

## Photosynthesis:

Plants trap and absorb light energy which is called photosynthesis

Photosynthesis is an endothermic reaction because it takes in energy

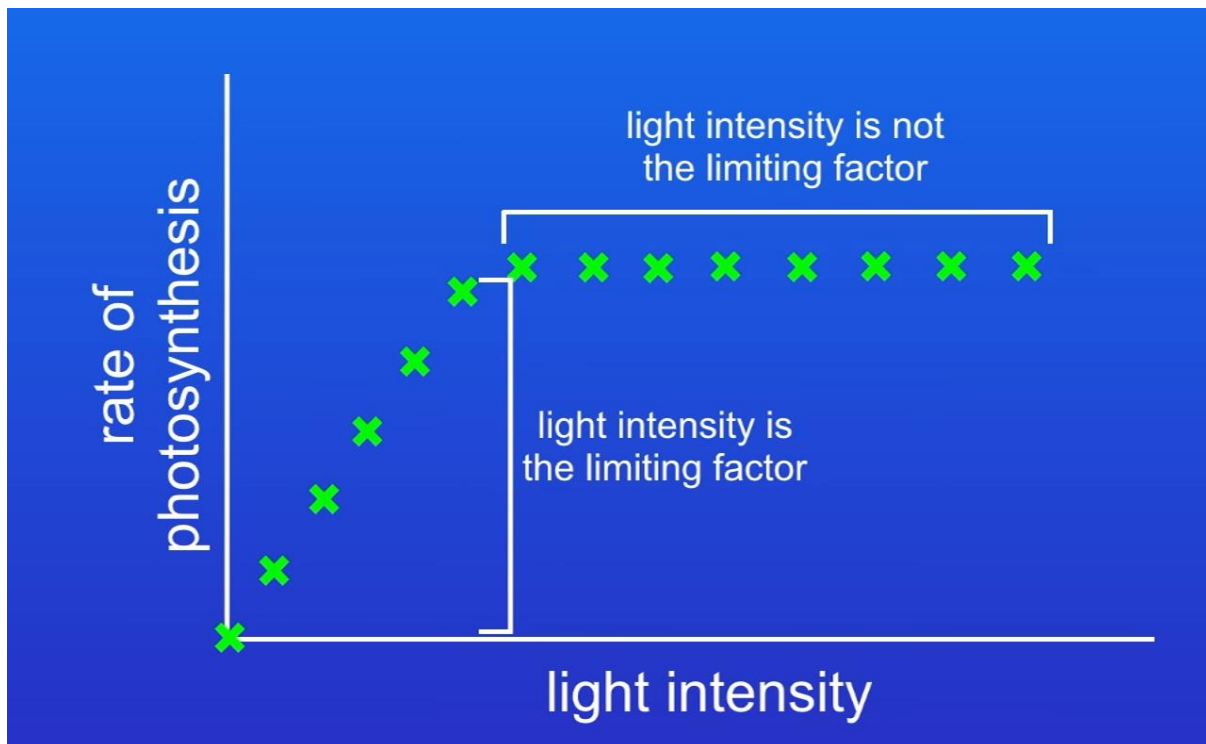
Photosynthesis takes place in the leaves of the plant

