

# INCREASING ACCESS TO SECONDARY SCHOOL LEVEL EDUCATION THROUGH THE PRODUCTION OF QUALITY LEARNING MATERIALS

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## JUNIOR SECONDARY LEVEL

# BIOLOGY

## Module 4: Nutrition and Digestion

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# **JUNIOR SECONDARY LEVEL SCIENCE - BIOLOGY**

## **MODULE 1 – Introduction to Biology and the Classification of Living Things**

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Unit 2 Biological Skills

## **MODULE 2 – The Living Cell**

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Unit 2 Levels of Organisation

Unit 3 Compounds of Life

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## **MODULE 6 – Support, Movement and Control**

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Unit 2 Hormonal and Nervous Control

Unit 3 Control and Regulation

## **MODULE 7 – Continuity of Life**

Unit 1 Reproduction

## **MODULE 8 – Organisms and the Environment**

Unit 1 Ecological Principles

Unit 2 Population Growth and Regulation

Unit 3 Human Influence on the Environment



# MODULE 4

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## NUTRITION AND DIGESTION

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### MODULE INTRODUCTION

In this Module we consider the essential nutrients required by humans. You will also learn about the fate of these nutrients once inside our body.

### MODULE OBJECTIVES

At the end of this Module you should be able to:

- define nutrition and state its salient features
- describe the structure and functioning of the human digestive system





# UNIT 1

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## NUTRITION IN LIVING ORGANISMS

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# UNIT 1

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## NUTRITION IN LIVING ORGANISMS

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### INTRODUCTION

A car will not run without fuel. This fuel supplies energy to move the car. The car also needs acid for its battery, water for its radiator, oil for its engine and grease for its wheels. In the same way the body of living organisms needs a supply of nutrients to provide it with the necessary energy to keep it alive and functioning properly. Other substances are also required. In this Unit, we shall look at these essential nutrients, and their uses in the living body and how they release the energy needed.

### OBJECTIVES

At the end of this Unit you should be able to:

- define nutrition
- state the different types of nutrition in living organisms
- describe the importance of nutrition.

## 1.0 NUTRITION - DEFINITION

Nutrition is the way in which organisms obtain their food. You will recall from Module one that it is a characteristic feature of life. Different organisms obtain their food or nutrients in different ways. For our discussion here, we shall consider 2 types of nutrition i.e.

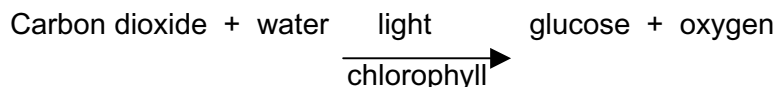
- Autotrophic Nutrition
- Heterotrophic Nutrition

## 1.1 NUTRITION TYPES

### Autotrophic Nutrition

'Auto' means self and 'trophic' means feeding. The way in which green plants obtain food is called autotrophic nutrition. Green plants make their food from simple inorganic substances by the process of photosynthesis.

The green plants combine carbon dioxide with water to make carbohydrates. They use light energy for this purpose. The green plants have a substance called chlorophyll to absorb light. During photosynthesis oxygen is also produced.



### Heterotrophic Nutrition

'Hetero' means other. Heterotrophic nutrition therefore means that an organism obtains food from other organisms.

Animals cannot make their own food. Think of your domestic dogs or cats. They cannot make their own food. You have to feed them daily with ready made food.

In other words, they depend upon other organisms for their food. Some animals eat other animals, while some feed on plant materials. However all the substances passing from one animal to another were first made by the green plants. This mode of nutrition is known as heterotrophic nutrition.

### Holozoic Nutrition

Humans and other mammals carry out holozoic nutrition. This is a form of heterotrophic nutrition. Here complex organic food substances are taken up by the digestive system. The food is then digested, absorbed and used by the body. Any food which remains undigested is passed out of the body or excreted.

## 1.2 NUTRITION - IMPORTANCE

Nutrients are the nourishing substances like:

- carbohydrates
- lipids
- proteins
- vitamins and minerals which are found in the food.

The food:

- (1) provides energy to the organism
- (2) supplies materials for growth of the organism
- (3) gives substances needed to repair and replace tissues which are worn out or damaged
- (4) keeps the organism healthy and helps it to fight diseases.

 *Before proceeding further, complete the following activity.*

**ACTIVITY 1**

1. *Explain each of the following, naming one organism which carries it out.*

(i) *autotrophic nutrition*

.....

.....

.....

(ii) *heterotrophic nutrition*

.....

.....

.....

(iii) *holozoic nutrition*

.....

.....

.....

2. *What is photosynthesis?*

.....

.....

.....

***You will find the answer at the end of the Module.***

## 1.3 HUMAN DIET

The food you take each day makes up your diet. The main nutrients in your diet should include the different classes of food. We shall now turn to them to see their important functions in the body.

The major sources and importance of these nutrients are as follows:

Nutrients	Functions	Sources	Deficiency/Disease
Carbohydrates	provide energy for 1. body activities 2. keeping the body warm	rice, flour, sugar, potato, maize, cassava, sweet potato	Poor health and growth
Fats	act as energy reserve in the body. Fats beneath the skin prevent heat loss from the body	butter, ghee, margarine, vegetable oils, animal fats, beef, pork	Lack of energy
Proteins	build body tissues during growth repair and replace damaged and worn-out tissues and cells helps to make enzymes and hormones which are useful for body activities	lean meat, poultry, fish, milk, pulses, eggs, cheese, beans, peas	Poor health, kwashiorkor, weak muscles
Vitamin A	helps to see in dim light improves resistance to infections	carrots, eggs, green vegetables, fish-liver oil, papaya, mango	Night blindness

Nutrients	Functions	Sources	Deficiency/Disease
Vitamin C	keeps gums healthy protects body against colds and infections important for wound healing	citrus fruits, guavas, lemons, oranges, mangoes, fresh vegetables	Bleeding gums
Iron	helps to form red blood pigment called haemoglobin. Haemoglobin is important for transport of oxygen by blood.	Liver, kidney, meat, green vegetables, watercress, eggs, pulses	Anaemic
Calcium	important for the formation of bones and teeth and for blood clotting	milk, cheese, fish, eggs, pulses, vegetables, dairy products	Soft and deformed bones
Water	helps important life processes like digestion and excretion is a major component of blood and is essential for good health helps to cool down the body by evaporation in sweat	drinking water water in food water produced during chemical activities in the body	dehydration
Fibre	makes food bulky and helps to move food in the intestines facilitates the elimination of faeces and prevents constipation	fruits, salads, vegetables, cereals	Constipation

We must know whether the food we take contains in it nutrients such as:

- carbohydrates
- fats
- proteins.



