

15 Respiratory System

LEARNING EXERCISES

Functions and Overview of Respiration

1. In the spaces on the left, write the terms that match the phrases about the sequence of events in respiration.

- A. _____ Exchange of air between atmosphere and lungs
- B. _____ Exchange of gases between lungs and blood
- C. _____ Function of blood in respiration
- D. _____ Exchange of gases between blood and tissues
- E. _____ Utilization of oxygen in the cells

Ventilation

1. Use the letter *U* to designate the regions of the upper respiratory tract and the letter *L* to designate the regions of the lower respiratory tract.

- A. _____ Bronchi
- B. _____ Nose
- C. _____ Larynx
- D. _____ Pharynx
- E. _____ Lungs
- F. _____ Trachea

2. In the spaces on the left, write the answers that match the phrases about the respiratory tract.

- A. _____ Functions of the nasal cavity (3)

- B. _____ Region of pharynx posterior to the nasal cavity
- C. _____ Location of the pharyngeal tonsils
- D. _____ Pharynx from the uvula to the hyoid bone
- E. _____ Lowest region of the pharynx
- F. _____ Cartilage that forms the Adam's apple
- G. _____ Most inferior cartilage of the larynx
- H. _____ Prevents food from entering the larynx

- I. _____ Opening between the true vocal cords
- J. _____ Passage commonly called the windpipe
- K. _____ Ridge of cartilage at bifurcation of the trachea
- L. _____ Tissue that forms lining of the trachea
- M. _____ Tissue that forms the alveoli

3. Arrange the following air passages in the correct sequence from largest to smallest by placing the numbers 1 to 7 in the spaces before the names. Use number 1 for the largest and number 7 for the smallest.

- A. _____ Alveolar ducts
- B. _____ Respiratory bronchioles
- C. _____ Alveoli
- D. _____ Segmental bronchi
- E. _____ Lobar bronchi
- F. _____ Terminal bronchioles
- G. _____ Primary bronchi

4. Place an R in the space preceding the phrase if it refers to the right lung. Place an L in the space if it refers to the left lung. If the phrase applies to both lungs, place a B in the space.

- A. _____ Cardiac notch
- B. _____ Two lobes
- C. _____ Shorter and wider
- D. _____ Divided into lobules
- E. _____ Rests on the diaphragm
- F. _____ Has two fissures
- G. _____ Enclosed by the pleura
- H. _____ Anchored at the root or hilum

5. In the spaces on the left, write the answers that match the phrases about pulmonary ventilation.

- A. _____ Name of pressure between layers of pleurae
- B. _____ Name of pressure outside the body
- C. _____ Name of pressure within the alveoli
- D. _____ Pressure that is normally less than the two others
- E. _____ Primary muscle involved in quiet breathing
- F. _____ Muscles used in forced expiration
- G. _____ Reduces surface tension within the alveoli
- H. _____ Instrument to measure respiratory volumes
- I. _____ Highest pressure during expiration
- J. _____ Highest pressure during inspiration

6. Write *I* in the space if the event occurs during inspiration, and write *E* if it occurs during expiration.

- A. _____ Diaphragm contracts
- B. _____ Intrapulmonary pressure exceeds atmospheric pressure
- C. _____ External intercostal muscles may contract
- D. _____ Atmospheric pressure is greater than intrapulmonary pressure
- E. _____ Lung volume increases
- F. _____ Diaphragm relaxes
- G. _____ Internal intercostal muscles may contract
- H. _____ Air flows into the lungs
- I. _____ Elastic recoil decreases the size of the alveoli

7. Match the lung volumes and capacities with their definitions.

TV = tidal volume

IRV = inspiratory reserve volume

ERV = expiratory reserve volume

RV = residual volume

VC = vital capacity

IC = inspiratory capacity

FRC = functional residual capacity

TLC = total lung capacity

- A. _____ Maximum amount of air that can be inhaled
- B. _____ Amount of air inhaled and exhaled in a quiet breathing cycle
- C. _____ Amount of air in lungs after quiet expiration
- D. _____ Equals TV + IRV + ERV
- E. _____ Maximum amount of air that can be inhaled after a tidal inspiration
- F. _____ Amount of air in lungs after maximum inspiration
- G. _____ Maximum amount of air that can be forcefully exhaled after tidal expiration
- H. _____ Equals RV + ERV
- I. _____ Amount of air in lungs after maximum expiration
- J. _____ Equals RV + ERV + TV + IRV

8. Complete the following table by writing in the correct values in the blank spaces.

TIC	VC	TV	ERV	IRV	RV
		500 mL	1000 mL	3000 mL	1200 mL
6000 mL	5000 mL		900 mL	3500 mL	
	4700 mL	600 mL	800 mL		1100 mL
5900 mL	4600 mL	400 mL		3000 mL	

9. If the individual type on the left tends to have greater lung volume than the type on the right, write > (greater than) on the blank in the center. If the left type tends to have less lung volume than the type on the right, write < (less than).

