




30.4 The Excretory System

Lesson Objectives

-  Describe the structures of the excretory system and explain their functions.
-  Explain how the kidneys clean the blood.
-  Describe how the kidneys maintain homeostasis.

Lesson Summary

Structures of the Excretory System Cells produce wastes such as salts, carbon dioxide, and ammonia. For homeostasis to be maintained, these wastes need to be removed from the body. **Excretion** is the process by which metabolic wastes are eliminated from the body.

- ▶ The skin excretes excess water, salts, and a small amount of urea in sweat.
- ▶ The lungs excrete carbon dioxide and water vapor.
- ▶ The liver converts potentially dangerous nitrogen wastes to urea.
- ▶ The kidneys are the major organs of excretion. They remove excess water, urea, and metabolic wastes from the blood. **Ureters** carry urine from the kidneys to the **urinary bladder**, where it is stored until it leaves the body through the **urethra**.

Excretion and the Kidneys The kidneys remove excess water, minerals, and other waste products from the blood. The cleansed blood returns to circulation. Each kidney has nearly a million processing units called **nephrons**. Filtration and reabsorption occur in the nephrons.

- ▶ **Filtration** is the passage of a fluid or gas through a filter to remove wastes. The filtration of blood in the nephron takes place in the **glomerulus**, a small, dense network of capillaries. Each glomerulus is encased by a cuplike structure called **Bowman's capsule**. Pressure in the capillaries forces fluids and wastes from the blood into Bowman's capsule. This fluid is called filtrate.
- ▶ Most of the material that enters Bowman's capsule is returned to circulation. The process by which water and dissolved substances are taken back into the blood is called **reabsorption**.
- ▶ A section of the nephron tubule, called the **loop of Henle**, conserves water and minimizes the volume of filtrate. The fluid that remains in the tubule is called urine.

The Kidneys and Homeostasis The kidneys remove wastes, maintain blood pH, and regulate the water content of the blood.

- ▶ The activity of the kidneys is controlled in part by the composition of blood. For example, if blood glucose levels rise well above normal, the kidneys excrete glucose into the urine.
- ▶ Disruption of kidney function can lead to health issues such as kidney stones and serious health issues such as kidney damage, and kidney failure.
 - Kidney stones occur when minerals or uric acid salts crystallize and obstruct a ureter.
 - Kidney damage is often caused by high blood pressure or diabetes.
 - When a patient's kidneys can no longer maintain homeostasis, the patient is said to be in kidney failure.

Structures of the Excretory System

1. Why does the body need an excretory system?

2. What is excretion?

3. What waste compounds are produced by every cell in the body?

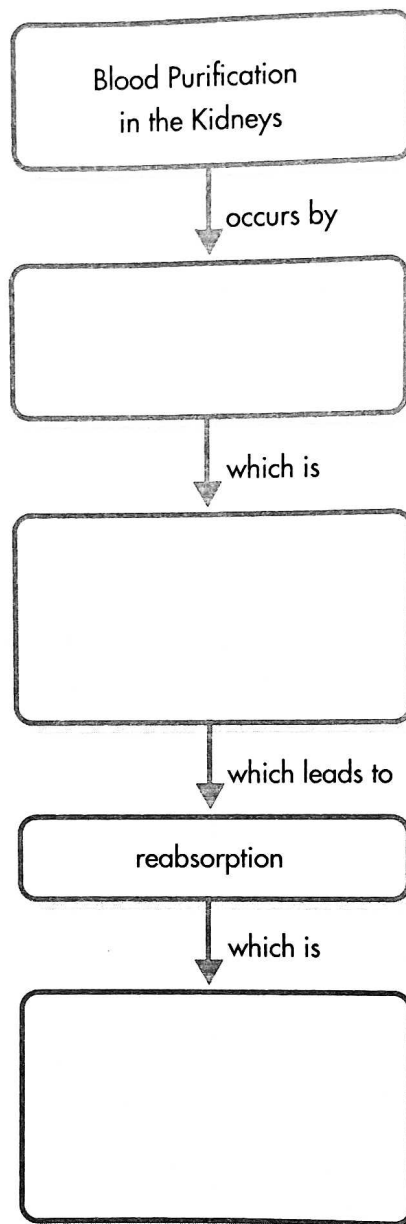
4. What organs are included in the excretory system?

