

## Chapter Six: Human Physiology: Excretory Products and Excretion

**Ques. ► 1**

System- A : Discharge Nitrogen based wastages.

System- B : Discharge CO<sub>2</sub>

[All board 18]

- What is epiglottis? 1
- What is meant by ultra filtration? 2
- Draw the structural and functional label diagram of system A of the stem. 3
- "System A and B belong to different system yet they discharge wastage"- Analyze. 4

**Ans. to the Ques. No. 1**

**a** The opening of the Larynx that is located in the oral cavity or the lid of the glottis is called the epiglottis.

**b** The filtration that occurs at the first step of urine formation in the renal corpuscle of nephron that is the structural and functional unit of kidney, is known as ultra-filtration. In this process of filtration, blood from the heart enters into the glomerulus at high pressure through the dorsal aorta, renal artery and afferent arterioles. As the diameter of efferent arteriole is narrower than afferent arteriole which causes high pressure that filters the blood as water, salt, carbohydrate, urea, uric acid and deposits as urine in glomerulus.

**c** The referred system-A in the stem also known as the main organ of excretory system, is kidney. The structural and functional unit of kidney is nephron. Labeled diagram of nephron is given below-

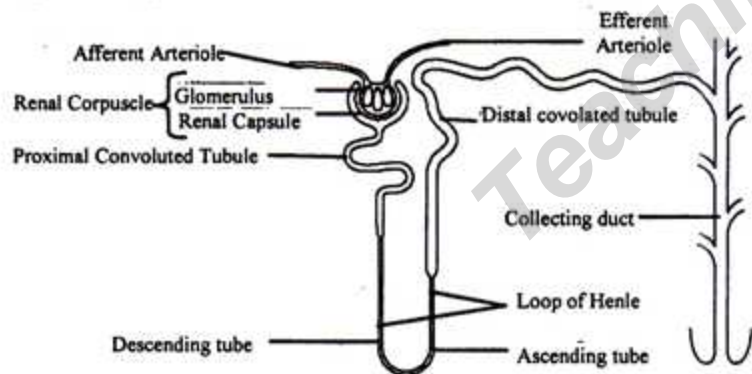


Figure: Nephron

**d** In the stem above, the system-A is excretory system and system-B is respiratory system. The excretory system discharge nitrogen based wastages from our body and respiratory system discharge CO<sub>2</sub> from our body which is a waste product of respiration. The two systems are different yet they function similarly, the description is given below- Excretory system is mainly consists of two bean seed shaped kidneys, excretory tubule, urinary bladder and ureter. The structural and functional unit of kidney is nephron which is consists of renal corpuscle and renal tubule. Through various filtration the whole excretory system filters the nitrogen based wastages (urea, creatinine etc.) of blood as urine and discharge from our body. Mainly the protein food that produces the energy and nitrogen based wastages through digestion.

On the other hand, the respiratory system is consists of nostrils, larynx, trachea, bronchus, lungs and alveolus. Energy and CO<sub>2</sub> are produced by the oxidation of O<sub>2</sub> in the cells. This CO<sub>2</sub> gas goes through the blood to the alveolus of the lungs and from there it is eliminated from our body.

The two substances described above, is harmful for our body. So the two wastages are discharged by two different systems. The two systems are structurally different yet the function similarly.

**Ques. ► 2**

The class teacher drew a figure same as a bean on the board and said that two important functions of this organ are:

- ⇒ plays a role in urine formation in the human body.
- ⇒ maintains the balance of water in the human body.

[C. B. 17]

- What is an adaptation? 1
- Why the pituitary gland is called the master gland? 2
- Describe the inner structure of the organ mentioned in the stem with a diagram. 3
- Explain how the organ does the second function mentioned in the stem. 4

**Ans. to the Ques. No. 2**

**a** The mechanism of formation of images of objects situated at various distances by changing the convexity of the lens keeping the distance between the object and the eye fixed, is called accommodation.

**b** The pituitary gland is an orbicular gland connected to the brain's hypothalamus. Most of the hormones are secreted from this gland and these hormones almost influences all other glands or coordinate their functions. For that this gland is called the master gland.

**c** In the stem above, the stated organ is bean seed shaped human kidney or kidney. Labeled diagram of its intersection is given below-

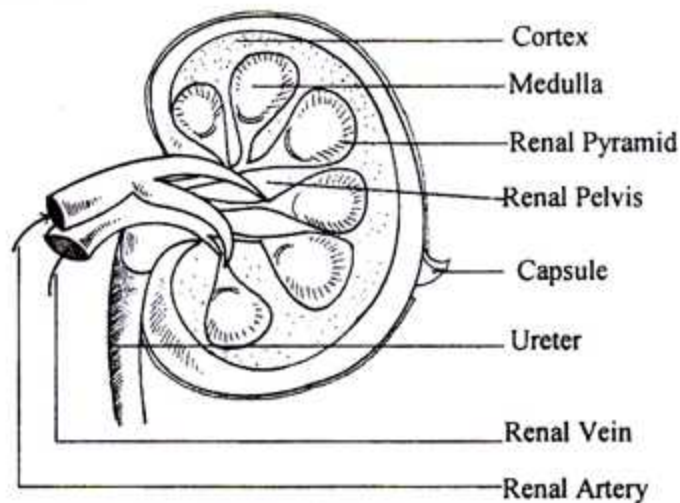


Fig- Human Kidney

It is seen in the intersection of the kidney that the cortex is located outside and the medulla is located inside of the kidney. The cortex part of the kidney is mainly composed of the malpighian corpuscles of nephron. There are 8-18 pyramids in the medulla region of the kidney which have longitudinal

arrangements. They are called Renal Pyramid. The visible cavity in the vertical section of kidney is called renal sinus. Gabini's pelvis region and adrenal veins and arteries are connected in the sinus. The top or papilla of each pyramid is exposed to minor calix. Some minor calix are exposed together to major calix. Some major calix are joint together to form the pelvis region. The structural and functional unit of kidney is located 85% in the cortex and 15% in the medulla of the nephron.

