

Chapter 16. Digestive System

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Solution 1:

Nutrition can be defined as the process which involves the utilization of food by an animal to obtain energy for growth and development. There are two types of nutrition – autotrophic and heterotrophic.

Solution 2:

1. **Autotrophs:** These are the organisms which prepare organic food in their body from simple inorganic materials like carbon dioxide, water, etc. **Example** – green plants and certain protists.
2. **Heterotrophs:** The organisms which cannot prepare their own food and depends on ready-made food synthesized by green plants are called heterotrophs. **Examples** – animals and human beings.
3. **Carnivores:** The organisms which feed upon other animals and animal products. **Examples** – tiger, lion, cat, etc.
4. **Omnivores:** The organisms which feed on all kinds of plant and animal food are called omnivores. **Examples** – Cockroach and human beings.
5. **Herbivores:** The organisms that feed on plants only are termed as herbivores. Examples – sheep, cow, goat, etc.

Solution 3:

1. **Parasites** are the organisms that live in or on the body of another organism called host, and obtain nourishment from its body whereas saprophyte is an organism that absorbs soluble organic nutrients from dead and decaying organic matter.
2. **Autotroph** is an organism which prepares organic food in their body from simple inorganic materials like carbon dioxide, water, etc. whereas heterotroph is an organism which cannot prepare its own food and depends on ready-made food synthesized by green plants.
3. **Holozoic nutrition** is a nutrition in which animals survive by consuming other organisms whereas **saprophytic nutrition** is the nutrition in which the animals absorb soluble organic nutrients from dead and decaying organic matter.
4. **Holophytic nutrition** is the nutrition in which organisms prepare organic food in their body from simple inorganic materials like carbon dioxide, water, etc. whereas in holozoic nutrition, the animals survive by consuming other organisms.

Solution 4:

The steps involved in animal nutrition are:

1. **Ingestion** – It means taking solid or liquid food inside the body.
2. **Digestion** – It is the breaking down of complex insoluble food components into simple soluble substances.
3. **Absorption** – It is the process by which soluble food passes from alimentary canal into blood and lymph through intestinal villi.



4. **Assimilation** – Utilization of absorbed food by different body cells is called assimilation.
5. **Egestion** – Elimination of undigested food as faeces is called egestion.

Solution 5:

There are four types of teeth:

1. **Incisors** – These are used for cutting.
2. **Canines** – These teeth are used for tearing.
3. **Premolars** – For masticating the food.
4. **Molars** – For grinding and masticating the food.

Solution 6:

(a) 1. Enamel; 2. Dentine; 3. Blood capillaries; 4. Cement; 5. Blood vessels; 6. Periodontal membrane; 7. crown; 8. root.

(b) Enamel, dentine and cement.

(c) Yes.

(d) The function of the root is to hold the teeth in the jaw and the function of the crown is it completely encircles and protects the teeth.

