

NUTRITION IN ANIMALS



Concepts Covered

- Theories, types, and mode of nutrition.
- Nutrient requirement, mode of intake of food, and its utilization in the body.
- The human digestive system and secretory glands.

Introduction

Nutrition in animals is as important as it is for plants.as animals do not have chlorophyll; they cannot prepare their food. They obtain their food directly or indirectly from plants.

Nutrition in animals depends upon the feeding habits of the animals. The process of taking in food is called ingestion. The method of ingestion is different in different animals For Example., Bees and humming birds suck nectar from plants, a python swallows its prey and cattle feed on grass.

Food has different components, called nutrients, like carbohydrates, fats, minerals, proteins, and vitamins, which are required for the maintenance of the body. These components are complex and cannot be used directly, so they are broken down into simpler components by the process of digestion

Human Digestive system

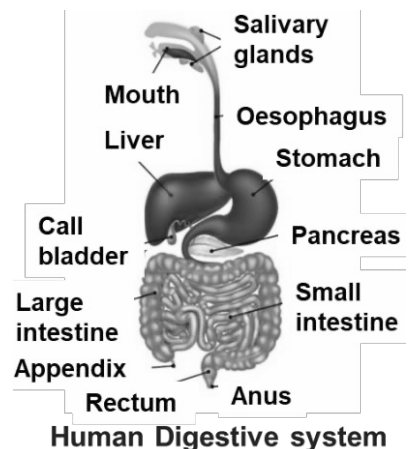
The human digestive system is a series of connected organs starting from the mouth to the anus. The digestive system allows us to break down the food we eat to obtain energy and nourishment.

The digestive system (approximately 30 feet in length in adults) is usually divided into the following parts:

(i) **Mouth:** It is a transverse slit which is also called the opening of the alimentary canal. The mouth opens into the buccal cavity.

(ii) **Buccal cavity:** The mouth opens into a cavity that contains teeth, tongue and salivary glands. Food is chewed and masticated in the buccal cavity. Buccal cavity includes –

(a) **Teeth:** Teeth are hard structures held in sockets of the jaws. Teeth cut, chew, and break food into smaller pieces. It helps in the physical breakdown of food.

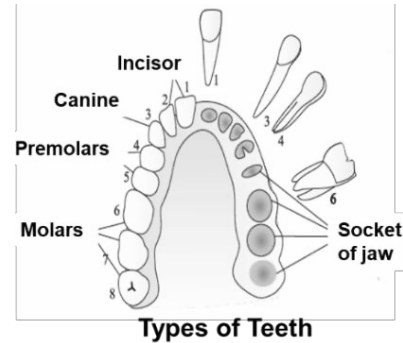
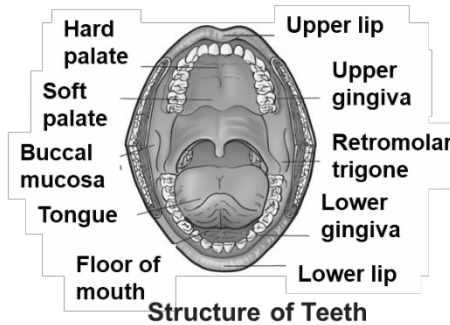


Types of teeth:

- Incisors-Biting the food.
- Canines- Wearing and tearing of food.
- Premolars- Crushing and grinding the food.
- Molars-Crushing and grinding the food.



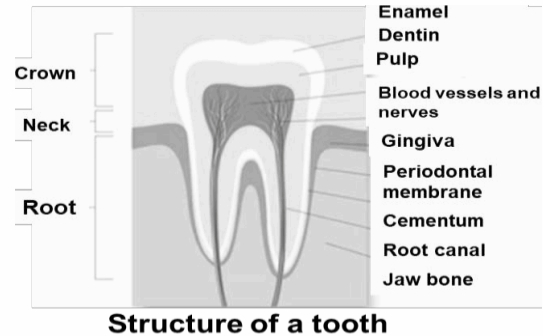
Wisdom teeth are also referred to as the third set of molars. They are the vestigial and final set of molars. This set of teeth appears between the age of 18 to 25.



Extended Learning

Dental Formula: The permanent dentition consists of 32 teeth in total, with the dental formula 123/2123, indicating two incisors, one canine, two premolars, and three molars in each quadrant.

