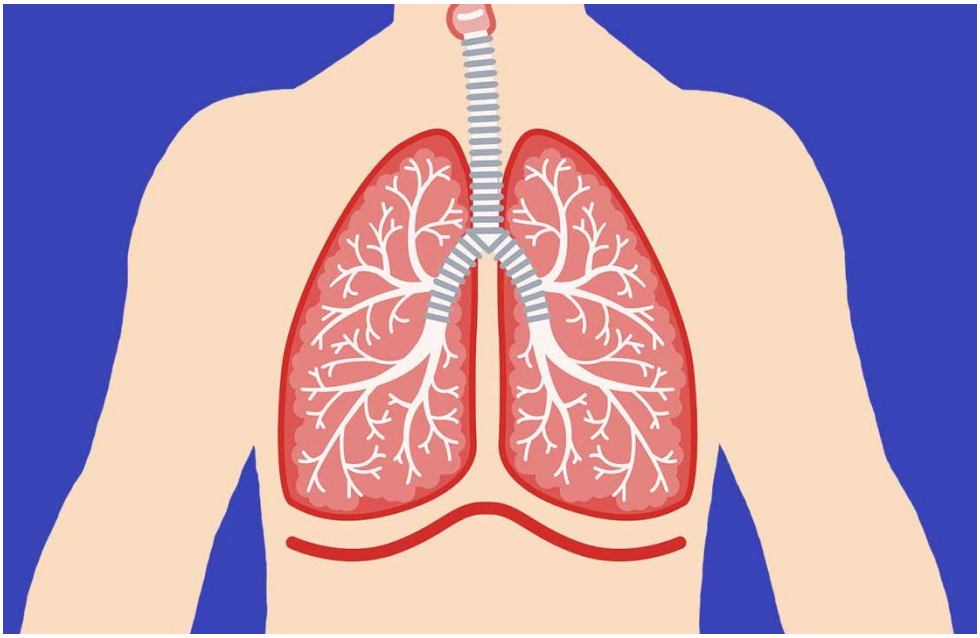
The respiratory system



The **respiratory system** consists of organs that deliver oxygen to the **circulatory system** for transport to all body cells. The respiratory system also assists in removing the waste product of carbon dioxide from the body.

Oxygen is a vital element for metabolism (cell reactions). The breaking apart of glucose (sugar) by oxygen in each cell to release energy is called **respiration**.

Breathing, Gas Exchange and Respiration… What's the difference?

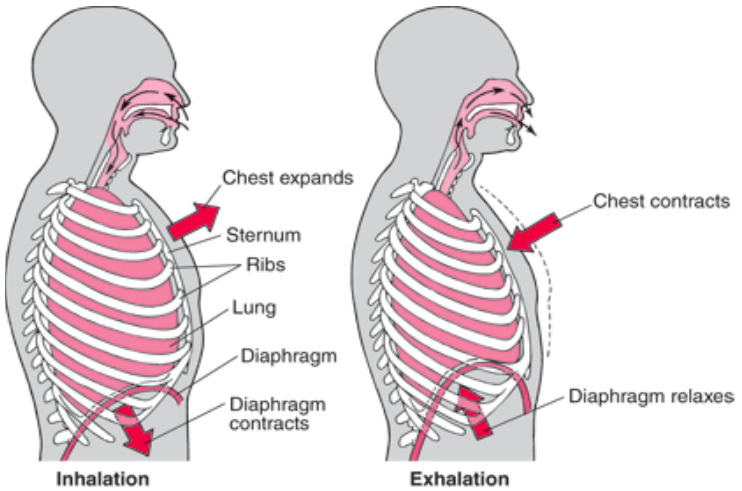
Breathing is the **physical process** by which air (containing oxygen) is forced into the lungs due to the ribcage and their associated muscles pulling the diaphragm downwards. The air (containing high amounts of carbon dioxide) is then forced out of the lungs by the same process that moves the diaphragm up. It involves Inhalation and Exhalation.

