Name _____ Period _____

Chapter 44: Osmoregulation and Excretion

The steady-state physiological condition that organisms must maintain is termed *homeostasis*. Osmoregulation and excretion are frequently cited examples of homeostasis and are the central ideas in this chapter.

Overview

1. Define these two terms.

   Osmoregulation

   Excretion

2. Why are nitrogenous wastes associated with nucleic acids and proteins, but not with lipids or carbohydrates?

Concept 44.1 Osmoregulation balances the uptake and loss of water and solutes

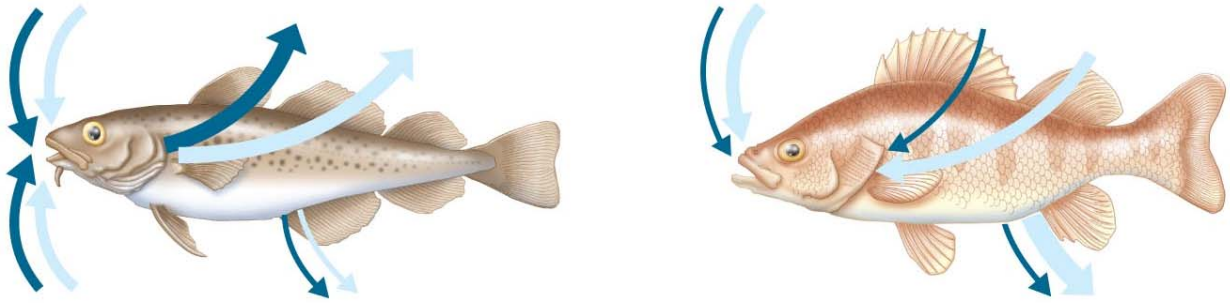
3. Notice the slight switch in terms when dealing specifically with *osmolarity*.

   a. Explain water movement in an *isoosmotic* condition.

   b. When two solutions differ in osmolarity, in which direction does water flow?

4. Explain the difference between *osmoconformers* and *osmoregulators*.

5. Use Figure 44.4 to label and explain *osmoregulation* in saltwater and freshwater fish.



6. Why do many organisms have a body fluid composition adapted to the salinity of their environment?

7. Using the terms *countercurrent exchange* and *transport epithelium*, explain why an albatross can consistently drink seawater and still maintain homeostasis, but humans cannot.

Concept 44.2 An animal's nitrogenous wastes reflect its phylogeny and habitat

8. Animals excrete nitrogenous wastes as _____, _____, or _____.

9. Describe the characteristics of the following nitrogenous waste molecules and the animal groups that excrete them.

Ammonia

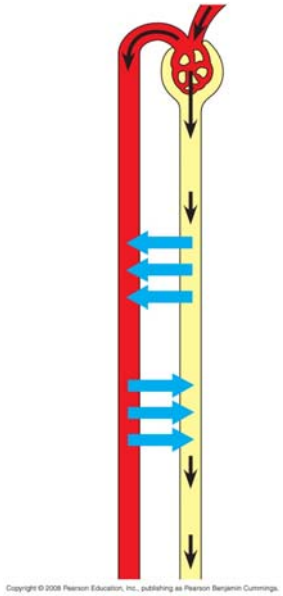
Urea

Uric acid

10. Why do many egg-laying animas secrete uric acid as their waste product?

Concept 44.3 Diverse excretory systems are variations on a tubular theme

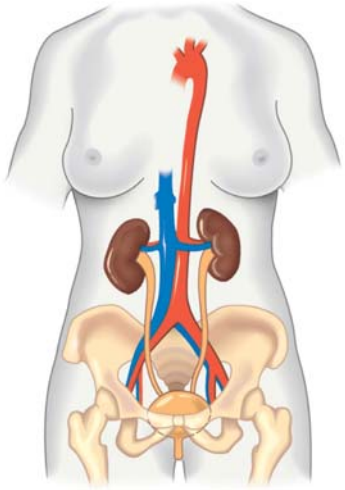
11. The basic process of excretion usually requires four steps. Label and explain the four processes in Figure 44.10.



12. The major types of excretory organs listed below are examples of evolutionary variations on the theme that complex networks of tubules provide a large surface area for the excretion of nitrogenous waste. For each excretory system, give a brief description of how the excretory system functions, followed by examples (phyla and common names where possible).

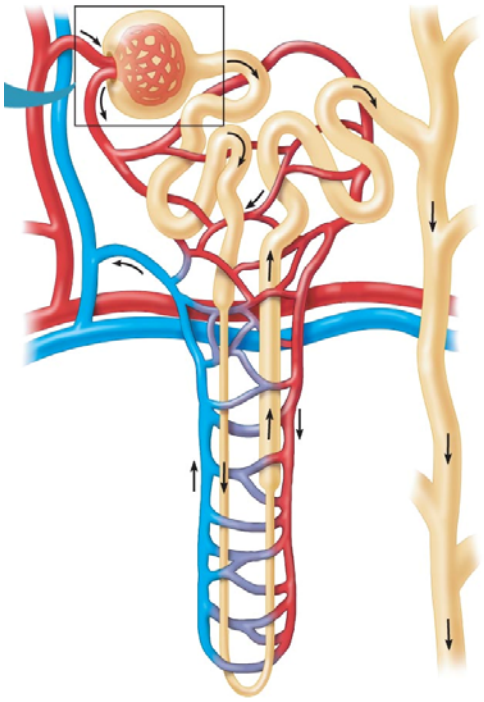
Excretory Organ	**Description**	**Examples**
Protonephridia		
Metanephridia		
Malpighian tubules		
Kidneys		

13. Understanding the workings of the mammalian kidney requires knowledge of the anatomy of the excretory system and then an understanding of how structure fits the function of excretion. Using Figure 44.14 as a guide, label all the excretory organs and major blood vessels.



