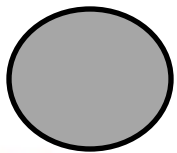


Bioenergetics

Biology Paper 1



Content you will **NOT** be assessed on



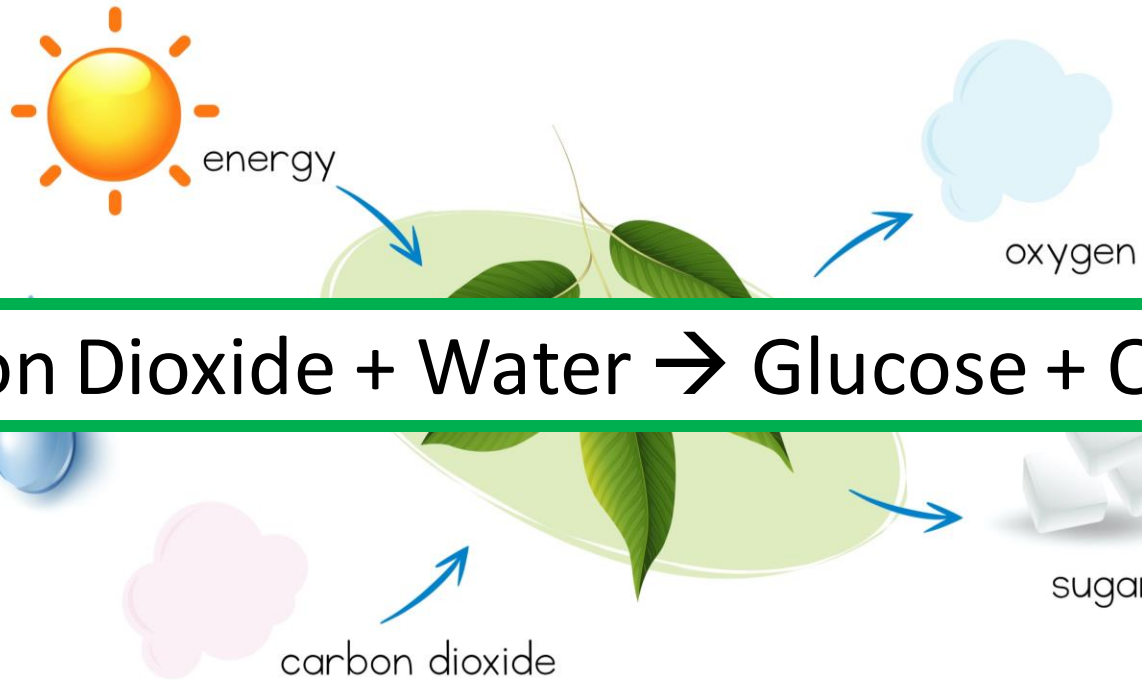
4.1.1 Photosynthetic Reaction

Think

Pair

Share

What is the equation for photosynthesis?



4.1.1 Photosynthetic Reaction

Think
Pair
Share

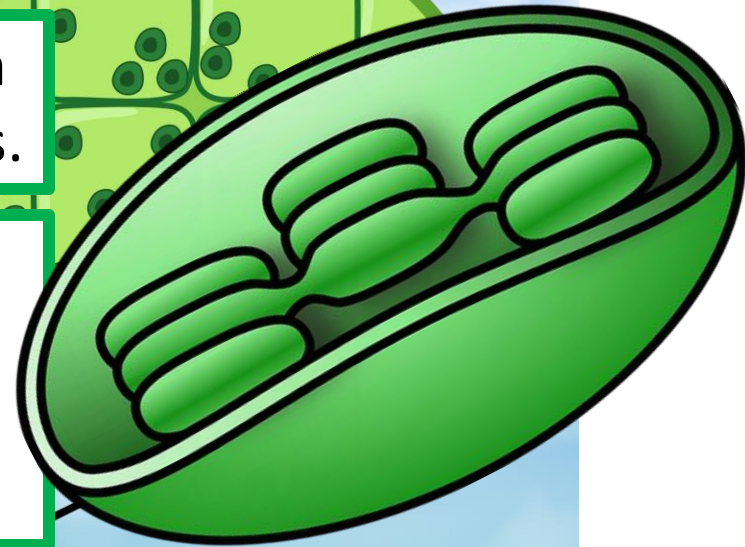
What happens during photosynthesis?

Photosynthesis as an **endothermic reaction** in which energy is transferred from the environment to the **chloroplasts** by light.

An endothermic reaction is a reaction that uses energy from its surroundings.

Chloroplasts are the cell structure where photosynthesis takes place. They contain a green pigment called **chlorophyll**.

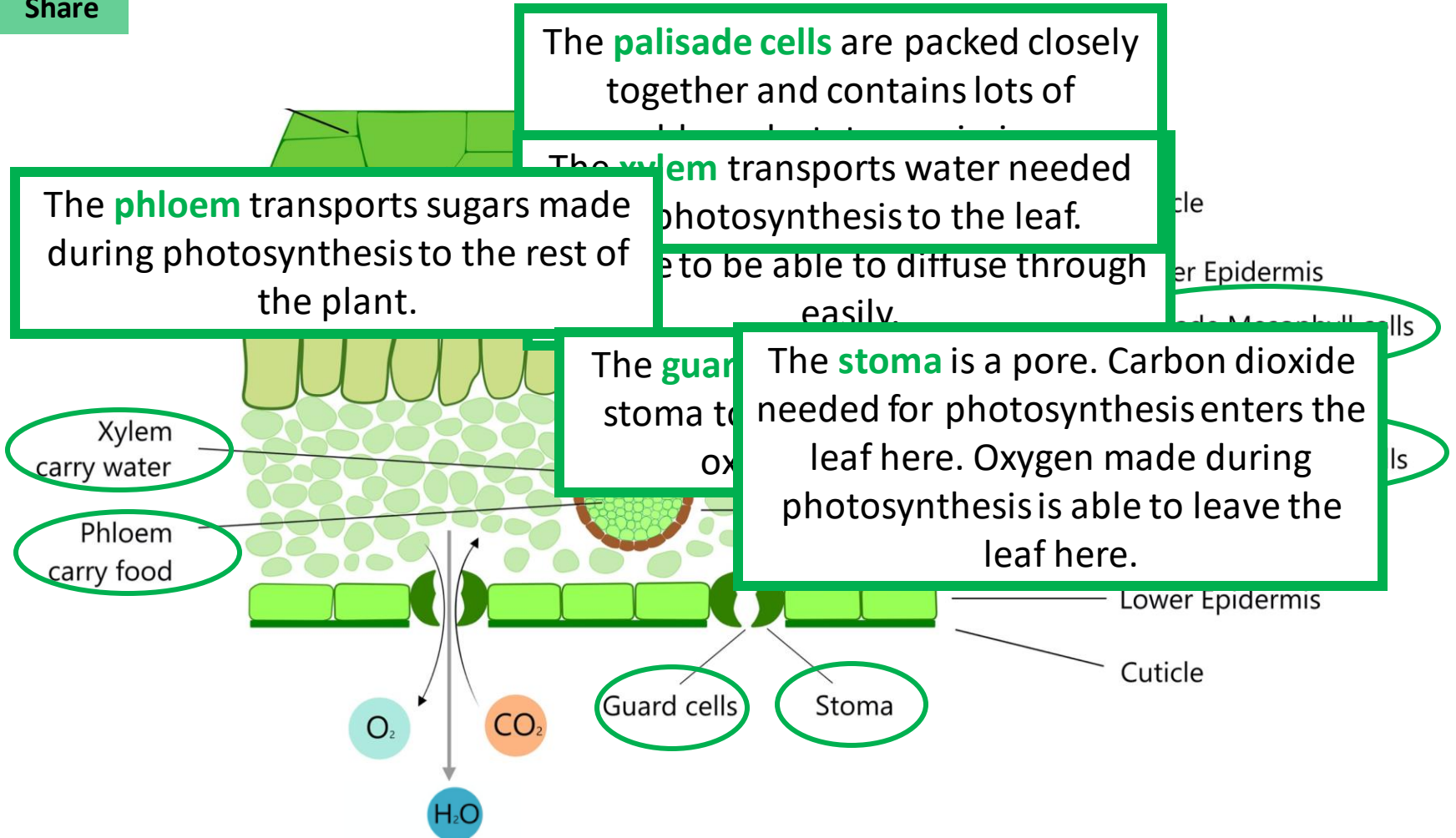
Chlorophyll is a green pigment needed for photosynthesis.



