Chapter – 8

Excretion

Textbook Evaluation Solved

Question 1.
Arrange the following structures in the order that a drop of water entering the nephron would encounter them?
(a) Afferent arteriole
(b) Bowman's capsule
(c) Collecting duct
(d) Distal tubule
(e) Glomerulus
(f) Loop of Henle
(g) Proximal tubule
(h) Renal pelvis

Answer:
(a) Afferent arteriole
(b) Bowman's capsule
(e) Glomerulus
(g) Proximal tubule
(j) Loop of Henle
(d) Distal tubule
(c) Collecting duct
(h) Renal pelvis

Question 2.
Name the three filtration barriers that solutes must come across as they move from plasma to the lumen of Bowman's capsule. What components of the blood are usually excluded by these layers?

Answer:
1. Glomerulus net filtration pressure – 55 mm Hg
2. Colloidal osmotic pressure – 30 mm Hg
3. Capsular Hydrostatic pressure -15 mm Hg

Protein amino acid glucose urea, uric acid creatinine, etc are excluded by these layers.

Question 3.

What forces promote glomerular filtration? What forces oppose them? What is meant by net filtration pressure?

Answer:

Glomerular hydrostatic pressure (55 mm Hg) is the force that promotes filtration. The colloidal osmotic pressure (30 mm Hg) and the capsular hydrostatic pressure (15 mm Hg) are the two opposing forces.

The difference between the force promoting and opposing filtration is the net filtration pressure. It is responsible for filtration. Net filtration pressure = Glomerular hydrostatic pressure – (Colloidal osmotic pressure + Capsular hydrostatic pressure).

Question 4.

Identify the following structures and explain their significance in renal physiology?

1. Juxtaglomerular apparatus
2. Podocytes
3. Sphincters in the bladder
4. Renal cortex

Answer:

1. Juxtaglomerular apparatus:

Juxtaglomerular apparatus is a specialized tissue in the afferent arteriole of the nephron that consists of macula densa and granular cells. The macula densa cells sense distal tubular flow and affect afferent arteriole diameter. The granular cells secrete an enzyme called renin. It plays an important role in reabsorption of water, Na^+ and excretion of K^+.

2. Podocytes:

The visceral layer of the Bowman's capsule is made up of epithelial cells called podocytes. The podocytes end in foot processes which cling to the basement

membrane of the glomerulus. The openings between the foot processes are called filtration slits. It is important for glomerular filtration.

3. Sphincters in the bladders:

Sphincter muscles in the bladder controls the flow of urine from the bladder. When urinary bladder is filled with urine, it stretches and stimulates the central nervous system through the sensory neurons of the parasympathetic nervous system and brings about contraction of the bladder.

Simultaneously, somatic motor neurons induce the sphincters to close. Smooth muscles contracts resulting in the opening of the internal sphincters passively and relaxing the external sphincter. When the stimulatory and inhibitory controls exceed the threshold, the sphincter opens and the urine is expelled out.

4. Renal cortex:

The outer portion of the kidney is the renal cortex. It contains renal corpuscles and the proximal and distal tubules. It is thin and fibrous.

Question 5.

In which segment of the nephron most of the re-absorption of substances takes place?

Answer:

In proximal convoluted tubule cells, Glucose, lactate, amino acids, Na+ and water, are reabsorbed. In the descending limb of Henle's loop, water is reabsorbed. In the ascending limb, Na^+, Cl and K^+ are reabsorbed. In the distal convoluted tubule, water is reabsorbed.

Question 6.

When a molecule or ion is reabsorbed from the lumen of the nephron, where does it go? If a solute is filtered and not reabsorbed from the tubule, where does it go?

Answer:

If a solute is filtered and not reabsorbed from the tubule, where does it go?

- The reabsorbed molecule of the lumen of the nephron goes to interstitial fluid and then goes to the blood.
- The filtered molecule when it is not reabsorbed by the tubules it will be excreted out through urine.

Question 7.
Match each of the following substances with its mode of transportation in proximal tubular reabsorption?
(a) Na^+ – Simple diffusion
(b) Glucose – Primary active transport
(c) Urea – Indirect active transport
(d) Plasma – Paracellular movement
(e) Proteins – Facilitated diffusion
(f) Water – Endocytosis

Answer:
(a) Endocytosis
(b) Paracellular movement
(c) Primary active transport
(d) Indirect active transport
(e) Simple diffusion
(f) Facilitated diffusion

Question 8.
Which segment is the site of secretion and regulated reabsorption of ions and pH homeostasis?

Answer:
Distal convoluted tubule.

Question 9.
What solute is normally present in the body to estimate GFR in humans?

Answer:
Creatinine.

Question 10.
Which part of the autonomic nervous system is involved in the micturition process?

Answer:
Para sympathetic nervous system.