Kidney plays the main role to control the second function stated above in the stem, also known as the equilibrium state of human body fluid.

**d** Kidney maintain the equilibrium state of body fluid by producing urine. Kidney produces a huge amount of hypotonic urine when the body receives much water. But if the amount of receiving water is less then it produces less hypertonic urine. This process occurs in two steps. Such as-

The secretion of ADH hormones increase when the amount of water in our body is inadequate. As a result, the permeability of nephron tube of kidney increases and the degree of reabsorption of water also increases as well as. Thus kidney produces little amount of urine by retaining water.

On the other hand, secretion of ADH decreases if the water in our body is abundant.

As a result, reabsorption rate of water also decrease as the permeability of nephron tube of kidney decrease. So hypotonic urine is produced and extra water is eliminated from our body.

Thus kidney regulates the water equilibrium through regulating the rate of water absorption.

**Ques. ► 3** A pair of organs of the human body shaped like beans continuously produces an acidic liquid waste product and eliminates it to free the body from toxicity.

- |  |   |
|--|---|
| a. What is ADH?  | 1 |
| b. What do you mean by osmoregulation?                                       | 2 |
| c. Draw the figure of the structural unit of the organ mentioned above.      | 3 |
| d. Discuss the mechanism of production of the liquid product in the passage. | 4 |

**Ans. to the Ques. No. 3**

**a** ADH is a kind of secreted hormone from posterior part of the pituitary gland.

**b** Osmoregulation is the maintenance of constant osmotic condition inside and outside environment of the body. Osmoregulation process regulates the balance of water and ion. The death of cell, acidosis and overflow of nitrogen in the blood are the results of inadequate osmoregulation process.

**c** Similar to the question no-1(c)

**d** The organ stated in the stem above is kidney, the main excretory organ of human body. The acidic fluid wastages that it discharges from our body is urine. The production process of urine is described below-

The urine that consists of nitrogen based waste substances is produced by the digestion of protein food. The production of urine has three steps-

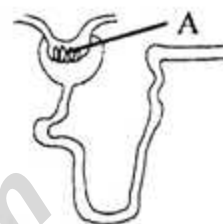
**Ultrafiltration:** Renal capsule of nephron, the unit of kidney function as the ultra-filter. Here the glomerulus stores almost entire water, salt, carbohydrate, urea, uric acid etc. except the blood's protein and blood cells in the capsular space by piercing the endothelium of capillary and base membrane and

epithelium of renal capsule as a result of hydrostatic pressure in the blood through ultrafiltration process. This filtrated fluid is called glomerular fluid.

**Selective reabsorption:** The process where various substances enter into the capillary after absorbed in the nephron's wall while glomerulus filtrate is flowing inside the nephron's tubule, is called the selective reabsorption. In this process, a lot amount of sodium and entire glucose, 65% water, 50% urea, amino acid, vitamin and chloride ions are absorbed from filtrate.

**Active secretion:** Active secretion of some eliminated substances such as- creatinine and a little amount of urea from capillary take place in the proximal convoluted tubule. Hydrogen, potassium and ammonium ion also secrete from the distal convoluted tubule. This substances are carried into the filtrate of tubule from the tissue fluid around the tubule. This glomerulus filtrate is the urine. It is discharged from our body by ureter.

**Ques. ► 4**



- |  |   |
|--|---|
| a. What is baroreceptor?   | 1 |
| b. What is meant by active secretion?  | 2 |
| c. Describe how wastes are separated from the part marked 'A' in the stem.   | 3 |
| d. If the organ directed by the stem be disordered among the temporary alternative measures what one do you think suitable? Write with reason. | 4 |

**Ans. to the Ques. No. 4**

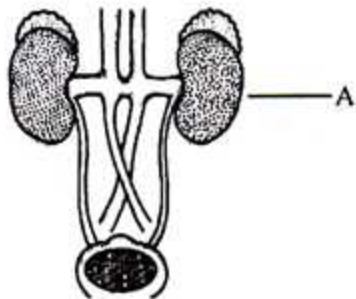
**a** Baroreceptor is the existing special sensitive edge of nerve in the wall of blood vessel that regulates the blood pressure of our body.

**b** Active secretion is the secretion of substances like creatinine and a little amount of urea with urine. Some eliminated substances such as- creatinine and a little amount of urea from capillary, enter into the proximal convoluted tubule and then discharge with the urine from the tissue fluid of the tubule through filtration. Besides in this process, pretty much ions secretes from distal convoluted tubule.

**c** In the figure in the stem the marked part- A is the glomerulus of kidney. Glomerulus functions as the mechanical filter. High pressure remains in the glomerulus as the afferent blood vessel's diameter of glomerulus is greater than efferent blood vessel's diameter. In normal condition, the degree of this pressure is equal to 70 mmHg. This high pressured blood is interrupted by two more pressures while flowing into the renal tubule through glomerulus. One is the osmotic pressure of blood's plasma protein and the other is the internal pressure of Bowman's capsule. The high blood pressure is interrupted by these two pressures in the glomerulus which produces the active filtration pressure. In this process, almost entire water, salt, carbohydrate, urea, uric acid etc. except the blood's protein and blood cells are stored in the capsular space by piercing the endothelium of capillary and base membrane and epithelium of renal capsule as a result of this pressure through ultrafiltration process. This filtrated fluid is called glomerular filtrate or primary urine which enters into the Bowman's capsules' cavity from glomerulus and later on it goes into the renal tubule from there. Thus the wastes are separated from glomerulus.

**Q1** In the stem, the stated organ is kidney. In case of failure of the organ, there are three methods of remedies. Such as: Controlled diet dialysis and kidney transplant. Kidney transplant is a lost-term solution. The others two are primary solution and controlled method is difficult to adopt between these two methods and dangerous harm can occur if any error take place while adopting diet. So I think the dialysis method as the suitable one. When the kidney fails, an artificial method that purify blood is called dialysis process. In this case, one end of the dialysis machine is connected to the artery of the patient's arm and the other end is connected to the vein of the same arm of the patient by a tube. The non-purified blood store in the dialysis machine from artery through the tube. As the wall of this tube in the machine is semi permeable in nature so the urea, uric acid and other harmful substances from blood store in the dialysis fluid inside the machine. Inside the machine, the structure of the dialysis fluid that inserted from outside is a lot similar to renal plasma. After elimination of waste substances, at first the filtered blood enters through the tube and then enters into the vein again. The dialysis fluid which consists the wastage product is diffused out through a leakage. Thus with the help of the dialysis machine the nitrogen based toxic waste products are eliminated from blood.

