CHAPTER 19

EXCRETORY PRODUCTS AND THEIR ELIMINATION

1 MARK QUESTIONS:

1. **Define excretion.**
   Excretion is the elimination of metabolic wastes and nitrogenous wastes from the body.

2. **Mention any one of the chief nitrogenous wastes produced by animals.**
   Ammonia / Urea / Uric acid

3. **Mention the most toxic form of nitrogenous waste that requires large amount of water for its elimination.**
   Ammonia

4. **Name the least toxic nitrogenous waste that can be removed with minimum loss of water.**
   Uric acid

5. **Mention the chief nitrogenous waste that is excreted by mammals.**
   Urea

6. **Define ammonotelism.**
   The process or phenomenon of excreting nitrogenous waste as ammonia is Ammonotelism.

7. **What are ammonotelic animals?**
   Ammonotelic animals are animals that excrete nitrogenous waste materials as ammonia.

8. **Mention an example for ammonotelic animal.**
   Bony fishes / Aquatic amphibians / Aquatic insects

9. **Name the nitrogenous waste in whose removal kidneys do not play a significant role.**
   Ammonia

10. **Terrestrial animals produce lesser toxic nitrogenous wastes like urea and uric acid. Why?**
    Terrestrial animals produce lesser toxic nitrogenous wastes for conservation of water.

11. **Define ureotelism.**
    The process or phenomenon of excreting nitrogenous waste as urea is ureotelism.

12. **What are ureotelic animals?**
    Ureotelic animals are animals that excrete nitrogenous waste materials as urea.

13. Mention an example for ureotelic animal.

Mammals / Terrestrial amphibians / Marine fishes

14. Define uricotelism.

The process or phenomenon of excreting nitrogenous waste as uric acid is uricotelism.

15. What are uricotelic animals?

Uricotelic animals are animals that excrete nitrogenous waste materials as uric acid.

16. Mention an example for uricotelic animal.

Reptiles / Birds / Terrestrial snails / Terrestrial insects

17. What is the advantage of excreting nitrogenous waste in the form of uric acid?

Excreting nitrogenous waste in the form of uric acid helps in conserving water.

18. Which organ in our body converts ammonia into urea?

Liver

19. Define osmoregulation.

Osmoregulation is the regulation of ionic and fluid volume in the body.

20. Name the excretory structures that are present in flatworms, rotifers and Amphioxus.

Protonephridia / Flame cells

21. Name the excretory structures that are present in annelids like earthworm.

Nephridia

22. Name the excretory structures that are present in majority of the insects.

Malpighian tubules

23. Name the excretory structures that are present in prawns and other crustaceans.

Antennal glands / Green glands

24. Name the complex organ which acts as the chief excretory structure in vertebrates.

Kidney

25. Where exactly the kidneys are located in the abdominal cavity of humans?

Kidneys are situated between the levels of last thoracic and third lumbar vertebra close to the dorsal inner wall of the abdominal cavity.

26. What is hilum in the kidneys?

Hilum is a notch towards the centre of the inner concave surface of the kidney through which ureter, blood vessels and nerves enter.

27. What are medullary pyramids?

Medullary pyramids are the conical masses present in the medulla of kidney.

28. What are columns of Bertini (renal columns)?

Columns of Bertini are the extensions of the cortex in between the medullary pyramids.

29. Mention the structural and functional units of kidneys.

Nephrons

30. What is glomerulus?

Glomerulus is a tuft of capillaries formed by the afferent arteriole that is enclosed by the Bowman's capsule.

31. Name the fine branch of renal artery which brings blood to Bowman's capsule for filtration.

Afferent arteriole

32. Name the blood vessel that carries blood away from glomerulus.

Efferent arteriole

33. What is Malpighian body / renal corpuscle?

Glomerulus along with Bowman's capsule is called the Malpighian body or renal corpuscle.

34. What are cortical nephrons?

Nephrons whose loops of Henle are too short and extend only very little into the medulla are called cortical nephrons.

35. What are juxtamedullary nephrons?

Nephrons whose loops of Henle are very long and run deep into the medulla are called juxtamedullary nephrons.