Question 11.
Match the following terms.
(a) a- adrenoceptor – 1. afferent arteriole
(b) Autoregulation – 2. basal lamina
(c) Bowman's capsule – 3. capillary blood pressure
(d) Capsule fluid – 4. colloid osmotic pressure
(e) Glomerulus – 5. GFR
(f) Podocyte – 6. JG cells
(g) Vasoconstriction – 7. plasma proteins Norepinepherine

Answer:
(a) 7
(b) 6
(c) 5
(d) 3
(e) 1
(f) 2
(g) 4

Question 12.
If the afferent arteriole of the nephron constricts, what happens to the GFR in that nephron? If the efferent arteriole constricts what happens to the GFR in that nephron? Assume that no autoregulation takes place?

Answer:
If the afferent arteriole of the nephron constricts, GFR is reduced. If the efferent arteriole constricts, GFR is increased.

Question 13.
How is the process of micturition altered by toilet training?

Answer:
The process of release of urine from the bladder is called micturition or urination. It is controlled by central nervous system and smooth muscles of sphincter. In young children, micturition cannot be controlled. By toilet training, one can temporarily postpone the signal reaching from the central nervous system to the motor neurons carrying stimuli to the urinary bladder.

Question 14.
Concentration of urine depends upon which part of the nephron?
a. Bowman's capsule
b. Length of Henle's loop
c. P.C.T.
d. Network of capillaries arising from glomerulus

Answer:
b. length of Henle's loop

Question 15.
If Henle's loop were absent from mammalian nephron, which one of the following is to be expected?
a. There will be no urine formation.
b. There will be hardly any change in the quality and quantity of urine formed.
c. The urine will be more concentrated.
d. The urine will be more dilute.

Answer:
d. The urine will be more dilute.

Question 16.
A person who is on a long hunger strike and is surviving only on water, will have
a. Less amino acids in his urine
b. Macula densa cells
c. Less urea in his urine
d. More sodium in his urine

Answer:
d. More sodium in his urine

Question 17.
What will happen if the stretch receptors of the urinary bladder wall are totally removed?
a. Micturition will continue
b. Urine will continue to collect normally in the bladder
c. There will be no micturition
d. Orine will not collect in the bladder

Answer:
c. There will be no micturition

Question 18.
The end product of Ornithine cycle is
a. Carbon dioxide
b. Uric acid
c. Urea
d. Ammonia

Answer:
c. Urea

Question 19.
Identify the wrong match
a. Bowman's capsule – Glomerular Alteration
b. DCT – Absorption of glucose
c. Henle's loop – Concentration of urine
d. PCT – Absorption of Na^+ and K^+ ions

Answer:
b. DCT – Absorption of glucose

Question 20.
Podocytes are the cells present on the
a. Outer wall of Bowman's capsule
b. Inner wall of Bowman's capsule
c. Neck of nephron
d. Wall glomerular capillaries

Answer:
b. Inner wall of Bowman's capsule

Question 21.
Glomerular filtrate contains
a. Blood without blood cells and proteins
b. Plasma without sugar
c. Blood with proteins but without cells
d. Blood without urea

Answer:
a. Blood without blood cells and proteins

Question 22.
Kidney stones are produced due to deposition of uric acid and
a. Silicates
b. Minerals
c. Calcium carbonate
d. Calcium oxalate

Answer:
d. calcium oxalate

Question 23.
Animal requiring minimum amount of water to produce urine are
a. Ureotelic
b. Ammonotelic
c. Uricotelic
d. Chemotelic

Answer:
c. Uricotelic

Question 24.
Aldosterone acts at the distal convoluted tubule and collecting duct resulting in the absorption of water through
a. Aquaporins
b. Spectrins

c. GLUT
d. Chloride channels

Answer:
a. Aquaporins

Question 25.
The hormone which helps in the reabsorption of water in kidney tubules is ……..
a. Cholecystokinin
b. Angiotensin II
c. Antidiuretic hormone
d. Pancreozymin

Answer:
b. Angiotensin II

Question 26.
Malphigian tubules remove excretory products from ……..
a. Mouth
b. Oesophagus
c. Haemolymph
d. Alimentary canal

Answer:
d. Alimentary canal

Question 27.
Identify the biological term Homeostasis, excretion, glomerulus, urea, glomerular filtration, ureters, urine, Bowman's capsule, urinary system, reabsorption, micturition, osmosis, glomerular capillaries via efferent arteriole, proteins?

a. A liquid which gathers in the bladder?
b. Produced when blood is filtered in a Bowman's capsule?
c. The temporary storage of urine?
d. A ball of inter-twined capillaries?
e. A process that changes glomerular filtrate into urine?

f. Removal of unwanted substances from the body?
g. Does each contain a glomerulus?
h. Carry urine from the kidneys to the bladder?
i. Contains urea and many useful substances?
j. Blood is filtered through its walls into the Bowman's capsule?
k. Scientific term for urination?
l. Regulation of water and dissolved substances in blood and tissue fluid?
m. Carry urine from the kidneys to the bladder?
n. Consists of the kidneys, ureters and bladder?
o. Removal of useful substances from glomerular filtrate?
p. The process by which water is transported in the proximal convoluted tubule?
q. Where has the blood in the capillaries surrounding the proximal convoluted tubule come from?
r. What solute does blood contain that is not present in the glomerular filtrate?

