Unit 3.1.2

The Microbiology of the Gastrointestinal Tract and Accessory Organs

Key Knowledge and Key Skills

3.1.2 - Key Knowledge

The microbiology of the gastrointestinal tract and accessory organs (tongue, salivary glands, pancreas, liver and gall bladder) in the sequential process of macronutrient digestion, absorption and utilisation, including enzymatic hydrolysis

3.1.2 - Key Skill

Explain the physiology of digestion and its relationship to absorption and utilisation of macronutrients.

VCE Food Studies Study Design p. 20 and 21

Key Terms and Definitions

Absorption in the digestive system occurs when nutrients pass through the small intestine lining.

An **accessory organ** is an organ that assists other organs to function in a system. An accessory organ releases chemicals that help to chemically digest food in the digestive system, but food does not pass through these organs during digestion.

Chemical digestion refers to the process whereby enzymes and acids, secreted during digestion, break the chemical bonds that hold food together so that it can be more easily digested.

Enzymatic hydrolysis is the term used to describe the process where enzymes use water to break down bonds during digestion.

Enzymes speed up the rate of a specific chemical reaction.

The **gastrointestinal tract** refers to the passage or tube in the digestive system that food passes through. It starts at the mouth and ends at the anus.

Macronutrient digestion occurs when the proteins, carbohydrates and fats in food are broken down into smaller molecules as they pass through the gastrointestinal tract.

Macronutrient utilisation refers to how the body uses the nutrients from food for energy, disease prevention, and everyday functioning.

Mastication is the term used to describe the process of chewing, where food is kneaded and crushed by the tongue and teeth.

Mechanical or **physical digestion** is the process whereby food is physically broken down into smaller particles and compounds by the digestive organs in our bodies.

Microbiology is the scientific study of organisms.

Peristalsis is the term used to describe the wave-like involuntary muscle contractions that move food along the digestive system.

The Gastrointestinal Tract and Accessory Organs

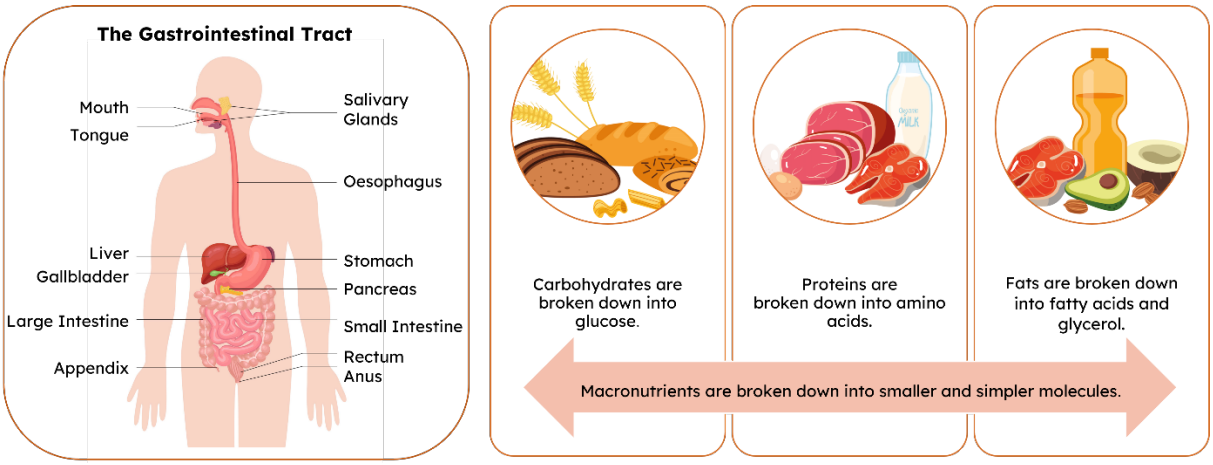
The food people eat is used for energy and the growth, maintenance, and repair of cells. The human body needs the nutrients in food to stay healthy and function well.

The gastrointestinal tract is a passage or tube in the body that food passes through. The organs through which food is digested, absorbed, and utilised make up the gastrointestinal tract. These include the mouth, oesophagus, stomach, small intestine, and large intestine. Other organs such as the tongue, salivary glands, pancreas, liver, and gall bladder are called accessory organs because they assist with the chemical digestion of food, but food does not actually pass through them during the digestive process.

Food that travels along the gastrointestinal tract is broken down into smaller and simpler molecules:

- carbohydrates into glucose;
- proteins into amino acids; and
- fats or lipids to fatty acids.

These smaller molecules are absorbed into the small intestine. The parts of food that the body cannot use leave as waste.



Mouth

The mouth, or oral cavity, is the first part of the digestive system. Food is broken up in the mouth by the teeth and kneaded by the tongue. Chemical digestion begins in the mouth when saliva is released and acts on the food ingested.

Tongue

The tongue is an accessory organ in the gastrointestinal tract. Our tongue kneads the food by moving it around, our teeth tear and grind the food, and our saliva moistens it making it easier to swallow. At this stage, the food is called a bolus.

Salivary Glands

The salivary glands are accessory organs in the gastrointestinal tract. Thousands of salivary glands are located around the mouth, tongue, and throat. The main three salivary glands can be found under the ears and beneath the jaw. Salivary glands produce saliva when we see, smell, taste, or even imagine eating something appetising. Saliva contains enzymes that help digest food. The enzyme salivary amylase in saliva breaks down some starches and sugars (carbohydrates) and lingual lipase begins to break down fats. Lingual lipase only plays a mininmal role in the break down of fats in the mouth.

Oesophagus

Once swallowed, waves of muscle contractions called peristalsis move the food down a muscular tube called the oesophagus. At the end of the oesophagus, a ring of muscle called a sphincter opens, allowing food to enter the stomach.

Stomach

Once inside the stomach, the muscles contract and mix the bolus with gastric juices. The gastric juices are secreted by the cells lining the stomach walls. These gastric juices contain various substances, including hydrochloric acid and enzymes. Hydrochloric acid kills some of the harmful bacteria present in the ingested food. It also lowers the pH of the stomach, which enables the enzyme pepsin to break down some of the protein into amino acids. Gastric lipase, also present in gastric juices, breaks down some fats into fatty acids. The bolus transforms into a mass of liquid called chyme in the stomach.

Small Intestine

The small intestine consists of three parts, the duodenum, the jejunum, and the ileum.

The primary function of the small intestine is to digest and absorb macronutrients. The gastrointestinal tract's three major accessory organs, the liver, the gallbladder, and the pancreas, assist with the chemical digestion of nutrients in the small intestine. A sphincter, which leads from the stomach to the small intestine, squirts chyme into the small intestine.