36. What are peritubular capillaries?

Peritubular capillaries are a fine capillary network formed by the efferent arteriole around the renal tubule.

37. What are vasa recta?

Vasa recta are U-shaped minute vessels of the peritubular network that run parallel to the Henle's loop.

38. Why glomerular filtration is also called ultrafiltration?

Glomerular filtration is called ultrafiltration because blood is filtered so finely through the membranes containing minute pores called filtration slits or slit pores.

39. What is the chief cause for filtration of blood in the glomerulus?

The chief cause for glomerular filtration is the glomerular capillary blood pressure.

40. What is the location of slit pores (filtration slits) in the epithelium of Bowman's capsule?

Slit pores are present between the epithelial cells called podocytes of Bowman's capsule.

41. Define glomerular filtration rate (GFR)?

The amount of the filtrate formed by the kidneys per minute is called glomerular filtration rate.

42. What is average amount of blood filtered by kidneys per minute?

125 ml. per minute

43. What is juxtaglomerular 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.

44. Even though 180 litres of filtrate is formed per day by the kidneys, only 1.5 litres of urine is released. Why?

It is because nearly 99% of the filtrate is reabsorbed by the renal tubules.

45. What is tubular secretion?

It is the secretion of substances like H^+, K^+ and ammonia into the filtrate by the cells of the kidney tubules (DCT and collecting duct).

46. Which part of the kidney tubule has brush bordered epithelium?

Proximal convoluted tubule (PCT)

47. Name the part of nephron where maximum amount of essential substances are absorbed from the filtrate.

Proximal convoluted tubule (PCT)

48. The filtrate gets concentrated as it moves down in the descending limb of Henle's loop. Why?

The filtrate gets concentrated as it moves down in the descending limb due to the reabsorption of water into the medullary fluid.

49. The concentrated filtrate gets diluted as it moves in the ascending limb of Henle's loop. Why?

The concentrated filtrate gets diluted as it moves in the ascending limb due to the reabsorption of electrolytes into the medullary fluid.

50. Mention a substance that is returned to the interstitium from the tubular part of nephron to maintain concentration gradient.

NaCl / Urea

51. What are osmoreceptors?

Osmoreceptors receptor cells in the body that detect changes in blood volume, body fluid volume and ionic concentration.

52. Name the enzyme released by juxtaglomerular apparatus.

Renin

53. Mention the role of renin in kidney function.

Renin converts angiotensinogen into angiotensin I and further to angiotensin II.

54. Name the hormone secreted by heart muscles that regulates kidney function.

Atrial Natriuretic factor / ANF

55. Atrial Natriuretic factor (ANF) decreases glomerular filtration rate. Why?

ANF causes vasodilation and thereby decreases the blood pressure which in turn decreases the GFR.

56. Name the hormone secreted by the neurohypophysis that helps in the reabsorption of water in the kidney tubules.

Vasopressin / Anti diuretic hormone / ADH

57. Mention the vasoconstrictor (hormone) that promotes the secretion of aldosterone.

Angiotensin II

58. Name the hormone secreted by the adrenal cortex which regulates kidney function.

Aldosterone

59. What is the pH of urine?

pH of urine is 6

60. Define micturition?

It is the process of release of urine.

61. What is micturition reflex?

The neural mechanisms causing micturition is called micturition reflex.

62. What do glycosuria and ketonuria indicate?

Glycosuria and ketonuria indicate diabetes mellitus.

63. What is glycosuria?

Glycosuria is the presence of glucose in urine.

64. What is ketonuria?

Ketonuria is the presence of ketone bodies in urine.

65. What is the primary function of sweat?

The primary function of sweat is to facilitate a cooling effect on the body surface.

66. How do lungs help in excretion?

Lungs remove large amounts of CO_2 and also significant quantities of water every day.

67. How does liver help in excretion?

Liver secretes bile containing substances like bilirubin, biliverdin, cholesterol, degraded steroid hormones, vitamins and drugs most of which ultimately pass out along with digestive wastes.

68. How do sweat glands help in excretion?

Sweat glands help in the removal of NaCl, small amounts of urea, lactic acid, water, etc.