5. Complete the table about the excretory system.

Organs of the Excretory System	
Organ	Function
Skin	
Lungs	
	Converts dangerous nitrogen wastes into urea
Kidneys	
	Transport urine from kidneys to the bladder
	Stores urine
Urethra	

Excretion and the Kidneys

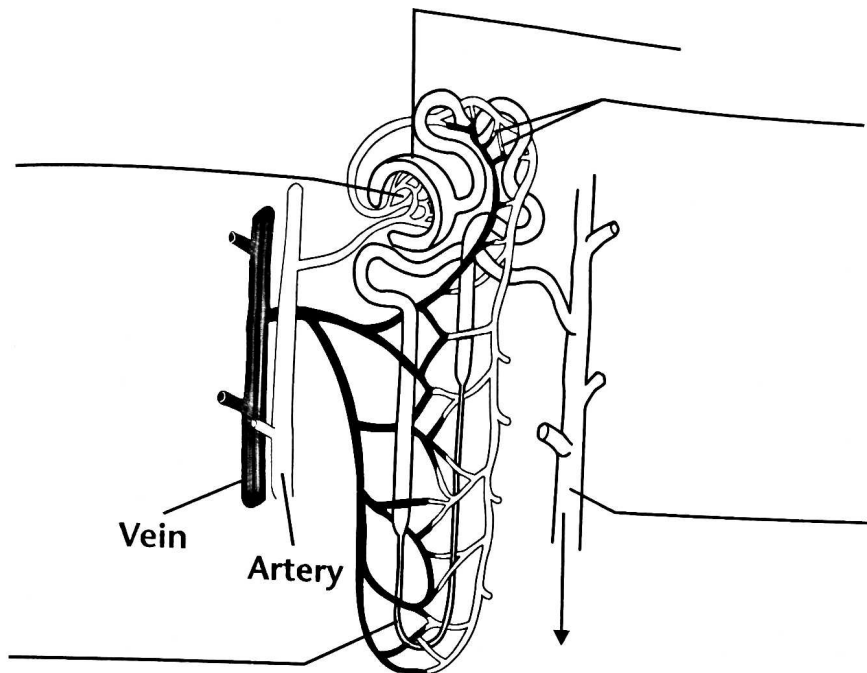
6. Complete the concept map.



For Questions 7–10, write *True* if the statement is true. If the statement is false, change the underlined word or words to make the statement true.

- _____ 7. Each kidney has nearly a million individual processing units called capillaries.
- _____ 8. The material that is filtered from the blood contains water, urea, glucose, salts, amino acids, and some vitamins.
- _____ 9. A number of materials, including salts, are removed from the filtrate by osmosis and reabsorbed by the capillaries.
- _____ 10. The glomerulus is responsible for conserving water and minimizing the volume of the filtrate.

11. **THINK VISUALLY** Label the diagram of a nephron.



The Kidneys and Homeostasis

12. Describe three ways that the kidneys help maintain homeostasis.

13. Explain how the kidneys regulate the levels of salt in the blood.

14. How does dialysis work?

Apply the Big Idea

15. Urine testing is a common way that doctors can monitor a patient's health. Suppose a urine test reveals that there are proteins in the patient's urine. What might be wrong with this patient? What part of the excretory system might not be functioning properly?

Chapter Vocabulary Review

Write the letter of the correct answer on the line at the left.

- _____ 1. Which type of tissue provides support for the body and connects its parts?
A. epithelial tissue C. nervous tissue
B. connective tissue D. muscle tissue
- _____ 2. Which organ absorbs most of the nutrients during digestion?
A. small intestine C. stomach
B. large intestine D. esophagus
- _____ 3. Which of the following is an enzyme released by the stomach during chemical digestion?
A. chyme C. pepsin
B. amylase D. bile

For Questions 4–8, complete each statement by writing the correct word or words.

4. The body's systems are constantly working to maintain _____.
5. The sugars found in fruits, honey, and sugar cane are simple _____.
6. The _____ is a long tube that connects the mouth and the stomach.
7. The _____ absorbs water from undigested material that will be eliminated.
8. The process by which metabolic wastes are eliminated is called _____.

For Questions 9–18, match the term with its definition.