Structure of Tooth: A tooth consists of enamel, dentin, cementum and pulp tissue. The portion of a tooth exposed to the oral cavity is known as the dental crown, and the portion below the dental crown is known as the tooth root.



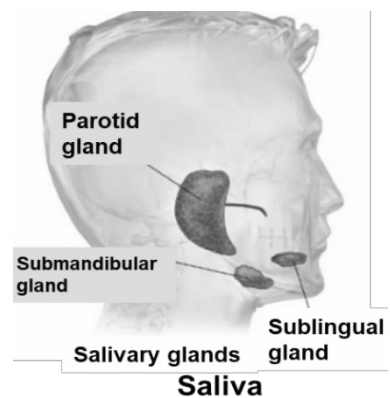
(b) Tongue:

- The tongue is the organ used for taste. It contains taste buds to distinguish whether the type of food is sweet, sour, bitter or hot.
- It also helps in rolling and pushing the food into the pharynx.
- It mixes food with saliva and also helps us in speaking.

(c) Salivary glands: Salivary glands secrete saliva which contains salivary amylase enzyme. Amylase works on starch and converts it into simple sugar.

Role of Saliva

- (1) Lubricating effect: moisturizes the inside of the mouth and creates smoother speech.
- (2) Solvent effect: dissolves food and allows the tongue to taste food.
- (3) Cleaning effect: washes away food debris and bacteria remaining in the mouth.



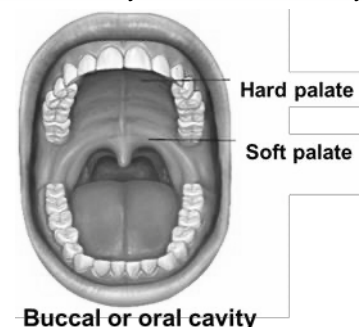
(d) Palate: It is the roof of the mouth in humans and other mammals. It separates the oral cavity from the nasal cavity. There are two types of the palate:

Hard palate

- It is present in the front part of the palate.
- The hard palate is strong and supported by bones.
- It keeps the food in place during mastication/ chewing.

Soft palate

- Smooth and fleshy part present at the backside is called the soft palate.
- Its smooth surface helps to swallow food easily.
- Function of the smooth palate is to close the nasal pathways during swallowing.



Extended Learning

Dental caries: Dental caries or tooth decay causes gradual softening of enamel and dentine. It begins when bacteria acting on sugars produce acids that softens or demineralizes the enamel. Masses of bacterial cells together with food particles stick to the teeth to form dental plaque. Brushing the teeth after eating removes the plaque before the bacteria produce acids. If untreated, microorganisms may invade the pulp, causing inflammation and infection.



Check Your Concept - 1

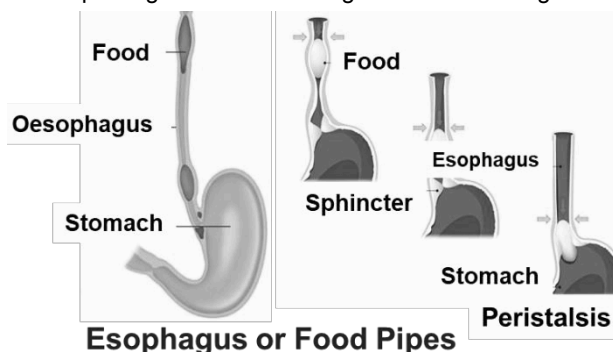
- (i) Why are algae green in color?
- (ii) Why is the sun called the ultimate source of energy for all living organisms?
- (iii) Plant cannot use the nitrogen present in the soil directly. Why?
- (iv) Name the pores present on the surface of the leaves and their function?

(iii) Pharynx:

The buccal cavity opens into the pharynx. It is the common passage for food and air. It leads into the esophagus. It is covered by a cartilaginous flap called the epiglottis that covers the passage towards the lungs while swallowing food.