**Ques. ► 5**



[R.B. 16]

- What is cranial nerve? 1
- Write the names of the main components of urine. 2
- Draw the labeled diagram of the structural unit of the marked part 'A' of the stem. 3
- Analyze the role of the marked part 'A' of the stem. 4

**Ans. to the Ques. No. 5**

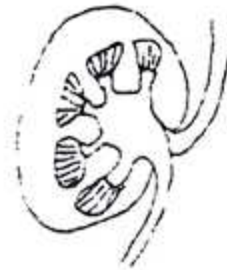
**a** The nerves that arises from the distinct parts of the brain, travels to the different organs of the body by elimination through the opening of the crania is known as cranial nerve.

**b** The main components of urine are- water, urea, uric acid, creatinine, sodium, potassium, ammonium, magnesium, chloride, phosphate, sulphate etc.

**c** The structural unit of the marked part 'A' is nephron. Its labeled diagram is given below.  
The answer is in 1(c) no. creative question.

**d** In the stem above the stated part 'A' of the diagram is kidney which plays an important role to discharge the  $N_2$  based waste substances from our body. Urine contains urea, uric acid, ammonia, creatinine etc. nitrogen based substances. Besides, a little amount of creatine and amino acid exits. As these are harmful for our body so after producing these should be eliminated as soon as possible. Kidney helps to eliminate these unnecessary and harmful waste substances as urine. Besides kidney regulates the water equilibrium in our body and blood. As well as kidney regulates the intensity of  $H^+$  by secreting renin and erythropoietin hormones. On the other hand it helps to regulate the osmotic relationship between tissue and blood as well as helps to keep specific the amount of some blood's element.

**Ques. ► 6**



[D]. B. 16]

- What is immunity? 1
- Write the name of excretory substances of human. 2
- Draw and labeled the different parts of the diagram of them stem. 3
- Describe the importance of the structural and functional unit of the organ of the stem. 4

**Ans. to the Ques. No. 6**

**a** Immunity is the defensive system of protect own self from harmful microscopic pathogenic organisms and damage from the toxic chemical substances by our body.

**b** The elements of human excretory products are: water, urea, uric acid, creatinine, sodium, potassium, ammonium, magnesium, chloride, phosphate, sulphate etc.

**c** The figure of the stem is of longitudinal section of human kidney. Labeled different parts of this diagram is given below-

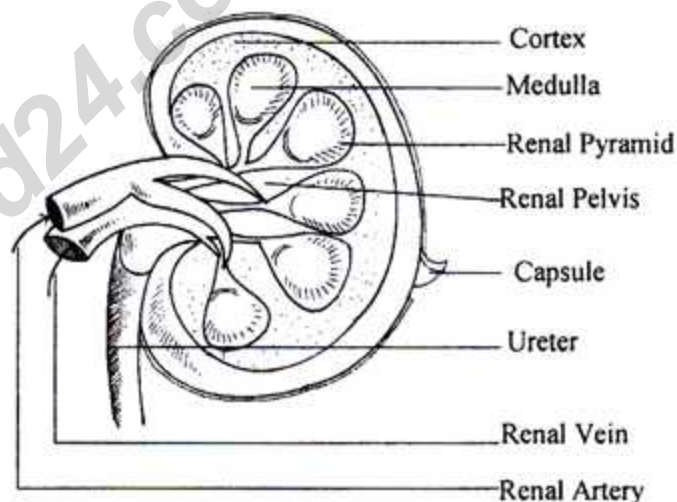


Fig- Human Kidney

**d** The figure of the stem above is of longitudinal section of human kidney. The structural and functional unit of kidney is nephron. Nephron keeps the body healthy by completing various function as the unit of kidney. Such as-

**Filtration:** The glomerulus of nephron send almost the entire elements except blood protein into the Bowman's capsule cavity by separating them.

**Reabsorption:** The important elements of renal tubule such as: glucose, major portion of salt and required water etc. enter into blood vessels after again absorption.

**Secretion of tubules:** The renal tubule doesn't only reabsorb, it secrets different kinds of contaminated elements such as-various kinds of sulphate based compound, creatinine and many kinds of organic acid etc. from the blood flow to the cavity of the tubule.

**New production of elements:** A few types of components like- non organic phosphate, ammonia, hippuric acid etc. are connected to cavity of tubule which is produced in the epithelial cells of renal tubule.

**Regulate the level of pH:** Protects the right levels of the body pH.

It can be clearly stated from the above discussion that the importance of nephron in human excretion is immense.

**Ques. ▶ 7** When our body contains salts and water, then different parts of our body gets swollen. Due to abnormality of density of blood if hormone increases to a special organ of our body, then this type of problem creates. [C.B.16]

- What is flame cell? 1
- Why lymphocyte is called the memory cell? 2
- Describe the structural unit of the organ. 3
- Discuss multipurpose behavior of bio-chemical substances of the stated organ. 4

**Ans. to the Ques. No. 7**

**a** Flame cell is a kind of special excretory cell which participates in the excretory function of the animals of Platyhelminthes phylum.

**b** Lymphocyte is a special kind of cell of human defense system that plays important role in defense. If any germ attacks our body for the first time, the lymphocyte preserves the process of detecting germ's antigen as memory. Later on entering a germ, the antigen of germs first identify and spread the message. As a result, the defense mechanism of body activates against the germ.

**c** The organ in the stem is the human excretory organ. Human excretory organ is kidney and the structural unit of kidney is nephron.