(e) 32

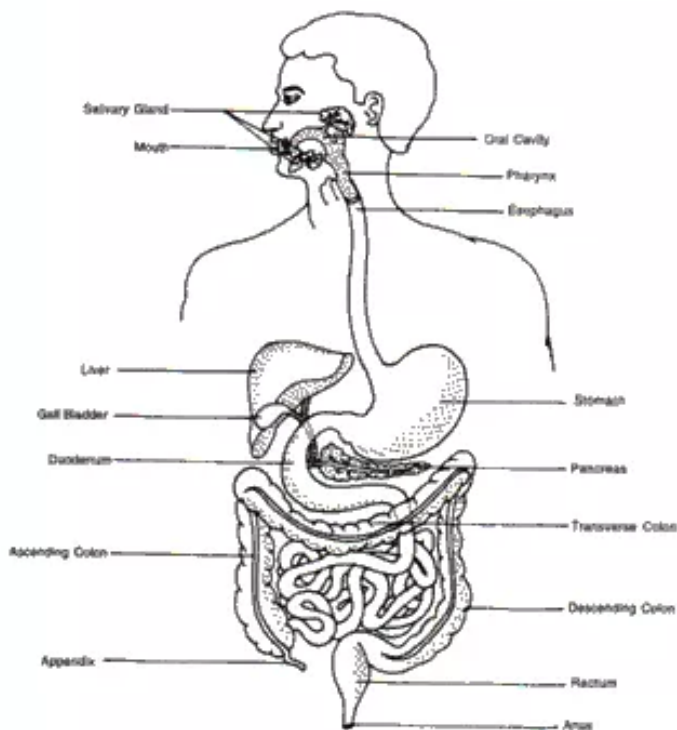
(f) The dental formula of humans is

$I \frac{2}{2}, C \frac{1}{1}, P \frac{2}{2}, M \frac{3}{3} (16 \times 2 = 32).$

Solution 7:

Human alimentary canal consists of:

- (a) Mouth – It is the first organ in the sequence which helps in sucking, chewing, salivation and swallowing. The food is ingested through mouth.
- (b) Pharynx – It is situated behind the soft palate and leads into oesophagus. It is divided into three parts – nasopharynx, oropharynx and laryngopharynx.
- (c) Oesophagus – It lies upto the middle of the thorax, behind the trachea and the heart. It pushes the food down into the stomach by peristaltic movements.
- (d) Stomach – It is the widest organ of the alimentary canal. It is J – shaped and is divided into three parts: cardiac, body and pyloric.
- (e) Intestine – It is of two types: small intestine and large intestine. Small intestine is the longest part of the alimentary canal and comprises of three regions – duodenum, jejunum and ileum. It helps in the absorption of food. Large intestine is divisible into three parts – caecum, colon and rectum. It absorbs water from the food.



Solution 8:

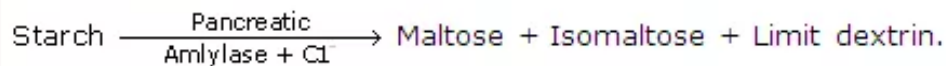
- (a) False
- (b) False
- (c) True
- (d) False

Solution 9:

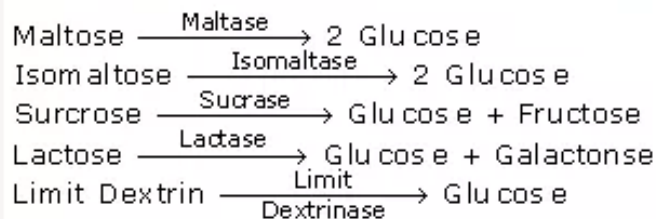
Digestion – It is the breaking down of complex insoluble food components into simple soluble substances.

Digestion in small intestine:

(a) Digestion of carbohydrates in the small intestine: 40% starch is partially digested by ptyalin while remaining 60% starch is digested by pancreatic amylase.



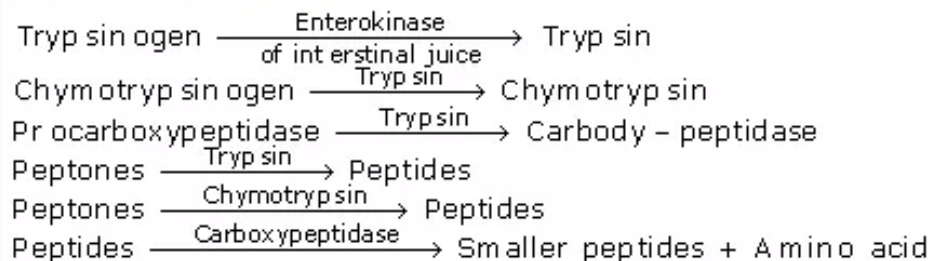
The enzymes of intestinal juice act as below:



The humans cannot digest the cellulose due to the absence of cellulose enzyme.

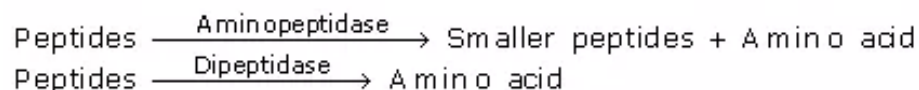
(b) Digestion of protein the small intestine:

Action of pancreatic juice. It contains proenzymes trypsinogen, chymotrypsinogen and procarboxypeptidase.