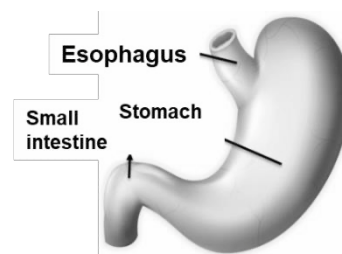
(iv) Esophagus or Food Pipes:

- It is a connecting tube between the mouth and stomach.
- The food is pushed down towards the stomach by the movement of the muscles of the food pipe.
- The muscles of the esophagus contract and relax continuously.
- This contracting and relaxing movement of esophageal muscles is called peristalsis.
- Peristalsis helps in the easy passage of food into the stomach.



(v) Stomach:

- Stomach is a J-shaped muscular bag-like structure that is situated towards the left side of the abdominal cavity, beneath the diaphragm. This vital organ acts as storage for the food and provides enough time to digest meals.
- Stomach walls contain tubular glands in their walls that secrete gastric juices (mixture of enzymes and HCl).
- Gastric juices contain three substances: hydrochloric acid, digestive enzymes, and mucus.



(1) Hydrochloric acid: It is the digestive fluid formed by the stomach during the process of digestion. It functions by destroying harmful microorganisms present in the food particles. It provides an acidic environment for the action of pepsin.

(2) Digestive enzymes: They are the group of enzymes that functions by breaking down polymeric macromolecules like proteins, carbohydrates and fats, etc. into their smaller and simpler substances. These enzymes need specific pH for efficient working. For example, hydrochloric acid facilitates the action of enzyme pepsin which digests the protein into simple substances.

(3) Mucous: It is an aqueous secretion produced by the mucous membranes. It functions by protecting the stomach lining from the acid. The partially digested food then goes from the stomach into the small intestine.



All enzymes work at a specific pH and temperature range. The enzymes in the stomach work at acidic pH while enzymes in the small intestine work at basic pH.

(vi) Small Intestine:

- Small intestine is highly coiled and is about 7.5 m long.
- The small intestine consists of the duodenum, jejunum, and ileum.

(1) Duodenum: It is about 25 cm in length and 'U' shaped in appearance. It receives the opening of the common bile and pancreatic duct.

(2) Jejunum: It is about 2.5 m in length and is narrower than the duodenum.

(3) Ileum:

- It is about 3.5 m in length.
- It contains finger-like projections called villi.
- Villi help in absorbing nutrients and energy into the blood after digestion.
- Small intestine releases intestinal juices which aid in the process of digestion. It also receives secretions from

- Liver secretes bile juice while pancreas secretes pancreatic juice.
- Food is mixed with bile juice and pancreatic juice in the small intestine.
- Bile juice breaks down bigger fats into smaller fat droplets.
- The pancreatic juice breaks down starch into simple sugar and proteins into amino acids.

Digestive Glands

Liver and Pancreas

(A) Liver:

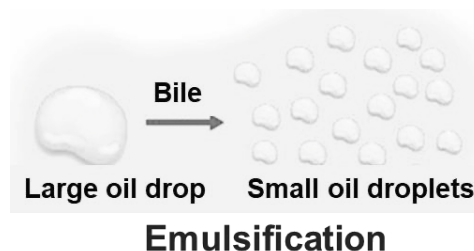
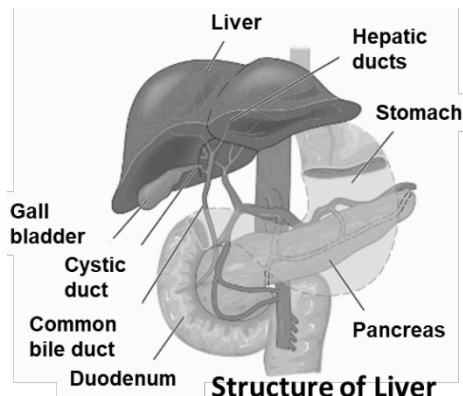
- It is the largest gland of the human body.
- It secretes bile juice.
- Bile juice is stored in the gall bladder and is carried to the duodenum by the common bile duct.

Bile juice:

- (1) It helps in the emulsification (break down) of fats into smaller fat globules. This increases surface area and thus fat digesting enzyme works well.
- (2) It provides an alkaline medium for food (coming from the stomach into the small intestine).
- (3) It activates enzyme lipase which breaks down the dietary fats into fatty acids.



The function of bile is to aid in the digestion of fats in the duodenum. Bile is composed of bile acids and salts, phospholipids, cholesterol, pigments, water, and electrolyte chemicals that keep the total solution slightly alkaline (with a pH of about 7 to 8).