To do so, we can now proceed with the following investigations.



### INVESTIGATION 1: Test for glucose (simple sugar)

<p><b>For each investigation you will require the materials indicated.</b></p>          <p><b>You should record your answers in the space provided.</b></p>	<p><b>Materials needed:</b></p> <ul style="list-style-type: none"><li>• test tube</li><li>• some glucose solution</li><li>• Benedict's solution.</li></ul> <p><b>Method:</b></p> <ol style="list-style-type: none"><li>1. Take 1 cm<sup>3</sup> of glucose solution in a test tube.</li><li>2. Add 1 cm<sup>3</sup> of Benedict's solution to it.</li><li>3. Heat this mixture gently over a Bunsen flame.</li><li>4. Note the colour changes inside the test tube. Record your observations ..... ..... ..... ..... .....</li><li>5. Look for an orange precipitate. This indicates the presence of a simple sugar.</li><li>6. What conclusion can you draw concerning glucose? ..... ..... ..... .....</li></ol>
---	--



## INVESTIGATION 2: Test for Starch

For each investigation you will require the materials indicated.

**You should record  
your answers in the  
space provided.**

### Materials needed:

- test tube
- some starch suspension
- iodine solution
- dropper

**Method:**

1. Take  $1\text{ cm}^3$  of starch suspension in the test tube.
2. Add two drops of iodine solution to it by means of the dropper.
3. Shake the mixture slightly.
4. What do you observe?

[illegible]

5. A blue black colour indicates the presence of starch.



### INVESTIGATION 3: Test for Fats - Greasy Spot Test

For each investigation you will require the materials indicated.

**You should record  
your answers in the  
space provided.**

### Materials needed:

- some cooking oil
- dropper
- filter paper

**Method:**

1. Place one drop of oil on the filter paper by means of the dropper

2. *Hold the filter paper against light.*

3. *What do you see through the spot?*

[illegible]

4. *A greasy spot appears on the filter paper. It is said to be translucent. It allows light to pass through it.*



### INVESTIGATION 4: Ethanol Emulsion Test

**For each investigation you will require the materials indicated.**

**You should record your answers in the space provided.**

**Materials needed:**

- some cooking oil
- test tube
- 5cm<sup>3</sup> of ethanol
- 3 cm<sup>3</sup> of water

**Method:**

1. *Add 5cm<sup>3</sup> of ethanol to a small drop of oil in a dry test tube. Shake the mixture thoroughly.*

*What do you observe?*

.....  
 .....  
 .....  
 .....

2. *Add 3cm<sup>3</sup> of water to the mixture. Record your observations.*

.....  
 .....  
 .....  
 .....

3. *A white emulsion indicates the presence of fats.*



## INVESTIGATION 5: Test for Proteins

For each investigation you will require the materials indicated.

**You should record  
your answers in the  
space provided.**

### Materials needed:

- test tube,
- egg-white,
- 5% sodium hydroxide solution,
- 1% copper sulphate solution,
- dropper.

**Method:**

1. Take  $1\text{ cm}^3$  of egg white suspension in the test tube.
2. Add  $1\text{ cm}^3$  of sodium hydroxide solution to it.
3. Carefully add 2 drops of the dilute copper sulphate solution to the mixture in the test tube.
4. Shake the test tube slightly and hold it against light.  
What change in colour do you observe?

.....

.....

.....

5. *A violet colour indicates the presence of proteins.*
6. *What conclusion can you draw concerning egg white?*

.....

.....

.....

.....

### 1.3.1 BALANCED DIET

If you eat only sweets, crisps or cream you would stay alive for sometime. However, you will not be healthy because you are not having all required nutrients in your food. That is, you are not taking a balanced diet.

A balanced diet is one which provides you with all the essential nutrients according to your body needs. It contains these nutrients in sufficient amounts and in correct proportions. Thus a balanced diet consists of a variety of foods to satisfy all your body needs.