The small intestine has a large surface area consisting of folds of tissue and finger-like projections called villi. These villi line the walls of the small intestine and absorb amino acids, glucose, and fats. Each villus has one vein, one artery and a network of blood capillaries which absorb amino acids and glucose. They also have a lacteal which runs through the centre of the villus and is connected to the lympatic system. This system transports the fatty acids and glucose.

Liver and Gallbladder

Bile is a thick, yellow-green substance produced by the liver. The gallbladder contracts and releases bile into the small intestine. The bile acts as an emulsifier and helps reduce large fat globules into smaller droplets. The liver breaks down glycogen into glucose and releases it into the bloodstream when the body needs energy quickly.

Pancreas

The pancreas releases pancreatic fluid or juices containing enzymes into the small intestine. The enzymes include:

- **Pancreatic amylase** which completes the process of carbohydrate digestion by breaking down starches and sugars into glucose.
- The enzyme, **pancreatic lipase**, which breaks down fat into fatty acids and glycerol.
- The enzyme **protease** that separates proteins into smaller amino acid units.

Large Intestine

Undigested food travels from the small intestine to the large intestine. The absorption of macronutrients has already occurred when the food reaches the large intestine; however, the absorption of some vitamins still occurs. A significant role of the large intestine is to remove the water from the waste and form a solid mass called a stool or faeces.

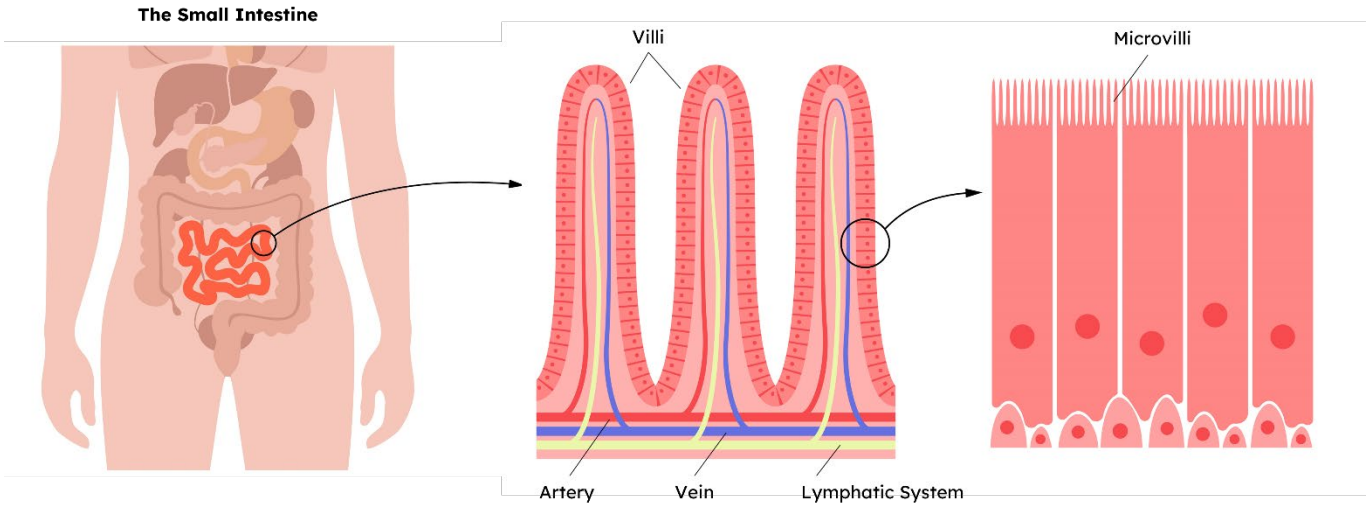
The large intestine also contains a vast range of beneficial bacteria. Some of these beneficial bacteria begin fermenting and breaking down carbohydrates and releasing short-chain fatty acids. These bacteria also produce large amounts of vitamins, especially vitamin K and biotin, for absorption into the blood.

Rectum and Anus

The rectum is a tube that connects the large intestine to the anus. The rectum receives and holds the waste until it needs to be emptied. The rectum has a mucous membrane lining that contains many nerves; these nerves send signals to the brain about how full the rectum is, the type of consistency of the stool, and if the bowel needs to be emptied. There is an outer sphincter at the base of the rectum that people can control; tightening or relaxing this sphincter muscle can stop or release a stool. The stool is released through the anus.

The Macronutrients in the Gastrointestinal Tract

Macronutrients are nutrients, including carbohydrates, fats, and proteins, are required in significant quantities by the body. During digestion, macronutrients are digested, absorbed, and used by the body. Carbohydrates are broken down into glucose, fats into glycerol and fatty acids, and proteins into amino acids.



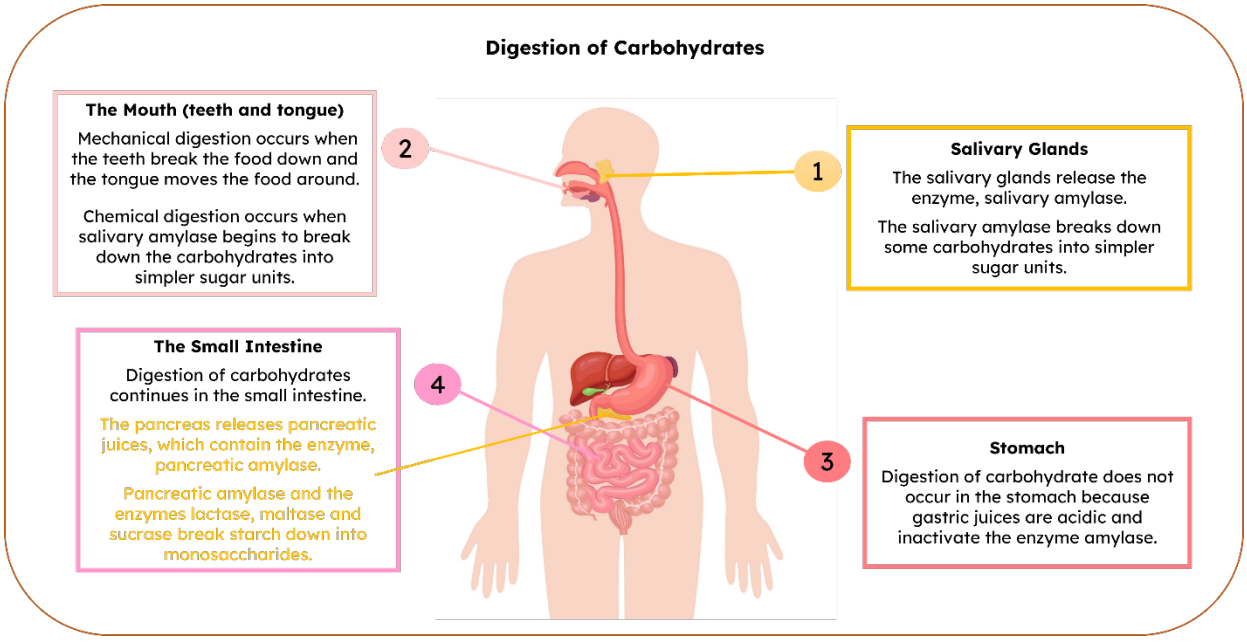
Digestion, Absorption and Utilisation of Carbohydrates

Carbohydrate Digestion

All carbohydrates are eventually broken down into glucose in the digestive process.

