Chapter 13 The Respiratory System

OVERVIEW

The purpose of this chapter is to teach the anatomy and physiology of the respiratory system and to present select concepts associated with pathophysiology or disease issues of the respiratory system.

Gas exchange and gas transport are two difficult concepts for most anatomy and physiology students. Cooperative learning can be useful here in that it can present multiple ways of explaining a topic that may work for an individual student's learning style. This chapter includes group activities on gas exchange and gas transport. Prior knowledge of muscle metabolism (Chapter 6) and the effects of exercise on the cardiovascular system (Chapter 11) can be reviewed to facilitate the group activity on the effects of exercise on the respiratory system listed under Individual Outcome 13.13.

The Discussion Point (Deep breath) listed under Individual Outcome 13.5 works well as an opening discussion for the system. The discussion can be left open-ended and returned to as more and more is learned about the anatomy and physiology of the system.

Chapter figures can be found in the Online Learning Center (OLC). Discussion points, group activities, and quizzes listed in the summary table below are explained under their individual outcomes following the table. Answer keys to the text chapter review questions, workbook concept maps, and workbook review questions are located at the end of the chapter.

A review guide is also available on the OLC. This guide lists all of the learning outcomes for the chapter and gives space for students to take notes and make sketches. This can be an important tool to encourage students to pay attention to what they are learning and to use to either take initial notes or to organize their existing notes before exams.

Learning Outcome	CAAHEP Competencies	ABHES Competencies
13.1 Use medical terminology related to the respiratory system.	I.C.1. Describe structural organization of the human body	3.a. Define and use entire basic structure of medical words and be able to accurately identify in the correct context, i.e., root, prefix, suffix, combinations, spelling and definitions
13.2 Trace the flow of air from the nose to the pulmonary alveoli and relate the function of each part of the respiratory tract to its gross and microscopic	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.

anatomy.		
13.3 Explain the role of surfactant.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
13.4 Describe the respiratory membrane.	I.C.3. Describe body planes, directional terms, quadrants, and cavities	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
13.5 Explain the mechanics of breathing in terms of anatomy and pressure gradients.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
13.6 Define the measurements of pulmonary function.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
13.7 Define partial pressure and explain its relationship to a gas mixture such as air.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
13.8 Explain gas exchange in terms of the partial pressures of gases at the capillaries and the alveoli and at the capillaries and the tissues.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
13.9 Compare the composition of inspired and expired air.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
13.10 Explain the factors that influence the efficiency of alveolar gas exchange.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
13.11 Describe the mechanisms for transporting O_2 and CO_2 in the blood.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
13.12 Explain how respiration is regulated to homeostatically control blood gases and pH.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
13.13 Explain the functions of the respiratory system.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
13.14 Summarize the effects of aging on the respiratory system.	I.C.10. Compare body structure and function of the human body across the life span	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.

13.15 Describe common diagnostic tests used for respiratory system disorders.	I.C.6. Identify common pathology related to each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
13.16 Describe respiratory system disorders and relate abnormal function to pathology.	I.C.6. Identify common pathology related to each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.

SUMMARY TABLE 13

LEARNING OUTCOME	LECTURE OUTLINE	ACTIVITIES – TALKING POINTS	ASSESSMENTS
13.1 Use medical terminology related to the respiratory system.		***WkBk Word Roots and Combining Forms***	***WkBk Chapter Review Questions:*** • Word Deconstruction: 1-5
13.2 Trace the flow of air from the nose to the pulmonary alveoli and relate the function of each part of the respiratory tract to its gross and microscopic anatomy.	I. Overview II. Anatomy of the respiratory system A. Nose 1. Nasal cavity a. Sinuses 2. Pharynx a. Nasopharynx b. Oropharynx c. Laryngopharynx 3. Larynx a. Vocal cords 4. Trachea 5. Lungs and the bronchial tree	***WkBk Coloring Book:*** • Upper respiratory tract ***WkBk figure:*** 13.1 (The upper respiratory tract) • Lower respiratory tract ***WkBk figure:*** 13.2 (The lower respiratory tract) **Talking Point:** The best way to study the respiratory structures is to trace a molecule of air as it passes through the various structures of the respiratory system. Identify the structures and discuss them as the molecule of air travels toward the alveoli of the lungs.	***Spot Check:*** 1-6 **Quiz: 1** (Covers LO 13.2. See Individual Outcome 13.2) Figure IMQ13.1 ***WkBk Chapter Review Questions:*** • MS: 7 • Completion:5

	a. Alveoli **Chapter Figures:** 13.2 (The respiratory system anatomy) 13.3 (The nose) 13.4 (The anatomy of the upper respiratory tract) 13.5 (The larynx) 13.6 (Action of laryngeal muscles on vocal cords) 13.7 (Endoscopic view of the vocal cords as seen with a laryngoscope) 13.8 (The trachea and bronchi) 13.9 (Lining of trachea) 13.10 (Gross anatomy of the lungs and bronchial tree) 13.11 (Cross section of a cadaver through the thoracic cavity) 13.12 (Bronchiole, alveoli, and respiratory membrane) 13.13 (Histology of the lung)		
13.3 Explain the role of surfactant.	b. Surfactant **Chapter figure:** 13.12 c (Bronchiole, alveoli, and		***WkBk Chapter Review Questions:*** • Completion:1

	the respiratory membrane)		
13.4 Describe the respiratory membrane.	c. Respiratory membrane **Chapter figure:** 13.12 c (Bronchiole, alveoli, and the respiratory membrane)	***WkBk Coloring Book:*** • Respiratory membrane ***WkBk figure:*** 13.3 (The respiratory membrane)	***WkBk Chapter Review Questions:*** • MS: 1, 3
13.5 Explain the mechanics of breathing in terms of anatomy and pressure gradients.	III. Physiology of the respiratory system A. Mechanics of breathing **Chapter Figures:** 13.14 (Respiratory muscles) 13.15 (A respiratory cycle of inspiration, expiration, and rest)	**Discussion Point:** Deep breath. See Individual Outcome 13.5. **Talking Point:** Mechanics of breathing demo. Two thin sheets of plastic, such as two transparencies, can be used to demonstrate the effect of pleural fluid between the parietal and visceral pleurae. See Individual Outcome 13.5. **Talking Point:** Stress this: when the diaphragm muscle contracts, it drops thus increasing the size of the thoracic cavity. An increase in the size of the thoracic cavity automatically reduces the internal pressure of the lungs --- air goes in. When the ribs go up, this also increases the size of the thoracic cavity. When the ribs go down and the diaphragm muscle goes up (relaxes) the size of the thoracic cavity decreases. A decrease in the size of the thoracic cavity will automatically increase	***WkBk Chapter Review Questions:*** • MS: 4 • Completion:4