- | | | |
|--------------------------------------|-------|-----------------------------------|
| A. Young adults | _____ | Senior citizens |
| B. Females | _____ | Males |
| C. Short people | _____ | Tall people |
| D. Normal weight people | _____ | Obese people |
| E. Healthy people | _____ | People with muscular disease |
| F. People in good physical condition | _____ | People in poor physical condition |

Basic Gas Laws and Respiration

1. Atmospheric air is a mixture of oxygen, nitrogen, and carbon dioxide. According to Dalton's law of partial pressures, if the atmospheric pressure is 750 mm Hg and the oxygen content is 21%, what is the pressure due to oxygen?

2. According to Henry's law, what two factors determine how much of each gas in a mixture will dissolve in a liquid?

3. Complete the following statements that define external and internal respiration.

External respiration is the exchange of gases between the _____ and the _____

Internal respiration is the exchange of gases between the _____ and the _____

4. List, in sequence, the six layers of the respiratory membrane through which oxygen must pass to diffuse from the alveolus into the blood capillary.

- A.
- B.
- C.
- D.
- E.
- F.

5. Indicate whether each of the following will increase or decrease the rate of gaseous exchange across the respiratory membrane. Use *I* for increase and *D* for decrease.
- A. _____ Decreasing the surface area of the respiratory membrane
 - B. _____ Fluid accumulation in the alveoli resulting from pulmonary edema
 - C. _____ Increasing tidal volume
 - D. _____ Decreasing breathing rate

Transport of Gases

1. List two ways in which oxygen is transported in the blood.

2. List three ways in which carbon dioxide is transported in the blood.

3. In the spaces on the left, write the answers that match the phrases about oxygen and carbon dioxide transport.

- A. _____ Compound in which most oxygen is transported
- B. _____ Method of most carbon dioxide transport
- C. _____ Combination of carbon dioxide and hemoglobin
- D. _____ Combination of water and carbon dioxide
- E. _____ Enzyme that speeds up the reaction between water and carbon dioxide

4. Place a check (✓) in front of the factors in the tissues that favor unloading of oxygen.

- A. _____ Increased partial pressure of oxygen
- B. _____ Increased partial pressure of carbon dioxide
- C. _____ Increased hydrogen ion concentration
- D. _____ Increased temperature
- E. _____ Increased pH
- F. _____ Increased cellular metabolism

5. Place an E before the phrases that refer to external respiration, and place an I before the phrases that refer to internal respiration.

- A. _____ Oxygen diffuses into the blood
- B. _____ Oxygen diffuses out of the blood
- C. _____ Carbon dioxide diffuses into the blood
- D. _____ Carbon dioxide diffuses out of the blood
- E. _____ Occurs in the alveolus
- F. _____ Occurs in the body tissues
- G. _____ Bicarbonate ion is formed
- H. _____ Bicarbonate ions release carbon dioxide
- I. _____ Oxyhemoglobin is formed
- J. _____ Oxyhemoglobin dissociates and releases oxygen

Regulation of Respiration

1. The respiratory center includes neurons in the _____ and _____.
2. The inspiratory areas of the respiratory center send impulses along the _____ nerve to the diaphragm and along the _____ nerves to the external intercostal muscles.
3. Place a *T* before each true statement and an *F* before each false statement about factors that influence the rate and depth of breathing.
 - A. _____ Chemoreceptors in the medulla oblongata are sensitive to changes in oxygen levels.
 - B. _____ Increases in blood CO₂ levels increase the rate and depth of breathing.
 - C. _____ Increases in hydrogen ion concentrations increase the rate and depth of breathing.
 - D. _____ Chemoreceptors in the medulla oblongata are sensitive to changes in carbon dioxide and hydrogen ion concentrations.
 - E. _____ A decrease in oxygen levels is usually a strong stimulus for breathing.
 - F. _____ Decreased oxygen levels usually make the respiratory center more sensitive to carbon dioxide changes.
 - G. _____ Peripheral chemoreceptors are located in the aortic and carotid bodies.
 - H. _____ The Hering-Breuer reflex prevents overinflation of the lungs.
 - I. _____ The Hering-Breuer reflex is a response to stretch receptors in the lungs.
 - J. _____ Higher brain centers may permanently override the respiratory center.

- K. _____ Anxiety decreases the rate and depth of breathing.
- L. _____ Chronic pain stimulates breathing, but sudden pain may cause a momentary cessation of breathing.
- M. _____ Decreasing body temperature increases the breathing rate.
- N. _____ The primary stimulus for breathing is decreased carbon dioxide levels in the respiratory center.

LABELING & COLORING EXERCISES

1. Figure 15-1 illustrates the conducting passages of the respiratory tract. Color the upper respiratory tract green and the lower respiratory tract yellow. Identify structures as indicated.