Chlorophyll can absorb light energy

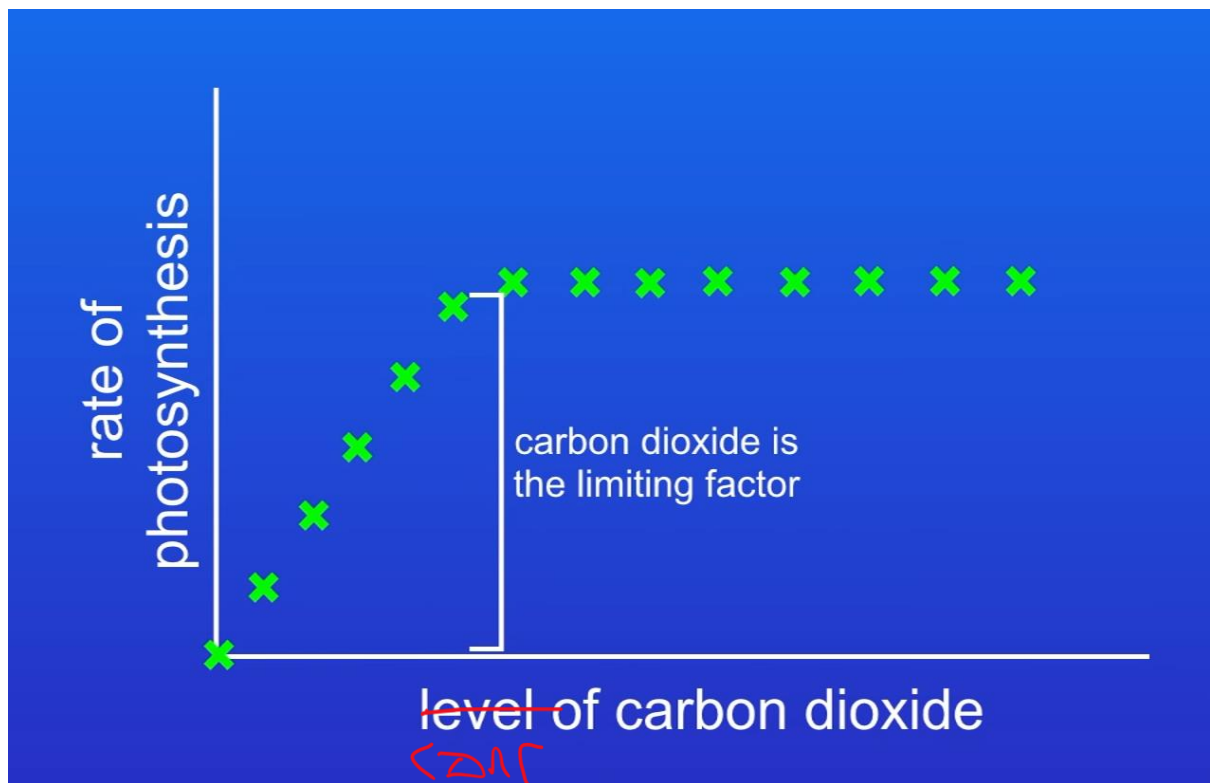
### Equation for photosynthesis:



