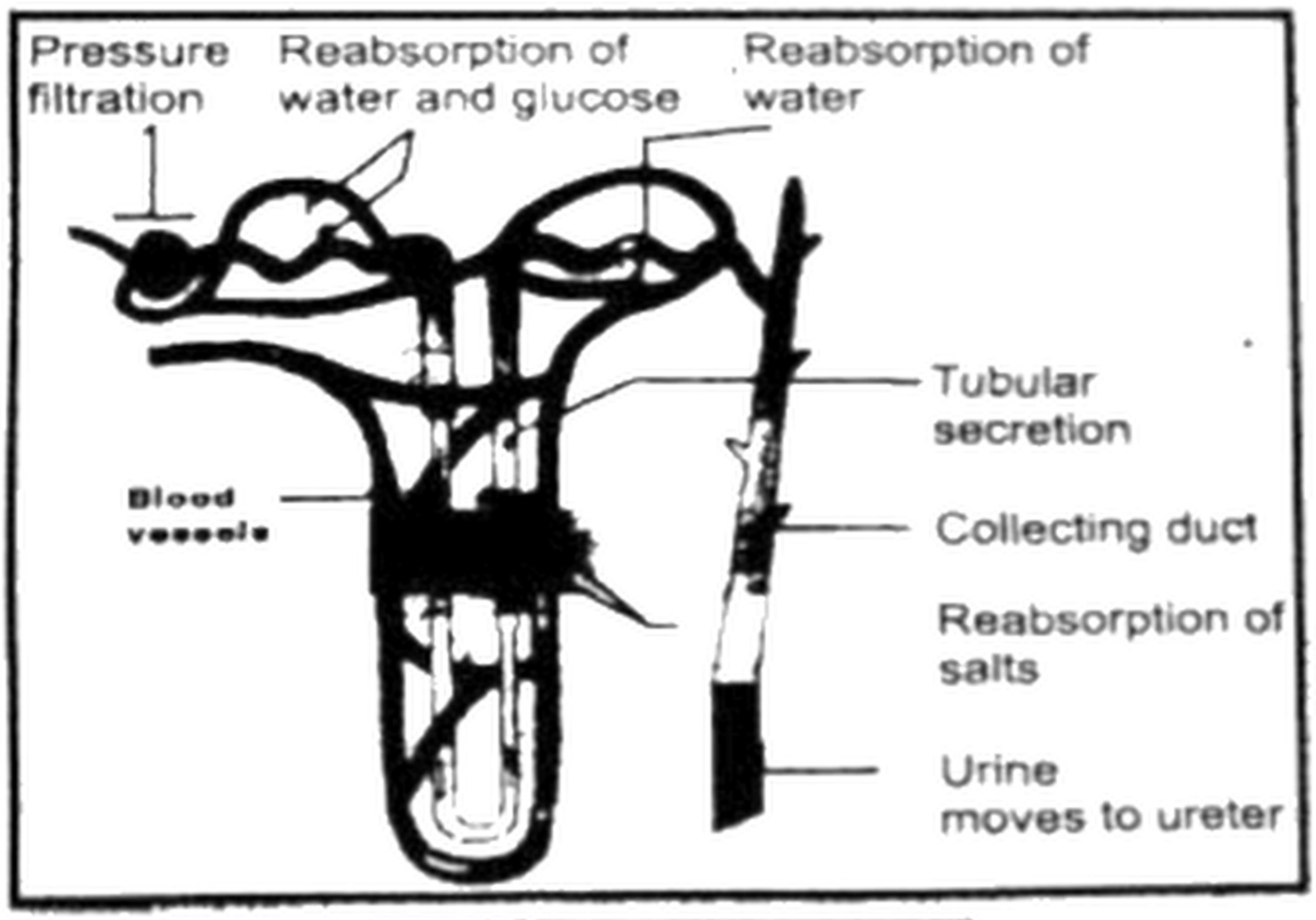
ii. Selective re-absorption:

The second step is the selective re-absorption. In this step about 99% of the glomerular filtrate is reabsorbed into the blood capillaries surrounding renal tubule. It occurs through osmosis, diffusion and active transport. Some water and most of the glucose is reabsorbed from the proximal convoluted tubule Here salts are reabsorbed by active transport and then water follows by

Osmosis. The descending limb of loop of Henle allows the reabsorption of water while the ascending limb of Loop of Henle allows the reabsorption of salts. The distal convoluted tubule again allows the reabsorption of water into the blood.

iii. Tubular secretion:

The third step is the tubular secretion. Different ions, creatinine, urea etc are secreted from blood into the filtrate in renal tubule. This is done to maintain blood at a normal pH (7.35 to 7.45)



Functioning of Kidney (nephron)

Urine:

After the above-mentioned steps, the filtrate present in renal tubules is known as urine. It moves into collecting ducts and then into pelvis.