69. How do sebaceous glands help in excretion?

Sebaceous glands eliminate certain substances like sterols, hydrocarbons and waxes through sebum.

70. Define uremia.

Uremia is the accumulation of urea in blood.

71. What is renal failure?

Renal failure (kidney failure) is the inability of the kidneys to filter or purify blood.

72. What is haemodialysis?

Haemodialysis is the removal of urea / nitrogenous wastes from the blood outside the body of the patient. **OR** Haemodialysis is the purification / filtration of blood outside the body of the patient.

73. Name the anticoagulant that is used in haemodialysis.

Heparin

74. What are renal calculi?

Renal calculi are stones or insoluble masses of crystallised salts (oxalates, etc.) formed within the kidney.

75. What is glomerulonephritis?

Glomerulonephritis is the inflammation of glomeruli of kidney.

76. In kidney transplantation, a close relative is preferred as a donor. Why?

In kidney transplantation, a close relative is preferred to minimise the chances of rejection of kidney by the immune system of the host (recipient).

2 MARK QUESTIONS:

1. **Mention any four substances produced during metabolic activities that should be removed totally or partially from the body.**

   Ammonia, urea, uric acid, carbon dioxide, water and ions like Na^+, K^+, Cl^-, phosphate, sulphate, etc., ½ x 4 = 2

2. **Define excretion. Mention two nitrogenous wastes that are produced during metabolism.**

   Excretion is the elimination of metabolic wastes and nitrogenous wastes from the body. 1
   Ex: Urea, Ammonia, Uric acid ½ x 2 = 1

3. **What are ammonotelic animals? Mention two examples.**

   Ammonotelic animals are animals that excrete nitrogenous waste materials as ammonia. 1
   Ex: Bony fishes, aquatic amphibians, aquatic insects ½ x 2 = 1

4. **What are ureotelic animals? Mention two examples.**

   Ureotelic animals are animals that excrete nitrogenous waste materials as urea. 1
   Ex: Mammals, terrestrial amphibians, marine fishes ½ x 2 = 1

5. **What are uricotelic animals? Mention two examples.**

   Uricotelic animals are animals that excrete nitrogenous waste materials as uric acid. 1
   Ex: Reptiles, birds, terrestrial snails, terrestrial insects ½ x 2 = 1

6. **Classify the following into ureotelic, ammonotelic and uricotelic animals:**
   (a) Bony fishes (b) Marine fishes (c) Terrestrial amphibians (d) Birds

   (a) Bony fishes – Ammonotelic
   (b) Marine fishes – Ureotelic
   (c) Terrestrial amphibians – Ureotelic
   (d) Birds – Uricotelic ½ x 4 = 2

7. **Mention the difference between ammonotelism and ureotelism.**
   - The process or phenomenon of excreting nitrogenous waste as ammonia is called ammonotelism. 1
   - The process or phenomenon of excreting nitrogenous waste as urea is ureotelism. 1

8. **Distinguish between ureotelism and uricotelism.**
   - The process or phenomenon of excreting nitrogenous waste as urea is ureotelism. 1
   - The process or phenomenon of excreting nitrogenous waste as uric acid is uricotelism. 1

9. **Mention the difference between ammonotelism and uricotelism.**
   - The process or phenomenon of excreting nitrogenous waste as ammonia is ammonotelism.1
   - The process or phenomenon of excreting nitrogenous waste as uric acid is uricotelism. 1

10. **Differentiate ammonotelic and ureotelic animals with an example each.**

- Ammonotelic animals are animals that excrete nitrogenous waste materials as ammonia. ½
  Ex: Bony fishes / Aquatic amphibians / Aquatic insects Any one: ½
- Ureotelic animals are animals that excrete nitrogenous waste materials as urea. ½
  Ex: Mammals / Terrestrial amphibians / Marine fishes Any one: ½

11. Differentiate ammonotelic and uricotelic animals with an example each.

- Ammonotelic animals are animals that excrete nitrogenous waste materials as ammonia. ½
  Ex: Bony fishes / Aquatic amphibians / Aquatic insects Any one: ½
- Uricotelic animals are animals that excrete nitrogenous waste materials as uric acid. ½
  Ex: Reptiles / Birds / Terrestrial snails / Terrestrial insects Any one: ½