## Factors affecting the rate of photosynthesis:

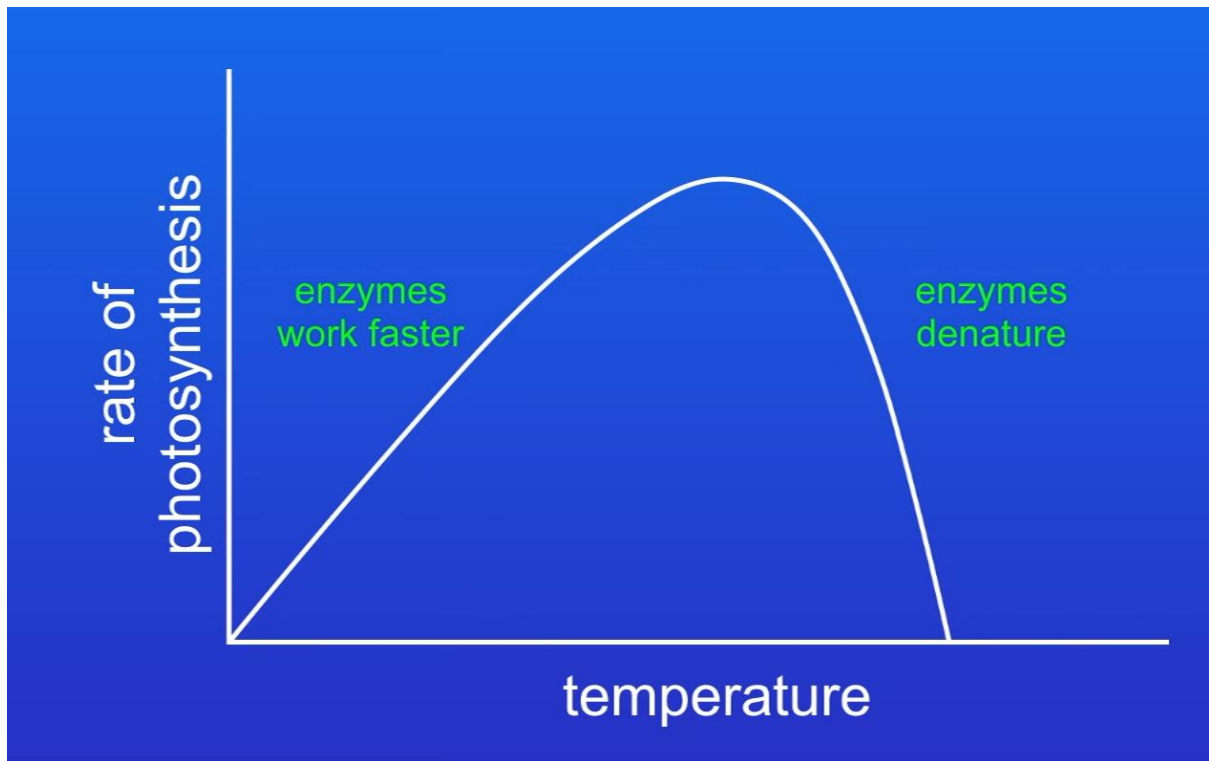


- When the light intensity is zero, the rate of photosynthesis is zero
- As we increase the light intensity, the rate of photosynthesis increases which makes light intensity a limiting factor
- If we increase the light intensity further, the rate of photosynthesis doesn't increase because the plant has a sufficient amount of light energy so this means that light intensity is not the limiting factor
- This means that plant needs other things to help it increase the rate of photosynthesis



- As we increase the concentration of carbon dioxide, the rate of photosynthesis increases meaning that carbon dioxide is a limiting factor
- As we increase it further, the rate of photosynthesis doesn't increase because the plant has a sufficient concentration of carbon dioxide meaning that carbon dioxide is not a limiting factor

Another factor could be the amount of chlorophyll, if there is less chlorophyll, the plant will have a lower rate of photosynthesis



- As we increase the temperature, the rate of photosynthesis will be faster meaning the enzymes will work faster and will reach the optimum temperature
- If we further increase the temperature, the rate of photosynthesis will start to fall because the enzymes become denatured

### **Uses of glucose:**

The first use of glucose is to release energy from respiration

Respiration takes place in the mitochondria

The second use of glucose is to produce starch. The starch can be converted back into glucose when plant is in need of it.

The third use is that the plant converts it into fats and oils which is used as a storage form for energy

The fourth use of glucose is to produce cellulose to strengthen the cell wall

The final use is to produce amino acids which is used to create proteins. To make amino acids, plants need to absorb nitrate ions from the soil

## **Photosynthesis required practical:**

### **How to perform:**

1. Start by taking a boiling tube and placing it 10cm away from an LED light source
2. An LED is used because it doesn't release much heat. Too much heat would change the temperature of the experiment
3. If we use a normal light source, then we need to place a test tube with water in between so this test tube absorbs the heat released from the light

4. We fill the test tube with sodium hydrogen carbonate solution which is needed for photosynthesis
5. We put a piece of pondweed into the boiling tube with the cut end at the top
6. We leave this for five minutes to adapt to the environment in the boiling tube
7. We should see bubbles forming at the top end of the pondweed
8. We start a stopwatch and count the number of bubbles produced in one minute
9. We repeat this two more times and then calculate the mean number of bubbles produced
10. We repeat the whole experiment again but this time from different distances such as 20cm, 30cm, 40cm