Terms	Definitions
_____ 9. Calorie	A. Inorganic molecule needed by the body in small quantities
_____ 10. proteins	B. Functional unit of the kidney
_____ 11. vitamins	C. Mixture of stomach fluids and partially digested food
_____ 12. amylase	D. Section of a nephron that conserves water and minimizes urine volume
_____ 13. mineral	E. Enzyme that breaks down carbohydrates
_____ 14. peristalsis	F. Organic molecules that regulate body processes
_____ 15. chyme	G. Unit equal to 1000 calories of heat or 1 kilocalorie
_____ 16. nephron	H. Smooth muscle contractions that squeeze food through the esophagus into the stomach
_____ 17. Bowman's capsule	I. Cup-shaped structure that surrounds a glomerulus
_____ 18. loop of Henle	J. Nutrients that provide the body with the building materials it needs for growth and repair

33.3 The Respiratory System

- ☐ Identify the structures of the respiratory system and describe their functions.
- ☐ Describe gas exchange.
- ☐ Describe how breathing is controlled.
- ☐ Describe the effects of smoking on the respiratory system.

Lesson Summary

Structures of the Respiratory System For organisms, *respiration* means the process of gas exchange between a body and the environment. The human respiratory system picks up oxygen from the air we inhale and releases carbon dioxide into the air we exhale. The structures of the respiratory system include the

- ▶ nose, where air is filtered, moistened, and warmed.
- ▶ **pharynx**, or throat, which serves as a passageway for both air and food.
- ▶ **trachea**, or windpipe, and the **larynx**, or vocal cords.
- ▶ **bronchi**, two large tubes that lead to the lungs. Each bronchus branches into smaller passageways called bronchioles that end in tiny air sacs called **alveoli** within the lungs.

Gas Exchange and Transport Oxygen and carbon dioxide are exchanged across the walls of alveoli and capillaries. Chemical properties of blood and red blood cells allow for efficient transport of gases throughout the body.

- ▶ Carbon dioxide and oxygen are exchanged across capillary and alveolus walls.
- ▶ Hemoglobin binds with and transports oxygen that diffuses from alveoli to capillaries. It also increases the efficiency of gas exchange.
- ▶ Carbon dioxide is transported in the blood in three ways. Most combines with water and forms carbonic acid. Some dissolves in plasma. Some binds to hemoglobin and proteins in plasma.

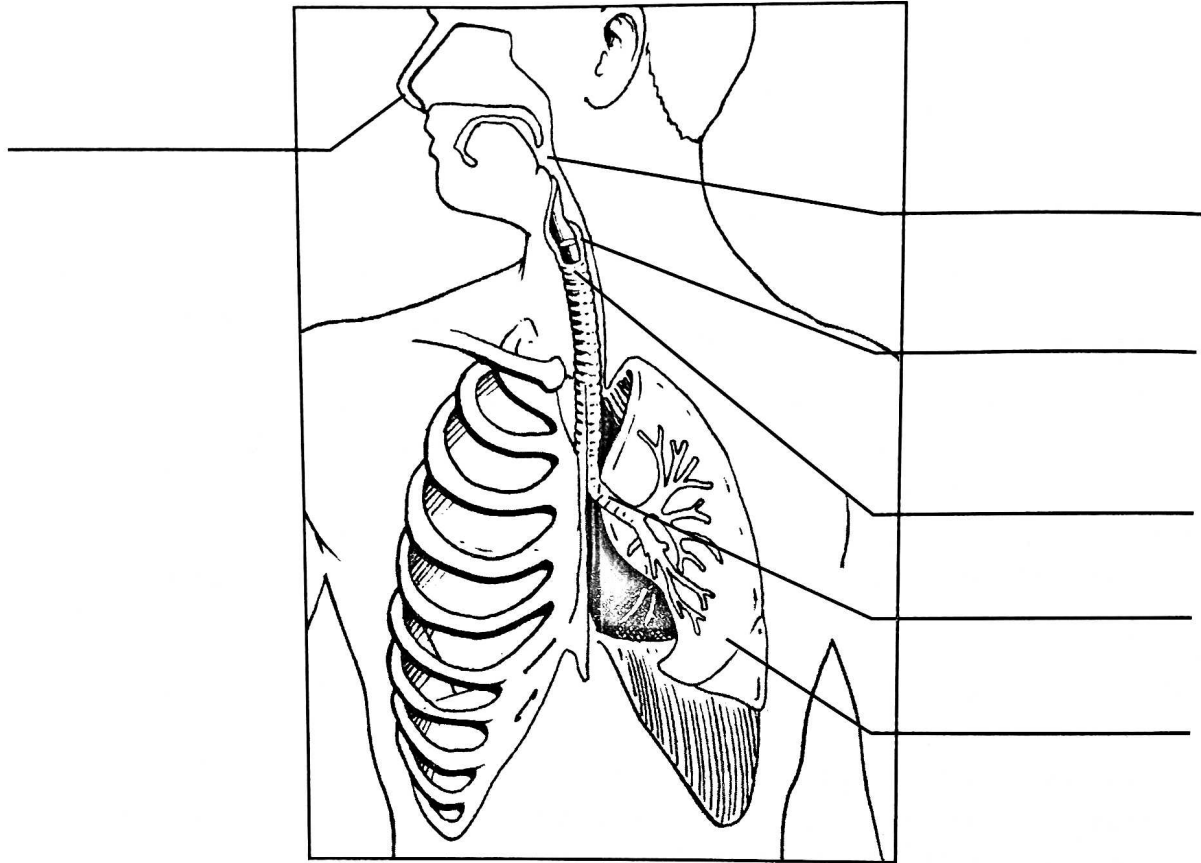
Breathing Movements of the diaphragm and rib cage change air pressure in the chest cavity during inhalation and exhalation.