12. Differentiate ureotelic and uricotelic animals with an example each.

- Ureotelic animals are animals that excrete nitrogenous waste materials as urea. ½
  Ex: Mammals / Terrestrial amphibians / Marine fishes Any one: ½
- Uricotelic animals are animals that excrete nitrogenous waste materials as uric acid. ½
  Ex: Reptiles / Birds / Terrestrial snails / Terrestrial insects Any one: ½

13. Mention any four excretory structures present in different animals.

Protonephridia (flame cells), Nephridia, Malpighian tubules, Green glands (Antennary glands), Kidneys Any four - ½ x 4 = 2

14. Mention the excretory structures present in each of the following:
(a) Amphioxus (b) Cockroach (c) Earthworm (d) Prawn

(a) Amphioxus – Protonephridia (flame cells)
(b) Cockroach – Malpighian tubules
(c) Earthworm – Nephridia
(d) Prawn – Green glands (Antennary glands) ½ x 4 = 2

15. Mention one example each for animals possessing the following excretory structures:
(a) Green glands (b) Protonephridia (flame cells) (c) Nephridia (d) Malpighian tubules

(a) Green glands – Prawn / Crustaceans
(b) Protonephridia (flame cells) – Flatworms (Planaria) / Rotifers / Some annelids, Amphioxus
(c) Nephridia – Earthworms and other annelids
(d) Malpighian tubules - Most of the insects (cockroaches) ½ x 4 = 2

16. Mention the difference between cortical nephrons and juxtamedullary nephrons.

- Nephrons whose loops of Henle are too short and extend only very little into the medulla are called cortical nephrons. 1
- Nephrons whose loops of Henle are very long and run deep into the medulla are called juxtamedullary nephrons. 1

17. Name any two layers through which glomerular blood is filtered in the Malpighian body.

The endothelium of glomerular blood vessels, the epithelium of Bowman's capsule and a basement membrane between these two layers Any two: 1 x 2 = 2

18. Define glomerular filtration rate. What is its value (amount) in a healthy individual?

- The amount of the filtrate formed by the kidneys per minute is called glomerular filtration rate.1
- The value of GFR is 125 ml. per minute / 180 litres per day. 1

19. Mention the role of juxtaglomerular apparatus in the regulation of glomerular filtration rate.

- A fall in GFR activates the JG cells to release renin which stimulates the conversion of Angiotensinogen into Angiotensin I and then into Angiotensin II. 1
- Angiotensin II increases the glomerular blood flow by vasoconstriction & thereby the GFR. 1

20. How does proximal convoluted tubule (PCT) help in maintaining the pH and ionic balance of body fluids?

- PCT absorbs 70 – 80 per cent of electrolytes and water. 1
- PCT also selectively secretes hydrogen ions, ammonia and potassium ions into the filtrate and absorbs HCO_3^- from it. 1

21. Mention the role of Henle's loop in urine formation.

- The descending limb of Henle's loop absorbs water, transfers it to medullary fluid and concentrates the filtrate as it moves down. 1
- The ascending limb absorbs electrolytes actively or passively, transfers them to medullary fluid and dilutes the concentrated filtrate as it moves upward. 1

22. Mention two substances that are absorbed actively and two substances that are absorbed passively from the filtrate in the kidney tubules.

- Actively absorbed substances – Glucose, amino acids, Na^+ ½ x 2 = 1
- Passively absorbed substances - Nitrogenous wastes (urea, uric acid, NH_3), water ½ x 2 = 1

23. Classify the following into actively or passively transported substances during reabsorption in kidney tubules:

(a) Water (b) Glucose (c) Amino acids (d) Urea

(a) Water – Passively absorbed substance
(b) Glucose – Actively absorbed substance
(c) Amino acids – Actively absorbed substances
(d) Urea – Passively absorbed substance ½ x 4 = 2

24. "Distal convoluted tubule maintains the pH and Sodium-Potassium balance in blood". Justify.