14. Draw the human kidney (use Figure 44.14B), and label the *renal medulla*, *renal cortex*, and *renal pelvis*.

15. What is a *nephron*?



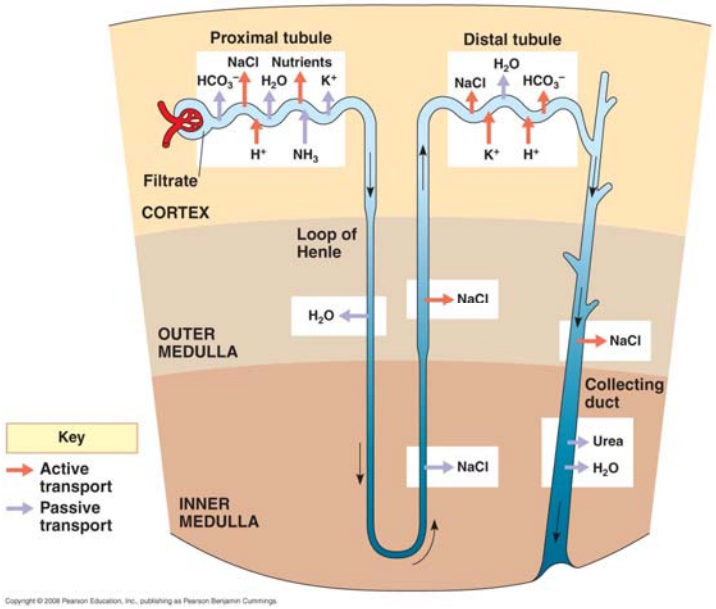
16. Try the following to help unravel the complicated anatomy involved with filtrate and blood flow. First, label the following structures: *glomerulus*, *Bowman's capsule*, *proximal tubule*, *loop of Henle*, *collecting duct*, and *renal pelvis*. Second, use color pencils and shade each structure a different color. Finally, label the following blood vessels: *afferent arteriole*, *efferent arteriole*, *peritubular capillaries*, and *vasa recta*.

17. What is the key function of *juxtamedullary nephrons*?

18. Before going to the next concept, it is important to understand the process of *filtration*. Explain where and how filtration occurs. Finally, describe what the filtrate contains.

Concept 44.4 The nephron is organized for stepwise processing of blood filtrate

19. The process of converting blood filtrate to urine requires four steps. Label each step in the figure that follows, and explain the key processes that occur in each step.



20. The four steps of excretion are listed below (from question 11). For each step, explain where and how the process occurs in the mammalian kidney.

Steps of Excretion	Location	Description/Explanation of Process
Filtration		
Reabsorption		
Secretion		
Excretion		

21. Explain the overall concept of the *two-solute model* for water conservation.

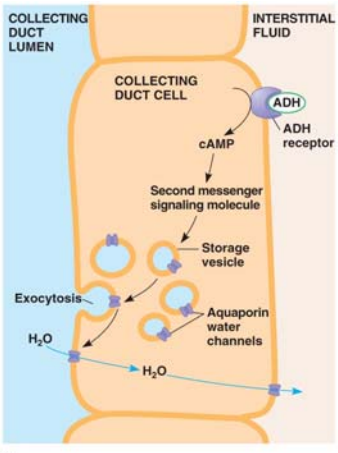
22. Figure 44.16 shows the increasing osmolarity of the kidney, moving from cortex to outer medulla to inner medulla. Why does the kidney expend great energy to maintain this gradient?

23. What is a *countercurrent multiplier system*?

Concept 44.5 Hormonal circuits link kidney function, water balance, and blood pressure

24. Explain the role of *antidiuretic hormone (ADH)* in maintaining blood osmolarity.

25. Your knowledge of biology from previous chapters should make understanding how ADH works easy to understand. Using the figure below, describe the four steps of ADH action.



26. The kidneys are central to the maintenance of proper blood pressure. Explain the influence of the following on blood pressure.

    a. What is the relationship between *renin* and *angiotensin II*?

    b. Which gland releases *aldosterone*, and how does it function?

    c. Why are drugs that inhibit angiotensin-converting enzyme (*ACE)* used to treat hypertension?

Testing Your Knowledge: Self-Quiz Answers
Now you should be ready to test your knowledge. Place your answers here:

1. _____ 2._____ 3. _____ 4. _____ 5. _____ 6. _____ 7. _____