The digestion of carbohydrates begins in the mouth, where the salivary glands release amylase. The salivary amylase breaks down some starch molecules into simpler sugar units. The digestion of carbohydrates does not occur in the stomach because the gastric juices are acidic and inactivate the amylase. The digestion of carbohydrates continues in the small intestine, where the pancreas releases pancreatic juices, which contain the pancreatic enzyme amylase. Pancreatic amylase and the enzymes lactase, maltase, and sucrase, which are found on the villi, break down starch into the monosaccharides: fructose, galactose, and glucose.

This diagram shows how **carbohydrates** are digested.



Carbohydrate Absorption

The villi and cells in the small intestine absorb the monosaccharides, which travel to the liver via the bloodstream. Fructose and galactose are converted into glucose in the liver.

The liver releases glucose into the bloodstream if energy is needed immediately. The glucose that is not immediately required is converted to glycogen and stored in the liver. This glycogen is converted back into glucose and released into the bloodstream when needed. The blood distributes glucose throughout the body as an energy source. However, the liver is unable to store large amounts of glycogen. Therefore, any excess glycogen is converted to fat and stored in the body.

Carbohydrate Utilisation

Carbohydrates are the body's preferred energy source. Sugars and starches are carbohydrates. Starches can be found in fruit and vegetables, bread, and grain products. Different forms of sugar are found in fruit, milk, and table sugar.

Fibre is often considered a carbohydrate; however, technically, it is not a carbohydrate. Various foods contain fibre, including fruits, vegetables, and grains. Fibre helps keep our digestive system healthy and stabilises our blood glucose and cholesterol levels. It helps prevent constipation and some diseases, including bowel cancer, coronary heart disease, and type 2 diabetes.

Carbohydrates are classified as monosaccharides, disaccharides, polysaccharides, and oligosaccharides.

- Monosaccharides are referred to as simple sugars, which are easily absorbed into the bloodstream. They are found in honey, fruit juices, and some vegetables. Glucose, fructose, and galactose are monosaccharides. Monosaccharides are simple sugar units that do not need to be broken down further during digestion.
- Disaccharides are composed of two monosaccharides linked together. They are found in sugar and milk. Lactose, maltose, and sucrose are disaccharides. Disaccharides need to be broken down into monosaccharides during digestion.
- Polysaccharides are more complex carbohydrates made up of many simple sugars linked together. They are found in corn, legumes, rice, starchy vegetables, wheat, and tubers such as cassava, potatoes, and yams. Polysaccharides need to be broken down into simpler sugar units during digestion.
- Oligosaccharides contain a small number of monosaccharides joined together. They cannot be digested in the small intestine and pass through to the large intestine, promoting the growth of bifidobacteria, which are beneficial for gut health. A wide range of foods contain oligosaccharides, but large amounts are found in bread, cereals, legumes, and pasta.

Digestion, Absorption, and Utilisation of Fat

Fat Digestion

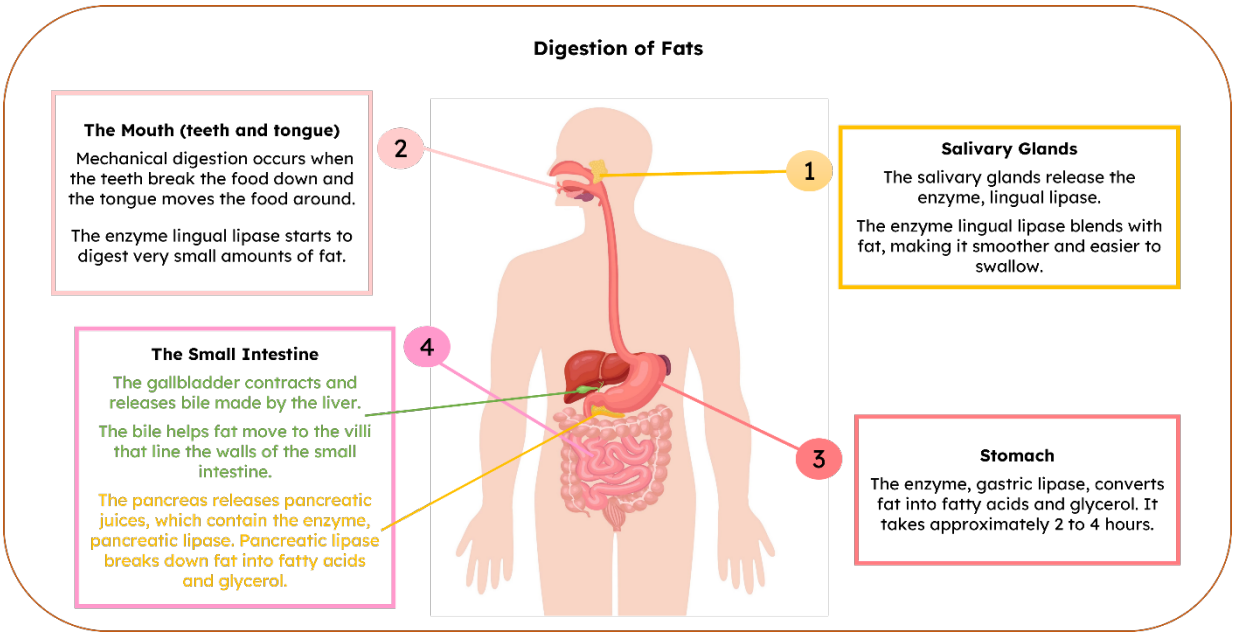
Fat is broken down into fatty acids and glycerol in the digestive system.

The digestion of fat begins in the mouth. The salivary glands release the enzyme lingual lipase, which acts on the bolus. This enzyme blends with fat, making it smoother and easier to swallow. Lingual lipase only plays a mininmal role in the break down of fats in the mouth. The bolus enters the stomach, where gastric lipase converts the fat into fatty acids and glycerol in about 2–4 hours.