- DCT reabsorbs of HCO_3^-. 1
- It also selectively secretes hydrogen and potassium ions and NH_3. 1

25. What is the role of the collecting duct in urine formation?

- Collecting duct absorbs large amounts of water to produce concentrated urine. 1
- It also allows absorption of small amounts of urea to maintain the osmolarity and selectively secretes H^+ and K^+ to maintain pH and ionic balance of blood. 1

26. Differentiate glycosuria and ketonuria.

- Glycosuria is the presence of glucose in urine. 1
- Ketonuria is the presence of ketone bodies in urine. 1

27. Mention the role of vasopressin (ADH) in urine formation.

- Vasopressin or antidiuretic hormone (ADH) helps in the reabsorption water from distal parts of the tubule and also collecting duct. 1
- ADH also constricts blood vessels, increases blood pressure and glomerular blood flow and thereby the glomerular filtration rate. 1

28. What is Atrial Natriuretic Factor (ANF)? How does it check Renin-Angiotensin mechanism?

- ANF is a hormone secreted by heart muscles that regulates kidney function. 1
- ANF causes vasodilation and thereby decreases the blood pressure which in turn decreases the GFR. Thus it checks Renin-Angiotensin mechanism. 1

29. List the role of aldosterone in kidney function.

- Aldosterone is responsible for the reabsorption of Na+ and water from the distal parts of the kidney tubule. 1
- This also causes an increase in blood pressure and GFR. 1

30. Mention the role of Angiotensin II in kidney function.

- Angiotensin II is a powerful vasoconstrictor that increases the glomerular blood pressure and thereby GFR. 1
- Angiotensin II also activates the release of Aldosterone which causes the reabsorption of Na^+ and water from the distal parts of the tubule and also increases blood pressure and GFR. 1

31. Mention the role of skin in excretion.

- Sweat glands produce sweat through which water, NaCl, small amounts of urea, lactic acid, etc. are eliminated. 1
- Sebaceous glands eliminate certain substances like sterols, hydrocarbons and waxes through sebum. 1

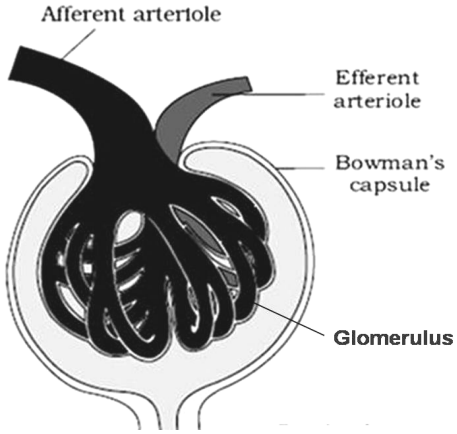
32. What is the composition of sweat?

Water, NaCl, small amounts of urea, lactic acid, etc. ½ x 4 = 2

33. Mention four structures or organs other than the kidneys in man that help in the elimination of metabolic wastes from the body.

Lungs, liver, skin and salivary glands ½ x 4 = 2

34. Draw a labeled diagram of the Malpighian body.



4 Labellings - ½ x 4 = 2

4 MARK QUESTIOS:

1. Define excretion. Describe different types of animals based on the chief nitrogenous waste produced in them with examples.

- Excretion is the elimination of metabolic wastes and nitrogenous wastes from the body. 1
- **Ammonotelic animals:** These are animals that excrete nitrogenous waste materials as ammonia. ½
  Ex: Bony fishes / Aquatic amphibians / Aquatic insects Any one - ½
- **Ureotelic animals:** These are animals that excrete nitrogenous waste materials as urea. ½
  Ex: Mammals / Terrestrial amphibians / Marine fishes Any one - ½
- **Uricotelic animals:** These are animals that excrete nitrogenous waste materials in the form of uric acid. ½
  Ex: Reptiles / Birds / Terrestrial snails / Terrestrial insects Any one - ½

2. Explain the function of PCT and Henle's loop during urine formation.

- PCT absorbs 70 – 80 per cent of electrolytes and water. 1
- PCT also selectively secretes hydrogen ions, ammonia and potassium ions into the filtrate and absorbs HCO_3^- from it to maintain pH and ionic balance. 1
- The descending limb of Henle's loop absorbs water, transfers it to medullary fluid and concentrates the filtrate as it moves down. 1
- The ascending limb absorbs electrolytes actively or passively, transfers them to medullary fluid and dilutes the concentrated filtrate as it moves upward. 1

