19

Excretory Products and their Elimination

Multiple Choice Questions (MCQs)

Q. 1 The following substances are the excretory products in animals. Choose the least toxic form among them.

(a) Urea
(b) Uric acid
(c) Ammonia
(d) Carbon dioxide

Thinking Process

Nitrogenous waste such as ammonia, urea and uric acid are produced during protein metabolism according to the species. Their excretory form product from the animals body depends on the availability of water.

Ans. *(b)* **Uric acid** is the least toxictions. Insects, land tortoises, lizards and birds change most of their nitrogenous waste into uric acid. It is the least toxic because it is insoluble in water as there are in solid form, thus, contains the least water. In birds, uric acid mixes with undigested food to form the bird dropping.

Urea moves to blood get filtered and eliminated with water in urine *via* kidneys.

Ammonia is very toxic and needs water for diffusion.

Carbon dioxide excretion takes place through the lungs.

Q. 2 Filtration of the blood takes place at

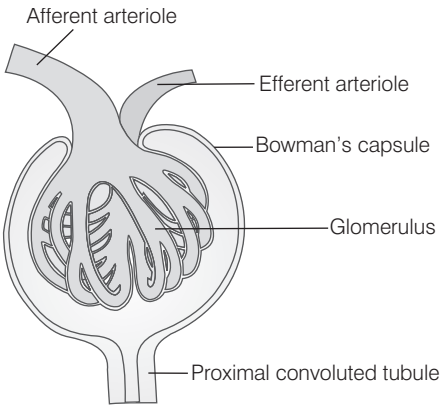
(a) PCT
(b) DCT
(c) Collecting ducts
(d) Malpighian body

Ans. *(d)* Filtration of blood takes place at **Malpighian body.**

Malpighian body or corpuscle comprises of **glomerulus** and **Bowman's capsule**. Filtration of blood takes place in glomerulus through glomerular filtration.

Get More Learning Materials Here : CLICK HERE www.studentbro.in

In which blood enters in the glomerules through an afferent arteriole and leaves it through efferent arteriole.



Malpighian body (renal corpuscle)

Proximal Convoluted Tubule (PCT), is lined by cuboidal epithelium cells bearing brush border and allows the reabsorption of salts by active transport.

Distal Convulated Tubule (DCT), allows conditional reabsorption of Na^+ and water and selective secretion of H , K^+, NH_3 to maintain pH and Na — K balance in blood.

Collecting Duct extends from cortex of kidney to the inner part of medulla. Large amount of water is reabsorbed from this region to produce the concentrated urine.

Q. 3 Which of the following statement is incorrect?

(a) ADH prevents conversion of angiotensinogen in blood to angiotensin
(b) Aldosterone facilitates water reabsorption
(c) ANF enhances sodium reabsorption
(d) Renin causes vasodilation

Ans. *(a)* ADH (Antidiuretic Hormone) or vasopressin is secreted by posterior pituitary. It is involved in facilitating water reabsorption from later parts of the tubule, hence preventing diuresis.

It regulates water excretion by increasing permeability of collecting duct for water and salt and by accelerating water and ion transfer determined by osmotic gradient.

Q. 4 A large quantity of one of the following is removed from our body by lungs.

(a) CO_2 only
(b) H_2O only
(c) CO_2 and H_2O
(d) ammonia

Thinking Process

CO_2 and water both are metabolic wastes produced during oxidation of food in the cells.

Ans. *(c)* Our lungs remove large amounts of CO_2 (18L /day) and also significant amount of water everyday.

While respiration, CO_2 alone can not be eliminated from the body and the same holds true for H_2O. Ammonia is highly toxic, out is not found in free NH_3^+ form, thus it is immediately converted to non-toxic form.

Get More Learning Materials Here : CLICK HERE www.studentbro.in

Q. 5 The pH of human urine is approximately

(a) 6.5 (b) 7 (c) 6 (d) 7.5

Thinking Process

The urine is a light yellow coloured watery fluid, which is slightly acidic and has a characteristic odour.

Ans. *(a)* The pH of human urine is approximately 6.0. Other options are not the pH of urine.

Q. 6 Different types of excretory structures and animals are given below. Match them appropriately and mark the correct answer from among those given below

	Excretory Structure/Organ		Animals
A.	Protonephridia	1.	Prawn
B.	Nephridia	2.	Cockroach
C.	Malpighian tubules	3.	Earthworm
D.	Green gland or antennal gland	4.	Flatworms

Codes

	A	B	C	D		A	B	C	D
(a)	4	3	2	1	(b)	2	3	1	2
(c)	4	3	1	2	(d)	2	3	2	4

Thinking Process

Animal kingdom possess a variety of excretory structures for excretion.

Ans. *(a)*
1. Prawn possesses **green glands** or **antennal gland**s as their excretory structures.
2. Cockroach possesses **Malpighian tubules** as their excretory structures.
3. Earthworm possesses **nephridia as** their excretory structures.
4. Flatworm possesses **protonephridia** as their excretory structures.