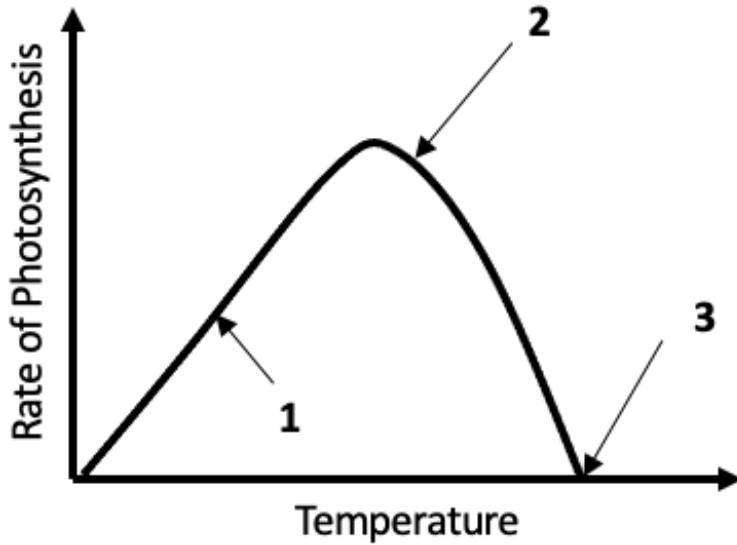
4.1.1 Photosynthetic Reaction

Think
Pair
Share

How is a plant adapted for photosynthesis?

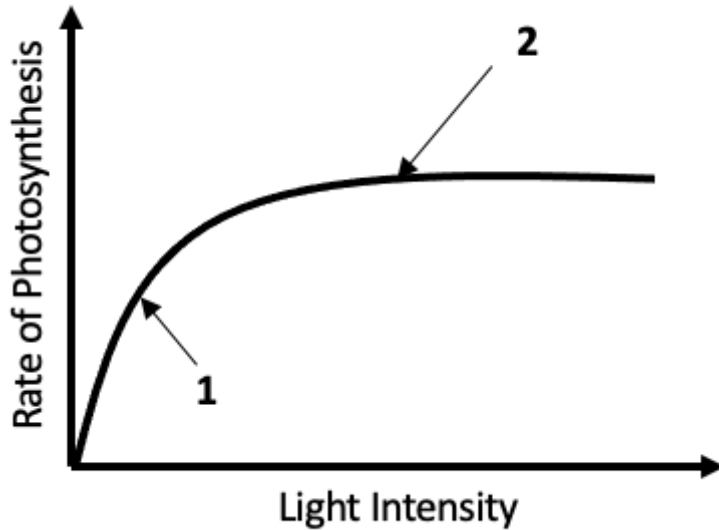


4.1.2 Rate of Photosynthesis



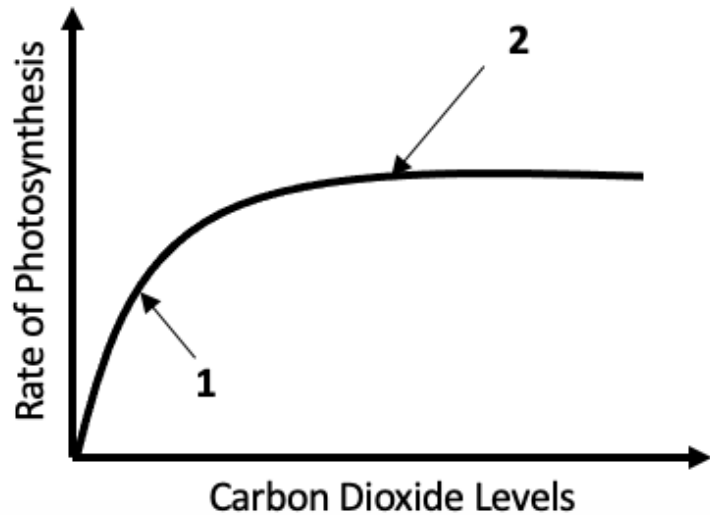
Temperature

4.1.2 Rate of Photosynthesis



Light Intensity

4.1.2 Rate of Photosynthesis



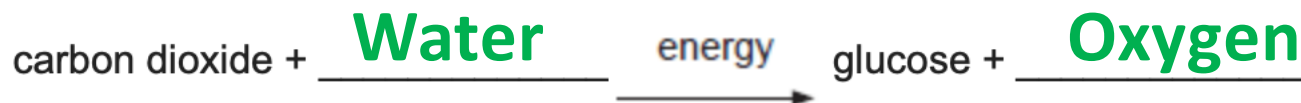
Carbon Dioxide Concentration



Exam Practice

L1

- (i) Complete the equation for photosynthesis.



(2)

- (ii) What type of energy does a plant use in photosynthesis?

Light

(1)

- (iii) Which part of a plant cell absorbs the energy needed for photosynthesis?

Chloroplast

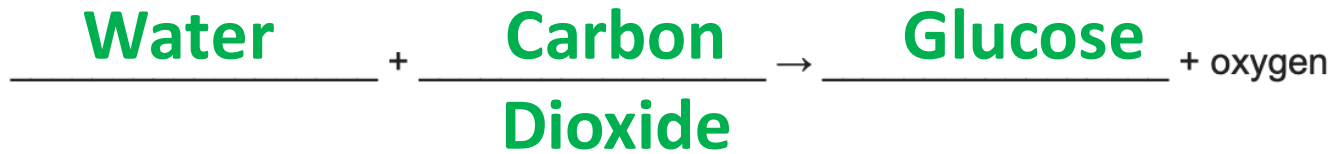
(1)



Exam Practice

L2

- (a) Complete the word equation for photosynthesis.



(2)

- (b) Describe how energy for the photosynthesis reaction is gained by plants.

Light

Absorbed by chloroplasts

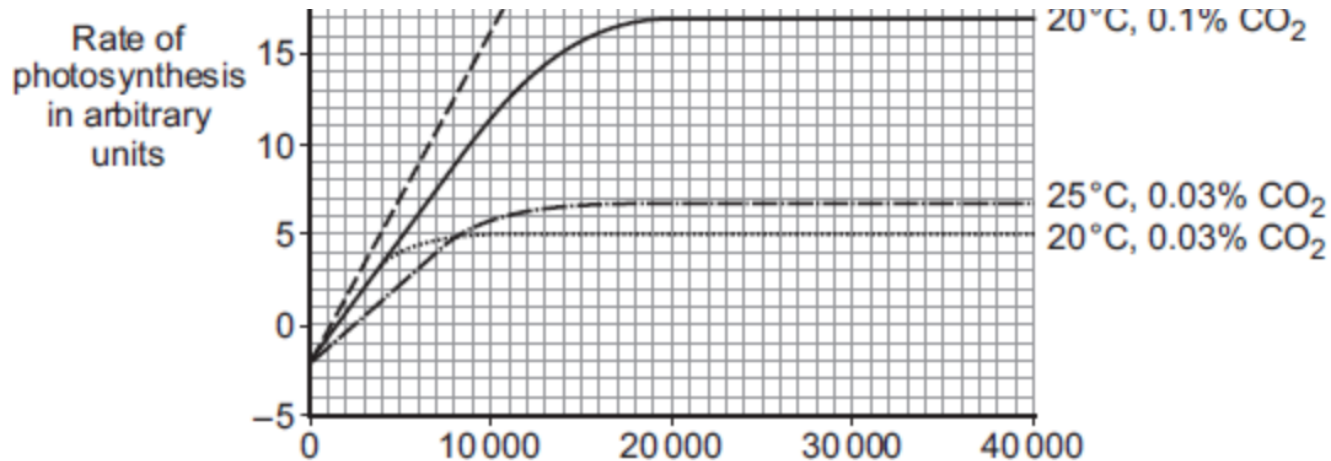
(2)



Exam Practice

L2

Although 25°C at 0.1% increases photosynthesis the cost of heating not economical



The farmer therefore decided to use the following conditions in his greenhouse during the day:

- 20°C **Most cost effective**
- 0.1% CO₂ **At 20°C the rate is much faster when CO₂ conc is 0.1 compared to 0.03%**
- no extra lighting. **Raises from 5 to 17**

Suggest why the farmer decided to use these conditions for growing the tomatoes.

(4)



Exam Practice

L3

The rate of photosynthesis in a plant depends on several factors in the environment. These factors include light intensity and the availability of water.

Describe and explain the effects of **two other** factors that affect the rate of photosynthesis.

You may include one or more sketch graphs in your answer.

CO₂

As CO₂ increases so does rate until it levels off

It is the raw material in photosynthesis/it levels off when there is another limiting factor.

Temperature

As temp increases so does rate until it decreases

Increases rate at there are more collisions/
enzymes are denatured



4.1.2 Rate of Photosynthesis

Think
Pair
Share

How can you use equipment to investigate the effect of light on the rate of photosynthesis?

