

# NCERT Solutions for Class-XI Biology

## Chapter-19

1. Define Glomerular Filtration Rate (GFR)
1. Glomerular filtration rate is the amount of glomerular filtrate formed in all the nephrons of both the kidneys per minute. In a healthy individual, it is about 125 mL/minute. Glomerular filtrate contains glucose, amino acids, sodium, potassium, urea, uric acid, ketone bodies, and large amounts of water.
2. Explain the autoregulatory mechanism of GFR.
2. The kidneys have built-in mechanisms for the regulation of glomerular filtration rate. One such efficient mechanism is carried out by juxta glomerular apparatus (JGA). JGA is a special sensitive region formed by cellular modifications in the distal convoluted tubule and the afferent arteriole at the location of their contact. A fall in GFR can activate the JG cells to release renin which can stimulate the glomerular blood flow and thereby the GFR back to normal.
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.
3.
  - (a) True
  - (b) False
  - (c) True
  - (d) True
  - (e) True
4. Give a brief account of the counter current mechanism.
4. The kidneys have a special mechanism for concentrating the urine, it is called counter current mechanism. The mechanism is said to be a counter current mechanism because the out flow (in the ascending limb) of Henle's loop runs parallel to and in the opposite direction of the inflow (in the descending limb) and vasa recta. As the mechanism begins to function, the ascending limb of loop of Henle actively transports chloride and sodium ions out into the vasa recta from where it is secreted into the interstitial fluid. As a result the interstitial fluid around the loop of Henle contains large quantities of NaCl. The filtrate passes from the ascending limb of loop of Henle and enters a collecting duct. The collecting duct passes adjacent to the loop of Henle where the interstitial fluid contains large amounts of NaCl. The high osmotic pressure created by NaCl causes water to diffuse out of the collecting duct in the interstitial fluid and eventually to the

blood of vasa recta. The filtrate becomes greatly concentrated and is now called urine. A similar counter current mechanism, operates between the interstitial fluid and blood passing through the vasa recta. As the blood capillary runs along the ascending limb of loop of Henle, NaCl diffuses out of the blood. The direction is reversed as the blood capillary passes along the descending limb of Henle. The blood flows in the vasa recta around the loop of Henle from ascending to the descending side while the fluid passing through the loop of Henle goes in the opposite direction. The arrangement helps to maintain the concentration gradient of NaCl.

The ‘overall function of counter current mechanism is to concentrate sodium chloride in the interstitial fluid and thereby cause water to diffuse out of the collecting ducts and concentrate the urine.

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

5. Liver, lungs, and skin also play an important role in the process of excretion.

Role of the liver:

Liver is the largest gland in vertebrates. It helps in the excretion of cholesterol, steroid hormones, vitamins, drugs, and other waste materials through bile. Urea is formed in the liver by the ornithine cycle. Ammonia – a toxic substance – is quickly changed into urea in the liver and thence eliminated from the body. Liver also changes the decomposed haemoglobin pigment into bile pigments called bilirubin and biliverdin.

Role of the lungs:

Lungs help in the removing waste materials such as carbon dioxide from the body.

Role of the skin:

Skin has many glands which help in excreting waste products through pores. It has two types of glands – sweat and sebaceous glands.

Sweat glands are highly vascular and tubular glands that separate the waste products from the blood and excrete them in the form of sweat. Sweat excretes excess salt and water from the body.

Sebaceous glands are branched glands that secrete an oily secretion called sebum.

6. Explain micturition.

6. The process of passing out urine from the urinary bladder is called micturition. Urine formed by the nephrons is ultimately carried to the urinary bladder where it is stored. This causes stretching of the wall of bladder that leads to the stimulation of stretch receptors on the walls of the bladder. This sends signal to the 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.

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
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7.

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

8. What is meant by the term osmoregulation?

8. The regulation of water and solute contents of the body fluids by the kidney is called osmoregulation.

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

9. Terrestrial animals are either ureotelic or uricotelic, and not ammonotelic. This is because of the following two main reasons:

(a) Ammonia is highly toxic in nature. Therefore, it needs to be converted into a less toxic form such as urea or uric acid.

(b) Terrestrial animals need to conserve water. Since ammonia is soluble in water, it cannot be eliminated continuously. Hence, it is converted into urea or uric acid. These forms are less toxic and also insoluble in water. This helps terrestrial animals conserve water.

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

10. Juxta glomerular apparatus (JGA) is a special sensitive region formed by cellular modifications in the distal convoluted tubule and the afferent arteriole at the location of their contact. The JGA plays a complex regulatory role. A fall in glomerular blood flow/ glomerular blood pressure/GFR can activate the JG cells to release renin which 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 GFR. Angiotensin II also activates the adrenal cortex to release aldosterone. Aldosterone causes reabsorption of Na<sup>+</sup> and water from the distal parts of the tubule. This also leads to an increase in blood pressure and GFR.

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.

11. (a) Amphioxus is an example of a chordate that has flame cells as excretory structures. Flame cell is a type of excretory and osmoregulatory system.

(b) The cortical portions projecting between the medullary pyramids in the human kidney are the columns of Bertini. They represent the cortical tissues present within the medulla.

(c) A loop of capillary that runs parallel to Henle's loop is known as vasa rectae. Vasa rectae, along with Henle's loop, helps in maintaining a concentration gradient in the medullary interstitium.

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.

12. (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 hormone ADH.

(c) Dialysis fluid contains all the constituents as in plasma except nitrogenous wastes.

(d) A healthy adult human excretes (on an average) 25 – 30 gm of urea/day.



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