

IGCSE Biology Workbook

12. Respiration

The stuff you need to know in this chapter:

12.1 RESPIRATION

Core:

- State the uses of energy in the body of humans: muscle contraction, protein synthesis, cell division, active transport, growth, the passage of nerve impulses and the maintenance of a constant body temperature
- State that respiration involves the action of enzymes in cells

12.2 AEROBIC RESPIRATION

Core:

- Define aerobic respiration as the chemical reactions in cells that use oxygen to break down nutrient molecules to release energy
- State the word equation for aerobic respiration

Extended:

- Investigate the uptake of oxygen by respiring organisms such as arthropods and germinating seeds
- State the balanced chemical equation for aerobic respiration
- Investigate the effect of temperature on the rate of respiration of germinating seeds

12.3 ANAEROBIC RESPIRATION

Core

- Define anaerobic respiration as the chemical reactions in cells that break down nutrient molecules to release energy without using oxygen
- State the word equations for anaerobic respiration in muscles during vigorous exercise (glucose → lactic acid) and the microorganism yeast (glucose → alcohol + carbon dioxide)
- State that anaerobic respiration releases much less energy per glucose molecule than aerobic respiration

Extended

- State the balanced chemical equation for anaerobic respiration in the microorganism yeast as

$$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$$
- State that lactic acid builds up in muscles and blood during vigorous exercise causing an oxygen debt
- Outline how the oxygen debt is removed during recovery, limited to:
 - aerobic respiration of lactic acid in the liver
 - continuation, after exercise, of fast heart rate to transport lactic acid in blood from muscles to the liver
 - continuation, after exercise, of deeper breathing supplying oxygen for aerobic respiration of lactic acid

(CIE, 2014)

Ref:

- CIE: Cambridge International Examination (2014) *0610 IGCSE Biology Syllabus Guide* [Online]

12.1 RESPIRATION

Make a list of physical activity you have done in the past 24 hours that requires energy. Include low energy activities as well, such as picking up a cup, typing on a keyboard etc. You should easily list 10 things or more.

Above you probably mentioned physical activities which require energy through muscle contractions. Apart from muscles contracting, what other types of activities has your body done in the past 24 hours that require energy? Complete the list below:

- Pr _____
- C _____ d _____
- A _____ t _____
- G _____
- S _____ n _____ i _____
- M _____ c _____ b _____ t _____

Respiration would happen very slowly without help. State which type of protein molecule increases the speed of respiration in cells.

12.2 AEROBIC RESPIRATION

Define aerobic respiration

Write the equations for aerobic respiration. Use the words/chemical symbols below to help.

H₂O CO₂ glucose O₂ water carbon dioxide oxygen C₆H₁₂O₆

Word Equation:

Chemical Equation:

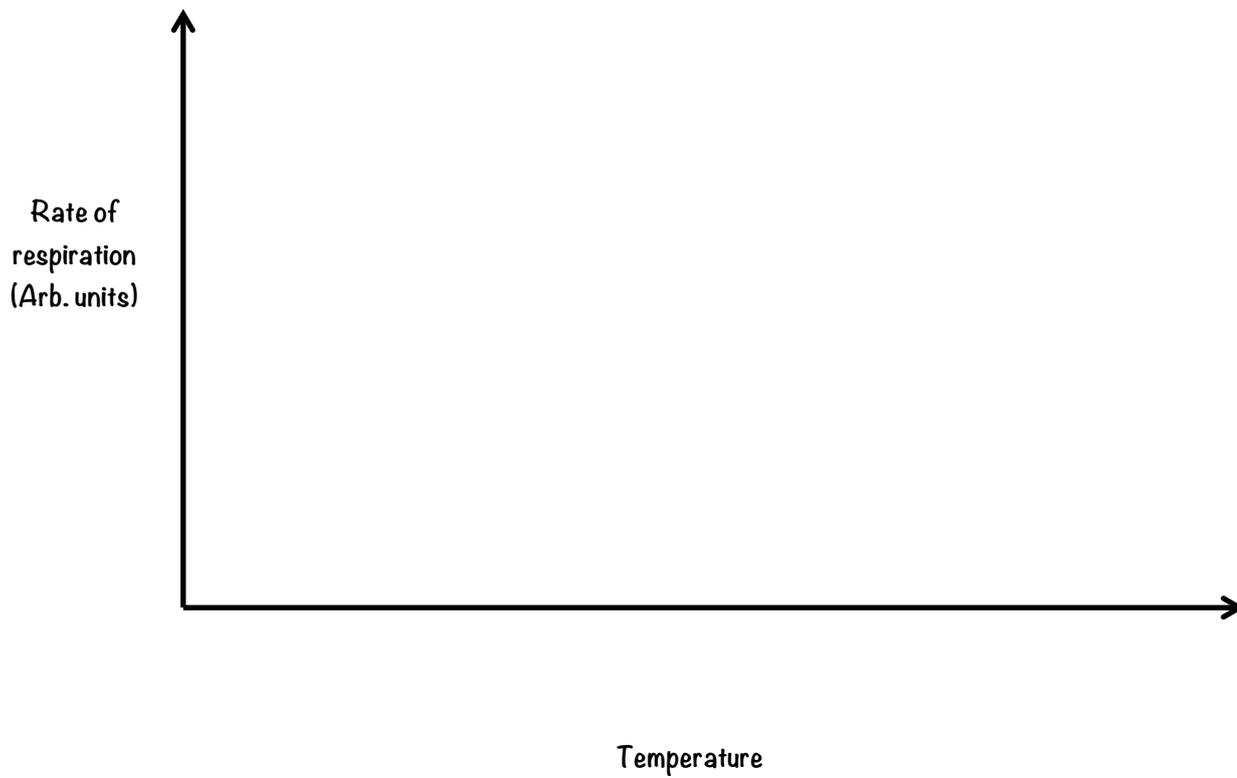
== Now BALANCE the chemical equation above (word equations don't need to be balanced) ==

Write the word equation for aerobic respiration in plants:

Yes, this is an easy question, it's not a trick!!

Organisms each have a specific optimum temperature for respiration to happen, meaning the reaction happens fastest at that temperature. Which molecule in cells determines the speed of the reaction? (Hint, it's a protein)

A plant that is endemic to a warm tropical country might respire best at about 30°C . Draw a graph to show how the rate of respiration might change for this plant between 0 and 60°C . Remember to add a scale to the x-axis.



Using what you know about enzymes, explain* the shape of your graph above.

***REMEMBER:** "Explain" is not the same as "describe". When you explain, you have to give reasons for the pattern/change you see.

12.3 ANAEROBIC RESPIRATION

Define anaerobic respiration

Write the equations for anaerobic respiration. Use the words/chemical symbols below to help.

CO₂ glucose water ethanol carbon dioxide C₂H₅OH lactic acid

Word Equation for anaerobic respiration in humans:

Word Equation for anaerobic respiration in yeast:

Balanced Chemical Equation for anaerobic respiration in yeast:

John says, "Aerobic respiration is better than anaerobic respiration because you get more energy from the same amount of oxygen."

State one thing about the statement that is correct:

State one thing about the statement that is incorrect:

State the product of anaerobic respiration in humans (look back at your word equation)

After anaerobic exercise, your body needs you to pay-back the oxygen you didn't provide during exercise. What name is given to this need additional oxygen?

What does your body do with the extra oxygen you breathe in?

Where does this process happen?

Explain why a fast heart rate and fast breathing rate must continue after anaerobic exercise