

# 2

## How Do ANIMALS TAKE FOOD

### NOTE FOR THE TEACHERS

- The students can be shown permanent slides of microscopic organisms like *amoeba*, *paramoecium* and *hydra*.
- Have discussions on the kind and amount of food a person eats and how digestive system processes it.
- Discuss factors that play key role in maintaining good health.
- Emphasize on eating healthy.

### Key Learning Points

- Classification of animals based on their food habits.
- Holozoic nutrition.
- Nutrition in *Amoeba*.
- Digestion in human beings.
- Nutrition in grass-eating animals

### First Food Factory

It was about 3.5 billion years ago bacteria type organisms emerged on the earth. 2.2 billion years ago cyanobacteria evolved that had the ability to use sunlight to breakdown water to make nutrients and release oxygen. In a chance encounter an *Amoeba* like organism engulfed the cyanobacterium. The prey got incorporated in the captors body making it the mother of true chloroplast, the first food factory on earth.

You have learnt in Chapter 1 that green plants are the primary source of food for all living organisms on earth. **Chlorophyll** present in green leaves traps the solar energy and converts it into chemical energy, which is stored as **starch**.

We know that animals feed on plants or other animals that have eaten plants. Hence they are called **heterotrophs**. Depending upon the food habits, animals are classified into following types:

- Herbivores** : Plant eaters, e.g., Cow
- Carnivores** : Flesh eaters, e.g., Lion
- Omnivores** : Both plant and meat eaters, e.g., Human beings.

We, humans are omnivores, eating different kinds of food from plant and animal sources. Food items like cereals, pulses, fruits and vegetables are plant sources while eggs, milk, meat and fish are derived from animals. You have studied about these in Class VI. All of us enjoy eating food that is pleasant to taste.

In the following table, note the food items you eat in a meal and the principal nutrients they contain.

S. No.	Food Item	Nutrients
1.	Rice	Carbohydrate
2.		
3.		
4.		
5.		
6.		
7.		

Do they make a balanced diet ?



The components of food animals eat such as **carbohydrates, fats and proteins** are complex solid organic matter. These are changed into simple soluble forms so that they can be easily absorbed in the body and provide nutrition.

**Animal nutrition** is the process of intake of food and its utilisation in the body for growth and energy. We, human beings take wholesome food and so do majority of animals. This type of nutrition of readymade solid or liquid organic food is called **holozoic nutrition**.

We shall study Holozoic nutrition in some detail.

## DIFFERENT STEPS OF HOLOZOIC NUTRITION

Holozoic nutrition involves five steps. These are :

### 1. Ingestion

Process of taking in food into the body of animal from external environment.

### 2. Digestion

Breakdown of complex organic food into simple soluble forms so that it can be absorbed by the body cells. Certain chemical substances, enzymes, help in the breakdown of these complex food.

### 3. Absorption

Taking in of soluble nutrients by the body cells.

### 4. Assimilation

Utilisation of absorbed nutrients by body cells.

### 5. Egestion

Removal of undigested waste products from the body.



## INSIGHT

When you visit a hospital, you will often notice patients getting intravenous nutrition. The glucose goes directly to the blood and is utilised by the body cells.

## WAYS OF INGESTING FOOD IN DIFFERENT ANIMALS

### Amoeba

Engulfing particles of food by projecting out its false feet called pseudopodia.



### Paramecium

Sweeping the food particles by cilia bent along water current into a mouth like structure.



### Hydra

Entangling small aquatic animals and paralysing the prey with special stinging cells and tentacles. Food is then pushed inside the mouth.



### Mosquito & Butterfly

Sucking blood or nectar by mouth parts that modify to form feeding tube.



### Frog

Shooting out sticky tongue to catch the prey and immediately withdrawing the tongue into mouth.



### Duck

Filtering tiny food particles floating nearby in water through holes in the beak.



### Human being

Using fingers and hands to lift food into the mouth cavity.