Q16. Enlist the normal chemical composition of urine?

Ans: Normal chemical composition of urine:

Normal chemical composition of urine (Source: NASA Contractor Report)	
Water	95%
Urea	9.3 g/l
Chloride ions	1.87 g/l
Sodium ions	1.17 g/l
Potassium ions	0.750 g/l
Other ions and compounds	Variable amounts

Q17. Explain osmoregulatory function of kidney?

Ans: Osmoregulatory:

Osmoregulation is defined as the regulation of the concentration of water and salts in blood and other body fluids.

Osmoregulatory Function of Kidney:

Kidneys play important role in osmoregulation by regulating the water contents of important process as excessive loss of water concentrates the body fluids whereas excess intake of water dilutes them.

Dilute (hypotonic) urine:

When there is excess water in body fluids, kidneys form dilute (hypotonic) urine For this purpose. kidneys filter more water from glomerular capillaries into Bowman's capsule. Similarly less water s reabsorbed and abundant dilute urine is produced. It brings down the volume of body fluids to normal.

Concentrated (hypertonic) urine:

When there is shortage of water in body fluids, kidneys filter less water from glomerular capillaries and the rate of reabsorption of water is increased Less filtration and more reabsorption produce small amount of concentrated (hypertonic) urine it increases the volume of body funds to normal This whole process is under hormonal control.

Q18. Predict about the functioning of body without a kidney.

Ans: Body without a kidney:

The kidneys play an important role in the body they filter the blood removing waste products and excess salt and water of the body is without kidneys body falter in above mentioned tasks, leaving the blood polluted.

OR (Second Answer)

The kidneys the body's natural filtration system perform many vital functions including removing metabolic waste products from the bloodstream regulating the body's water balance and maintaining the ph. (acidity/alkalinity) of the body's fluids Approximately one and a half quarts of blood per minute are circulated through the kidneys where waste chemicals are filtered out and eliminated from the body along with excess water in the form of urine.

Without a kidney body could not perform the above functions which ultimately leads to the death.

Q19. Relate too much sugar intake by a diabetic with the functioning of kidney.

Ans: In such situation diabetics are at risk for kidney failure. Kidney failure in diabetics occurs when high blood sugar levels destroy small blood vessels und in the kidney Diet modifications are used to control diabetes and kidney failure

Q20. What causes the material to move from glomerular capillaries to Bowman's capsule?

Ans: Blood Pressure.

Q21. List the disorder of kidney?

Ans: Disorders of kidney:

There are many different kidney disorders.

i. Kidney Stones ii. Kidney (Renal) failure

Q22. State the signs, symptoms, causes and treatments of kidney stones?

Ans: Kidney Stones:

When urine becomes concentrated, crystals of many salts e.g. calcium oxalate, calcium and ammonium phosphate, uric acid etc. are formed in it Such large crystals cannot pass in urine and form hard deposits called kidney stones Most stones start in kidney. Some may travel to ureter or urinary bladder.

Causes of kidney stones:

The major causes of kidney stones are age, diet (containing more green vegetables, salts, vitamins C and D), recurring urinary tract infections, less intake of water, and alcohol consumption.

Symptoms of kidney stones:

The symptoms of kidney stones include severe pain in kidney or in lower abdomen, vomiting, frequent urination and foul-smelling urine with blood and pus.

Treatments of kidney stones:

About 90% of all kidney stones can pass through the urinary system by drinking plenty of water. In surgical treatment, the affected area is opened and stone(s) are removed.

Lithotripsy:

Lithotripsy is another method for the removal of kidney stones in this method, non-electrical shock waves from outside are bombarded on the stones in the urinary system. Waves hit the dense stones and break them. Stones become pend like and are passed through unne.

Interesting Information

Abu Nasr al-Farabi (872-951) was a prominent scientist who wrote many books that contained information about kidney diseases. The genius Abu al-Qasım Al-Zahrawi (known as Albucasis: 936-1013), is considered to be Islar's greates! Surgeon who invented many surgical procedures including the surgical removal of stones from the urinary bladder. His encyclopedia. Al-Tashi ("The Method contained over 200 surgical medical instruments he personally designed.