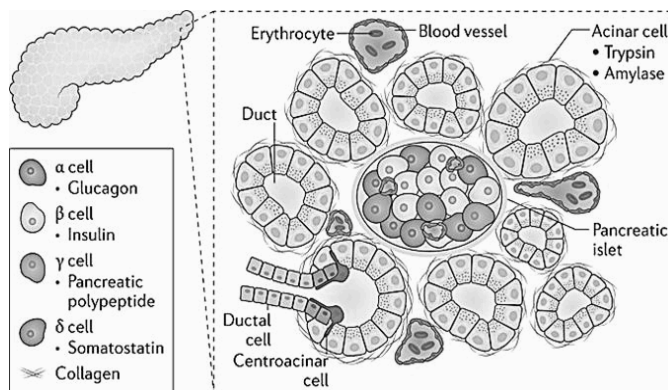
(B) Pancreas:

- (1) It is a cream-colored gland and is located just below the stomach. It secretes pancreatic juice into a small intestine. It is the second-largest gland of the human body.
- (2) The pancreatic juice has the following enzymes:
 - (a) Trypsin: Converts peptones into amino acids.
 - (b) Pancreatic amylase: Breaks the remaining starch into maltose.
 - (c) Lipase: Converts fat to fatty acid and glycerol.



Check Your Concept - 2

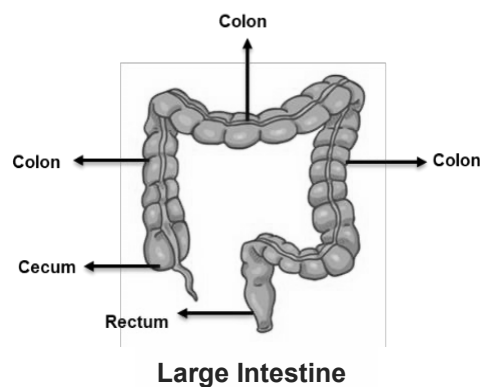
- (i) Give the name of the largest gland in the Human body.
- (ii) What does the liver do to help digestion?
- (iii) What is the role of digestive glands in the human body?
- (iv) What type of enzymes are secreted by the Pancreas?



Pancreas

(vii) Large intestine:

- The large intestine is wider and shorter than the small intestine. It is about 1.5 m in length.
- It is the last organ of the digestive system.
- It consists of four parts:
- Colon is about 1 m long inverted 'U'- shaped structure. It is the largest portion of the large intestine.
- Rectum is the terminal part of the alimentary canal and opens to the exterior by the anus.
- Anus is guarded by an anal sphincter that regulates the passage of fecal matter. It absorbs excess water from the undigested food, secretes mucus, and helps in the egestion of undigested food.



Large Intestine

Functions of the Large Intestine:

- (1) Reabsorption of water and mineral ions such as sodium and chloride.
- (2) Formation and temporary storage of faeces.
- (3) Maintaining a resident population of over 500 species of bacteria.
- (4) Bacterial fermentation of indigestible materials.

Absorption of Food

- The small intestine is the main region for the absorption of digested food.
- The inner surface of the small intestine has numerous finger-like projections called villi which increase the surface area for rapid absorption of digested food.
- The digested food which is absorbed through the walls of the small intestine goes into our blood.

Assimilation of food

- The blood carries these useful substances to every part of the body. The body uses these substances for its growth and maintenance. The absorption of digested food and its utilization by the body is known as assimilation.
- Glucose, which is the final product of carbohydrate digestion, is broken down with the help of oxygen into carbon dioxide and water to release energy. Amino acids are used for the growth and repair of worn-out cells.
- Fatty acid and glycerol are stored below the skin as energy reserves.

Egestion of Food

The elimination of undigested remains of the food from the alimentary canal is called egestion or defecation. Excess water is absorbed in the large intestine and the contents become semi-solid feces which pass out into the rectum and are expelled out through the anus.



Check Your Concept - 3

- (i) What is peristalsis and why is it useful?
- (ii) In which part of the alimentary canal, does most of the absorption take place?
- (iii) Name the part of the stomach which is attached to the small intestine.
- (iv) What are villi? What is their location and function?