1

Set up equipment as shown in the diagram.

2

Place the pondweed 10cm away from the light.

3

Turn on the light and leave 5 mins to acclimatise.

4

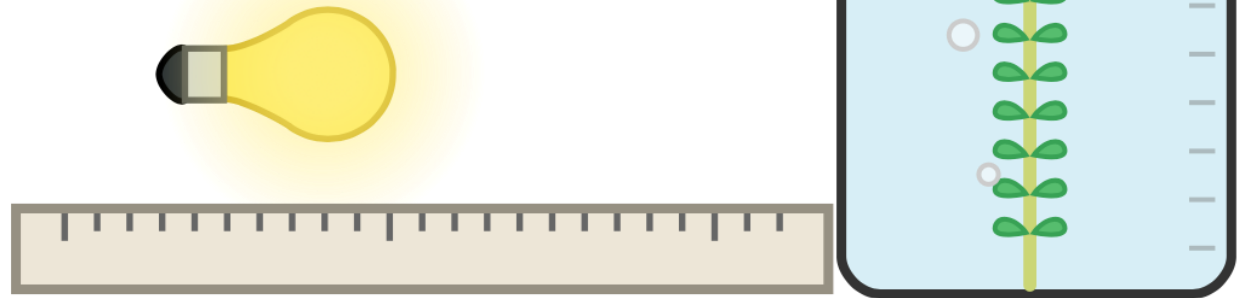
Count the number of bubbles in 1 minute.

5

Repeat at 20, 30, 40 and 50cm

6

Repeat to identify outliers and calculate averages



4.1.2 Rate of Photosynthesis

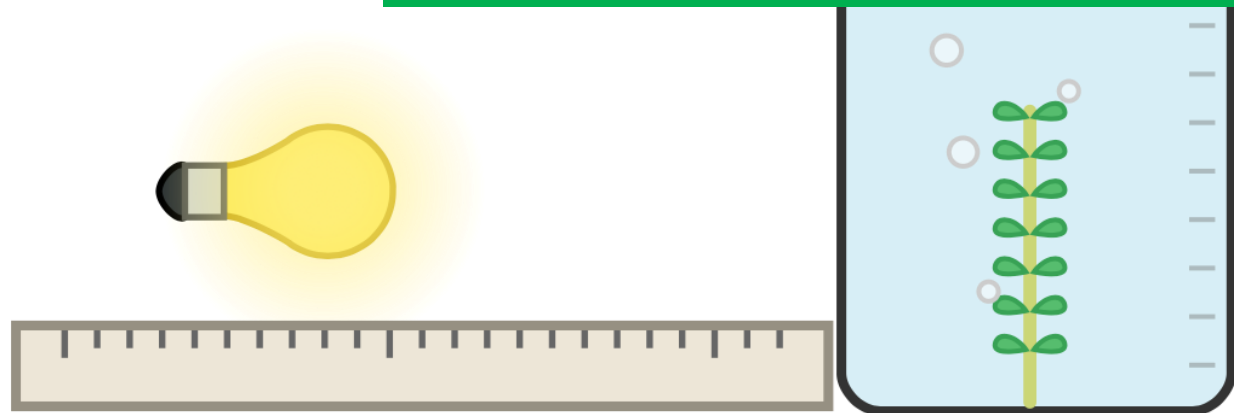
Think
Pair
Share

How would you ensure experimental data is valid?

Have
Done
Repeats
Variables

Any value that appears to change during an experiment can identify outliers.

These outliers would then not be included when calculating an average.



4.1.2 Rate of Photosynthesis

Control Variable	How it will be controlled
Size of pondweed	
Type of pondweed	
Colour of light	
Temperature of water	
Time for plant to equilibrate	
Carbon dioxide concentration	
Volume of water in beaker	



Exam Practice

L1

Pondweed	Number of bubbles produced in 1 minute
<i>Elodea</i>	17
<i>Cabomba</i>	28
<i>Egeria</i>	8

The student said:

“I suggest that people grow *Cabomba* in garden ponds to oxygenate the water fastest.”

Give **three** variables the student should have controlled to make sure his conclusion was valid.

Use information from the student’s method and the diagram.

1. **Mass/length of pondweed**

Volume of water

2. **Light intensity**

Light colour

3. **CO₂ concentration**

pH

Temperature



Exam Practice

L2

Light intensity, carbon dioxide concentration and temperature are three factors that affect the rate of photosynthesis.

Place pondweed in beaker of water. of photosynthesis?

Shine light on beaker. apparatus you might use.

Place bulb 10cm away from the pondweed.

Leave for 5 minutes to acclimatise.

Count the number of bubbles in a minute.

Repeat at 20,30,40 and 50cm

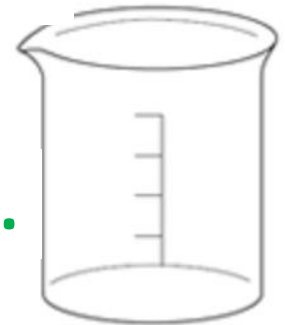
Do 3 repeats.

Identify outliers and discard from averages.

State a control variable. and the materials you would use

Description of how controlled.

- how you could make this a fair test.



Not to scale



Exam Practice

L2

A thermometer was placed in the glass beaker.

Why was it important to use a thermometer in this investigation?

To measure temperature

To check temperature isn't changing

Temperature is a control variable

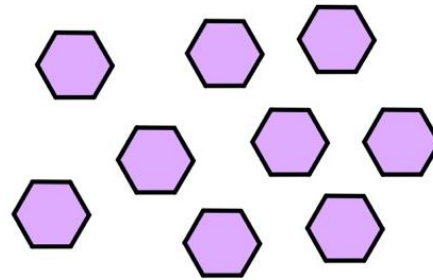
(3)



4.1.3 Uses of Glucose

Used to make amino acids for protein synthesis.

Respiration

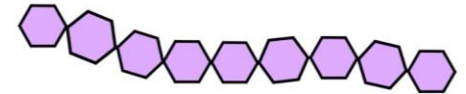


Glucose

Used to make cellulose

Made into insoluble starch for storage

Used to make fats or oils for storage



4.2.1 Respiration

Think

Pair

Share

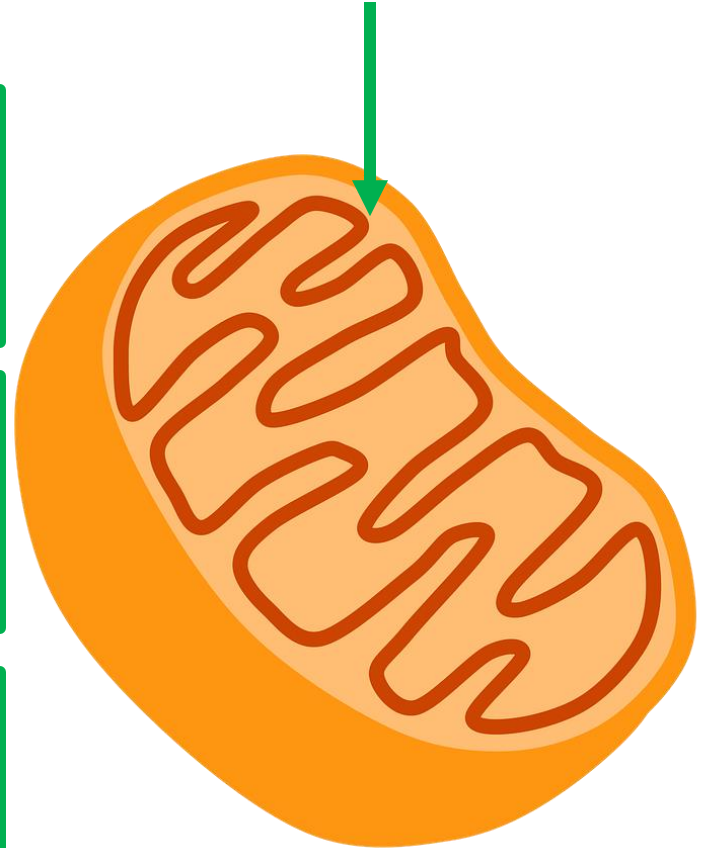
What is respiration?

It is as an exothermic reaction which is continuously occurring in living cells.

The energy transferred supplies all the energy needed for living processes.

Respiration in cells can take place aerobically (using oxygen) or anaerobically (without oxygen), to transfer energy.

Aerobic respiration takes place in mitochondria.



4.2.1 Respiration

Think

Pair

Share

What do we need energy for?

