1. Organs of the Respiratory System

a. Label the parts of the upper respiratory tract by placing the numbers of the structures by the correct labels.

11 Conchae  
7 Epiglottis  
18 Laryngopharynx  
8 Larynx  
17 Lingual tonsil  
1 Nasal cavity

14 Nasopharynx  
2 Nostril  
5 Oral cavity  
16 Oropharynx  
3 Palate, hard  
4 Palate, soft

15 Palatine tonsil  
13 Pharyngeal tonsil  
10 Sinus, frontal  
12 Sinus, sphenoidal  
6 Tongue  
9 Trachea
b. Label the parts of the lower respiratory tract by placing the numbers of the structures by the correct labels.

- **9** Bronchiole
- **8** Bronchus, tertiary
- **5** Pleural cavity
- **6** Bronchus, primary
- **1** Larynx
- **2** Trachea
- **7** Bronchus, secondary
- **4** Parietal pleura
- **3** Visceral pleura

![Diagram of the respiratory tract](image)

c. Write the words that complete the sentences in the spaces at the right.

Air enters the nasal cavity via the ___1___, and it is ___2___, ___3___, and ___4___ as it flows over the nasal mucous membranes. Mucus and entrapped particles are moved by ___5___ to the ___6___ and are swallowed.

- 1) **Nostrils**
- 2) **Warmed**
- 3) **Filtered**
- 4) **Moistened**
- 5) **Cilia**
- 6) **Pharynx**

d. Write the names of the structures that match the statements in the spaces at the right.

- 1) Openings allowing air to enter nose.
- 2) Interior chamber of nose.
- 3) Separates oral and nasal cavities.
- 4) Increase surface area of nasal cavity.
- 5) Connects nasal cavity with larynx.

Nostrils
Nasal cavity
Palate
Nasal conchae
Pharynx
6) Air-filled cavities in skull bones.  
7) Lymphoid tissue in upper pharynx.  
8) Lymphoid tissue at junction of pharynx and oral cavity.  
9) Cartilaginous boxlike structure containing vocal folds.  
10) Opening between vocal folds.  
11) Cartilage forming Adam’s apple.  
12) Flops over larynx opening in swallowing.  
13) Windpipe extending from larynx to bronchi.  
14) Bronchi that enter lungs.  
15) Support walls of bronchial tree passageways larger than bronchioles.  
16) Lines air passageways larger than bronchioles.  
17) Tiny air sacs at ends of alveolar ducts.  
18) Membrane covering outer surface of lung.  
19) Membrane lining inner wall of thorax.  
20) Potential space between pleurae.

2. Breathing

a. Write the words that complete the sentences in the spaces at the right.

Air flows into the lungs during __1___ and out of the lungs during __2___. During breathing, air flows from an area of __3___ pressure to an area of __4___ pressure. Contraction of the __5___ and the __6___ muscles causes an increase in the __7___ of the lungs, which decreases the air __8___ within the lungs. Air flows into the lungs because of the __9___ atmospheric pressure. When the muscles of inspiration relax, the __10___ of the lungs is decreased, which increases the air __11___ within the lungs. Air flows out of the lungs because of the __12___ air pressure within the lungs.

b. Indicate whether each statement is true (T) or false (F).

- T Negative pressure in the pleural cavity is necessary for inspiration.
- T Surfactant prevents collapse of alveoli.
- T Forceful expiration involves contraction of abdominal and internal intercostal muscles.
- T Pneumothorax causes collapse of a lung.
- T Breathing exchanges air between the atmosphere and the alveoli of the lungs.
3. **Respiratory Volumes**

Match the respiratory volumes with the statements.

1) Expiratory reserve volume
2) Inspiratory reserve volume
3) Residual volume
4) Tidal volume
5) Total lung capacity
6) Vital capacity

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4. **Control of Breathing**

Write the terms that match the statements in the spaces at the right.

1) Locations of respiration control centers.
   - Medulla oblongata
   - Pons

2) Controls forceful expirations.
   - Medullary expiratory center

3) Coordinates the depth and length of inspiration.
   - Pons respiratory center

4) Controls normal rhythmic breathing.
   - Medullary respiratory center

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5. **Factors Influencing Breathing**

Indicate whether each statement is true (T) or false (F).