Answer:

a) Urine
b) Glomerular filtrate
c) Urinary bladder
d) Glomerulus
e) Reabsorption
f) Excretion
g) Bowman's capsule
h) Ureters
i) Glomerular filtrate
j) Glomerulus
k) Micturition
l) Homeostatic
m) Ureters
n) Urinary system
o) Reabsorption
p) Osmosis
q) Glomerular capillaries via the efferent arteriole
r) Proteins

Question 28.
With regards to toxicity and the need for dilution in water, how' different are ureotelic and uricotelic excretions? Give examples of animals that use these types of excretion?

Answer:
Ureotelic animals excrete urea with minimum loss of water, e.g., Mammals and terrestrial amphibians. Uricotelic animals excrete uric acid with the least loss of water, e.g., Birds and reptiles.

Question 29.
Differentiate protonephridia from metanephridia?

Answer:

Protonephridia	Metanephridia
1. Primitive kidneys are protonephridia	1. Tubular excretory structures are
2. These are found in flatworms.	2. These are found in annelids and mollusks

Question 30.
What is the nitrogenous waste produced by amphibian larvae and by adult animals?

Answer:
Amphibian larvae produce ammonia and the adult produces urea.

Question 31.
How is urea formed in the human body?

Answer:
More toxic ammonia produced as a result of breakdown of amino acids is converted into less toxic urea in the liver by a cyclic process called Ornithine cycle.

Question 32.
Differentiate cortical from medullary nephrons?

Answer:

Cortical nephrons	Medullary nephrons
1. These are found in the cortex.	1. These are found in the medulla.
2. These have short Henle's loop.	2. These have long Henle's loop.

Question 33.
What vessels carry blood to the kidneys? Is this blood arterial or venous?

Answer:
The renal artery carries oxygenated (arterial) blood to the kidney.

Question 34.
Which vessels drain filtered blood from the kidneys?

Answer:
Renal veins carry deoxygenated blood from the kidney.

Question 35.
What is tubular secretion? Name the substances secreted through the renal tubules?

Answer:
The movement of substances such as H^+, K^+, NH_4^+, creatinine, and organic acids from the peritubular capillaries into the tubular fluid, the filtrate is called Tubular secretion.

Question 36.
How are the kidneys involved in controlling blood volume? How is the volume of blood in the body related to arterial pressure?

Answer:
Renin-Angiotensin stimulates Na^+ reabsorption from the glomerular filtrate. This stimulates Adrenal cortex to secrete aldosterone that causes reabsorption of Na^+, K^+ excretion and absorption of water.

This reduces the loss of water into the urine. This maintains the volume of blood. An increase in blood volume increases central venous pressure. This increases right atrial pressure, right ventricular end-diastolic pressure, and volume. This increases ventricular stroke volume and cardiac output and arterial blood pressure.

Question 37.
Name the three main hormones that are involved in the regulation of renal function?

Answer:
Antidiuretic hormone, aldosterone and atrial natriuretic peptide factor.

Question 38.
What is the function of the antidiuretic hormone? Where is it produced and what stimuli increase or decreases its secretion?

Answer:
Antidiuretic hormone increases reabsorption of water in the kidney tubules. It is produced in the posterior lobe of the pituitary gland. When there is excess loss of fluid from the body or increase in the blood pressure, ADH is secreted more. When there is no loss of fluid from the body, it is secreted less.

Question 39.
What is the effect of aldosterone on kidneys and where is it produced?

Answer:
Aldosterone is produced by the Adrenal cortex. It increases reabsorption of sodium and water by distal convoluted tubule and increased secretion of potassium. Hence, it maintains blood volume, blood pressure and urine output.

Question 40.
What evolutionary hypothesis could explain the heart's role in secreting a hormone that regulates renal function? What hormone is this?

Answer:
The cardiac atrial cells secrete atrial natriuretic peptide or factor. It travels to

the kidney and increases blood flow to the glomerulus. It acts as a vasodilator on the afferent arteriole and vasoconstrictor on the efferent arteriole. It decreases aldosterone release for the adrenal cortex and decreases the release of renin Angiotensin-II. Health of the heart depends on the normal blood pressure and hence evolution might have preserved atrial natriuretic factor which acts upon the renal function.