

The structure and functions of the cardio-respiratory system



UNTAMED
EDUCATION

1.1.2 Applied anatomy and physiology

Respiratory System

Gaseous Exchange

Heart

Oxyhemoglobin

Inspiration

The structure and functions of the cardio-vascular system

Spirometer

Expiration

Stroke Volume

Blood Vessels

Cardiac Output



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1. Respiratory system

Nose - has three functions.

- **Warms** the air to internal temperatures.
- **Cilia** hairs filter the air and remove small particles.
- **Moistens** the air so it can be absorbed more easily.

Trachea

- **Cartilage rings** keep the windpipe open.

Diaphragm

- **Flattens** to move air into the lungs.
- **Relaxes** into a dome shape to expire air.

Alveoli

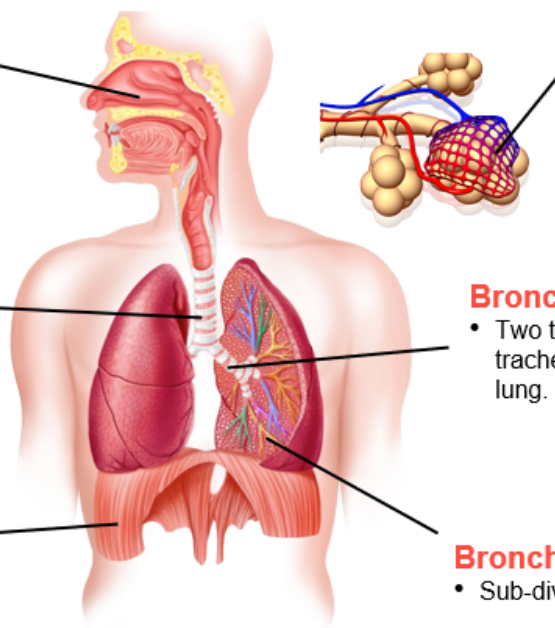
- **Gaseous exchange** happens between the capillaries that surround them.

Bronchi

- Two tubes branch from the trachea into the left and right lung.

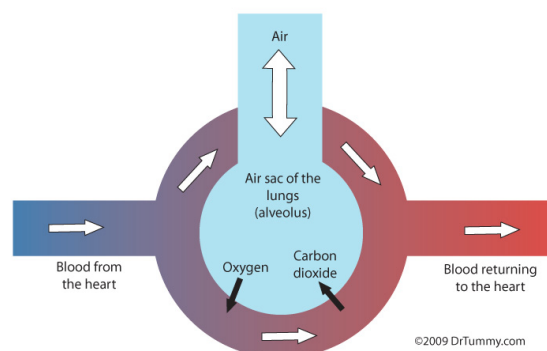
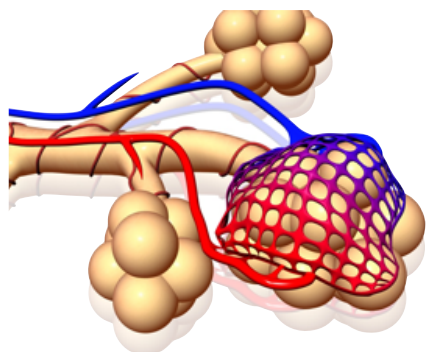
Bronchioles

- Sub-divisions of the bronchi.



2. Gaseous exchange

- ▶ **Oxygen** breathed in travels **to the** _____ which are surrounded by _____.
- ▶ Oxygen combines with haemoglobin to form _____ and is carried around the body.
- ▶ At the same time _____ is **released** by haemoglobin into the alveoli to be breathed out.





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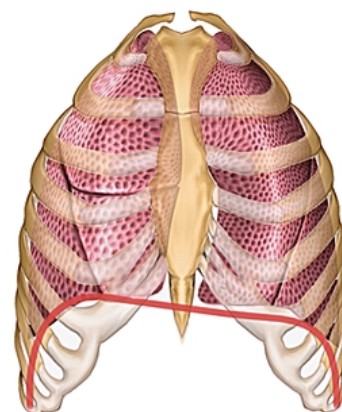
_____ (diffusion) occurs efficiently for the following reasons:

- ▶ **Large surface** _____ of alveoli and lots of capillaries allows for large amounts of oxygen and carbon dioxide to diffuse between the lungs and the blood vessels.
- ▶ The alveoli have **thin** _____ that are one cell thick. This reduces the distance of diffusion.
- ▶ The alveoli provide _____ as gases must first dissolve in liquid before they can diffuse.
- ▶ The circulatory system provides a **large blood supply**. This maintains a **concentration** _____ as gases need to move from a high concentration to a low concentration.