Nephron is almost 3cm in length. It is mainly divided into two sections- Malpighian corpuscle and renal tubule. Malpighian corpuscle is located in renal cortex. It is divided into two sections- Bowman's capsule and glomerulus. Bowman's capsule is nephron's closed and swollen part. There is a bunch of rounded blood vessels is located in this two layered capsule. It is constituted with renal tubule, proximal convoluted tubule, distal convoluted tubule, henli's loop and collecting duct. The next 14mm part of malpighian corpuscle is called the proximal convoluted tubule which is composed of one layered cuboidal epithelial cell. The endpoint of this tube enters straightly into the medulla region and constitute a 'U' shaped loop which is known as the loop of henli. There are two parts of this loop. Such as: ascending tubule and descending tubule. The next 5mm of ascending tubule of this loop is distal convoluted tubule. The next part of this tubule is collecting duct. Some collecting duct together constitutes the duct of Bellini. At last many ducts of Bellini in medulla are exposed together to the pelvis through papillary duct.

**d** The organ of the stem shows multipurpose behavior of bio-chemical substances or hormones in kidney.

**Aldosterone hormone:** This hormone is secreted from the adrenal gland, exits at the top of the kidney. It regulates the blood pressure of kidney. It increases the reabsorption power of various ions and water and reserves sodium (Na<sup>+</sup>).

**Antidiuretic hormone (ADH):** The absorption of water of kidney is regulated by pituitary gland secreted Antidiuretic hormone (ADH). The secretion of ADH hormones increase when the amount of water in our blood is inadequate. As a result, a great amount of water is absorbed by renal tubule. On the contrary, the secretion of ADH hormones decrease when the amount of water in blood increase and so little amount of water is reabsorbed by renal tubule. As a result, the amount of urine increase and the density decrease.

**Atrial natriuretic hormone (ANH):** The hormones are released from some cells present in the atrium wall of the heart. It effects the sodium excretory rate by increasing and decrease the amount of blood and blood pressure in our body. It interrupts the secretion of renin-angiotensin.

**Angiotensin II:** It secretes from the lungs in an inactive condition. Aldosterone secretion increases, blood pressure increases, reabsorption of sodium in nephron and stimulation of ADH secretion of pituitary gland are the effects of it.

**Ques. ▶ 8** Teacher said, CO<sub>2</sub> and N<sub>2</sub> are produced as the metabolic waste of our body and excrete through different organs. As a result, we remain healthy. [S.B.16]

- What is nephron? 1
- What is the consequences of the lungs due to smoking? 2
- The first metabolic waste in the stem is transported as chemical compound- Explain it. 3
- Failure of the 2<sup>nd</sup> waste removing organ, mentioned in the stem is harmful to human being- Analyze. 4

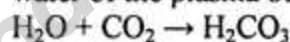
**Ans. to the Ques. No. 8**

**a** Nephron is the structural and functional unit of kidney.

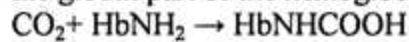
**b** Due to smoking, lungs are damaged in many ways. Due to smoking, alveoli of lungs gets damaged and takes on a blackish color which never grows anymore. Besides, the interior wall of the cilia of lungs becomes unsteady, as a result, dust store inside it. In addition to many breathing difficulties diseases, emphysema, bronchitis even cancer can be caused by smoking.

**c** At first in the stem, the teacher has explained metabolic wastage CO<sub>2</sub>. CO<sub>2</sub> is produced during the oxidization of carbohydrate at body cells. This CO<sub>2</sub> constitutes different types of compounds when it is transported to the lungs through blood and releases from body through exhalation.

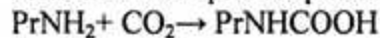
As a physical solution: A few amount (5%) of CO<sub>2</sub> is transported by constituting carbonic acid with a reaction to the water of the plasma of blood.



As carbamino compound: CO<sub>2</sub> is transported as carbamino hemoglobin after combining with the amino group (-NH<sub>2</sub>) of the globin part of the hemoglobin of blood.



Again, a part of CO<sub>2</sub> constitute carbamino protein by directly combined with plasma protein.



As bi-carbonate compound: Most of (65%) the CO<sub>2</sub> is transported through plasma as NaHCO<sub>3</sub> and through red blood cell as KHCO<sub>3</sub>.

Some metabolic waste is transported as compounds of CO<sub>2</sub>- this statement is correct.

**d** Nitrogenous wastes are produced a result of metabolism of protein-like food and emitted from body mainly through kidney. In this stem, the teacher has told about this metabolic waste N<sub>2</sub>. As kidney is the waste emitter so when it is disabled, that means it does not work correctly, toxic wastage accumulate inside our body and the body will move forward to horrific consequences. When kidney become disable, the following problems arise:

The amount of urination decreased or

Excessive sweating, vomiting tendency, diarrhea, bleeding etc.

Sleepiness, repugnancy to food and weakness.

Frequent breathing, accumulation of water at chest, pain at muscles, weak pulse motion.

Pain at bone joint.

Blood-urine.

To be senseless etc.

So when kidneys become disabled proper treatment should be taken through the advice of specialist doctors. If necessary dialysis should be conducted and if it is possible kidney should be transplanted. But this kind of treatment is very expensive. So the transplantation of kidney is deadly for life.

**Ques. ► 9** Amino acid participates in the energy production process. In this process, some nitrogen based excretory elements are produced. Urine is the main excretory element of human and kidney is the main excretory organ. *[J.B.16]*

- What is excretion?
- What is meant by osmoregulation?
- Draw the labeled diagram of the structural unit of the stated organ in the stem above.
- In the stem above, the production and elimination of the stated element is very important-analyze.

**Ans. to the Ques. No. 9**

**a** Excretion is the process of elimination of harmful and unnecessary fluid wastage elements which is produced due to metabolic function.

**b** Osmoregulation is the maintenance of constant osmotic condition inside and outside environment of the body. Osmoregulation process regulates the balance of water and ion. The death of cell, acidosis and overflow of nitrogen in the blood are the results of inadequate osmoregulation process.

