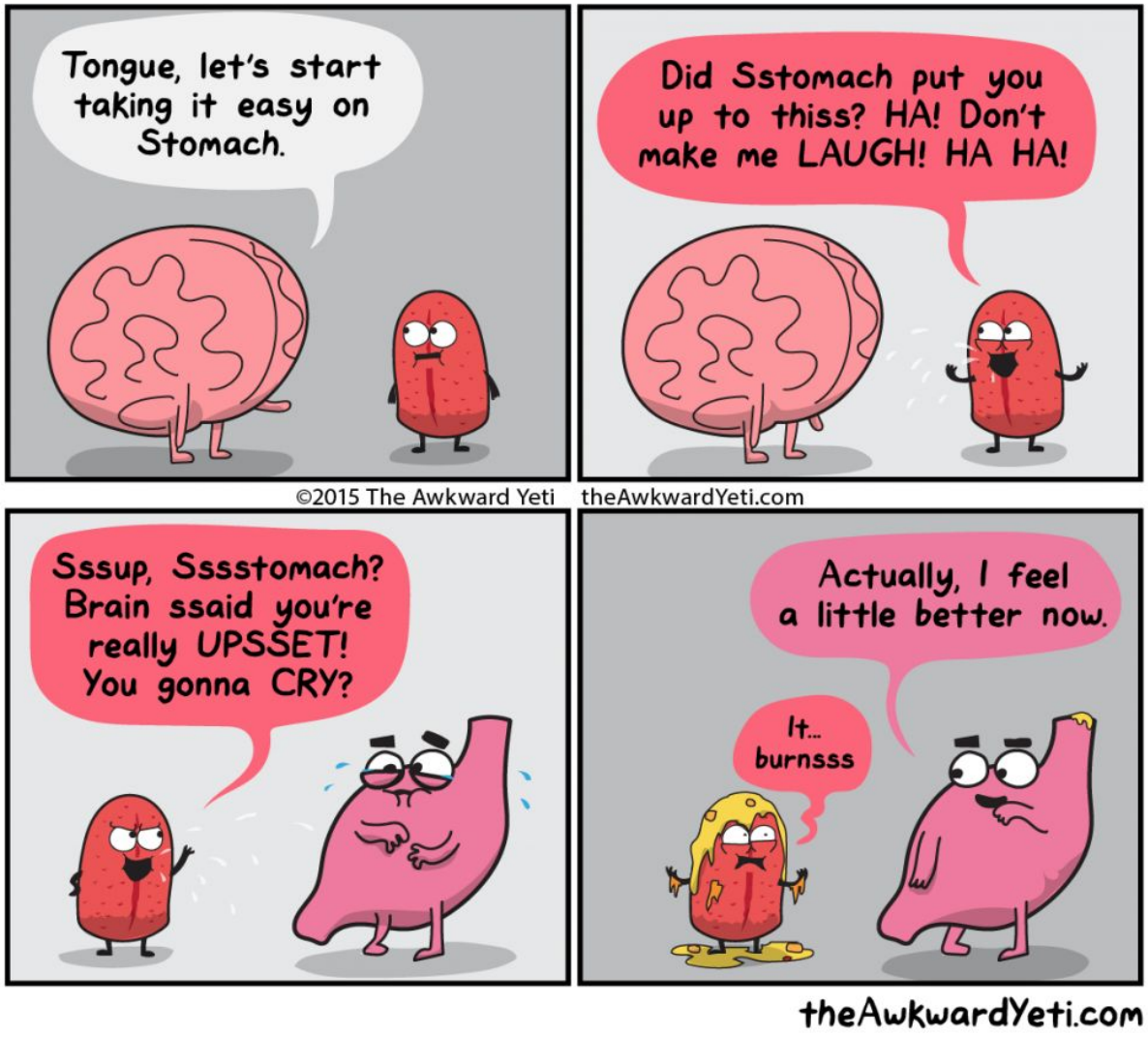
Digestion



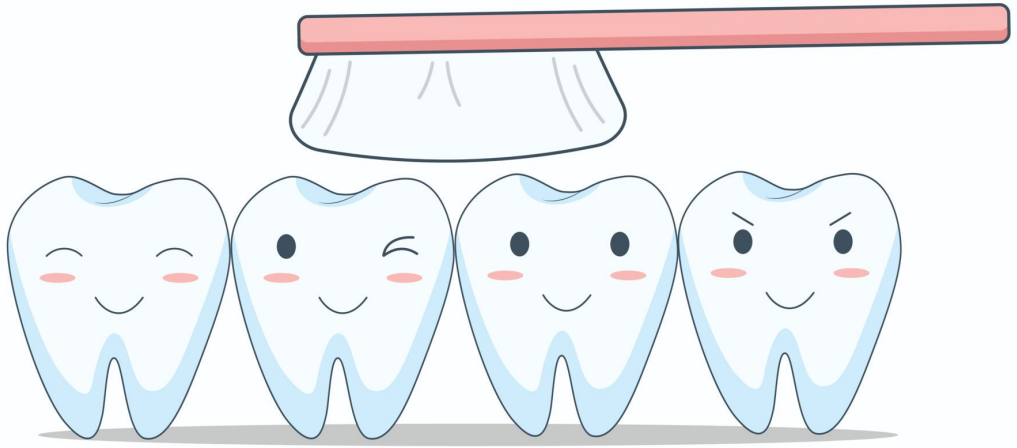
Lesson Objectives:

- Define Digestion
- Distinguish between mechanical and chemical digestion
- Define Enzymes and explain their role in digestion
- Discover the parts of the digestive system

Digestion is the mechanical and chemical breakdown of food into smaller components that are more easily absorbed into a blood stream.

So what does the **Mechanical Digestion** involve?