The stomach contents then enter the small intestine, where the gallbladder contracts and releases bile made by the liver. Bile contains various substances that help break down the fat into smaller droplets.

At the same time, the pancreas releases digestive juices that reduce the acidity of the chyme. The enzyme pancreatic lipase, released by the pancreas, breaks down the fat into fatty acids and glycerol.

This diagram shows how **fats** are digested.



Fat Absorption

Bile helps fat move to the villi that line the small intestine walls. The fat droplets are too large to enter the blood capillaries in the villi, so they enter the lacteal instead, which connects to the lymphatic system. The lymphatic system transports the fats via the bloodstream to the liver and tissues such as the fat and muscle tissue, where they are stored or used by cells.

Fat Utilisation

Fat is a nutrient essential for good health. Fat provides energy, absorbs certain nutrients, and maintains the core body temperature. Good fats are also important for brain development in unborn babies, infants, children, and adolescents. Too much fat, however, can cause people to gain weight and may cause other health problems.

Cholesterol is a term often associated with fat. It is a fatty substance that the body needs for processes such as making hormones and building cells. Many people obtain the cholesterol they need from the foods they consume; however, the body is also capable of making it.

Fats are classified as unsaturated and saturated.

- Saturated fats are often referred to as unhealthy fats. They are found in foods of animal origin like butter, dairy foods, meat, and poultry. They are also found in plants, for example, coconut oil. Eating large amounts of saturated fat is linked with an increased risk of heart disease and high blood cholesterol levels.
- Unsaturated fats are an essential part of a healthy diet. There are two types of unsaturated fats: polyunsaturated and monounsaturated fats.
  - Monounsaturated fats help lower the level of bad cholesterol in your blood. Sources of monounsaturated fats include avocados, olive and canola oil, and some nuts, such as cashews and almonds.
  - Polyunsaturated fats contain Omega-3 and Omega-6 fatty acids, which are needed for heart health and brain function. Sources of polyunsaturated fats include brazil nuts, chia seeds, fish, flaxseed, pine nuts, tahini, walnuts, and some vegetable oils and margarines.

Note: Trans fats are unsaturated fats that have undergone processing. Eating trans fats increases bad cholesterol levels and decreases good cholesterol levels in the body. Sources of trans fats are found in packaged foods like donuts and cakes, and some butter and margarines.

Digestion, Absorption, and Utilisation of Protein

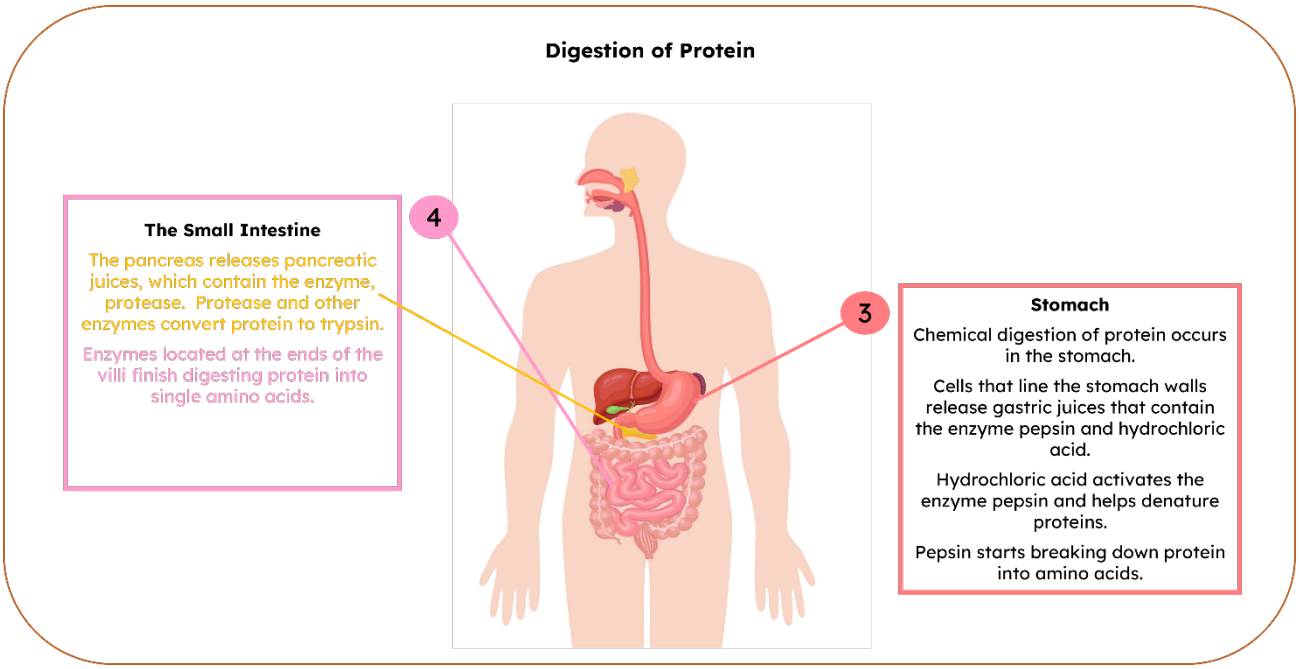
Protein Digestion

Proteins are broken down into amino acids during digestion.

Protein digestion begins in the mouth, where the food is broken down into smaller particles by the teeth and tongue. Chemical digestion of protein begins in the stomach. The cells that line the stomach walls release the enzyme pepsin and hydrochloric acid. Hydrochloric acid helps denature proteins, causing them to unfold and, most importantly, activates the enzyme pepsin. Pepsin then begins to break down some of the proteins into amino acids.

The pepsin is deactivated when the chyme enters the small intestine because the small intestine is too acidic for the pepsin to break down protein any further. Instead, the pancreas releases the enzyme protease and other enzymes that convert to trypsin. Protease and trypsin assist with the further breaking down of proteins. Some enzymes located at the ends of the villi finish digesting the proteins into single amino acids.

This diagram shows how **proteins** are digested.



Protein Absorption

Amino acids are absorbed into the bloodstream via the villi in the small intestine to the liver. From the liver, the amino acids are transported to where they are needed around the body or converted to glucose as a source of energy. The body can store excess protein as fat.

Protein Utilisation

Proteins are large molecules that are critical to many functions in the body. They assist with the growth, maintenance, and repair of cells. Protein forms the basis of bones, blood, cartilage, muscles, and skin in the body. It also helps make hormones and enzymes. The body uses protein as a source of energy when carbohydrates are not available. Proteins are broken down into amino acids during digestion.