- T A fever increases the breathing rate.
- F The respiratory center detects blood levels of carbon dioxide and oxygen.
- T An increase in the blood H⁺ concentration increases the breathing rate.
- F A mild increase in blood oxygen concentration decreases the breathing rate.
- T An increase in blood CO₂ concentration increases the breathing rate.
- F Higher brain centers can permanently override the action of the respiratory center.
- T Chemoreceptors for blood oxygen are located in the carotid and aortic bodies.
- T A very low blood oxygen concentration increases the breathing rate.
6. Gas Exchange

Write the words that complete the sentences in the spaces at the right.

The exchange of respiratory gases occurs by _____1____. In comparison to the air in the alveoli, blood returning to the lungs has a lower concentration of _____2____ and a higher concentration of _____3____. Therefore, oxygen diffuses from the _____4____ into the _____5____, and carbon dioxide diffuses from the _____6____ into the _____7____. Blood leaving the lungs is _____8____-rich and _____9____-poor.

In comparison to concentrations in tissue cells, blood entering tissue capillaries has a lower concentration of _____10____ and a higher concentration of _____11____. Therefore, oxygen diffuses from the _____12____ into the _____13____, and carbon dioxide diffuses from the _____14____ into the _____15____. Blood leaving tissue capillaries is _____16____-rich and _____17____-poor.

7. Transport of Respiratory Gases

a. Write the terms that match the statements in the spaces at the right.

1) Compound in which most oxygen is transported. ____________________________________________ 1) Diffusion

2) Cell in which most oxygen is transported. ____________________________________________ 2) Oxygen

3) Compound in which most CO₂ is carried. ____________________________________________ 3) Carbon dioxide

4) Combination of hemoglobin and CO₂. ____________________________________________ 4) Lungs (alveoli)

5) Enzyme speeding up reaction of CO₂ and H₂O to form carbonic acid. ____________________________________________ 5) Blood

6) Cell in which most carbonic acid is formed. ____________________________________________ 6) Blood

b. Indicate whether each statement is true (T) or false (F).

_____ T_____ Hemoglobin can carry both O₂ and CO₂ at the same time.

_____ T_____ Oxygenated blood carries some carbon dioxide.

_____ T_____ Deoxygenated blood carries some oxygen.

_____ T_____ Hemoglobin loads or unloads oxygen, depending on the surrounding oxygen concentration.

_____ F_____ Oxygen and carbon dioxide compete for the same binding site on the hemoglobin molecule.

_____ T_____ Blood loads or unloads CO₂ depending upon the surrounding carbon dioxide concentration.
8. Disorders of the Respiratory System

Write the disorders that match the statements in the spaces at the right.

1) Accumulation of fluid in the lungs. **Pulmonary edema**
2) Inflammation of the bronchi. **Bronchitis**
3) Rupture of alveoli due to exposure to airborne irritants. **Emphysema**
4) Acute inflammation of alveoli due to viral or bacterial infection. **Pneumonia**
5) Collapse of alveoli in infants due to an insufficient amount of surfactant. **Respiratory distress syndrome**
6) Wheezing, labored breathing due to constriction of bronchioles. **Asthma**
7) Viral disease characterized by fever, chills, aches, and coldlike symptoms. **Influenza**
8) Disorder characterized by a reduction of the respiratory surface area and decrease in the expiratory reserve volume. **Emphysema**
9) Inflammation of nasal membranes. **Cold**
10) Blockage of artery in lung by a transported blood clot. **Pulmonary embolism**

9. Clinical Applications

a. One treatment for hyperventilation is having the patient breathe into a paper bag. How does this reestablish normal breathing? As **CO$_2$** increases and **O$_2$** decreases in the bag, rebreathing the air in the bag decreases **O$_2$** and increases **CO$_2$** concentrations in blood to normal levels, returning respiration rates to normal.

b. A newborn infant, born a month early, is having difficulty breathing and is placed under an **O$_2$** hood. What is the probable problem? **Insufficient surfactant**

Should the infant receive pure oxygen or an oxygen-carbon dioxide mixture? **O$_2$ - CO$_2$ mixture**

Explain. **An O$_2$ - CO$_2$ mixture can supply additional oxygen while stimulating normal breathing. Also, pure O$_2$ may cause damage to the eyes (retinopathy of prematurity).**