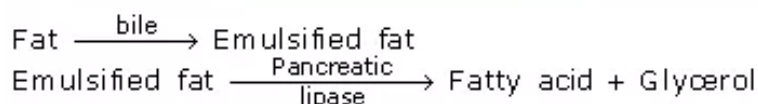
Trypsinogen converts into trypsin in the presence of enterokinase. Trypsin converts chymotrypsinogen into chymotrypsin; procarboxypeptidase into carboxypeptidase; and peptones into peptides. Chymotrypsin also converts peptones into peptides. Peptides get converted into smaller peptides and amino acids in the presence of carboxypeptidase.

Action of intestinal juice. Intestinal juice contains endokinase, aminopeptidase and dipeptidase. Actions of these enzymes are summarized below:



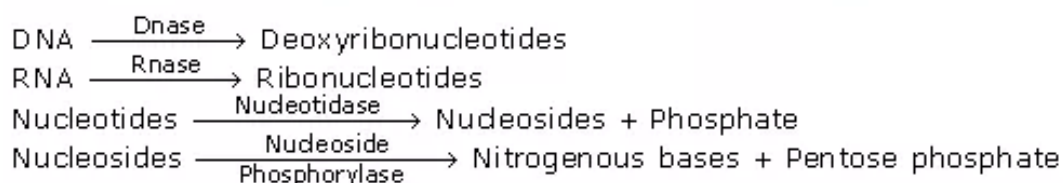
(c) Digestion of Fats:

Digestion of fats occurs in small intestine and reactions occur as below:



(d) Digestion of Nucleic Acids:

Nucleic acids are digested in the small intestine as below:



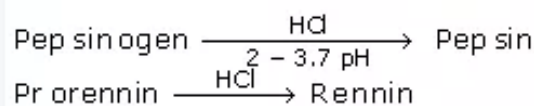
The enzyme Dnase converts DNA into Deoxyribonucleotides, Rnase converts RNA into ribonucleotides, nucleotidase converts the nucleotides into nucleosides and phosphate and finally nucleoside phosphorylase converts nucleosides into nitrogenous bases and pentose phosphate.

Solution 10:

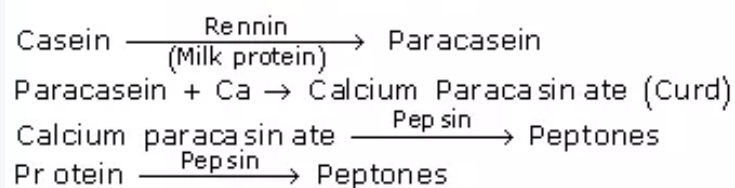
Digestion of proteins in humans:

There is no digestion of protein in the oral cavity because protein digestive enzymes are absent in the saliva.

(a) Digestion of protein in the stomach: Gastric juice contains HCl and two proenzyme, pepsinogen and prorennin. HCl maintains a pH of 2 – 3.7 and kills bacteria and other pathogens. Gastric juice mixes with food until it becomes semi-solid mass called Chyme. Proenzymes become activated as below:

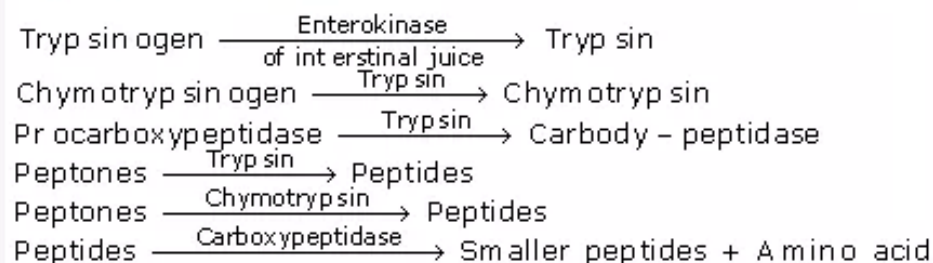


These enzymes act as follows:

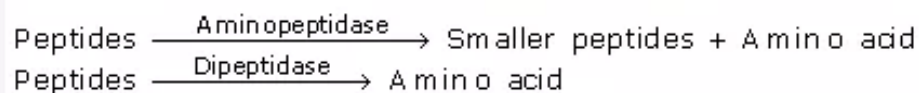


(b) Digestion of protein the small intestine

Action of pancreatic juice. It contains proenzymes trypsinogen, chymotrypsinogen and procarboxypeptidase.

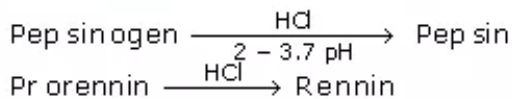


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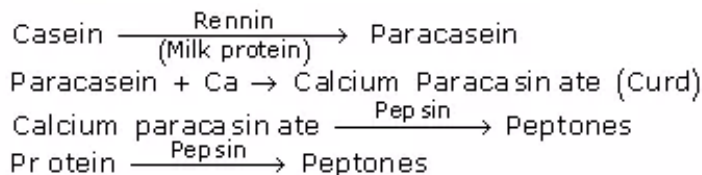


Solution 11:

- (a) Rennin is produced by the stomach in an inactive form, called prorennin. After milk is consumed, the gastric acids present in stomach activate the inactive prorennin to active rennin which acts upon casein and converts it into paracasein. Paracasein with the help of calcium ions form Calcium Paracaseinate or forms coagulated milk. This coagulated milk turns into peptones in the presence of pepsin.

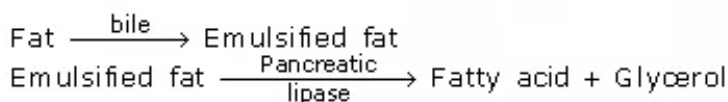


These enzymes act as follows:



If milk were not coagulated, it would rapidly flow through the stomach and the digestion of proteins will not take place.

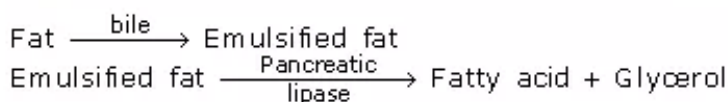
- (b) Emulsification: Digestion of fats occurs in small intestine and reactions occur as below:



- (c) Digestion of Fats:

Digestion of fats occurs in small intestine and reactions occur as below:

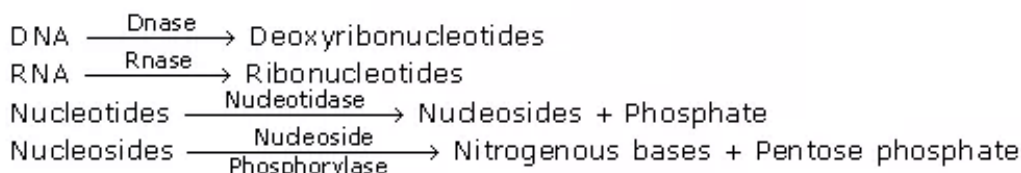
Digestion of fats occurs in small intestine and reactions occur as below:



- (d) Digestion of Nucleic Acids:

The enzyme Dnase converts DNA into Deoxyribonucleotides, Rnase converts RNA into ribonucleotides, nucleotidase converts the nucleotides into nucleosides and phosphate and finally nucleoside phosphorylase converts nucleosides into nitrogenous bases and pentose phosphate.

Nucleic acids are digested in the small intestine as below:



Solution 12:

Salivary Glands – Three pairs in man and secrete 1000 to 1500 cc saliva per day.

Saliva is slightly acidic and its pH is 6.8.

