CHAPTER

16

EXCRETORY PRODUCTS AND THEIR ELIMINATION

CLASS 11TH

NCERT EXERCISE AND SOLUTIONS - BIOLOGY

Q. 1. **Define Glomerular Filtration Rate (GFR).**

ANSWER:-

Glomerular Filtration Rate (GFR) refers to the volume of filtrate produced by the kidneys (nephrons) per minute. In a healthy individual, the GFR is approximately 125 ml per minute. The GFR mainly consists of water, along with other components like amino acids, glucose, potassium, sodium, urea, uric acid, and ketone bodies.

Q. 2. **Explain the autoregulatory mechanism of GFR.**

ANSWER:-

The kidneys regulate the glomerular filtration rate through an auto-regulatory mechanism involving the juxtaglomerular apparatus. This microscopic structure is located between the returning distal convoluted tubule and the vascular pole of the renal corpuscle within the same nephron. It helps regulate both the glomerular filtration rate and renal blood flow. When the GFR decreases, the juxtaglomerular cells are stimulated to release renin, which enhances glomerular blood flow and restores the GFR to normal levels. Renin achieves this by activating the renin-angiotensin system.

Q. 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.

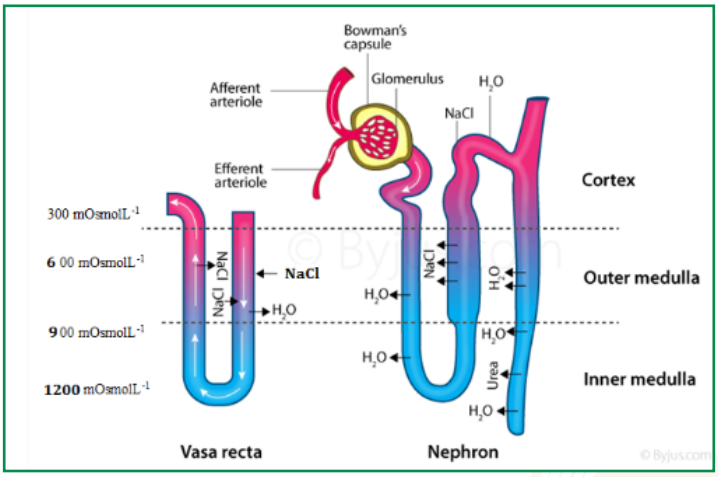
ANSWER:-

(a) Micturition occurs through a reflex. – True
(b) ADH aids in water elimination, making the urine hypotonic. – False
ADH promotes water reabsorption, resulting in hypertonic urine.
(c) Protein-free fluid is filtered from blood plasma into the Bowman's capsule. – True
(d) Henle's loop plays a crucial role in concentrating urine. – True
(e) Glucose is actively reabsorbed in the proximal convoluted tubule. – True

Q. 4. Give a brief account of the counter current mechanism.

Ans. The primary adaptation for water conservation in the kidney is the counter-current mechanism. There are two counter-current mechanisms in the kidney:

- Henle's loop
- Vasa recta



- Henle's loop is a U-shaped section of the nephron, where blood flows in opposite directions in the two branches of the loop, creating counter currents.
- Vasa recta, an efferent arteriole, forms a capillary network around the tubules in the renal medulla, running parallel to Henle's loop. Vasa recta also have a U-shape, with blood flowing in opposite directions in the two limbs. As a result, the blood entering the renal medulla through the descending limb is in close proximity to the outgoing blood in the ascending limb.
- This counter-current mechanism increases osmolarity in the cortex from 300 mOsmol/L to about 1200 mOsmol/L in the inner medulla, maintaining the concentration gradient. This gradient facilitates the movement of water from the collecting tubules. The gradient is created by the movement of urea and NaCl.

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

ANSWER:-

The liver, lungs, and skin each play important roles in the excretion process:

Liver

- The liver is the primary site for removing inactivated products such as steroid hormones, cholesterol, drugs, and vitamins.
- Dead erythrocytes contain hemoglobin, which is broken down into bile pigments (biliverdin and bilirubin) as waste products.
- These waste products are transported via bile to the intestine, where they are eliminated.