		internal pressure --- air goes out. **Demonstration:** Ask for two volunteers to have the size of their chest measured. Use a tape measure, such as the type a seamstress uses, to measure the size of each person's chest at rest and after taking a deep breath. The deep breath measurement should be larger in girth. **Talking Point:** Pneumothorax Clinical Point. Figure 13.11 is a cadaver photo that represents a pneumothorax. There is a separation of the visceral and parietal pleurae of the left lung, so the lung will not expand with the thoracic wall during inspiration.	
13.6 Define the measurements of pulmonary function.	B. Measurements of pulmonary function 1. TV 2. IRV 3. ERV 4. RV 5. FRC 6. IC 7. VC 8. TLC	***WkBk Lab Exercises and Activities:*** • Spirometry ***WkBk figures:*** 13.4 (Wet spirometer) 13.5 (Student spirometry graph)	**Quiz:** 2 (Covers LO 13.6. See under Individual Outcome 13.6 below) ***WkBk Chapter Review Questions:*** • MS: 2 **Case Study:** 1

	Chapter Figures: 13.16 (Spirometry) 13.17 (Graph of pulmonary volumes and capacities) **Table:** 13.1 (Lung volumes and capacities)		
13.7 Define partial pressure and explain its relationship to a gas mixture such as air.	C. Composition of air	***WkBk Concept Maps:*** Figure 13.7 (Partial pressure concept map)	***Spot Check:*** 7 ***WkBk Chapter Review Questions:*** • MS: 9 • Completion: 2
13.8 Explain gas exchange in terms of the partial pressures of gases at the capillaries and the alveoli and at the capillaries and the tissues.	D. Gas exchange **Chapter Figures:** 13.18 (Gas exchange) 13.19 (Changes in P_{O2} and P_{CO2} along the respiratory route)	***WkBk Lab Exercises and Activities:*** • Gas exchange ***WkBk figure:*** 13.6 (Gas exchange) ***WkBk Concept Maps:*** Figure 13.8 (Gas exchange concept map) **Talking Point:** Mention that the wall of the alveolar sacs is only one layer thick of squamous cells. This thin layer is necessary in order for gas exchange. The draw-back for being so thin is if they burst due to cigarette smoke (for example), they cannot repair themselves. However, if they	***WkBk Chapter Review Questions:*** • MS: 3 • Critical Thinking: 2 **Case Study:** 3, 4

		were made of several layers, they could possibly repair but gas exchange would be hindered.	
13.9 Compare the composition of inspired and expired air.	1. Comparison of inspired and expired air **Chapter Figure:** 13.19 (Changes in P_{O2} and P_{CO2} along the respiratory route)	***WkBk Concept Maps:*** Figure 13.7 (Partial pressure concept map)	**Quiz:** 3 (Covers LO 13.7-13.9. See Individual Outcome 13.9) Figure IMQ13.3 ***WkBk Chapter Review Questions:*** • MS: 5 • Critical Thinking: 2 **Case Study:** 3, 4
13.10 Explain the factors that influence the efficiency of alveolar gas exchange.	2. Factors that influence gas exchange a. Concentration of the gases b. Membrane area c. Membrane thickness d. Solubility of the gas e. Ventilation-perfusion coupling i. Lung perfusion ii. Alveolar		***Spot Check:*** 8 ***WkBk Chapter Review Questions:*** • MS: 3, 8 • Matching: 8 • Completion:3

	ventilation **Chapter Figures:** 13.20 (Influence on gas exchange) 13.21 (Glass of club soda) 13.22 (Ventilation-perfusion coupling)		
13.11 Describe the mechanisms for transporting O_2 and CO_2 in the blood.	E. Gas transport 1. Systemic gas exchange and transport 2. Alveolar gas exchange and transport **Chapter Figures:** 13.23 (Systemic gas exchange and transport) 13.24 (Alveolar gas exchange and transport)	**Group Activity:** Gas Transport. See Individual Outcome 13.11 ***WkBk Concept Maps:*** Figure 13.9 (Oxygen transport concept map) Figure 13.10 (Carbon dioxide transport concept map)	***WkBk Chapter Review Questions:*** • Matching: 6, 7, 9, 10
13.12 Explain how respiration is regulated to homeostatically control blood gases and pH.	F. Regulation of respiration 1. Stretch receptors in the thoracic wall. 2. Proprioceptor in muscles and joints.	***WkBk Concept Maps:*** Figure 13.11 (Regulation of respiration concept map)	***WkBk Chapter Review Questions:*** • MS: 10 • Critical Thinking: 1

	3. Pontine respiratory group in the pons. 4. Cerebral cortex 5. Peripheral chemoreceptors in the aortic arch and carotid arteries. **Chapter Figures:** 13.25 (Control centers for respiration) 13.26 (Peripheral chemoreceptors of respiration)		
13.13 Explain the functions of the respiratory system.	G. Functions of the respiratory system 1. Acid-base balance 2. Speech 3. Sense of smell 4. Creation of pressure gradients necessary to circulate blood and lymph. **Chapter Figure:** 13.27 (Carol)	**Group Activity:** Exercise. See Individual Outcome 13.13.	***WkBk Chapter Review Questions:*** • Critical Thinking: 3
13.14 Summarize the effects of aging on the respiratory system.	IV. Effects of aging on the respiratory system		***WkBk Chapter Review Questions:*** • MS: 6

13.15 Describe common diagnostic tests used for respiratory system disorders.	V. Diagnostic tests for respiratory system disorders. A. Arterial blood gas B. Biopsy C. Chest X-ray D. CBC E. CT F. Mantoux text for TB G. Monospot test H. Oxygen saturation test I. Peak flow meter J. Pulmonary angiogram K. Pulse oximetry L. Rapid influenza test M. Rapid strep test N. Spirometry O. Thoracentesis P. Ultrasound **Table:** 13.2 (diagnostic tests for respiratory system disorders)		***Spot Check:*** 9 ***WkBk Matching:*** 1-5
13.16 Describe respiratory system disorders and relate abnormal function to pathology.	VI. Respiratory system disorders A. Respiratory infections 1. Cold 2. Influenza		***Spot Check:*** 10 ***WkBk Case Study:*** 1, 2, 3, 4

	3. Pharyngitis 4. Laryngitis 5. Croup 6. Tuberculosis 7. Pertussis 8. Acute bronchitis 9. Pneumonia B. COPDs 1. Chronic bronchitis 2. Emphysema **Chapter Figures:** 13.28 (Lung x-ray showing tuberculosis) 13.29 (Ruptured alveoli from a lung of a patient with emphysema) 3. Asthma C. Respiratory distress syndrome D. Cancers of the respiratory system 1. Laryngeal cancer 2. Lung cancer a. Squamous cell carcinoma		

	b. Adenocarcinoma c. Oat cell carcinoma **Table:** 13.3 (Summary of diseases and disorders of the respiratory system) **Chapter Figures:** 13.30 (Laryngeal cancer) 13.31 (Lung cancer)		

INDIVIDUAL OUTCOMES

OUTCOME 13.2

Spot Check 1: Why do you think the vestibule is stratified epithelial tissue instead of mucous membranes?

