

Respiratory System Review

1. *Why do organisms require oxygen?*

The function of the respiratory system is to ensure that oxygen is available to all cells. Oxygen must be available for cellular respiration to take place. Cellular respiration provides cells with energy in the form of ATP. Carbon dioxide is a waste product formed during cellular respiration and it needs to be eliminated from cells.

2. *What is the purpose of the epiglottis?*

Food (bolus) propelled from the pharynx into the esophagus is prevented from entering the trachea (windpipe) by the **epiglottis**. This flap of tissue acts like a trap door, closing the trachea during swallowing.

3. *Fully describe the alveoli.*

Alveoli are tiny air sacs in the lungs surrounded by capillaries. In the alveoli, oxygen and carbon dioxide are exchanged in the blood by a process named diffusion according to concentration and pressure gradients, getting rid of the carbon dioxide and giving the oxygen to the red blood cells to be delivered to all of the muscles and organs. Alveoli are elastic, which means that they can stretch when they are filled with air.

4. *Exercise increases breathing. How?*

When exercising, the tissues in your body require more oxygen than when you are at a relaxed state. Your heart begins to pump faster and your respiration increased in an attempt to keep up with the oxygen demands of your body. In the lungs, the gas exchange takes place, and the red blood cells in the blood transport the oxygen to the tissues in your body.

5. *Describe the process of external respiration and internal respiration.*

- **External Respiration:**
 - The gas exchange that occurs at the **lungs**.
 - Getting the gasses ***in and out of the body!***
 - O₂ enters body (alveoli → blood)
 - CO₂ leaves the body (blood → alveoli)

- **Internal Respiration:**
 - The gas exchange that occurs at the **tissue level**
 - Getting the gasses ***in and out of our cells***.
 - O₂ is delivered (blood → tissue)
 - CO₂ is removed (tissue → blood)

6. Place the following structures in the order in which air passes through them during exhalation:

- Bronchioles
- Trachea
- Pharynx
- Nasal cavity
- Alveolus
- Bronchi
- Alveolus
- Bronchioles
- Bronchi
- Trachea
- Pharynx
- Nasal cavity

7. What structural characteristic of alveoli helps with the process of gas exchange?

The alveoli have a structure specialised for efficient gaseous exchange:

- Walls are extremely thin, often one to two cells thick allowing for simple diffusion of gas.
- They have a large surface area in relation to volume.
- They are fluid lined enabling gases to dissolve.
- They are surrounded by numerous capillaries.

8. Imagine a person enters an environment where the concentration of oxygen is very low. How might that affect their respiration process?

When living in areas of low oxygen concentration such as areas of high altitude, much greater volumes of air are necessary to supply enough oxygen to the body from atmospheric air. Because of this, respiration increased as the body works to ensure the oxygen intake is adequate for the functions of the tissues in the body.

9. What is the difference between the conductive zone and the respiratory zone?

Respiratory Zone

The combination of all the structures that convey air from the outside of the body to the lungs

Purpose:

- Transport air to the respiratory zone
 - **Filter** incoming air
 - **Humidify** incoming air
 - **Warm** the inspired air

Conductive Zone

The structures that are involved with the exchange of gases between inspired air and the blood

Purpose:

- Rapid Gas exchange (O₂ & CO₂) via diffusion
 - Alveoli = functional unit (1 cell thick membrane)
 - 300 million = ~ 2800 square feet of surface area
 - Alveoli are covered with capillaries (1 cell thick membrane)

10. List the three rules that determine Gas movement for Breathing

Three Rules That Determine Gas Movements For Breathing

1. Gasses move from high to low **pressure** (Law of partial pressures).
2. Gasses move from **high concentration** to **low concentration**.
3. Gasses move within the body by means of **diffusion**. (as the concentration gradient increases, greater rates of diffusion are observed)

11. What is Henry's Law?

Henry's Law

- The amount of gas that will dissolve/diffuse into a liquid is proportional to the partial pressure of the gas and the solubility of the gas.
- A gas will continue to dissolve into solution until equilibrium is reached.