Nutrition in Ruminants

A ruminant is an herbivore animal that regurgitates its food & digests it in step.

Example: Cow, goats, sheep, etc.

The 2 steps involved in the digestion of ruminants are:

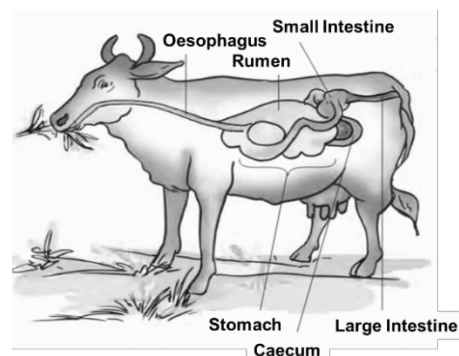
- (1) The ruminant first eats the foods & regurgitates a semi-digested food called cud.
- (2) The ruminant then eats the cud when at rest. This process of eating the cud is called ruminating.

Ruminants have a special stomach with 4 chambers, which are as follows:

- (a) **Rumen:** This is the largest chamber of the stomach. It is namely used for storing food.
- (b) **Reticulum:** It helps in moving the food back to the mouth when needed.
- (c) **Omasum:** This is the smallest chamber of the stomach. Its main function is to absorb excess water.
- (d) **Abomasum:** This is a true stomach where gastric juices are secreted to help digestion. Here the food is digested just like in the human stomach.

Process of Digestion of Food in Ruminants

- The ruminants mostly eat grasses and leaves which are rich in cellulose. The ruminants can digest cellulose because cellulose-digesting bacteria and protozoa are present in their stomach.
- Half-chewed grass travels from the mouth to the first chamber of the stomach called the rumen where it is acted upon by bacteria and microorganisms.
- It then goes into the reticulum from where it is returned to the mouth as cud through chewing called rumination.
- Finally, it enters the fourth chamber called abomasum where enzymes act upon it and digestion is completed. It is finally sent to the small intestine where the absorption of the nutrients takes place.



Solved Examples

(1) **What is digestion?**

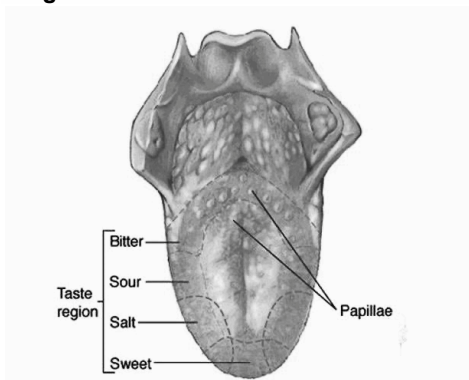
Answer: The process in which complex food materials are broken into simpler and absorbable substances is called digestion.

(2) **Name of various digestive organs of humans.**

Answer: The organs which are used to intake digest and absorb the food are called digestive organs. The various digestive organs are the mouth, buccal cavity, esophagus, stomach, small intestine, large intestine, liver, gall bladder, and pancreas.

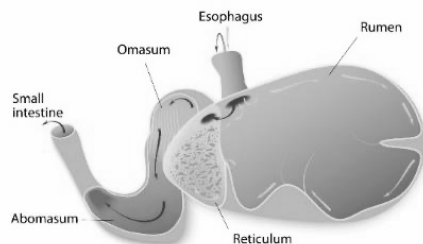
(3) **Draw the figure of tongue and label the regions of salt, bitter, sweet and sour sensations on the tongue.**

Answer:



(4) **Explain the process of rumination.**

Answer: The grass-eating animals chew continuously even when they are not eating grass. Some animals that eat grass store it to a special chamber in their stomach called the rumen where it is acted upon by bacteria and microorganisms. It then goes into the reticulum from where it is returned to the mouth as cud through chewing.



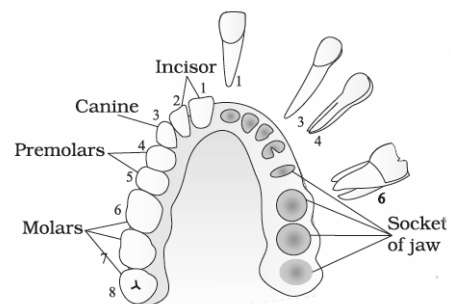
(5) **What happens if we do not clean our teeth after eating the food?**

Answer: If we do not clean our teeth after eating the food, then various harmful bacteria begin to live and grow in it. These bacteria break down the sugar present in the food and remain attached to teeth. The acid is formed which gradually damages the teeth. This is called tooth decay.