Answer: It is a stronger, more durable tissue to withstand probing fingers.

Spot Check 2: Compare the direction the cilia move debris in the nasopharynx to the direction they move debris in the trachea. How do they differ?

Answer: The cilia in the nasopharynx move the debris down to the oropharynx, while the cilia of the trachea move the debris up toward the pharynx.

Spot Check 3: A patient on a ventilator has a tube inserted into the trachea through a procedure called a **tracheostomy.** What should be done to the air delivered through a ventilator considering the respiratory anatomy leading to the trachea has been bypassed?

Answer: The air should be warmed and moistened because it has bypassed much of the mucous membranes of the upper respiratory tract.

Spot Check 4: Penny is an inquisitive 18-month-old girl, who likes to see what fits into what. One morning, she put a small, metal washer that she found on the floor into her nose just as her mother entered the room. Her mother gasped when she saw what Penny had done. This scared Penny, so she gasped, too, and the metal washer was gone. She had inhaled it. What route do you think the metal washer will take (trace the pathway)?

Answer: The washer will travel to the nasal cavity to the nasopharynx, to the oropharynx, to the laryngopharynx, through the glottis to the larynx, to the trachea, to a main bronchus, and—depending on the size of the washer—the bronchial tree.

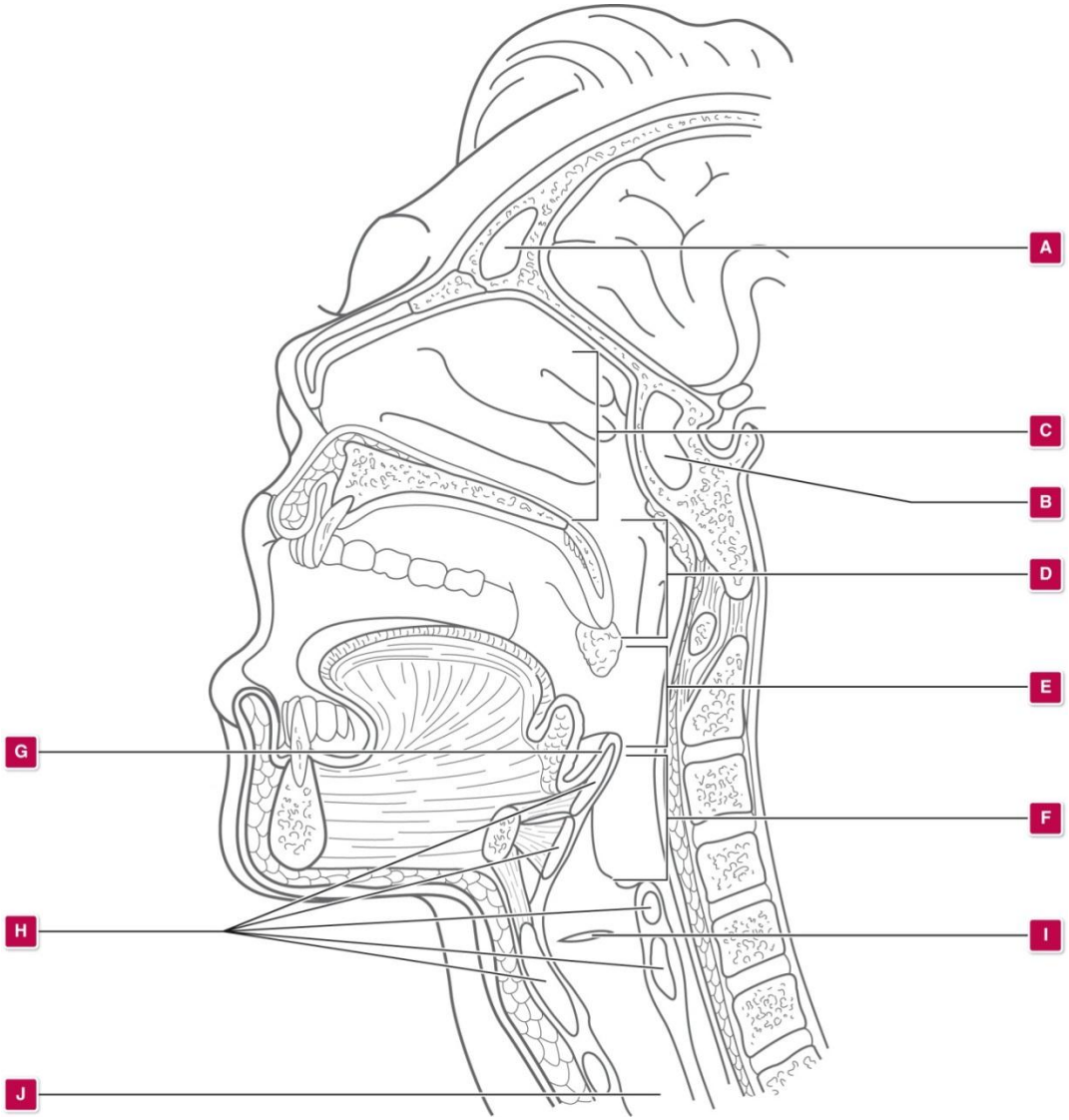
Spot Check 5: In which lung will the doctor at the clinic find the metal washer? Explain.

Answer: The metal washer will most likely go down the right bronchus into the right lung because the right bronchus is more vertical than the left bronchus. The washer is more likely to follow a straight line than make a turn at the left bronchus.

Spot Check 6: Why must the vessel represented in this figure be an artery and not a capillary, and why must the tube be a bronchiole and not a bronchus of the bronchial tree? (*Hint:* Look at the histology).

Answer: The vessel does not have a single layer to its wall, so it cannot be a capillary. The tube does not have any cartilage, so it cannot be a ***bronchus.***

Quiz: 1



Use this figure to answer the following questions.

1. Identify A.	*Frontal sinus*
2. Identify B.	*Sphenoid sinus*
3. What is the function of A and B?	*To warm and moisturize the air and give resonance to the voice.*
4. What type of tissue lines C?	*Ciliated pseudostratified epithelial tissue*
5. What direction does the lining of C move debris?	*Towards the nasopharynx*
6. Identify area D.	*Nasopharynx*
7. Identify area E.	*Oropharynx*
8. Identify area F.	*Laryngopharynx*
9. Identify I.	*Vocal chords*
10. What is the function of I.	*To vibrate to produce sound, speech*

OUTCOME 13.5

Discussion Point: This discussion should take place before a lecture on the mechanics of breathing. Ask the students to take a deep breath. Then ask them how they did it.

