

14 Respiration

I. Chapter Outline

- A. Breathing
 - 1. Air Passageway: Filters, Warms, Moistens
- B. The Mechanism of Breathing
 - 1. Inspiration Is Active
 - 2. Expiration Is Usually Passive
 - 3. How Much Do Lungs Hold?
 - 4. Dead Space in Airways
- C. External and Internal Respiration
 - 1. External Respiration: Air Sacs and Blood
 - 2. Internal Respiration: Blood and Tissue Fluid
- D. Respiration and Health
 - 1. Respiratory Tract Infections
 - 2. Lung Disorders

II. Chapter Review

Page	Questions
239	1. Write the equation for cellular respiration. What does the term <i>respiration</i> refer to?
	2. Define the 4 components of respiration.
	3. Contrast the composition of inspired air with that of expired air.
241	4. What happens to the air as it moves along the air passages? What happens to the air as it is expired?
	5. How do we get a sinus headache? What tube leads into the nasopharynx from the middle ears?
	6. What 2 passages temporarily join in the pharynx?
	7. Name the opening at the top of the larynx. Why doesn't food enter the glottis when food is swallowed?
243	8. What factors determine the pitch of the voice? The loudness of the voice?
	9. What is the function of the C-shaped cartilaginous rings in the trachea? Of the cilia? Of a tracheotomy?
	10. As the bronchial tubes divide what happens to their walls? Describe each alveolar sac.
	11. Describe what happens in infant respiratory distress syndrome.
244	12. Give 2 important things to remember in order to explain ventilation. What is the importance of having the intrapleural pressure less than the atmospheric pressure?
245	13. What are the primary stimuli that cause us to breathe? List the chemoreceptors that respond to $[H^+]$, carbon dioxide, and oxygen in the blood.
	14. What happens when the respiratory center sends out nerve impulses to the diaphragm and the rib cage?
	15. Is inspiration an active or passive process? Why is it said that humans breathe by negative pressure?
	16. What causes the air to be pushed out during expiration?
247	17. Although expiration is normally a passive process, when can it become an active process?
	18. Define the following terms: <i>tidal volume</i> , <i>vital capacity</i> , <i>inspiratory reserve volume</i> , <i>expiratory reserve volume</i> , and <i>residual volume</i> .
	19. How can some of the inspired air never reach the lungs? What is that region termed?
248	20. Where does external respiration occur? What governs gas exchange at this site? What structural and physical features allow for this exchange to occur?
	21. Why does carbon dioxide diffuse out of the blood into the alveoli? How is most of the carbon dioxide being carried to the lungs?
252	22. What happens to hemoglobin in the blood when the partial pressure of oxygen increases in the lungs? How does this relate to temperature and pH?
253	23. Why does oxygen diffuse out of the blood and into the tissue during internal respiration?
	24. What is the role of carbonic anhydrase in red blood cells at the tissue site?
	25. How is carbon dioxide transported in the blood? Which is the most abundant way for CO_2 transport?
	26. Why is it important for hemoglobin to combine with excess hydrogen ions?
	27. What accounts for the rapid spread of a flu virus?
	28. What causes acute bronchitis? Name the organism that causes strep throat. How can it be treated?
	29. Name the organism that is usually responsible for pneumonia in AIDS patients?

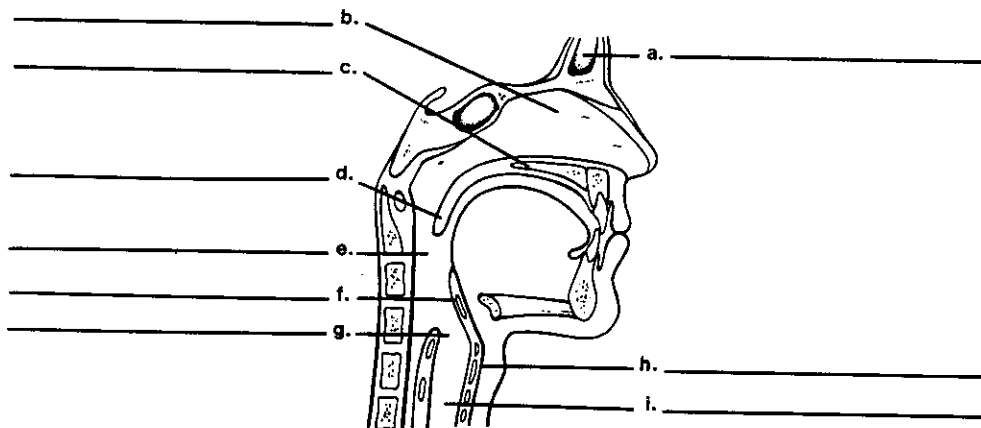
- 254 30. What is tuberculosis caused by? What does it form in the lungs?
 255 31. In emphysema, what happens to the alveolar walls? Why does this occur? How does this affect breathing?
 32. Why has lung cancer in women surpassed breast cancer as a cause of death? In lung cancer, what is the final step in the process?

