

15 Excretion (Part 4 Continued)

I. Chapter Outline

- A. Excretory Substances and Organs
 - 1. Nitrogenous Wastes
 - 2. Water and Other Wastes
 - 3. Four Excretory Organs
- B. The Urinary System
 - 1. The Path of Urine
 - 2. Kidneys: Three Regions
- C. Urine Formation
 - 1. Pressure Filtration: Divides Blood
 - 2. Selective Reabsorption: Passive and Active
 - 3. Tubular Excretion: Second Addition of Wastes
 - 4. Reabsorbing Water
- D. Regulatory Functions of the Kidneys
 - 1. Maintaining Blood pH and Salt Balance
 - 2. Maintaining Blood Volume
- E. Problems with Kidney Function
 - 1. When Kidneys Fail

II. Chapter Review

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|------|---|
| 260 | 1. What does excretion do for the body and why is this important? |
| | 2. What are the 4 nitrogenous waste products that are excreted by the kidney? |
| | 3. How is ammonia formed? Urea is formed from what 2 molecules? What nitrogenous molecule will be excreted by many terrestrial animals? What happens when uric acid crystals collect in the joints? |
| 262 | 4. What are bile pigments derived from? Trace the flow of bile. How does jaundice occur? |
| | 5. List 3 reasons why excretion of certain ions (salts) from the blood is important. What is the role of calcium, iron, and sodium ions? |
| 263 | 6. How is carbon dioxide excreted? What fluid helps to determine blood pressure? |
| | 7. Name the organ of excretion that: (a) has sweat glands that aid in cooling the body. (b) excretes bile pigments that are stored in the gallbladder. (c) removes carbon dioxide and water. (d) excretes iron and calcium via defecation. (e) rids the body of urine. What pigment derived from heme is found in urine? |
| 264 | 8. List the organs of the urinary system and give their functions. |
| | 9. What are the 3 major regions of a kidney? What are the conical masses of tissue in the medulla called? |
| | 10. Name the microscopic unit of the kidney. How many of these units are there per kidney? |
| 265 | 11. List the 5 parts of each nephron. Which parts are found in the cortex? In the pyramids? |
| 267 | 12. What are the 2 capillary regions of each nephron called? Where are they found? |
| | 13. State the 3 steps that are involved in urine formation in the nephron. |
| | 14. Under the influence of glomerular blood pressure, _____ molecules move from the _____ to the inside of the _____. This is a pressure _____ process because _____ molecules and formed elements are unable to pass through. The _____ contains small dissolved molecules in approximately the same concentration as the _____. |
| 269 | 15. What are the 2 factors that aid in the movement of water molecules by passive reabsorption? |
| | 16. Name the 2 anatomical features in the proximal convoluted tubule that contribute to active reabsorption and state why they are important. |
| | 17. Why is reabsorption by active transport said to be selective? |
| | 18. What happens when the blood glucose level goes beyond the maximal rate of transport, as in diabetes mellitus? |
| 270 | 19. Define tubular excretion. Where does it occur? Is it an active or passive process? List 5 substances that are excreted. |
| | 20. Excretion of a hypertonic urine is dependent upon what 2 segments of the nephron? |

- 270 21. Name the 2 solute molecules that contribute to the high osmotic concentration in the inner medulla? Where do they originate? Where do you find the highest concentration of solutes?
 22. Compare the movement of salt and water in the thick portion of the ascending limb of the loop of Henle.
 23. Define the countercurrent mechanism. What does it ensure?
- 271 24. How does the collecting duct create urine that is hypertonic to blood plasma?
- 272 25. If the blood is acidic, what ions will be excreted and reabsorbed to restore the pH? If blood is basic?
 26. Blood volume is primarily maintained by which hormone? Where is this hormone produced? When ADH is present, more _____ is reabsorbed and a _____ amount of urine results.
 27. How does alcohol cause diuresis? What are diuretics used for?
 28. What hormone maintains sodium and potassium ion balance? Where and how does this hormone act?
 29. Describe what happens if the blood pressure is insufficient to promote efficient filtration. What is the role of renin? What does an ACE inhibitor do?
- 274 30. Name the infection (or condition) if it occurs within the: urethra? the bladder? the kidneys? with urea accumulation in the urine?
 31. Which condition is of greatest concern: uremia or retention of water and salts? Why?
- 275 32. If a satisfactory donor cannot be found for a kidney transplant, what alternative treatments can be used?
 33. Define dialysis. Describe how hemodialysis is achieved.