Talking Point: Mechanics of breathing demo. Two thin sheets of plastic, such as two transparencies, can be used to demonstrate the effect of pleural fluid between the parietal and visceral pleurae. Demonstrate the mechanics of breathing by having your right hand represent the thoracic wall and the transparency in your right hand (palm the transparency) as the parietal pleura. Your left hand then represents the lung and the transparency in that hand represents the visceral pleura. Put your two hands together with the transparencies touching. During inspiration the thoracic wall moves away from the lung and the parietal pleura goes with it. But that has no effect of the visceral pleura and the lung. Ask students what is missing in your demo. (pleural fluid) Add a little water between the transparencies and repeat the demo. Now the two transparencies stick together, so as the thoracic wall moves away from the lung, the parietal pleura, visceral pleura, and lung goes with it. If you turn the transparencies over so the dry sides are together, you can show what happens if air is introduced in the pleural cavity (pneumothorax).

OUTCOME 13.6

Quiz: 2

1. Define tidal volume.	*The amount of air moved in a normal breath at rest.*
2. Define vital capacity.	*The maximum amount of air that can be moved.*
3. Define inspiratory capacity.	*The maximum amount of air that can be inspired after the expiration of a normal breath at rest.*
4. Define total lung volume.	*The maximum amount of air the lung can hold.*
5. Define inspiratory reserve volume.	*The amount of air that can be forcefully inspired beyond the amount inspired in a normal breath at rest.*
6. Define expiratory reserve volume.	*The amount of air that can be forcefully expired beyond the amount expired in a normal breath at rest.*
7. Define residual volume.	*The amount of air in the lungs that cannot be moved.*
8. Define functional reserve capacity.	*The amount of air remaining in the lungs after the expiration of a normal breath.*
9. What is the inspiratory capacity if the tidal volume equals 400 mL and the inspiratory reserve volume equals 3,000 mL?	*3,400 mL*
10. What is the vital capacity if the inspiratory capacity equals 3,400 mL and the functional residual capacity equals 2.200 mL?	*5,600 mL*

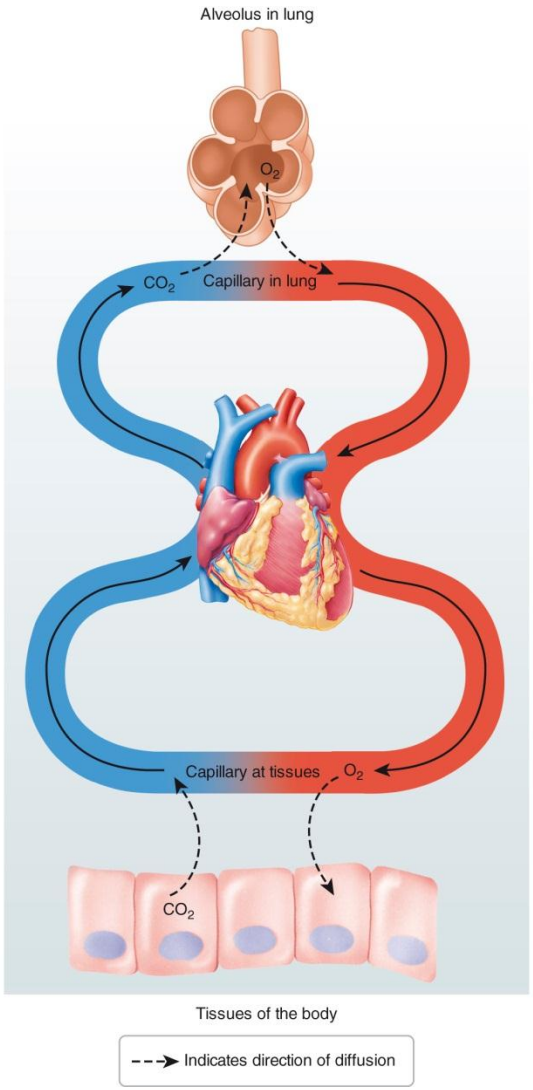
OUTCOME 13.7

Spot Check 7: The atmospheric pressure in Miami on Wednesday was 760 mmHg. However, the atmospheric pressure in Denver on the same day was 640 mmHg. What was the partial pressure of CO_2 in Denver that day? What was the partial pressure of O_2?

Answer: P_{CO2}=0.26 mmHg, P_{O2}=133.7 mmHg.

OUTCOME 13.9

Quiz: 3



1. Define partial pressure. *The amount of pressure a single gas contributes to the total pressure of the mixture.*
2. How does the partial pressure of oxygen entering the alveolus compare to the partial pressure of oxygen in the capillary arriving at the lung? *It is greater*
3. How does the partial pressure of oxygen leaving the alveolus compare to the partial pressure of oxygen in the capillary leaving the lung? *It is equal*
4. How does the partial pressure of carbon dioxide entering the alveolus compare to the partial pressure of carbon dioxide in the capillary arriving at the lung? *It is less*
5. How does the partial pressure of carbon dioxide leaving the alveolus compare to the partial pressure of carbon dioxide in the capillary leaving the lung? *It is equal*
6. How does the partial pressure of oxygen in the capillary arriving at the tissues compare to the partial pressure of oxygen in the tissues? *It is less*
7. How does the partial pressure of oxygen in the capillary leaving the tissues compare to the partial pressure of oxygen in the tissues after gas exchange has taken place? *It is equal*
8. How does the partial pressure of carbon dioxide in the capillary arriving at the tissues compare to the partial pressure of carbon dioxide in the tissues? *It is less*
9. How does the partial pressure of carbon dioxide in the capillary leaving the tissues compare to the partial pressure of carbon dioxide in the tissues after gas exchange has taken place? *It is equal*
10. How does the composition of expired air compare to the composition of inspired air concerning oxygen, carbon dioxide and nitrogen? *Expired air contains less oxygen, more carbon dioxide, and an equal amount of nitrogen as inspired air.*

