

13

The Respiratory System

Body cells require an abundant and continuous supply of oxygen to carry out their activities. As cells use oxygen, they release carbon dioxide, a waste product that must be eliminated from the body. The circulatory and respiratory systems are intimately involved in obtaining and delivering oxygen to body cells and in eliminating carbon dioxide from the body. The respiratory system is responsible for gas exchange between the pulmonary blood and the external environment (that is, external respiration). The respiratory system also plays an important role in maintaining the acid-base balance of the blood.

Questions and activities in this chapter consider both the anatomy and physiology of the respiratory system structures.

FUNCTIONAL ANATOMY

1. The following questions refer to the primary bronchi. In the spaces provided, insert the letter *R* to indicate the right primary bronchus and the letter *L* to indicate the left primary bronchus.

1. Which of the primary bronchi is larger in diameter? _____
2. Which of the primary bronchi is more horizontal? _____
3. Which of the primary bronchi is the most common site for lodging of a foreign object that has entered the respiratory passageways? _____

2. Complete the following statements by inserting your answers in the answer blanks.

- _____ 1. Air enters the nasal cavity of the respiratory system through the (1). The nasal cavity is divided by the midline (2).
- _____ 2. The nasal cavity mucosa has several functions. Its major functions are to (3), (4), and (5) the incoming air.
- _____ 3. Mucous membrane-lined cavities called (6) are found in several bones surrounding the nasal cavities. They make the skull less heavy and probably act as resonance chambers for (7).
- _____ 4. The passageway common to the digestive and respiratory systems, the (8), is often referred to as the throat; it connects the nasal cavity with the (9) below. Clusters of lymphatic tissue, (10), are part of the defensive system of the body. Reinforcement of the trachea with (11) rings prevents its collapse during (12) changes that occur during breathing. The fact that the rings are incomplete posteriorly allows a food bolus to bulge (13) during its transport to the stomach. The larynx or voice box is built from many cartilages, but the largest is the (14) cartilage. Within the larynx are the (15), which vibrate with exhaled air and allow an individual to (16).
- _____ 5.
- _____ 6.
- _____ 7.
- _____ 8.
- _____ 9.
- _____ 10.
- _____ 11.
- _____ 12.
- _____ 13.
- _____ 14.
- _____ 15.
- _____ 16.

3. Circle the term that does not belong in each of the following groupings.

- 1. Sphenoidal Maxillary Mandibular Ethmoid Frontal
- 2. Nasal cavity Trachea Alveolus Larynx Bronchus
- 3. Apex Base Hilus Larynx Pleura
- 4. Sinusitis Peritonitis Pleurisy Tonsillitis Laryngitis
- 5. Laryngopharynx Oropharynx Transports air and food Nasopharynx
- 6. Alveoli Respiratory zone Alveolar sac Primary bronchus

4. Figure 13-1 is a sagittal view of the upper respiratory structures. First, correctly identify all structures provided with leader lines on the figure. Then select different colors for the structures listed below and use them to color in the coding circles and the corresponding structures on the figure.

- | | |
|------------------------------------|---|
| <input type="radio"/> Nasal cavity | <input type="radio"/> Larynx |
| <input type="radio"/> Pharynx | <input type="radio"/> Paranasal sinuses |
| <input type="radio"/> Trachea | |