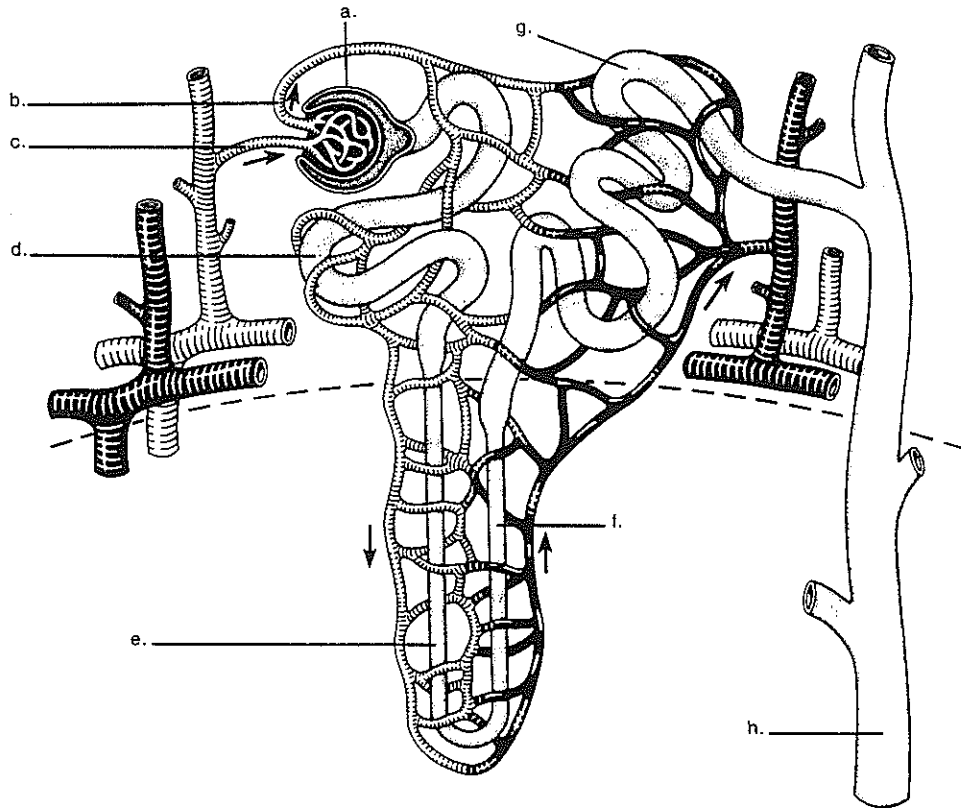
III. Objective Chapter Test

Completion and Short Answer Questions

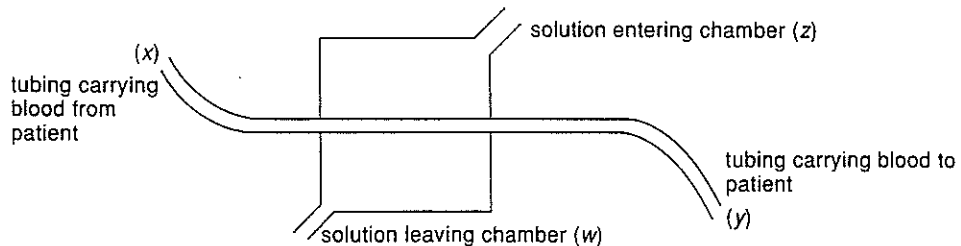
- Urea is a waste product formed from _____ and _____ and is made in the _____ and excreted by the _____.
- The large intestines excrete _____.
- The outermost portion of the kidney is called the _____.
- Fill in the missing parts of the nephron as fluid travels through the nephron: Bowman's capsule → _____ → loop of Henle → _____ → collecting tubule.
- Glucose reabsorption primarily occurs in the _____ portion of the nephron.
- Name a substance that is filtered, maximally reabsorbed, and still in the urine. _____
- Glucose is not normally found in the urine; it is usually totally reabsorbed by means of _____.
- When ADH is present, there is increased _____ reabsorption but a decrease in _____ volume.
- What substance(s) do these organs excrete?
 - sweat glands: _____
 - lungs: _____
 - liver: _____
 - kidneys: _____
 - large intestines: _____
- Complete this table of nitrogenous waste products.