3. Inspiration and expiration

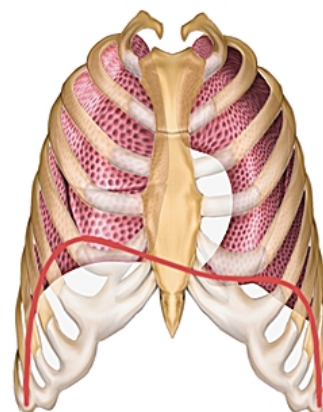
Inspiration

- ▶ The **diaphragm** _____ and **flattens**.
- ▶ The **intercostal muscles** _____.
- ▶ The **ribs** move _____ and _____.
- ▶ Air **pressure inside** the lung cavity _____.
- ▶ **Air** from the atmosphere **moves into** the **lungs**.



Expiration

- ▶ The **diaphragm** _____ into a dome shape.
- ▶ The **intercostal muscles** _____.
- ▶ The **ribs** move _____ and _____.
- ▶ Air **pressure inside** the lung cavity _____.
- ▶ Air **moves** from inside the lungs **to** the **atmosphere**.

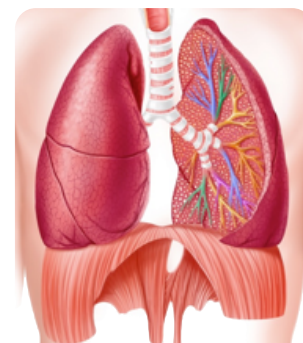




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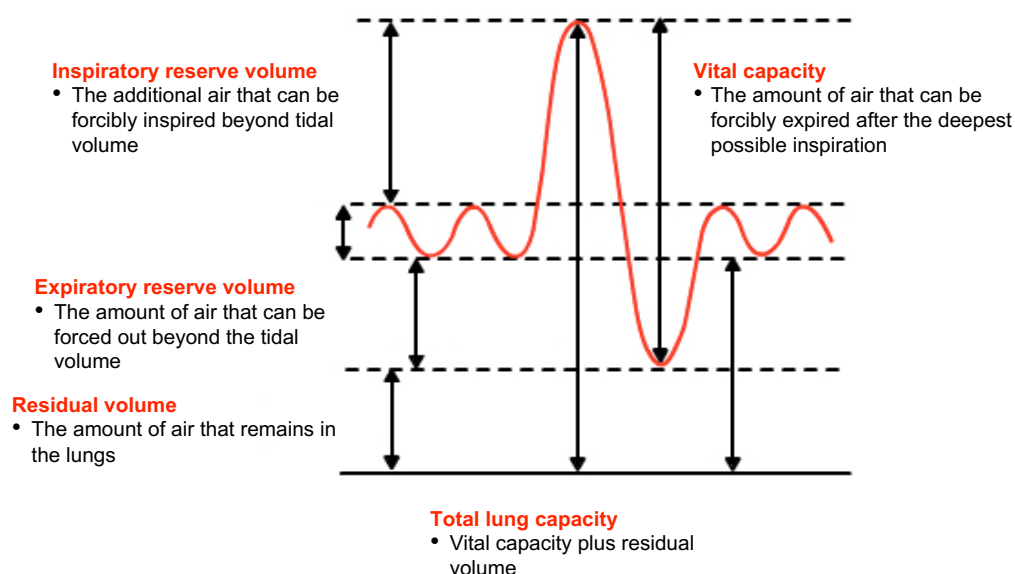
4. Respiratory changes

- ▶ Breathing rate _____.
- ▶ Depth of breathing increases due to the use of pectorals and sternocleidomastoid.
- ▶ When expiring the abdominals are used to force the air out more quickly.
- ▶ Increased _____ of oxygen and carbon dioxide at the lungs.



