

Chapter: EXCRETORY PRODUCTS AND THEIR ELIMINATION

Exercise

Question 1. Define Glomerular Filtration Rate (GFR)?

Answer:

The glomerular filtration rate is the amount of glomerular filtrate formed per minute in all nephrons of both kidneys. It is approximately 125 mL/minute in a healthy individual. The value of glomerular filtrate is high in glucose, amino acids, sodium, potassium, urea, uric acid, ketone bodies, and water.

Question 2. Explain the autoregulatory mechanism of GFR?

Answer:

The kidney regulates the glomerular filtration rate through an autoregulative mechanism. The juxtaglomerular apparatus is in charge of it. The juxtaglomerular apparatus is a microscopic structure located between the renal corpuscle's vascular pole and the returning distal convoluted tubule of the same nephron. It regulates the renal blood flow and the glomerular filtration rate. When the glomerular filtration rate decreases, the juxtaglomerular cells become activated and release renin. This stimulates glomerular blood flow, restoring the GFR to normal. Renin restores GFR to normal by activating the renin-angiotensin system.

Question 3. Indicate whether the following statements are true or false:

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

Answer:

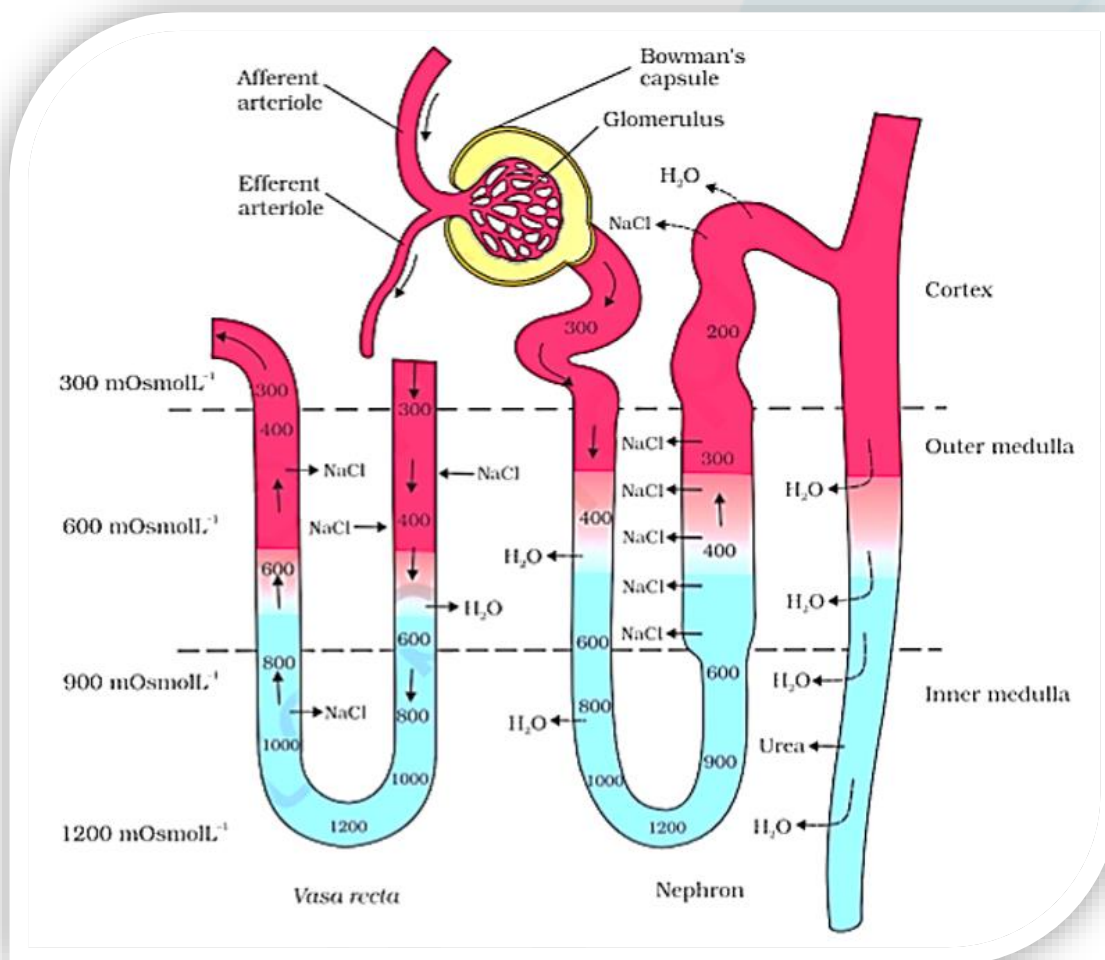
- (a) True
- (b) False
- (c) True
- (d) True
- (e) True

Question 4. Give a brief account of the countercurrent mechanism?

Answer:

The main adaptation for water conservation is the countercurrent mechanism that operates within the kidney. Within the kidneys, there are two countercurrent mechanisms.

Henle's loop and the vasa recta are two examples of vasa recta. The nephron's Henle's loop is a U-shaped structure. Blood flows in opposite directions in the two limbs of the tube, resulting in countercurrents. The Vasa recta is an efferent arteriole that creates a capillary network around the tubules within the renal medulla. In the two limbs of the vasa recta, blood flows in opposite directions. As a result, blood entering the renal medulla from the descending limb comes into close contact with blood leaving the ascending limb.



