

The Human Respiratory System Study Guide

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Zones of the Respiratory System:

Conducting Zone:

- Function: Warms, cleanses, and humidifies incoming air.
- Structures: Nose, pharynx, larynx, trachea, primary bronchi, lungs.

Respiratory Zone:

- Function: Site of gas exchange.
- Structures: Respiratory bronchioles, alveolar ducts, alveolar sacs, alveoli.

Pathway of Air:

1. Enters through external nares (nostrils).
2. Moves into the nasal cavity.
3. Passes through the pharynx:
 - Nasopharynx: Contains pharyngeal (adenoids) tonsils and connects to the auditory tube.
 - Oropharynx: Contains palatine tonsils.
 - Laryngopharynx: Contains lingual tonsils.
4. Passes the larynx.
5. Travels down the trachea.
6. Divides into left and right primary bronchi.
7. Further branches into secondary and tertiary bronchi.
8. Enters bronchioles, then alveolar ducts.
9. Ends in alveolar sacs and alveoli, where gas exchange occurs.

Structures and Functions:

- Nasal Cavity: Filters, warms, and humidifies incoming air.
- Conchae: Increase surface area and create turbulence to enhance filtration.
- Palate: Separates nasal and oral cavities; hard palate is bony, soft palate is muscular.
- Paranasal Sinuses: Lighten the skull, produce mucus, and act as resonance chambers.
- Pharynx: Muscular passageway for air and food (~5 inches long); houses tonsils.
- Larynx: Voice box; passageway for air; contains vocal cords; routes air and food.
- Epiglottis: Elastic cartilage flap; closes larynx during swallowing.
- Thyroid Cartilage: Largest laryngeal cartilage (Adam's apple).
- Vocal Cords and Glottis: Produce sound by vibrating with expelled air.
- Trachea: Windpipe, ~4 inches long; lined with ciliated mucus to trap dust and bacteria.
- Primary Bronchi: Two main branches to each lung; air is fully warmed, cleansed, and humidified.
- Bronchioles: Smallest conducting passageways, leading to respiratory zones.

- Alveoli: Small air sacs resembling grape clusters; site of gas exchange.
- Capillaries: Surround alveoli; site of oxygen and carbon dioxide exchange.
- Visceral Pleura: Membrane covering lungs.
- Parietal Pleura: Lines thoracic cavity; pleural fluid reduces friction during breathing.

Sinuses:

- Maxillary, Frontal, and Sphenoidal.
- Function: Lighten skull, produce mucus, act as resonance chambers.

Gas Exchange and Transport:

- External Respiration: Exchange of gases between alveoli and pulmonary capillaries.
- Internal Respiration: Exchange of gases between systemic capillaries and tissue cells.
- Oxygen Transport: Binds to hemoglobin as oxyhemoglobin complex; carried to tissues.
- Carbon Dioxide Transport: Mostly as bicarbonate ions (HCO_3^-); some binds to hemoglobin or dissolves in plasma.

Breathing Mechanisms:

Muscles:

- Inspiration: Diaphragm contracts downward; external intercostals elevate rib cage.
- Exhalation: Muscles relax; lungs recoil; intrapulmonary pressure rises, expelling air.

Pressure-Volume Relationship:

- Inhalation: Volume increases, pressure decreases → air enters.
- Exhalation: Volume decreases, pressure increases → air exits.

Forced Expiration:

- Required in disorders such as asthma, chronic bronchitis, and pneumonia.

Respiratory Volumes and Capacities:

<u>Term</u>	<u>Definition</u>	<u>Volume</u>
Tidal Volume (TV)	Air exchanged in normal breathing.	500 mL
Inspiratory Reserve Volume (IRV)	Maximum air forcibly inhaled after TV.	2100-3200 mL
Expiratory Reserve Volume (ERV)	Maximum air forcibly exhaled after TV.	1200 mL
Residual Volume (RV)	Air remaining after maximum exhalation.	1200 mL
Vital Capacity (VC)	Total exchangeable air (TV +	4800 mL

	IRV + ERV).	
Dead Space	Air in the conducting zone not reaching alveoli.	Variable
Total Lung Capacity	VC + RV.	6000 mL

Neural Control of Breathing:

- Medulla Oblongata and Pons: Control rate and rhythm of breathing.
- Chemoreceptors: Carotid and aortic arteries detect CO₂ levels and pH changes.
- Primary Stimulus: CO₂ concentration, not oxygen.

Breathing Patterns and Reflexes:

Patterns:

- Eupnea: Normal moderate breathing (12–18 breaths/min).
- Hyperventilation: Rapid and deep.
- Hypoventilation: Slow and shallow.
- Apnea: Temporary cessation of breathing.
- Cheyne-Stokes: Alternating slow and fast breathing.

Reflexes:

- Cough: Clears lower respiratory tract.
- Sneeze: Clears nasal passages.
- Hiccups: Diaphragm spasms.
- Yawn: Deep inhalation to increase oxygen.

Respiratory Disorders:

- Emphysema: Fibrosis enlarges alveoli, decreasing surface area.
- Tuberculosis: Lung infection caused by airborne bacteria.
- Apnea: Lack or cessation of breathing.
- Chronic Bronchitis: Increased mucus production, coughing, airway blockage.
- Lung Cancer: Chronic deterioration of lungs from hazardous exposure.
- Tonsillitis: Inflammation of tonsils.
- CO Poisoning: Inhaling carbon monoxide blocks oxygen transport.
- SIDS: Accidental suffocation in infants.
- Cystic Fibrosis: Inherited disorder causing excessive mucus.
- Pleurisy: Infection of pleural membranes.
- Asthma: Narrowed airways; forced expiration.
- Pneumonia: Lung infection causing alveolar inflammation.