5. Spirometer

A spirometer measures air capacity of the lungs

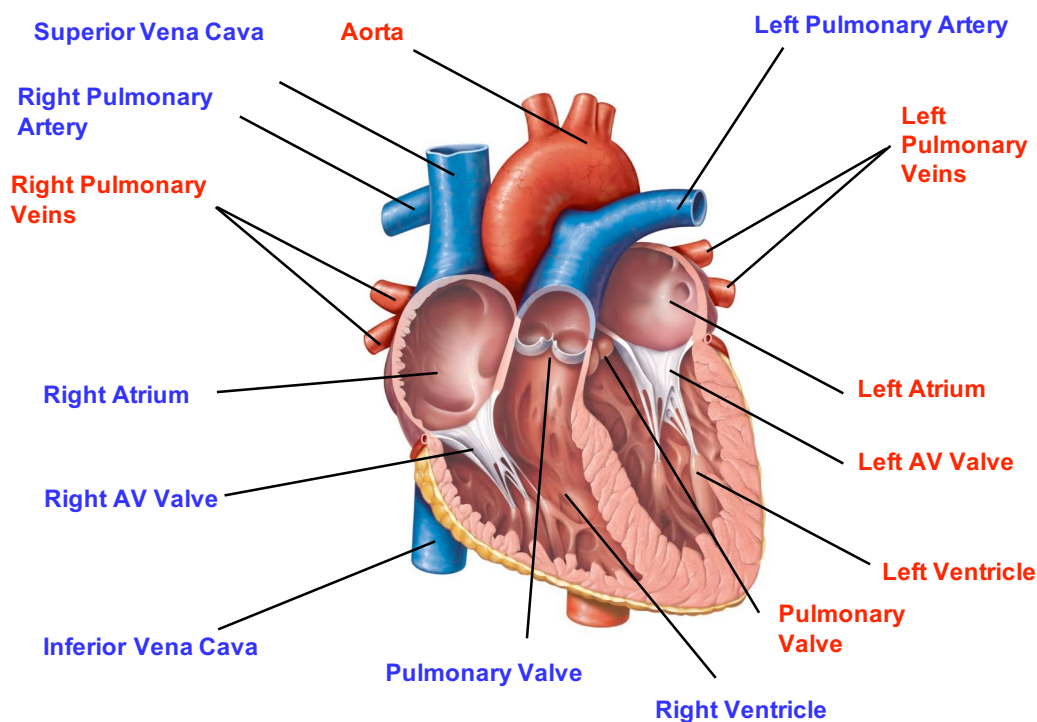


- ▶ Tidal volume _____ with exercise.
- ▶ Expiratory reserve volume _____ during exercise.
- ▶ Inspiratory reserve volume _____ during exercise.
- ▶ Residual volume does not _____ during exercise.
- ▶ Vital capacity does not _____ during exercise.
- ▶ Total lung volume does not _____ during exercise.



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6. The heart



7. Blood transportation

3. Left and right pulmonary artery

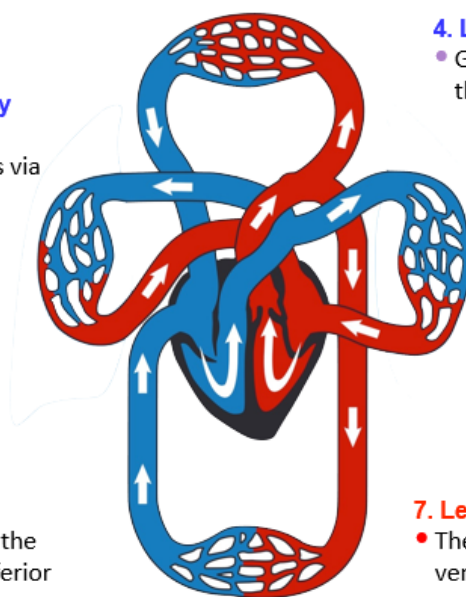
- These arteries transport deoxygenated blood to the lungs via the semi-lunar valves.

2. Right ventricle

- Blood is pumped into the right ventricle through the tricuspid valve.
- Right ventricle contracts and pumps the blood to the lungs.

1. Right atrium

- Deoxygenated blood flows into the RA through the superior and inferior vena cava.



8. Organs and tissues

- Gaseous exchange occurs at the organs and tissues.

4. Left and right lungs

- Gaseous exchange occurs at the left and right lungs.

5. Pulmonary vein

- Transports oxygenated blood to the left atrium.