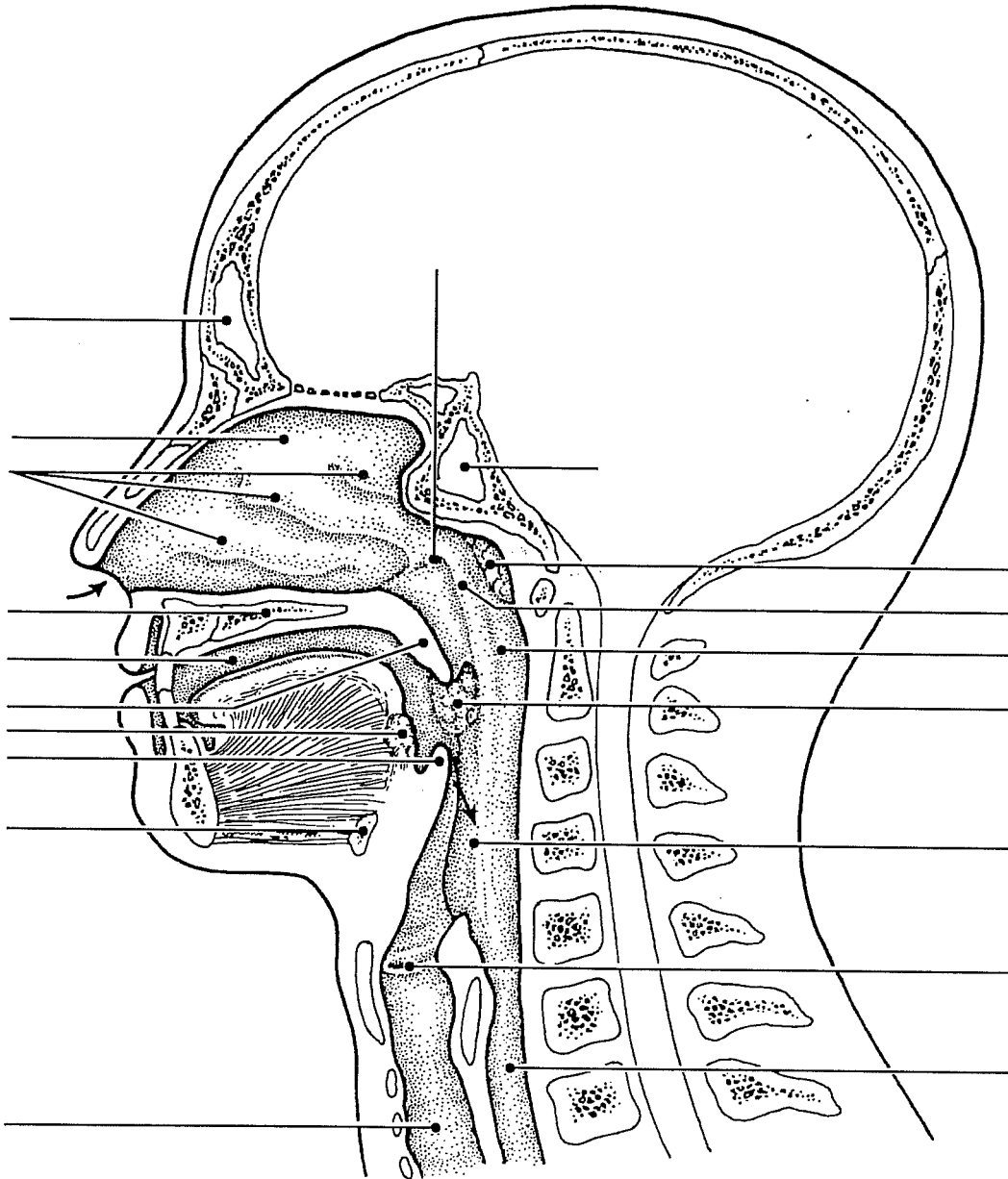


Figure 13-1

5. Using the key choices, select the terms identified in the following descriptions by inserting the appropriate term or letter in the answer blanks.

Key Choices

- | | | | |
|----------------|---------------|--------------------|--------------------|
| A. Alveoli | D. Epiglottis | G. Palate | J. Main bronchi |
| B. Bronchioles | E. Esophagus | H. Parietal pleura | K. Trachea |
| C. Conchae | F. Glottis | I. Phrenic nerve | L. Visceral pleura |

- _____ 1. Smallest conducting respiratory passageways
- _____ 2. Separates the oral and nasal cavities
- _____ 3. Major nerve, stimulating the diaphragm
- _____ 4. Food passageway posterior to the trachea
- _____ 5. Closes off the larynx during swallowing
- _____ 6. Windpipe
- _____ 7. Actual site of gas exchanges
- _____ 8. Pleural layer covering the thorax walls
- _____ 9. Pleural layer covering the lungs
- _____ 10. Lumen of larynx
- _____ 11. Fleshy lobes in the nasal cavity which increase its surface area

6. Complete the following paragraph concerning the alveolar cells and their roles by writing the missing terms in the answer blanks.