(6) **Write down the steps in animal nutrition.**

Answer:

- (1) Ingestion: It is the process by which food is taken inside.
- (2) Digestion: It is the process of converting or breaking down complex food into simple and soluble forms.
- (3) Absorption: It is the process by which the digested nutrients or taken to different parts of the body by the circulatory systems.
- (4) Assimilation: It is the process of using absorbed food molecules for producing energy and growth.
- (5) Egestion: It is the process of removing undigested food materials from the body.



(7) **Explain the various type of teeth in human beings.**

Answer: There are four kinds of teeth in human beings situated in each jaw:

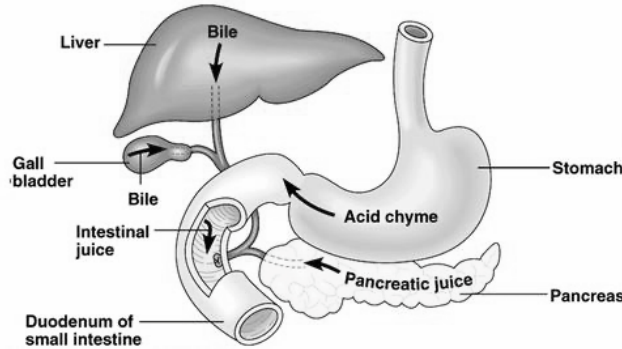
- (i) Incisor: They are four in number and help to cut and bite food.
- (ii) Canine: They are two in number and help in piercing and tearing food.
- (iii) Premolar: They are four in number and help in chewing and grinding the food.
- (iv) Molar: They are six in number and also help in chewing and grinding the food like premolar teeth.

(8) **Explain the process of digestion in the stomach.**

Answer: Process of digestion in the stomach

The inner lining of the stomach secretes the following things:

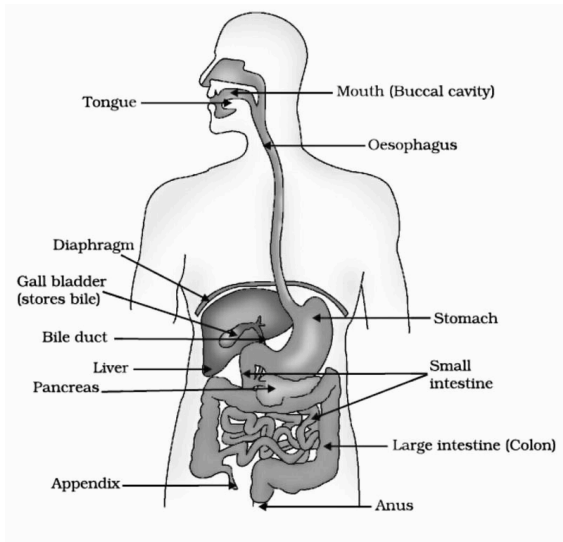
- (i) Mucous: It protects the lining of the stomach.
- (ii) Hydrochloric Acid: It kills bacteria and makes food acidic.
- (iii) Digestive juices: They breakdown the proteins into a simpler substance



(9) **Explain the human digestive system with the help of a labeled diagram.**

Answer:

- When we ingest food in our mouth, salivary glands of the mouth secrete saliva which moistens the food. It also converts the starch into sugar. The tongue helps in chewing by moving the food in various directions. Saliva contains an enzyme called salivary amylase which converts starch into sugar (maltose).
- From the mouth food goes into a food pipe called the esophagus. As food enters the food pipe, muscles of its wall start contraction and relaxation movement. This movement is called the peristaltic movement which pushes the food into the stomach. The peristaltic movement occurs through the alimentary canal. The esophagus leads the food to a sea-like structure called the stomach.
- The food is churned and partly digested in the stomach. The semi-solid food passes from the stomach to a coiled tube-like structure called the small intestine.
- The small intestine serves two purposes: digestion and absorption of the digested food. It is about 20 feet long. The inner surface of the small intestine has a large number of finger-like projections called villi.
- The villi increase the surface area for the absorption of digested food. The absorbed food enters the bloodstream and is carried away to various parts of the body for assimilation.
- The undigested food moves from the small intestine to the large intestine where mainly absorption of water from the undigested food takes place. From the large intestine, the undigested food passes to the rectum which pushes it out of the body through the opening called anus as the faeces.