**c** In the stem above the stated organ is kidney and its structural unit is nephron. Its labeled diagram is given below- The diagram is similar to the question no-1(c)

**d** In the stem above, the stated element is nitrogen based substance that is discharged through urine from our body. Various cells of our body is constantly busy with the continuous activities. So due to the tendency of surviving, different types of chemical substances are produced and few substances are break apart. In this essential process, some unnecessary and byproduct is produced. In this byproduct urea, uric acid etc. nitrogen based substances are eliminated from body as urine. The abundant amount of this substances are harmful for our body. If their amount increase inside the body and they remain for a long time they may create different types of problems for the body. So for the production of important things for the body, these nitrogen based elements are necessary. At the same time, the emission of these elements for the body is also very necessary.

**Ques. ► 10** Many necessary elements are produced in our body due to physiological function, at the same time some byproduct is also produced. On the both side of the spinal cord in the stomach cavity, there is a subtle structure inside the bean seed shaped organ through which the produced byproduct elements are discharged from body. *[B.B.- 16]*

- What is symmetry? 1
- What is meant by parental-care? 2
- How the stated organ in the stem discharge the byproduct elements? 3
- Besides eliminating the byproduct elements, the stated organ in the stem also regulates the water equilibrium-analyze. 4

**Ans. to the Ques. No. 10**

**a** By maintaining an adjustment with the axis, the equal two divisional separation of animal body is known as symmetry.

**b** From the period of the pregnancy as well as the birth of a child to the period of the child's self-reliance, their parents take care of them and it is called the parental care. Though this type of behavior is mostly seen in mammals and bird species, it is also specially observed in the insects, fish, amphibious and reptile species.

**c** In human body, nitrogen based waste substances are mainly discharged by bean seed shaped kidney. In the stem above, the stated organ kidney has a subtle structure called nephron which function as the structural and functional unit of it. Nephron plays a role in eliminating the byproduct substances as urine.

The glomerulus of nephron stores almost entire water, salt, carbohydrate, urea, uric acid etc. except the blood's protein and blood cells in the capsular space by piercing the endothelium of capillary and base membrane and epithelium of renal capsule as a result of hydrostatic pressure in the blood through ultrafiltration process. This filtrated fluid is called glomerular fluid. After that in selective reabsorption process, a lot amount of sodium and entire glucose, 65% water, 50% urea, amino acid, vitamin and chloride ions are absorbed from filtrate. Active secretion of some eliminated substances such as-creatinine and a little amount of urea from capillary take place in the proximal convoluted tubule. A few types of components like- non organic phosphate, ammonia, hippuric acid etc. are exposed to the cavity of tubule which is produced in the epithelial cells of renal tubule.

Thus, the filtrated fluid is discharged by the excretory organ as urine.

**d** In the stem above, the stated kidney discharge the wastages and at the same time regulates the water equilibrium of body. The maintenance of constant osmotic condition inside and outside environment of the body is Osmoregulation.

In the following two ways kidney plays role to reserve water or eliminate water in the need of the body.

i. The secretion of ADH hormones increase when the amount of water in our body is inadequate. As a result, the permeability of nephron tube of kidney increases and the degree of reabsorption of water also increases as well as. Thus kidney produces little amount of urine by retaining water.

ii. On the other hand, secretion of ADH decreases if the water in our body is abundant. As a result, reabsorption rate of water also decrease as the permeability of nephron tube of kidney decrease. So hypotonic urine is produced and extra water is eliminated from our body.

**Ques. ► 11** Kidney is an important organ of man. It helps to eliminate the nitrogenous wastes when the organ suddenly become unable to remove waste product, is called chronic kidney failure. *[Viqarunnisa Noon School & College, Dhaka]*

- What is Symmetry? 1
- Mention the organic components of wine. 2
- Describe structure and function of the basic unit of stem organ. 3
- In case of chronic stem organ failure, what measures you will be taken— Explain it logically. 4

**Answer to the question no. 11**

**a** Dividing an animal body into equal parts with reference of some axis is called symmetry.

**b** Wine is mainly produced from grapes. The organic compounds present in grapes are also found in wine. They are sugar, tartaric acid, malic acid. potassium bitartrate, phenols, nitrogenous compounds such as amino acids, peptides and proteins. Other than this some minerals, aroma compounds also found in wine.

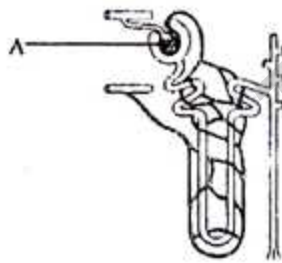
**c** According to the stem, the organ is kidney which is the main excretory organ of human body. The basic unit of kidney is nephron. The structure and function of nephron is given below—

Nephron is the structural and functional unit of kidney. It consists of malpighian corepuscle and renal tubules. Malpighian corepuscle has two part- Bownen's capsule and glomerulus. Renal tubules has 4 parts- proximal convoluted tubules, loop of Henle, distal convoluted tubules and collecting tubule. Bowman's capsule is a bi-layered cup shaped part. It contains the glomerulus. Afferent arteriol, originated from renal artery is divided into capillaries and made glomerulus. This capillaries again collectively create efferent arteriole and comes out from Bowman's capsule. Nephron does many functions. They filtrate the waste products apart from protein from blood. They also reabsorp necessary elements from the filtration. Renal tubules secrete several waste products in the filtrate. They manufacture new substance and balance the pH of blood.

**d** According to the stem, the organ is kidney which is the main excretory organ of human body. It removes waste products (mainly nitrogenous) from the body. If it fails to excrete, then lots of problems happen to body. If chronic kidney failure occur then some measures can be taken. they are describing below-

Human body has two kidney. If one kidney fails, the other can carries out the excretion process. But both kidney fail, then body will face serious problem. Because the waste products can not come out of body. This are very harunful for body. In this case kidney transplant can work. By this process a kidney from a healthy person is transplant in the patients' body. But the donar's tissue and blood group must be matched with kidney receiver's. Kidney can be taken from patient's mother, father, siblings, uncle, aunt and even from a dead person. Other than this, collected kidney should be free from HIV and other infections. This transplantation should be done within 48 hours of collection from the donor. This is a very costly process. So everyone should take proper care of their own kidney.