There are two major types of amino acids: essential and non-essential amino acids. There are nine essential amino acids that the body cannot make and, therefore, our diets must provide them. The remaining amino acids are non-essential because the body can produce them.

Proteins are classified as complete and incomplete:

- Complete proteins contain all nine of the essential amino acids. Animal sources like beef, chicken, eggs, and yoghurt contain complete proteins. Some plant foods also contain complete proteins, including amaranth, buckwheat, quinoa, tofu made from soya beans, and some plant-based meat products.
- Incomplete proteins contain some but not all the essential amino acids. Most plant protein sources lack one or more of the essential amino acids and are therefore considered incomplete protein sources. It is recommended that people who do not consume animal products eat a combination of plant foods such as nuts, legumes (beans, peas, and lentils), seeds, whole grains, and vegetables. This will help them obtain the protein they require.

Eating foods rich in protein every day is the best way to ensure you get enough of this essential nutrient.

Written Activity One

Amy's Wonton

Below is a story about a girl called Amy and how the food she eats is digested, absorbed and utlised by the body.

Some keywords are missing from the story.

Fill in the gaps with the correct word from the word banks.

What happens before Amy eats the wonton?

Amy is at a party, standing near a table of appetisers for the guests to eat. She has not eaten for a few hours and starts to feel her stomach rumbling, which tells her she is _____ . This rumbling is a signal to her body that her blood _____ levels are low and need restoring. Everyone else is eating the colourful looking food, and she can smell the strong aromas, so she starts to gain an _____ . She selects a wonton and admires its ruffled, golden wrapper, which is moist, smooth, and slightly transparent. It has a mild, savoury _____ with a hint of spicy ginger. This enters her nose and her cilia (microscopic nose hairs) and sends a message to her _____ giving it the idea that she is about to eat the wonton. This is where the _____ process begins.

Keywords: brain, digestive, appetite, aroma, glucose, hungry.

What happens to the wonton in Amy's mouth?

Amy's mouth and intestinal glands begin producing digestive chemicals. Amy uses her _____ to bite off pieces of the wonton and chew them in her mouth. This is the first occurrence of _____ digestion, where Amy uses force to break down the wonton. She uses her tongue to move the pieces around in her mouth. Meanwhile, her _____ glands release saliva, which contain the enzyme _____. This enzyme begins the _____ digestion of the carbohydrates in the wonton. The bits of wonton blend with her saliva and form a clump that can easily slide down her throat. This clump of food is called a _____.

Keywords: amylase, salivary, bolus, chemical, teeth, mechanical.

What happens to the wonton in Amy's oesophagus?

Amy uses her tongue to push the bolus towards the _____ which opens and lets the food enter the _____. The muscles of this organ contract and relax in wave-like motions called _____ (another form of mechanical digestion), and a rush of saliva is produced to move food along. The bolus makes it way to Amy's _____ where the digestive process continues.

Keywords: peristalsis, stomach, esophagus, sphincter

What happens to the wonton in Amy's stomach?

The wall of Amy's stomach contracts to break down the food even further (mechanical digestion) and gastric juices containing hydrochloric _____and _____ such as pepsin, are secreted and begin the chemical digestion of the _____ in the wonton. The main source of protein in the wonton is the pork mince, which is a source of _____ protein as it contains all nine _____ amino acids. At this stage in the digestive process, pepsin and hydrochloric acid break down some of the protein into amino acids. By now, the wonton has turned into a liquefied mass called _____. The wave-like contractions of Amy's stomach wall squeeze the mass to the first part of her small intestine, the _____.

Keywords: essential, complete, duodenum, enzymes, protein, chyme, acid.

What happens to the wonton in Amy's small intestine?

Amy's small intestine continues the process of breaking down the bonds within the food, using a form of chemical digestion called _____ _____. When the chyme enters her small intestine, it stimulates the secretion of _____ fluid from her pancreas, which contains different _____ (protease, lipase and pancreatic amylase) that help digest macronutrients.

Keywords: pancreatic, hydrolysis, enzymes, enzymatic.

Protein

The digestion of protein is finished off in Amy's small intestine, where it is broken down further into amino acids by the enzyme _____. Then the _____ are absorbed by the walls of the small intestine.

Keywords: amino acids, protease.

Carbohydrates

The wonton wrapper contained carbohydrate, some of which has undergone digestion. This carbohydrate is broken down further in Amy's small intestine by _____ _____, an enzyme released in the pancreatic fluid. Monosaccharides, such as glucose, are easily absorbed into the bloodstream but _____ and polysaccharides need to be broken down into smaller units for this to happen. The cells in Amy's small intestines secrete the enzymes _____, lactase and maltase which break down disaccharides and _____ into the monosaccharide_____.

Keywords: polysaccharides, sucrase, glucose, pancreatic amylase, disaccharides

Fat

Amy's liver produces_____, which is a compound that helps to digest _____ and eliminate waste products from the blood. This bile is released by her _____ into the duodenum

and with the help of the pancreatic enzyme _____, the bile begins to emulsify (blend) with fat. This breaks the saturated fats from the pork mince down into _____ and *_____. Amy's food is then squeezed to the lower parts of the digestive system, the _____* and *_____ where the nutrients will be absorbed by the villi. The _____ are finger-like projections that create a large surface area for the nutrients to be absorbed. In the centre of each villus is a_____ which is surrounded by blood capillaries which lead to the blood circulatory and lymphatic system. _____ and glycerol are absorbed into the lacteal, which is connected to the lymphatic system. Glucose is absorbed through the network of blood capillaries and then circulated around the bloodstream. Amino acids are also absorbed through the blood capillaries and dissolve in the blood before being sent to the liver to be stored.*

Keywords: glycerol, bile, lipase, jejunum, villi, lacteal, ileum, gall bladder, fat, fatty acids.

What happens to the wonton in Amy's large intestine?

The _____ remainder from Amy's wonton moves into her large intestine and passes through the colon by peristalsis. _____ break down the *_____ that helps keep her large intestine healthy. _____ fibre dissolves in water throughout the digestive system and _____ fibre helps prevent constipation by pushing the waste through the system. In the large intestine water is removed from the waste, turning the mass into a solid. This enables the remaining substance to be bundled together to form faeces, which is received by the rectum.*

Keywords: indigestible, insoluble, bacteria, soluble, fibre, resistant starch.

What happens to the wonton in Amy's large intestine?