Q. 7 Which one of the following statements is incorrect?

(a) Birds and land snails are uricotelic animals
(b) Mammals and frogs are ureotelic animals
(c) Aquatic amphibians and aquatic insects are ammonotelic animals
(d) Birds and reptiles are ureotelic

Thinking Process

Animals secreting urea as their excretory product are called ureotelic animals. Animals secreting uric acid and ammonia are called uricotelic and ammonotelic respectively.

Ans. *(d)* **Birds** and **reptiles** are uricotelic (not ureotelic) as they excrete nitrogenous waste uric acid in the form of pellet or paste with a minimum loss of water.

Q. 8 Which of the following pairs is wrong?

(a) Uricotelic ..... Birds (b) Ureotelic ..... Insects
(c) Ammonotelic ..... Tadpole (d) Ureotelic ..... Elephant

Ans. *(b)* Insects excrete nitrogenous wastes as **uric acid** hence are **uricotelic.**

Ureotelic animals involve **mammals**, adult **amphibians** and elasmobranchs.

Whereas, birds are uricotelic (correct option) and tadpoles excretion ammonia. Elephant being a mammal is ureotelic.

Get More Learning Materials Here : CLICK HERE www.studentbro.in

Q. 9 Which one of the following statement is incorrect?

(a) The medullary zone of kidney is divided into a few conical masses called medullary pyramids projecting into the calyces

(b) Inside the kidney the cortical region extends in between the medullary pyramids as renal pelvis

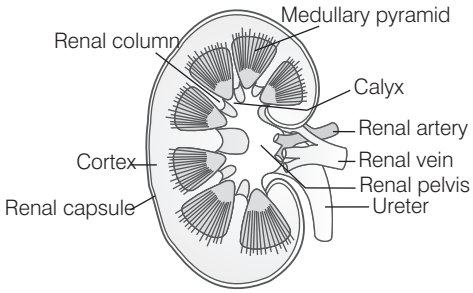
(c) Glomerulus along with Bowman's capsule is called the renal corpuscle

(d) Renal corpuscle, Proximal Convoluted Tubule (PCT) and Distal Convoluted Tubule (DCT) of the nephron are situated in the cortical region of kidney

Thinking Process

Inside the kidney, there are two zones, an outer cortex and an inner medulla.

Ans. *(b)* Inside the kidney the cortical region extends in between the medullary pyramids as renal columns are called **column of Bertini,** not as renal pelvis. Rest other statements are true.



Diagrammatical representation of kidney

Q. 10 The condition of accumulation of urea in the blood is termed as

(a) renal calculi (b) glomerulonephritis

(c) uremia (d) ketonuria

Ans. *(c)* **Uremia** is accumulation of urea in blood . It occurs due to malfunctioning of kidney.

Renal calculi refers to the formation of stones or insoluble mass of crystallised salts (oxalates, etc) with in the kidney.

Glomerulonephritis is the inflammation of glomeruli of kidney.

Ketonuria is a medical condition in which ketone bodies are present in the urine. It is seen during starvation or more commonly in **type 1 diabetes mellitus.**

Q. 11 Which one of the following is also known as antidiuretic hormone?

(a) Oxytocin (b) Vasopressin (c) Adrenaline (d) Calcitonin

Ans. *(b)* Vasopressin is also known as **Antidiuretic Hormone** (ADH). It is secreted from the **neurohypophysis** of pituitary and facilitates water reabsorption from latter parts of the tubule, thereby preventing diuresis.

Oxytocin is a mammalian neurohypophysial hormone produced by the hypothalamus and is stored and secreted by the posterior pituitary gland. Oxytocin stimulus contractions of uterus at the end of pregnancy and also contractions of mammary glands the help in flow of milk.

Adrenaline is relesed by adrenal medulla at the time of emergency, hence has a role in 'fight or flight' reaction.

Calcitonin is produced in humans primarily by the parafollicular cells of the thyroid. It acts to reduce blood calcium (Ca^{2+}), level opposing the effect of **parathyroid hormone.**

Get More Learning Materials Here : CLICK HERE www.studentbro.in

Q. 12 Match the following columns.

Column I		Column II	
A.	Proximal convoluted tubule	1.	Formation of concentcrated urine
B.	Distal convoluted tubule	2.	Filtration of blood
C	Henle's loop	3.	Reabsorption of 70-80% of electrolytes
D.	Counter current mechanisms	4.	Ionic balance
E.	Renal corpuscle	5.	Maintenance of concentration gradient in medulla.

Codes

	A	B	C	D	E
(a)	3	5	4	2	1
(c)	1	3	2	5	4

	A	B	C	D	E
(b)	3	4	1	5	2
(d)	3	1	4	5	2

Ans. *(b)* **Proximal convoluted tubule** is involved in reabsorption of 70-80% of electrolytes.

Distal convoluted tubule is involved in secretion of hydrogen, potassium ions and NH_3 in order to maintain pH and sodium-potassium balance in blood (ionic balance).

