



LO: Identify on diagrams and name the larynx, trachea, bronchi, bronchioles, alveoli and associated capillaries



LO: State the characteristics of, and describe the role of, the exchange surface of the alveoli in gas exchange

Adaptations of alveoli for gaseous exchange:

- Numerous alveoli provide a large surface area for gaseous exchange.
- <u>Alveolar walls</u> are <u>one cell thick</u>, allowing for <u>faster diffusion of gases</u>.
- <u>Thin film of moisture</u> on the inner surface of the alveoli allows <u>oxygen to dissolve in</u> <u>it.</u>
- Walls of the alveoli are <u>richly supplied with blood capillaries</u>. The flow of blood maintains the <u>concentration gradient</u> of gases.





LO: Describe the removal of carbon dioxide from the lungs, including the role of the carbonic anhydrase enzyme

At the body cells/ tissues:

• <u>Carbonic anhydrase</u>, an enzyme found in red blood cells catalyses the conversion of <u>carbon dioxide and water</u> to <u>carbonic acid</u>.

Carbonic anhydrase

carbon dioxide + water \rightarrow carbonic acid CO₂ + H₂O \rightarrow H₂CO₃

- <u>Carbonic acid</u> is converted to <u>hydrogen carbonate ions</u> which <u>diffuse</u> out of the red blood cells.
- Most carbon dioxide is carried in the blood plasma as hydrogen carbonate ions.

In the lungs:

• <u>Carbonic anhydrase</u> found in red blood cells catalyses the conversion of <u>carbonic</u> <u>acid back to carbon dioxide and water.</u>

Carbonic anhydrase

carbonic acid \rightarrow carbon dioxide + water H₂CO₃ \rightarrow CO₂ + H₂O

• <u>Carbon dioxide diffuses out of the blood capillaries into the alveoli</u> to be removed during exhalation.



CO₂ forms at the lungs & is exhaled

Concepts Summary Notes Nan Hua High School Biology





LO: Describe the role of cilia, diaphragm, ribs and intercostal muscles in breathing

Cilia	Diaphragm	Ribs	Intercostal muscles
Found on the epithelial cells which sweeps and <u>remove mucus</u>	Inspiration: Diaphragm muscle contracts and flattens to increase volume of thoracic cavity and lungs expand. Pressure in lungs decrease and air is forced into the lungs.	Inspiration: Swings upwards and outwards to increase volume of thoracic cavity. Expiration: Swing downwards and inwards to decrease volume of thoracic cavity.	Inspiration: External intercostal muscles contract while the internal intercostal muscles relax Expiration: Internal intercostal muscles contract while the external intercostal muscles relax
Goblet/gland cell produces and secretes mucus	Expiration: Diaphragm muscle relaxes and arches upwards to decrease volume of thoracic cavity and lungs contract. Pressure in lungs increase and air is forced out of the lungs.		(Note: External and internal intercostal muscles are antagonistic , when one contracts, the other relaxes.)



LO: Describe the effect of tobacco smoke and its major toxic components – nicotine, tar and carbon monoxide, on health

Chemical	Properties of the chemicals	Effects on the body
Nicotine	 Addictive Causes release of adrenaline Causes blood to clot easily 	 Increase in heartbeat and blood pressure Increased risk of blood clots in blood vessels
Carbon monoxide	 Binds with haemoglobin to form <u>carboxyhaemoglobin</u> which <u>reduces the oxygen</u> <u>carrying capacity of red blood</u> <u>cells, reducing the amount of</u> <u>oxygen being transported</u> around the body. Increases the rate of fatty deposits on inner arterial wall Damages lining of blood vessels 	 Death if concentration in air is increased by 1% Increased risk of atherosclerosis Increased risk of blood clotting in arteries

Concepts Summary Notes Nan Hua High School Biology





 Carcinogenic (cancer causing) chemical which induce uncontrolled cell division of the epithelium Paralyses cilia lining the air passages 	•	Blockage in the air sacs and reduction in gas exchange efficiency Dust particles trapped in the mucus lining the airways cannot be removed
---	---	---

LO: Define and state the equation, in words and symbols, for aerobic respiration in humans

Definition:

Aerobic respiration is the <u>oxidation of glucose in the presence of oxygen</u> with the <u>release</u> <u>of a large amount of energy</u>. <u>Carbon dioxide and water</u> are released as waste products.

Word equation:

Glucose + Oxygen \rightarrow Carbon dioxide + Water + Large amount of energy

Chemical equation:

 $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + Large amount of energy$

LO: Define and state the equation, in words only, for anaerobic respiration in humans

Definition:

Anaerobic respiration is the oxidation of glucose in the absence of oxygen. Anaerobic respiration releases lesser energy than aerobic respiration and produces lactic acid.

Word equation:

Glucose \rightarrow Lactic acid + Small amount of energy

Compare aerobic respiration and anaerobic respiration:

Similarities:

Both aerobic and anaerobic respiration release energy for cellular activities.

Both aerobic and anaerobic respiration <u>involves breakdown/oxidation of glucose/ use</u> <u>glucose as a substrate</u>.





Differences:

Aerobic Respiration	Anaerobic Respiration		
requires oxygen to be present	does not require oxygen to be present		
releases large amount of energy	releases small amount of energy		
breaks down glucose to water and carbon dioxide	breaks down glucose to lactic acid in humans / ethanol and carbon dioxide in plants		
occurs in the mitochondria	occurs in the cytoplasm		

LO: Describe the effect of lactic acid in muscles during exercise

- Exercise increases muscular contractions.
- Energy demand increases.
- Rate of respiration increases to meet increased in energy demand.
- Heart rate increases to increase blood supply which contains oxygen and glucose to the muscles.
- If the increased oxygen intake is not able to meet the oxygen demand, an <u>oxygen</u> <u>debt results</u> and <u>anaerobic respiration</u> takes place to <u>release the energy</u> required.
- Lactic acid builds up slowly in muscles during exercise.
- At high enough concentrations, lactic acid will cause <u>fatigue</u> and <u>muscular pain</u>. The body needs to rest and recover.
- An oxygen debt is the volume of oxygen required to remove the lactic acid that has been built up.
- Breathing rate continues to be <u>high</u> and <u>starts to decrease</u> after exercise to <u>repay</u> <u>the oxygen debt</u> and lactic acid is removed from the muscles and transported to the <u>liver.</u>
- In the liver, the <u>lactic acid is oxidised to release energy</u>, which is used to convert the remaining lactic acid to glucose, which is transported back to the muscles.