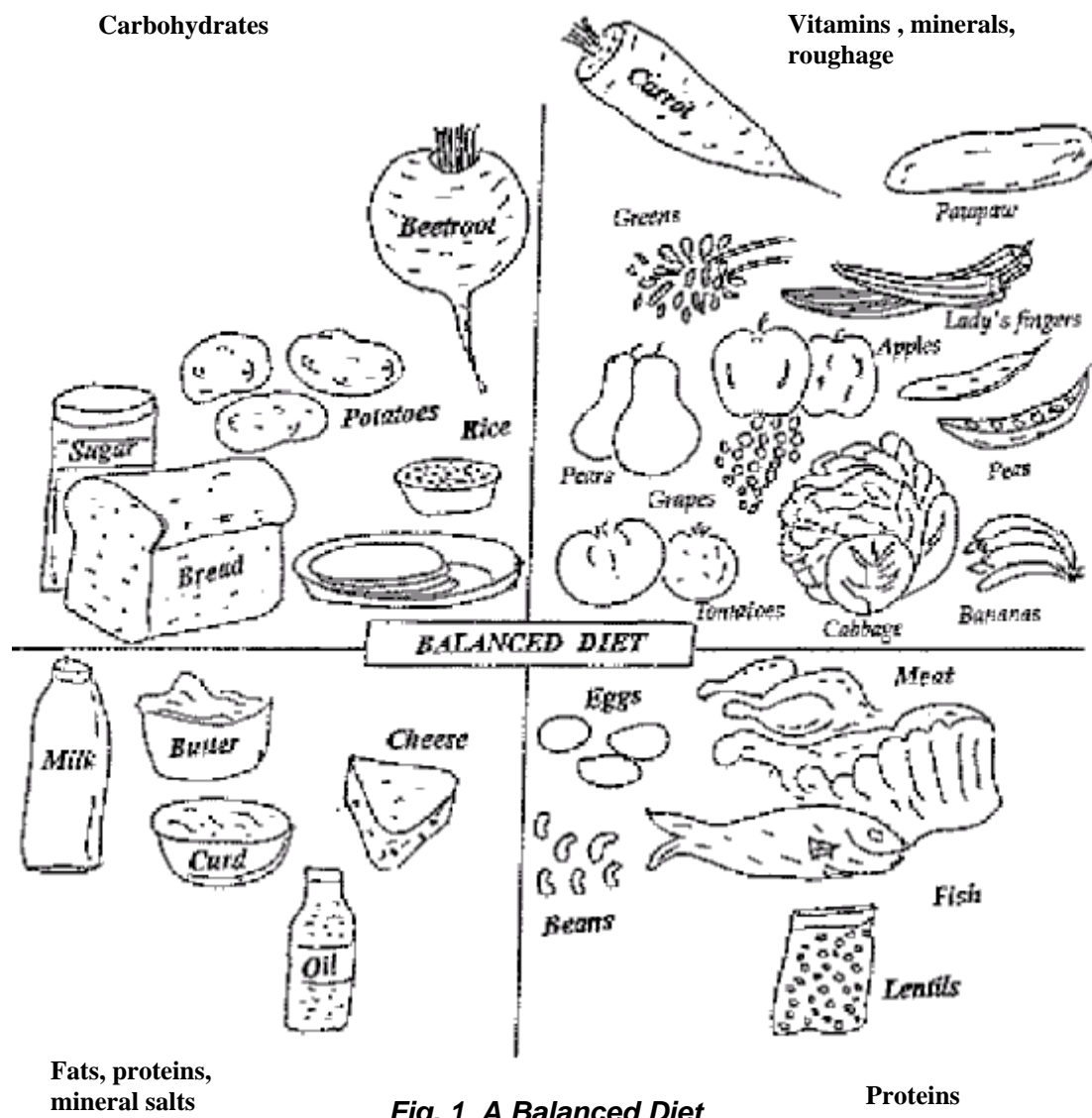


Fig. 1 A Balanced Diet

## 1.4 ENERGY REQUIREMENTS

The amount of food you need depends on the energy you use daily. In fact, we all need the same nutrients, but in varying amounts. This varies with our age, sex, daily activities and state of health.

<b>Age</b>	Teenagers use more energy than babies, but the younger child has a higher growth rate. Growing children need relatively more body-building foods than adults.
<b>Sex</b>	Males use more energy than females of the same age or doing the same work. This is because males have more muscles and a thinner layer of fats beneath their skin. Therefore males require more energy-giving food.
<b>Activity</b>	It is quite obvious that a labourer in the field needs more energy than an office worker daily. The harder and longer a person works or plays, the more energy-giving foods he needs. Thus a footballer uses more energy than a snooker player.
<b>Health</b>	Sick people need food to re-build their bodies and provide for any deficiency

### Malnutrition

Malnutrition or bad nutrition is caused by feeding on an unbalanced diet. If you eat too much, your body stores the surplus as fats. This makes you overweight and obese. If you eat too little, you lose weight. You feel weak and suffer from deficiency diseases.

## Undernutrition

In some countries, many people experience scarcity of food. Sometimes there is a shortage of the right kind of food, especially food containing proteins and vitamins. Many families are often too poor to buy the right kind of food. However, some people may not eat the right foods because they have not been educated about the importance of a balanced diet.

It is important to note that more than five million children die every year due to under nutrition. You must remember that diseases like pneumonia and measles are great killers under conditions of under nutrition.

Milk, cheese, fish for e.g. which are important components of the diet contain calcium. If a child doesn't get enough calcium because of undernutrition, the bones become deformed and remain soft. A disease called **rickets** may arise.

In most drinking water and sea foods, iodine is present. Lack of iodine affects the proper function of the thyroid gland which enlarges causing **goitre**.

## Over nutrition

In some countries people tend to consume excess sugar and fats in their daily diet. Surplus sugar not only causes obesity but it also increases the risk of tooth decay and diabetes mellitus. Excess fats lead to overweight and increases the risk of diseases like high blood pressure, heart failure and diabetes. Obese people are also more likely to suffer from chest infections, varicose veins which cause skin ulcers which may take a long time to heal.



 *Before proceeding further, complete the following activity.*

### **ACTIVITY 2**

1. Give three reasons why you need food?

.....  
.....  
.....

2. Name five classes of food which make up a balanced diet.

.....  
.....

3. Name two foods rich in:

(a) Carbohydrates

.....

(b) Starch

.....

(c) Fats

.....

(d) Proteins

.....

(e) Vitamin A

.....

(f) Vitamin C

.....

(g) Iron

.....

(h) Calcium

.....

(i) Fibre

.....

4. Give examples of two foods needed::

(a) for growth

.....  
.....

(b) to avoid constipation

.....  
.....

(c) for strong bones and teeth

.....  
.....

(d) to avoid scurvy

.....  
.....

(e) to avoid anaemia

.....  
.....

5. (a) What is a balanced diet?

.....  
.....  
.....

(b) Give one importance of a balanced diet?

.....  
.....  
.....

6. *What happens if you eat:*

(a) *more than you need?*

.....

.....

.....

(b) *less than you need?*

.....

.....

.....

7. (a) *List the factors that determine the amount of food you need daily.*

.....

.....

.....

8. *Name two diseases associated with:*

(a) *under nutrition*

.....

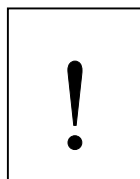
.....

(b) *over nutrition*

.....

.....

***You will find the answer at the end of the Module.***



## POINTS TO REMEMBER

- Nutrition is the way living organisms obtain their food. It is a characteristic of life.
- Green plants carry out autotrophic nutrition while animals perform heterotrophic nutrition.
- Food consists of nutrients. These provide energy, materials for growth and repair of damaged tissues.
- The different classes of foods are carbohydrates, fats, proteins, vitamins, minerals, fibre and water.
- Carbohydrates and fats are energy-giving foods. Consuming too much sugar and fats lead to health problems.
- Proteins are used for growth, body-building and repair of damaged tissues.
- Vitamins and minerals are essential to maintain good health.
- You must consume a sufficient amount of water and fibre daily.
- A balanced diet provides the right quantity and quality of food.
- Food requirements of an individual depend on age, sex, activity or occupation and his/her state of health.

## UNIT 2

# HUMAN DIGESTIVE SYSTEM

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## UNIT 2

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# HUMAN DIGESTIVE SYSTEM

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## INTRODUCTION

In Unit 1, we looked at the various foods we need. Have you ever wondered about what happens to these foods when we eat them? They get into the blood to be carried to the body's cells. But before your body can use the foods they have to be digested.

Food is digested inside a tube in your body called the alimentary canal which runs from the mouth to the anus.