It involves the **teeth.**



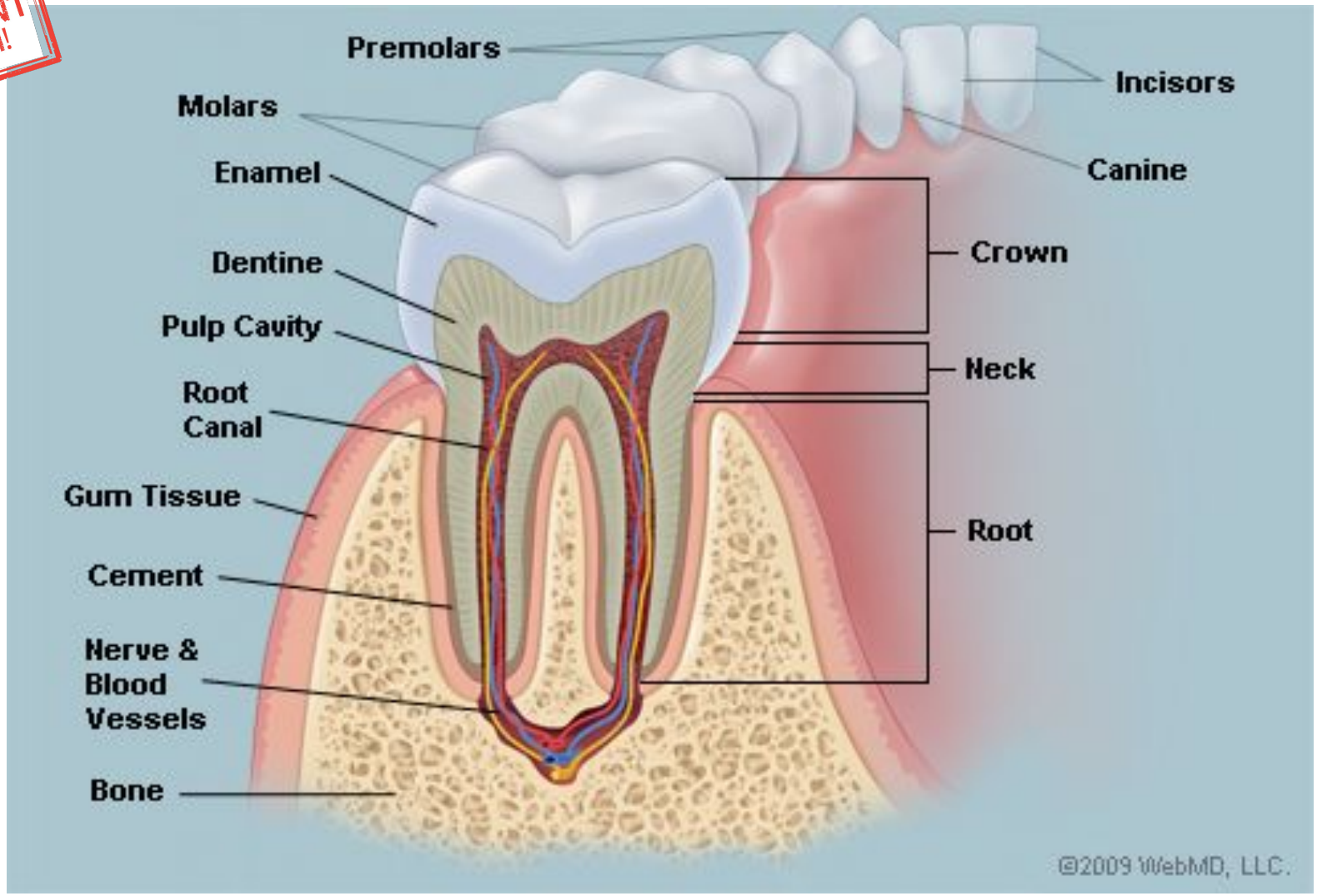
Teeth

In humans teeth are held firmly in place by the jaw.

They are used to cut tear and grind **food breaking it down into smaller pieces**.

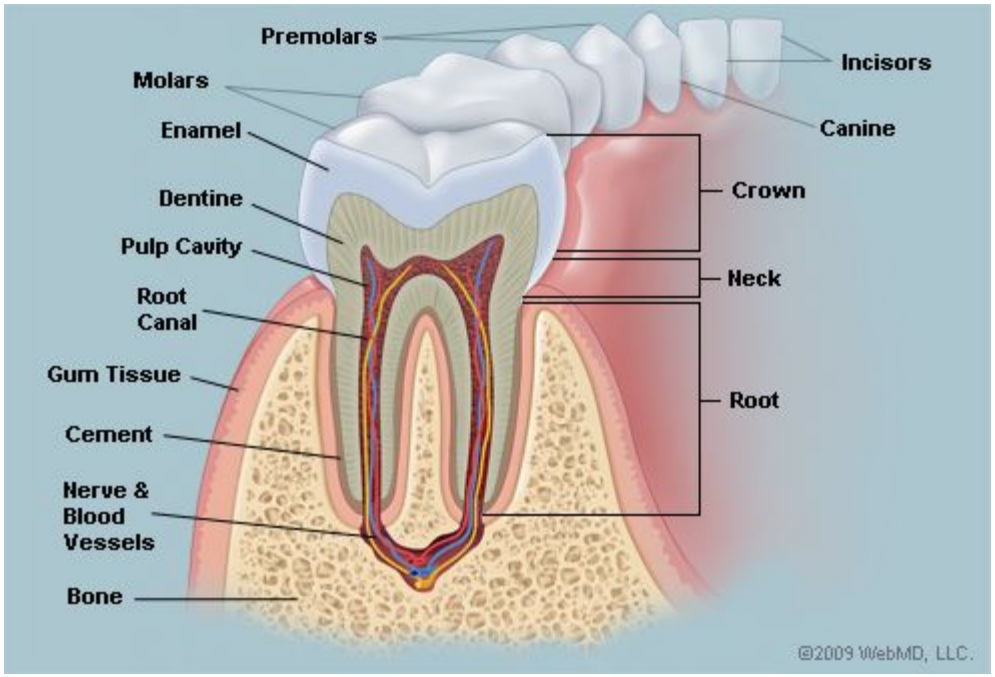
This greatly increases the surface area of the food so that the enzymes can act on them (we will discuss enzymes later).

IMPORTANT DIAGRAM!



Section of a tooth showing parts.

