

**12.0 : Introduction :**

**Q.1. Which processes are responsible for providing energy to humans?**

**Ans:** Nutrition and respiration are the two processes responsible for providing energy to humans.

**Q.2. Define nutrition.**

**Ans:** The sum total of all processes through which food is taken in, digested, absorbed, utilized and finally the undigested matter is eliminated outside the body is called nutrition.

**Q.3. Enlist and explain various steps involved in nutrition.**

**Ans: Nutrition involves the following steps:**

- i. Ingestion:** It is the introduction of food into mouth, i.e. intake of food (eating) inside the body.
- ii. Digestion:** The process during which the complex, non-diffusible and non-absorbable food substances are converted into simple, diffusible and absorbable substances by the action of enzymes is called digestion.

Complex + non-diffusible food substances  $\xrightarrow[\text{digestion}]{\text{enzymes}}$  simple + diffusible substances

- iii. Absorption:** The process of diffusion of digested food into blood and lymph is called absorption.
- iv. Assimilation:** The process by which protoplasm is synthesized into each cell of the body by utilizing simple food substances is called assimilation.
- v. Egestion:** The elimination of undigested food (faeces) from the body is called egestion.

**12.1 : Digestive system :**

**Q.4. Describe alimentary canal of man with the help of a neat labelled diagram.**

**OR**

**Describe the structure and functions of the various parts of the alimentary canal.**

**Ans: Human digestive system:**

Human digestive system consists of alimentary canal and associated digestive glands.

**Alimentary canal:**

Alimentary canal is a long tube-like structure of varying diameter starting from mouth and ending with anus.

The associated digestive glands include salivary glands, liver and pancreas.

Alimentary canal is about 8 - 10 metres long. Alimentary canal consists of mouth, buccal cavity, pharynx, oesophagus, stomach, small intestine, large intestine and anus.

**i. Mouth:**

It is the anterior transverse slit-like opening of the alimentary canal.

It leads to buccal cavity or oral cavity.

**Function:** It helps in ingestion of food.

**ii. Buccal cavity:**

Buccal cavity contains tongue, teeth and 3 pairs of salivary glands.

Its walls are formed of cheeks, roof is formed of palate and floor by tongue.

Mucous membrane lines the buccal cavity from the inner side.

Tongue, teeth and salivary glands are also present in the buccal cavity.

**a. Tongue:**

It is the muscular fleshy organ and is roughly triangular in shape.

**Functions:** The upper surface of the tongue bears numerous projections called papillae. These

papillae contain sensory receptors called taste buds, which are used to detect different tastes of the food.

Besides, the tongue mixes saliva with food to form bolus.

It helps in swallowing and in speech.