## OBJECTIVES

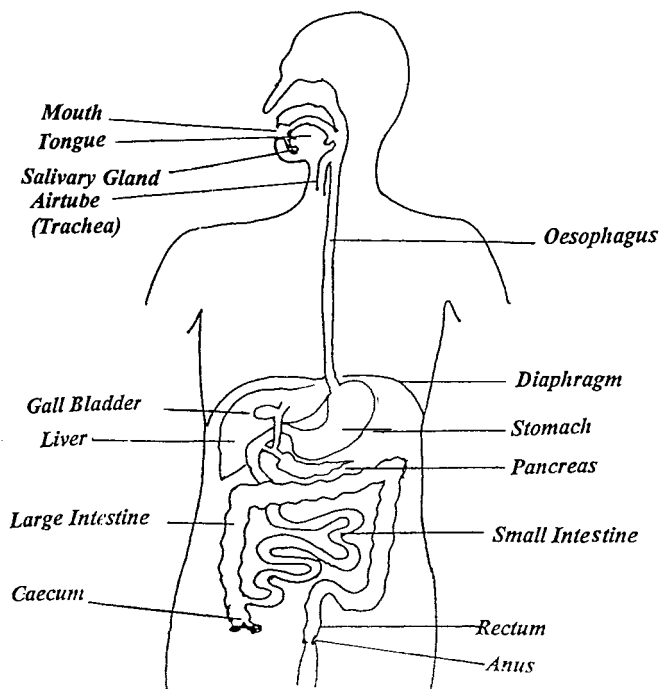
At the end of this Unit you should be able to:

- describe the structure and functions of the human alimentary canal
- explain physical and chemical digestion
- identify the types of human teeth and describe their functions
- state the causes of dental decay and describe proper teeth care
- state the role of the liver in metabolism.

Let us now devote some time to the study of the alimentary canal focusing mainly on the various parts, their structure and functions.

Look at the diagram below to have an idea of what it looks like.

## 2.0 HUMAN ALIMENTARY CANAL



**Fig. 2 Human Alimentary Canal**

### 2.1 MAIN PROCESSES ALONG ALIMENTARY CANAL

The human alimentary canal is a long muscular tube which starts at the mouth and ends at the anus. Your alimentary canal is over seven metres long and coiled inside your body. The following processes occur as the food passes down the alimentary canal.

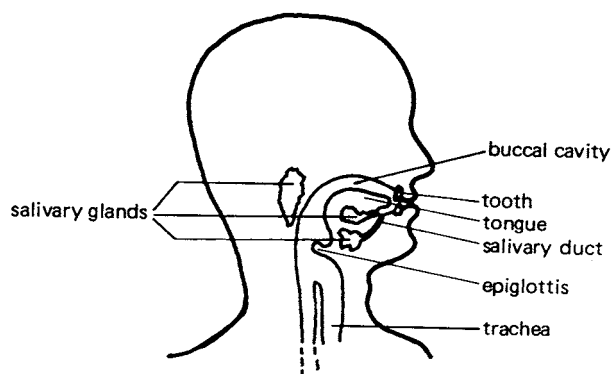
(i) Ingestion	taking in of food into the mouth
(ii) Digestion	breaking down of complex, insoluble food into simpler soluble form
(iii) Absorption	passage of digested food into the blood
(iv) Egestion	removal of the undigested food substances in the form of faeces at the anus.



We said earlier that the alimentary canal consists of different regions. Each region has a particular structure and functions. We shall now look at each in turn.

### 2.1.1 BUCCAL CAVITY

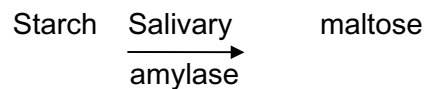
This is the mouth cavity. Food is taken into it by ingestion. It is a box-like structure. The sides have muscular cheeks and the floor consists of a muscular tongue. The ceiling of this cavity has a palate. At the back it opens into the pharynx. There is an upper and a lower jaw. Teeth are firmly fixed in the jaws. There are also salivary glands which produce saliva.



**Fig. 3 Buccal Cavity**

The food is cut into pieces with the front teeth and the cut pieces are then chewed with the back teeth. This act moistens the food with saliva which also lubricates it so that swallowing is easy. Saliva contains an enzyme\* called salivary amylase. This acts on cooked starch in the food and breaks it down to maltose. There is a slightly alkaline medium in the mouth cavity.

**\*Note:** Enzymes are an important group of substances which alter the speed of reactions taking place in living organisms.



## Digestion

Digestion is the gradual or stepwise breakdown of large, complex food molecules into simpler, soluble ones that can be easily absorbed.

### Mechanical Digestion

The front teeth first cut and then the back teeth crush the food. This is the first stage of ***mechanical digestion*** which also continues when the food reaches the stomach. As the stomach is muscular in nature, waves of contraction pass along now and again to churn the food into a mushy fluid called **chyme**.

### Chemical Digestion

Mechanical digestion in turn helps to present a large surface area for the action of enzymes on the food particles, which is ***chemical digestion***.

#### 2.1.2 PHARYNX

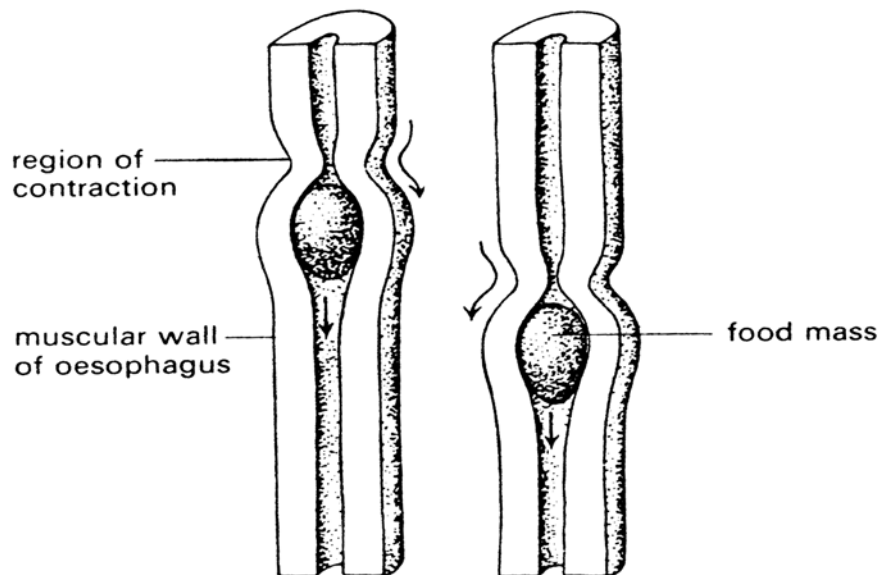
This is found at the back of the buccal cavity. Here two tubes open. One of them leads to the lungs and it is called the ***trachea***. The other tube leads food to the stomach. It is known as the oesophagus.

A flap of skin called the epiglottis drops over the top of the trachea or air tube. This stops food getting into your lungs. Otherwise you can choke.

### 2.1.3 OESOPHAGUS

This is also called the gullet or food pipe. It is a muscular tube which leads to the stomach. The oesophagus and the rest of the alimentary canal have longitudinal and circular muscles in their tubes.

The food moves down the alimentary canal by a process called peristalsis, as shown in Figure 4.