Lungs

- The lungs expel carbon dioxide from the body, eliminating approximately 200ml of it every minute.
- Water is also eliminated in the form of water vapor.
- The loss of water increases in colder conditions and decreases in hot, humid conditions.
- During exhalation, the lungs also release several volatile substances.

Skin

- The skin plays a key role in thermoregulation, primarily for cooling the body.
- Sweat, which contains nitrogenous wastes, is excreted through sweat glands to help cool the body.
- Sweat contains urea, NaCl, and lactic acid.
- The sebaceous glands secrete sebum, which removes hydrocarbons, sterols, and waxes.
- Sebum also provides a protective oily layer for the skin.

Q. 6. Explain micturition.

ANSWER:-

Micturition is the process of urine release, triggered by a neural mechanism called the micturition reflex. The urinary bladder temporarily stores the urine produced by the kidneys. As the bladder fills, it stretches, which triggers a signal. In response, receptors in the bladder walls send signals to the central nervous system (CNS). The CNS then transmits motor signals that cause the relaxation of the urethral sphincters and contraction of the bladder's smooth muscles, resulting in the release of urine.

Q. 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:-

(a) – (iii), (b) – (v), (c) – (iv), (d) – (i), (e) – (ii)

Q. 8. What is meant by the term osmoregulation?

ANSWER:-

Osmoregulation is the process of controlling the osmotic concentration in the body's cells by regulating the levels of water and salts.

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

ANSWER:-

Ammonia is a highly toxic nitrogenous waste that requires a large amount of water to dilute and reduce its toxicity. Terrestrial animals, however, do not have sufficient water to effectively dilute ammonia. If accumulated, ammonia can become dangerously poisonous. Therefore, in these animals, ammonia is converted into less toxic substances like uric acid and urea. As a result, terrestrial animals are typically either uricotelic or ureotelic.

Q. 10. What is the significance of juxta glomerular apparatus (JGA) in kidney function?

ANSWER:-

The juxtaglomerular apparatus is a specialized, sensitive region formed by cellular modifications in the distal convoluted tubule and the afferent arteriole where they meet.

Significance:

Its function is regulated through the renin-angiotensin-aldosterone system (RAAS). When the glomerular filtration rate drops, the juxtaglomerular apparatus is activated, leading to the release of renin. Renin converts angiotensinogen, a protein, into angiotensin, a hormone that increases GFR and blood flow through three mechanisms:

- Constricting the efferent arterioles to raise glomerular pressure.
- Stimulating the proximal convoluted tubule (PCT) to reabsorb more water and NaCl.
- Prompting the adrenal glands to release aldosterone, which enhances the reabsorption of water and NaCl in the distal convoluted tubule (DCT).

This process results in increased blood volume and blood pressure, reduced urine volume, and the production of hypertonic urine.

Q. 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 the Henle's loop.

ANSWER:-

(a) A chordate species with flame cells as excretory structures – Amphioxus Flame cells, also known as protonephridia, serve as the excretory structures in certain animals.

(b) Cortical projections between the medullary pyramids in the human kidney – Columns of Bertini The medulla of the kidney is divided into conical structures (medullary pyramids) that extend into the calyces. The cortex extends between these pyramids, forming renal columns called Columns of Bertini.

(c) A capillary loop running parallel to Henle's loop – Vasa recta The vasa recta are a network of tiny vessels that runs parallel to Henle's loop, forming a U-shape. Vasa recta are more prominent in juxtamedullary nephrons and are highly reduced in cortical nephrons.

Q. 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 contain all the constituents as in plasma except _____.

(d) A healthy adult human excretes (on an average) _____ gm of urea/day.

ANSWER:-

(a) Impermeable, permeable

(b) Vasopressin (antidiuretic hormone)

(c) Nitrogenous waste

(d) 25-30