- _____ 1. With the exception of the stroma of the lungs, which is (1) tissue, the lungs are mostly air spaces, of which the alveoli
- _____ 2. comprise the greatest part. The bulk of the alveolar walls are made up of squamous epithelial cells, which are well suited
- _____ 3. for their (2) function. Much less numerous cuboidal cells produce a fluid that coats the air-exposed surface of the alveolus and contains a lipid-based molecule called (3) that
- _____ 4. functions to (4) of the alveolar fluid.

7. Figure 13-2 is a diagram of the larynx and associated structures. On the figure, identify each of the structures listed below. Select a different color for each and use it to color in the coding circles and the corresponding structures on the figure. Then answer the questions following the diagram.

- Hyoid bone Tracheal cartilages Cricoid cartilage
 Thyroid cartilage Epiglottis

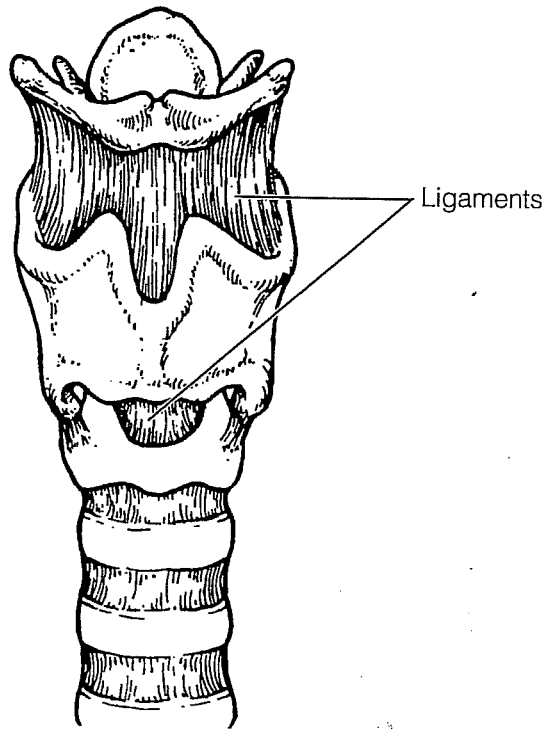


Figure 13-2

1. What are three functions of the larynx? _____

2. What type of cartilage forms the epiglottis? _____
3. What type of cartilage forms the other eight laryngeal cartilages? _____
4. Explain this difference. _____

5. What is the common name for the thyroid cartilage? _____

8. Figure 13-3 illustrates the gross anatomy of the lower respiratory system. Intact structures are shown on the left; respiratory passages are shown on the right. Select a different color for each of the structures listed below and use it to color in the coding circles and the corresponding structures on the figure. Then complete the figure by labeling the areas/structures that are provided with leader lines on the figure. Be sure to include the following: pleural space, mediastinum, apex of right lung, diaphragm, clavicle, and the base of the right lung.

- | | | |
|-----------------------------------|---|---------------------------------------|
| <input type="radio"/> Trachea | <input type="radio"/> Main bronchi | <input type="radio"/> Visceral pleura |
| <input type="radio"/> Larynx | <input type="radio"/> Secondary bronchi | <input type="radio"/> Parietal pleura |
| <input type="radio"/> Intact lung | | |