Parts of the Tooth



The part of the tooth that can be seen is called the **crown .**

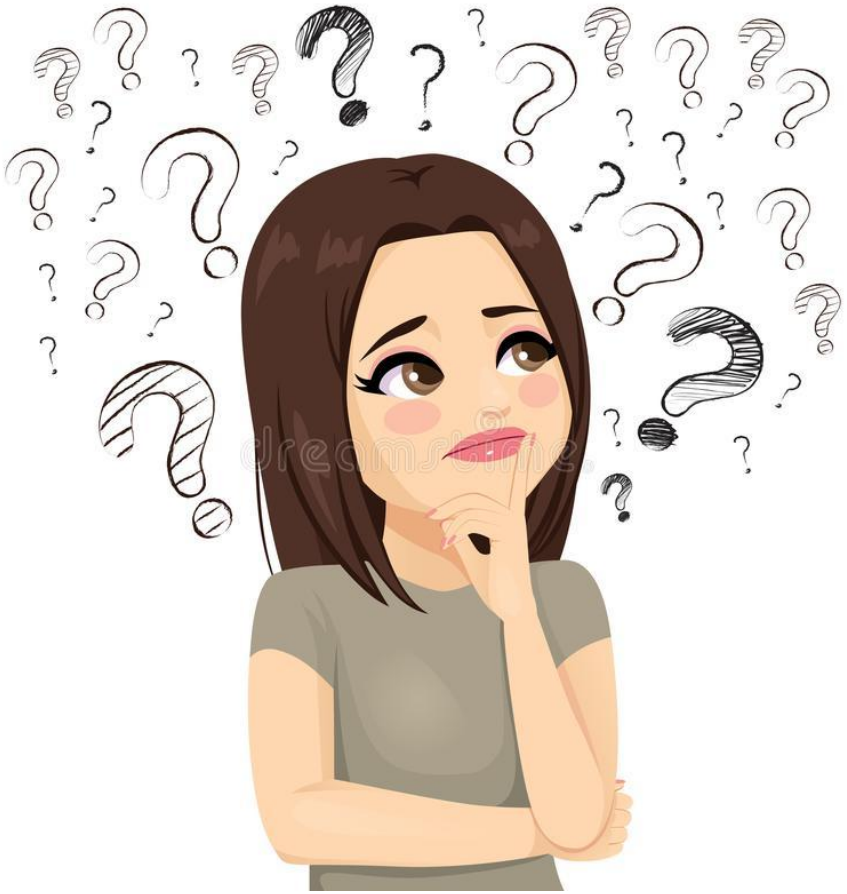
The crown is covered in **enamel** which is the hardest material in the human body.

Parts of the Tooth

The **dentine** found under the enamel is similar to bone in structure and is also hard. The central pulp cavity has nerves and blood vessels that contain cells that make dentine.

Dentine is less mineralized and less brittle than enamel, it is necessary for the support of the enamel.

What are some ways we take care of our teeth?



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Teeth Care

If not properly cared for teeth can decay. Avoid sweet sticky foods these make acids that destroy enamel eventually exposing the pulp cavity which contains nerves that are sensitive to heat and cold and eventually cause tooth ache.


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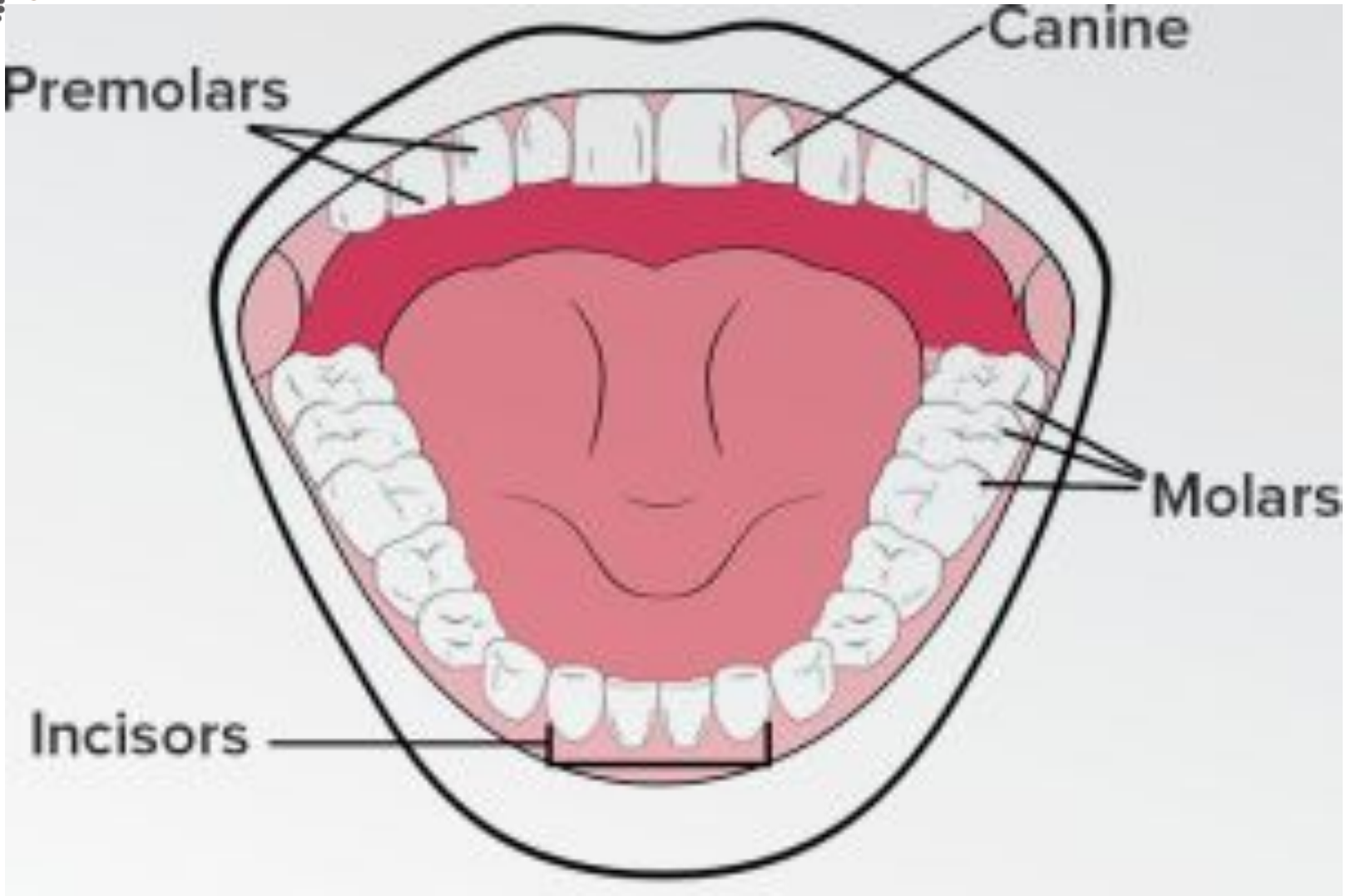
Proper care of teeth.

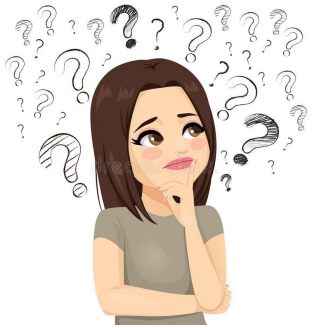
- Regular dental visits
- Brush at least twice per day
- Eat crunchy foods that stimulate membrane blood activity.
- Eat foods rich in calcium phosphorus and vitamin C and D
- Fluorine in water.
- Do not suck fingers.
- Floss regularly this removes plaque and all foods between teeth.