There are three types of salivary glands:

1. **Parotid glands:** It is the largest salivary gland and situated near the ears. It opens into oral cavity by Stenon's duct.
 2. **Sublingual glands:** It is located beneath the tongue. It opens into the floor of oral cavity by duct of Rivinus.
 3. **Submandibular or sub-maxillary glands:** It is situated at the angles of the lower jaws. It opens into oral cavity by Wharton's duct.
- Each gland secretes saliva which is transported to the mouth cavity. At the time secrete saliva.

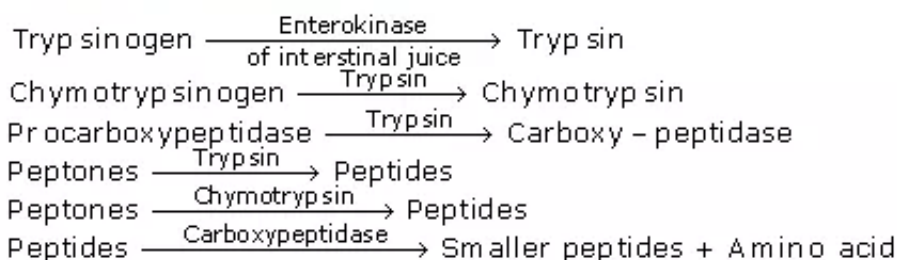
Solution 13:

- (a) Lipase
- (b) Lungs
- (c) Rectum

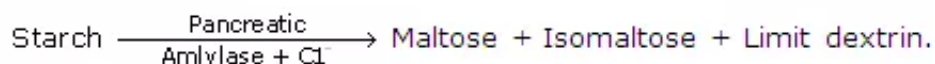
Solution 14:

The pancreatic juice contains proenzymes trypsinogen, chymotrypsinogen, procarboxypeptidase, pancreatic amylase and pancreatic lipase.

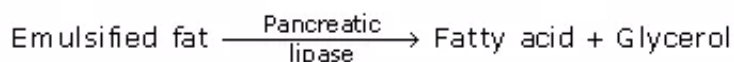
- (a) Digestion of proteins by pancreatic juice: Trypsinogen converts into trypsin in the presence of enterokinase. Trypsin converts chymotrypsinogen into chymotrypsin; procarboxypeptidase into carboxypeptidase; and peptones into peptides. Trypsin, chymotrypsin and carboxypeptidase acts upon proteins. Chymotrypsin also converts peptones into peptides. Peptides get converted into smaller peptides and amino acids in the presence of carboxypeptidase.



- (b) Digestion of carbohydrates by pancreatic juice: Pancreatic amylase acts upon starch in the presence of chloride ions and converts it into maltose, isomaltose and dextrin.



- (c) Digestion of fats: Pancreatic juice contains pancreatic lipase which emulsifies the fats into fatty acids and glycerol.



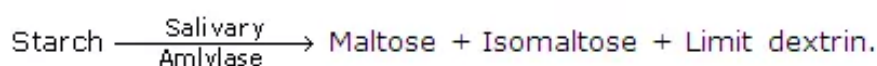
Solution 15:

Column A	Column B
1. HCl	Pepsin
2. Rennin	Casein
3. Enteropeptidase	Trypsin
4. Cellulose	Rumen
5. Ptyalin	Starch
6. Vitamin	Pernicious anaemia
7. Intestinal juice	Lactose
8. Bile salt	Micelle
9. Vitamin A	Night-blindness
10. Goitre	Iodine

Solution 16:

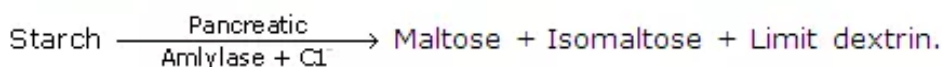
Digestion of starch:

(a) Digestion of starch in the oral cavity: Food is mixed with saliva and salivary amylase or ptyalin converts starch into maltose, isomaltose and limit dextrins.