3. Explain the function of DCT and collecting duct during urine formation.

- DCT helps in conditional reabsorption of Na^+ and water. 1
- DCT also reabsorbs of HCO_3^- and selectively secretes hydrogen and potassium ions and NH_3 to maintain pH and sodium-potassium balance in blood. 1
- Collecting duct absorbs large amounts of water to produce concentrated urine. 1
- Collecting duct also allows absorption of small amounts of urea to maintain the osmolarity and selectively secretes H^+ and K^+ to maintain pH and ionic balance of blood. 1

4. Explain the steps involved in haemodialysis.

- Blood is drained from a convenient artery. An anticoagulant like heparin is added to it. 1
- This blood is pumped into a dialysing unit that contains a coiled cellophane tube surrounded by dialysing fluid (the same composition as that of plasma except the nitrogenous wastes). 1
- The porous cellophane membrane of the tube allows the passage of molecules based on concentration gradient. As nitrogenous wastes are absent in the dialysing fluid, these substances freely move out, thereby clearing the blood. 1
- The cleared blood is pumped back to the body through a vein after adding anti-heparin to it.1

5. What is micturition reflex? Write about the neural mechanism involved in this.

- The neural mechanisms causing micturition is called micturition reflex. 1

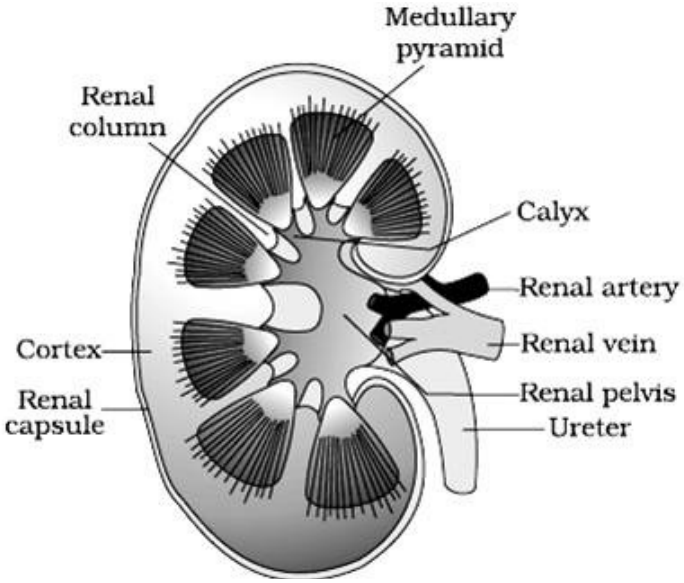
Neural mechanism involved in micturition reflex:

- A voluntary signal is initiated by the stretching of urinary bladder as it gets filled with urine. 1
- In response, the stretch receptors on the walls of the bladder send signals to the CNS. 1
- 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. 1

6. Explain the role of Renin – Angiotensin in the regulation of kidney function.

- Renin secreted by JG cells converts angiotensinogen in blood to angiotensin I and further to angiotensin II. 1
- Angiotensin II which is a powerful vasoconstrictor, increases the glomerular blood pressure and thereby GFR. 1
- Angiotensin II also activates the adrenal cortex to release Aldosterone which causes reabsorption of Na^+ and water from the distal parts of the tubule. 1
- Aldosterone also leads to an increase in blood pressure and GFR. 1

7. Draw a neat labelled diagram of the longitudinal section of human kidney.



Any six labellings - ½ x 6 = 3

Neat and correct diagram - 1

5 MARK QUESTIONS:

1. Explain the mechanism of urine formation.

Glomerular filtration:

- Due to glomerular filtration pressure, blood is filtered through minute spaces called filtration slits or slit pores present between the podocytes of the epithelial cells of Bowman's capsule (ultrafiltration). This produces about 125ml of glomerular filtrate / minute. 1

Tubular reabsorption:

- Nearly all of the essential nutrients like glucose, amino acids, etc., HCO_3^- and 70% - 80% of electrolytes and water are reabsorbed by PCT by active or passive process. 1
- Descending limb of Henle's loop absorbs water and ascending limb absorbs electrolytes like NaCl. 1
- Conditional reabsorption of Na^+ and water and the absorption of HCO_3^- take place in DCT. Collecting duct also absorbs large amounts of water. 1

Tubular secretion:

- The tubular cells PCT and DCT) secrete substances like H^+, K^+ and ammonia into the filtrate and make the urine concentrated. 1

2. Explain the mechanism of concentration of the glomerular filtrate.

- The flow of glomerular filtrate in the two limbs of Henle's loop and the flow of blood through the two limbs of vasa recta are in counter current pattern. 1
- The proximity between the Henle's loop and vasa recta and the counter current in them maintains higher osmolarity towards the inner medullary interstitium than in the cortex. This gradient is mainly caused by NaCl and urea. 1
- NaCl is transported by the ascending limb of Henle's loop which is exchanged with the descending limb of *vasa recta*. NaCl is returned to the interstitium by the ascending portion of vasa recta. 1
- Similarly, small amounts of urea enter the thin segment of the ascending limb of Henle's loop which is transported back to the interstitium by the collecting tubule. 1
- This counter current mechanism maintains a concentration gradient in the medullary interstitium which helps in the easy passage of water from the collecting tubule, thereby, concentrating the filtrate (urine). 1

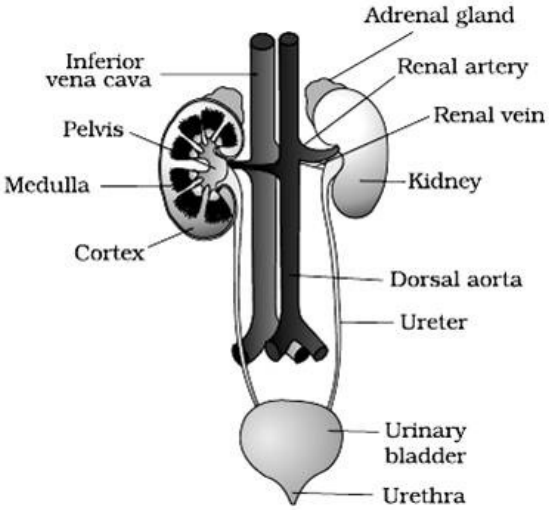
3. Explain micturition.

- Micturition is the process of release of urine. 1
- It is caused by neural mechanisms which is collectively called micturition reflex. 1
- A voluntary signal is initiated by the stretching of urinary bladder as it gets filled with urine. 1
- In response, the stretch receptors on the walls of the bladder send signals to the CNS. 1
- 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. 1

4. Explain the role of different hormones in the regulation of kidney function.

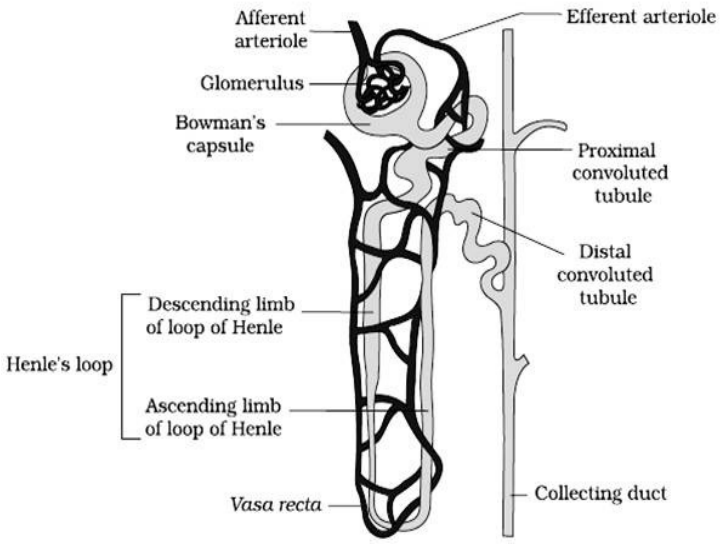
- Vasopressin or antidiuretic hormone (ADH) helps in the reabsorption water from distal parts of the tubule and also collecting duct. 1
- ADH also constricts blood vessels, increases blood pressure and glomerular blood flow and thereby the glomerular filtration rate. 1
- Angiotensin II which is a powerful vasoconstrictor, increases the glomerular blood pressure and thereby GFR. 1
- Angiotensin II also promotes the release of aldosterone that causes reabsorption of Na^+ and water from the distal parts of the tubule. It also increases blood pressure and thereby glomerular filtration rate. ½ + ½
- Atrial Natriuretic Factor (ANF) secreted by the heart muscles causes vasodilation and thereby decreases the blood pressure and thereby glomerular filtration rate. 1