Types of Teeth

There are four different types of teeth:

- **Incisors**
- **Canines**
- **Premolars**
- **Molars.**


Canine
Premolars
Molars
Incisors



Which types of teeth are important to digest which foods below? (a.incisors, b.canines, c.premolars d.molars)

1.

2.

3.

4.

Types of Teeth

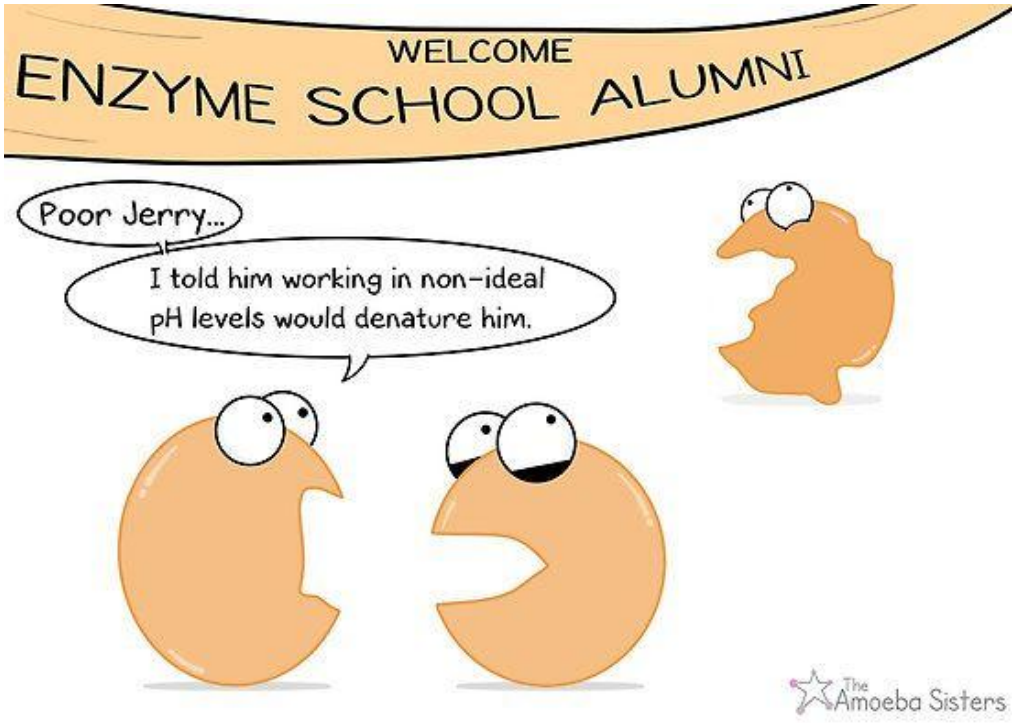
For man we have two sets of teeth there are the **milk teeth or baby teeth** and the **permanent teeth.**

- **Milk teeth** start to appear from about 6 months and start falling out from about 6 years old. They consist of 8 incisors, 4 canines and 8 molars.

- Permanent teeth replace the 20 lost milk teeth and an additional 12 develop. They consist of 8 incisors, 4 canines, 8 premolars and 12 molars.

So what does the **Chemical Digestion** involve?