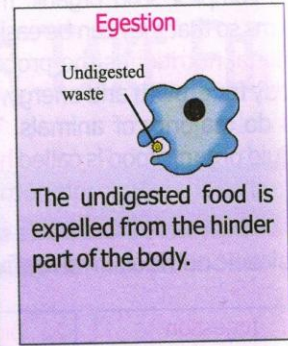
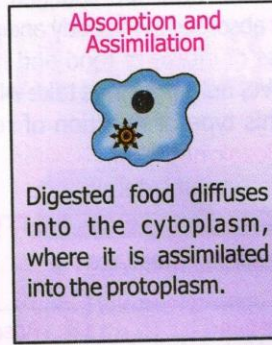
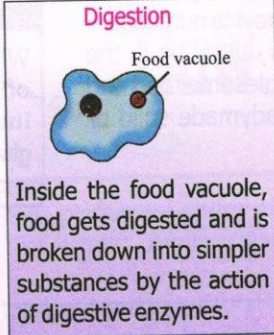
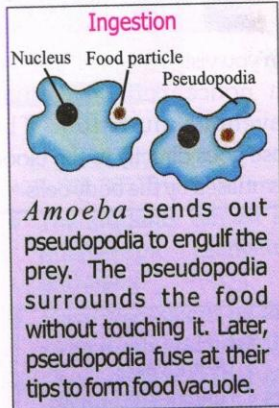


## HOLOZOIC NUTRITION IN AMOEBIA

*Amoeba*, a protozoan is single-celled microscopic organism found in ponds, ditches and canals. It constantly changes its shape by giving out finger-like projections, the **pseudopodia** (false feet) that aid in locomotion and food capture. It feeds on microscopic plants and animals floating in water. Its mode of nutrition is holozoic involving the steps of **ingestion, digestion, absorption, assimilation** and **egestion**.

Let us find out how it takes place.





### Enzymes

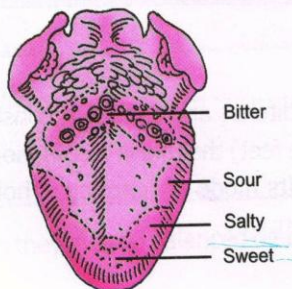
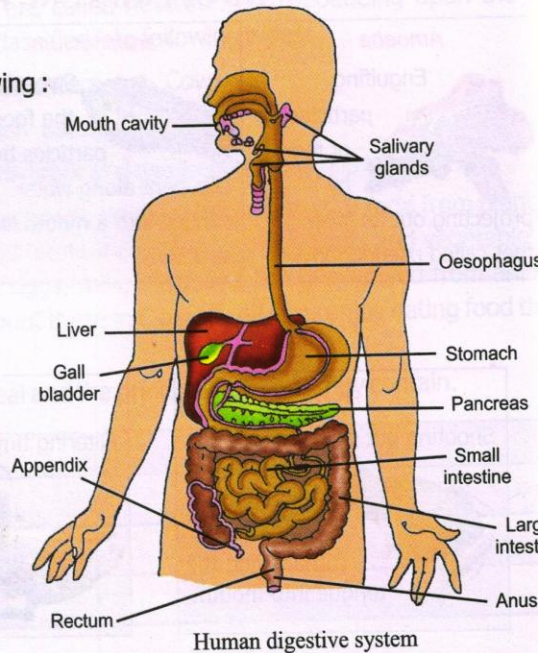
Chemical substances that act as biocatalysts, *i.e.*, they speed up the chemical reactions. They remain unchanged at the end of the reaction. Examples are **Salivary amylase** in mouth; **Pepsin** in stomach.

Into the body of animal from the external environment, so that it can be absorbed by the body cells. Certain chemical substances **enzymes**, help in the breakdown of these complex food.