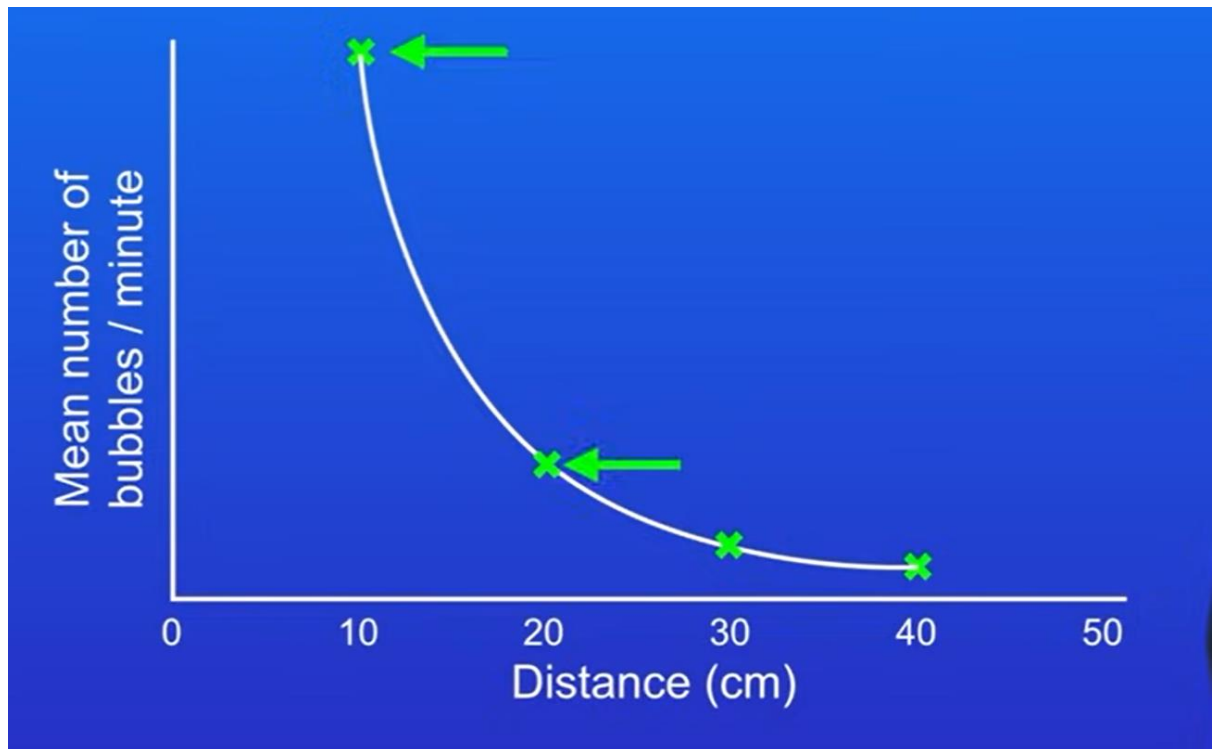
### **Problems with this practical:**

- The bubbles can be too fast to count
- The size of the bubbles differ which means that they all count the same

### **We can solve this by measuring the volume of oxygen produced:**

1. Place a funnel on top of the pondweed and place a measuring cylinder on top of the funnel

2. We use the measuring cylinder to measure the volume of oxygen produced



If we double the distance, then the number of bubbles per minute falls by a factor of four or 4 times

This is called the inverse square law

### **Limiting factors:**

Factors which affect photosynthesis:

- Amount of chlorophyll
- Temperature
- Light intensity
- Concentration of carbon dioxide

## **Farmers increase the rate of photosynthesis by growing plants in a greenhouse:**

- They can switch the lights on during the night
- They can adjust the temperature
- They can also add carbon dioxide

Some gardeners use oil burners which release heat and carbon dioxide at the same time

## **Respiration:**

### **Uses of energy in humans:**

- Movements
- Maintain body temperature
- Chemical reactions to occur to build larger molecules