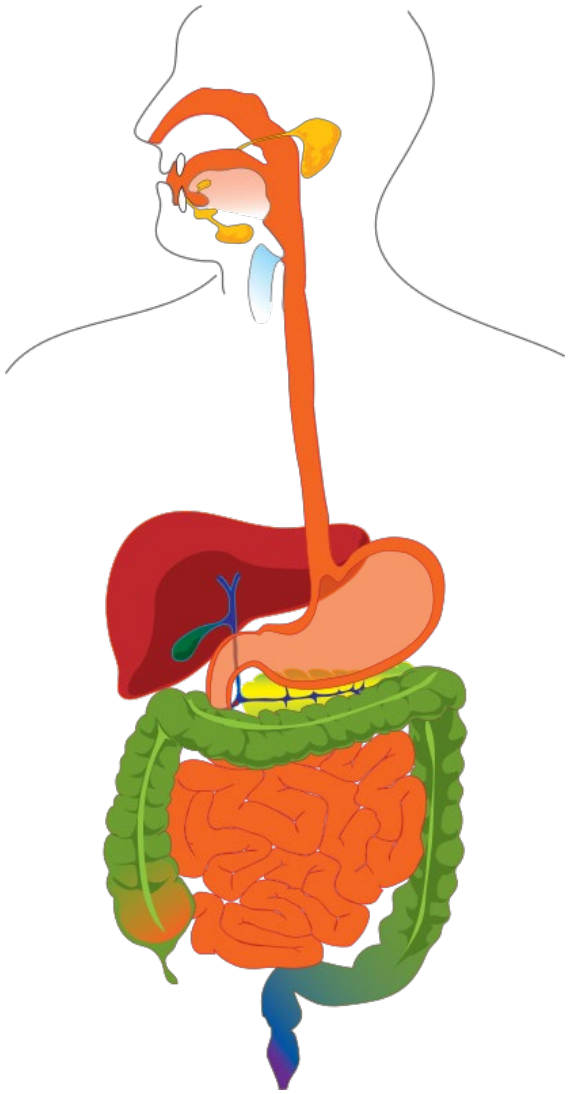
The faeces are stored in Amy's rectum until it is removed from her body through the _____ by more _____ contractions.

Keywords: muscular, anus

Written Activity Two

The Gastrointestinal Tract

1. Identify the parts of the gastrointestinal tract.
2. Identify the accessory organs.
3. Annotate the diagram with notes about the enzymes that digest carbohydrates, fats and proteins.
4. Annotate the diagram with notes about how the body absorbs carbohydrates, fats and proteins.



Written Activity Three

The Gastrointestinal Chart

Fill in the gastrointestinal chart below:

Organ		What mechanical digestion occurs?	What chemical digestion occurs?	If the macronutrients are absorbed? How are they absorbed?
Mouth & Tongue				
Salivary Glands				
Oesophagus				
Stomach				
Small Intestine	Duodenum			
	Jejunum			
	Ileum			
Large Intestine				
Rectum & Anus				

Written Activity Four

The Gastrointestinal Tract Enzymes

Fill in the chart below.

Enzyme	Where is it made?	Where does it work?	What does it do?
Salivary Amylase			
Lingual Lipase			
Pepsin			
Gastric Lipase			
Pancreatic Lipase			
Protease			
Pancreatic Amylase			
Sucrase, lactase and Maltase			

Written Activity Five

Digestion, Absorption and Utilisation of the Macronutrients

Fill in the table below:

Carbohydrate	
Describe this macronutrient.	
How is this nutrient digested? Refer to the organs and enzymes involved.	
How is this macronutrient absorbed?	
How does the body utilise this macronutrient?	
What are some good food sources of this macronutrient?	
Fat	
Describe this macronutrient.	
How is this nutrient digested? Refer to the organs and enzymes involved.	
How is this macronutrient absorbed?	

How does the body utilise this macronutrient?	
What are some good food sources of this macronutrient?	
Protein	
Describe this macronutrient.	
How is this nutrient digested? Refer to the organs and enzymes involved.	
How is this macronutrient absorbed?	
How does the body utilise this macronutrient?	
What are some good food sources of this macronutrient?	

Practical Activity One

Wontons Four Ways

1. Divide students into groups of two.
2. Students prepare the wontons together.
3. Each group cooks about 3 to 4 wontons by following steaming, poaching, and pan-frying instructions. The students give the teacher two wontons to deep-fry, or the teacher can observe the students deep-frying the two wontons.
4. After cooking the wontons, the students conduct a sensory analysis on each wonton that is cooked in a different way
5. Students conduct a nutritional evaluation by completing the positive, minus and interesting charts provided.

Watch this video to find out how you can fold the wontons:

https://www.youtube.com/watch?v=ktkr5ylByoq

Wonton Wrappers	
Makes: Approximately 20 wrappers	**Resting Time:** 30 minutes
Ingredients:	
1 cup plain flour	⅓ cup water, adding a little water if needed
30 grams beaten egg	½ teaspoon salt

Method:

1. **Tie** back long hair, **wash** hands and **put** an apron on.
2. **Collect** and **measure** the ingredients for the wonton wrappers.
3. **Combine** the egg, cold water and salt in a bowl.
4. **Sift** the flour into a large bowl.
5. **Make** a well in the centre and **add** the egg mixture.
6. **Combine** the mixture by stirring with a fork. If needed, **add** a little more water to bring the dough together.
7. **Knead** the dough on a lightly floured surface for 5 minutes or until smooth.
8. **Shape** the dough into a ball and place it into a bowl. **Cover** the bowl with plastic and **set aside** for 30 minutes.
9. **Divide** the dough into two pieces.
10. **Sprinkle** a clean surface with flour. **Roll** out one portion of the dough until it is very thin.
11. Using a cutter or ruler as a guide, **cut** the dough into 8cm circle or square shapes.
12. **Repeat** with the remaining dough.

Wonton Filling

Ingredients:

- 150 grams of pork or chicken mince
- 1 spring onion
- ¼ cup water chestnuts, drained and finely chopped
- 1 cm piece of ginger, peeled and finely grated
- 1 garlic clove, peeled and crushed
- 2 teaspoons soy sauce
- ¼ teaspoon sesame oil
- ½ teaspoon sugar

Method:

1. **Collect** and **measure** the ingredients.
2. **Prepare** the ingredients as stated in the ingredient list.
3. **Place** the meat, spring onion, water chestnuts, ginger, garlic, soy sauce, oil and sugar in a bowl.
   Mix with hands until thoroughly combined.
4. **Roll** meat mixture into small balls (approximately 2 teaspoons).
5. **Place** the balls into the centre of each wonton wrapper
6. **Moisten** fingertips or a pastry brush and lightly **brush** the edges of the wonton wrapper with water.
7. **Bring** edges together and **press** together to seal.
8. **Repeat** with remaining filling and wonton wrappers.

