

# GCSE Biology Topic 4.4.2: Respiration

This is the second part of Biology Topic 4 – Bioenergetics. It mainly focuses on aerobic and anaerobic respiration and how our body uses it during exercise. We also explore the idea of metabolism.

## Respiration Formulae

Aerobic Respiration:



**Glucose + Oxygen -> Carbon Dioxide + Water**

Anaerobic Respiration in muscle cells:



**Glucose -> Lactic Acid**

Anaerobic Respiration in plants and yeast cells:



**Glucose -> Ethanol + Carbon Dioxide**

### Cover up the *blue* boxes

Cover up the boxes above using a paper or bookmark in blue and try to recall it either out loud or in your head. Try it out: *it's way better than just reading.*

### How to Revise

Cover up the boxes in blue below and try to recall it either out loud or in your head. Factual Recall is important for specific definition questions.

Biology Fact Recall Table	
What type of reaction is cellular respiration and what's happening?	Cellular respiration is an exothermic reaction which is continuously occurring in living cells.
Why is respiration needed?	The energy transferred supplies all the energy needed for living processes.
Compare the processes of aerobic and anaerobic respiration with regard to the need for oxygen, the differing products and the relative amounts of energy transferred.	Aerobic respiration uses oxygen, anaerobic respiration does not. Aerobic respiration produces carbon dioxide and water from the reaction (as well as the ATP). Anaerobic respiration only produces lactic acid. As the oxidation of glucose is incomplete in anaerobic respiration, much less energy is transferred than in aerobic respiration.
Define Respiration.	Respiration is the process of transferring energy from glucose, which goes on in every cell.

Give three examples of how organisms use the energy transferred by respiration.	1: To build up larger molecules from smaller ones (like proteins from amino acids)
	2: In animals it's used to allow the muscles to contract (so they can move about)
	3: In mammals and birds the energy is used to keep their body temperature steady in colder surroundings.
Define the term "anaerobic".	In the absence of oxygen.
Define the term "aerobic".	In the presence of oxygen.
What is an exothermic reaction?	A reaction that gives out energy.
Name the type of cellular organelle in which respiration occurs.	Mitochondria, also known as the power house of the cell.
What is the symbol equation for aerobic respiration?	$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$
Respiration in cells can take place in which two ways?	Aerobically (using oxygen) and anaerobically (without oxygen) to transfer oxygen
Why do organisms need energy?	1. Chemical reactions to build larger molecules; 2. Movement; 3. Keeping warm
What is the equation for <b>aerobic</b> respiration?	Glucose + Oxygen → Carbon dioxide + water
What is the equation for <b>anaerobic</b> respiration in <b>humans</b> ?	Glucose → Lactic acid
Why is there less energy transferred in <b>anaerobic</b> respiration?	As the oxidation of glucose is incomplete in anaerobic respiration much less energy is transferred than in aerobic respiration.
What is the equation for <b>anaerobic respiration</b> in <b>plants and yeast cells</b> ?	Glucose → Ethanol + Carbon dioxide
What is <b>anaerobic</b> respiration in <b>yeast cell</b> called?	Fermentation
Why is fermentation important?	It has economic importance in the manufacture of bread and alcoholic drinks.
Explain why some cells, such as sperm and muscle, contain more mitochondria than others.	Muscle cells have many mitochondria, which allows them to respond quickly to the need for doing work. Mitochondria produce ATP during aerobic respiration and ATP is needed for muscle to contract.
What happens during exercise?	During exercise the human body reacts to the increased demand for energy. The heart rate, breathing rate and breath volume increase during exercise to supply the muscles with more oxygenated blood.

What happens if we run out of oxygen during exercise? What happens during long periods of exercise and what happens?	If insufficient oxygen is supplied anaerobic respiration takes place in muscles. The incomplete oxidation of glucose causes a buildup of lactic acid and creates an oxygen debt. During long periods of vigorous activity muscles become fatigued and stop contracting efficiently.
What causes muscle fatigue?	Long periods of exercise
How does vigorous exercise cause lactic acid?	Our body can't supply oxygen to our muscles quickly enough when doing vigorous exercise, so they start respiring anaerobically. Lactic acid therefore builds up, which gets painful.
Explain what an "oxygen debt" is.	Oxygen debt is the amount of extra oxygen your body needs to react with the buildup of lactic acid and remove it from the cells.
How does liver play a role into breaking down lactic acid?	The blood that enters your muscles transports the lactic acid to the liver. In the liver, the lactic acid is converted back to glucose.
What does metabolism include?	Conversion of glucose to starch, glycogen and cellulose
	The formation of lipid molecules from a molecule of glycerol and three molecules of fatty acids
	The use of glucose and nitrate ions to form amino acids which in turn are used to synthesize proteins
	Respiration
	Breakdown of excess proteins to form urea for excretion
What is metabolism?	The sum of all of the reactions that happen in a cell or the body
Give three examples of how larger molecules are made from smaller ones.	Lots of small glucose molecules are joined together in reactions to form <b>starch</b> (a storage molecule in plant cells), <b>glycogen</b> (a storage molecule in animal cells) and <b>cellulose</b> (a component of plant cell walls).
	Lipid molecules are each made from one molecule of glycerol and three fatty acids.
	Glucose is combined with nitrate ions to make amino acids, which are then made into proteins.
Give two examples of how larger molecules are broken down into smaller ones.	Glucose is broken down in respiration. Respiration transfers energy to power all the reactions in the body that make molecules.
	Excess protein is broken down in a reaction to produce urea. Urea is then excreted in urine.

What is the energy transferred by metabolism in cells used for?

The energy transferred by respiration in cells is used by the organism for the continual enzyme controlled processes of metabolism that synthesize new molecules.

***Recall recall recall***

Make sure you can recall all the definitions before moving on. Spread out this recall session over a few days to ensure it's in your long-term memory.