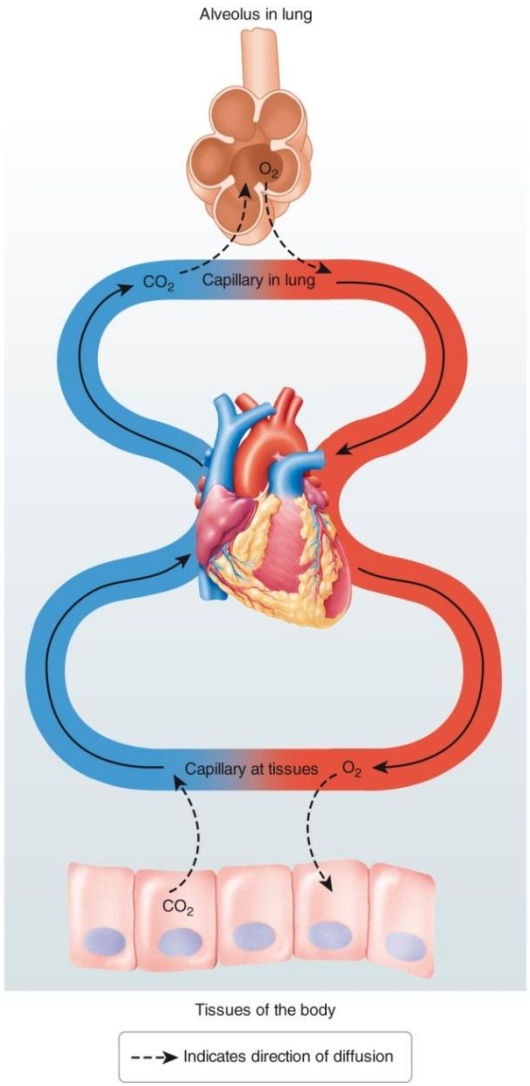
OUTCOME 13.10

Spot Check 8: The atmospheric pressure is 760 mmHg in New York City and 630 mmHg in Breckenridge, Colorado. In which city should more gas exchange take place? Explain.

Answer: New York City. The partial pressures of each gas are greater in New York City because the total pressure is greater than in Breckenridge. So, there is a greater concentration of each gas in New York City.

OUTCOME 13.11

Group Activity: Gas transport.



Divide the class into groups. Have each group diagram the majority of gas transport for oxygen and carbon dioxide by using Figure IMGA12.1 and adding the appropriate chemical equations to show gas exchange and how the majority of oxygen and carbon dioxide are transported from the lungs, to the heart, to the tissues, back to the heart and back to the lungs. When finished, each group exchanges their work with another group for review, after which each group may modify their work. Each member of the group should be prepared to explain the group's work to the class.

OUTCOME 13.13

Group Activity: Exercise

Divide the class in groups. Each member of the group should have his/her respiratory rate measured by another member of the group. The group selects one member of the group to run in place for two minutes. That member's respiratory rate is again measured by the group immediately after exercise. The group should also observe the apparent depth of respirations and record their results. The task for the group is to explain any change in rate or depth of respirations following exercise. They should explain the anatomy and physiology of the mechanisms involved including receptors, part of the brain, etc.

OUTCOME 13.15

Spot Check 9: Consider all of the diagnostic tests listed in Table 13.2. Which tests can be used to diagnose a respiratory infection?

Answer: A few of the tests are: Cultures and sputum analysis, Mantoux test for TB, monospot test, rapid influenza test, rapid strep test, thoracentesis, and ultrasound.

OUTCOME 13.16

Spot Check 10: What is the difference between acute respiratory distress syndrome and hyaline membrane disease?

Answer: Acute respiratory distress syndrome is a condition where the patient is experiencing an illness or a major trauma. Hyaline membrane disease is a respiratory distress disorder in premature infants due to the collapse of the alveoli due to a lack of surfactant.

Case Study

1. What effect has years of smoking had on Jimmy's lungs?

Answer: The cilia of the columnar cells lining the trachea become nonfunctional. This will result in an accumulation of mucus within the trachea thereby hindering inhalation and exhalation. The alveolar sacs will be damaged, which reduces the diffusion of adequate amounts of oxygen into the bloodstream.

2. With Jimmy's diagnosis of COPD, what respiratory disorders is he most likely suffering from?

Answer: Jimmy is most likely suffering from chronic bronchitis and /or emphysema.

3. Why would Jimmy need supplemental oxygen to help with his condition? Explain your answer.

Answer: Jimmy's inhalation of oxygen has been hindered due to years of smoking. The alveolar sacs have also been damage over the years. Both of these situations result in a decrease in oxygenation of the blood. Therefore, supplemental oxygen will be necessary in order for the body to maintain adequate amounts of oxygen.

4. What is the difference between acute respiratory distress syndrome and hyaline membrane disease?

Answer: Acute respiratory distress syndrome is found in patients who are already experiencing illness whereas hyaline membrane disease is respiratory distress in infants due to the collapse of alveoli from the lack of surfactant.