- A. _____
- B. _____
- C. _____
- D. _____
- E. _____
- F. _____

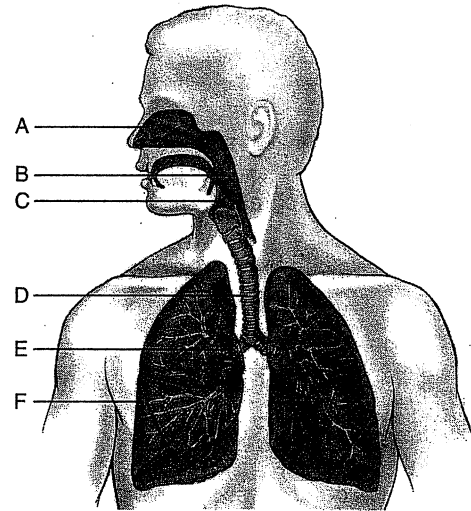


Figure 15-1 Respiratory tract.

2. Figure 15-2 illustrates some of the features of the upper respiratory tract. Color the two sinuses yellow and the tonsils red. Identify structures as indicated.

- A. _____
- B. _____
- C. _____
- D. _____
- E. _____
- F. _____
- G. _____
- H. _____
- I. _____
- J. _____

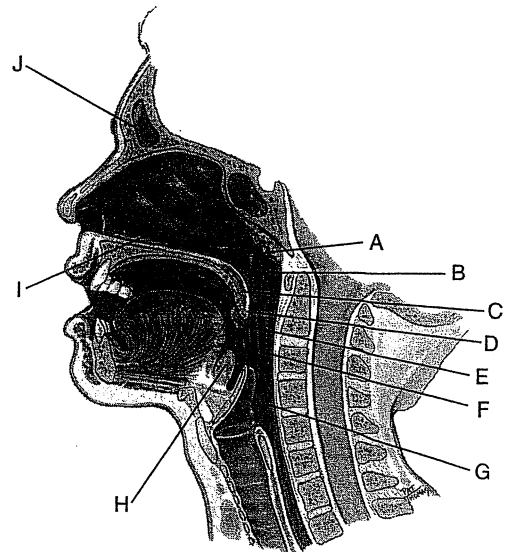


Figure 15-2 Upper respiratory tract.

23. Which normally provides more stimulus for breathing—a decrease in oxygen or an increase in carbon dioxide?
24. How is most of the carbon dioxide transported by the blood?
25. Where is the respiratory center located in the brain?
26. What nerve sends inspiratory impulses to the diaphragm? To the external intercostal muscles?

FUNCTIONAL RELATIONSHIPS

It is important to remember that no system in the body works alone. It takes the interaction of all systems to maintain homeostasis. The following exercises reinforce the concept that all systems work together to maintain the health and wellbeing of other systems and the individual.

Match the system on the right with what it provides for the respiratory system on the left. Use the functional relationships page in your concepts textbook as a resource.

- | | | |
|-----------|--|-------------------|
| 1. _____ | Helps maintain body temperature | A. Cardiovascular |
| 2. _____ | Encloses the lungs for protection | B. Digestive |
| 3. _____ | Creates pressure changes necessary for ventilation | C. Endocrine |
| 4. _____ | Controls rate and depth of breathing | D. Integumentary |
| 5. _____ | Epinephrine stimulates bronchodilation | E. Lymphatic |
| 6. _____ | Transports oxygen and carbon dioxide | F. Muscular |
| 7. _____ | IgA protects respiratory mucosa | G. Nervous |
| 8. _____ | Absorbs nutrients for cell maintenance | H. Reproductive |
| 9. _____ | Eliminates waste products generated by respiratory system | I. Skeletal |
| 10. _____ | Sexual arousal stimulates changes in rate and depth of breathing | J. Urinary |

2. For each of the following systems, write what the respiratory system provides for it.

- A. Cardiovascular _____

- B. Skeletal _____

- C. Reproductive _____
- _____
- D. Endocrine _____
- _____
- E. Lymphatic _____
- _____
- F. Muscular _____
- G. Nervous _____
- _____
- H. Digestive _____
- _____
- I. Urinary _____
- J. Integumentary _____

REPRESENTATIVE DISORDERS

Match the disorder of the respiratory system on the right with its description of the left.

- | | |
|---|---|
| <ul style="list-style-type: none"> 1. _____ Hereditary disorder characterized by the accumulation of excessively thick and adhesive mucus 2. _____ Excessive pressure in the pulmonary arteries 3. _____ Accumulation of fluid in the space between the visceral and parietal layers of pleura 4. _____ Recurrent attacks of difficult breathing because of spasmodic constriction of the bronchi 5. _____ Terminal bronchioles become plugged with mucus, lung tissue loses elasticity, and expiration becomes difficult 6. _____ Lung pathology that occurs after long-term inhalation of pollutants 7. _____ Accumulation of air in the pleural space 8. _____ Abnormality in surfactant that causes alveoli to collapse; often occurs in infants 9. _____ Inflammation of one or more bronchi 10. _____ Infectious, inflammatory disease of the lungs | <ul style="list-style-type: none"> A. Asthma B. Bronchitis C. Cystic fibrosis D. Emphysema E. Pleural effusion F. Pneumoconiosis G. Pneumothorax H. Pulmonary hypertension I. Respiratory distress syndrome J. Tuberculosis |
|---|---|