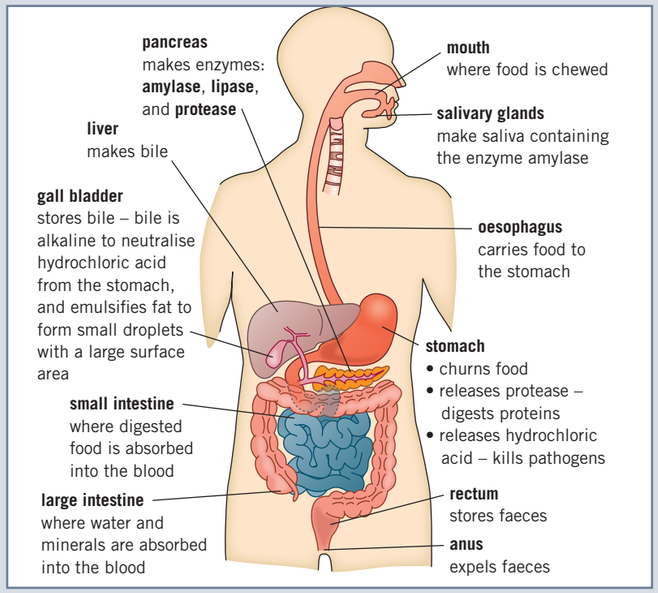
Chapter 3: Organisation and the digestive system

Knowledge organiser

There are five **levels of organisation** in living organisms:

- **cells** – basic building blocks
- **tissues** – groups of cells that have similar structures and functions
- **organs** – groups of tissues working together to perform a specific function
- **organ systems** – groups of organs working together
- **organisms** – organ systems work together, forming an organism

Digestive system



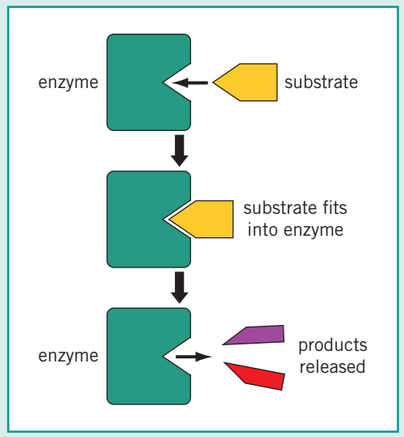
Digestive enzymes

Digestive enzymes convert food into small, soluble molecules that can then be absorbed into the bloodstream. For example, carbohydrases break down carbohydrates into simple sugars.

Enzyme	Sites of production	Reaction catalysed
amylase	salivary glands pancreas small intestine	starch → glucose
proteases	stomach pancreas small intestine	proteins → amino acids
lipases	pancreas small intestine	lipids → fatty acids and glycerol

Enzymes

Enzymes are large proteins that **catalyse** (speed up) reactions. Enzymes are not changed in the reactions they catalyse.



Lock and key theory

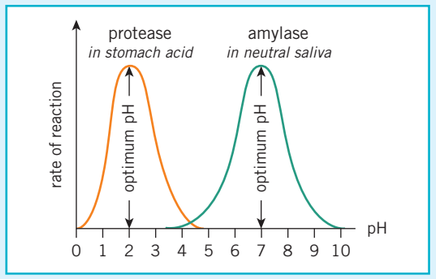
This is a simple model of how enzymes work:

1. The enzyme's **active site** (where the reaction occurs) is a specific shape.
2. The enzyme (the lock) will only catalyse a specific reaction because the **substrate** (the key) fits into its active site.
3. At the active site, enzymes can break molecules down into smaller ones or bind small molecules together to form larger ones.
4. When the products have been released, the enzyme's active site can accept another substrate molecule.