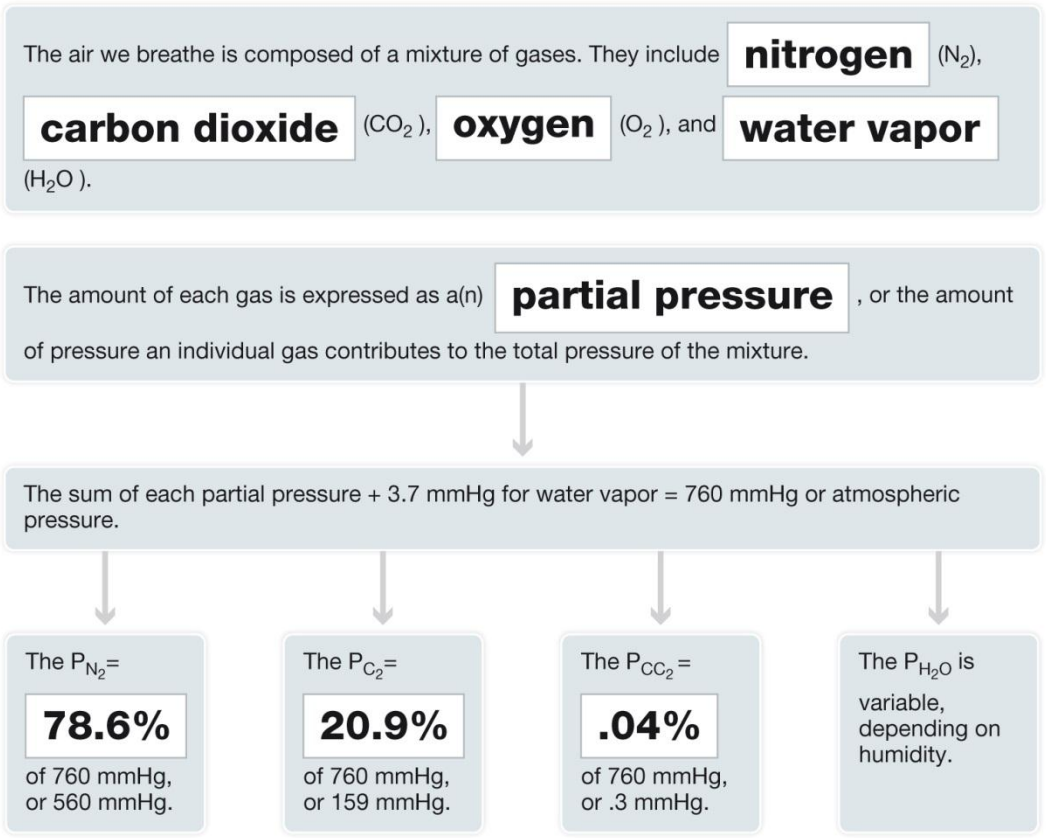
ANSWER KEYS

Chapter Review Questions

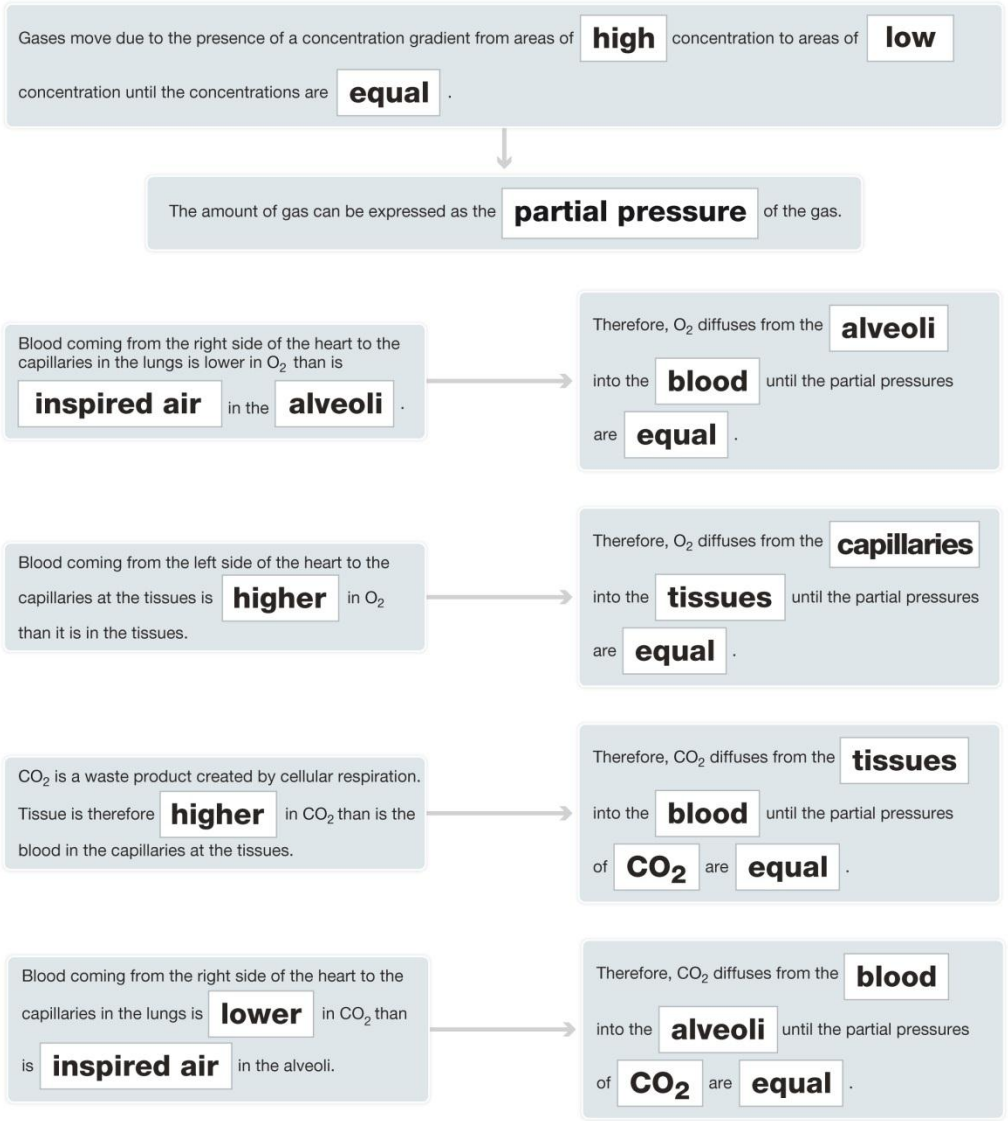
1. C
2. A
3. C
4. B
5. B
6. A
7. B
8. B
9. A
10. D
11. A
12. A
13. B
14. B
15. B
16. B