- ▶ The dome-shaped muscle at the bottom of the chest cavity is the **diaphragm**. During inhalation, contraction of the diaphragm and rib muscles increases chest volume and air rushes in. In exhalation, these muscles relax and air rushes out.
- ▶ The nervous system has final control of the breathing muscles. Breathing does not require conscious control.

Smoking and the Respiratory System Chemicals in tobacco smoke damage structures throughout the respiratory system and have other negative health effects. Smoking causes a number of diseases, including chronic bronchitis, emphysema, and lung cancer.

Structures of the Respiratory System

1. Label each of the structures indicated in this drawing of the human respiratory system.



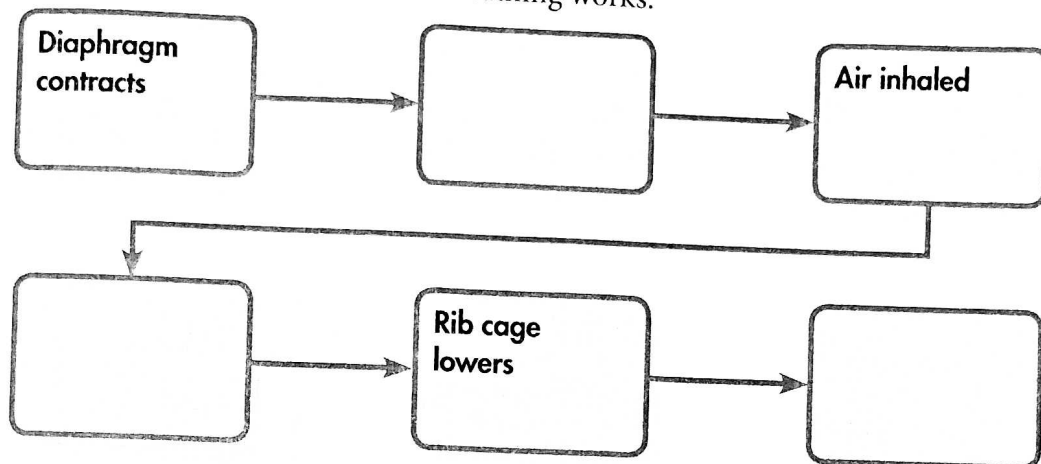
Gas Exchange and Transport

For Questions 2–7, complete each statement by writing the correct word or words.

2. The surface area for gas exchange in the lungs is provided by the _____.
3. The gases exchanged in the lungs are carbon dioxide and _____.
4. The process that exchanges gases across the walls of capillaries is _____.
5. Oxygen diffuses from an area of _____ concentration to an area of lesser concentration.
6. _____ binds with oxygen and increases the blood's oxygen-carrying capacity.
7. Most carbon dioxide combines with _____ in the blood, forming carbonic acid.

Breathing

8. Complete the flowchart to show how breathing works.



Smoking and the Respiratory System

9. Complete the table to describe the health effects of three substances in tobacco smoke.

Substance	Effect
Nicotine	
Carbon monoxide	
Tar	

10. What causes smoker's cough?

11. Smoking even a few cigarettes on a regular basis can lead to chronic bronchitis. What happens to people with this disease?

Apply the Big Idea

12. Smoking and secondhand smoke damage both the respiratory system and the circulatory system. Explain how the close structural relationship of these two systems accounts for the effect of smoke on both systems.