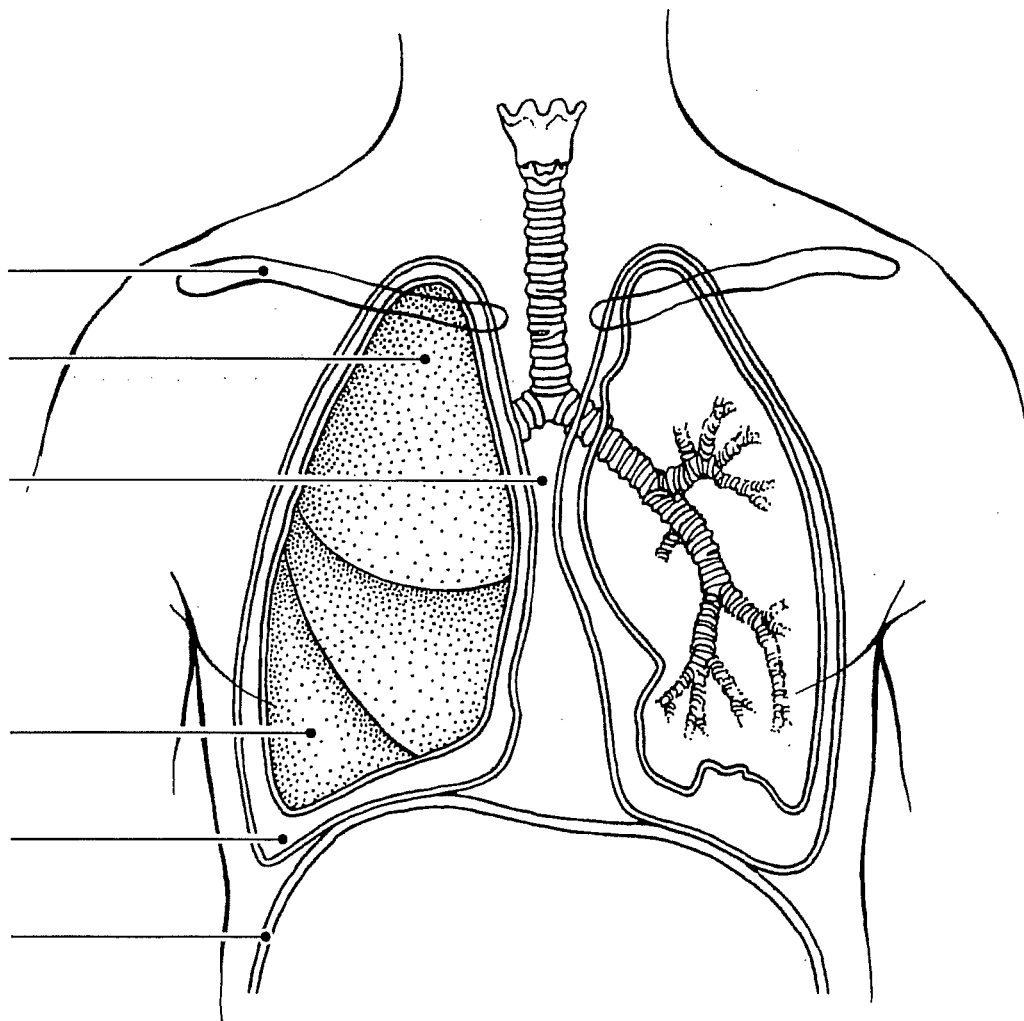
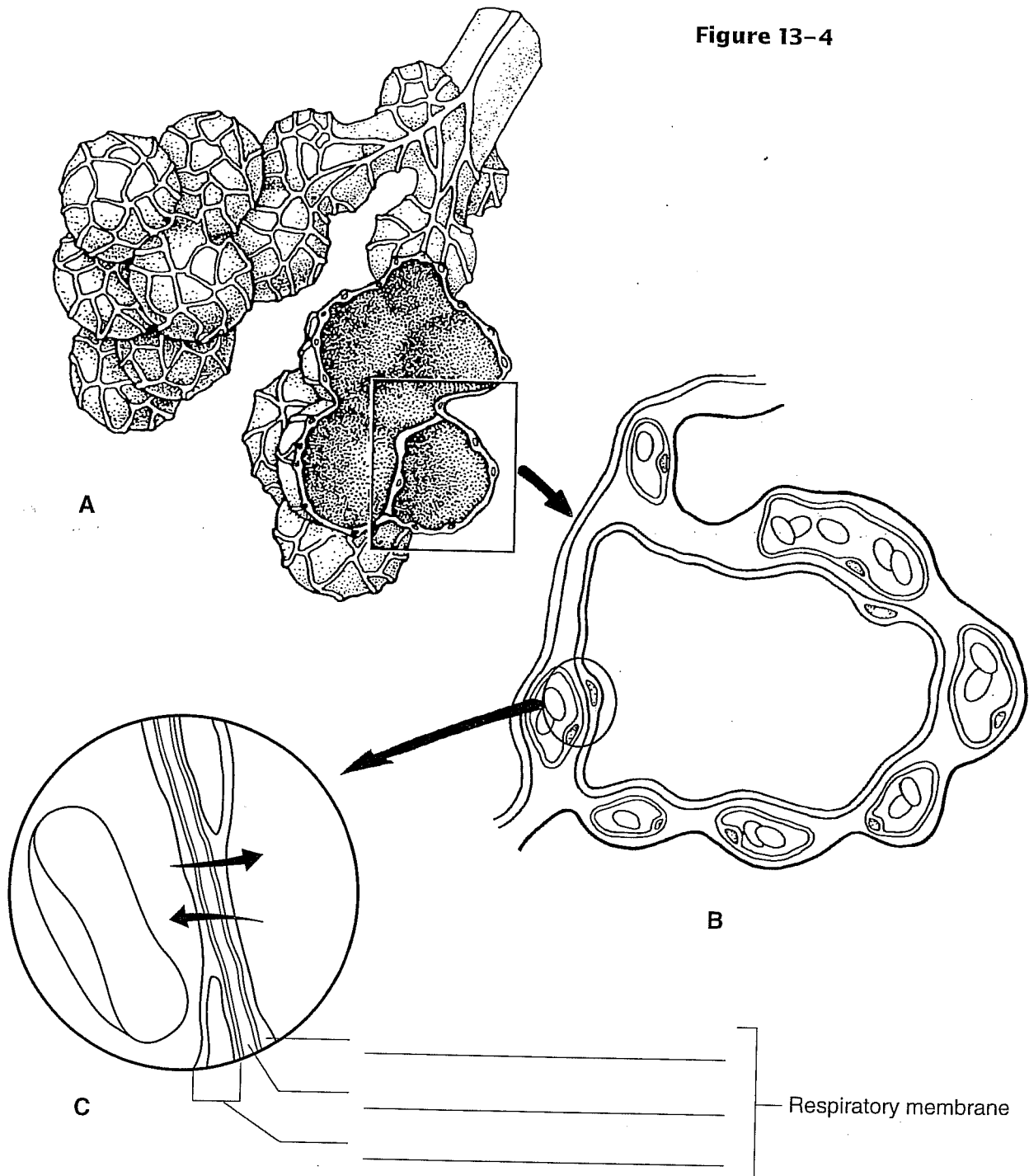