It involves the **Enzymes.**

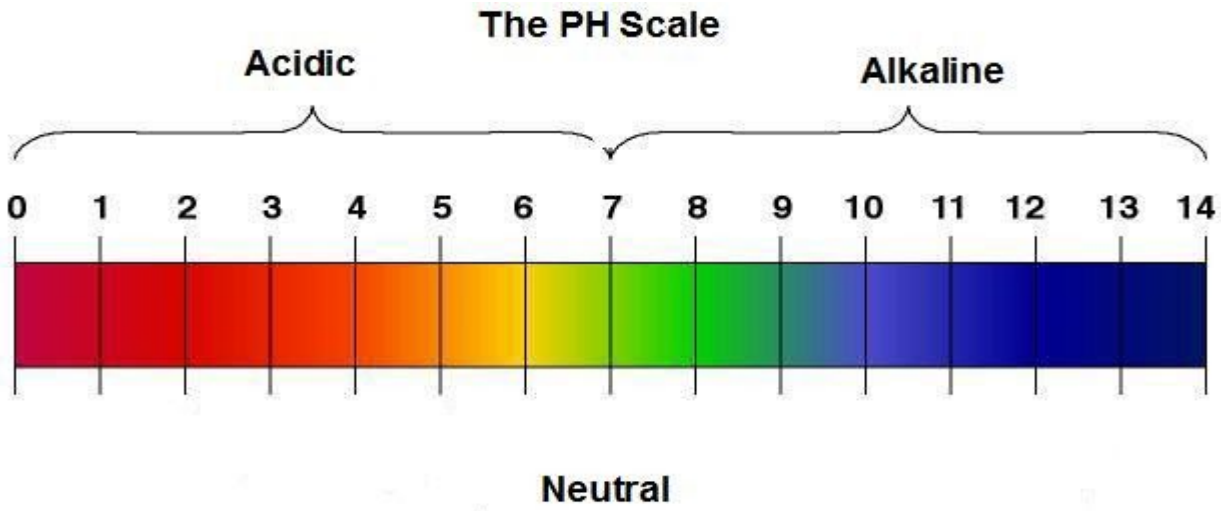


Enzymes

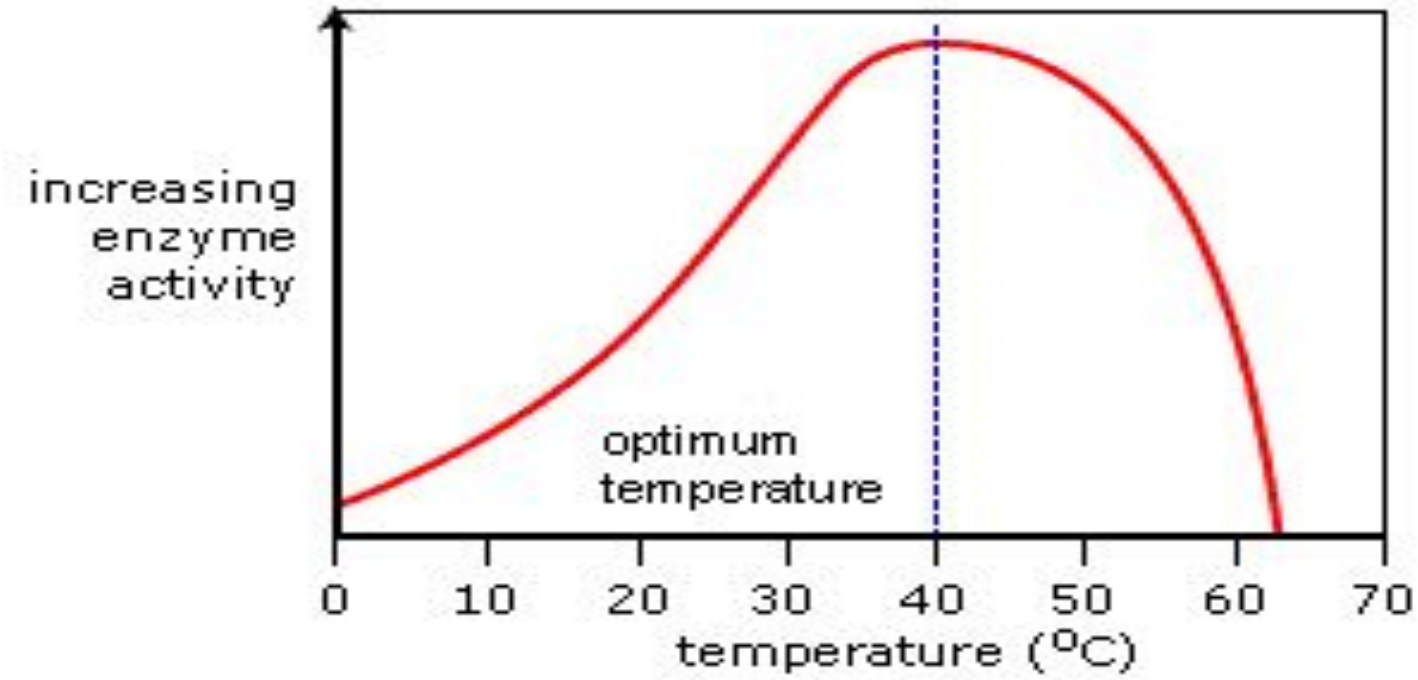
Enzymes are complex proteins that change (speed up) the rate of a chemical reaction without being changed themselves. They **speed up reactions.**

Properties of enzymes:

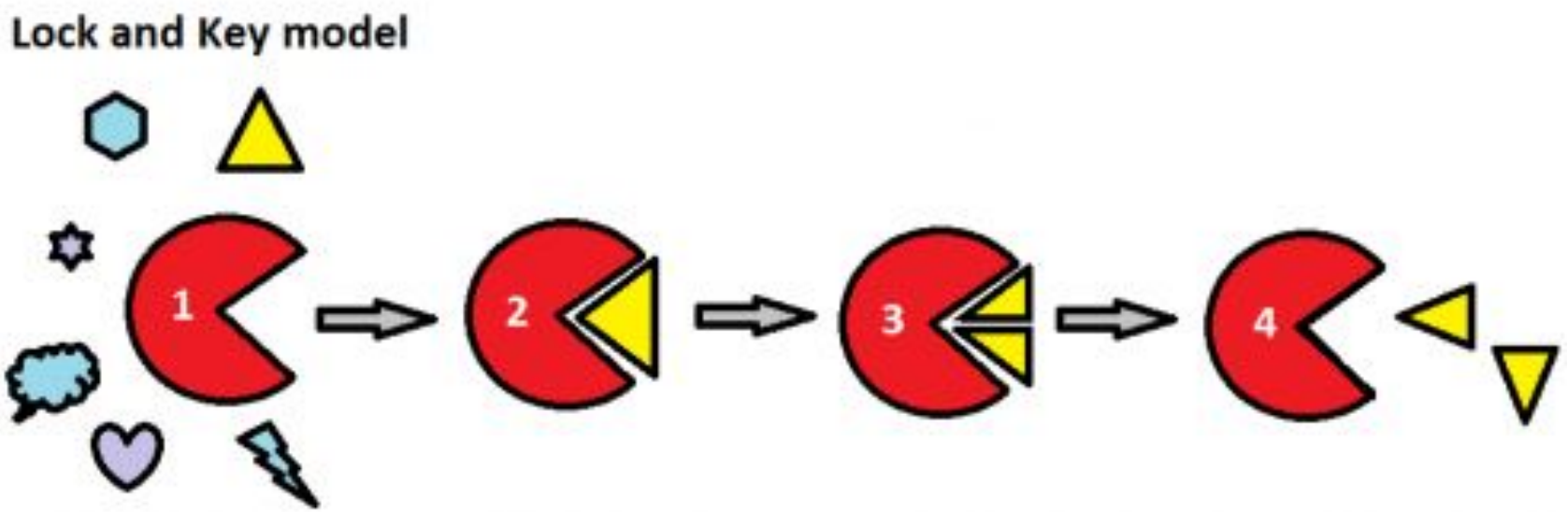
1. They work best at a particular pH, pH refers to acidity or alkalinity. pH is rated on a scale of one to fourteen. One to six is acid, seven is neutral and eight to fourteen is alkaline.



(2) They work best at a particular temperature. Too cold they become inactivated and too hot and they are denatured or destroyed.