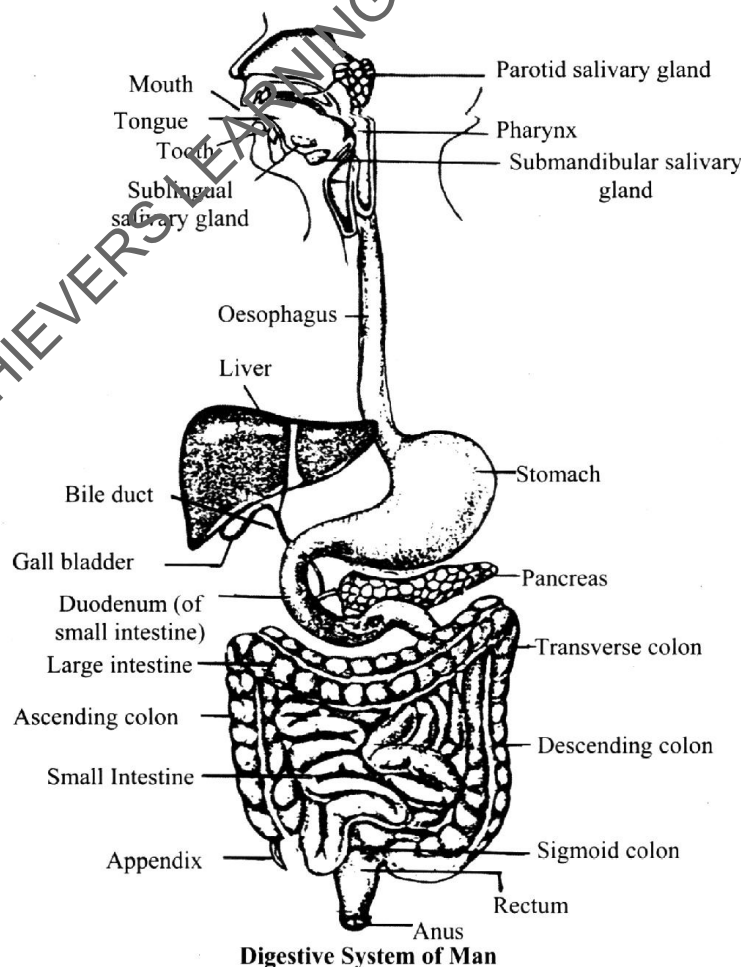
**b. Teeth:**

There are total 32 teeth in the buccal cavity of an adult human being.

Teeth are of four types:

Incisors (cutting teeth), canines (tearing teeth), premolars and molars (grinding teeth).

**Function:** Teeth masticate the food into small particles and help to mix food with saliva.



**iii. Pharynx:**

The buccal cavity leads to pharynx which is the meeting point of the digestive and respiratory systems. The opening of the respiratory system in pharynx is called glottis.

It is guarded by a cartilagenous flap called epiglottis.

**Functions:**

It prevents entry of food into the respiratory system.

Pharynx passes the food towards the oesophagus.

**iv. Oesophagus:**

It is a long, thin and narrow tube connecting pharynx to the stomach.

Its length is 25 cms.

It passes through the thoracic cavity, pierces the diaphragm and enters the stomach.

The food moves through the oesophagus due to the rhythmic contraction of longitudinal and circular muscles.

Oesophagus leads into stomach.

**Function:**

Mucus secreted by the epithelial cells in the inner lining helps in the smooth passage of food.

It pushes the food to the stomach.

v. **Stomach:**

It is a J-shaped, sac-like structure.

It is about 25 - 30 cms long organ.

It can be divided into three parts namely: cardiac, fundus and pyloric stomach.

Cardiac stomach is the first part in which oesophagus opens.

The middle part is called fundus and the last part is the pyloric stomach.

The pyloric stomach opens into the duodenum.

**Functions:**

It stores food.

There is partial digestion of protein component of food in stomach.

In stomach, food is mixed with gastric juice (HCl and enzymes) for its proper digestion.

It helps in mechanical churning and chemical digestion of food.

vi. **Sphincters:**

There are two types of sphincters present at both the ends of stomach.

a. **Cardiac sphincter:** The cardiac sphincter prevents the regurgitation of food, i.e. the passage of food back into the buccal cavity.

b. **Pyloric sphincter:** The pyloric sphincter regulates the passage of food into the duodenum of intestine.

vii. **Small Intestine:**

The stomach leads into a long, tubular, muscular, glandular and vascular structure called small intestine.

It is about 6 metres long and 2.5 cms broad tube, compactly coiled within abdominal cavity.

It has the following 3 regions: Duodenum, Jejunum, Ileum. ,

**Functions:** In small intestine, digestion of food and absorption of nutrients take place.

viii. **Large Intestine:**

a. The small intestine opens into large intestine.

b. Its length is about 1.5 metres.

c. It can be divided into two parts:

1. **Colon:** It is the anterior region and is differentiated into three parts: the ascending colon, the transverse colon and the descending colon.

**Function:** The colon is lined internally by mucosal cells which secrete mucus.

These cells make the passage of undigested materials easy.

2. **Rectum:** It is the posterior region of large intestine.

Undigested material known as faecal matter is stored in the rectum temporarily before it is expelled through the anus.

At the junction of the ileum and colon, there is a blind pouch called caecum. An elongated worm like vermiform appendix arises from the caecum.