Henle's loop (the descending limb) is permeable to water, but almost impermeable to electrolytes. This concentrates the urine (filtrate) as it moves down.

Counter current mechanisms helps to maintaining a concentration gradient in the medullary interstitium of kidney.

Renal corpuscle involves filtration of blood *via* **glomerulus** and **Bowman's capsule.**

Q. 13 Match the following columns.

Column I		Column II	
A.	Glycosurea	1.	Accumulation of uric acid in joints
B.	Renal calculi	2.	Inflammation in glomeruli
C.	Glomerular nephritis	3.	Mass of crystallised salts within the kidney
D.	Gout	4.	Presence of glucose in urine

Codes

	A	B	C	D
(a)	1	3	2	4
(c)	4	3	2	1

	A	B	C	D
(b)	3	2	4	1
(d)	4	2	3	1

Ans. *(c)* **Glycosurea/glucosuria** is the presence of glucose in the urine.

Renal calculi is the formation of mass of crystallised salts within the kidney.

Glomerular nephritis is the inflammation of glomeruli of kidney.

Gout is the accumulation of uric acid crystals in joints causing inflammation.

Get More Learning Materials Here : CLICK HERE www.studentbro.in

Q. 14 We can produce a concentrated/dilute urine. This is facilitated by a special mechanism. Identify the mechanism.

(a) Reabsorption from PCT
(b) Reabsorption from collecting duct
(c) Reabsorption/Secretion in DCT
(d) Counter current mechanism in Henle's loop/vasa recta

Ans. *(d)* Counter current mechanism in Henle's loop and vasa recta helps to maintain concentration gradient in the **medullary interstitum**. Presence of such interstitial gradient helps an easy passage of water from the collecting tubule thereby **concentrating the urine**.

PCT helps in maintaining pH and ionic balance of the body fluid by the secretion of H^+, ammonia and potassium ions and reabsorbing 70-80% of electrolytes and water.

Collecting duct helps in reabsorption of water to produce concentrated urine and in maintaining osmolarity. It also plays a vital role in maintaining pH and ionic balance in blood by secreting H^+ and K^+ ion.

DCT reabsorb Na^+ and water along with HCO_3^-, maintaining pH and sodium-potassium/ionic balance in blood by the selectively secreting hydrogen and potassium ions.

Q. 15 Dialysing unit (artificial kidney) contains a fluid which is almost same as plasma except that it has

(a) high glucose
(b) high urea
(c) no urea
(d) high uric acid

Thinking Process

Dialysis is a process for removing waste and excess water from the blood and is used primarily as an artificial replacement for lost kidney function in people with renal failure.

Ans. *(c)* The dialysing unit (fluid) has the same composition as that of plasma except the nitrogenous waste (urea).

Other options are wrong, as dialysing unit will not have high glucose, high urea or high uric acid.

Very Short Answer Type Questions

Q. 1 Where does the selective reabsorption of glomerular filtrate take place?

Ans. The selective reabsorption of glomerular filtrate takes place in Proximal Convoluted Tubules (PCT) and Distal Convoluted Tubules (DCT).

In PCT all essential elements nutrients, 70-80% of electrolytes and water is absorbed whereas, Distal Convoluted Tubule (DCT) is involved in conditional reabsorption of Na^+ and water.

Get More Learning Materials Here : CLICK HERE www.studentbro.in

Q. 2 What is the excretory product from kidneys of reptiles?

Thinking Process

Animals accumulate ammonia, urea, uric acid, carbon dioxide, water and ions like Na^+, K^+, Cl^- *phosphate sulphate, etc., either by metabolic activities or by other means like excess ingestion. The waste products are removed in the form of nitrogenous water.*

Ans. Reptiles excrete nitrogenous wastes as uric acid in the form of pellet or paste with a minimum loss of water and are called **uricotelic** animals.

Q. 3 What is the composition of sweat produced by sweat glands?

Thinking Process

Perspiration (sweating, transpiration) is the production of sweat and secretion by the sweat glands in the skin of mammals.

Ans. Sweat produced by sweat glands is a watery fluid **containing NaCl, small amounts of urea, lactic acid,** etc. Its primary function is to facilitate a cooling effect on the body surface and also to helps in removal of waste.

Q. 4 Identify the glands that perform the excretory function in prawns.

Ans. In prawns, the excretory organs are known as **antennary glands** or **green glands**. These glands are opaque-white pea sized structures, enclosed in the coxa of each 2nd antenna. They mainly excrete ammonia.

Q. 5 What is the excretory structure in *Amoeba*?

Thinking Process

Amoeba is a protozoan which forms the simplest of all organism in the animal kingdom. Inspite of being unicellular, it is physiologically balanced and performs all the essential processes of an animal.

Ans. Contractile vacuole is the excretory organ in *Amoeba*. It is also involved in osmoregulation.