Movement

Keeping Warm

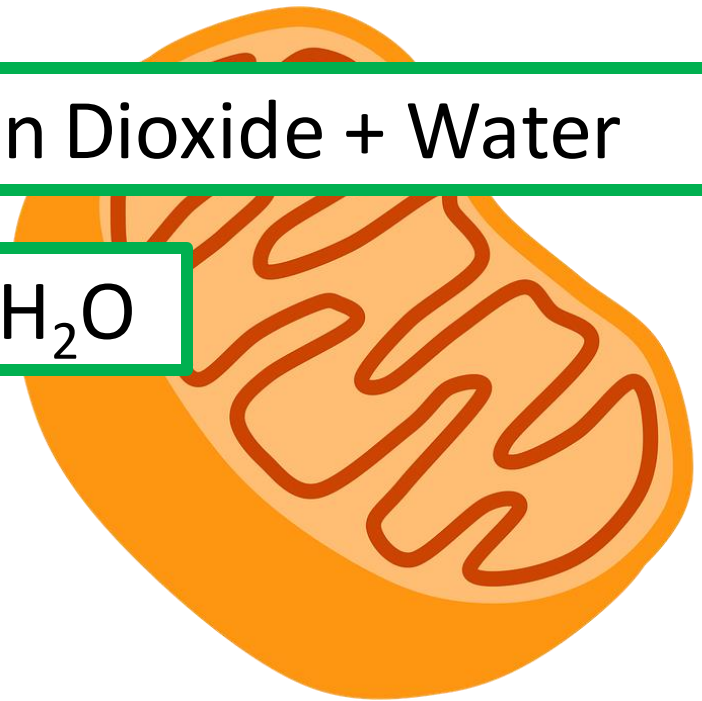
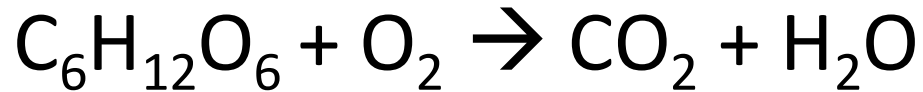
Chemical reactions
to build larger
molecules



4.2.1 Respiration

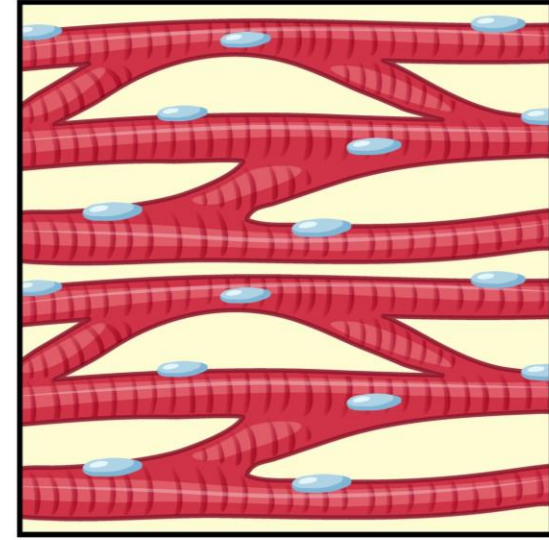
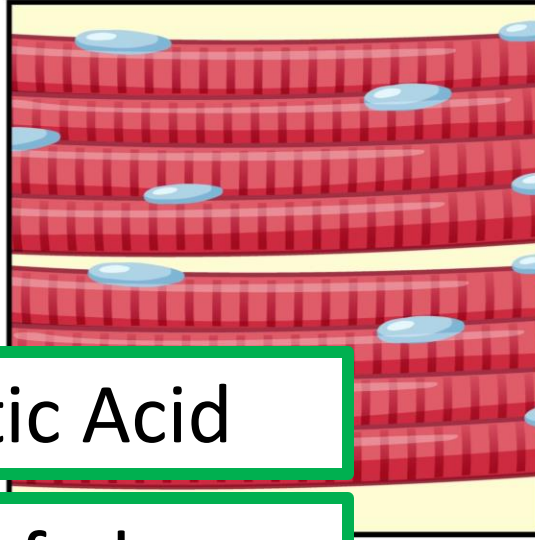
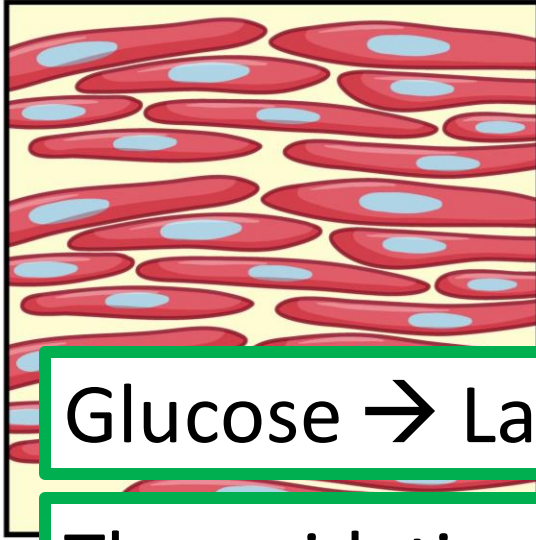
Aerobic Respiration:

Glucose + Oxygen → Carbon Dioxide + Water



4.2.1 Respiration

Anaerobic Respiration in muscles:



Glucose \rightarrow Lactic Acid

The oxidation of glucose is incomplete and so this transfers less energy than aerobic respiration.



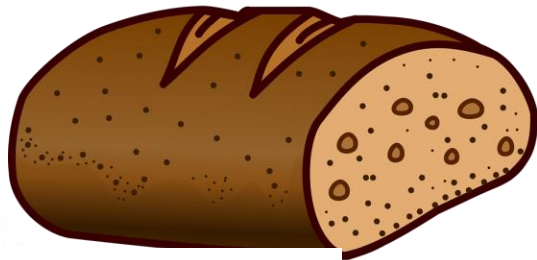
4.2.1 Respiration

Anaerobic Respiration in yeast and plant cells:

Glucose \rightarrow Ethanol + Carbon Dioxide

Anaerobic respiration in yeast cells is known as fermentation

Fermentation is used to make bread and alcoholic drinks



4.2.1 Respiration

Type of Respiration	Aerobic	Anaerobic
Need for Oxygen		
Products		
Relative Amount of Energy Transferred		



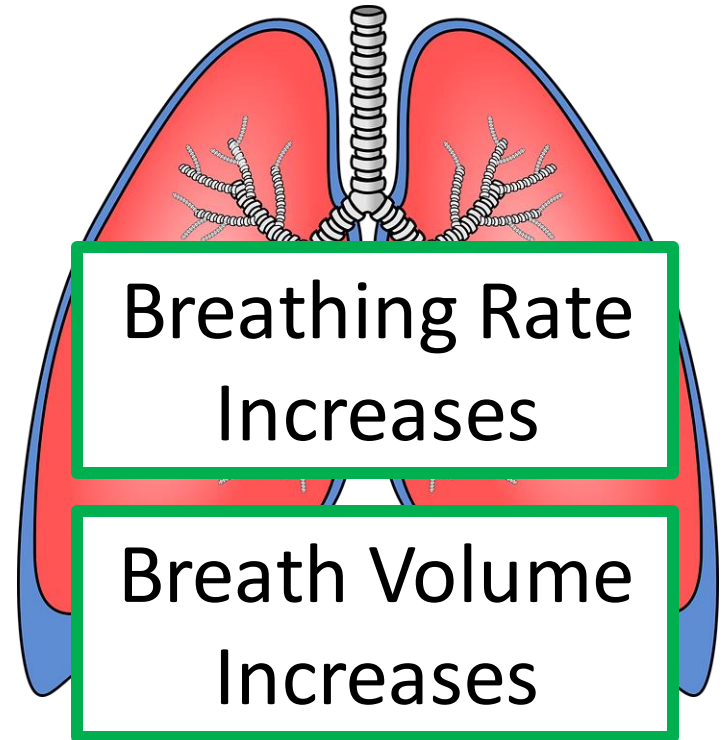
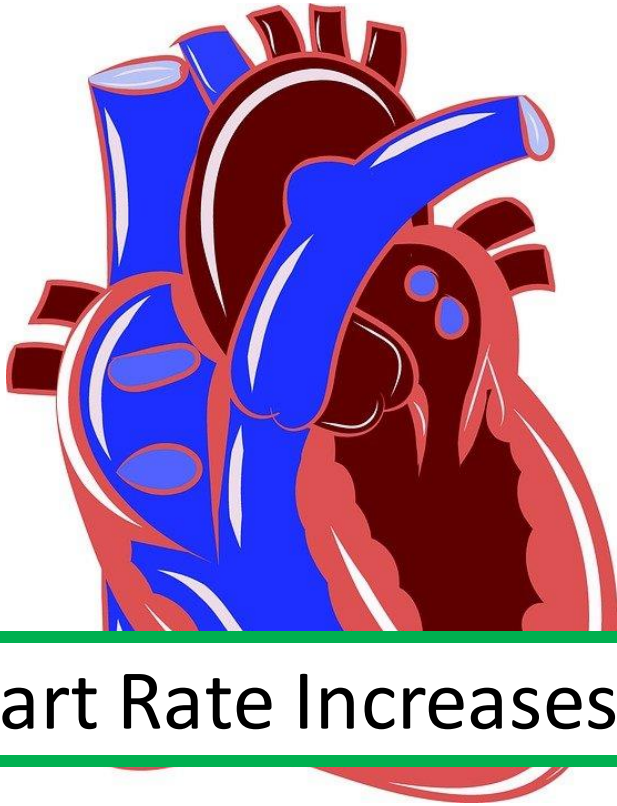
4.2.2 Response to Exercise

Think

Pair

Share

What happens to the body during exercise?