**Ques. ► 12**



[Adamjee Cantonment College, Dhaka]

- What is blood pressure? 1
- What do you mean by osmoregulation? 2
- Describe how wastes are separated from the part marked 'A' in the stem. 3
- If the organ directed by the stem be disordered among the temporary alternative measures what one do you think suitable? Write with reason. 4

**Answer to the question no. 12**

**a** Blood pressure is the force created by circulating blood on the walls of blood vessels.

**b** The process of maintaining water and electrolyte balance in a body is called osmoregulation. It is done by kidney. Kidney maintain the osmosis pressure of cell by absorbing proper amount of water and electrolyte. A hormone (ADH) released by hypothalamus of brain plays a role in osmoregulation process.

**c** According to the stem, the figure is nephron. It is structural and functional unit of kidney. Kidney is the main excretory organ of human body. The marked "A" in the nephron is glomerulus. It separates the waste products from blood. The process is described below-

The glomerulus of kidney works as a mechanical filter. It filtrates the nitrogenous waste products by ultra filtration process. As the diameter of afferent vessel is larger than the diameter of efferent vessel, a high pressure is always maintained in the glomerulus. The pressure is equivalent with 70 mm(Hg) pressure. This high pressured blood has to encounter two more pressure obstacles. They are osmotic pressure of blood plasma proteins and internal pressure of Bowman's capsule. These two pressures affect the high pressure of glomerulus and facilitate the creation of active filtration pressure. This pressure facilitates the filtration of blood components apart from the blood plasma proteins. These are called glomerular filtrate. In this way waste products are filtrated and cutters the vacuoles of Bowman's capsule and then moves the renal tubules.

**d** According to the stem, the figure is nephorn. It is the structural and functional unit of kidney. Kidney excrete nitrogenous waste products from the body. If any problem occurs, some temporary alternative measures are taken like- drinking more water, take saline, avoid protein foods. If the situation become more bad and nitrogenous wastes increase in blood, then dialysis can be done. Two types of dialysis (Haemo dialysis and peritoneal dialysis) can be done. But if kidney becomes disorder after these measures, then kidney transplant is the only way to recover this problem.

As human body has two kidneys, so one can be donated. But the donar's tissue and blood group must be matched with kidney receiver's. Even kidney can be collected from a dead person. But the collected kidney should be free from HIV and other infections. This transplant should be done within 48 hours of collection from the donor. This is a very costly process. So everyone should take proper care of its own kidneys.

**Ques. ► 13** The excess of amino acids is to be removed from our body. For the purpose they are converted to montoxic compounds and are removed from body through urine.

[Mirzapur Cadet College, Tangail]

- What is deamination? 1
- What do you mean by osmoregulation? 2
- How urine is produced? Explain. 3
- Analyze the importance of the system that is involved in urine production. 4

**Answer to the question no. 13**

**a** The removal of Amino groups ( $\text{NH}_2$ ) from the amino acid in the presence of deaminase enzyme is called deamination.

**b** The process of maintaining water and electrolyte balance in a body is called osmoregulation. It is the maintenance of constant osmotic condition in the body It involves regulation of water content and solute concentration of the fluid particularly of sodium, potassium and chloride.

**c** The epithelial cells from renal tubules can release several components, into the tubular cavity. Those filtrate is acidic, thick and contains several component which is known as urine. The urine formation process are given below—

Each kidney contains 1 million tiny structure called nephron and each nephron has glomerulus. Inside the glomerulus, blood pressure pushes fluid from capillaries into the glomerular capsule through filtration membrane, that allows water and small solutes to pass but block blood cells large protein. The filtrate flows from the glomerular capsule for their into the nephron. The glomerulus filter water and small solutes act of the blood stream. The resulting filtrate contains waste but also other substances the body needs. But after going through reabsorption process the vital nutrient and water reabsorbed into capillaries. At the same time waste ion and hydrogen ion pass from the capillaries into renal tubule. Those secreted ions combine with filtrate and become urine.

**d** The system that is involved in urine production is excretory system. The importance of the system are given below—

Different excretory substances or waste substances are ammonia, urea, creatine, uric acid which travel through whole body with blood flow. Usually they are harmful and exert a toxic effect on body. So removal of such substances from the system is obligatory to do physiological events. Through this physiological process, urine reaches the cavity of kidney with blood flow and enters the Bowman's capsule after going through the filtration mediated by the glomerulus of a nephron. Usually blood is partially purified through this process. Excretion process removes harmful nitrogenous liquid waste from the body and purifies blood while doing so. This process also excretes extra water from the system, thus keeps a body healthy by maintaining the water balance.

The process of maintaining water and electrolyte balance in a body is called osmoregulation. it is highly essential to maintain a proper balance between liquids inside cells and liquids outside of cells, for example: blood plasma, tissue fluids, lymph etc. balance of water and electrolyte density. Kidney plays an important role to maintain a physiological balance of the inner body.

Usually liquids are taken in a body through our regular diet. These liquids are removed from the body as water through respiration, sweating, urination etc. excretion processes. Excessive liquid is harmful for the body, similarly excessive removal of fluid from body is also harmful. Because somatic cells become dehydrated due to excessive water loss which can trigger further physiological complexity. balance of fluid in cells because kidney doesn't permit any decrease or increase of the osmotic pressure.

**Ques. ► 14**



[Mymensingh Girls' Cadet College, Mymensingh]

- |   |   |
|---|---|
| a. What is dialysis?                            | 1 |
| b. What are the components of urine?            | 2 |
| c. Describe the causes of above organs failure. | 3 |
| d. How the urea formate through above organ?    | 4 |

**Answer to the question no. 14**

**a** **Dialysis** : Dialysis is an artificial produce which can remove toxic wastes and unnecessary water deposited in the blood when the kidney fails to function properly.

**b** **Components of urine** : Urine is a nitrogenous liquid wastage which consists of :

- i. Water (about 95%)
- ii. Chloride
- iii. Sodium
- iv. Potassium
- v. Creatinine
- vi. Creatine and

other organic and inorganic substances such as proteins, amino acids, hormones etc.