### DIGESTION IN HUMAN BEINGS

The **digestive system** of human beings consists of the following :

Alimentary canal	Digestive glands
A long, continuous and muscular tube consisting of organs of varying diameter and shape. In an adult, it is about nine metres long. It has opening at both ends and consists of following parts:	Organs associated with the alimentary canal which secrete digestive juices into it. The different glands are :
(a) Mouth	(a) Salivary gland
(b) Oesophagus/Food pipe	(b) Liver
(c) Stomach	(c) Pancreas
(d) Small intestine	
(e) Large intestine	
(f) Rectum	



Taste areas of tongue

### The Mouth Cavity

**Mouth** is the opening of alimentary canal. Food is taken in or ingested in the mouth cavity. What changes take place, when you put food in the mouth? You feel the taste of food by your **tongue**, food is then acted upon by the **teeth** and **saliva**. The role of these may be summarised as follows

- **Teeth** help in biting, chewing and grinding the food. They also make the food soft and easy to swallow.



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- The muscular **tongue** has **taste buds** on its surface that help us to taste food of different tastes—sweet, sour, salty and bitter. The tongue also helps in moving the food in the mouth cavity so that it is properly chewed and mixed with saliva. Without a tongue we would not be able to speak clearly nor swallow the chewed food.
- The **saliva**, secreted by three pairs of salivary glands, is poured into mouth cavity. It moistens the food and lubricates it so that food becomes easy to swallow.

### Teeth

Our teeth give the shape to our face. They help us to speak clearly. They break the food into smaller pieces that is of help in the digestion process.

### Two Sets of Teeth

Human beings have different numbers of teeth at different times in their lives. You had no teeth when you were born. They started growing when you were about six months old. They grew till you were about two years of age and were twenty in total number. These were your **milk teeth**. But these did not last for long. Around the age of six, they probably started falling out. New teeth grew out in their place from your gums. These were your **permanent teeth**. By now, you all must have had your milk teeth replaced by permanent teeth. Have you tried to count them? See your reflection in the mirror with open mouth and count all your teeth. How many permanent teeth do you have now? If you lose any tooth of this set you will not get any new one in its place. An adult has thirty two permanent teeth.

### ACTIVITY - 1

**Aim:** To study human dentition.

**Materials Required:** A set of denture and classroom friends.

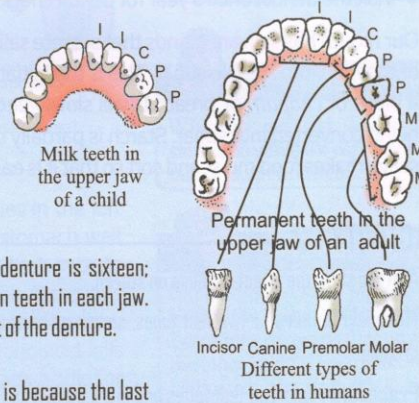
**Procedure:** Ask your teacher to get a complete set of denture from the dentist who visits your school. Count the number of teeth and observe the different shapes of the teeth in each jaw.

Now ask your friend to open his/her mouth, wide enough to be able to see all the teeth properly. Identify the different types of teeth and compare it with the denture.

**Observation:** You will see that the number of teeth per jaw in the denture is sixteen; representing the denture of an adult. Your friend will have only fourteen teeth in each jaw. The shape of the individual tooth in your friend's jaw will be similar to that of the denture.

Similarly tell your friend to observe your dentition.

**Conclusion:** Children like you have twenty eight permanent teeth. This is because the last four molars, called **wisdom teeth** are yet to erupt.



### INSIGHT

An adult secretes about 1.5 litre saliva a day.

### Types of Teeth

Following four types of teeth occur in an adult human.

Name of tooth →	Incisor	Canine	Premolar	Molar
<b>Shape</b>	Chisel-shaped	Sharp and pointed	Flat and ridged with small grooves	Flat and wide
<b>Function</b>	Cutting and biting	Tearing	Crushing and cracking	Grinding and chewing
<b>Upper jaw</b>	4	2	4	6
<b>Lower jaw</b>	4	2	4	6
<b>Total (32)</b>	8	4	8	12



### INSIGHT

The third molars are also called **wisdom teeth**. These are the last molar teeth of each side in both the jaws. So an adult denture will have four wisdom teeth. It is so called because it usually appears when a person is between eighteen to twenty years of age.