Steamed Wontons

Method:

1. **Line** a large bamboo steamer basket with a sheet of baking paper.
2. **Arrange** four wontons in a single layer in the steaming basket.
3. **Bring** about 5 cm of water to a boil in a medium-sized saucepan or wok.
4. **Reduce** heat to a medium temperature.
5. **Place** the steamer over the saucepan or wok, ensuring the base does not touch the water.
6. **Place** the lid on the steamer and steam for about 10 minutes or until cooked through.
7. **Lift out** using a slotted spoon.

Note: Check the water now and then to ensure that it has not evaporated; add more water as necessary.

Poached Wontons

Ingredients:

- 500 ml water
- 1 - 2 teaspoons chicken or vegetable stock powder

Method:

1. **Collect** and **measure** ingredients.
2. **Prepare** the ingredients.
3. **Pour** the water and stock powder into a medium frypan.
4. **Bring** to the boil.
5. **Reduce** the heat to a simmer.
6. **Place** the wontons in the simmering liquid..
7. **Lift** out with a slotted spoon and place in a bowl with a little stock.

Pan-fried Wontons

Ingredients:

2 tablespoons vegetable oil

Method:

1. **Collect** and **measure** ingredients.
2. Using a non-stick frypan, **heat** the oil over medium to high heat for 2 to 3 minutes.
3. **Place** some wontons in the pan, spacing them about 2 to 3 cm apart.
4. **Cook** for about 3 minutes or until the bottoms of the wontons turn golden brown.
5. Carefully **add** ½ cup of cold water into the pan. The water will start sizzling and boiling immediately. **Ensure** the wontons are half sitting in the water.
6. Quickly **cover** with the lid. Lower the heat to medium.
7. **Cook** for a further 7 to 8 minutes or until almost all the water has evaporated.
8. **Remove** the lid and reduce heat to a medium heat.
9. **Cook** for another 2 minutes or until all the water has been absorbed. The bottoms of the wontons should be crispy.

Deep-fried Wontons

Ingredients:

Oil for deep-frying

Method:

Follow your teacher's instructions to deep-fry wontons.

Ensure you are always supervised when using the deep-fryer.

Wontons Four Ways Sensory and Nutritional Evaluation

1. **Create** a star diagram by downloading a copy of the excel spreadsheet at the link below:

   http://archive.foodafactoflife.org.uk/attachments/2f7a4b74-04b5-4651c209eeee.xls

2. **Open** the spreadsheet and **select** *enable editing*.

3. **Choose** a range of words that describe what you feel is the perfect wonton (crunchy, spicy or smooth).

   Enter these words under the heading *attributes*; you will begin to see the words appear in the star diagram.

4. **Change** the product headings to *steamed wonton*, *poached wonton*, *pan-fried wonton* and *deep-fried wonton*.

   Conduct a sensory evaluation on each type of wonton and **give** each wonton a rating out of 5; 1 = low and 5 = high.

   You will see a star or hexagon shape form as you rate each product. The more the shape forms a star or hexagon, the more the product meets the desired characteristics.

   Save or **print** a copy of your star diagram.

5. **Fill in** the positive, minus and interesting chart below.

   Comment on each type of wonton's nutritional and sensory properties in your discussion.

Wonton Variety	Positive	Minus	Interesting
Steamed			
Poached			
Pan-fried			
Deep-fried			

6. **Select** the type of wonton you prefer and **justify** your selection by stating why you chose this wonton and not the others.

   Relate your response to the sensory and nutritional properties of the wontons.

Summary Activity

Complete the summary activity below.

What is the main idea about the key knowledge & key skills?	
Outline the role of these organs in the gastrointestinal tract.	
Oesophagus	
Stomach	
Small Intestine	
Large Intestine	
Rectum and Anus	
Define the term accessory organ.	

Outline the role of these accessory organs in the gastrointestinal tract.	
Tongue	
Salivary Glands	
Pancreas	
Liver	
Gall Bladder	
Identify the compounds (smaller units) that the macronutrients are broken down into.	
Carbohydrates	
Fat	
Protein	
List the enzymes that help digest macronutrients and summarise what they do and where they are released.	
Carbohydrates	
Fat	
Protein	

Outline how each of the macronutrients are utilised by the body.	
Carbohydrates	
Fat	
Protein	

Exam Preparation

Section A - Multiple Choice Questions (5 marks)

Question

Once digested, carbohydrates can be utlised by the body to:

a. eliminate waste.
b. support the growth of beneficial bacteria.
c. build, maintain and repair body cells.
d. provide the body with energy.

Question 2

Digestion of protein occurs in the:

a. mouth and stomach.
b. stomach and small intestine.
c. mouth and small intestine.
d. the small intestine only.

Question 3

For enzymatic hydrolysis to occur, the following is required:

a. enzymes and water
b. appealing sensory properties.
c. peristalsis.
d. bile.

Question 4

Where does digestion begin?

a. Small intestine
b. Rectum
c. Mouth
d. Stomach

Question 5

Which one of these is an accessory organ?

a. Oesophagus
b. Tongue
c. Duodenum
d. Anus

Section B – Short Answer Responses (20 marks)

Question 1 (3 marks)

Provide an example of mechanical digestion in the organs listed. 3 marks

Organ	Mechanical Digestion
Mouth	
Oesophagus	
Stomach	

Question 2 (6 marks)

Complete the following table by outlining how protein and carbohydrates are utilised in the body. 6 marks

Macronutrient	Simplest Substance	Utilisation
Protein		
Carbohydrate		

Question 3 (3 marks)

Explain how carbohydrates are utilised by the body and give an example of a food source. 3 marks

Question 4 (8 marks)

Fats are an essential macronutrient.

a. Identify one accessory organ involved in the chemical digestion of fat and discuss its role in this process. 3 marks

b. State where fat absorption occurs and describe the absorption process. 3 marks

c. Explain how the body utilises fat. 2 marks

Exam Preparation

Section A - Multiple Choice Questions (5 marks)

Question 1

Once digested, carbohydrates can be utlised by the body to:

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Question 5

Which one of these is an accessory organ?