6. Left atrium

- Receives oxygenated blood and pumps it into the left ventricle through the bicuspid valve.

7. Left ventricle

- The heart contracts and the left ventricle pumps oxygenated blood to the body's organs and tissues via the aorta.



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8. Blood vessels

Arteries

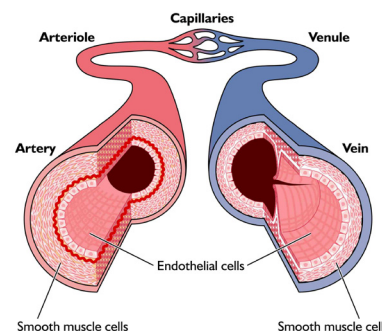
- ▶ Carry oxygenated blood _____ from the **heart**.
- ▶ Thick walls withstand **high blood** _____.

Capillaries

- ▶ These are the _____ **blood vessels** with walls that are only one cell thick.
- ▶ They are very _____ **at gaseous exchange** at the lungs and muscles.

Veins

- ▶ Carry deoxygenated blood _____ the **heart**.
- ▶ They have a _____ **diameter**.
- ▶ They work under _____ **pressure** so have _____ to prevent the back flow of blood.



9. Vasoconstriction and vasodilation

When we are too hot or we need more _____ at our working _____.

- ▶ The **arteries** and **capillaries** to the skin and working muscles _____ to _____ the **blood flow**.
- ▶ **Heat** is _____ due to radiation and sweating at the skin and the **working muscles** receive **more** _____.

Vasoconstriction is the _____ to **vasodilation**.

- ▶ During exercise blood flow is _____ to _____ **muscles** and organs.
- ▶ The arteries and capillaries _____ to _____ blood flow to the working **muscles** and **skin**.

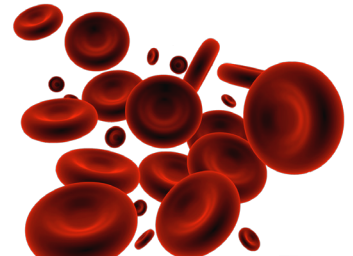


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10. Components of blood

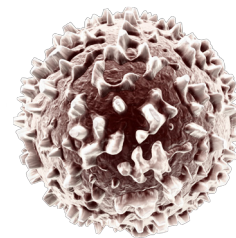
1. Red Blood Cells (RBC)

- ▶ RBC's main function is to **carry** _____ to the working muscles.
- ▶ _____, found in RBCs, is the **oxygen carrying protein**.
- ▶ **Altitude training** can _____ the number of **RBCs**.
- ▶ The _____ **RBCs** the _____ **oxygen** can be **delivered** to the working **muscles**.
- ▶ The more RBCs the _____ the performer can participate.



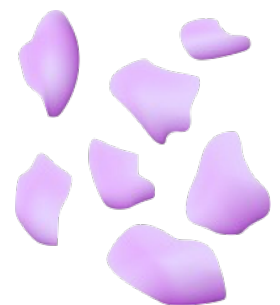
2. White Blood Cells (WBC)

- ▶ WBCs are our **defence** against **infection and disease**.
- ▶ They **fight infections** and reduce illness.
- ▶ This **aids recovery** and allows the participant to **continue training and performing**.



3. Platelets

- ▶ The role of platelets is to _____ **our blood** when it comes into contact with air.
- ▶ If we sustain a cut, platelets will clot the blood to form a _____.
- ▶ Cuts and grazes can happen frequently in contact sport so platelets **prevent heavy blood** _____ and **aid** _____.





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4. Plasma

- ▶ Plasma is the **blood** _____ system.
- ▶ It carries vital nutrients (**glucose**, **vitamins**, **minerals**, etc.) and hormones such as **adrenalin**, which is important in readying a performer to participate.
- ▶ It **removes** _____ products such as **carbon dioxide** and **lactic acid**.
- ▶ Plasma _____ the body's _____ by balancing our water content.
- ▶ It also maintains the **correct chemical** _____.



11. Cardio-vascular measurements

Heart Rate

- ▶ This is the amount of times your heart **beats per** _____.
- ▶ A _____ **resting heart rate** indicates an _____ **heart** and circulatory system, delivering more oxygen per minute.