## Tooth Decay

Bacteria, present in the surroundings of teeth are the cause of tooth decay. If we do not keep our teeth clean, bits of food, sticking to the teeth can cause growth of bacteria. The bacteria attack the sugar present in food and form a white film called **plaque**. Plaque that is not removed by proper brushing produces acid that dissolves the enamel, making little holes or cavities. This brings about tooth decay. Through these cavities, infection gets inside the tooth and when it reaches the nerves it causes toothache. Tooth decay results in bad breath, toothache, bleeding gums and indigestion.



Tooth decay

## Hygiene of Teeth

- Avoid eating too much sweets.
- Eat a wholesome diet containing abundant minerals.
- Brush your teeth daily in the morning and at night before going to bed.
- Use a dental floss for removing matter from places where toothbrush cannot reach.
- Visit the dentist once a year for dental check-up.

Our mouth has **salivary glands** that secrete **saliva**. Saliva contains **enzymes** to breakdown the insoluble starch of the food into soluble sugar. This is the initiation of digestion. You can actually feel this change as you chew a piece of *chapatti* or bread. It will slowly begin to taste sweet, which means that the starch of *chapatti* is being converted into sugar. Starch is partially digested in mouth. The combined action of teeth and saliva makes food moist and soft so that it is easy to swallow.

## ACTIVITY - 2

**Aim:** To show the effect of saliva on starch.

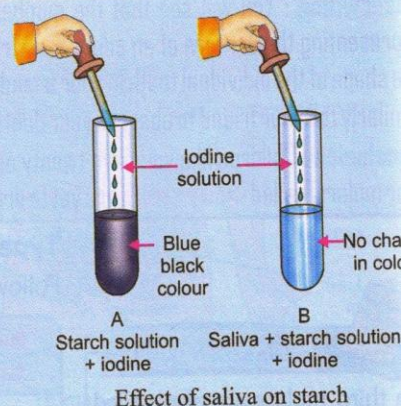
**Materials Required:** Two test tubes, starch powder, iodine solution, water and dropper.

**Procedure:** Take two test tubes and mark them A and B. Half fill the test tube A with water. Mix a pinch of starch powder to it in order to make starch solution. Pour half of the starch solution from test tube A to test tube B. Now put about 3 ml of saliva from your mouth into test tube B and mix it by shaking. After 5-6 minutes, add a few drops of iodine solution to each of the test tubes A and B.

### Observation:

- Test tube A gives a blue-black colour.
- No change in colour is observed in test tube B.

**Conclusion:** This is because the test tube A has starch solution, thus it confirms the starch test by changing into blue-black colour. Test tube B also has starch solution, but it changes into sugar by the action of enzymes present in saliva. Hence no change in colour is observed.



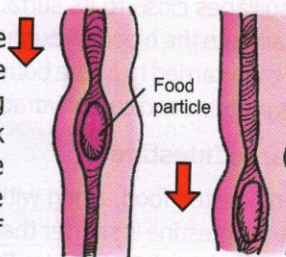


## Let us Revise

1. How does an *Amoeba* form its food vacuole ?
2. What type of teeth are used to eat the following foodstuffs ?  
(a) Apple (b) Meat (c) Sugarcane (d) *Chapatti* (e) Porridge  
(f) Carrot (g) Cashew nut.
3. List the steps of holozoic nutrition.
4. How many molars do you have ?
5. Digestion of food begins in the mouth. True or False.
6. The alimentary canal of human being is about ..... long.
7. .... is the crushing teeth.

## Oesophagus

When a portion of the food is chewed, the tongue helps in rolling and pushing it to the pharynx. From pharynx, food passes to a long tubular **oesophagus** that runs along the neck and chest. No digestion takes place here. The food is gently squeezed downwards into the **stomach** by the rhythmic contractions of muscular walls of the oesophagus. This type of movement is called **peristalsis** and occurs throughout the alimentary canal.