Nitrogenous Waste	Derived From
a. Urea	
b. Creatinine	
c. Uric acid	

11. List the organs of the urinary system in sequence according to the path taken by urine. _____
 → _____ → _____ → _____
12. Macroscopically, the kidney is composed of three parts: _____, _____, and the _____.
13. Label the important parts of the nephron in the diagram shown below.

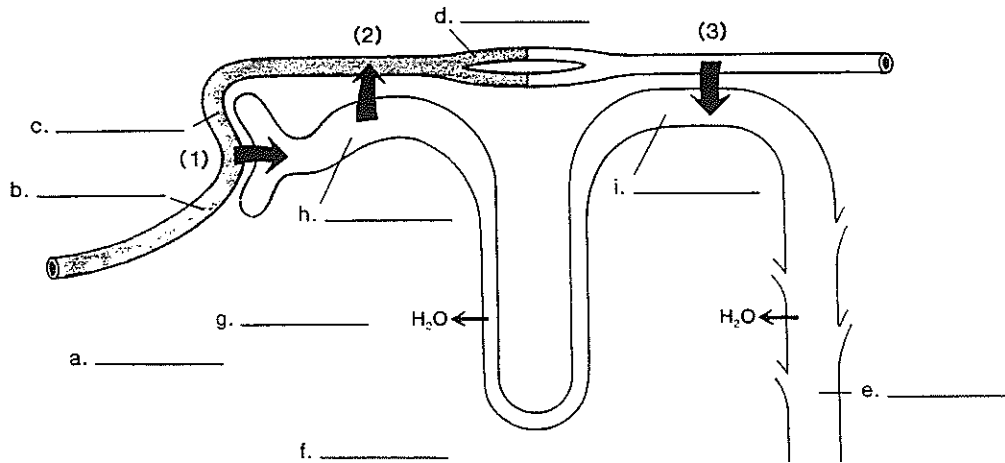


14. The two capillary regions found in each nephron are the (a) _____ and (b) the _____ capillaries.
15. The simplified diagram below explains how the artificial kidney works.



At *x*, the patient's blood carries impurities. As it passes through the artificial kidney (box), the impurities pass out of the blood. At *y*, the patient's blood is rid of nitrogenous wastes. What should be the makeup of the solution that enters the chamber at *z* ? _____

16. When the amino group (-NH) from an amino acid is removed, the process is termed _____.
17. In the _____ mechanism, water leaves the descending limb of the loop of Henle to encounter an increasing concentration of solute from the top to the bottom.
18. Add to the diagram below the 3 steps utilized in urine formation at the arrows (1, 2, 3). Label the remaining components of the nephron at each of the letters with one of the following words: *distal convoluted tubule*, *proximal convoluted tubule*, *Bowman's capsule*, *loop of Henle*, *collecting duct*, *peritubular capillary*, *efferent arteriole*, *glomerulus*, and *afferent arteriole*.



19. In the diagram above, blood approaches the glomerulus in the afferent arteriole. Blood can be thought of as being composed of two portions in the glomerulus:

Filterable Blood Components

nutrients (glucose, amino acids)
 nitrogenous wastes (urea, uric acid)
 ions (salts); water

Nonfilterable Blood Components

formed elements (RBC, WBC etc.)
 proteins

- a. Which of these portions will enter into the Bowman's capsule and be called the filtrate? _____
- b. Which of the molecules in the filtrate will tend to be selectively reabsorbed? _____
- c. Which of the molecules in the filtrate will tend to *not* be reabsorbed? _____
- d. Name a substance that undergoes tubular excretion. _____
- e. According to the diagram above, where is water reabsorbed? _____
 Because water is reabsorbed, the urine becomes _____.

20. Countercurrent exchange (optional).

- a. Darken the portion of Henle's loop in the diagram above that is impermeable to water.
- b. Add to the diagram one set of colored arrows to indicate the active release of Na⁺Cl⁻.
- c. Add to the diagram another set of arrows to indicate the release of urea.
- d. Add to the diagram another set of arrows of a different color to indicate the movement of water out of the loop and the collecting duct.

