

# 2.2.1 The human digestive system

## AQA GCSE Biology (Higher) Question and answer notes

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### How to use these notes

These notes cover everything you need to know for this part of the specification. They have been written in question-answer format to make them easier for you to study from.

In order to study successfully, I recommend you do the following for each question and answer:

- Read it carefully and make sure you **understand** it.
- **Memorise** the answer.
- **Practice** applying your understanding to past exam questions.

A good way to memorise information is to use **retrieval practice**. This is when you practise retrieving information from your memory. You could do this by making a flashcard for each question with the question on one side and the answer on the other. Or you could use a flashcard app. Alternatively, use a sheet of paper to cover up the answer so you can only see the question. Try to answer the question and then check how you did.

You should practise retrieving each answer from your memory until you can do it perfectly. Even once you can retrieve the answer perfectly, your ability to retrieve it will probably fade as time passes without practising. Therefore you will need to keep going back to the questions that you have previously mastered and practising them again. However, each time you re-learn the answer, the memory will be stronger and will last longer than the time before.

### What two processes need to take place after food is eaten?

Digestion and absorption.

### What is digestion?

Digestion is the process of breaking large food molecules down into smaller ones so that they can be absorbed.

### What is absorption?

Absorption is the process of transporting small food molecules from the digestive system into the bloodstream so that they can be used by the body.

**What kinds of food molecules need to be digested? What are they broken down into?**

Proteins, complex carbohydrates, lipids, DNA and RNA need to be digested. This is because they are all large molecules which cannot be absorbed.

Proteins are broken down into amino acids.

Complex carbohydrates are broken down into sugars.

Lipids are broken down into glycerol and fatty acids.

DNA and RNA are broken down into nucleic acids.

**What kinds of food molecules can be absorbed?**

Only small food molecules can be absorbed into the bloodstream. This includes amino acids, sugars, glycerol, fatty acids, nucleic acids, minerals, vitamins and water.

**What are two types of digestion?**

The two types of digestion are mechanical digestion and chemical digestion. Mechanical digestion is when food is physically broken down into smaller pieces, for example by chewing. Chemical digestion is when enzymes break down large food molecules into smaller ones.

**What are enzymes?**

Enzymes are proteins that catalyse (speed up) chemical reactions. They are often referred to as biological catalysts.

**How do enzymes work?**

Each enzyme catalyses a specific chemical reaction. The substances that are reacting (called the substrates) bind to a site on the enzyme called the active site. The chemical reaction takes place in the active site, turning the substrates to products. The products then leave the active site.

**What is the 'lock and key' model?**

The 'lock and key' model is a model of the way that enzymes work. It says that the active site has the exact complementary shape to the substrates, allowing the substrates to fit into the active site perfectly, like a key in a lock.

**What is enzyme activity?**

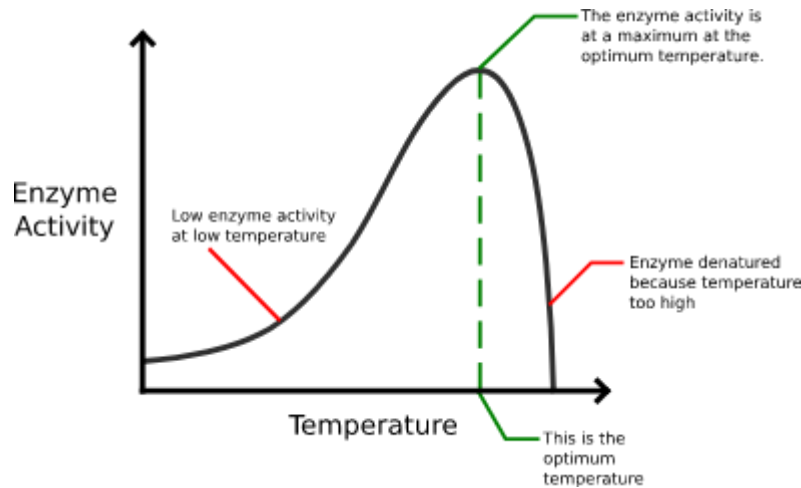
Enzyme activity is the rate at which the reaction catalysed by a particular enzyme is taking place.