Exercise

FILL IN THE BANKS

- (1) The set of teeth that grows during infancy is called _____.
- (2) The route common for food & air is _____.
- (3) The pushing down of food in the stomach due to rhythmic contraction & relaxation of the wall of the alimentary canal is called _____.
- (4) The largest gland in human body is _____.
- (5) _____ is the enzyme present in saliva which is meant for the digestion of starch of food.
- (6) _____ are finger like outgrowths in inner walls of small intestine which increases.
- (7) The tongue helps in mixing _____ with food.
- (8) Digestion of starch starts in _____.
- (9) _____ provide energy to our body.
- (10) The _____ takes digested food to all the cells of the body.

TRUE OR FALSE

- (1) Digestion is the mechanical and chemical breakdown of food into smaller components that are more easily absorbed into the blood stream.
- (2) The four chambers of a ruminant's stomach are the rumen, reticulum, omasum and abomasum.
- (3) The process of incorporation of absorbed food into cell components is called digestion.
- (4) Enamel is the hardest substance in the human body.
- (5) Food pipe is also called the esophagus.
- (6) Process of changing food to a usable form is called digestion.
- (7) Skin helps in the excretion of water only.
- (8) Glucose breaks down with the help of carbon dioxide and water, and energy is released.
- (9) Large intestine is about 4.5 in length.
- (10) The fecal matter is removed through the anus from time to time. This is called egestion.

OBJECTIVE TYPE QUESTIONS

- (1) Which of the following organs stores bile?
(A) Liver (B) Pancreas
(C) Gallbladder (D) Gastric gland
- (2) Which of the following is not a part of nutrition?
(A) Digestion (B) Absorption
(C) Excretion (D) Assimilation
- (3) The walls of the large intestine absorb -
(A) Cellulose (B) Water
(C) Digested food (D) Digested proteins
- (4) Small intestine has this to increase the surface area for absorption
(A) Villi (B) Glands
(C) Liver (D) Pancreas
- (5) Chief function of bile is
(A) To digest fat by enzymatic action (B) To emulsify fat for digestion
(C) To eliminate waste product (D) To regulate process of digestion
- (6) Pepsin digests -
(A) Proteins in stomach (B) Carbohydrates in duodenum
(C) Proteins in duodenum (D) Fats in ileum
- (7) Chief function of HCl is
(A) To maintain a low pH to activate protein digesting enzyme
(B) To facilitate absorption
(C) To maintain low pH to activate amylase
(D) To dissolve enzyme secreted in stomach
- (8) Saliva is poured in buccal cavity by the help of
(A) Pinus gland (B) Thyroid gland
(C) Adrenal gland (D) Salivary gland

- (9) A digestive enzyme, salivary amylase, in the saliva begin digestion of
 (A) Protein (B) Nucleic acids
 (C) Fats (D) Carbohydrates
- (10) The acid secreted in the stomach to assist in the process of digestion is
 (A) Hydrochloric acid (B) Sulphuric acid
 (C) Phosphoric acid (D) Nitric acid

Answer Key

FILL IN THE BANKS

- | | |
|----------------------|-------------------|
| (1) Temporary | (6) Villi |
| (2) Pharynx | (7) Saliva |
| (3) Peristalsis | (8) Buccal cavity |
| (4) Liver | (9) Carbohydrates |
| (5) Salivary amylase | (10) Blood |

TRUE OR FALSE

- | | |
|-----------|-----------|
| (1) True | (6) True |
| (2) True | (7) False |
| (3) False | (8) False |
| (4) True | (9) False |
| (5) True | (10) True |

OBJECTIVE TYPE QUESTIONS

- | | |
|---------|----------|
| (1) (C) | (6) (A) |
| (2) (C) | (7) (A) |
| (3) (B) | (8) (D) |
| (4) (A) | (9) (D) |
| (5) (B) | (10) (A) |