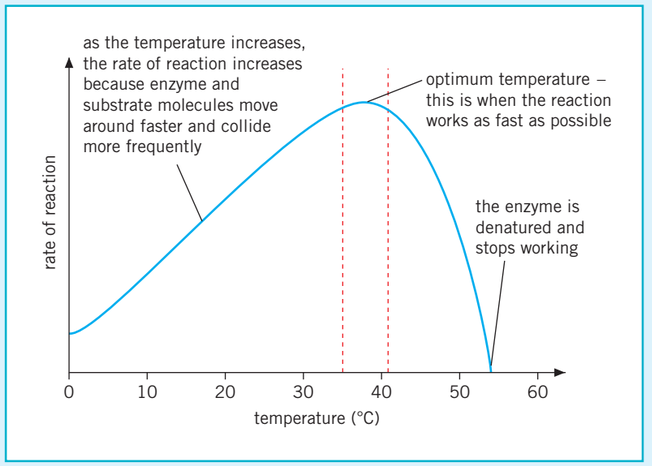
The effect of pH on enzymes

Different enzymes have different **optimum** pH values.

This allows enzymes to be adapted to work well in environments with different pH values. For example, parts of the digestive system greatly differ in pH.

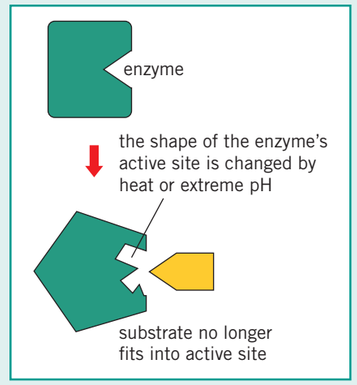


The effect of temperature on enzymes



Denaturation

At extremes of pH or at very high temperatures, the shape of an enzyme's active site can change.



The substrate can no longer bind to the active site, so the enzyme cannot catalyse the reaction – the enzyme has been **denatured**.

Key terms

Make sure you can write a definition for these key terms.

active site *amylase* *catalyse* *denatured* *enzyme* *lipase* *optimum* *organ* *organ system* *pH* *protease* *substrate* *temperature* *tissue*

Chapter 3: Organisation and digestive system

Retrieval questions

Learn the answers to the questions below then cover the answers column with a piece of paper and write as many as you can. Check and repeat.

	B3 questions	Answers
1	Name the five levels of organisation.	cells → tissues → organs → organ systems → organisms
2	What is a tissue?	group of cells with similar structures and functions
3	What is an organ?	group of tissues working together to perform a specific function
4	What is the function of the liver in digestion?	produces bile, which neutralises hydrochloric acid from the stomach and emulsifies fat to form small droplets with a large surface area
5	What is the function of saliva in digestion?	lubrication to help swallowing – contains amylase to break down starch
6	Name three enzymes produced in the pancreas.	amylase, protease, lipase
7	What are enzymes?	protein molecules that catalyse specific reactions in organisms
8	Why are enzymes described as specific?	each enzyme only catalyses a specific reaction, because the active site only fits together with certain substrates (like a lock and key)
9	Describe the function of amylase.	to break down starch into glucose
10	Where is amylase produced?	salivary glands, pancreas, and small intestine
11	Describe the function of proteases.	to break down proteins into amino acids
12	Where are proteases produced?	stomach, pancreas, and small intestine
13	Describe the function of lipases.	to break down lipids into fatty acids and glycerol
14	Where are lipases produced?	pancreas and small intestine
15	What are two factors that affect the rate of activity of an enzyme?	temperature and pH
16	What does denatured mean?	shape of an enzyme's active site is changed by high temperatures or an extreme pH, so it can no longer bind with the substrate
17	Describe the effect of temperature on enzyme activity.	as temperature increases, rate of reaction increases until it reaches the optimum for enzyme activity – above this temperature enzyme activity decreases and eventually stops
18	Describe the effect of pH on enzyme activity.	different enzymes have a different optimum pH at which their activity is greatest – a pH much lower or higher than this enzyme activity decreases and stops
19	Why do different digestive enzymes have different optimum pHs?	different parts of the digestive system have very different pHs – the stomach is strongly acidic, and the pH in the small intestine is close to neutral
20	What is an organ system?	a group of organs working together to perform a specific function

Put paper here