3. They are specific – Enzymes will only work on one particular substrate. Similar to a lock and key mechanism.

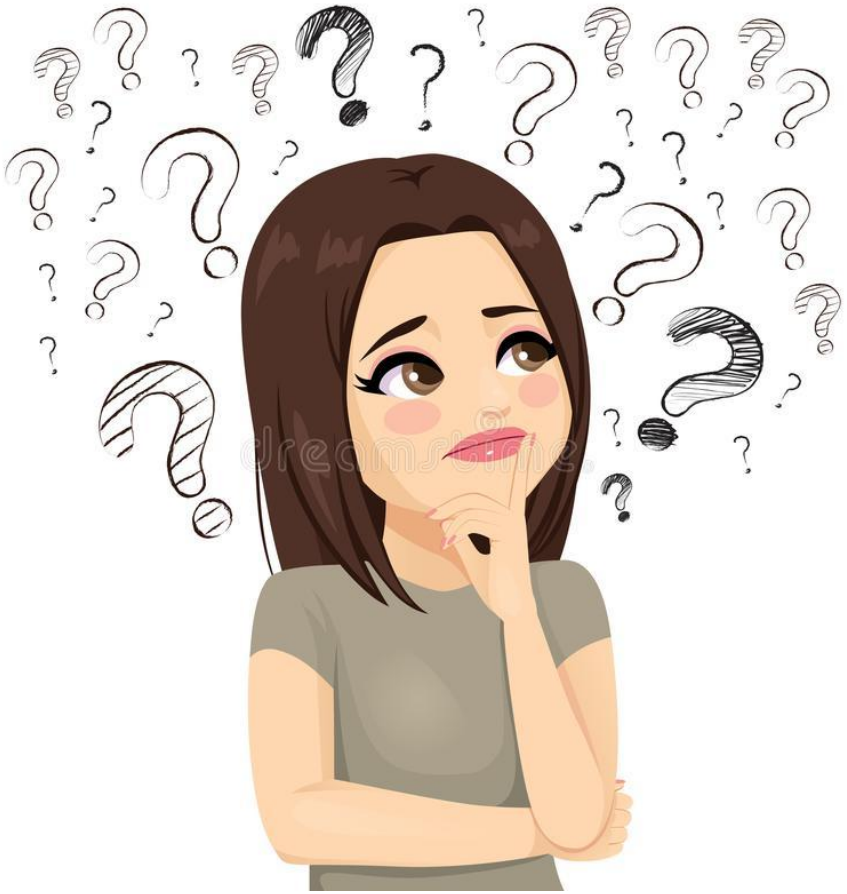


4. They break down large quantities of substrate. A little enzyme is needed to break down large quantities of substrate.

5. They are not chemically changed at the end of the reaction. As a result they can go on to react with more substrate.

6. They are sensitive to poisons.

State two properties of Digestive Enzymes?



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Digestion and Enzyme Activity

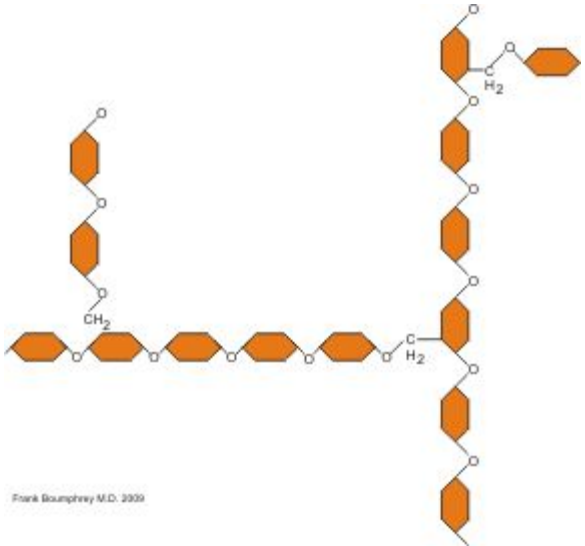
We will look at the digestion of three macronutrients. These are Carbohydrates, Proteins and Fats.

Carbohydrate Digestion:

As we learnt earlier carbohydrates can be classed as three molecules

- Polysaccharides
-
- Disaccharides
-
- Monosaccharides

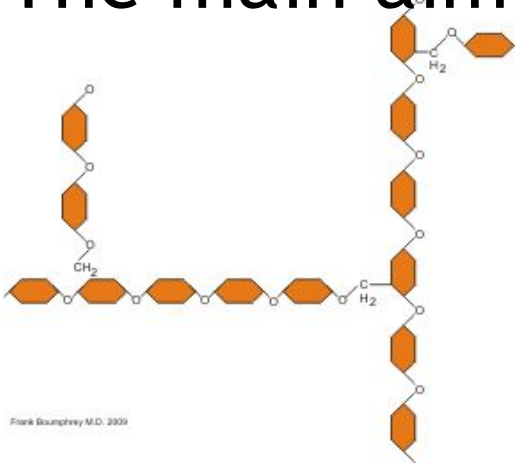
Most of the carbohydrate that we eat is in the polysaccharide form.



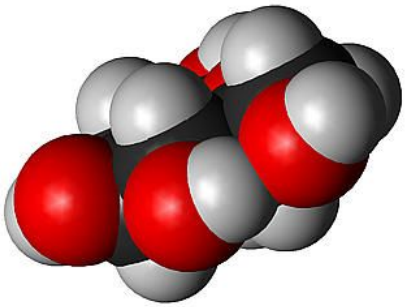
Polysaccharide chain-Many single sugar units together.

Polysaccharide chains must be converted to monosaccharide units so that they can be absorbed.

The main aim of digestion is to do this.



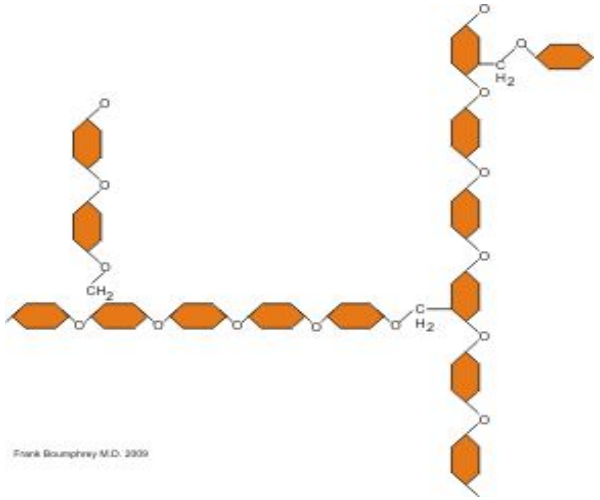
Polysaccharide unit



Monosaccharide unit

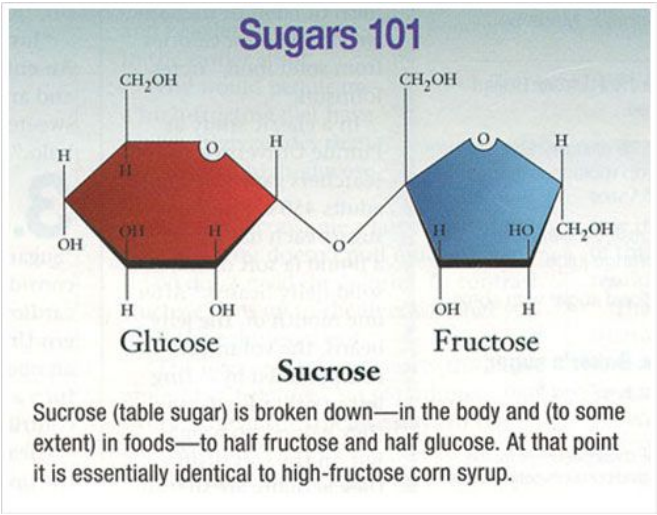
Digestion begins in the mouth:

The enzyme in saliva called **Salivary Amylase** takes starch, which is a polysaccharide and converts it to maltose which is a disaccharide unit. The pH of the mouth is **neutral** to slightly alkaline. Salivary amylase works best at these conditions, it is specific as such it will not work on protein or fats these are broken down by other enzymes at other parts of the digestive system.