4.2.2 Response to Exercise

Think

Pair

Share

What happens to the body during exercise?

These changes happen due to the increased demand for energy.

The amount of oxygen supplied to muscle cells increases.

There is more oxygen for respiration...

..which releases more energy.



4.2.2 Response to Exercise

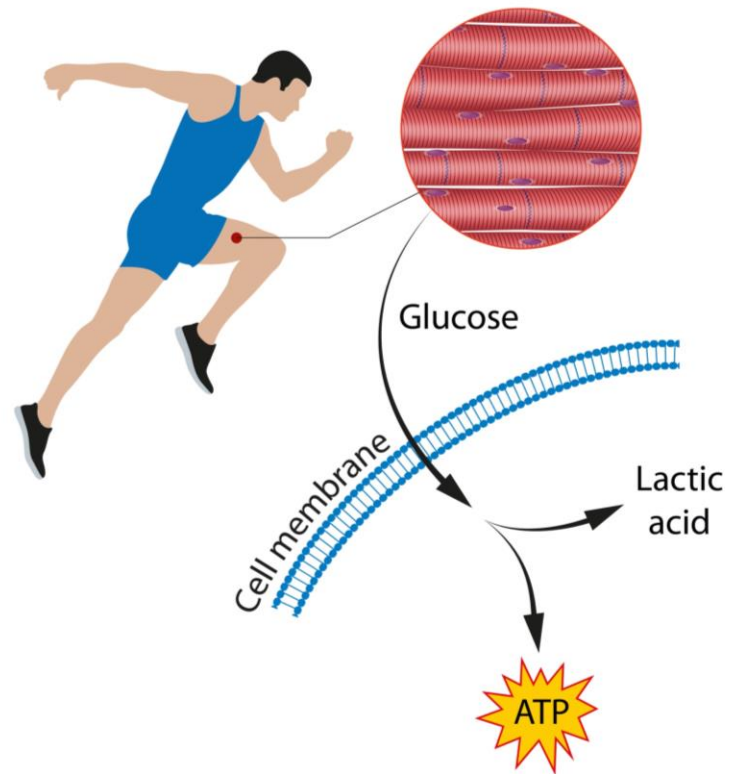
Think
Pair
Share

What happens if there is an insufficient supply of oxygen during exercise?

When there is insufficient supply of oxygen to muscles anaerobic respiration takes place.

The incomplete oxidation of glucose causes a build up of lactic acid and creates an oxygen debt.

During long periods of vigorous activity muscles become fatigued and stop contracting efficiently.



4.2.2 Response to Exercise

Think

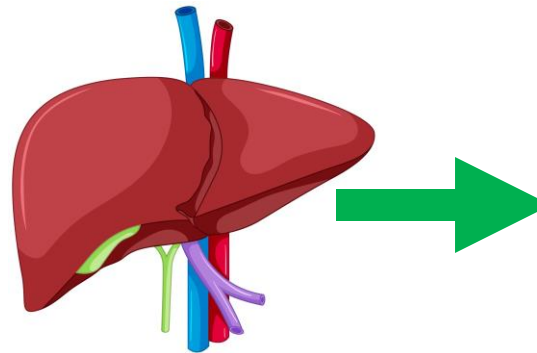
Pair

Share

What is oxygen debt?

Key Term	Definition
Oxygen Debt	

Blood flowing through the muscles transports the lactic acid to the liver.



The lactic acid is converted back into glucose.

CS/F

CS/H

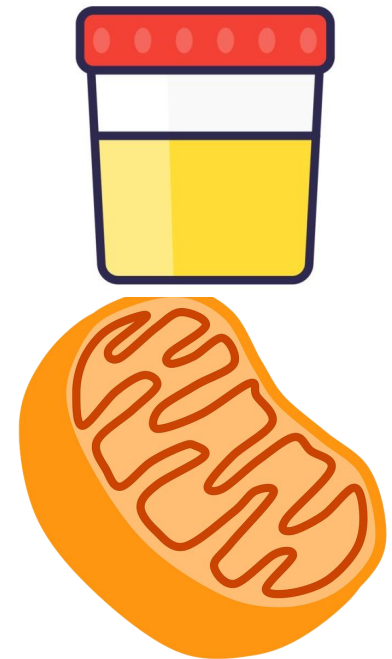
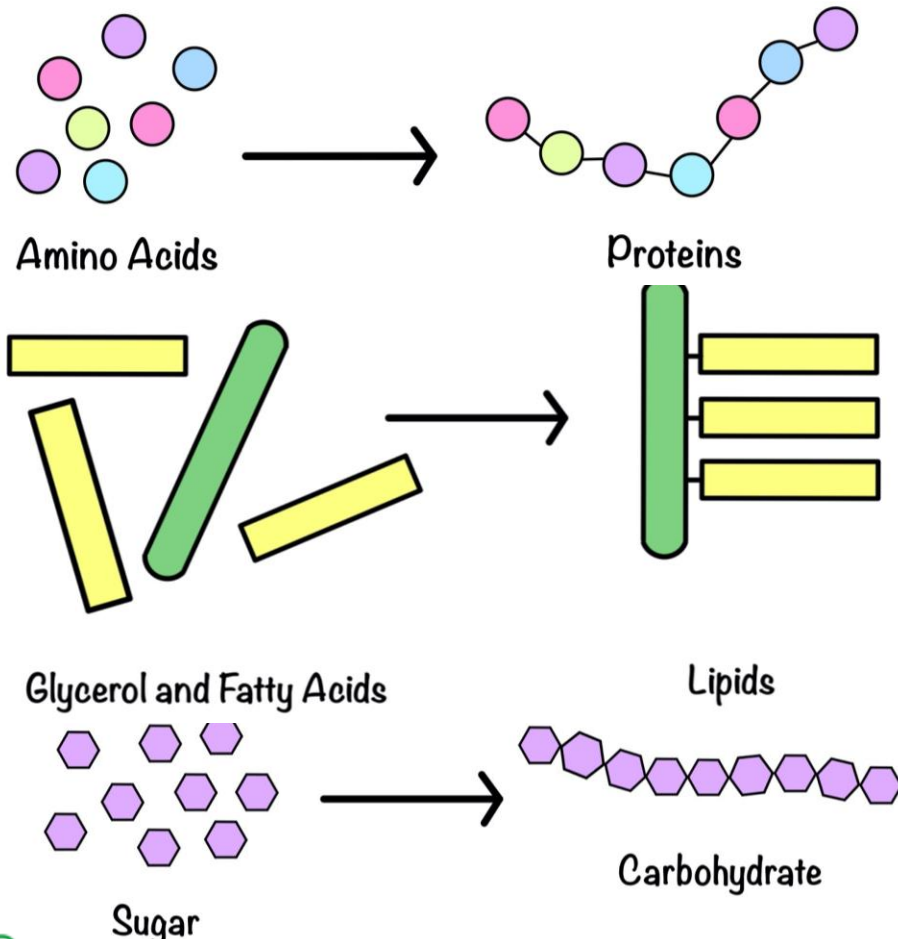
SS/F

SS/H



4.2.3 Metabolism

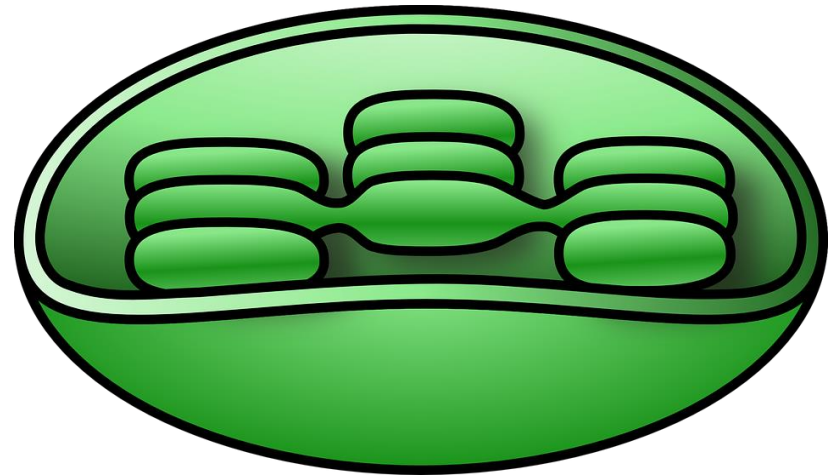
Metabolism is all the chemical reactions that happen in a cell or the body.