Figure 13-3

9. Figure 13-4 illustrates the microscopic structure of the respiratory unit of lung tissue. The external anatomy is shown in Figure 13-4A. Color the intact alveoli yellow, the pulmonary capillaries red, and the respiratory bronchioles green.

A cross section through an alveolus is shown on Figure 13-4B and a blow-up of the respiratory membrane is shown in Figure 13-4C. On these illustrations color the alveolar epithelium yellow, the capillary endothelium pink, and the red blood cells in the capillary red. Also, label the alveolar chamber and color it pale blue. Finally, in Figure 13-4C label the region of the fused basement membranes; add the symbols for oxygen gas (O_2) and carbon dioxide gas (CO_2) in the sites where they would be in higher concentration and arrows correctly showing their direction of movement through the respiratory membrane.

Figure 13-4



12. Use the key choices to respond to the following descriptions. Insert the correct term or letter in the answer blanks.

Key Choices

- A. External respiration C. Inspiration E. Ventilation (breathing)
 B. Expiration D. Internal respiration

- _____ 1. Period of breathing when air enters the lungs
 _____ 2. Exchange of gases between the systemic capillary blood and body cells
 _____ 3. Alternate flushing of air into and out of the lungs
 _____ 4. Exchange of gases between alveolar air and pulmonary capillary blood

13. Although normal quiet expiration is largely passive due to lung recoil, when expiration must be more forceful (or the lungs are diseased), muscles that increase the abdominal pressure or depress the rib cage are enlisted.

1. Provide two examples of muscles that cause abdominal pressure to rise.

_____ and _____

2. Provide two examples of muscles that depress the rib cage.

_____ and _____

14. Four nonrespiratory movements are described here. Identify each by inserting your answers in the spaces provided.

1. Sudden inspiration, resulting from spasms of the diaphragm. _____

2. A deep breath is taken, the glottis is closed, and air is forced out of the lungs against the glottis; clears the lower respiratory passageways. _____

3. As just described, but clears the upper respiratory passageways. _____

4. Increases ventilation of the lungs; may be initiated by a need to increase oxygen levels in the blood. _____

15. The following section concerns respiratory volume measurements. Using key choices, select the terms identified in the following descriptions by inserting the appropriate term or letter in the answer blanks.