**Function:** Faecal matter is stored for sometime in rectum and after that it is eliminated outside the body.

**Anus:** Rectum opens to the outside by the opening called anus. Anus is guarded by a sphincter.

**Function:** It removes undigested matter by the process of egestion.

**Q.5. Name the three parts of small intestine in man.**

**Ans:** Small intestine of man is distinguished into duodenum, jejunum and ileum.

**Q.6. Name the vestigial organ in the alimentary canal of man.**

**Ans:** Vermiform appendix is the vestigial organ in the alimentary canal of man.

**Q.7. How many total teeth are present in human buccal cavity?**

**Ans:** There are 32 teeth present in human buccal cavity.

**Q.8. In which part of the alimentary canal of man, there is no peristaltic movement?**

**Ans:** Pharynx is the part of the alimentary canal of man in which there is no peristaltic movement.

**Q.9. Name two types of intestinal glands of man.**

**Ans:** Crypts of Lieberkuhn and Brunner's glands.

**Q.10. Write a short note on small intestine.**

**Ans:** It is about 6 metres long and 2.5 cms broad tube.

It is present in coiled form in the abdominal cavity. These coils are held together by connective tissue membrane called mesenteries.

It consists of three parts: i. Duodenum ii. Jejunum iii. Ileum

**i. Duodenum:**

It is 'U' shaped and is about 25 cms long.

The bile duct and the pancreatic duct open into the duodenum.

**ii. Jejunum:**

It is about 2.5 metres long and narrower than the duodenum.

It is situated in between duodenum and ileum.

**iii. Ileum:**

It is about 3.5 metres long.

It is a little bit broader than the jejunum.

Histologically mucosa, the innermost layer of the small intestine is highly folded into numerous finger-like projections called villi.

Each villus is lined by columnar epithelium cells.

These cells have microvilli to increase the area of absorption.

The core of each villus has loose connective tissue with a central lymph vessel called lacteal.

It absorbs fat. There are a large number of capillaries in the core for absorption.

**Q.11. Explain the terms thecodont and diphodont.**

**Ans: i. Thecodont:** It is a condition in which teeth are embedded in socket of jaw bone.

**ii. Diphodont:** Milk teeth are replaced by permanent teeth in the adults. Two sets of teeth arise during lifetime in human beings.

**Q.12. What do you mean by heterodont condition?**

**Ans:** There are four different types of teeth in the buccal cavity of man, so it is called as heterodont condition.

**Q.13. What is meant by dentition?**

**Ans:** The study of teeth with respect to their number, arrangement, development, etc. is known as dentition.

**Q.14. Differentiate between small and large intestine.**

**Ans:**

No.	Small intestine	Large intestine
i.	It is about 6 meters long.	It is about 1.5 meters long.
ii.	Small intestine is 2.5 cms broad tube.	Large intestine is broader than the small intestine.
iii.	It is divided into three parts, as Duodenum, Jejunum, Ileum.	It is divided into two parts as – colon and rectum.
iv.	Absorbs the digested nutrients.	Takes part in absorption of water and minerals.
v.	Villi present.	Villi absent.
vi.	Digestion is completed in small intestine.	No role in digestion.

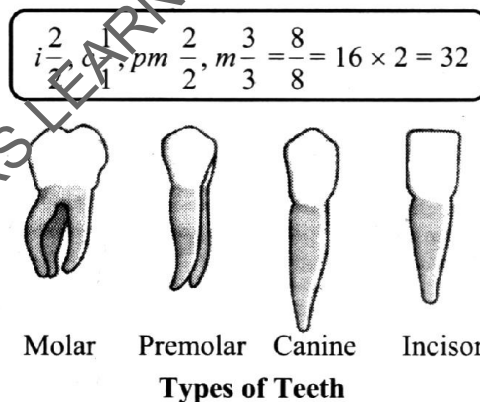
**Q.15. Describe in brief the various types of teeth in humans. Add a note on dental formula of man.**

**Ans: Teeth:** Teeth are of four different types namely:

- i. **Incisors (I):** They are used for biting and cutting.
- ii. **Canines (C):** They are helpful in tearing.
- iii. **Premolars (PM) and**
- iv. **Molars (M):** Premolars and molars are teeth used for grinding food.
- v. In children, there are 20 milk/deciduous teeth which are replaced by 32 permanent teeth.

**Dental formula of man:**

Human dentition in adult can be represented in the form of a formula called dental formula as follows:  
Each half of a jaw shows.



Thus, the total number of teeth in the upper jaw is 16 and that in the lower jaw is also 16.

Therefore, the total number of teeth in the buccal cavity is 32.