Q. 6 The following abbreviations are used in the context of excretory functions, what do they stand for?

(a) ANF (b) ADH

(b) GFR (d) DCT

Ans. (a) **ANF** Atrial Natriuretic Factor

(b) **ADH** Antidiuretic Hormone

(c) **GFR** Glomerular Filteration Rate

(d) **DCT** Distal Convoluted Tubule

Q. 7 Differentiate glycosuria from ketonuria.

Ans. *Difference between glycosuria and ketonuria is as follows*

Glycosuria	Ketonuria
The presence of glucose in urine is known as glycosuria. It occurs in **diabetes mallitus**.	Presence of abnormally high ketone bodies in urine is termed as ketonuria. Increase ketones in urine usually occurs at the time of **longtime fasting**.

Get More Learning Materials Here : CLICK HERE www.studentbro.in

Q. 8 What is the role of sebaceous glands?

Ans. Sebaceous glands are involved in the elimination of certain substances like cholesterol, squalene, triglycerides wax and esetrs through sebum. This secretion provides oily covering to the skin.

Q. 9 Name two actively transported substances in glomerular filtrate.

Ans. The substances that are actively transported in the glomerular filtrate are glucose and amino acids.

Q. 10 Mention any two metabolic disorders, which can be diagnosed by analysis of urine.

Ans. *Metabolic disorders that can be diagnosed by analysis of urine are*

(i) **Hematuria** It is the presence of blood or blood cells in the urine, which could be a sign of kidney stone or a tumor in urinary tract.

(ii) **Albuminuria** It is the presence of albumin in urine and occurs in **nephritis** *i.e.*, inflammation of glomeruli. In this condition the size of filtering slits becomes enlarged.

Q. 11 What are the main processes of urine formation?

Ans. Urine formation includes **glomerular filteration** (ultra filteration), **selective reabsorption** and **tubular secretion** that takes place in different parts of the nephron.

Glomerular filteration involves the filteration of blood, which is carried out by glomerulus.

Selective reabsorption is the absorption of filtrate through renal tubules either actively or passively.

Tubular secretion involves secretion through tubular cells in urine in order to maintain ionic and acid-base balance of body fluids.

Q. 12 Sort the following into actively or passively transported substances during reabsorption of GFR. *e.g.,* glucose, amino acids, nitrogenous wastes, Na^+, water.

Thinking Process

The tubular epithelial cells in different segments of nephron perform reabsorption either by active or passive mechanism.

Ans. **Actively transported** substances during reabsorption of GFR- Glucose, amino acids, Na^+.
Passively transported substances during reabsorption of GFR– Nitrogenous wastes, water.

Q. 13 Complete the following

(a) Urinary excretion = tubular reabsorption + tubular secretion –

(b) Dialysis fluid = plasma –

Ans. (a) **Urinary excretion** = tubular reabsorption + tubular secretion – filtration

(b) **Dialysis fluid** = plasma – nitrogenous wastes.

Get More Learning Materials Here : CLICK HERE www.studentbro.in

Q. 14 Mention the substances that exit from the tubules in order to maintain a concentration gradient in the medullary interstitium.

Ans. The concentration gradient in medullary interstitium is established primarily by renal tubules of loop of Henle and the blood vessels surrounding them (vasa recta) in a process called countercurrent exchange.

The substances that exit from tubules for maintenance of such gradient are mainly sodium chloride (NaCl), water and urea (containg H^+, K^+ and NH_3^+).

Q. 15 Fill in the blanks appropriately

Organ	Excretory wastes
(a) Kidneys	.....
(b) Lungs	.....
(c) Liver	.....
(d) Skin	.....

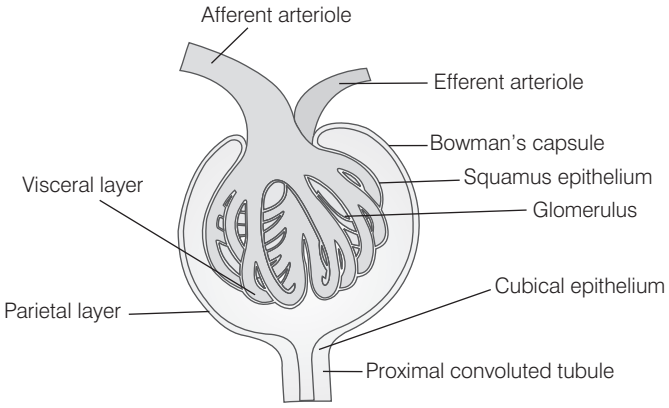
Ans.

Organ	Excretory wastes
(a) Kidneys	Urine
(b) Lungs	CO_2
(c) Liver	Urea
(d) Skin	Sweat

Short Answer Type Questions

Q. 1 Show the structure of a renal corpuscle with the help of a diagram.

Ans. *Representing the structure of a renal corpuscle*



Renal corpuscles

Get More Learning Materials Here : CLICK HERE www.studentbro.in

Q. 2 What is the role played by renin-angiotensin in the regulation of kidney function?

Thinking Process

The functioning of kidney is efficiently monitered and regulated by hormonal feedback mechanisms involving the hypothalamus, JGA and to certain extent, the heart.

