

Chapter 16: Excretory Products and their Elimination

NCERT · Class 11 · Biology

Textbook exercises

Question 1

Define Glomerular Filtration Rate (GFR)

Solution

Ans: The amount of glomerular filtrate which is formed by the kidneys in a minute is known as glomerular filtration rate, which is about 125ml per minute.

It is used to check the amount of blood passing through the glomeruli.

Question 2

Explain the Autoregulatory mechanism of GFR.

Solution

Ans: The regulation of GFR through the kidney is autoregulatory and it is regulated by the juxtaglomerular apparatus, which is a microscopic structure located between the renal corpuscles and distal convoluted tubules of the same nephron.

- GFR helps regulate renal blood flow and glomerular filtration rate. Fall in GFR activates juxtaglomerular cells which releases renin.
 - By the renin-angiotensin mechanism, the reabsorption of sodium and water takes place with increased blood pressure which brings GFR back to normal.
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Question 3

Indicate whether the following statements are true or false:

1. Micturition is carried out by a reflex.
2. ADH helps in water elimination, making the urine hypotonic.
3. Protein-free fluid is filtered from blood plasma into the Bowman's capsule. Henle's loop plays an important role in concentrating the urine.
4. Glucose is actively reabsorbed in the proximal convoluted tubule.

Solution

Ans:

1. Micturition is carried out by neural mechanisms which cause contraction of smooth muscles and relaxation of the urethral sphincter which is known as micturition reflex therefore the given statement is True.
2. ADH release takes place when an excessive fluid loss takes place from the body. This ADH helps in water reabsorption and also prevents diuresis. Therefore the given statement is False.
3. The blood plasma with proteins passes through the lumen of Bowman's capsule whereas the rest of the plasma without proteins passes through the membrane of Bowman's capsule, therefore the given statement is true. The important part of the nephron is the Henle's loop as it helps in maintaining the ionic balance of fluid and also in concentrating the urine therefore the given statement is true.
4. The proximal convoluted tubule has a large surface area for reabsorption of nutrients, water, and minerals therefore the given statement is True.

Question 4

Give a brief account of the countercurrent mechanism.

Solution

Ans: The Henle's loop and vasa recta help in the concentration of filtrate through counter current mechanism because the limbs of Henle's loop carry filtrate and the limb of vasa recta carry blood in opposite directions.

- The counter-current between the Vasa recta and Henle loops helps in maintaining the osmolarity from 300 mOsmol per liter in the cortex to 1200 mOsmol per liter in the inner medulla.

- The NaCl in the ascending loop of Henle's gets exchanged with the descending loop of the vasa recta and then after getting returned into the interstitium by the vasa recta through its ascending portion.
- The transportation of urea takes place through collecting tubules to the interstitium.
- The production of urine takes place four times more concentrated than initial filtrate in humans.

Question 5

Describe the role of the liver, lungs, and skin in excretion.

Solution

Ans: Liver:

- Liver is one of the most important organs of our body as it helps in passing out digestive wastes along with other substances like bilirubin, biliverdin, vitamins, etc.
- Dead erythrocytes possess hemoglobin which is also disintegrated into bile pigments and carries substances to the intestine for elimination.

Lungs:

- Lungs carry gases from the atmosphere to the inside and remove carbon dioxide from the body with small quantities of water with them.
- Responsible for the elimination of water in the form of water vapors.
- Several volatile substances are also eliminated during the process of expiration.

Skin:

- The skin consists of both the sweat gland and sebaceous gland which help in the excretion of sweat in the form of watery fluid with NaCl along with urea and lactic acids.

- The sebaceous gland helps in the excretion of sterols, hydrocarbons, and waxes and sebum provides a protective oily covering.

Question 6

Explain micturition.

Solution

Ans: The excretion of urine from the urinary bladder by contraction and relaxation of smooth muscles of the bladder is known as micturition. When urine accumulates in the urinary bladder, a voluntary signal passes out from the CNS which leads to the excretion of urine.

Accumulation of urine leads to the passage of signals from stretch receptors to CNS by which the motor neuron initiates the contraction and relaxation of smooth muscle and release of urine.

On average a healthy adult can excrete 1 to 1.5 liters of urine per day.

Question 7

Match the items of Column I with those of column II:

Column I		Column II	
(a)	Ammonotelism	(i)	Birds
(b)	Bowman's capsule	(ii)	Water reabsorption
(c)	Micturition	(iii)	Bony fish
(d)	Uricotelism	(iv)	Urinary bladder
(e)	ADH	(v)	Renal tubule

Solution

Ans:

Column I	Column II
Ammonotelism	Bony fish
Bowman's capsule	Renal tubule
Micturition	Urinary bladder
Uricotelism	Birds
ADH	Water reabsorption

Question 8

What is meant by the term osmoregulation?

Solution

Ans: The regulation of optimum temperatures of waters and salts in tissues and body fluids is known as osmoregulation. It helps to maintain the internal temperature of the body by balancing the water- ionic concentration.

Question 9

Terrestrial animals are generally either ureotelic or uricotelic, not ammonotelic, why?

Solution

Ans: The main reasons behind the terrestrial animals being ureotelic and uricotelic is as follows:

- Due to the high toxicity of ammonia, the body of terrestrial animals converts it into less toxic forms like urea and uric acid.
- Terrestrial animals conserve water to regulate the body temperature and ammonia is water-soluble, so to resist the continuous elimination of water it gets converted into less water-soluble urea and uric acid.

Question 10

What is the significance of juxtaglomerular apparatus(JGA) in kidney function?

Solution

Ans: Juxtaglomerular apparatus (JGA) is formed by modifying the distal convoluted tubule and afferent arteriole.

- It is located where the afferent arteriole and the distal convoluted tubule (DLT) come in contact.
- It contains juxtaglomerular cells which are the specialized cells of the arteriole and also contain an enzyme that regulates blood pressure and this enzyme is called renin.
- Fall in glomerular filtration rate activates the juxtaglomerular cell which causes the release of renin. Renin stimulates the glomerular blood flow by which the glomerular filtration rate comes to normal.
- Angiotensin gets converted into Angiotensin I with the help of renin and further conversion into Angiotensin II takes place. Angiotensin II increases the glomerular filtration rate by an increase in glomerular blood pressure. It also releases aldosterone by activating the adrenal cortex. The mechanism of renin and angiotensin is known as the Renin-Angiotensin mechanism.

Question 11

Name the following:

1. A chordate animal having flame cells as excretory structures.

2. Cortical portions projecting between the medullary pyramids in the human kidney.
3. A loop of capillary running parallel to Henle's loop.

Solution

Ans:

1. The flame cell is a specialized cell that helps in osmoregulation and excretion and it is present in the amphioxus which is an example of Cephalochordata.
2. The columns of Bertini are the cortical portion that projects between the medullary
3. Vasa recta is the loop of capillaries that runs parallel to the loop of Henle's.

Question 12

Fill in the gaps

- (1) Ascending limb of Henle's loop is _____ to water whereas the descending limb is _____ to it.
- (2) Reabsorption of water from the distal part of the tubules is facilitated by hormone _____.
- (3) Dialysis fluid contains all the constituents as in plasma except _____.
- (4) A healthy adult human excretes an average _____ gm of urea per day.

Solution

Ans: (1) Impermeable, Permeable

(2) Vasopressin

(3) The nitrogenous waste

(4) 25-30