Gas exchange is the process where **gasses diffuse** across a gaseous exchange surface. In humans, oxygen diffuses from the inhaled air into the blood and carbon dioxide diffuses from the blood into the exhaled air. The gaseous exchange surface in Humans is the Alveoli.

Respiration is the metabolic process that **occurs in the cell** where organic molecules are broken down to release energy. In humans, this process takes place inside the mitochondria of cells. Aerobic respiration requires oxygen whereas anaerobic respiration takes place in absence of oxygen.

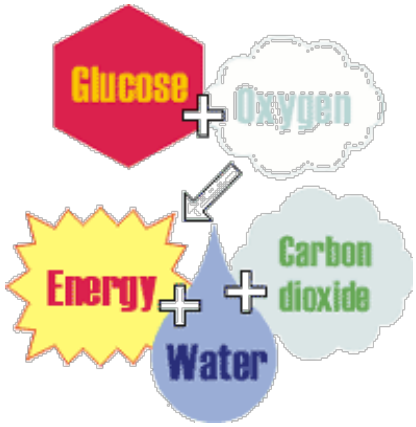
Breathing mechanism.

Breathing (the movement of air in and out of the lungs) is produced by pressure differences created by changing the size of the pleural cavity. The **diaphragm** contracts and the rib cage is raised. The volume of the pleural cavity is increased, creating a partial vacuum between the lung cavity and the atmosphere, and air enters the lung. Air breathed out contains more carbon dioxide and less oxygen than air breathed in.



Respiration - EXTENSION

Cellular respiration is a process whereby energy is released from the breakdown of molecules in food at the cellular level.

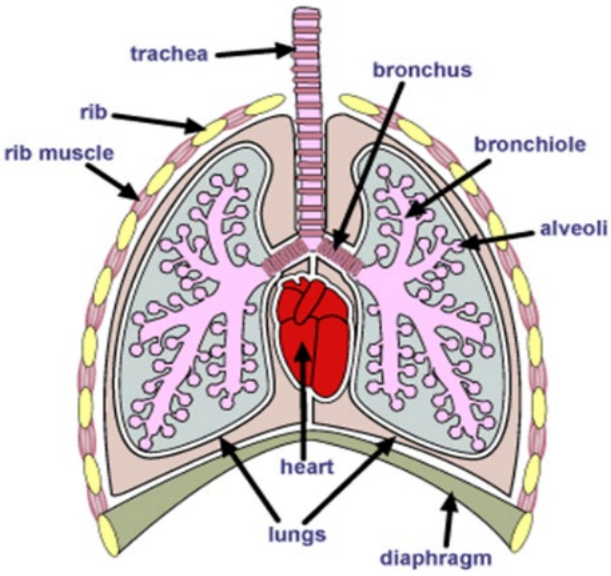


Glucose enters the cell and **oxygen** diffuses in – which has previously entered the body via the respiratory system and transported to each cell through the circulatory system. Glucose is broken apart in a series of steps to release **energy** required for the body. Each reaction is assisted by enzymes. The products of these reactions are **water** and **carbon dioxide** – which diffuses back out of the cell and eventually out of the body via the circulation and respiratory systems.

Aerobic respiration involves transferring energy from glucose to a cell; oxygen is needed, and carbon dioxide is produced. Sometimes our muscles require more oxygen than we can supply by normal breathing. Without enough oxygen present, **anaerobic** respiration takes place. The glucose is broken down and releases some energy. Carbon dioxide is produced along with lactic acid. The **lactic acid** is a waste product and must be removed from the body.