Key Choices

- | | | |
|------------------------------------|-------------------------------------|------------------------|
| A. Dead space volume | C. Inspiratory reserve volume (IRV) | E. Tidal volume (TV) |
| B. Expiratory reserve volume (ERV) | D. Residual volume (RV) | F. Vital capacity (VC) |

- _____ 1. Respiratory volume inhaled or exhaled during normal breathing
- _____ 2. Air in respiratory passages that does not contribute to gas exchange
- _____ 3. Total amount of exchangeable air
- _____ 4. Gas volume that allows gas exchange to go on continuously
- _____ 5. Amount of air that can still be exhaled (forcibly) after a normal exhalation

16. Figure 13–5 is a diagram showing respiratory volumes. Complete the figure by making the following additions.

1. Bracket the volume representing the vital capacity and color the area yellow; label it VC.
2. Add green stripes to the area representing the inspiratory reserve volume and label it IRV.
3. Add red stripes to the area representing the expiratory reserve volume and label it ERV.
4. Identify and label the respiratory volume, which is *now just yellow*. Color the residual volume (RV) blue and label it appropriately on the figure.
5. Bracket and label the inspiratory capacity (IC).

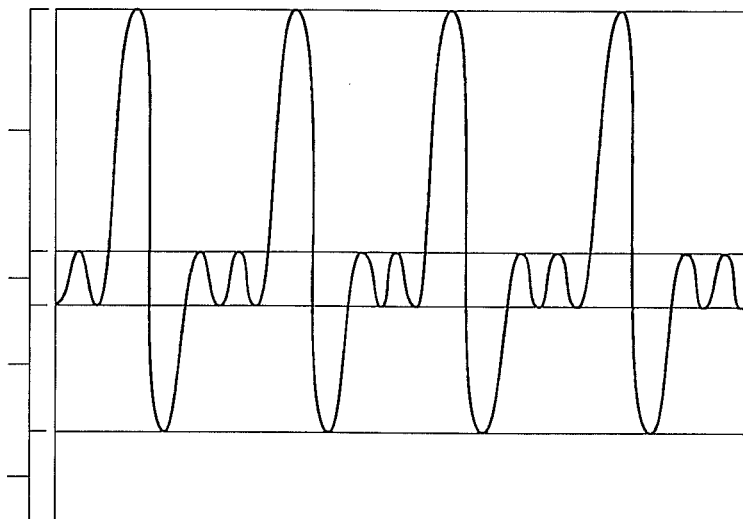


Figure 13–5

20. There are several levels of breathing control. Match the structures given in Column B to the appropriate descriptions provided in Column A. Place the correct term or letter response in the answer blanks provided.

Column A	Column B
_____ 1. Smooth out the basic rhythm of breathing set by the medulla	A. Chemoreceptors in the aortic and carotid bodies
_____ 2. Respiratory control center in the medulla	B. Intercostal
_____ 3. Respond to overinflation of the lungs	C. Inspiratory center
_____ 4. Respond to decreased oxygen levels in the blood	D. Phrenic
_____, _____ 5. Nerves that carry activating impulses to the muscles of inspiration	E. Pons centers
	F. Stretch receptors in the lungs

RESPIRATORY DISORDERS

21. Match the terms in Column B with the pathologic conditions described in Column A.

Column A	Column B
_____ 1. Lack or cessation of breathing	A. Apnea
_____ 2. Normal breathing in terms of rate and depth	B. Asthma
_____ 3. Labored breathing, or "air hunger"	C. Chronic bronchitis
_____ 4. Chronic oxygen deficiency	D. Dyspnea
_____ 5. Condition characterized by fibrosis of the lungs and an increase in size of the alveolar chambers	E. Emphysema
_____ 6. Condition characterized by increased mucus production, which clogs respiratory passageways and promotes coughing	F. Eupnea
_____ 7. Respiratory passageways narrowed by bronchiolar spasms	G. Hypoxia
_____ 8. Together called COPD	H. Lung cancer
_____ 9. Incidence strongly associated with cigarette smoking; outlook is poor	I. Tuberculosis
_____ 10. Infection spread by airborne bacteria; a recent alarming increase in drug users and AIDs victims	