Ans. Renin is released from the Juxta-Glomerular Apparatus (JGA) on activation by fall in the glomerular blood pressure/flow. Renin converts angiotensinogen in blood to angiotensin I and further to angiotensin II. Angiotensin II, being a powerful vasoconstrictor, increases the glomerular blood pressure and thereby Glomerular Filteration Rate (GFR).

Angiotensin II also activates the adrenal cortex to release aldosterone. Aldosterone causes reabsorption of Na^+ and water from the distal parts of the tubule. This also, leads to an increase in blood pressure and GFR. This complex mechanism is generally known as **Renin Angiotensin Aldosterone System** or RAAS.

Q. 3 Aquatic animals generally are ammonotelic in nature where as terrestrial forms are not. Comment.

Ans. The process of excreting ammonia is called **ammonotelism**. many bony fishes, aquatic amphibians and aquatic insects are **ammonotelic** in nature. Ammonia, as its readily soluble, in water is excreted by diffusion across body surface or through gill surfaces (in fishes) as **ammonium ions**.

It is highly soluble in water and requires large amounts of water to be lost from the body. Such a mode of excretion is thus suitable for aquatic organisms which have a constant access to water.

Terrestrial adaptation requires the production of lesser toxic nitrogenous wastes like urea, as urea is less toxic and less soluble in water. This is important adaptation for water conservation in animals body. Mammals, many terrestrial amphibians and marine fishes mainly excrete urea and are called **ureotelic** animals.

In most insects land snails, reptiles etc., uric acid is excreted, hence they are called uricotelic animals. Conversion of ammonia to uric acid and its elimination requires less water, thus it is very essential for terrestrial forms that do not have constant water supply.

Q. 4 The composition of glomerular filtrate and urine is not same. Comment.

Ans. The composition of **glomerular filtrate** and **urine** is not the same as the glomerular filtrate contains a large amount of water and other dissolved substances such as urea, uric acid, creatinine, amino-acid, glucose, sodium, potassium vitamins, etc.

Urine on the other hand is a transparent, light yellow fluid, which is formed after rigrous reabsorption and secretion from the filterate. It constitute about 95% water and 5% of other organic and inorganic substances.

Organic substances in urine includes nitrogen, urea, creatine, ammonia uric acid, oxalic acid, vitamins, hormones and enzymes.

Whereas inorganic substance in urine include chloride, phosphate, sulphate, potassium, sodium, calcium, magnesium, iodine, arsenic and lead. Glucose is not found in urine normally. Hence, composition of glomerular filtrate and urine is different.

Get More Learning Materials Here : CLICK HERE www.studentbro.in

Q. 5 What is the procedure advised for the correction of extreme renal failure? Give a brief account of it.

Thinking Process

Malfunctioning of kidneys can lead to the accumulation of urea in blood (uremia), which is highly harmful and may lead to kidney failure.

Ans. **Kidney transplantation** is the ultimate method for the correction of acute/extreme renal failure (kidney failure). A functional kidney is used as a transplant from a donor, preferably a close relative, to minimise its chances of rejection by the immune system of the host. Modern clinical procedures have increased the success rate of such a complicated technique.

Q. 6 How have the terrestrial organisms adapted themselves for conservation of water?

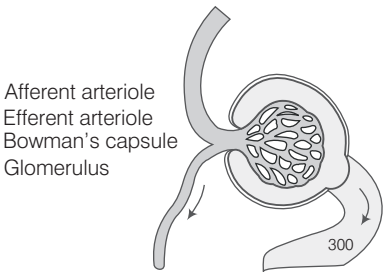
Ans. **Terrestrial adaptation** necessitated the production of lesser toxic nitrogenous wastes like urea and uric acid for the **conservation of water**. Mammals and many terrestrial amphibians mainly excrete urea and are called uriotelic animals.

Ammonia produced by metabolism is converted into urea in the liver of these animals and released into the blood, which is filtered and excreted out by the kidneys.

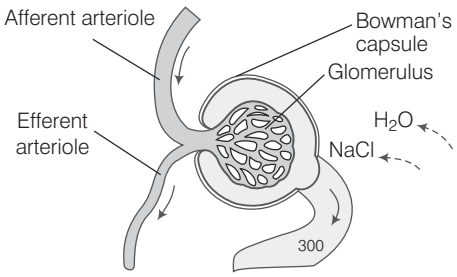
Some urea is retained in kidney in order to maintain osmolarity, reptilelos birds, land snails and insects excrete nitrogeneous waste, as **uric acid** in the form of pellet or paste with a minimum loss of water and are called **uricotelic animals.** Conversion of ammomia to uric acid and its subsequent elimination requires lesser amount of water.

Hence, due to less availability of water on land, and in order to minimise water loss, terrestrial organism adapted themselves accordingly.