4.2.3 Metabolism

Metabolism is all the chemical reactions that happen in a cell or the body.

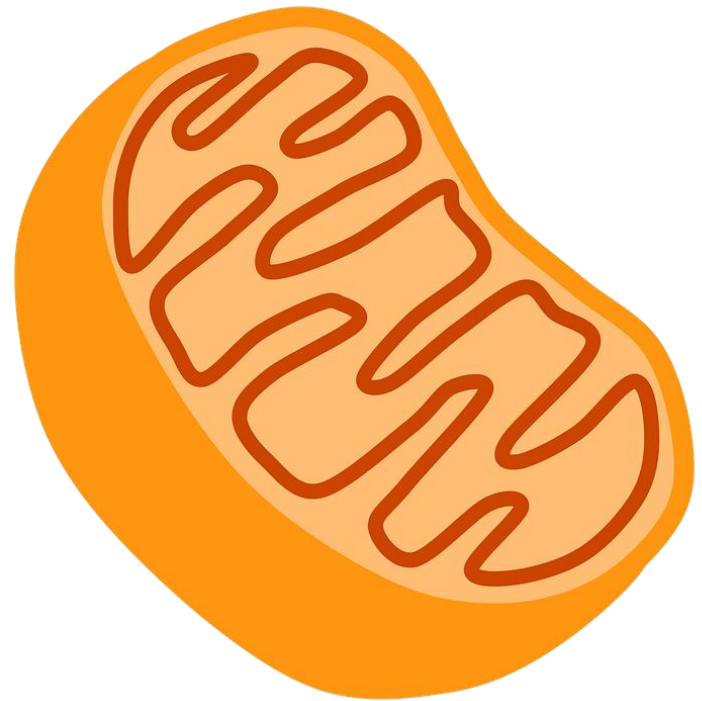
Photosynthesis



4.2.3 Metabolism

Metabolism is all the chemical reactions that happen in a cell or the body.

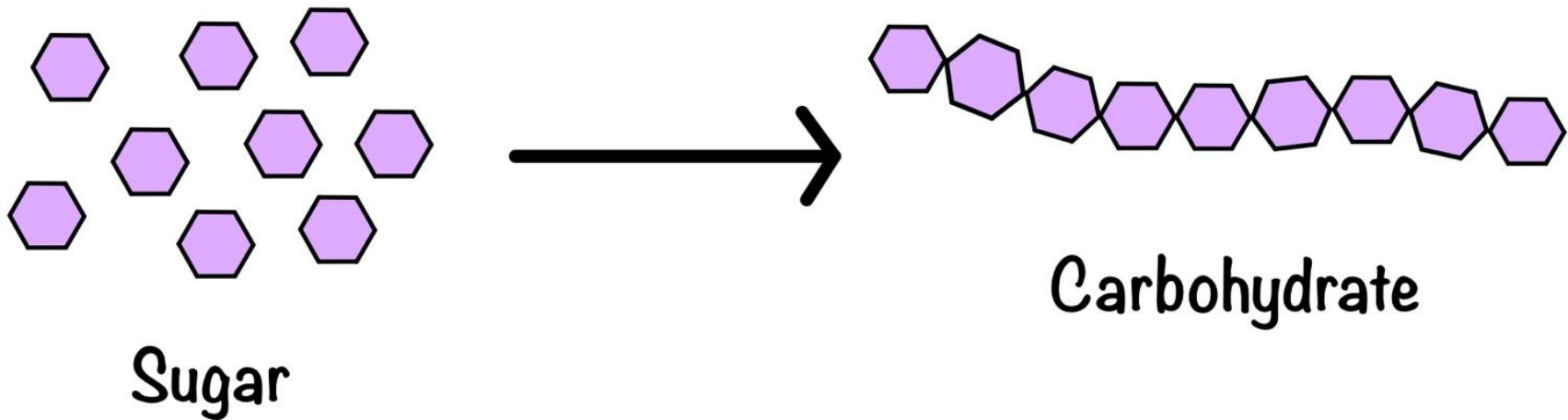
Respiration



4.2.3 Metabolism

Metabolism is all the chemical reactions that happen in a cell or the body.

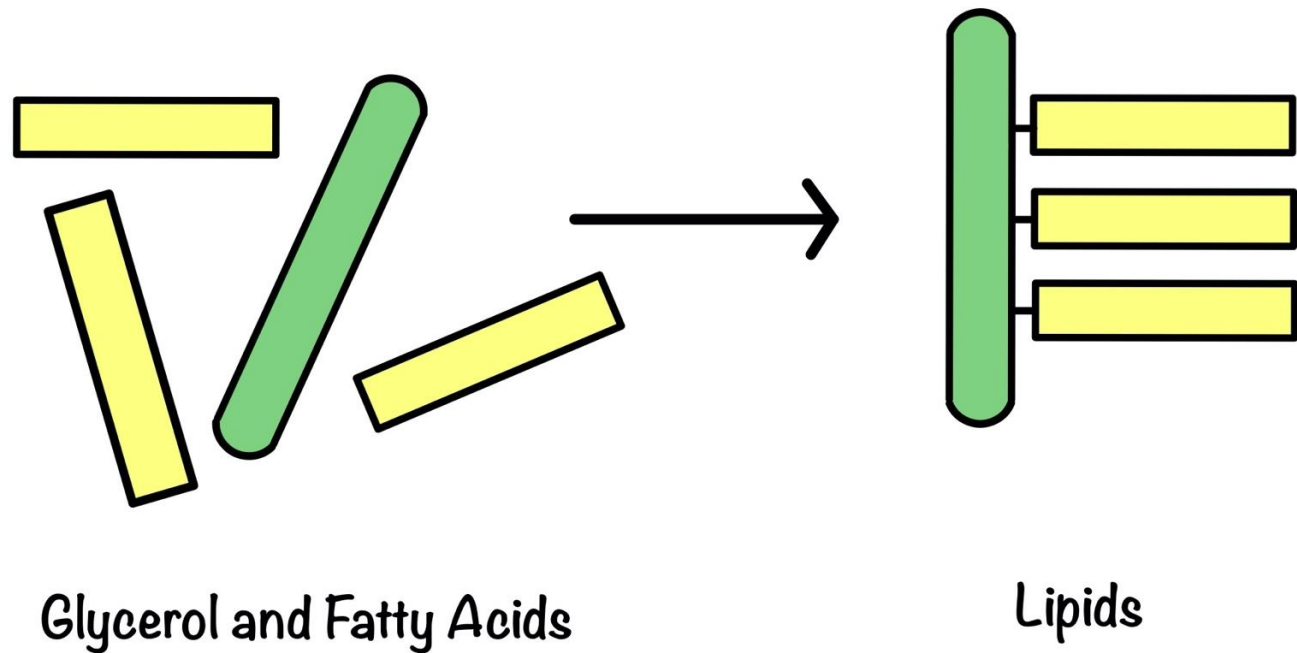
Using Glucose to make starch, glycogen and cellulose



4.2.3 Metabolism

Metabolism is all the chemical reactions that happen in a cell or the body.

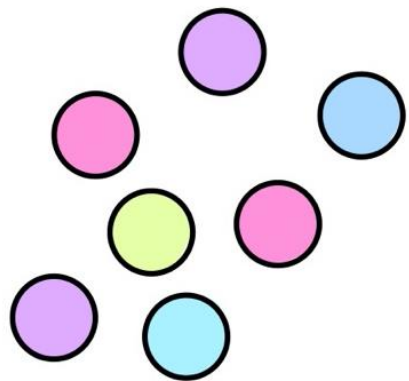
Making lipids from glycerol and 3 fatty acids.