**What does 'denatured' mean?**

An enzyme is described as 'denatured' if it is not folded properly, meaning that the active site cannot bind to the substrates. An enzyme could become denatured because the temperature is too high, or because the pH is too high or too low.

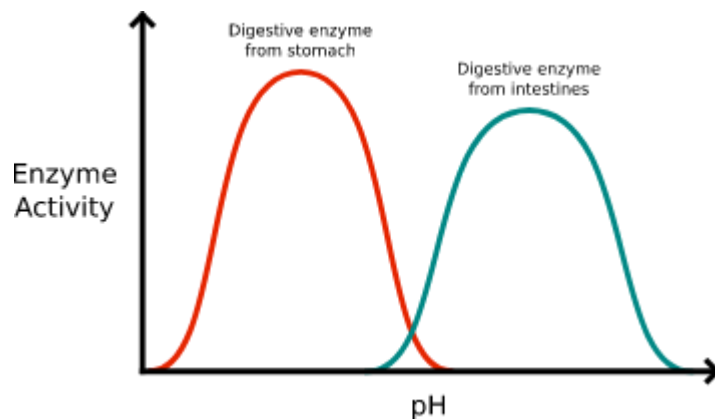
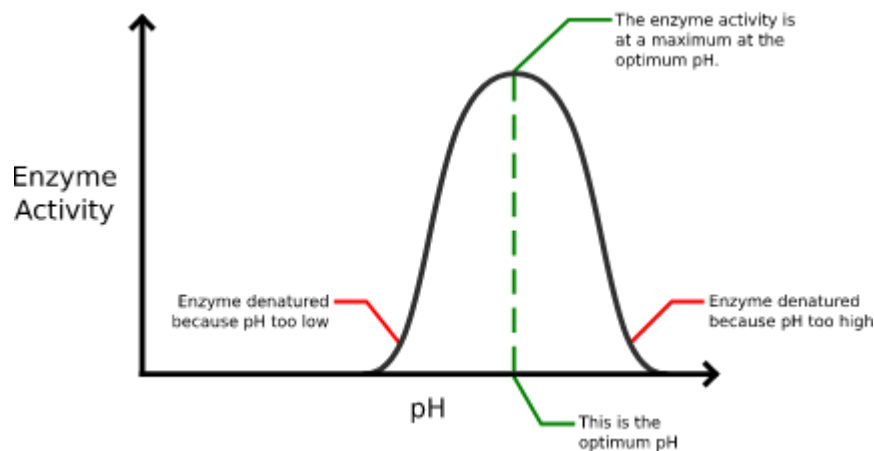
### How does enzyme activity change with temperature?

Initially, increasing temperature causes enzyme activity to increase due to increased kinetic energy. The temperature at which the enzyme activity is highest is called the optimum temperature. Above the optimum temperature the enzyme becomes denatured, causing the activity to fall to zero.



### How does enzyme activity change with pH?

The pH at which the enzyme activity is highest is called the optimum pH. Above or below the optimum pH, the enzyme becomes denatured and the activity falls towards zero.



**How is enzyme activity measured?**

Enzyme activity is measured by measuring the amount of a substrate used up or the amount of a product produced in a particular amount of time. The amount used/produced is divided by the time to calculate the enzyme activity.

**What are digestive enzymes? What are the main types?**

Digestive enzymes are enzymes that break down large food molecules into smaller food molecules.

The main types of digestive enzymes are carbohydrases (such as amylase), proteases and lipases.

**What are carbohydrases? What is amylase?**

Carbohydrases are enzymes that break down complex carbohydrates into sugars.

Amylase is a carbohydrase which breaks down starch (a complex carbohydrate) into maltose (a sugar).

**What are proteases?**

Proteases are digestive enzymes that break down proteins into amino acids.

**What are lipases?**

Lipases are digestive enzymes that break down lipids into fatty acids and glycerol.

**What is the digestive system?**

The digestive system is an organ system in which several organs work together to digest and absorb food.