12. List the actions related to both inhalation and exhalation.

Inhalation	Exhalation
<ul style="list-style-type: none">• Active process• Diaphragm contracts (moves down).• Intercostals contract pushing the ribs up.• Volume of chest cavity ↑'s.• Pressure ↓'s in the lungs• P out > P in• Air rushes in.• Alveoli fill with air.	<ul style="list-style-type: none">• Passive or forced process• Diaphragm relaxes.• Intercostals relax.• Volume of chest cavity ↓'s.• Pressure ↑'s in the lungs• P in > P out• Air rushes out.• Alveoli recoil and empty.

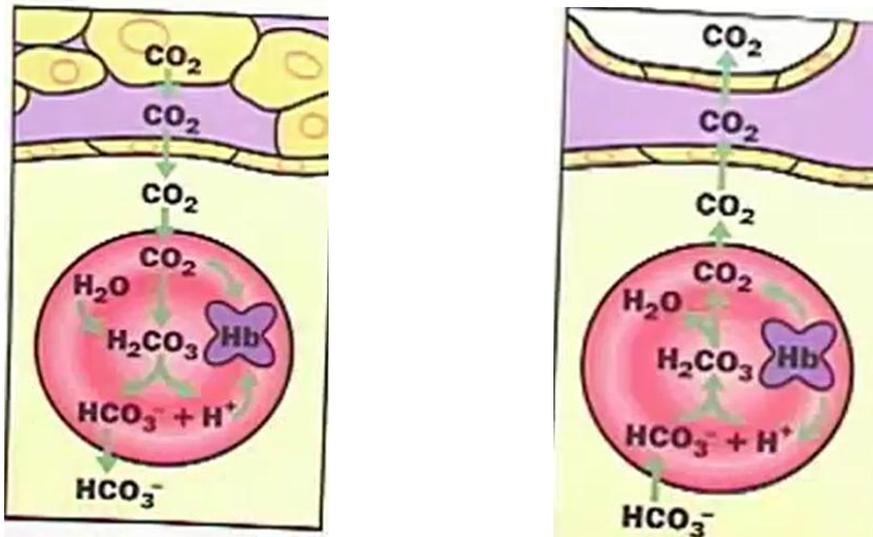
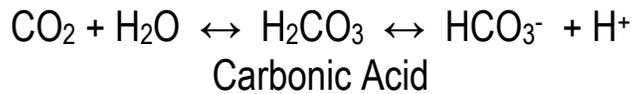
13. Explain how oxygen is transported in the blood.

- 2% dissolved in plasma
- 90 – 98% bound to hemoglobin (Hgb) = oxy-hemoglobin
- Each Gram of hemoglobin in the blood has the capacity to bind **1.34ml** of O₂
- The average concentration of hemoglobin in the blood is **16 mg/100ml** of blood.

14. Explain how Carbon Dioxide is transported in the blood.

- 1) ~ 5 – 10 % dissolved in the plasma
- 2) 90 – 95% diffuses into the RBC's
 - ~ 20% of which forms carboxy-hemoglobin (only when the O₂ concentration is low)
 - ✓ **At the tissue:** As O₂ leaves CO₂ binds to Hgb
 - ✓ **At the lungs:** New O₂ forces CO₂ off Hgb
 - ~ 70 – 75% as Bicarbonate Ions (HCO₃)⁻ (**BICARBONATE BUFFER SYSTEM**)
 - ✓ CO₂ transforms into bicarbonate ions in the RBC's

Carbonic Acid Bicarbonate Buffer System



15. Describe in your own words the term partial pressure of oxygen.

The air we breathe is a mixture of gasses. primarily

- nitrogen,
- oxygen,
- carbon dioxide.

So, the air you blow into a balloon creates pressure that causes the balloon to expand (& this pressure is generated as all the molecules of nitrogen, oxygen, & carbon dioxide move about & collide with the walls of the balloon).

However, the total pressure generated by the air is due in part to nitrogen, in part to oxygen, & in part to carbon dioxide. **That part of the total pressure generated by oxygen is the 'partial pressure' of oxygen**, while that generated by carbon dioxide is the 'partial pressure' of carbon dioxide. A gas's partial pressure, therefore, is a measure of how much of that gas is present (e.g., in the blood or alveoli).