

Topic – Hydrolysis of Starch

This set of work is to be done over the week, from Monday 22nd June to Friday 26th June. Here is a list of the resources you should be using this week, on the following pages the resources have been screenshotted so you all only need this one document open to work from for the whole week.

1. Mark HW 13 – Videos and written solutions can be found here:

https://glowscotland-my.sharepoint.com/:f:/r/personal/gw19mallonkaty_glow_sch_uk/Document%20s/S2%20Homework%20solutions?csf=1&web=1&e=hKO5oJ

2. Notes to copy into notes jotter and learn – Hydrolysis of Starch.

Instructions are in the text boxes down the side, in bold and italic text. There are 3 notes in total. If you have the option to do so at home, feel free to print and stick them into your notes jotter.

3. Watch the following videos:

Respiration experiment:

https://glowscotland.sharepoint.com/:v:/s/S2Chemistry2018/EV3Bbg3cnAdCn_NE43am8DgBIAk2tR34Qg6f3IQFH60fuA?e=4twVdS

Digestion experiment:

<https://glowscotland.sharepoint.com/:v:/s/S2Chemistry2018/EelcQCQ67utEusqBbWSLBuIBLO5gJ6lGcM1rxodryMkKvA?e=gbl9Dr>

4. Self Checks 3 and 4
5. Please attempt the Microsoft Form on this work.

Deadline is Fri 26/06 at 2.30pm, the link for it is here:



<https://forms.office.com/Pages/ResponsePage.aspx?id=oyzTzM4Wj0KVQTctawUZKeSVSAJoJ4FKoNm9KbBanehUQUJIMjBKVE1RSDhFVVU3SEVEUzU4V1FNMi4u>

Notes

1.

As discussed in last week's notes, food is broken down during digestion. There are many types of hydrolysis reactions and digestion can be classed as one because water is a reactant during the breakdown of food into smaller molecules starch → glucose.

You do not need to draw this diagram

Digestion

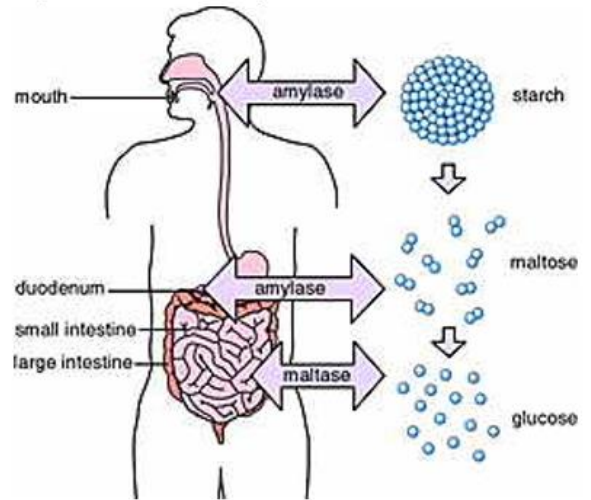
Digestion of food in our body is an example of a hydrolysis reaction.

Starch can be digested (hydrolysed) by:

1. Amylase (an enzyme)

or

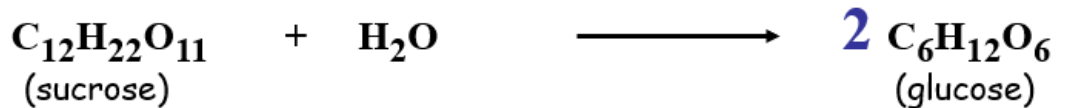
2. Hydrochloric acid



Once the starch is hydrolysed to glucose, it can pass through the gut wall and into the blood stream. It can then be used by the body during respiration.

2.

The following two reactions are examples of hydrolysis:



HYDRO | **LYSIS**

↑ ↑

WATER **BREAKING**

Definition: breaking molecules using water.

These are chemical equations to show the breakdown of larger carbohydrates (sucrose and starch) into glucose.

In both examples, the reactants are larger molecules than the products.

You do not need to learn these chemical equations off by heart, but you do need to know the definition of a hydrolysis reaction and be able to identify digestion as a hydrolysis reaction.

3.