Stroke Volume

- ▶ This is the _____ of blood the _____ **ventricle of your heart pumps** in _____ beat.
- ▶ An **improved stroke volume** increases gaseous exchange, delivering **more oxygen** and **removing more waste products**.

Cardiac Output (Q)

- ▶ This is the _____ of blood pumped from the left ventricle **in 1** _____.

$$\text{Heart Rate} \times \text{Stroke Volume} = \text{Cardiac Output}$$

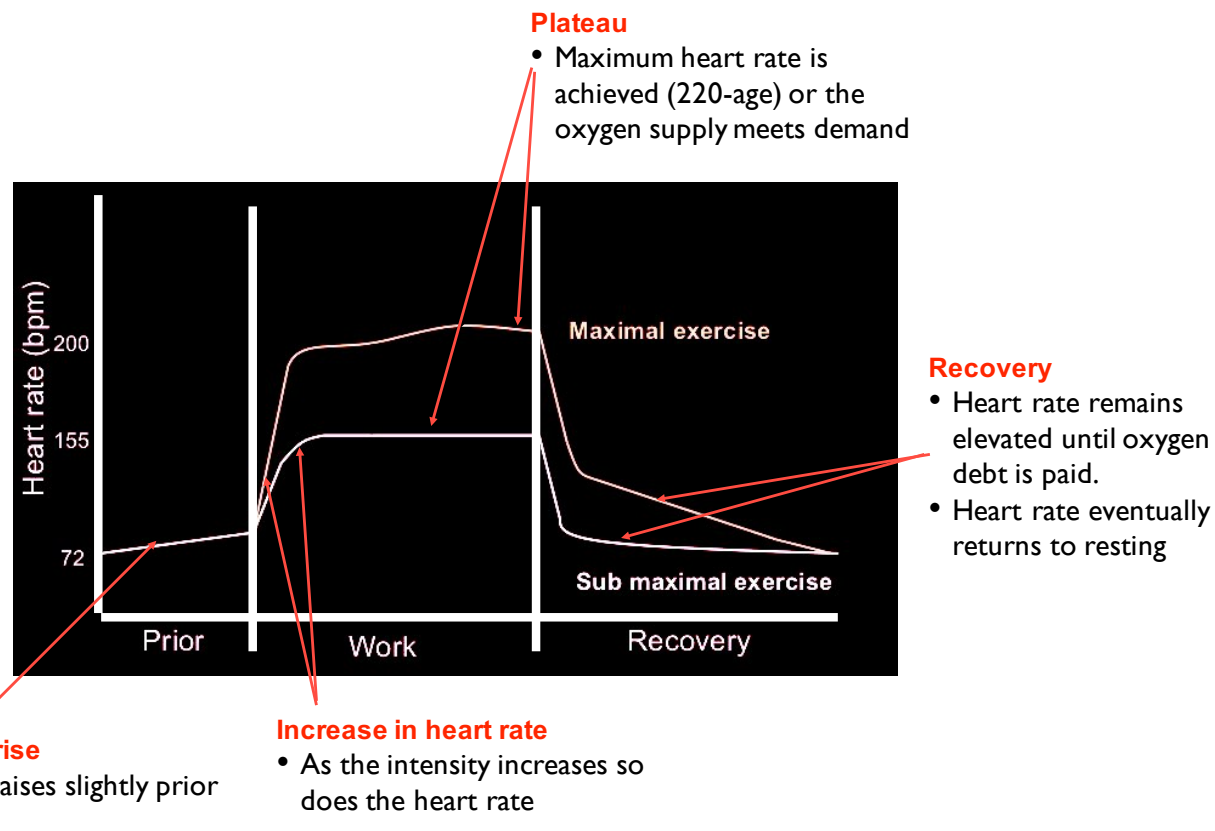
Heart Rate x
Stroke Volume =
Cardiac Output





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12. Heart rate graph



15. How the cardiovascular system and respiratory system work together.

Air is _____ at the _____ and _____ **exchange** of carbon dioxide and oxygen occurs at the alveoli and capillaries.

1. **Oxygenated** blood passes through the _____ and is pumped to the rest of the _____.
2. The tissues of the body **use** the **oxygen** and **create** _____ when creating energy from glucose.
3. **Deoxygenated** blood is pumped back to the _____ through the _____.
4. Approximately **5 liters** of blood is oxygenated and pumped **per** _____.

