

## Chapter 16 Respiratory System Study Guide Answers

Chapter 16 Respiratory System Study Guide Answers Chapter 16 Respiratory System Study Guide Answers This study guide provides answers to key questions about the respiratory system covering its structure function and related processes It is designed to help you master the material presented in Chapter 16 of your textbook I Structure of the Respiratory System A The Upper Respiratory Tract 1 What are the components of the upper respiratory tract Nose The external opening of the respiratory system filtering and warming incoming air Nasal Cavity The internal chamber within the nose lined with mucous membrane and containing turbinates for air conditioning Pharynx The throat connecting the nasal cavity to the larynx and serving as a passage for both air and food 2 How do the turbinates and mucous membrane in the nasal cavity contribute to respiration Turbinates These bony structures increase surface area for air conditioning enhancing warming moistening and filtering Mucous membrane Its secretions trap dust bacteria and other contaminants protecting the lower respiratory tract B The Lower Respiratory Tract 1 What are the components of the lower respiratory tract Larynx The voice box containing the vocal cords responsible for sound production Trachea The windpipe a tube lined with ciliated epithelium that transports air to the lungs Bronchi The two branches of the trachea leading to the left and right lungs Bronchioles Smaller branches of the bronchi ultimately leading to the alveoli Alveoli Tiny air sacs within the lungs responsible for gas exchange 2 How does the structure of the bronchioles differ from that of the bronchi Bronchi are larger with cartilage rings while bronchioles are smaller and have a more smooth muscle composition 2 The smooth muscle in bronchioles allows for diameter regulation controlling airflow C The Lungs 1 Describe the structure of the lungs Pleural Membranes Doublelayered membranes surrounding each lung creating a space filled with pleural fluid Lobes The lungs are divided into lobes with three on the right and two on the left Alveoli The functional units of the lungs responsible for gas exchange with capillaries 2 What is the role of the pleural membranes and pleural fluid Pleural membranes lubricate and allow smooth movement during breathing while the pleural fluid prevents friction and maintains lung expansion II Mechanics of Breathing A Inspiration and Expiration 1 Explain the mechanics of inspiration and expiration Inspiration An active process involving contraction of the diaphragm and external intercostal muscles increasing lung volume and decreasing pressure drawing air into the lungs Expiration

Usually a passive process relying on elastic recoil of the lungs and relaxation of the muscles decreasing lung volume and increasing pressure pushing air out

2 How does the pressure gradient between the atmosphere and the lungs drive airflow

Inspiration creates a negative pressure within the lungs drawing air in from the higher pressure atmosphere

Expiration creates a positive pressure within the lungs pushing air out to the lower pressure atmosphere

B Lung Volumes and Capacities

1 Define the following lung volumes and capacities

Tidal Volume TV The amount of air inhaled or exhaled during normal breathing

Inspiratory Reserve Volume IRV The maximum volume of air that can be inhaled after a normal inspiration

Expiratory Reserve Volume ERV The maximum volume of air that can be exhaled after a normal expiration

Residual Volume RV The volume of air remaining in the lungs after a forced expiration

Inspiratory Capacity IC The maximum volume of air that can be inhaled after a normal expiration

TV IRV

3 Vital Capacity VC The maximum volume of air that can be exhaled after a maximum inhalation

TV IRV ERV

Total Lung Capacity TLC The total volume of air that the lungs can hold

VC RV

2 How can these lung volumes and capacities be measured

Spirometry A device that measures the volume of air inhaled and exhaled

III Gas Exchange and Transport

A Gas Exchange in the Alveoli

1 Describe the process of gas exchange in the alveoli

Partial Pressure Gases move from areas of high partial pressure to low partial pressure

Diffusion Oxygen diffuses from alveoli into capillaries while carbon dioxide diffuses from capillaries into alveoli

Factors influencing diffusion

Partial pressure gradients surface area of alveoli thickness of the respiratory membrane