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b. Tongue
c. Duodenum
d. Anus

Section B – Short Answer Responses (20 marks)

Question 1

Provide an example of mechanical digestion in the organs listed. 3 marks

Organ	Mechanical Digestion
Mouth	*One mark was awarded for providing an example of mechanical digestion.* *A suitable response could have included one of the following:* *Teeth grinding and tearing food apart.* *The tongue moving food around, kneading it and shaping it into a small ball.*
Oesophagus	*One mark was awarded for providing an example of mechanical digestion.* *Wave-like contractions move the food down the oesophagus. Or, Wave-like contractions called peristalsis move the food down.*
Stomach	*One mark was awarded for providing an example of mechanical digestion.* *The muscles in the stomach contracting.*

Question 2

Complete the following table by outlining how protein and carbohydrates are utilised in the body. 6 marks

Macronutrient	Simplest Substance	Utilisation
Protein	*For one mark, the student needed to identify protein's simplest substance.* *Amino Acids*	*Two marks were awarded for outlining one way protein is utilised in the body.* *A suitable response could have included one of the following:* *Protein assists with the growth, maintenance and repair of cells.* *Protein forms the basis of bones, muscles, cartilage, skin, and blood in the body.* *Protein helps make hormones and enzymes.* *The body will use protein as a source of energy when carbohydrates are not available.*
Carbohydrate	*For one mark, the student needed to identify carbohydrate's simplest substance.* *Glucose*	*Two marks were awarded for outlining one way carbohydrate is utilised in the body.* *A suitable response could have included one of the following:* *Carbohydrate is the body's preferred energy source.* *Carbohydrate provides the body with energy.*

Question 3 (3 marks)

Explain how carbohydrates are utilised by the body and give an example of a food source. 3 marks

The student needed to outline how carbohydrates were used by the body.

A suitable response could be:

Carbohydrates are used as the body's preferred energy source. Bread is an example of a food source.

Question 4

Fats are an essential macronutrient. *(8 marks)*

a. Identify one accessory organ involved in the chemical digestion of fat and discuss its role in this process. 3 marks

One mark was awarded for identifying an accessory organ involved in the chemical digestion of fat.

Two marks were awarded for discussing the role of this organ in the chemical digestion of fat.

A suitable response could have included one of the following:

The gallbladder is an accessory organ involved in the chemical digestion of fat. The gallbladder contracts and releases bile made by the liver. Bile contains substances that help break down fat into tiny droplets, making it easier to break down further.

Or

The pancreas is an accessory organ involved in the chemical digestion of fat. When chyme enters the small intestine, the pancreas releases digestive juices containing the pancreatic enzyme lipase, which helps break down fat into fatty acids and glycerol.

Or

The liver is an accessory organ involved in the chemical digestion of fat. The liver makes bile which contains emulsifying substances that break down fat into tiny droplets, making it easier to break them down further.

b. State where fat absorption occurs and describe the absorption process. 3 marks

One mark was awarded for stating where fat absorption occurs.

Fat absorption occurs in the small intestine.

Two marks were awarded for describing the absorption process.

Fat droplets enter the lacteal in the villi of the small intestine. The lacteal connects to the lymphatic system, which transports the fat to the liver and tissues, such as the fat and muscle tissue, where cells store or use them.

c. Explain how the body utilises fat. 2 marks

The student needed to state how the body utilises fat for two marks.

A suitable response could have included one detailed response or two brief responses.

Fat provides the body with energy.

Fat absorbs certain nutrients.

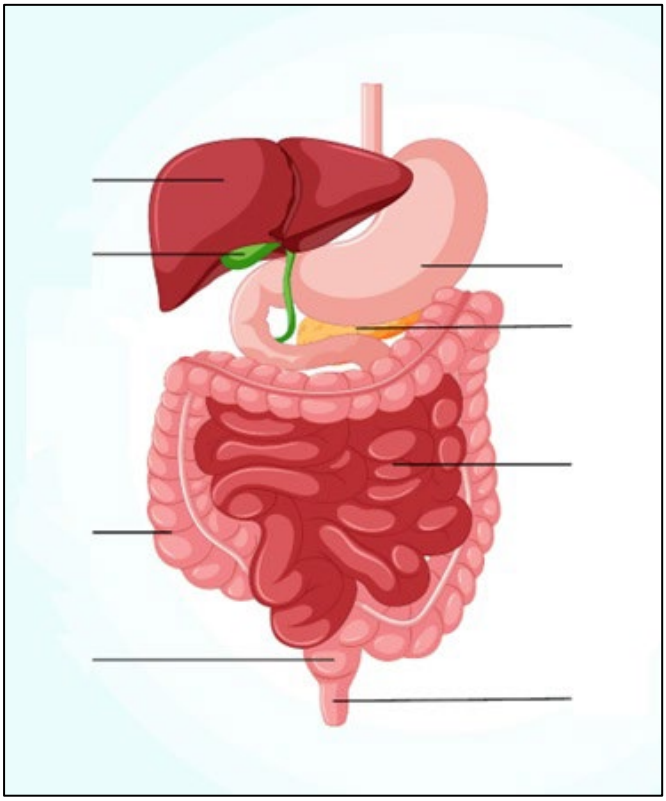
Fat maintains the core body temperature.

Good fats are also important for brain development in unborn babies, infants, children, and adolescents.

Fat protects the organs in the body.

Starter Activity One

Label the diagram of the Digestive System:



Starter Activity Two

Read each of the following statements carefully.

Mark the statement with an ‘F’ if you think it is false and a ‘T’ if you think it is true.

- [ ] Chemical digestion begins in the mouth.
- [ ] Chyme enters the stomach via the oesophagus.
- [ ] Nutrients are mainly absorbed in the small intestine.
- [ ] A bolus passes through the pancreas before reaching the stomach.
- [ ] Proteins are broken down to amino acids in the stomach and small intestine.
- [ ] Amylase in the saliva breaks down fat into fatty acids.
- [ ] The gall bladder releases bile into the small intestine.
- [ ] The blood capillaries absorb amino acids and glucose but not fats.
- [ ] Carbohydrates are required by the body for growth, maintainence and repair of cells.
- [ ] The large intestine contains beneficial bacteria.

Starter Activity Three

Celebrity Heads

The teacher selects a few students to stand in front of a whiteboard.

The teacher writes one of the terms listed below behind each player so they cannot see it. Everyone will know the terms except the players standing in front of the whiteboard.

To find out what the term is, each player takes turns asking questions that will, hopefully, help them work out what their term is.

To win the game, a player must be the first to guess the term behind them.

Here are a list of words that could be used:

- Mouth
- Salivary Gland
- Tongue
- Oesophagus
- Stomach
- Small Intestine
- Large Intestines
- Rectum
- Villi
- Pancreas
- Gall Bladder
- Liver
- Bolus
- Chyme

Starter Activity Four

In the table below:

Name the three macronutrients.			
List the functions of each macronutrient in the body.			
Identify some food sources of each macronutrient.			