Hydrolysis of Starch Experiment

Aim: To hydrolyse starch in the presence of an enzyme or an acid.

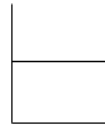
This note explains the stages of the hydrolysis of starch experiment.

A video of this experiment was attached earlier in the pdf.

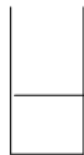
This is so replicate the breakdown of starchy foods such as bread when they mix with the amylase in our saliva. We can then use our knowledge of testing carbohydrates to prove that glucose has been formed during hydrolysis.

If only starch remained at the end of this reaction, no colour change would be seen with Benedict's solution.

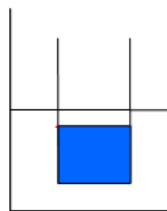
Part 1 Hydrolysis with an enzyme (amylase)



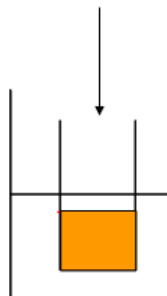
Half fill a small beaker with water and heat to 40°C.



Add 3cm³ starch solution and 1cm³ of amylase to a test tube. Place the test tube in the beaker and leave for 5 minutes in the warm water.



Add 2 cm³ of blue Benedict's solution and heat until the water boils.



The blue Benedict's solution turns orange/red. This proves the starch has hydrolysed to smaller sugar molecules.

Note: Enzymes work best at 37°C (body temperature).
At high temperatures they are destroyed.

Self Check 3

1. For the following carbohydrates

Glucose : $C_6H_{12}O_6$ Sucrose : $C_{12}H_{22}O_{11}$ Fructose : $C_6H_{12}O_6$

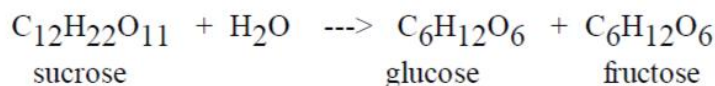
Maltose : $C_{12}H_{22}O_{11}$ Starch : $(C_6H_{10}O_5)_n$

- Which pairs are isomers?
 - Which gives a positive iodine test?
 - Which is a sugar which will not react Benedict's solution?
 - Which are sugars which will react with Benedict's solution?
 - Which is not a sugar?
2. Which of the substances below are carbohydrates?

- Lactose $C_{12}H_{22}O_{11}$
- Methanol CH_4O
- Ethanoic acid $C_2H_4O_2$
- Oxalic acid $C_2H_2O_4$

Self Check 4

1. When sucrose is heated gently with hydrochloric acid it breaks down into glucose and fructose. The equation for the reaction is:



- What name is given to reactions like that shown above?
 - What name is given to compounds like glucose and fructose which have the same molecular formula?
 - Sucrose and fructose are both white crystalline solids, explain how you would distinguish chemically between sucrose and fructose?
2. Starch is a large molecule made of many glucose units joined together. The starch molecule is too large to be easily absorbed into our bloodstream. In our bodies a substance called amylase helps break down the starch into glucose which is more easily absorbed.
- What name is given to the reaction in which starch is broken down into glucose?
 - What name is given to substances like amylase which speed up reactions in living things?
3. When a sample of starch is heated with hydrochloric acid for 30 minutes all of the starch is converted into glucose.
- How would you show that no starch remained in the mixture?
 - A pupil heated the reaction mixture with Benedict's solution which then turned brick red. He concluded that this proved the presence of glucose in the reaction mixture. Explain why the pupil was wrong.

Self Check Answers 3

- Sucrose and Maltose are a pair of isomers ; Glucose and Fructose are another pair.
 - Starch
 - Sucrose
 - Glucose, Fructose and Maltose
 - Starch

- The carbohydrates are (a) Lactose and (c) Ethanoic acid.

Self Check Answers 4

- Hydrolysis
 - Isomers
 - Heat samples of both with Benedict's solution. The sugar which turns the solution from blue to brick red is fructose.

- Hydrolysis
 - Enzymes

- Add iodine solution, no colour change would occur.
 - Glucose is not the only sugar which reacts with Benedicts's solution. Other sugars such as maltose and lactose also react with Benedict's's solution.