**Which organs make up the digestive system?**

The digestive system is made up of the mouth, oesophagus, stomach, liver, pancreas, gall bladder, small intestine, large intestine, rectum and anus.

**What is the path that food takes as it moves through the digestive system?**

Food enters the body through the mouth. It then travels through the oesophagus to the stomach. From there, it travels through the small intestine and then the large intestine. The remaining undigested food is then stored in the rectum until it passes out of the body through the anus.

**What is the role of the mouth in digestion?**

The mouth begins the process of digestion. This happens in two ways:

- 1) Chewing the food to break it down into smaller chunks (mechanical digestion);
- 2) The use of amylase to break down starch (chemical digestion).

Amylase is found in the saliva, which is secreted into the mouth from the salivary glands.

The saliva also lubricates the food, making it easier to swallow.

When the food is swallowed, it leaves the mouth and travels through the oesophagus to the stomach.

### **What is the role of the stomach in digestion?**

The stomach has two roles: it kills bacteria and it continues the process of digestion. The stomach contains hydrochloric acid. This kills bacteria and other microorganisms which are mixed in with the food, thus protecting the body from potential pathogens (harmful microorganisms). The hydrochloric acid also helps with the process of digestion. The stomach contains proteases to digest proteins.

### **What are the roles of the liver and the gall bladder in digestion?**

The liver produces a fluid called bile, which will eventually be mixed with the food entering the small intestine. Bile has two roles:

- 1) It is alkaline, to neutralise the acid in the food coming from the stomach into the small intestine. This creates alkaline conditions in the small intestine, which helps in the digestion of lipids.
- 2) It emulsifies lipids - that is, it breaks down large lipid droplets into smaller ones. This increases the surface area for lipase enzymes to work on.

Once bile has been produced in the liver, it travels to the gall bladder where it is stored. From the gall bladder, bile is secreted into the small intestine.

### **What is the role of the pancreas in digestion?**

The pancreas produces proteases, lipases and carbohydrases - including amylase. These are secreted into the small intestine, where they carry out chemical digestion.

### **How are the liver, gall bladder and pancreas connected to the small intestine?**

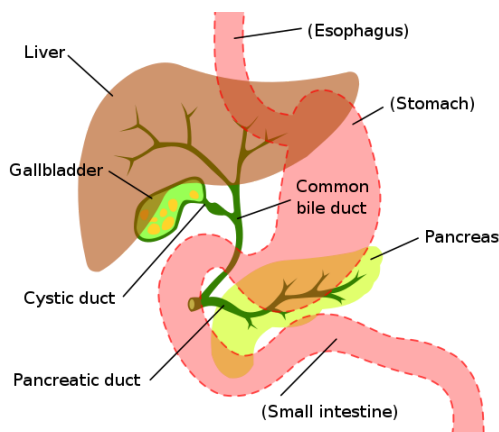
There is a duct (tube) from the liver to the gall bladder.

The gall bladder has a duct coming out of it called the bile duct.

The pancreas has a duct coming out of it called the pancreatic duct.

The bile duct and the pancreatic duct join together to form a single duct which then feeds into the small intestine.

This duct connects to the beginning of the small intestine, just past the point where food enters the small intestine from the stomach. This ensures that food entering the small intestine is immediately mixed with bile and digestive enzymes.



**Where in the digestive system does absorption take place?**

Most of the absorption takes place in the small intestine. Small food molecules are absorbed through the walls of the small intestine into the bloodstream.

Water is mainly absorbed in the large intestine.

**What are the products of digestion used for?**

Once the products of digestion have been absorbed, they are used in two ways:

- 1) As building blocks for making larger molecules. Amino acids are combined to make new proteins. Glycerol and fatty acids are combined to make new lipids. Sugars are combined to make new complex carbohydrates. Nucleic acids are combined to make new DNA and RNA molecules.
- 2) As a source of energy - some of the glucose that is absorbed is used in respiration as a source of energy. Not all of the glucose is used in this way - otherwise there would be no glucose to make other molecules out of.