**c** Causes of kidney failure can happen from three main reasons :

1. **Sexually transmitted** : This type of kidney diseases can affect several portions from kidney, urinary bladder, urethra etc. and reduce functioning capability of kidney. Even a kidney can be turned into dysfunctional because of this disease.
2. **Hereditary** : Some kidney diseases are observed to be inherited from one generation to another though these disease might not be expressed in every generation. Sometimes it takes 5-6 generation to be expressed as a disease.
3. **Acquired** : Nephritis or swelling of the kidney is the most prominent acquired kidney disease. Any blockage in the kidney or urethra developed from several reasons can facilitate this disease. As a result to this disease, the kidney becomes dysfunctional or a complete failure of kidney is observed.

Moreover following reasons can facilitates sudden kidney failure :

- i. Diarrhea and excessive vomiting.
- ii. Deficiency of water and electrolytes in blood.
- iii. Severe burn in body.
- iv. Haematemesis, surgical operations and abortion of pregnancy.

**d** Urea formulate from kidney is given below :

Physiology of excretion : Unused proteins from our body is converted into ammonia with the help of an enzyme called de-amylase. This ammonia then reaches in the liver and is converted into urea through the ornithine cycle with the help of enzyme, arginase. This ammonia reaches the kidney. Meanwhile blood containing excretory substances also reaches the kidney through renal artery. All of them are carried toward glomerulus with the afferent vessel. All nitrogenous liquid waste produced in a body reach the kidney nephron through the blood flow of renal artery. Nephron can further work on them to produce urine. About 90% of the urine is water. Urine also contains urea, uric acid, ammonia etc. nitrogenous excretory products. Usually several inorganic components and metabolic components are excreted with the urine.

1. Protein food  $\xrightarrow{\text{Enzyme}}$  Amino acid
2. Amino acid  $\xrightarrow{\text{Deamination}}$  Keto acid +  $-\text{NH}_2$
3.  $-\text{NH}_2 + \text{H}^+ \longrightarrow \text{NH}_3$
4.  $2\text{NH}_3 + \text{CO}_2 \xrightarrow{\text{Ornithine cycle}}$   $\text{CO}(\text{NH}_2)_2$  (Urea) +  $\text{H}_2\text{O}$

**Ques. ► 15** [A] Ultrafiltration → [B] Selective Reabsorption

→ [C] Tubular Secretion [Joypurhat Girls' Cadet College, Joypurhat]

- What is Opsonin? 1
- Differentiate innate and learning behavior. 2
- Describe the structure of the place where step [A] of the stem take place. 3
- Illustrate the whole process of the stem briefly. 4

**Answer to the question no. 15**

**a Opsonin:** Any substance (e.g. *antibody*) that binds to the surface of a particle (e.g. antigen) to enhance the uptake of the particle by a phagocyte (e.g. *macrophage*)

**b** Difference between innate and learning behavior:

Learning behaviour	Innate behaviour
1. Animal behaviour obtained through learning, effort and experience.	1. Animal behaviour obtained through heredity, produced reflex action, past experience, without learning.
2. Not well-defined species.	2. Well defined species.
3. Complex in nature and not instinctive.	3. Simple in nature and instinctive.
4. Always variable.	4. Not variable.
5. Not reflected in heredity.	5. Reflected in heredity.

**c** In stem A is ultrafiltration is take place in Bowman's capsule.

1. **Bowman's capsule:** It is the closed and swollen portion of the nephron. Bi-layered Bowman's capsule contains glomerulus which is a round web of blood capillaries. The layer adjacent to glomerulus is called visceral layer and the other one is known as parietal layer. The internal cell layer is made up with amoeba like flat cells which are known as podocyte. Podocytes are narrow cells which are arranged on a less prominent basal membrane. This looks like a cup or funnel. English doctor Sir William Bowman had discovered this organ.

**d** Ultrafiltration > Selective reabsorption > Tubular Secretion

**Ultrafiltration**

Blood enters the afferent arteriole and flows into the glomerulus. Blood in the glomerulus has both filterable blood components and non-filterable blood components. Filterable blood components move toward the inside of the glomerulus while non-filterable blood components bypass the filtration process by exiting through the efferent arteriole. Filterable Blood components will then take a plasma like form called glomerular filtrate. A few of th filterable blood components are water, nitrogenous waste, nutrients and salts (ion). Non filterable blood components include formed elements such blood cells and platelets along with plasma proteins.

**Selection reabsorption**

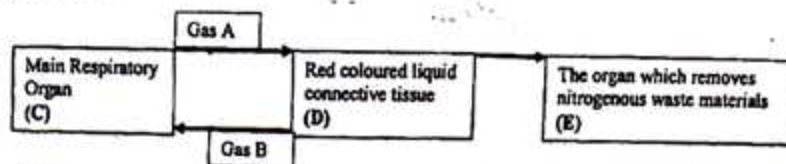
Within the peritubular capillary network, molecules and ions are reabsorbed back into the blood. Sodium Chloride reabsorbed into the system increases the osmolarity of blood in comparison to the glomerular filtrate. This reabsorption process allows water (H<sub>2</sub>O) to pass from the glomerular filtrate back into the circulatory system.

Glucose and various amino acids also are reabsorbed into the circulatory system, If all of the carrier molecules are used up, excess glucose or amino acids are set free into the urine. A complication of diabetes is the inability of the body to reabsorb glucose.

**Tubular Secretion**

Some substances are removed from blood through the peritubular capillary network into the distal convoluted tubule or collecting duct. These substances are Hydrogen ions, creatinine, and drugs. Urine is a collection of substances that have not been reabsorbed during glomerular filtration or tubular re absorption.

**Ques. ► 16** Observe the stem and answer the following questions.



[Feni Girls' Cadet College, Feni]

- What is Coronary Artery? 1
- What do you mean by Gluconeogenesis? 2
- Write down the role of E in Osmoregulation. 3
- How A and B are transported in the body? Discuss briefly. 4

**Answer to the question no. 16**

**a** The coronary arteries are the arteries of the coronary circulation, which transports blood into and of the cardiac muscle.