21. Explain why albumin is not normally found in the urine. _____
22. The small capillary network within the confines of the Bowman's capsule is called the _____.
23. Place an *x* in the box opposite the component of blood if it is associated with the structure, process, or substance listed vertically.

Components of Blood	(a) Afferent Arteriole	(b) Filtrate	(c) Efferent Arteriole	(d) Reab-sorption	(e) Tubular Excretion	(f) Urine	(g) Venous Blood
(1) Plasma proteins							
(2) Red blood cells							
(3) White blood cells							
(4) Glucose							
(5) Amino acids							
(6) Sodium chloride							
(7) Water							
(8) Urea							
(9) Uric acid							
(10) Penicillin							

24. The solution produced when blood is filtered through the walls of the glomerulus and the Bowman's capsule is called the _____.
25. The force that causes filtration to occur in the glomerulus is called _____.

Matching. Match the functions below with the following correct structure: a. glomerulus b. Bowman's capsule c. renal cortex d. loop of Henle e. collecting duct

- _____ 26. extends into the medulla
- _____ 27. a tuft of capillaries
- _____ 28. variably permeable to water
- _____ 29. region of afferent/efferent arterioles
- _____ 30. blind end of the proximal convoluted tubule

Multiple Choice Questions

31. In which of the following would you find urine?
- a. uterus
 - b. urethra
 - c. intestine
 - d. gallbladder
 - e. hepatic portal vein

32. Pressure filtration should be associated with the
- Bowman's capsule.
 - distal convoluted tubule.
 - proximal convoluted tubule.
 - collecting duct.
 - loop of Henle.
33. Glucose
- is in the filtrate and urine.
 - is in the filtrate and not in the urine.
 - undergoes tubular excretion and is in the urine.
 - undergoes tubular excretion and is not in urine.
34. The collecting ducts are primarily found in the
- cortex.
 - medulla.
 - pelvis.
 - afferent arteriole.
35. Which of the following describes the contents of the renal vein that leaves the kidney?
- low in O₂, low in urea
 - high in CO₂, high in urea
 - high in O₂, high in urea
 - low in CO₂, high in urea
36. Kidneys are organs of homeostasis because they
- regulate the blood volume.
 - regulate the pH of the blood.
 - help maintain the correct concentration of ions in the blood.
 - excrete nitrogenous wastes.
 - All of the above are true.
37. Sodium is removed from the kidney tubule by
- passive reabsorption.
 - active reabsorption.
 - an attraction to Cl⁻
 - tubular excretion.
38. The region around the tip of the loop of Henle has a(n)
- very low solute concentration.
 - intermediate solute concentration.
 - very high solute concentration.
 - very high water concentration.
39. The dialysis fluid in an artificial kidney machine should be
- separated from the blood by a membrane permeable only to proteins.
 - low in urea concentration.
 - low in sugar concentration.
 - low in amino acid concentration.
 - All of the above are correct.
40. Which of the following is *not* a true statement?
- People with kidney disease often have high blood pressure.
 - Kidney failure involves damage to the glomeruli.
 - Failure of the kidney to maintain proper body pH is more serious than uremia.
 - Sugar in the urine indicates kidney disease.
 - Protein in the urine indicates kidney disease.

True (T) or False (F) Questions. If you believe the statement to be false, then rewrite the statement as a true one.

41. A person who lacks ADH has too much urine.

Answer: _____ Restatement: _____

42. Drinking alcohol causes diuresis because it increases ADH secretion.

Answer: _____ Restatement: _____

43. The hormone ADH is released from the adrenal cortex, whereas aldosterone is released from the posterior pituitary.

Answer: _____ Restatement: _____

44. The juxtaglomerular apparatus will release the hormone renin whenever there is a decrease in the blood pressure.

Answer: _____ Restatement: _____

45. The upper portion of the ascending loop of Henle actively transports salt out but is impermeable to water.

Answer: _____ Restatement: _____

IV. Subjective Chapter Test

46. In both defecation and excretion, waste products are eliminated from the body. What is the difference, then, between the two terms?

47. Explain the relationship between the structure and function of the proximal convoluted tubule.