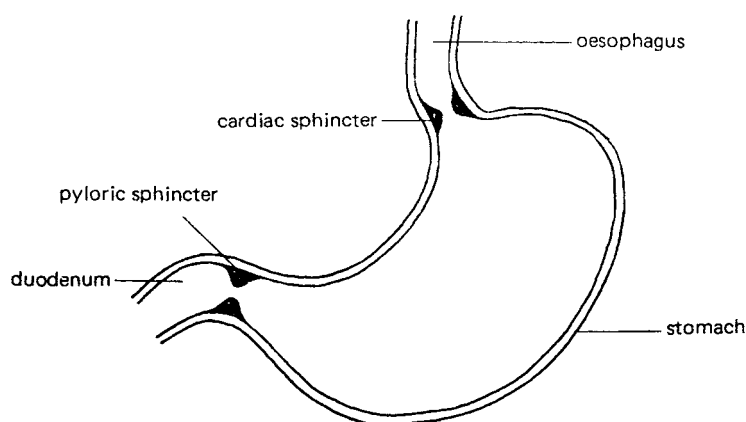
***Fig. 4 Peristalsis in the Alimentary Canal***

This is a wave-like contraction of the muscular wall of the gut or alimentary canal. The mucus in the inner lining of the gut lubricates the food as it moves down.

The action of salivary amylase on starch continues in the oesophagus. This is because the medium is still slightly alkaline.

### 2.1.4 STOMACH

The stomach is a large muscular bag-like structure. It is found just below the diaphragm in the abdomen, on the left side. It has thick muscular walls. These contain gastric glands which produce gastric juice. The stomach wall also produces a thick layer of mucus on its inner surface. The food stays in the stomach for three or four hours. The entrance and exit of the stomach are controlled by a ring of muscle called the sphincter.



**Fig. 5 Structure of the Stomach**

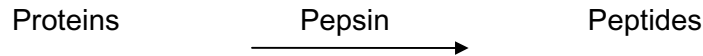
When food reaches the stomach there are strong peristaltic movements. These churn the food and break the large food particles into smaller ones. The food is turned into a semi-solid. It is a process of mechanical digestion and helps the food to present a large surface for the action of enzymes. The churning also mixes the food thoroughly with the gastric juice. The gastric juice has the following components and functions:

(i) **Hydrochloric acid**

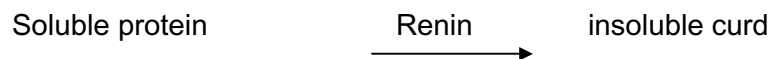
This acid kills any bacteria present in the food. It stops the action of salivary amylase on starch. It also provides a suitable acidic medium for the enzymes pepsin and renin (present for gastric juice to work).

**(ii) Pepsin**

The enzyme pepsin acts on proteins present in the food and converts them to smaller molecules called peptides.

**(iii) Renin**

This enzyme clots the soluble protein component of milk to insoluble curds. Thus milk stays longer in the stomach for pepsin to act on it.



You must note that the thick layer of mucus in the inner stomach wall protects it against the action of hydrochloric acid and pepsin. This is because the stomach wall itself is made of muscles which are protein in nature.

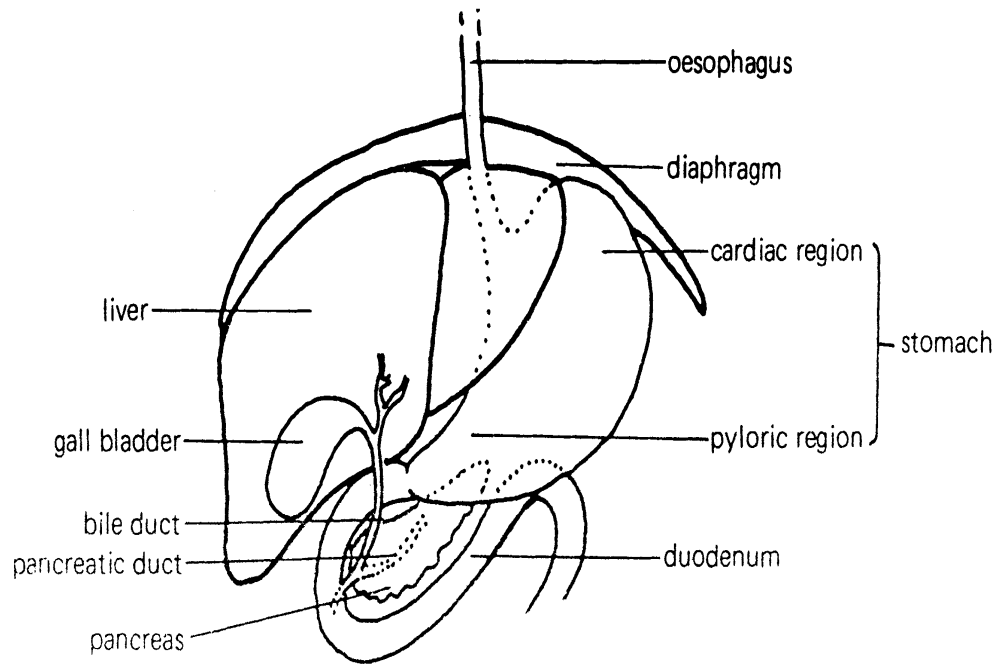
The pyloric sphincter at the exit of the stomach opens from time to time to allow a small amount of the partly digested food to pass into the duodenum.

**2.1.5 SMALL INTESTINE**


The small intestine is a long, narrow and coiled muscular tube. It consists of the duodenum and ileum. Digestion and absorption of food mainly takes place here. It receives digestive juices from the liver and pancreas.

## Duodenum

This is the first part of the small intestine and is a U-shaped tube.



**Fig. 6 Relationship of Stomach, Liver, Pancreas, and Duodenum**

 *Before proceeding further, complete the following activity.*

### **ACTIVITY 1**

1. *Explain the following terms:*

(a) *Ingestion*

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(b) *Digestion*

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(c) *Absorption*

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(d) *Egestion*

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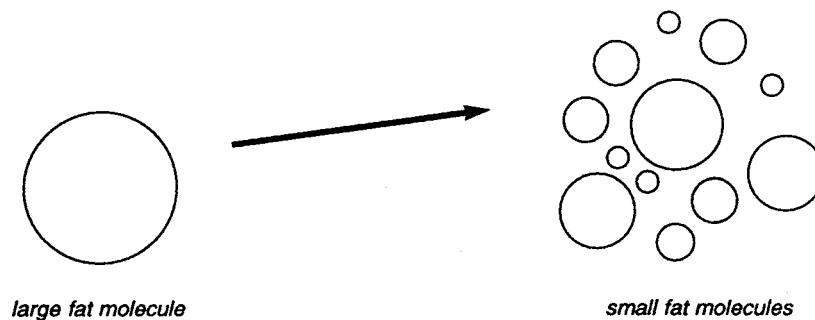
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***You will find the answer at the end of the Module.***

### 2.1.6 THE LIVER

The liver is a large organ found on the right side of the abdomen, just beneath the diaphragm. It produces bile which is stored in the gall bladder. The bile reaches the duodenum through a tube called the bile duct. Bile is alkaline in nature. It emulsifies fats, that is, it breaks down large fat molecules into smaller ones. This makes digestion more rapid.