Q23. State the signs, symptoms, causes and treatments of kidney (Renal) failure?

Ans: Kidney (Renal) failure:

Kidney failure means a complete or partial failure of kidneys to function

Causes of kidney failure:

Diabetes mellitus and hypertension are the leading causes of kidney failure in certain cases, sudden interruption in the blood supply to kidney and drug Overdoses may also result in kidney failure.

Symptoms of kidney failure:

The main symptom of kidney failure is the high level of urea and other wastes in blood, which can result in vomiting, nausea, weight loss, frequent unration and blood in urine Excess fluids in body may also cause swelling of legs feet and face and shortness of breath.

Treatments of kidney failure:

The kidney failure is treated with dialysis and kidney transplant.

Q24. Explain the different methods of dialysis?

Ans: Dialysis:

Dialysis means the cleaning of blood by artificial ways

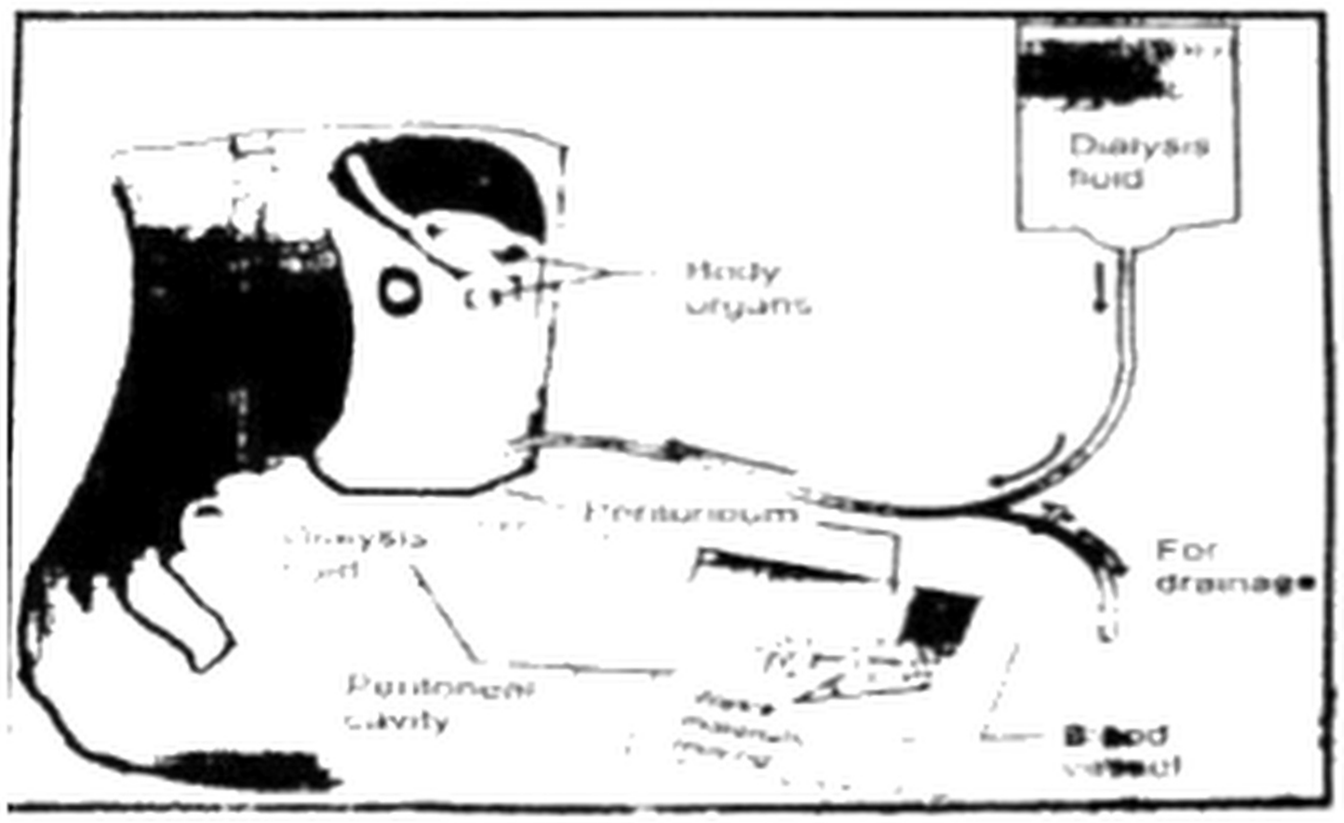
Methods of dialysis:

There are two methods of dialysis

1. **Peritoneal Dialysis:**

In this type of dialysis, the dialysis fluid is pumped for a time into the peritoneal cavity c h is the space around gut. This cavity is lined by peritoneum.