Q. 7 Label the parts in the following figure.



Ans. *The labelling part of the given figure are as listed*



Get More Learning Materials Here : CLICK HERE www.studentbro.in

Q. 8 Explain, why a haemodialysing unit called artificial kidney?

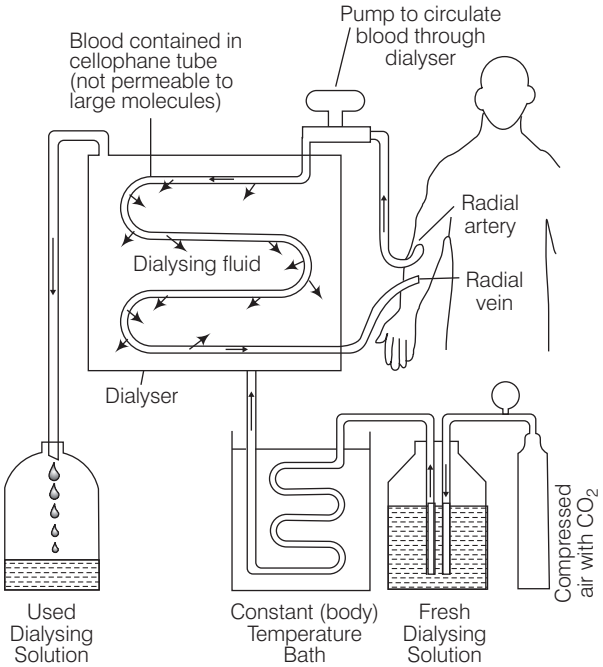
Ans. **Haemodialysis** This method is a boon for thousands of uremic (accumulation of urea in blood) patients all over the world.

Haemodialysing unit act an on artificial kidney by removing urea from patients blood due to kidney failure. In this process blood is drained from artery an pumped into a dialysing unit after the addition of an anticoagulant like **heparin**.

The unit contains a coiled cellophane tube surrounded by a dialysing fluid having the same composition as that of plasma except nitrogenous waste. The porous cellophane membrane of the tube allows the passage of molecules based on concentration gradient.

Due to the absence of nitrogenous wastes in dialysing fluid these substances freely move out, thereby clearing the blood.

In the end the cleared blood is pumped back to the body through a vein after the addition of anti-heparin to it thereby completing the process.



Haemodialyser and its working

Q. 9 Comment upon the hormonal regulation of selective reabsorption.

Ans. The functioning of the kidneys is efficiently monitored and regulated by **Antidiuretic Hormone** (ADH), **Juxtaglomerular Apparatus** (JGA) and **Atrial Natriuretic Factor** (ANF).

(a) **Antidiuretic Hormone** (ADH) or vasopressin from the neurohypophysis, facilitates water reabsorption from latter parts of tubule, *i.e.,* **distal convoluted tubule** and **collecting duct** by increasing the permeability to water and salt and by accelerating water and ion transfer in a direction determined by the osmotic gradient.

(b) **Juxta Glomerular Apparatus** (JGA) operates a multihormonal. **Renin Angiotensin Aldosterone System** (RAAS). JG cells secrete an enzyme, **renin**, which, changes plasma protein called **angiotensinogen** to a peptide called angiotensin I and further to **angiotensin II,** which works as a hormone.

Get More Learning Materials Here : CLICK HERE www.studentbro.in

Angiotensin II, being a powerful **vasoconstrictor** increases the glomerular blood pressure and thereby GFR. It also stimulate's soduim absorption by proximal tubules.

(c) Angiotensin II also activates the adrenal cortex to release aldosterone. **Aldosterone** induces the distal convoluted tubule to absorb more Na^+ and water.

(d) **Atrial Natriuretic Factor** (ANF) is produced by the atria of heart. It regulates blood flow by causing vasodilation and increasing sodium excretion. It is also involved in checking of renin-angiotensin mechanism.