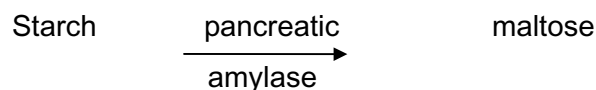
**Fig. 7 Emulsification of Fat**

### 2.1.7 PANCREAS

This is a leaf-like gland present in the loop of the duodenum. It produces pancreatic juice which is carried to the duodenum through the pancreatic duct. This juice contains the following digestive enzymes:

(i) **Pancreatic Amylase**

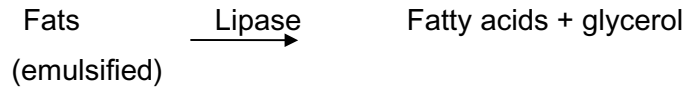
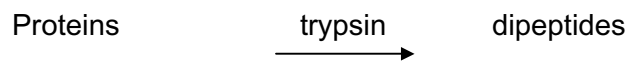
This completes the digestion of any starch still remaining in the food.



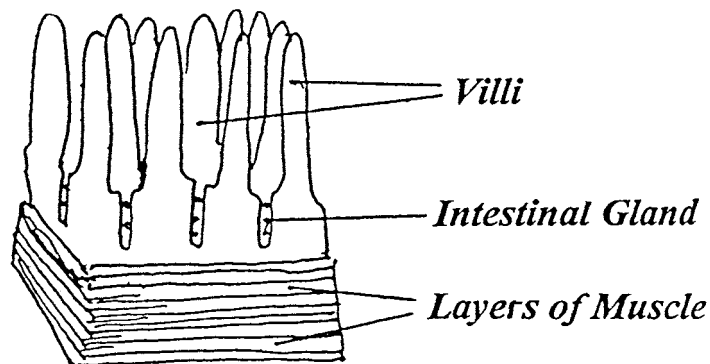


**(ii) Lipase**

This breaks down the emulsified fats into fatty acids and glycerol.

**(iii) Trypsin****2.1.8 ILEUM**

This is the last part of the small intestine. It is a long and highly coiled muscular tube. Its inner wall consists of numerous finger-like structures called villi.

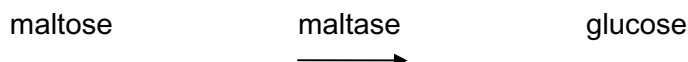


**Fig. 8 Inner Wall of Smaller Intestine**

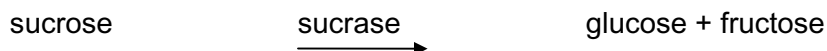
These villi increase the surface in contact with food. The wall of each villus consists of a single layer of cells. The villus also contains a network of blood capillaries.

Intestinal glands are found in between the villi in the wall of the ileum. These glands produce intestinal juice containing enzymes which work in the alkaline medium of the ileum as follows:

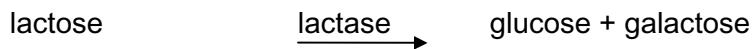
- (i) maltase which changes maltose to glucose.



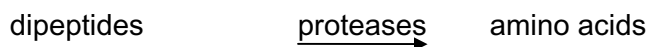
- (ii) sucrase which converts sucrose to fructose and glucose.



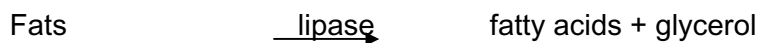
- (iii) lactase which changes lactose to glucose and galactose



- (iv) proteases which convert dipeptides to amino acids



- (v) lipase which changes fats into fatty acids and glycerol.



### 2.1.9 ABSORPTION

By now all the large, complex food molecules have been reduced into simpler, soluble and diffusible ones. They are now ready to be absorbed.

The villus is adapted for absorbing the digested food as follows:

- (1) Its finger-like shape provides a large surface area for rapid absorption of digested products.
- (2) The wall of the villus is thin as it consists of a single layer of cells. This facilitates rapid diffusion of digested food.
- (3) The villus contains a network of blood capillaries. Food is easily absorbed into the blood and carried away.

The digested food is absorbed through the wall of the villi into the blood. The food which enters the blood is transported first to the liver. The liver checks the content of the different nutrients in the blood.

### **2.1.10 ASSIMILATION**

This refers to the fate of the absorbed food substances.


The sugar in the form of glucose is oxidised to produce energy during respiration. Excess glucose is changed to glycogen or even fats in the liver and muscles where it is stored.

The fats are used to build cell membranes or act as an energy source when required. Excess fats are deposited beneath the skin to reduce heat loss from the body. They also form a thin protective layer around body organs to absorb shocks.

The amino acids are used to form new proteins for growth, repair and making of enzymes and hormones. Excess amino acids cannot be stored in the body. They are deaminated in the liver. This causes the removal of amino group to form a nitrogenous waste called urea. The urea is then excreted by kidneys and skin. The non-nitrogenous part is changed to glucose or glycogen.

### **Large Intestine**

This is the lower part of the alimentary canal. It is wider but shorter than the ileum. It has a thick muscular wall which does not have any villi. It has no digestive function. It simply absorbs water and minerals from the undigested food.

 Before proceeding further, complete the following activity.

### ACTIVITY 2

1. Why do you need to digest your food?

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.....

.....

2. Complete the table below

<b>Food</b>	<b>Food Class</b>	<b>Region of alimentary canal where digestion begins</b>	<b>Final Products of digestion</b>
<i>Bread</i>		<i>Stomach</i>	<i>Glucose</i>
<i>Butter</i>			
<i>Fish</i>			<i>Amino acids</i>

3. State and explain what happens to:

(a) milk in the stomach?

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(b) fats in presence of bile?

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4. Explain how the villi are suited for absorption of digested food.

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5. Explain assimilation

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**You will find the answer at the end of the Module.**

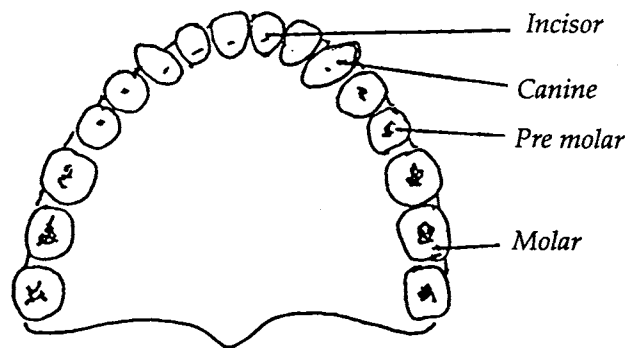
### 2.1.11 RECTUM AND ANUS

The large intestine leads to the rectum. As the undigested material passes along, it becomes more solid. This goes to the rectum where it is stored temporarily as faeces. Eventually the faeces are expelled at intervals through the anus. This is called egestion.