Peristalsis pushes the food down the alimentary canal

## Stomach

The stomach is a J-shaped muscular bag like structure. It lies in the left side of abdomen just below the ribs. Gentle movement of stomach wall churns the food. The wall of stomach is lined by glands that secrete protein digesting enzymes, hydrochloric acid and mucus. The secretions of these glands are collectively called **gastric juice**. Protein digesting enzymes breakdown proteins into simpler forms. Hydrochloric acid kills many bacteria in the food and makes the medium in stomach acidic for digestive enzymes to be active. The mucus protects stomach wall from being corroded by the action of hydrochloric acid. Food remains in the stomach from a few minutes to a few hours depending on the type of food.

## Small Intestine

The homogeneous, semidigested, food passes from stomach into the **small intestine**. Most digestion takes place in the upper part of small intestine. Here the food is mixed with two important secretions from **liver** and **pancreas**. Some enzymes are also produced by the walls of small intestine. The **liver** is a reddish-brown coloured gland, situated on the right side, just above the stomach. It is the **largest gland** in the body. It secretes a green liquid, called **bile**. Bile is temporarily stored into a hollow pear-shaped organ, the **gall bladder** attached to the liver. Bile is alkaline and helps to neutralise the acidity of food leaving the stomach. It also helps in breakdown of fats.



## INSIGHT

The entrance of the oesophagus and windpipe is guarded by a flap-like structure, the epiglottis. This acts like a policeman helping in controlling and directing food and air along proper channels. In swallowing, it closes the passage of wind pipe, thus preventing food from entering the lungs.



## Your Wisdom

Why do we get a choking sensation while we eat in a hurry, talk or laugh while eating ?



## INSIGHT

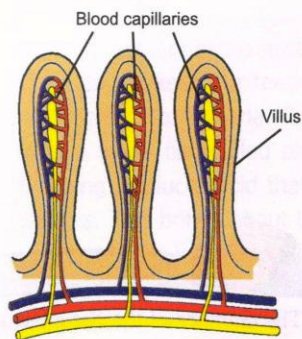
Excessive acidic secretions irritate the lining of the stomach. Secretions of mucus that protects the inner lining is also diminished. Ultimately, the stomach lining is eroded causing lesions known as **peptic ulcer**.



## INSIGHT

Small intestine is not really small. It is the longest part of the alimentary canal measuring 7.5 m in length and 2.5 cm in diameter. It is a coiled and tubular structure. The first portion of small intestine is the **duodenum** which is the most important site of digestion. In the lower portion of small intestine, the **ileum**, absorption of digested food takes place.





Transverse section of small intestine showing villi



### INSIGHT

Alcohol is directly absorbed by the stomach and carried by blood-stream straight to brain cells on which it acts.

### Do you know ?

In 1822, Alexis St. Martin, a Canadian fur trapper was wounded in his left side by a shot gun blast. When his wound healed, he had a small hole between the stomach and the outside. Dr. William Beaumont, a surgeon, took samples of food from Alexis's stomach through the hole and carried out experiments on the role of digestive juices in digestion. His work has greatly increased our understanding of how food is digested.

Pancreas, a leaf-shaped gland present below the stomach secretes pancreatic juice, that act on carbohydrates and proteins, changing them further into simpler forms. The intestinal glands produce **intestinal juice**, containing enzymes that complete the digestion of carbohydrates, proteins and fats. Thus digestion of food is complete and

- **Carbohydrates** are converted into **glucose**.
- **Proteins** are converted into **amino acids**.
- **Fats** breakdown into **fatty acids** and **glycerol**.

Digested food, in soluble forms is taken in, through the walls of small intestine into the blood stream. The wall of the small intestine has thousands of tiny, finger-like projections, the **villi** which increases the surface area for absorption of nutrients. Each villus has fine blood capillaries close to its surface. The nutrients pass through the intestinal walls into the blood through these capillaries by the process of **diffusion**. It is then carried to all the body cells for building of complex substances such as proteins and carbohydrates.