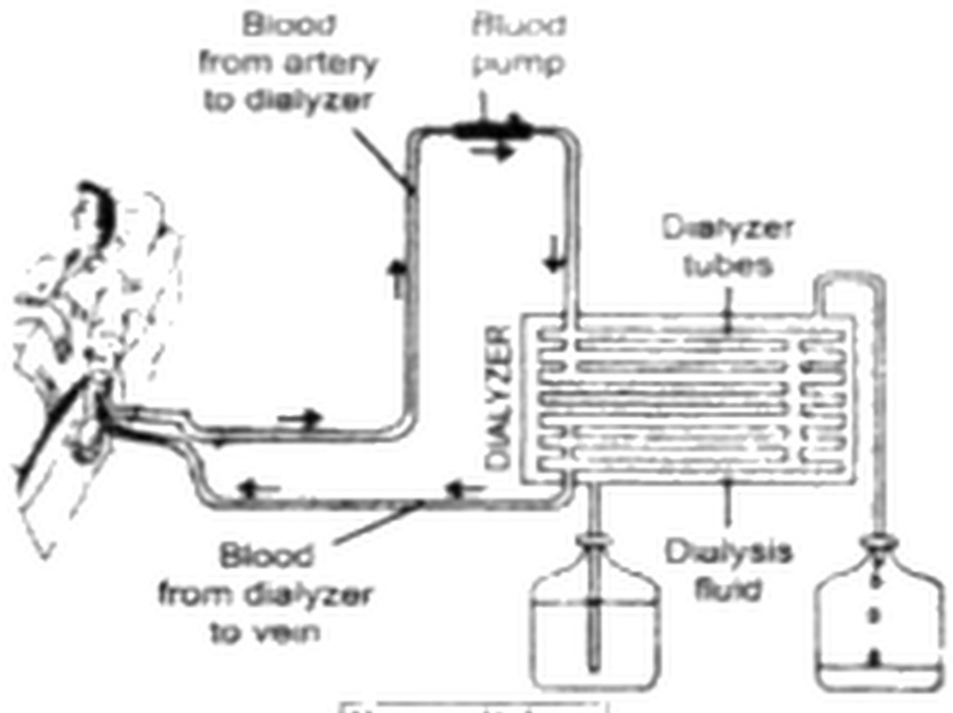
Peritoneum contains blood vessels. When we place dialysis fluid in Peritoneum cavity waste materials tom peritoneal blood vessels diffuse into the dialysis fluid which is then drained out. This type of dialysis can be performed at home but must done every day.



Peritoneal Dialysis

2. Hemodialysis:

In hemodialysis patient's blood is pumped through an apparatus called dialyzer. The dialyzer contains tubes the wall of which act as permeable membranes. Blood flows through the tubes while the dialysis fluid flows around the tubes. Extra water and wastes move from blood into the dialysis fluid. The cleansed blood is then returned back to body. The hemodialysis treatments are typically given in dialysis centers three times per week.



Haemodialysis

Q25. Explain the procedure of kidney transplant?

Ans: Kidney Transplant:

Dialysis needs to be repeated after every few days and su n t for patients and attendants. Another treatment for the end-stage kidney failure is kidney transplantation.

Kidney transplant is the replacement of patient's damaged kidney with a donor healthy kidney by cellophane paper and Kidney may be donated by a deceased-donor or living donor. The donor may or may not be a relative of the patient. Before transplant, the tissue proteins of donor and patient are matched. The donor's kidney is transplanted in patient's body and is connected to the patients' blood and urinary system.

Problems faced by kidney transplant:

The average lifetime for a donated kidney is ten to fifteen years. When a transplant fails, the patient may be given a second kidney transplant in this situation, the patient is treated through dialysis for some intermediary time Problems after a transplant may include transplant rejection Infections imbalances in body salts which can lead to bone problems and ulcers.

Q26. Rationalize why dialysis machine is considered as artificial kidney.

Ans: in medicine dialysis is a process for removing waste and excess water from the blood, and is used primarily to provide an artificial replacement of kidney function in people with renal failure. Therefore dialysis machine is used to treat artificial kidney.