Long Answer Type Questions

Q. 1 Explain the mechanism of formation of concentrated urine in mammals.

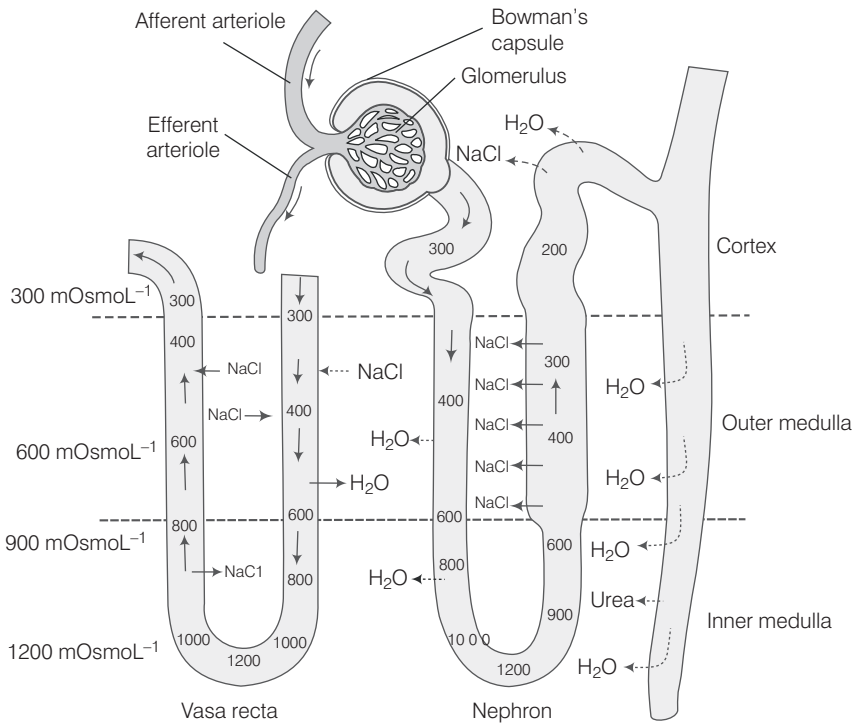
Thinking Process

Urine is transparent, light yellow liquid with a slightly acidic pH (6.0). The colour of urine is caused by the pigment urochrome, which is a breakdown product of haemoglobin from wornout RBCs.

Ans. Mammals have the ability to produce concentrated urine. The loop of Henle and vasa recta play a significant role in it, *which can be discussed as follows*

(i) The proximity between the **Henle's loop** and **vasa recta**, as well as the counter current (formed due to the flow of filtrate in two limb's of Henle's loop in opposite direction) help in maintaining an **increasing osmolarity** towards the inner medullary interstitium,

i.e., from 300 $mOsmoL^{-1}$ in the cortex to about 1200 $mOsmoL^{-1}$ in the inner medulla.



Diagrammatic representation of a nephron and vasa recta showing counter current mechanism

Get More Learning Materials Here : CLICK HERE www.studentbro.in

(ii) This gradient is caused mainly due to **NaCl** and **urea**. NaCl is transported by the ascending limb of Henle's loop, which is exchanged with the descending limb of vasa recta.

(iii) NaCl is returned to the interstitium by the **ascending portion** of vasa recta.

(iv) Similarly, a small amount of urea enters the thin segment of the **ascending limb** of Henle's loop, which is transported back to the interstitium by the **collecting tubule.**

(v) This special arrangement of Henle's loop, and vasa recta, is called the **counter current mechanism.**

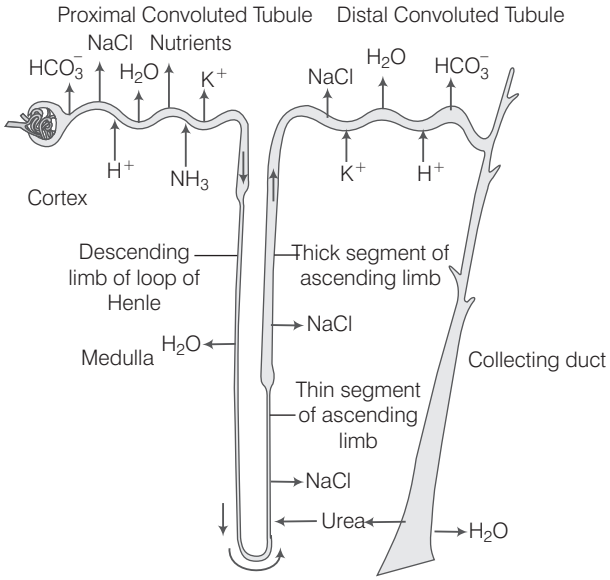
(vi) The counter current exchange reduces the rate of dissipation. This, inturn reduces the rate at which the current must pump Na^+ to maintain any given gradient.

(vii) Presence of such interstitial gradient helps in an easy passage of water from the collecting tubule thereby concentrating the filtrate (urine).

(viii) Human kidneys can produce urine nearly four times concentrated than the initial filtrate formed.

Q. 2 Draw a labelled diagram showing reabsorption and secretion of major substances at different parts of the nephron.

Ans. *A diagram showing reabsorption and secretion of major substances at different parts of the nephron are as follows*



Get More Learning Materials Here : CLICK HERE www.studentbro.in

Q. 3 Explain briefly, micturition and disorders of the excretory system.

Ans. The process of release of urine is called **micturition** and the neural mechanism. causing it is called the **micturition reflex.**

The urinary bladder and the internal sphincter are supplied by **sympathetic** and **parasympathetic** nervous systems of autonomic nervous system. In response, the stretch receptors on the walls of the bladder send signals to the Central Nervous System (CNS).

The CNS passes on motor messages to initiate the contraction of smooth muscles of the bladder and simultaneous relaxation of the urethral sphincter causing the release of urine.

Disorders of excretory system includes

(i) **Uremia** It is the malfunctioning of kidneys, which leads to accumulation of urea in blood in turn the kidney faliure. In such patients urea can be removed by **haemodialysis**.