**b** **Gluconeogenesis (GNG)** is a metabolic pathway that results in the generation of glucose from certain carbohydrates non-carbohydrate carbon substrates. Gluconeogenesis is one of several main mechanisms used by humans and many other animals to maintain blood glucose levels. In vertebrates, gluconeogenesis takes place mainly in the liver and, to a lesser extent, in the cortex of the kidneys.

**c** In stem E mentioned as kidney.

Role of kidney in osmoregulation:

**Osmoregulation:** The process of maintaining water and electrolytes in a body is called osmoregulation. Kidney plays an important role to maintain a physiological balance of the inner body. Balancing the body osmotic pressure is another important physiological event to ensure healthy life.

Usually liquids are taken in a body through our regular diet. These liquids are removed from the body as water through respiration, sweating, urination etc. excretion processes. Excessive liquid is harmful for the body, similarly excessive removal of fluid from body is also harmful. Because somatic cells become dehydrated due to excessive water loss which can trigger further physiological complexity. So it can be said that the internal environment of a somatic cell should possess a proper amount of fluid. Kidney is the prime organ to maintain such balance of fluid in cells because kidney does not permit any decrease or increase of the osmotic pressure. Kidney maintains the fluid balance and osmotic pressure of a human body through maintaining the amount of excretory urine.



**d** In the stem gas A is oxygen and gas B is carbon dioxide.

**Transportation:** The primary function of the respiratory system is to exchange oxygen and carbon dioxide. Inhaled oxygen enters the lungs and reaches the alveoli. The layers of cells lining the alveoli and the surrounding capillaries are each only one cell thick and are in very close contact with each other. Oxygen passes quickly through this air-blood barrier into the blood in the capillaries. Similarly, carbon dioxide passes from the blood into the alveoli and is then exhaled. Oxygenated blood travels from the lungs through the pulmonary veins and into the left side of the heart, which pumps the blood to the rest of the body. Oxygen-deficient, carbon dioxide-rich blood returns to the right side of the heart through two large veins, the superior vena cava and the inferior vena cava. Then the blood is pumped through the pulmonary artery to the lungs, where it picks up oxygen and releases carbon dioxide.

**Ques. 17**

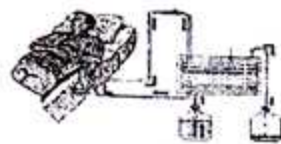
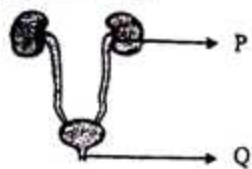


Figure-R

[Barishal Cadet College, Barishal]

- What is nephrosis? 1
- Why glucose was not present in normal condition of urine? Explain. 2
- Explain the producing mechanism of the mentioned liquid substance that emit through 'Q' marked part. 3
- Analyze the relationship between 'P' marked organ and Figure R. 4

#### Answer to the question no. 17

**a** Nephrosis: A syndrome characterized by edema and large amounts of protein in the urine and usually increased blood cholesterol; usually associated with a complication of various systemic diseases. A disease affecting the kidneys.

**b** Glucose is filtered through the glomerulus into the Bowman's capsule. However, in the proximal convoluted tubule (PCT), glucose molecules, almost 100% of them, are actively reabsorbed back into the blood. That is why glucose does not present in urine.

**c** Q-marked part emitted substance is urine. Producing mechanism of urine-

Scientist Kushnir had divided the whole process of urine production into 4 steps. They are:

- Glomerular filtration:** Glomerulus of the kidney works as a mechanical filter. Filtration process observed in here is different from a typical filtration. This filtration is pressure mediated hence the name ultrafiltration. As the diameter of afferent vessel is larger than the diameter of efferent vessel, a high pressure is always maintained in the glomerulus. Usually it is equivalent with 70mm mercury pressure [70 mm (Hg) pressure]. This high

pressured blood has to encounter two more pressure obstacles while going from the glomerulus to the kidney tubules. They are osmotic pressure of blood plasma proteins and internal pressure of Bowman's capsule. These two pressures affect the high pressure of glomerulus and facilitate the creation of active filtration pressure.

- Tubular re-absorption:** Several necessary components of body, for example: glucose, amino acids, sodium, potassium, phosphates, vitamins etc. are re-absorbed through the proximal convoluted tubule from the liquid filtrate. Different components from the glomerular filtrate enter renal tubules except for blood plasma proteins and most of them return back to the blood through re-absorption.
- Tubular secretion:** Renal tubules are not solely devoted on re-absorption. It can secrete several wastes, for example: different sulfur containing compounds, creatinine and several organic acids from the blood to the cavity of the tubule.
- Formation of new substances in tubule:** The epithelial cells from renal tubules can release several components, for example: ammonia, hippuric acid etc. into the tubular cavity. Such filtrate is acidic, thick and contains several components and known as urine.

**d** In the stem p-marked is kidney and R-marked is Haemo dialysis. When kidney fail to excrete nitrogenous and other wastage from body haemo dialysis is done for it. Its described below:

**1. Haemo dialysis:** In this process, blood is subjected to flow within specific machineries and this blood is usually returned into the body after removing waste materials from it. Dialyser is consisted with a box like structure which contains channels for entry and the exit of dialysed solution and blood, 1 pump machine, 1 dialyser tube and a semi-permeable membrane. One end of the dialysing tube is connected with the artery from the wrist of a patient and the other end is connected with the vein from that hand. Then blood is pumped from the artery to the vein through the pumping machine. Heparin is mixed with the blood to prevent blood clotting.

The nitrogenous wastes are removed through diffusion. This machine contains a coil of cellophane tube made up with a semi-permeable membrane and liquid substance. When blood flows through this coil, waste materials enter into the dialysis solution from blood through diffusion. This helps to purify blood by removing urea, uric acid and other harmful components. But the glucose and water from the blood cannot be removed.

Dialysis is conducted at least 2-3 times a week. It is a costly and time consuming process that requires around 4-5 hours. Moreover this process cannot restore kidney activity. But haemodialysis is more effective than peritoneal dialysis.