III. Objective Chapter Test

Completion and Short Answer Questions

- The 2 processes involved in breathing are _____ and _____.
- Fill in the blanks to describe the path that air takes in sequence: nasal cavities → _____ → larynx → _____ → bronchi → _____ → alveoli.
- During inspiration, the rib cage moves up and _____; the diaphragm moves _____.
- The primary stimulus for breathing is the amount of _____ in the blood.
- Oxygen moves from the alveoli to the capillaries by means of _____.
- Carbon dioxide is carried primarily in the plasma as the _____ ion.
- Hemoglobin readily takes up oxygen in the lungs where the pH is _____ and the temperature is _____ (*cool, warm, hot*).
- At the tissues, _____ diffuses out of the blood and _____ diffuses into the blood.
- When food is swallowed, the respiratory passage is closed off. How are the nasal passages closed off? _____

 How is the trachea (larynx) closed off? _____
- Label this drawing showing the path of air.



- Indicate whether the following phrases describe (1) inspiration or (2) expiration.
 - ___ a. lungs expanded
 - ___ b. muscles (diaphragm and ribs) relaxed
 - ___ c. diaphragm dome-shaped
 - ___ d. chest enlarged
 - ___ e. less air pressure in lungs than in the atmosphere

12. Put the following statements into the proper sequence.
- Respiratory center stops sending messages to diaphragm and rib muscles.
 - Respiratory center sends excitatory message to diaphragm and rib muscles.
 - Diaphragm becomes dome-shaped and rib muscles relax.
 - Chest expands as diaphragm goes down and rib cage goes out.
 - Air goes rushing out as lungs recoil.
 - Air comes rushing in as lungs expand.
 - Expanded lungs send message to respiratory center.

Letter answers: _____

13. External and internal respiration. After studying figure 14.10 in the text, answer these questions:

- Where does oxygen enter the blood? _____
- Where does oxygen exit from the blood? _____
- Where does carbon dioxide enter the blood? _____
- Where does carbon dioxide exit from the blood? _____
- In the diagram, what 2 types of vessels are high in oxygen concentration? _____

- In the diagram, what 2 types of vessels are high in carbon dioxide concentration? _____

14. Transport of gases

- Give the overall equation that describes how oxygen is transported by hemoglobin in the blood. Label one arrow *lungs* and the reverse arrow *tissues*.
- Give the overall equation that describes how most of the carbon dioxide is transported in the blood. Label one arrow *lungs* and the reverse arrow *tissues*.

15. a. What is the name of the enzyme that speeds up the reaction in question 14b above? _____
- b. Carbon dioxide transport produces hydrogen ions. Why does the blood not become acid? _____

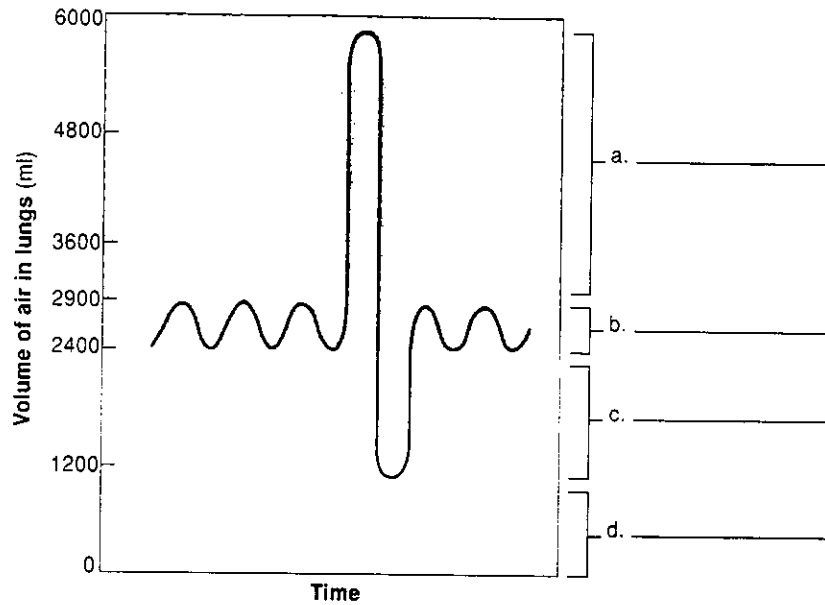
16. a. Hemoglobin is remarkably suited to the transport of oxygen. Why? _____

- b. How does hemoglobin help with the transport of carbon dioxide? _____

17. The name of an instrument used to measure the amount of air that can be maximally inhaled and exhaled is _____

18. The operation used to place a tube inside the trachea is termed a _____

19. In the diagram below, label the parts with the following terms: *tidal volume*, *residual volume*, *inspiratory reserve volume*, and *expiratory reserve volume*.