Feature	Aerobic respiration	Anaerobic respiration
Oxygen requirement	Yes always	none
Waste products	Carbon dioxide and water	Carbon dioxide and lactic acid
Efficiency in releasing energy from glucose	Very efficient (most of glucose's energy is released)	Less efficient (some energy locked in lactic acid is not released)
Some energy is released as heat	yes	Yes, but less than for aerobic respiration

The structure of the Human Respiratory system



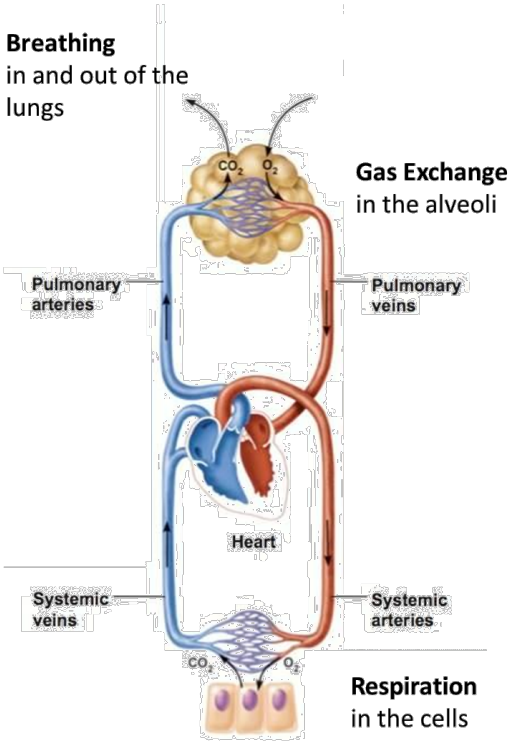
The human respiratory system consists of the nose, pharynx, larynx, trachea, 2 bronchi, and lungs (composed of bronchioles and alveoli). The lungs are housed in an airtight cavity framed by the rib cage and diaphragm.

Air (comprised of about 21% **oxygen**) enters the nose, where tiny hairs filter out dust and particles. Tissues moisten and warm the air, making it more suitable for **gas exchange** in the lungs. Air passes from the pharynx to the larynx (containing vocal cords) and into the trachea. The **trachea** divides into the left and right bronchi which subdivide into smaller and smaller tubes called bronchioles. These airways are lined by mucous membranes and many **cilia** hairs which trap and remove particles from the lungs. Bronchioles open into the **alveoli** which are clustered like grapes.

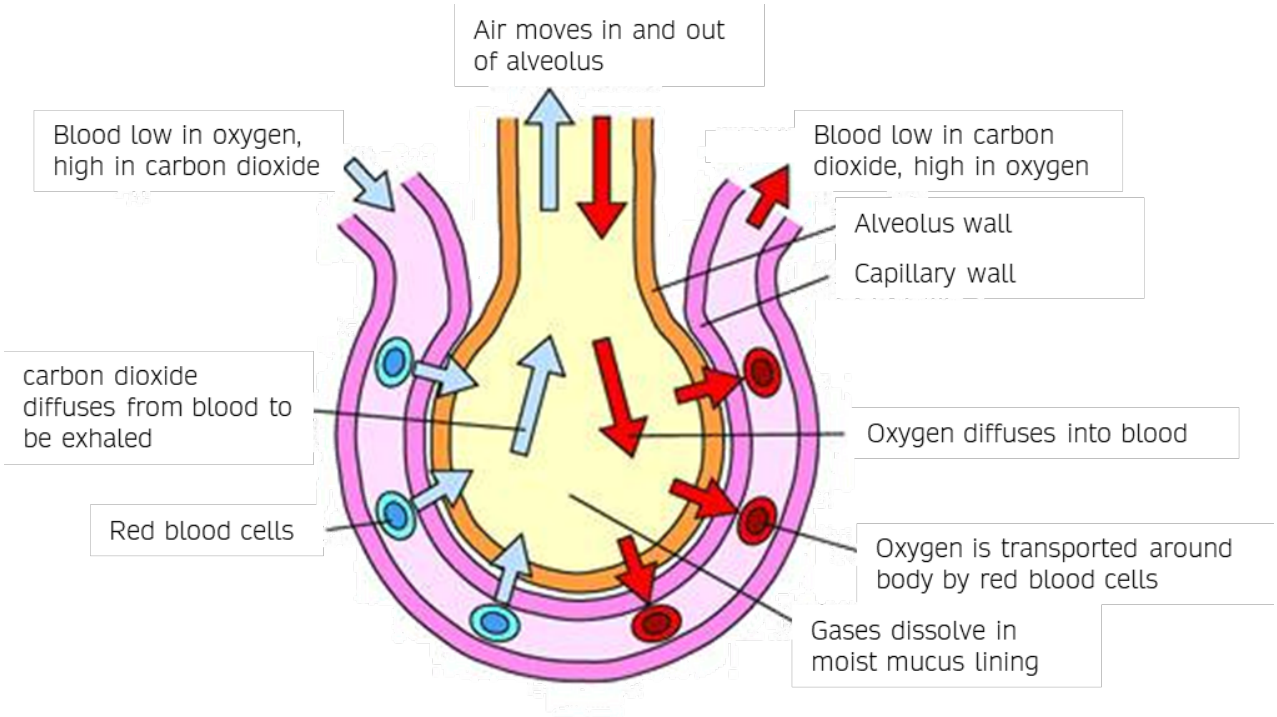
The structure of the alveoli and blood capillaries enable gaseous exchange to occur.