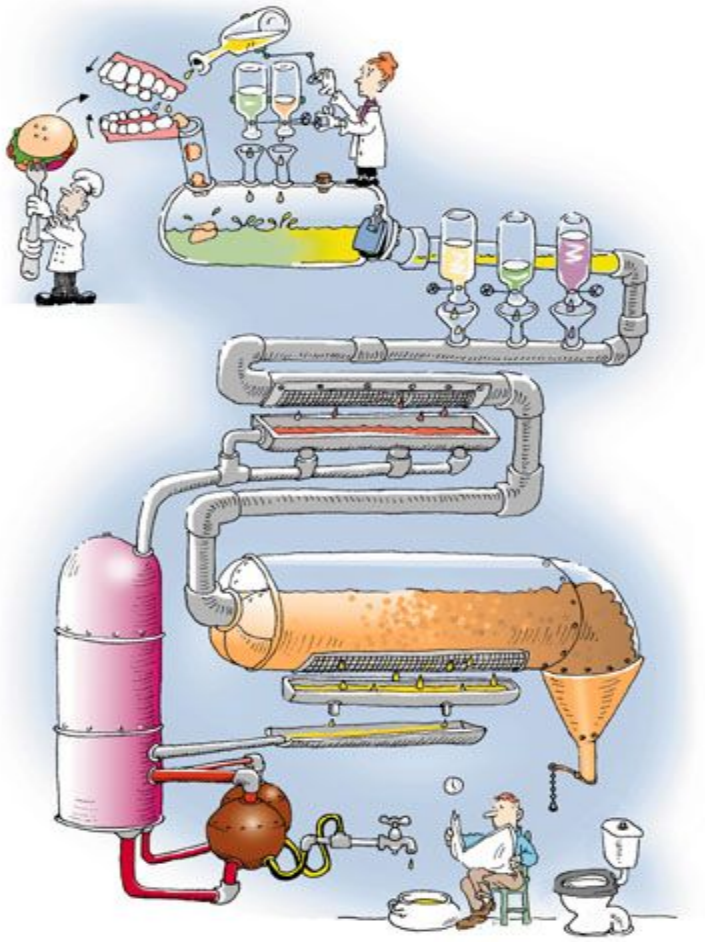
Polysaccharide

Starch



Disaccharide

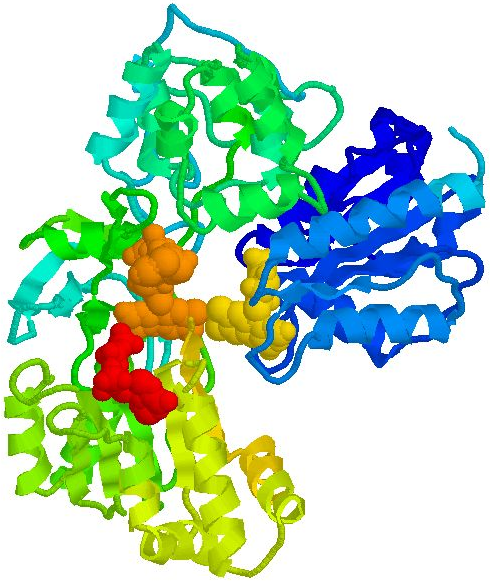
Maltose



We will return to carbohydrate digestion later on

Protein Digestion

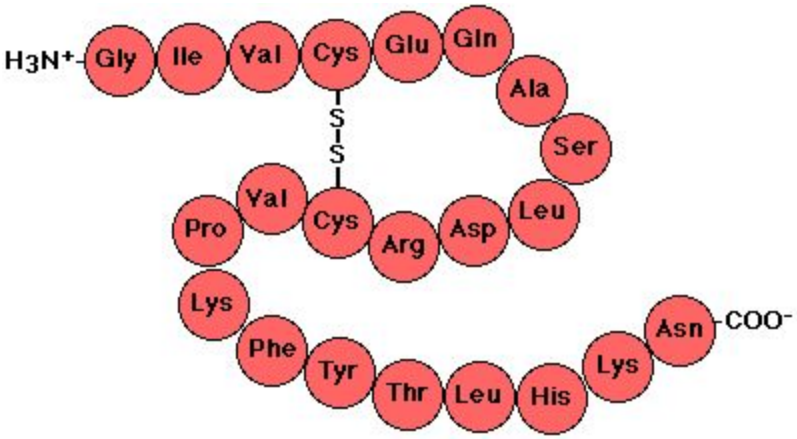
Food enters the **stomach** from the oesophagus. It is here that protein digestion begins. The stomach walls secrete gastric juices that have dilute hydrochloric acid and the enzymes **pepsin** and **rennin**. The pH of the stomach is **acidic**. As such salivary amylase will not work. Pepsin and rennin work best in acidic conditions, they are used to begin the digestion of protein.



Protein

Pepsin in the stomach breaks the chain

Polypeptide Chain



Proteins are broken down into **polypeptides** which are smaller chains of amino acids linked together.

This is not the end product however as the polypeptide chain must become an **amino acid**, this occurs in the **duodenum**.

The duodenum is the first part of the gut known as the **small intestine.**

In the duodenum bile that is made in the liver and stored in the gall bladder.

Pancreatic juice is made by the pancreas. They are poured into the duodenum, Bile has sodium bicarbonate which neutralizes the acid from the stomach that makes the food acid.

The pH of the duodenum is now alkaline.

Pepsin and rennin cannot work here. Pepsin and rennin only work in acidic environments.

Table 3.11 *A summary of chemical digestion*

Organ	Digestive juice	Source	Main components	Functions of the components
Mouth	Saliva (pH 7–8)	Salivary glands.	• Water and mucus • **Salivary amylase***	• Moisten and lubricate the food allowing tasting and easy swallowing. • Begins to digest: **starch** ⟶ **maltose** (a disaccharide)
Stomach	Gastric juice (pH 1–2)	Cells in the stomach wall.	• Hydrochloric acid • **Rennin*** • **Pepsin***	• Maintains an optimum pH of 1–2 for pepsin and rennin, and kills bacteria. • Produced in infants to clot soluble protein in milk so the protein is retained in the stomach. • Begins to digest: **protein** ⟶ **peptides** (shorter chains of amino acids)