By using a countercurrent mechanism, osmolarity rises from 300 mOsmolL⁻¹ in the cortex to 1200 mOsmolL⁻¹ in the inner medulla. It aids in the maintenance of the concentration gradient, which aids in the easy movement of water from collecting tubules. The movement of NaCl and urea causes the gradient.

Question 5. Describe the role of the liver, lungs, and skin in excretion?

Answer:

The liver, lungs, and skin all play important roles in excretion.

The liver's function: The liver is the largest gland in vertebrates. It aids in the elimination of cholesterol, steroid hormones, vitamins, drugs, and other waste products via bile. The ornithine cycle occurring in the liver leads to the production of urea. Ammonia, a toxic substance, is rapidly converted into urea in the liver and then excreted from the body. The decomposed hemoglobin pigment is also converted by the liver into bile pigments known as bilirubin and biliverdin.

The lungs function: Lungs play an important role in the removal of waste materials from the body, such as carbon dioxide.

The skin's role: The skin contains numerous glands that aid in the excretion of waste products through pores. It has two kinds of glands: sweat glands and sebaceous glands.

Sweat glands are highly vascular and tubular glands that separate waste products from the blood and expel them like sweat. Sweating rids the body of excess salt and water. Sebaceous glands are branched glands that secrete sebum, an oily secretion.

Question 6. Explain micturition?

Answer:

Micturition is a process in which urine is excreted from the urinary bladder via the urethra. The muscular walls of the bladder expand as urine accumulates. The bladder's sensory nerves are stimulated by the walls, resulting in a reflex action. This reflex stimulates the desire to urinate. The urethral sphincter relaxes and the smooth muscles of the bladder contract to allow urine to pass. This pushes urine from the bladder.

An adult human excretes approximately 1–1.5 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

Answer:

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

Question 8. What is meant by the term osmoregulation?

Answer:

Osmoregulation is a homeostatic mechanism that controls the optimal temperature of water and salts in tissues and bodily fluids. It keeps the body's internal environment stable through the use of water and ionic concentration.

Question 9. Terrestrial animals are generally either ureotelic or uricotelic, not ammonotelic, why?

Answer:

Terrestrial animals are ureotelic or uricotelic, not ammonotelic. This is due to the following two primary reasons:

- (a) In nature, ammonia is extremely toxic. As a result, it must be converted to a less toxic form, such as urea or uric acid.
- (b) Terrestrial animals require water conservation. Because ammonia is soluble in water, it cannot be eliminated indefinitely. As a result, it is converted to urea or uric acid. These forms are less toxic and water-insoluble. This assists terrestrial animals in conserving water.

Question 10. What is the significance of juxtaglomerular apparatus (JGA) in kidney function?

Answer:

The juxtaglomerular apparatus (JGA) is a complex structure composed of glomerulus cells, distal tubules, and afferent and efferent arterioles. It is found in a specialized region of the nephron where the afferent arteriole and the distal convoluted tubule (DLT) make direct contact. The juxtaglomerular apparatus is made up of specialized afferent arteriole cells known as juxtaglomerular cells. Renin, an enzyme that detects blood pressure, is found in these cells. When glomerular blood flow (or glomerular blood pressure or glomerular filtration rate) decreases, juxtaglomerular cells become activated and release renin. Renin converts angiotensinogen in the blood into angiotensin I, which is then converted into angiotensin II. Angiotensin II is a potent vasoconstrictor that raises glomerular blood pressure and glomerular filtration rate. Angiotensin II also stimulates the adrenal cortex, which produces aldosterone. Aldosterone increases the rate of sodium-ion and water absorption from the distal convoluted tubule and collecting duct. This raises blood pressure and the rate of glomerular filtration. This mechanism, known as the renin-angiotensin system, eventually leads to an increase in blood pressure.

Question 11. Name the following:

- (a) A chordate animal having flame cells as excretory structures
- (b) Cortical portions projecting between the medullary pyramids in the human kidney
- (c) A loop of capillary running parallel to Henle's loop.

Answer:

- (a) Amphioxus is an example of a chordate with excretory structures such as flame cells. Flame cells are osmoregulatory and excretory systems.
- (b) The columns of Bertini are the cortical portions of the human kidney that project between the medullary pyramids. They are the cortical tissues found within the medulla.
- (c) Vasa recta is a capillary loop that runs parallel to Henle's loop. Vasa recta, in conjunction with Henle's loop, aids in the maintenance of a concentration gradient in the medullary interstitium.

Question 12. Fill in the gaps:

- (a) Ascending limb of Henle's loop is _____ to water whereas the descending limb is _____ to it.
- (b) Reabsorption of water from distal parts of the tubules is facilitated by hormone _____.
- (c) Dialysis fluid contains all the constituents as in plasma except _____.
- (d) A healthy adult human excretes (on an average) _____ gm of urea/day.

Answer:

- (a) Ascending limb of Henle's loop is impermeable to water, whereas the descending limb is permeable to it.
- (b) Reabsorption of water from distal parts of the tubules is facilitated by the hormone vasopressin.
- (c) Dialysis fluid contains all the constituents as in plasma, except the nitrogenous waste.
- (d) A healthy adult human excretes (on average) 25 - 30 gm of urea/day.