### Large Intestine

Undigested food, along with water moves down into large intestine. The large intestine is shorter than small intestine and is wider. It is about 1.6 m in length and 6 cm wide. It absorbs water and useful minerals from the watery mass of undigested food remains. The undigested food material becomes semi-solid and is then called **faeces**. It passes through the large intestine and is stored in the **rectum**. It gets expelled out from the body through **anus** at periodic intervals.

### NUTRITION IN GRASS EATING ANIMALS

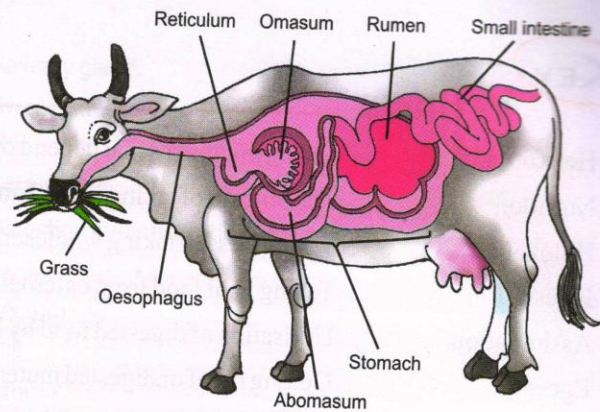
Grass eating animals chew half digested food and are called **ruminants**. They ruminate or bring back the swallowed food to chew it again. Observe the cows, buffaloes and goats chewing continuously at rest, even when they are not eating. All ruminants are **herbivores**.

Grass is rich in **cellulose** and difficult to digest. Many animals, including humans cannot digest the cellulose. Then how do ruminants digest their food ?

- Firstly, it requires more chewing that is why ruminants have big chewing teeth with powerful jaw muscles.
- Ruminants have a unique stomach divided into four compartments- **rumen**, **reticulum**, **omasum** and **abomasum**.
- The half chewed grass is swallowed and it first goes from mouth to **rumen**, the largest of the four compartments.
- Bacteria and protozoa, present in the rumen breakdown the cellulose found in grass.
- This half digested food then goes into the second muscular chamber, the **reticulum** from where it is sent back to the mouth as **cud** to be chewed again. This action is known as **ruminating**.



- The rechewed matter is swallowed for the second time.
- By-passing the first two chambers, it enters the third chamber, the **omasum**, where food is broken down into still smaller pieces. Excess water is absorbed.
- Finally it enters the fourth chamber, the **abomasum** which is the **true stomach**. Enzymes act upon the food and digestion progresses.



Digestive system of a cow, a ruminant

### Let us Revise

1. What are the end products of carbohydrate and protein digestion ?
2. The largest gland in the body is pancreas. True or False.
3. Which part of alimentary canal helps in absorption of water ?
4. What is ruminating ?
5. .... is the organ of digestive system that helps in killing of bacteria.

### Quick Review

- Animal nutrition includes the process of food intake, its digestion and utilisation in the body for growth and to obtain energy.
- Animals ingest their food in different ways. Different animals have special organs for the process.
- Simplest unicellular animals like *amoeba* and the most complex forms like us, humans obtain food by holozoic nutrition which involves ingestion, digestion, absorption, assimilation and egestion.
- Humans have two different sets of teeth in their lifetime – the milk teeth and permanent teeth.
- The human digestive system consists of mouth, oesophagus, stomach, small intestine, large intestine and rectum.
- Digestive enzymes are produced by salivary glands, gastric glands, pancreas, liver and intestine.
- Food travels down the alimentary canal by a series of contraction and expansion of its muscular walls. This is called peristalsis.
- The digested food is absorbed through finger-like projections called villi in the inner wall of the small intestine.
- The absorbed food is transported by blood to all parts of the body.
- In the large intestine, water and useful minerals are absorbed from undigested food remains.
- Undigested semi-solid food, in the form of faeces is egested through the anus.
- Grass eating animals show special features in digestion – they have a four-chambered stomach and often ruminate in order to digest food.