Workbook Concept Maps

Partial pressure

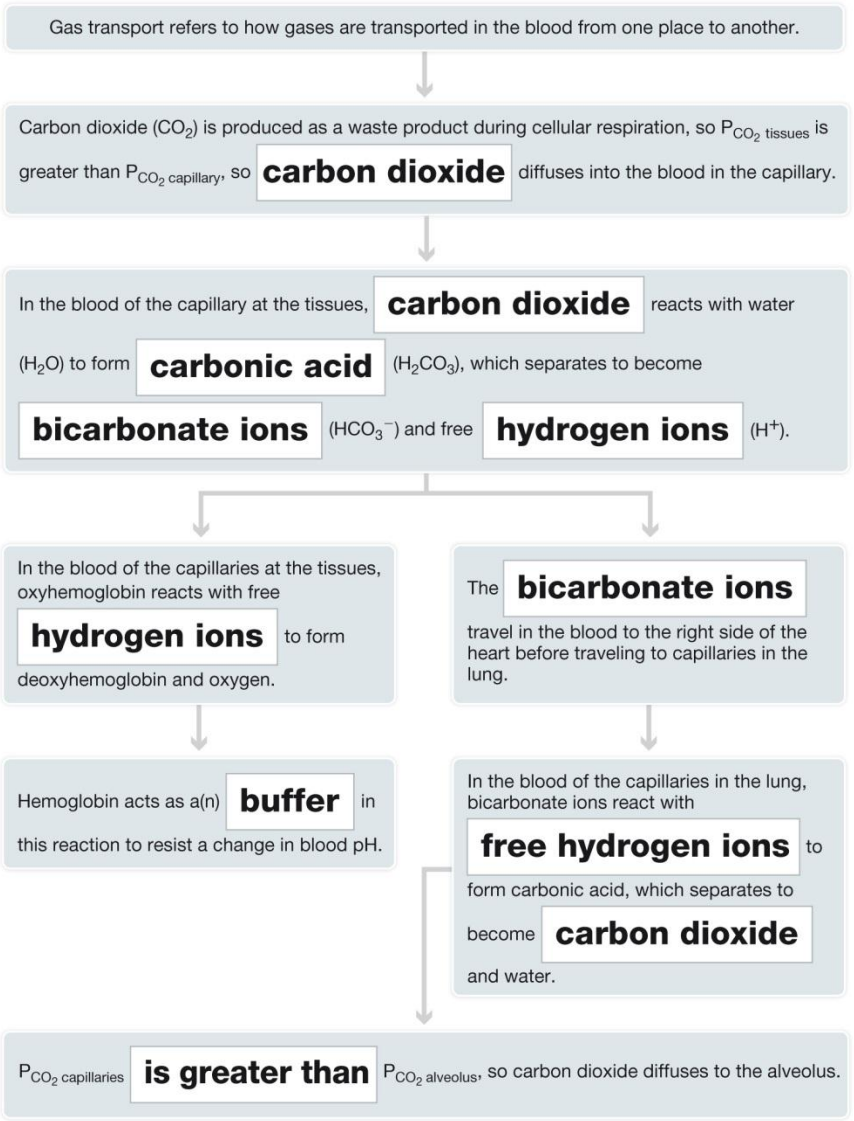


Gas exchange

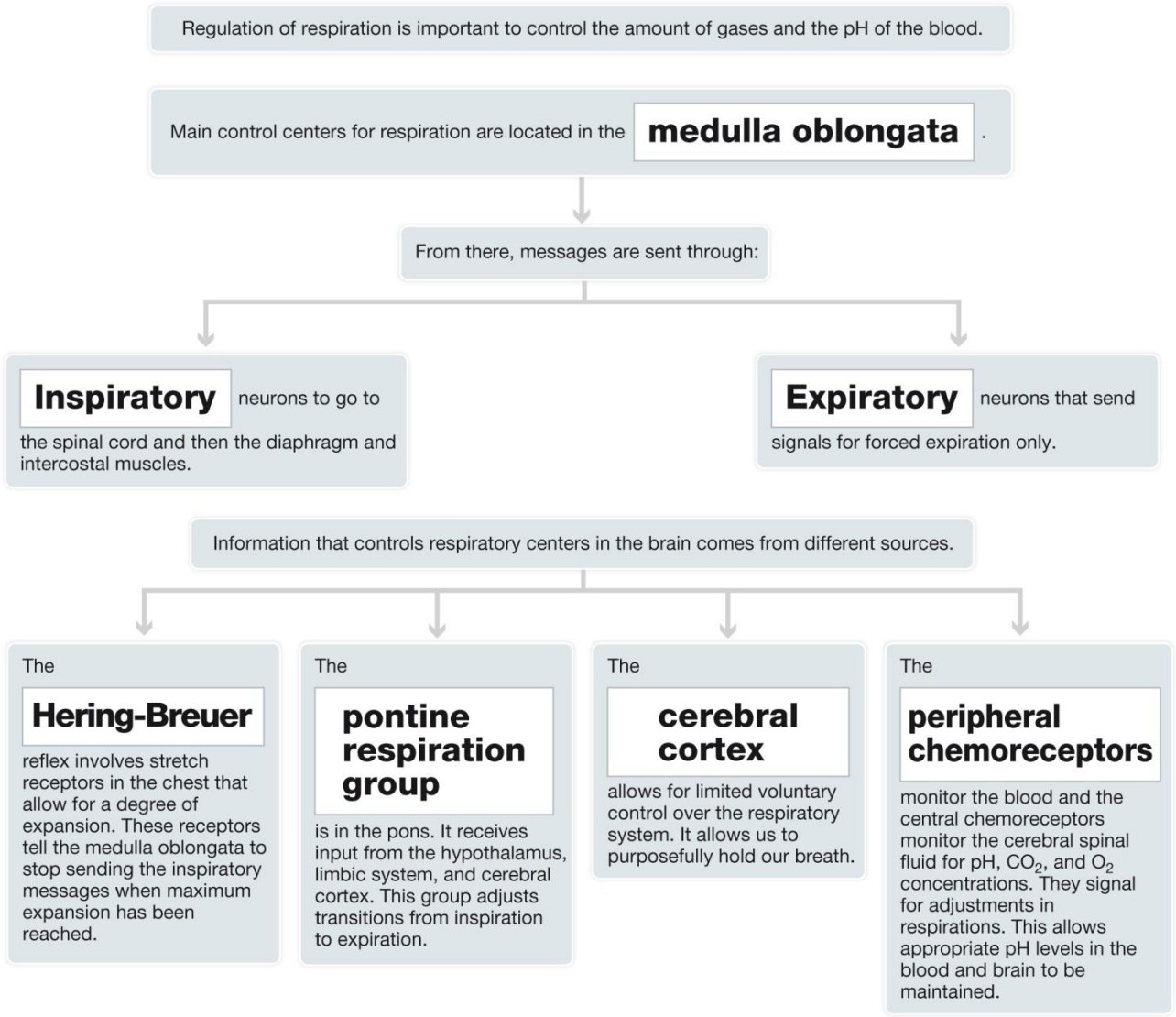


Oxygen transport

Carbon dioxide transport



Regulation of respiration



WORKBOOK CHAPTER REVIEW QUESTIONS:

Word Deconstruction:

In the textbook, you built words to fit a definition using the combining forms, prefixes, and suffixes. Here you are to break down the term into its parts (prefixes, roots, and suffixes) and give a definition. Prefixes and suffixes can be found inside the back cover of the textbook.

FOR EXAMPLE: Dermatitis: dermat/itis—inflammation of the skin

1. Capnia: __*Capn/ia, condition of carbon dioxide*_____

2. Bronchoscopy: __*Broncho/scopy, visual examination of the bronchial tube*_____

3. Lobectomy: ___*Lob/ectomy, removal of a lobe*_____

4. Spirometry: ___*Spiro/metry, measurement of breathing*_____

5. Tracheostomy: _*Tracheo/stomy, new opening of the trachea*_____

Multiple Select:

Select the correct choices for each statement. The choices may be all correct, all incorrect, or any combination of correct and incorrect.

1. What is the respiratory membrane?

    a. It is composed of two layers of simple squamous cells with water and surfactant between the layers.

    b. It is where gas exchange takes place at the tissues.

    c. It is ciliated mucous membranes.

    d. It is composed of pleural membranes.

    e. It is located in the bronchial tree.

2. What are pulmonary volumes and capacities?

a. Inspiratory capacity is the maximum amount of air that can be inspired including a normal breath.

b. Expiratory reserve volume is the amount of air that can be maximally exhaled after expiration of a normal breath.

c. Vital capacity is the maximum amount of air that can be moved in the lungs.

d. Residual volume is the amount of air that still remains in the lungs after maximum expiration.

e. Total lung volume is the maximum amount of air the lungs can hold and includes air that can and cannot be moved.