Only one cell thick, **alveoli** have direct contact with capillaries for gas exchange. The grapelike arrangement of alveoli creates an enormous surface area, enough for exchanging oxygen and carbon dioxide for the entire body.

Carbon dioxide, dissolved in the plasma of the blood, is carried to the alveoli so it can be breathed out, while oxygen, contained in the air breathed in, moves from the alveoli across to the red blood cells in the capillaries and back to the heart to be distributed.



Gas exchange across the alveoli.



Oxygen is transported to the cells of the body mainly by binding to **haemoglobin** which is found within red blood cells. Carbon dioxide is transported by diffusion into the plasma. **Diffusion** occurs because the oxygen is in higher concentration in the alveoli and moves to the lower concentration in the blood of the capillary.

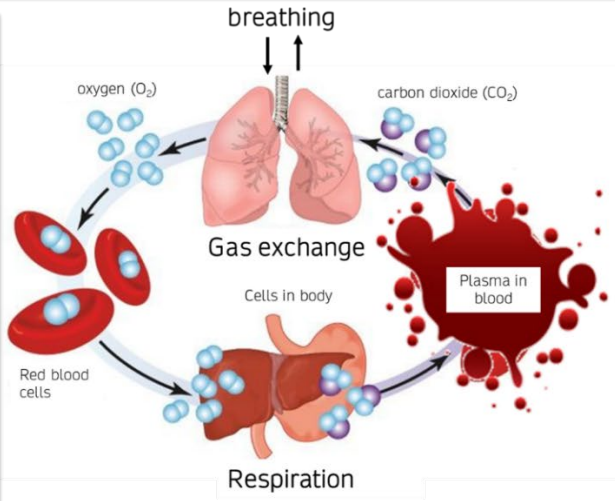
The CO_2 in the blood diffuses into the alveoli and out of the body because it also moves from high to low concentration. The oxygen molecules must diffuse through both the lining of the alveolus and the lining of the blood capillary and is eventually picked up by red blood cells.