5. Draw a neat labelled diagram of the human urinary (excretory) system.



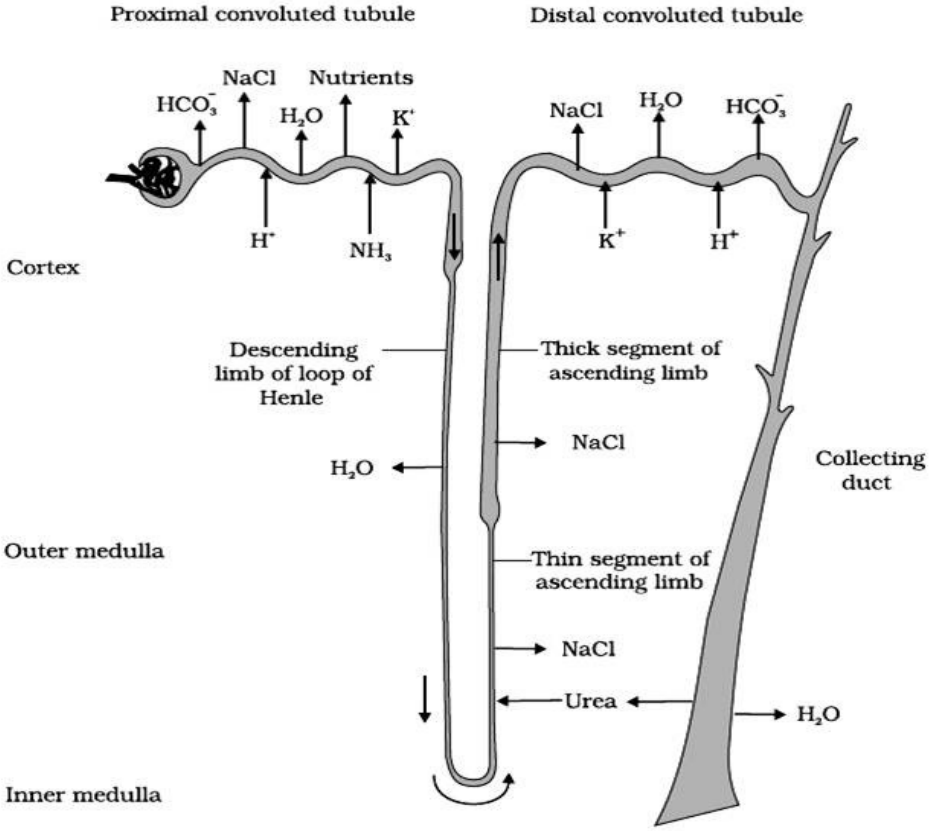
Any eight labellings - ½ x 8 = 4
Neat and correct diagram - 1

6. Draw a neat labelled sketch of nephron.



Any eight labellings - ½ x 8 = 4
Neat and correct diagram –1

7. Write a diagrammatic representation that shows the reabsorption of major substances in different parts of the nephron.



Correct location of different parts of the tubule in cortex, outer medulla and inner medulla - 1

Correct representation of absorption in PCT – 1

Correct representation of absorption in DCT – 1

Correct representation of absorption in descending limb of Henle's loop – ½

Correct representation of absorption in ascending limb of Henle's loop – ½

Correct representation of absorption in thin segment of Henle's loop – ½

Correct representation of absorption in collecting duct – ½