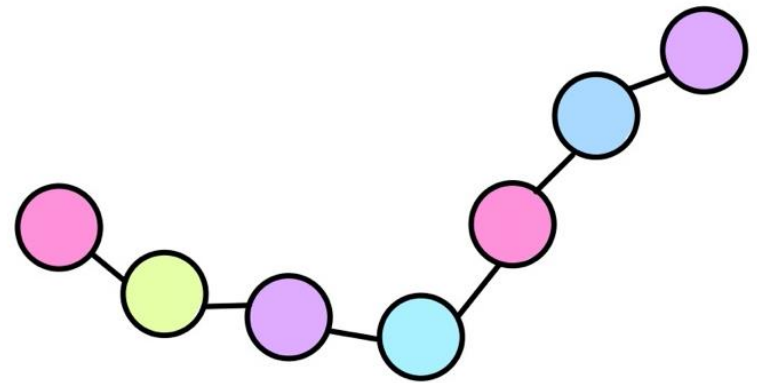
4.2.3 Metabolism

Metabolism is all the chemical reactions that happen in a cell or the body.

Amino acid making proteins.



Amino Acids



Proteins

4.2.3 Metabolism

Metabolism is all the chemical reactions that happen in a cell or the body.

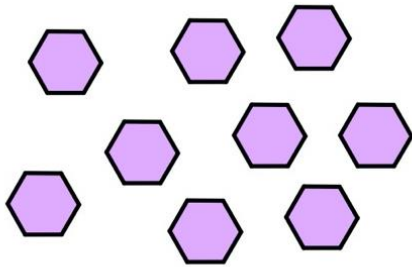
Breakdown of proteins to make urea.



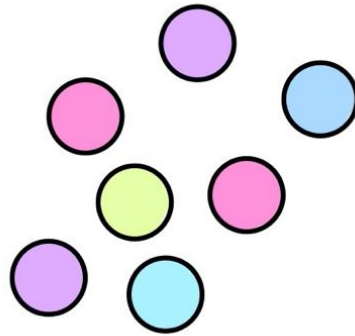
4.2.3 Metabolism

Think
Pair
Share

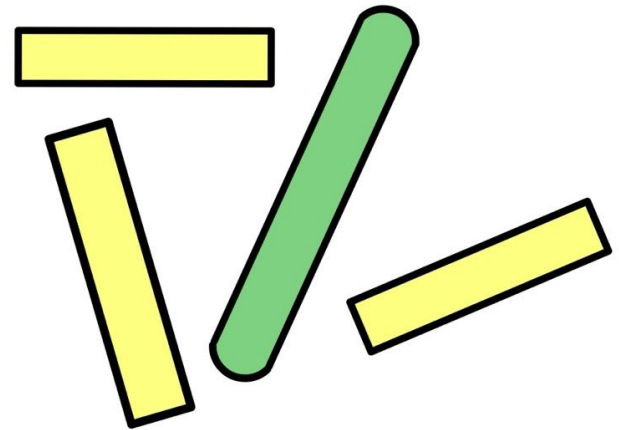
Why are sugars, amino acids, fatty acids and glycerol important in the body?



Sugar



Amino Acids



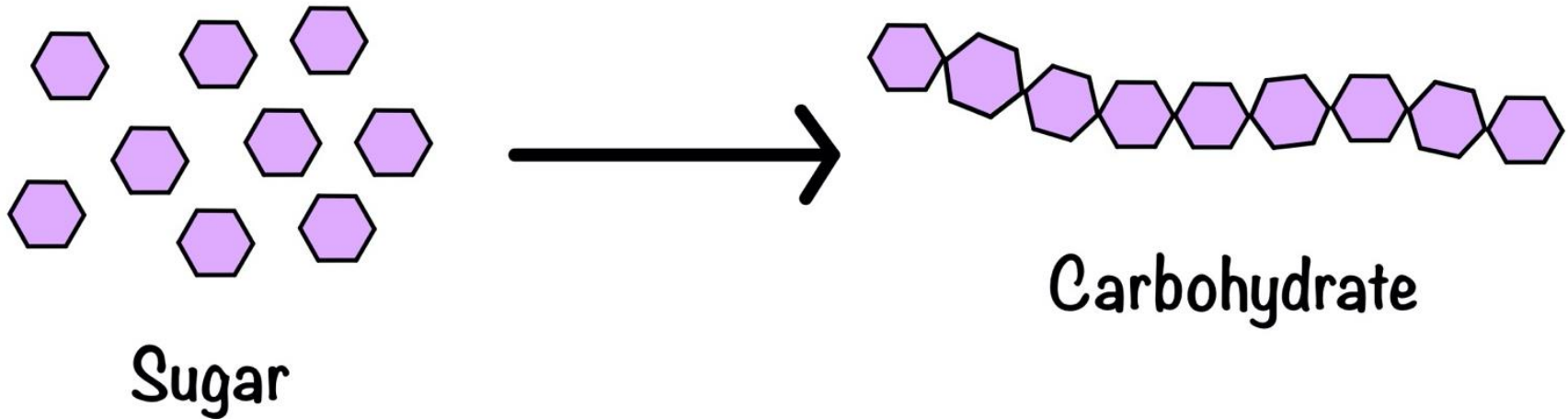
Glycerol and Fatty Acids



4.2.3 Metabolism

Think
Pair
Share

Why are sugars, amino acids, fatty acids and glycerol important in the body?



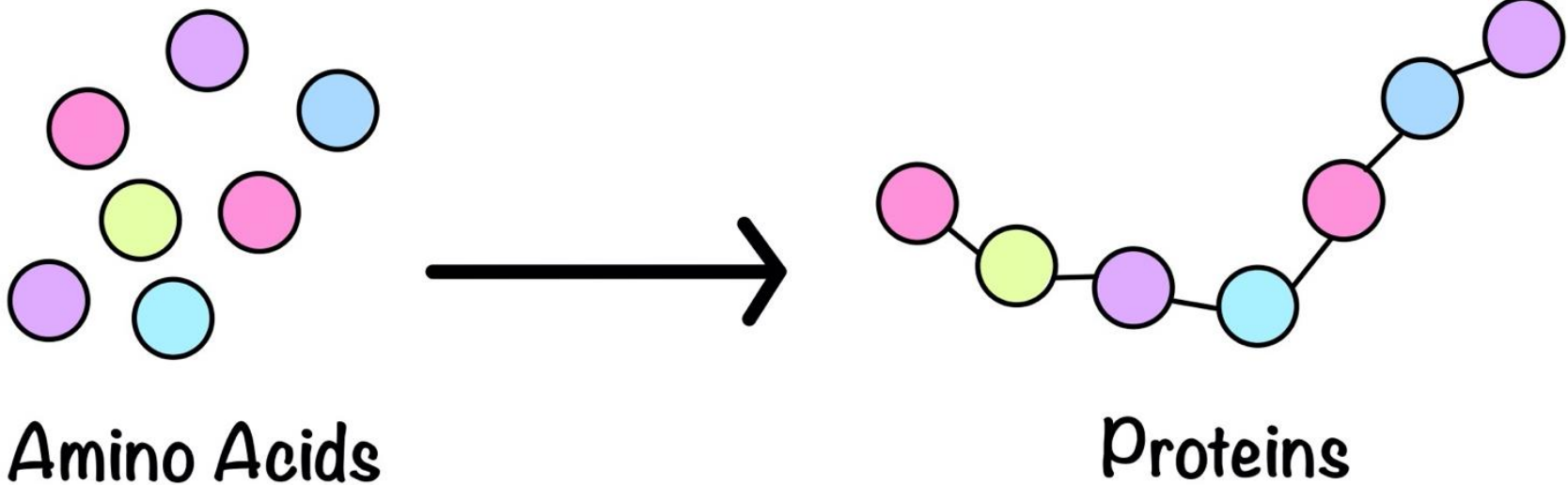
Sugar can be used in the body to make glycogen.

The body stores this in muscle and liver cells as a source of energy.

4.2.3 Metabolism

Think
Pair
Share

Why are sugars, amino acids, fatty acids and glycerol important in the body?