3. What happens at the respiratory membrane?

a. CO_2 diffuses across the capillary wall to the alveolar wall to a layer of water with surfactant.

b. O_2 diffuses across the capillary wall to the alveolar wall to a layer of water with surfactant.

c. CO_2 diffuses across the thin layer of water with surfactant to the alveolar wall to the capillary wall to the blood.

d. O_2 diffuses across the thin layer of water with surfactant to the alveolar wall to the capillary wall to the blood.

e. N_2 does not move across the respiratory membrane at normal atmospheric pressure.

4. What happens when you take a deep breath and blow out the candles of your birthday cake?

a. Intercostal muscles expand the chest, and the diaphragm flattens during inspiration.

b. Intercostal muscles and the diaphragm simply relax as you blow out the candles.

c. Intercostal muscles and the diaphragm contract as you blow out the candles.

d. The parietal pleura pulls on the visceral pleura because of surfactant.

e. The phrenic nerve is involved in inspiration and expiration.

5. How does inspired air compare to expired air?

a. Inspired air has more nitrogen than expired air.

b. Inspired air has more oxygen than expired air.

c. Inspired air has more carbon dioxide than expired air.

d. Inspired air has the same amount of nitrogen as expired air.

e. Both inspired air and expired air contain water vapor.

6. Which of the following will have a long-term effect on Peggy's respiratory system?

a. Taking calcium supplements and vitamin D

b. Regular exercise

c. Surgery to improve her scoliosis

d. Keeping her weight within normal limits

e. Scuba diving.

7. Where does air travel as it is expired?

a. Air travels from a bronchus to a bronchiole as it is expired.

b. Air travels from the laryngopharynx to the oropharynx as it is expired.

c. Air travels from the trachea to the larynx as it is expired.

d. Air travels through the glottis to the larynx as it is expired.

e. Air travels past the vocal cords before going through the glottis as it is expired.

8. Which of the following would *not* affect alveolar gas exchange?

a. A lobectomy to remove a cancerous tumor

b. Pulmonary edema

c. Mountain climbing

d. An asthma attack

e. Snorkeling (swimming with a breathing tube in shallow water to observe fish).

9. If the atmospheric pressure of air is 700 mmHg, what else is true?

a. The partial pressure of oxygen is approximately 147 mmHg.

b. The partial pressure of nitrogen is approximately 553 mmHg.

c. The partial pressure of carbon dioxide is approximately .04 percent.

d. The partial pressure of nitrogen is approximately 79 percent.

e. The partial pressure of oxygen is approximately 21 percent.

10. Peter is a five-year-old who is stubbornly giving his baby-sitter trouble. He is threatening to "hold his breath so he turns blue and dies" if he does not get his way. His wise baby-sitter (an A&P student) allows him to hold his breath. What does the baby-sitter know?

a. Voluntary control of breathing is limited.

b. Breathing is controlled by respiratory centers in the medulla oblongata.

c. As Peter holds his breath, carbon dioxide levels will rise in his blood.

d. Peter's central and peripheral chemoreceptors will detect a rise in pH.

e. If Peter is stubborn enough to pass out from holding his breath, his medulla oblongata will start his breathing again as soon as Peter is unconscious.

Matching:

Match the disorder to the description. Some of the choices may be used more than once. Some of the descriptions fit more than one choice.

__*b*___ 1. Bronchioles are hyperreactive to a stimulus.	a. Tuberculosis
__*e*___ 2. Protection is achieved through a DPT shot.	b. Asthma
__*d*___ 3. Affected cells metastasize easily.	c. Influenza
_*a,e*___ 4. This is a bacterial infection.	d. Oat cell carcinoma
__*c*___5. This is a viral infection.	e. Pertussis

Matching:

Match the gas to the description. Some of the choices may be used more than once. Some of the descriptions fit more than one choice.

_*a, c*__ 6. Binds to hemoglobin in the lungs	a. Oxygen
__*b*___ 7. Mixes with water at the tissues to form an acid	b. Carbon dioxide
__*d*___ 8. Becomes soluble at pressures higher than normal	c. Carbon monoxide
__*b*___ 9. Is transported through the blood as an ion	d. Nitrogen
__*a*___ 10. Separates from hemoglobin at the tissues	

Completion:

Fill in the blanks to complete the following statements.

1. _*Surfactant*_ is secreted by great alveolar cells, and it reduces the __*surface tension*_ of water.

2. The definition of partial pressure is __*the amount of pressure an individual gas contributes to the total pressure of the mixture of gases.*_

3. _*Ventilation-perfusion coupling*_ is matching airflow to blood flow in the lung.

4. A(n) __*pneumothorax*_ occurs if air is introduced between the pleural membranes.

5. The mucous membranes of the upper respiratory tract function to _*warm*_, __*filter*_, and ___*moisten incoming air*_.

Critical Thinking

1. An uncontrolled diabetic, who is using fat and protein as an energy source because he cannot use glucose, may develop a condition called *ketoacidosis.* This condition causes excess hydrogen ions to accumulate in the blood. What would be the effect of ketoacidosis on his respiratory rate? Explain which receptors will detect this condition and how his respiratory rate is regulated in this case.

_*Respiration rate would increase because peripheral chemoreceptors in carotid arteries would recognize the drop in pH and send signals to respiratory center in medulla oblongata.*

2. A drowning victim may be administered cardiopulmonary resuscitation (CPR). During the process of CPR, the person administering the CPR breathes in and then forcefully expires into the mouth of the recipient. Compare the amount of alveolar gas exchange that occurs in the recipient to that of the person administering CPR. Explain in terms of partial pressures of inspired and expired air.

_*There would be a greater alveolar gas exchange in the person giving CPR than the person receiving it. There is more O_2 in the inspired air of the person administering CPR than the expired air the recipient is receiving.*

3. If the respiratory system fails, a patient may be kept alive with a respirator. Will a respirator be able to fulfill all the functions of the respiratory system? Explain.

The respirator can provide air for gas exchange and create the pressure gradient necessary to circulate blood and lymph. However, air will not be moving through the nasal cavity for the sense of smell or possibly the larynx to facilitate speech. The respirator would not be responsive to the respiratory centers in the medulla oblongata to regulate the acid-base balance of the blood.

Case Study:

1. Years of smoking has caused damage to Jimmy's lungs resulting COPD, a collection of pulmonary disorders that result in a decrease in the ventilation of the lungs.

2. COPD is chronic pulmonary obstructive disorders that include chronic bronchitis, emphysema, and asthma.

3. Supplemental oxygen will help Jimmy obtain the amount of oxygen he needs. Due to his condition, he is unable to inhale enough oxygen on his own.

4. COPD is a progressive disorder that gets worse over time. Jimmy's COPD can be treated but the damage to Jimmy's lungs cannot be reversed.