2 What factors influence the rate of gas exchange

Partial pressure gradients The greater the difference in partial pressure between the alveoli and capillaries the faster the diffusion

Surface area A larger surface area allows for more efficient gas exchange

Thickness of the respiratory membrane A thinner membrane facilitates faster diffusion

B Transport of Gases in the Blood

1 How is oxygen transported in the blood

Hemoglobin Red blood cells contain hemoglobin which binds to oxygen and transports it throughout the body

2 How is carbon dioxide transported in the blood

Dissolved in plasma A small percentage of CO<sub>2</sub> is dissolved directly in the plasma

Bound to hemoglobin Some CO<sub>2</sub> binds to hemoglobin

Bicarbonate ion HCO<sub>3</sub><sup>-</sup> The majority of CO<sub>2</sub> is converted to bicarbonate ions in red blood cells transported in the plasma

IV Regulation of Respiration

A Neural Control

1 Describe the role of the medulla oblongata in regulating breathing

Respiratory Center The medulla oblongata contains a respiratory center that controls the rate and depth of breathing

4 Dorsal Respiratory Group DRG Responsible for inspiration

Ventral Respiratory Group VRG Controls both inspiration and expiration particularly during forceful breathing

2 What is the role of the pons in regulating breathing

Pneumotaxic Center Regulates the length of inspiration preventing overinflation of the lungs

Apneustic Center Promotes inspiration preventing premature termination of inspiration

B Chemical Control

1 How does blood CO<sub>2</sub> levels

affect breathing rate  
**Chemoreceptors** Sensors in the medulla oblongata and carotid and aortic bodies detect changes in blood CO<sub>2</sub> levels  
**Increased CO<sub>2</sub>** Leads to increased acidity in the blood stimulating the respiratory center to increase breathing rate and depth to eliminate excess CO<sub>2</sub>  
**2 How does blood oxygen levels affect breathing rate**  
**Chemoreceptors** Sensors in the carotid and aortic bodies detect changes in blood oxygen levels  
**Decreased O<sub>2</sub>** Stimulates the respiratory center to increase breathing rate and depth to increase oxygen intake  
**V Respiratory Disorders**  
**A Common Respiratory Disorders**  
**1 Describe the following respiratory disorders**  
**Asthma** A chronic inflammatory disease that causes airway narrowing and bronchospasm leading to wheezing shortness of breath and coughing  
**Chronic Obstructive Pulmonary Disease COPD** A group of progressive lung diseases characterized by airflow obstruction including chronic bronchitis and emphysema  
**Pneumonia** An infection of the lungs that can be caused by bacteria viruses or fungi resulting in inflammation and fluid buildup  
**Tuberculosis TB** A bacterial infection that primarily affects the lungs causing coughing fever and weight loss  
**2 What are the causes and symptoms of these disorders**  
**Asthma** Can be triggered by allergens irritants exercise cold air or infections  
**COPD** Primarily caused by smoking and exposure to air pollution  
**Pneumonia** Caused by inhaling infectious agents leading to inflammation and fluid buildup in 5 the alveoli  
**Tuberculosis** Caused by Mycobacterium tuberculosis transmitted through airborne droplets  
**B Smoking and Respiratory Health**  
**1 How does smoking affect respiratory health**  
**Nicotine** Constricts blood vessels decreasing oxygen delivery to the lungs  
**Tar** Damages cilia leading to impaired mucus removal and increased susceptibility to infections  
**Carbon monoxide** Reduces the oxygen-carrying capacity of hemoglobin  
**2 What are the long-term consequences of smoking**  
**COPD** Emphysema chronic bronchitis and other respiratory conditions  
**Lung cancer** A leading cause of cancer deaths  
**Cardiovascular disease** Heart attack stroke and peripheral vascular disease  
**Conclusion** This study guide has provided answers to key questions regarding the respiratory system By understanding its structure function and related processes you are better equipped to appreciate the vital role it plays in maintaining life Be sure to review this material thoroughly and consult your textbook and other resources for further clarification

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