## 2.2 TEETH

You cannot swallow an apple whole! To eat the apple or any large piece of food, you first have to bite off a piece of it. Then you have to chew the piece until it has been ground enough for easy swallowing. Muscles, jaws and teeth all play a part in this breakdown of the food. The teeth are firmly fixed in the jaws.

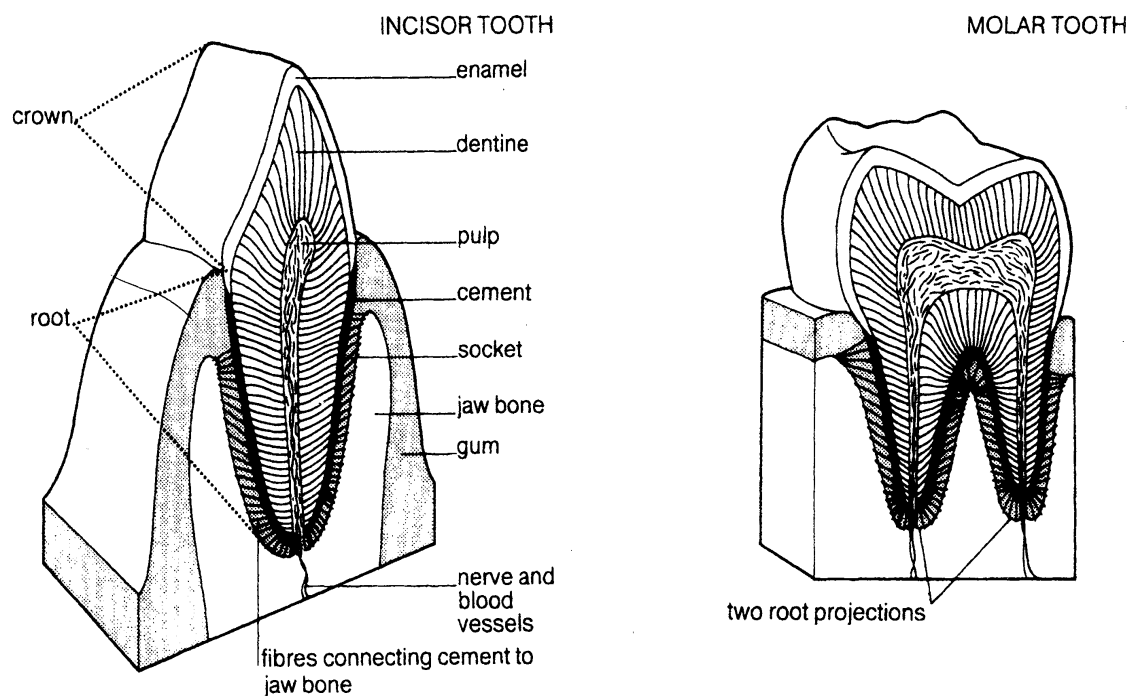
Fig. 9 below shows the arrangement of the different kinds of teeth in the upper jaw of the mouth.



**Fig. 9 Different Kinds of Teeth**

Each jaw of a human adult has 16 teeth in it. The front four are sharp biting teeth. They are called **incisors**. Behind them are two **canine** teeth. These are pointed and used for piercing and tearing purposes. The remaining ten 'back' teeth are larger and much flatter. Four of these are **premolars** and the other six are called **molars**. These teeth help to crush and grind the food with their surfaces.

The following diagrams show the different types of teeth and their functions.



**Fig. 10 Structure of teeth**

The part of the tooth which you can see above the gum is called the **crown**. It consists of a very hard non-living substance called **enamel**. This protects the tooth and prevents it from being worn away.

The enamel covers a living part of the tooth called the dentine. This is bone-like but it is softer than the enamel. It forms the main substance of the tooth.

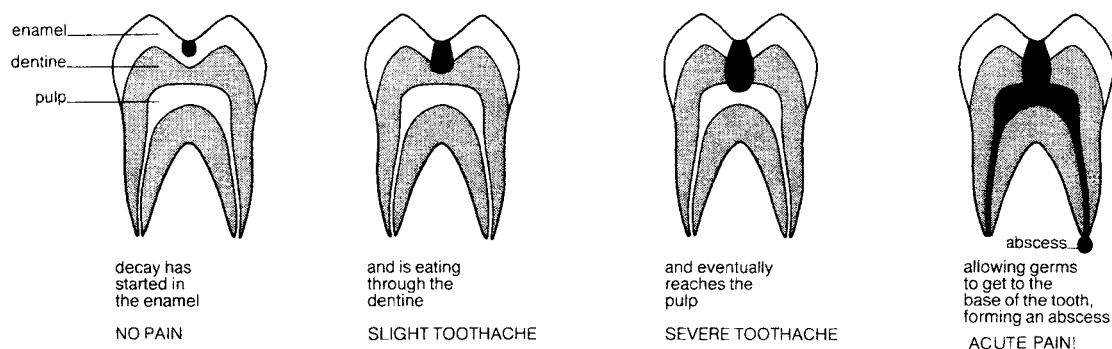
In the centre of the tooth is the pulp cavity. This consists of soft tissue called **pulp**. It is made up of living cells. It also contains nerves and blood vessels.

The part of the tooth which is inside the jawbone is called the **root**. A thin layer of bony material called **cement** holds the tooth in the jaw bone.

The narrow middle part of the tooth, between crown and root is called the neck. It is the part which is surrounded by the gum.

### 2.2.1 TOOTH DECAY

If you do not take care of your tooth, it will come to a sticky end! The figure below illustrates the process of dental decay.



**Fig. 11 Dental Decay**

When you eat food, broken pieces of the food are caught between the teeth. A sticky substance called plaque also forms on your teeth. These support bacterial growth. When you eat sweet foods, lots of bacteria grow.

The bacteria change sugars into acids. The acids dissolve the enamel of the tooth. This makes a small hole. If you do not take care this reaches the dentine as the decay spreads. Further decay leads to the infection of the pulp cavity. It then becomes very painful. Finally an abscess may be formed below the tooth. By now you will lose this tooth as it has to be extracted.

