RESPIRATION

Respiration is a chemical reaction which happens in almost all cells in the body to produce energy from nutrient molecules. This energy can be used in a variety of processes including:

- Muscle contraction
- Protein synthesis
- Cell division
- Active transport
- Growth
- Nerve impulses
- Maintaining body temperature

TYPES OF RESPIRATION:

1)AEROBIC RESPIRATION: Aerobic respiration occurs in the presence of oxygen. Glucose is broken down into carbon dioxide, water and energy with the help of oxygen. This occurs in the cell mitochondria. Cells which require lots of energy, such as muscle cells, therefore have high amounts of mitochondria.

Equations for aerobic respiration:

- glucose + oxygen → carbon dioxide + water
- $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

2) ANAEROBIC RESPIRATION: Anaerobic respiration occurs when oxygen is not present. It is less efficient than aerobic respiration and produces less energy per glucose molecule. It occurs in the cell cytoplasm and thus does not require mitochondria.

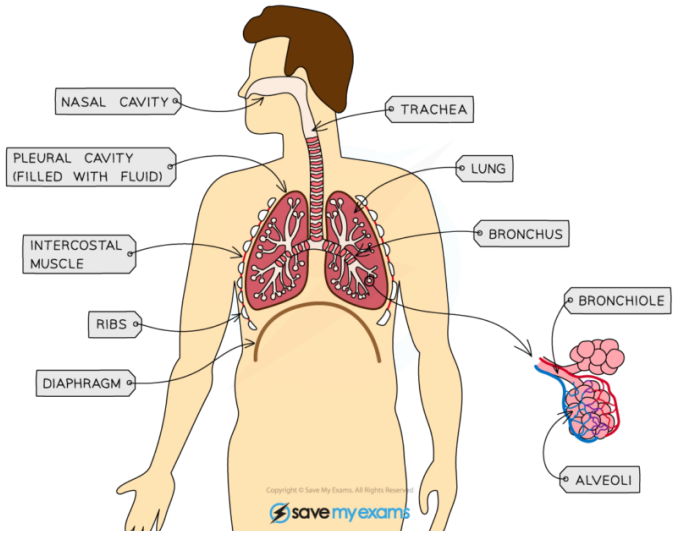
Animal cells undergo anaerobic respiration during vigorous exercise as not enough oxygen is delivered to muscles. In this reaction, glucose is broken down to produce lactic acid, as well as releasing energy. This lactic acid builds up in muscles and causes muscle fatigue. Anaerobic respiration also produces an

‘oxygen debt’. To repay this, the lactic acid must be transported to the liver where it is broken down into carbon dioxide and water using oxygen. This is the reason why the breathing and heart rates remain high after exercise.

Equation for anaerobic respiration in animal cells:

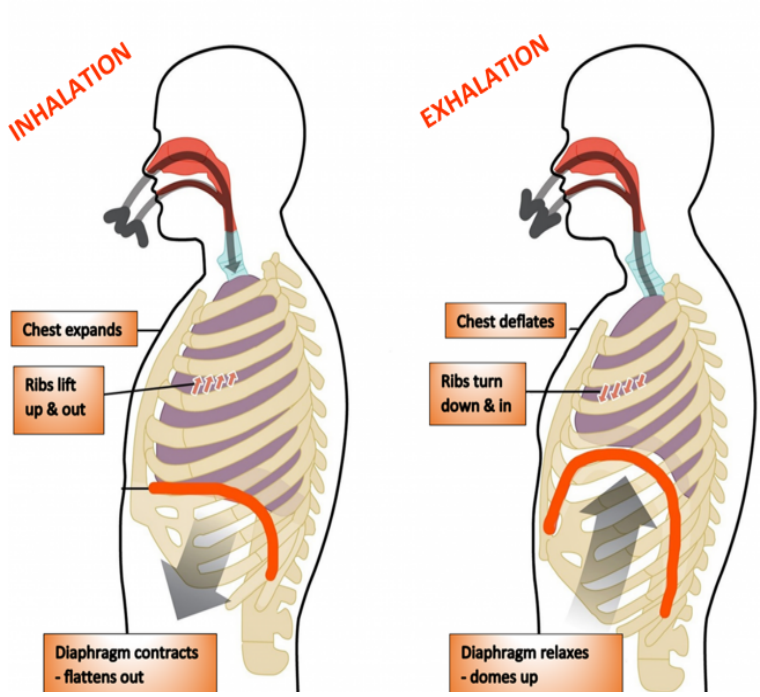
- glucose → lactic acid

Structure of the Breathing System



Structure	Description
Ribs	Bone structure that protects internal organs such as the lungs
Intercostal muscle	Muscles between the ribs which control their movement causing inhalation and exhalation
Diaphragm	Sheet of connective tissue and muscle at the bottom of the thorax that helps change the volume of the thorax to allow inhalation and exhalation
Trachea	Windpipe that connects the mouth and nose to the lungs
Larynx	Also known as the voice box, when air passes across here we are able to make sounds
Bronchi (pl)	Large tubes branching off the trachea with one bronchus (sin) for each lung
Bronchioles	Bronchi split to form smaller tubes called bronchioles in the lungs connected to alveoli
Alveoli	Tiny air sacs where gas exchange takes place

VENTILATION is the movement of a volume of gas into and out of the lungs.



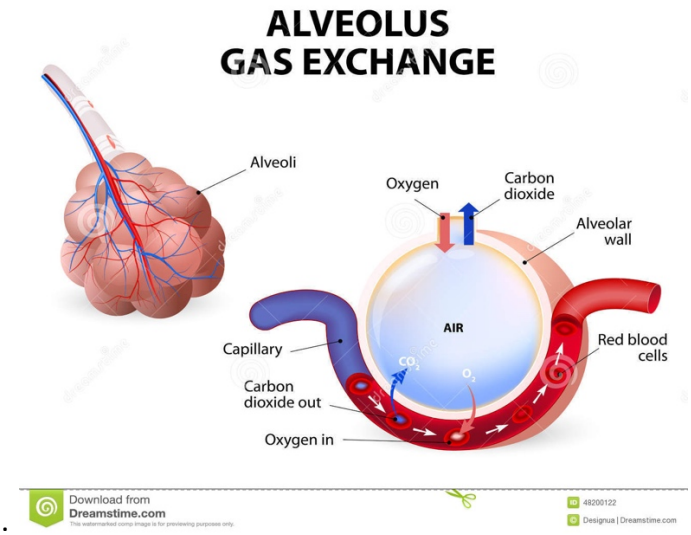
INHALATION:	EXHALING:
1)The internal intercostal muscles relax and the external intercostal muscles contract, pulling the ribcage upwards and outwards 2) The diaphragm contracts, pulling downwards 3) The volume in the thorax gets bigger, forcing the lungs to expand, and the air pressure inside decreases 4) Air is pushed into the lungs	1)The external intercostal muscles relax and the internal intercostal muscles contract, pulling the ribcage downwards and inwards 2) The diaphragm relaxes, moving back upwards 3)The lungs are elastic and shrink back to their relaxed volume and the air pressure inside increases 4) Air is pushed out of the lungs.

GASEOUS EXCHANGE:

Gaseous exchange refers to the exchange of oxygen and carbon dioxide, which takes place between the air and the blood vessels in the lungs.

Gas exchange in the lungs happens in the alveoli. Some of the features of alveoli include:

- thin walls (just one cell thick)
- large surface area
- moist surface
- many blood capillaries



Composition between inspired and expired air

	oxygen	carbon dioxide	water vapour
inhaled/%	21	0.04	variable
exhaled/%	16	4	saturated

BREATHING RATE AND EXERCISE:

- The increased rate and depth of breathing during exercise allows more oxygen to dissolve in the blood and supply the active muscles.
- The extra carbon dioxide that the muscles put into the blood is detected by the brain, which instructs the intercostal muscles and diaphragm muscles to contract and relax more rapidly, increasing the breathing rate.
- Carbon dioxide will be removed by the faster, deeper breathing.
- The rate of breathing can be measured by counting the number of breaths in one minute. The depth of breathing can be measured using a spirometer (a device that measures the volume of air inhaled and exhaled).