## KEY WORDS

Heterotrophs	: Living organisms that depend on other organisms for food.
Nutrition	: The process of taking in food and utilising it for growth and development.
Holozoic	: The process of taking wholesome readymade organic food.
Ingestion	: Taking in of food from external environment.
Assimilation	: Utilisation of digested food by body cells to get energy.
Egestion	: Getting rid of undigested material as faeces.
Pseudopodia	: Finger-like extensions of the body of <i>Amoeba</i> .
Wisdom Teeth	: The third molars which erupt between eighteen and twenty years.
Pancreas	: A gland present above the stomach that secretes insulin and pancreatic juice.
Gall Bladder	: A pear-shaped organ that stores bile and attached to the liver.
Villi	: Finger-like projections on the inner wall of small intestine.
Rectum	: The last part of digestive system that stores faeces.
Ruminant	: Herbivores that bring back half digested food into their mouth to chew it again.

## EXERCISES

### A. Multiple Choice Questions :

- Human beings are heterotrophs as they feed on
  - Plants
  - Meat
  - Cannot make their own food
  - All of these
- Which of the following is not a part of nutrition ?
  - Absorption
  - Digestion
  - Ingestion
  - Expiration
- Digestion of food begins in \_\_\_\_\_ .
  - Stomach
  - Oesophagus
  - Mouth
  - None of these
- Which of the acid is secreted in the stomach ?
  - Hydrochloric acid
  - Nitric acid
  - Sulphuric acid
  - Phosphoric acid
- Which component of food is absorbed in large intestine ?
  - Carbohydrate
  - Protein
  - Roughage
  - Water
- Bile is produced by
  - Liver
  - Gall bladder
  - Pancreas
  - Small intestine







### E. Alternative Response Type :

#### True(T)/False(F) Type :

1. The mode of taking in food vary in different animals.
2. Saliva changes sugar into starch.
3. Milk teeth are permanent teeth.

#### Right(✓)/Wrong(×) Type :

1. Digestive juices are secreted by oesophagus.
2. Cud is similar to curd.
3. A twelve years old boy has 32 teeth.

#### Yes(Y)/No(N) Type :

1. Holophytic nutrition involves taking in of wholesome food.
2. The teeth that help in grinding of food is called molar.
3. Bile is an enzyme that acts on the fat present in food.

### F. Analogy Type :

1. Temporary set : Twenty teeth :: Permanent set : \_\_\_\_\_
2. \_\_\_\_\_ : Biting :: Canine : Tearing.
3. *Amoeba* : Engulfing :: Hydra : \_\_\_\_\_
4. Salivary glands: Saliva :: Liver : \_\_\_\_\_

### G. Very Short Answer Type Questions :

1. What are the food components you eat, in order to make a balanced diet ?
2. What is the type of nutrition in *Amoeba* and *Hydra* ?
3. Define holozoic nutrition.
4. Name the glands associated with digestion.
5. Which of the teeth will the dentition of a five year old child not have ?
6. Why does a piece of bread taste sweet on chewing ?
7. What is the role of large intestine ?
8. Where in the alimentary canal are the villi located ?
9. Where is bile produced and in which part is it stored ?
10. How is stomach of a cow different from that of a man ?

### H. Short Answer Type Questions :

1. What are the differences between milk teeth and permanent teeth ?
2. What is epiglottis ? State its function.
3. What are the functions of gastric juice?
4. Where and how does absorption of digested food take place ?
5. How does *Amoeba* ingest its food ?
6. What would happen to the organisms if undigested food was allowed to accumulate in their body ?
7. What are enzymes ? Give two examples of enzymes involved in digestion.

### I. Long Answer Type Questions :

1. Explain all the steps of holozoic nutrition.
2. Make a neat drawing of the human digestive system. Label its various organs and the associated gland.
3. How does cellulose digestion occur in grass eating animals ?
4. With the help of a diagram, describe nutrition in *Amoeba*.
5. Describe an adult human dentition. Explain the role of the different types of teeth.