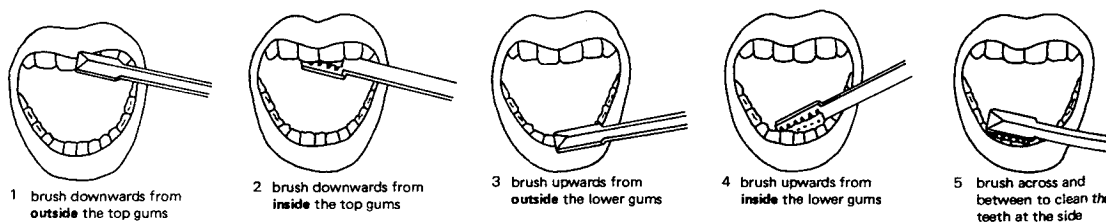
### **2.2.2 CARE OF THE TEETH**

What happens to your teeth depends very much on you. It can have either a sad ending or a happy one. The following are helpful pieces of advice:


1. Avoid sweets
2. Brush your teeth after every meal. Use a proper toothbrush.
3. Use toothpaste in brushing the teeth.  
Toothpaste
  - (i) contains an abrasive substance which removes plaques easily
  - (ii) helps to kill bacteria in the mouth
  - (iii) is alkaline in nature. It neutralises acids produced by bacteria.
4. consume a well-balanced diet.  
This promotes healthy growth of teeth.
5. Add fluorine in drinking water.  
This helps to reduce tooth decay.
6. Have an annual dental check.



Your dentist will keep a close check on your teeth. He will fill cavities and treat dental caries as soon as they appear and reduce the risk of dental decay.



**Fig. 12. Proper ways to brush the teeth**

 **Before proceeding further, complete the following activity.**

### **ACTIVITY 3**

1. Name and describe the process which causes food to move along the alimentary canal.

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2. State the function of hydrochloric acid in the stomach.

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3. Why can't you breathe while you are swallowing?

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4. *State the different types of teeth that you have and mention the function of each.*

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5. *In the space below make a labelled drawing of your incisor tooth.*

6. *Explain the process of dental decay.*

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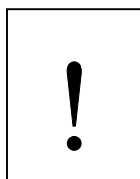
7. *State the measures you can take to prevent dental decay.*

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***You will find the answer at the end of the Module.***



## POINTS TO REMEMBER

- The alimentary canal is a muscular tube about seven metres long. It consists of various parts where food is ingested, digested and absorbed.
- Food must be digested before it is absorbed.
- The teeth in the mouth cavity start the mechanical digestion of food.
- Food is chemically digested by the action of enzymes as it moves down the alimentary canal.
- Food moves in the alimentary canal by a process called peristalsis.
- The stomach stores food temporarily. Its wall secretes gastric juice which contains hydrochloric acid and enzymes pepsin and resin.
- The liver produces bile which is stored in the gall bladder. The bile emulsifies fats and helps in their digestion.
- Digested food is absorbed through the lining of finger-like structures called villi. These villi are found in the ileum.
- Surplus sugars are changed into fats. Excess fats are stored beneath the skin and around body organs.
- Assimilation refers to what happens to the food that has been absorbed in the blood.
- Excess proteins cannot be stored. It is deaminated to produce urea and glycogen. The glycogen is stored in the liver while the urea is excreted.
- The large intestine has no digestive function. It absorbs water and minerals from the undigested food.
- Undigested and unabsorbed food from faeces is egested through the anus.
- You have four different kinds of teeth. These are incisors, canines, pre-molars and molars.
- Each type of tooth has specific functions in the mechanical digestion of food.
- Food that remains between teeth favours the growth of bacteria. These act on sugar in the food to produce acid. The acid brings about dental decay.
- Improper brushing of the teeth allows plaque to collect on the teeth. This leads to dental decay.



# ANSWERS TO ACTIVITIES

## UNIT ONE

### Activity 1

1.
  - (i) It is a process by which organisms make their own food. Green plants.
  - (ii) It is a process by which organisms obtain their food from other organisms. Animals.
  - (iii) In holozoic nutrition animals take complex food substances in their digestive system to be digested and absorbed. Mammals.
2. It is a process by which green plants make their food from simple inorganic substances in presence of light.

### Activity 2

1. Food - provides energy, materials for growth, substances to repair body tissues.
2. Carbohydrates, Fats, Proteins, Vitamins, Minerals.
3. 

(a) sugar, maize	(b) rice, potato	(c) butter, oils
(d) fish, meat	(e) carrots, mango	(f) citrus fruits, guava
(g) liver, meat	(h) milk, cheese	(i) fruits, vegetables.
4. 

(a) milk, beans	(b) fruits, salads	(c) milk, eggs	(d) oranges, lemons
(e) meat, green vegetables	(f) carrots, fish-liver oil		
5.
  - (a) It provides you with all the essential nutrients according to your body needs.
  - (b) It prevents malnutrition.

- 6.     (a)     You become obese and have a high risk of developing diabetes and heart diseases.  
         (b)     You lose weight, feel weak and suffer from deficiency diseases.
  
- 7.     Age, sex, activity, state of health.
  
- 8.     (a)     anaemia, anorexia  
         (b)     high blood pressure, diabetes.

## UNIT TWO

### Activity 1

1.
  - (a) It is the taking in of food into the mouth.
  - (b) It consists of breaking down complex, insoluble food into simpler soluble form.
  - (c) It is the passage of digested food into the blood.
  - (d) It is the removal of undigested food substances in the form of faeces.

### Activity 2

1. So that it can be absorbed and used by the body cells.

2.	Food	Food Class	Region of alimentary canal where digestion begins	Final products of digestion
	Bread	Carbohydrates Proteins	Buccal cavity Stomach	glucose amino acids
	Butter	Lipids	Duodenum	Fatty acids + Glycerol
	Fish	Proteins	Stomach	Amino acids

3.
  - (a) Renin curdles the milk. Pepsin then acts on milk protein and changes them to peptides.
  - (b) Bile emulsifies fats.
4. Villi
  - present a large surface area
  - have thin walls to facilitate diffusion of digested food
  - contain network of blood capillaries to absorb food easily.
5. Assimilation is the utilisation of the absorbed food substances by the body.

**Activity 3**

1. The process is peristalsis. It occurs by alternate contraction and relaxation of muscles in the wall of the alimentary canal.
2. It stops the action of salivary amylase on starch, kills germs in the food and provides an acidic medium for enzymes in gastric juice.
3. During swallowing the epiglottis covers the opening of the trachea or air tube.
4. Refer to figure 9 and what follows.
5. Refer to figure 10.
6. Refer to figure 11.
7. Avoid sweets  
Brush teeth after every meal  
Use toothpaste in brushing teeth  
Consume a balanced diet.  
Go for regular dental check ups