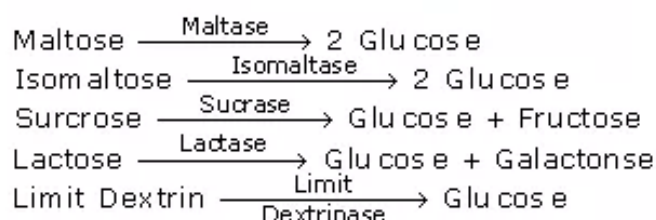


(b) Digestion of starch in stomach: Gastric juice does not contain carbohydrate digestive enzyme, hence no digestion of starch takes place in the stomach.

(c) Digestion of starch in small intestine: 40% starch is partially digested by ptyalin while remaining 60% starch is digested by pancreatic amylase.



The enzymes of intestinal juice act as below:



The humans cannot digest the cellulose due to the absence of cellulose enzyme.



Solution 17:

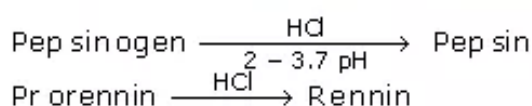
- (a) Carboxypeptidase
- (b) Rennin
- (c) Caecum
- (d) HCl
- (e) Pepsin
- (f) Digestion
- (g) Protein
- (h) Bilirubin

Solution 18:

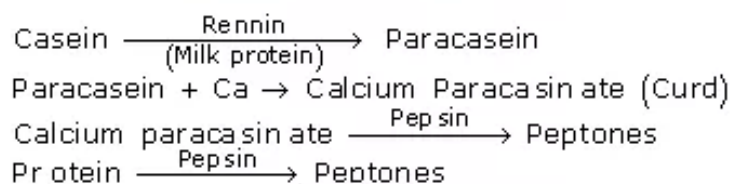
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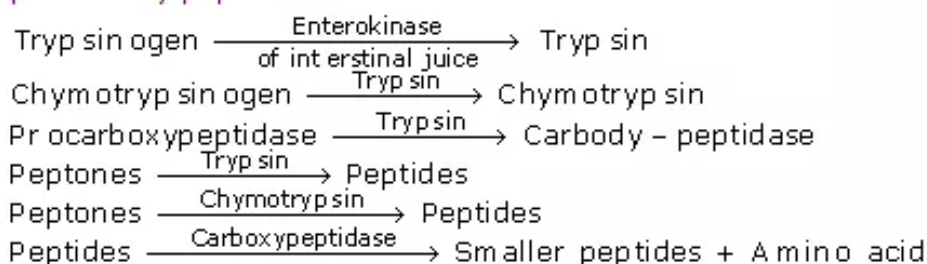


These enzymes act as follows:

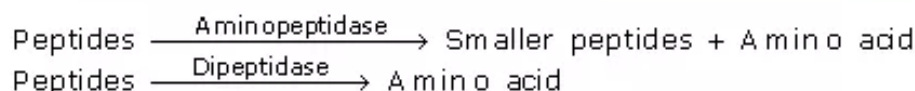


- (b) Digestion of protein the small intestine

Action of pancreatic juice. It contains proenzymes trypsinogen, chymotrypsinogen and procarboxypeptidase.



Action of intestinal juice. Intestinal juice contains enterokinase, aminopeptidase and dipeptidase. Actions of these enzymes are summarized below:



Solution 19:

1. **Stomach** – Pepsin
2. **Salivary glands** – Salivary amylase/Ptyalin
3. **Pancreas** – Trypsin, Chymotrypsin, Carboxy peptidase, Pancreatic amylase and Pancreatic lipase.
4. **Ileum** – Enterokinase, Endokinase, Aminopeptidase and Dipeptidase.

Solution 20:

- (i) (a) Larynx
- (ii) (c) club-shaped villi and Peyer's patches
- (iii) (c) 750-1000 ml
- (iv) (d) all the above
- (v) (b) Gall bladder
- (vi) (a) Proteins
- (vii) (a) Below ears
- (viii) (d) Intestine
- (ix) (a) Proteins
- (x) (b) Pharynx
- (xi) (d) Rat
- (xii) (a) Four
- (xiii) (b) $\frac{2123}{2123}$
- (xiv) (c) Enamel
- (xv) (a) 4