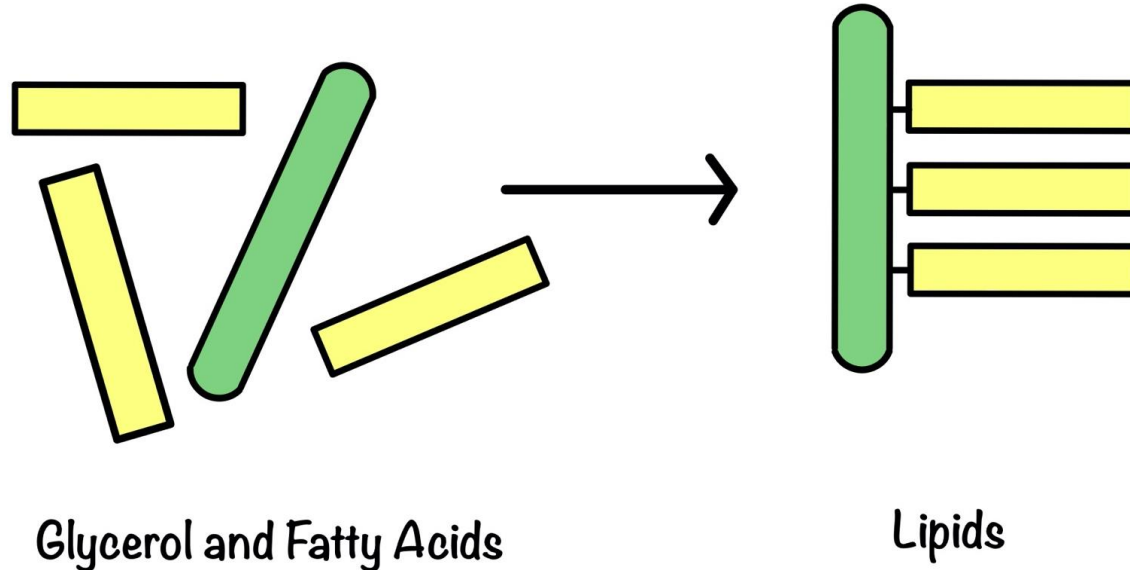
Amino acids are used in the body to make proteins.

These proteins can then be used for growth and repair.

4.2.3 Metabolism

Think
Pair
Share

Why are sugars, amino acids, fatty acids and glycerol important in the body?



Glycerol and fatty acids are the building blocks to make lipids.

These lipids (fats) are then used as a store of energy.



4.2.3 Metabolism

Think

Pair

Share

What factors can affect metabolic rate?

This table shows that gender can affect metabolic rate...

..and so can age.

But there are other factors.

Age in years	Mean metabolic rate in kJ/m ² /hour	
	Males	Females
5	53	53
15	45	42
25	39	35
35	37	35
45	36	35

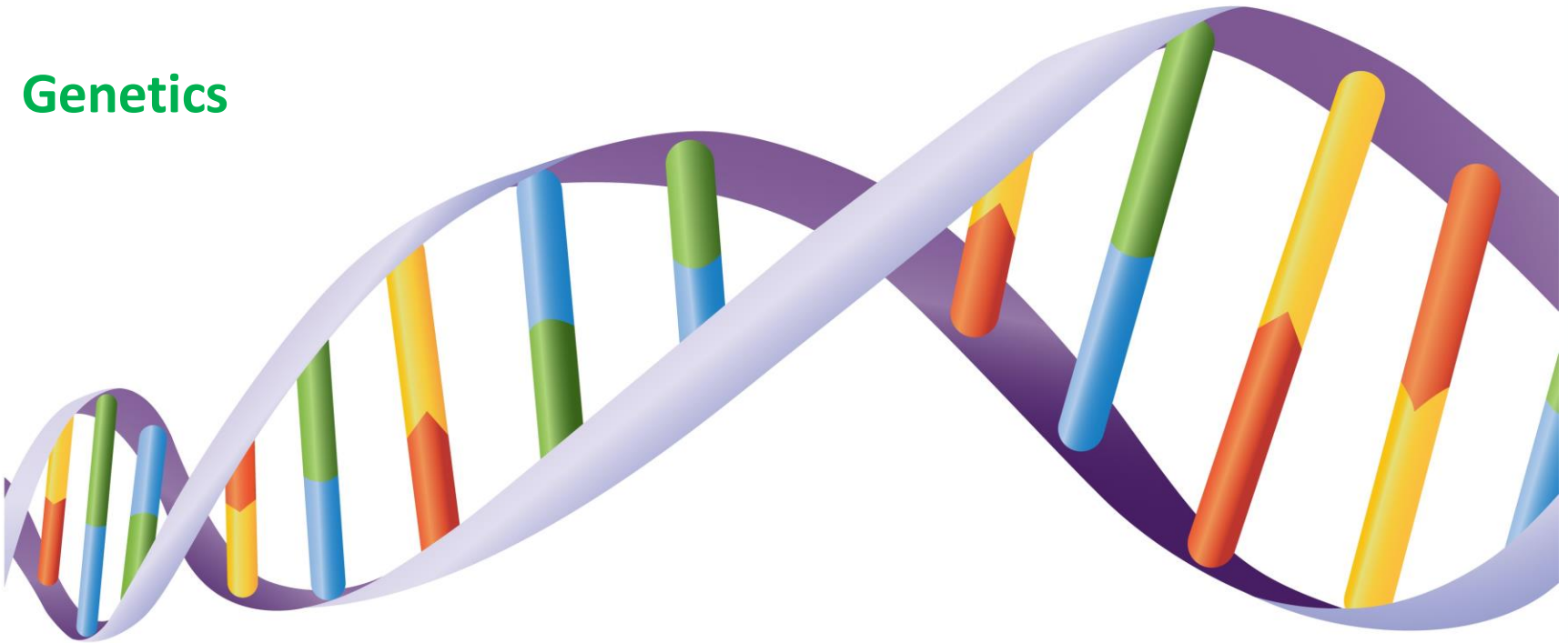


4.2.3 Metabolism

Think
Pair
Share

What factors can affect metabolic rate?

Genetics



4.2.3 Metabolism

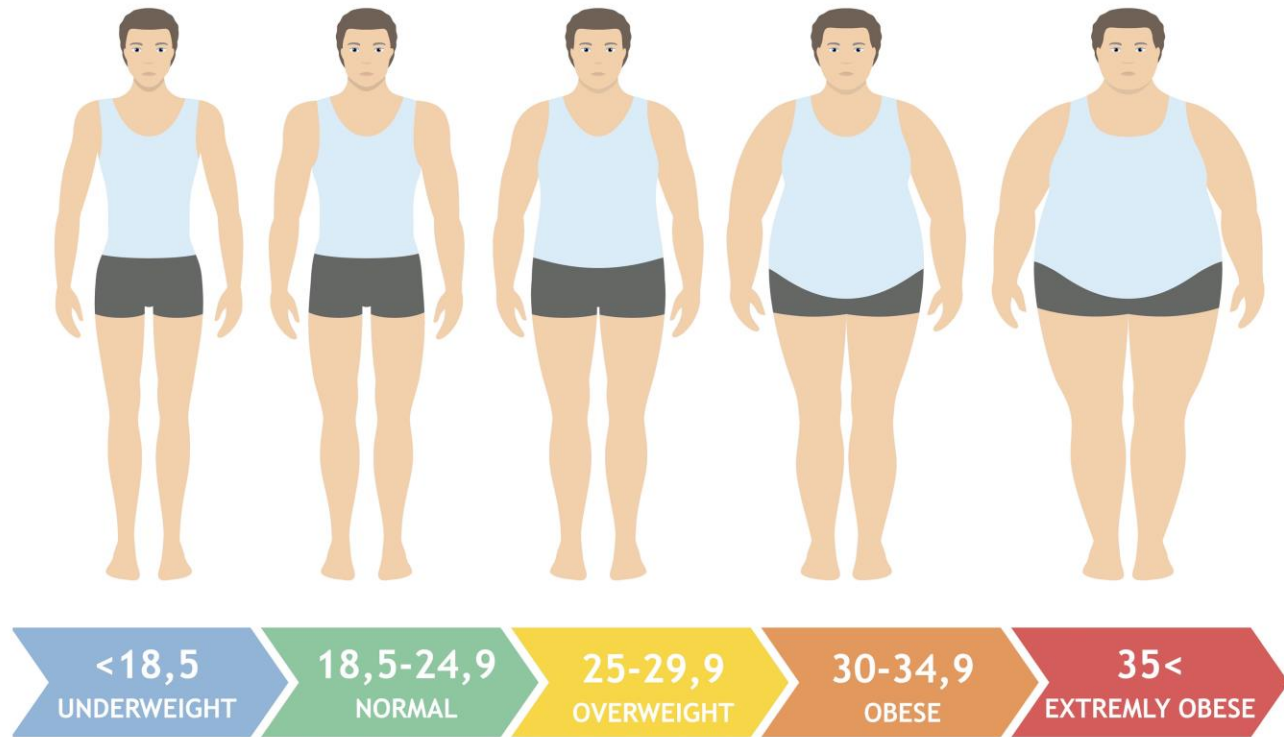
Think

Pair

Share

What factors can affect metabolic rate?

Body Mass Index



4.2.3 Metabolism

Think

Pair

Share

What factors can affect metabolic rate?

Exercise