1. Summarise each process in your own words

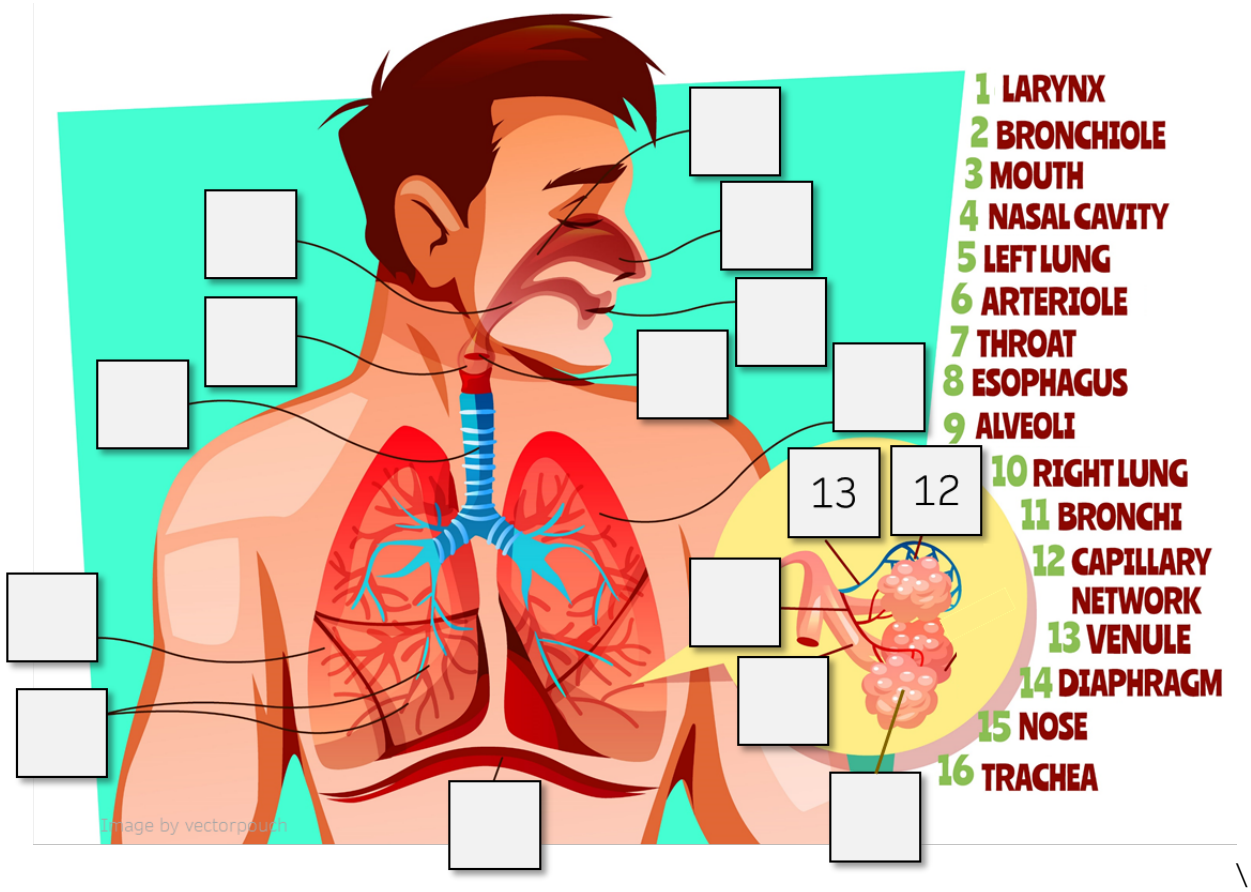
Breathing

Gas Exchange

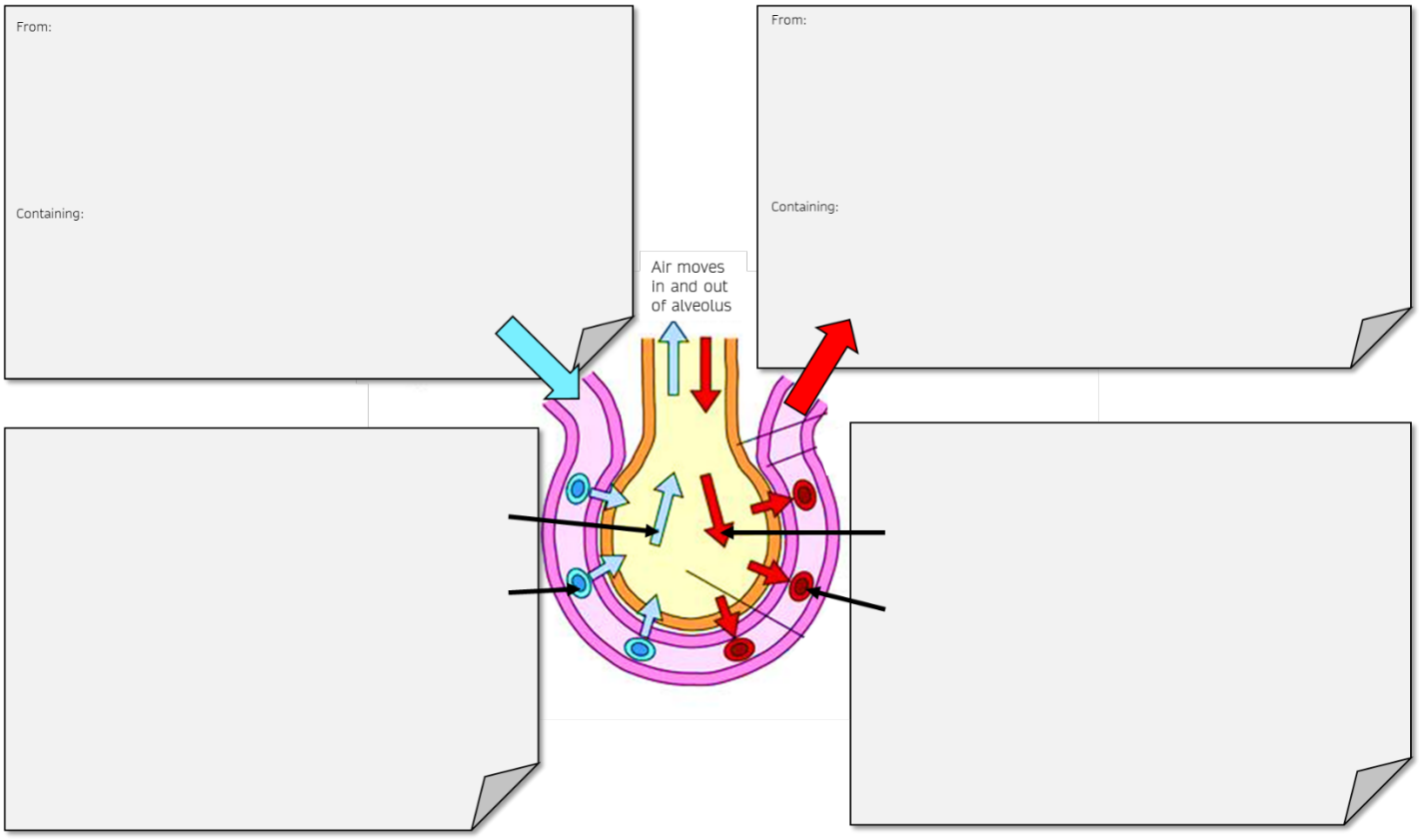
Respiration



2. Write in the remaining numbers that match the correct part of the respiratory system



3. The diagram below shows gas exchange in the alveoli of the lung. Add details to the labels to show what is happening during this process



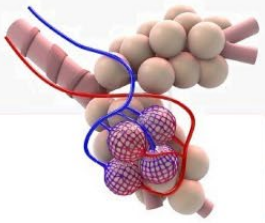
4. Respiration occurs in every cell. A chemical reaction with glucose and oxygen releases energy, along with carbon dioxide and water. Write this reaction in the form of a chemical reaction

+	→	+

5. Complete the chart on comparison between aerobic and anaerobic respiration - **EXTENSION**

Feature	Aerobic respiration	Anaerobic respiration
Oxygen requirement		
Waste products		
Efficiency in releasing energy from glucose		

6. Respiration rate can be affected by the amount and type of exercise you do. It can be measured by the number of breathes per minute. **Design an investigation** that you could easily carry out in your class. Consider all the variables that need to be controlled, as well as the independent variable (what you will change) and dependent variable (what you will measure)



My question:

My prediction: I predict that

Independent variable (change)	Control Variables (I will keep the same)
Dependent variable (measure) How I will do this (diagrams and words)	

Step One	Step Two
Step Three	Step Four