20. In the above diagram, the sum of the volumes labeled *a*, *b*, and *c* is termed the _____.

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

21. Diffusion of gases occurs in the lungs but not in the tissues.
 Answer: _____ Restatement: _____
22. The trachea is held open by cartilaginous rings so that food can pass down more easily.
 Answer: _____ Restatement: _____
23. The glottis is covered over by the epiglottis during swallowing.
 Answer: _____ Restatement: _____
24. The alveolus is a thin-walled air sac surrounded by a thick capillary wall.
 Answer: _____ Restatement: _____
25. The thoracic cavity and lungs are separated by a fluid-filled space having a positive pressure.
 Answer: _____ Restatement: _____
26. Chemoreceptors found in the carotid and aortic bodies communicate with the respiratory center in the medulla.
 Answer: _____ Restatement: _____

27. When the lungs are expanded, the respiratory center is inhibited by nerve impulses from the alveolar walls.

Answer: _____ Restatement: _____

28. The direction in which gases move between the lungs and the blood is determined by temperature.

Answer: _____ Restatement: _____

29. When hemoglobin is combined with oxygen, it tends to be red in color.

Answer: _____ Restatement: _____

30. The pleural membrane is a sheet of muscle that separates the chest cavity from the abdominal cavity in humans.

Answer: _____ Restatement: _____

Multiple Choice Questions

31. External respiration is defined as

- a. an exchange of gases in the lungs.
- b. breathing.
- c. an exchange of gases in the tissues.
- d. cellular respiration.

32. The structure(s) that receive(s) air after the bronchi is (are) the

- a. pharynx.
- b. trachea.
- c. bronchioles.
- d. villi.

33. When the lungs recoil,

- a. inspiration occurs.
- b. external respiration occurs.
- c. internal respiration occurs.
- d. expiration occurs.
- e. All of the above are true.

34. The breathing center

- a. is excited by carbon dioxide.
- b. is located in the medulla.
- c. sends excitatory messages to the diaphragm and rib cage.
- d. can be inhibited.
- e. All of the above are true.

35. Carbon dioxide is carried in the plasma

- a. in combination with hemoglobin.
- b. as the bicarbonate ion.
- c. combined with carbonic anhydrase.
- d. in red blood cells.
- e. Both answers *a* and *b* are correct.

36. Hemoglobin combines with _____ more readily in the _____

- a. oxygen; lungs.
- b. carbon dioxide; tissues.
- c. oxygen; tissues.
- d. carbon dioxide; lungs.
- e. Both answers *a* and *b* are correct.

37. Smoking cigarettes

- a. causes tuberculosis.
- b. leads to emphysema and cancer.
- c. increases the vital capacity of the lungs.
- d. leads to good health and a longer life.

38. The chest is

- a. expanded during inspiration.
- b. closed off from the abdominal cavity by the diaphragm.
- c. divided into an area for the lungs and an area for the heart.
- d. All of the above are true.

39. When carbonic acid dissociates,
- hemoglobin is directly involved in buffering the blood.
 - the lungs have a lower pH than tissues.
 - it does not do so in the presence of hemoglobin.
 - buffering of the blood does not occur.
40. Before oxygen is picked up in the lungs by hemoglobin, it first diffuses through (a) alveolar cells, (b) blood plasma, (c) erythrocyte membranes, and (d) capillary walls, though not necessarily in this order. What is the correct order?
- a, b, d, c
 - a, d, b, c
 - d, a, c, b
 - a, b, c, d
 - a, d, c, b
41. The crossing of the digestive and respiratory tracts in the pharynx creates a need for
- swallowing.
 - external nares.
 - an epiglottis.
 - a diaphragm.
 - olfactory epithelium.
42. The alveoli will collapse due to high surface tension if an infant has
- pneumonia.
 - emphysema.
 - lung cancer.
 - respiratory distress syndrome.
43. _____ is a condition in which the lungs are inflated due to trapped air caused by a destruction of the bronchioles.
- Pneumonia.
 - Tuberculosis
 - Emphysema
 - Lung cancer
 - Pulmonary fibrosis
44. For ventilation to take place, which of the following is not necessary?
- continuous column of air from pharynx to alveoli
 - sealed-off thoracic cavity
 - breath by a positive pressure
 - intrapleural pressure less than atmospheric pressure
 - outer and inner pleural membranes separated by film of fluid

IV. Subjective Chapter Test

45. The surface area of the alveoli in the lungs is approximately 40 times the surface area of the skin. Why is this huge surface area so important? How does this relate to the velocity of blood within the capillaries surrounding the alveoli?