Respiration is an exothermic reaction which releases energy

Respiration takes place in all living cells



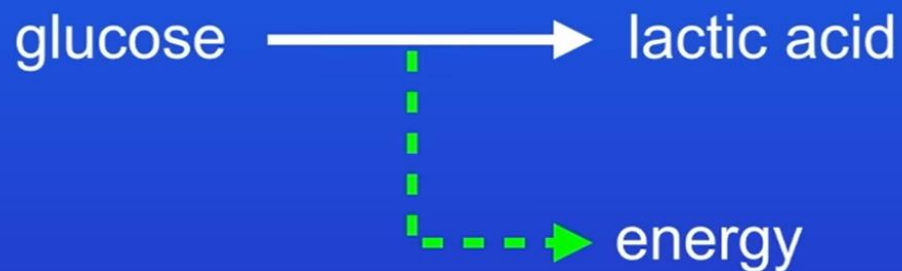
## Aerobic Respiration



Anaerobic respiration is needed when there is not enough oxygen (during exercise)

Muscle cells need anaerobic respiration

## Anaerobic respiration in muscles



Anaerobic respiration doesn't release as much energy as aerobic respiration.

This is because the oxidation of glucose is incomplete whereas the oxidation of glucose in aerobic respiration is complete

In yeast cells and plant cells, products would be:

- Ethanol
- Carbon dioxide

glucose → ethanol + carbon dioxide + energy released

### **Exercise:**

During exercise the body needs a lot of energy for muscle contraction. This causes aerobic respiration to increase. This means that body cells need more oxygen.

### **To provide extra oxygen for the body:**

- We breathe more frequently
- We take deeper breaths
- The heart rate also increases to pump oxygenated blood around the body
- The heart pumps with more force

When we are exercising hard, anaerobic respiration takes place in the muscles

The lactic acid produced during anaerobic respiration causes the muscles to become fatigued and causes cramps. This stops the muscles from contracting.

The body needs to remove this lactic acid, this creates the condition oxygen debt:

- The lactic acid is transported out of the body by the blood
- The lactic acid is taken to the liver and is converted into glucose through chemical reactions using enzymes and oxygen

Oxygen debt – Amount of extra oxygen needed after exercise to deal with the lactic acid.

This is why some people breathe very heavily after exercising

0 4	This question is about exercise.
0 4 . 1	During vigorous exercise, anaerobic respiration occurs in a person's body. Explain <b>two</b> effects of anaerobic respiration on the person's body. <span style="float: right;">[4 marks]</span>
1	<hr/> <hr/> <hr/> <hr/>
2	<hr/> <hr/> <hr/> <hr/>

Question	Answers	Extra Information	Mark
04.1	<p>any <b>two</b> from:</p> <ul style="list-style-type: none"> <li>• <i>(effect)</i> muscle fatigue <b>or</b> oxygen debt occurs (1)</li> <li><i>(reason)</i> caused by (build-up of) lactic acid (1)</li> <li>• <i>(effect)</i> (continued) heavy / deep / fast breathing (1)</li> <li><i>(reason)</i> to provide the oxygen needed to break down (built-up) lactic acid (1)</li> <li>• <i>(effect)</i> (continued) increased heart rate (1)</li> <li><i>(reason)</i> to provide the oxygen needed to break down (built-up) lactic acid (1)</li> <li>• <i>(effect)</i> fewer / weaker muscle <u>contractions</u> (1)</li> <li><i>(reason)</i> (because) less energy is released / available (1)</li> </ul>	<p>mark as pairs</p> <p>allow muscle cramp ignore fatigue / cramp unqualified</p> <p>allow to repay the oxygen debt</p> <p>allow to repay the oxygen debt</p> <p>do <b>not</b> accept energy being produced / made / created</p>	4

## **Metabolism:**

Metabolism is the sum of all the chemical reactions in a cell or the body

## **Glucose in humans:**

- Used for glycogen which a storage form of glucose

1 glycerol + 3 fatty acids = 1 lipid molecule (which is found in the cell membrane)

Excess proteins are broken down into urea which is then excreted by the kidneys