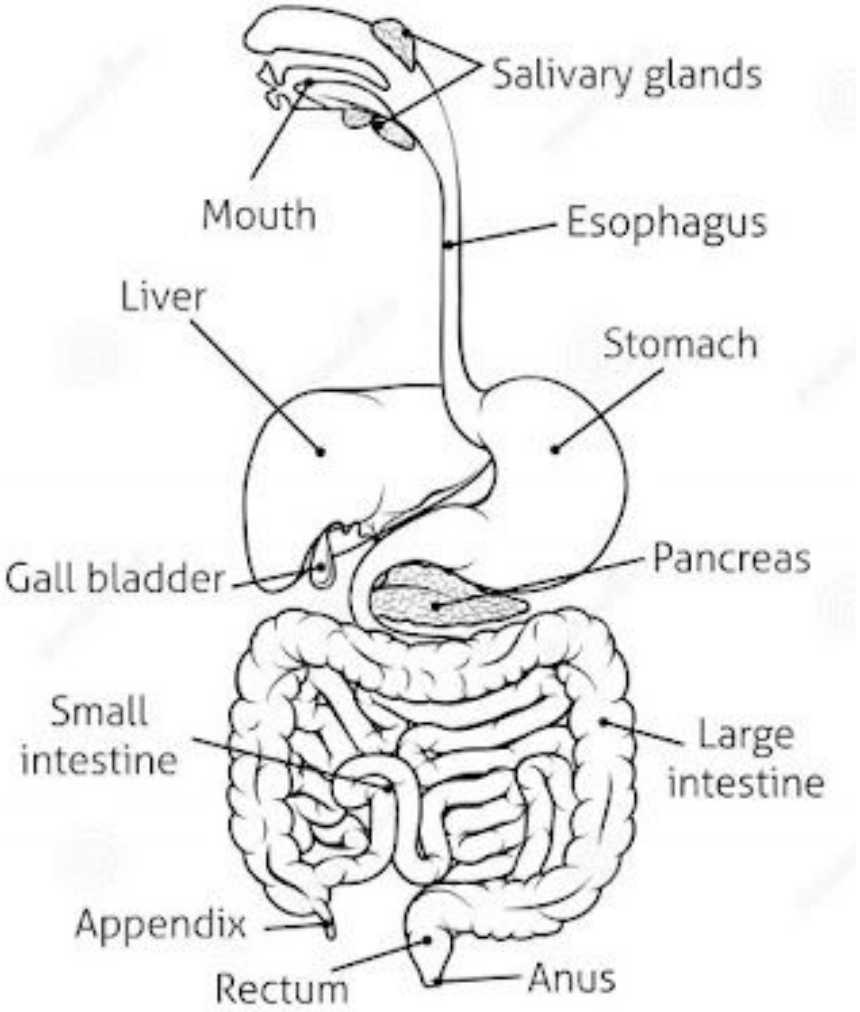
Source: Concise Revision Course: Human and Social Biology

Small intestine (duodenum and ileum)	Bile (pH 7–8)	Cells in the liver. It is stored in the gall bladder and enters the duodenum via the bile duct.	• Bile pigments, e.g. bilirubin • Organic bile salts	• Excretory products from the breakdown of haemoglobin in the liver. Have no function in digestion. • **Emulsify lipids**, i.e. break large lipid droplets into smaller droplets increasing their surface area for digestion.
	Pancreatic juice (pH 7–8)	Cells in the pancreas. It enters the duodenum via the pancreatic duct.	• **Pancreatic amylase*** • **Trypsin*** • **Pancreatic lipase***	• Continues to digest: **starch** → **maltose** • Continues to digest: **protein** → **peptides** • Digests: **lipids** → **fatty acids** and **glycerol**
	Intestinal juice (pH 7–8)	Cells in the walls of the small intestine.	• **Maltase*** • **Sucrase*** • **Lactase*** • **Peptidase* (erepsin)**	• Digests: **maltose** → **glucose** • Digests: **sucrose** → **glucose** and **fructose** • Digests: **lactose** → **glucose** and **galactose** • Digests: **peptides** → **amino acids**

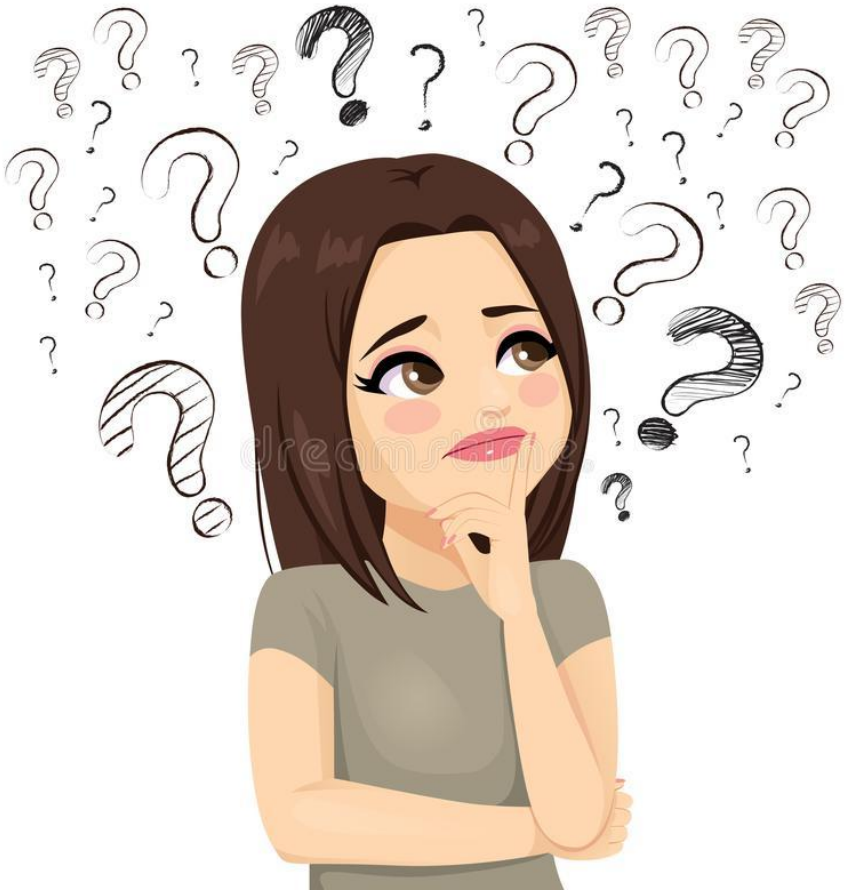
Source: Concise Revision Course: Human and Social Biology

IMPORTANT DIAGRAM!

Parts of the Digestive System



State three parts of the Digestive system where chemical digestion takes place.



Lesson Sources:

- Concise Revision Course - Human and Social Biology - a Concise Revision Course for CSEC® Textbook by Anne Tindale and Shaun deSouza

- Human & Social Biology for CSEC® Examinations 6th Edition Student's Book by Phil Gadd