(ii) **Renal Failure** (RF) It is caused by a decrease in glomerular filteration. In Acute Renal Failure (ARF) both kidneys abruptly stop working due to damaged renal tubules, kidney stones, antibiotics, etc. Haemodialysis and renal transplant are the only ways to auruve overcome renal failure.

(iii) **Renal Calculi** It is the formation of stones or insoluble mass of crystallised salts in the kidney.

(iv) **Glomerulonephritis** It is the inflammation of glomeruli of kidney.

Q. 4 How does tubular secretion help in maintaining ionic and acid-base balance in body-fluids?

Thinking Process

Tubular secretion is an important step in urine formation as it helps in the maintenance of ionic and acid base balance of body fluid.

Ans. In addition to the role of Proximal Convoluted Tublues (PCT) in selective reabsorption of materials from the glomerular filtrate back into the blood of peritubular capillaries *via* the renal interstitium, they also alter the composition of filtrate by the process of **secretion**.

In its distal part, epithelial cells extract certain excretory substances from the blood of peritubular capillaries and secrete these into the filtrate.

Creatinine, hippuric acid, pigments, drugs including penicillin are actively secreted into the filtrate in the proximal convolued tubule from the interstitial fluid. Hydrogen ions and ammonia are also secreted into the proximal convoluted tubules.

Urea enters the filtrate *via* diffusion in the thin segment of ascending limb of Henle's loop.

Maximum hydrogen secretion occurs in the proximal convoluted tubules. Removal of hydrogen ion and NH_3 from the blood in the PCT and Distal Convoluted Tubule (DCT) helps in maintaining pH of the blood, *i.e.,* between 6 to 8.

Tubular secretion although possess a minor role in functioning of the human kidney, but plays an essential role in animals like marine fishes and desert amphibians, because these animal do not possess well developed glomeruli hence their urine is mainly formed by the tubular secretion of **urea, creatinine** and **mineral ions**.

Q. 5 The glomerular filtrate in the loop of Henle gets concentrated in the descending and then gets diluted in the ascending limbs. Explain.

Ans. The **glomerular filtrate** in the loop of Henle gets concentrated in the descending loop and then gets diluted in the ascending limb. The thin wall of **descending** limb of **Henle's loop** is permeable to water, but not to the solutes. The isotonic tubular fluid flows down the limb.

Get More Learning Materials Here : CLICK HERE www.studentbro.in

It gradually looses its water the by **exosmosis** due to increasing osmolarity of medullary interstitium through which the limb extends.

Thus, the filtrate becomes hypertonic to blood plasma. The **ascending limb of loop** of **Henle** is impermeable to water, but permeable to ions like K^+, Cl^-, Na^+ and it is partially permeable to urea.

Thus, in the thick ascending limb of the loop of Henle, Na, K, Ca, Mg and Cl are reabsorbed, making the filtrate **hypotonic** to blood plasma and diluted as compared to descending limb.

Q. 6 Describe the structure of a human kidney with the help of a labelled diagram.

Thinking Process

In humans, the excretory system consists of a pair of kidneys, one pair of ureters, a urinary bladder and a urethra.

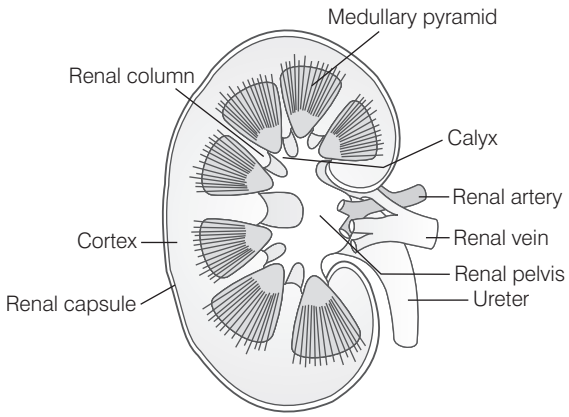
Ans. **Human kidney** are reddish-brown, bean-shaped structures situated between the last thoracic and third lumbar vertebra close to the dorsal inner wall of the abdominal cavity. Each kidney of an adult human measures 10-12 cm in length, 5-7 cm in width, 2-3 cm in thickness with an average weight of 120-170 gm.

The kidney is covered by a fibrous connective tissue, the renal capsula, which protect the kidney. Internally, it consists of outer dark cortex and an inner light medulla, both containing nephron (structural and functional units of kidney.

The median conconcave border of a kidney contains a notch called hilum. Through which ureter blood vessels and urinitus.

The renal cortex is granular in apperance and contains convoluted tubules and Malpighian corpuscles. The renal medulla contains loop of Henle, collecting ducts and tubules and ducts of Bellini.

Medulla is divided into conical masses, the medullary pyramids which further form papillae.The papillae form calyces, which join to renal pelvis leading to ureter. Between the medullary pyramids, cortex extends into medulla and forms renal columns which are called as column of Bertini.



LS of human kidney

Get More Learning Materials Here : CLICK HERE www.studentbro.in