**Q.16. Describe various types of glands associated with digestive system. Also mention functions of these glands.**

**Ans: Digestive glands:** The various digestive glands associated with digestive system are salivary glands, liver and pancreas.

i. **Salivary glands:**

There are three pairs of salivary glands in the mouth cavity.

- a. **Sub-lingual glands:** These are present below the tongue.
- b. **Sub-mandibular/Submaxillary glands:** These are present below the lower jaw.
- c. **Parotid glands:** These are present in front of the ear.

The salivary glands have two types of secretory cells as: serous cells and mucous cells.

**Functions:**

The serous cells produce a watery fluid which contains the digestive enzyme salivary amylase or ptyalin.

The mucous cells produce mucous. It binds the food and makes it slippery, so that it can be easily swallowed.

The secretion of the salivary glands is called saliva.

ii. **Liver:**

It is the largest gland of the body.

It is a dark reddish brown highly vascular gland weighing about 1.5 kg in an adult.

It is located on the right side of the abdomen, just below the diaphragm in contact with the stomach. Structurally, it is divided into two unequal lobes, i.e. the right and the left lobe.

Cells of the liver produce the bile juice which is stored in a small bag-like structure called gall bladder.

**Functions of liver:**

- i. It secretes bile which emulsifies fats and food becomes alkaline.
- ii. It stores excess of glucose in the form of glycogen which is utilized during starvation.
- iii. Vitamin A, D, K and  $BI_2$  are synthesized in liver.
- iv. Prothrombin and fibrinogen produced by liver helps in blood clotting.
- v. Kupffer cells digest old RBCs.
- vi. It acts as haemopoietic organ. It produces red blood cells during early development

### iii. Pancreas:

It is a leaf-shaped gland lying in the gap between the duodenum and stomach.

Pancreas are actually made up of two parts, viz. exocrine and endocrine parts.

Exocrine parts: Its secretion is carried by ducts.

Endocrine parts: Its secretion is poured directly into the blood stream.

The exocrine part is made up of pancreatic lobules called acini.

These cells secrete the pancreatic juice.

The endocrine part is made up of groups of cells present in the connective tissue between the acini.

These are called Islets of Langerhans.

#### Functions:

- a.  $\alpha$  cells secrete glucagon and  $\beta$  cells secrete insulin.
- b. Glucagon and insulin together control blood sugar level.
- c.  $\delta$  cells secrete somatostatin hormone, which inhibits glucagon and insulin secretion.

### Q.17. Name the digestive glands.

- Ans: i. Salivary gland  
ii. Liver  
iii. Pancreas

### Q.18. Name the salivary glands found in man.

Ans: Parotid, submandibular, and sublingual salivary glands.

### Q.19. Differentiate between Salivary glands and gastric glands.

Ans:

No.	Salivary glands	Gastric glands
i.	These are multicellular glands opening into buccal cavity.	These are simple, tubular, branched or unbranched glands
ii.	Made up of two cells – serous cells and mucous cells.	Made up of three type of cells – chief cells, parietal cells, mucous cells.
iii.	These secretes saliva which is alkaline.	They secrete gastric juice which is acidic.
iv.	These glands secrete ptyalin or salivary amylase which digests starch into maltose.	These glands secrete pepsin which digest proteins into proteoses and peptones.

### Q.20. Write a short note on Islets of Langerhans.

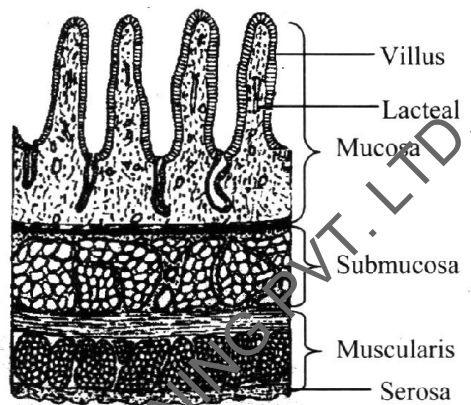
Ans: Islets of Langerhans:

- i. The endocrine part of pancreas is made up of groups of cells present in the connective tissue between the acini. These are called as Islets of Langerhans.
- ii. They are made up of alpha ( $\alpha$ ) cells and beta ( $\beta$ ) cells.
- iii.  $\alpha$  cells secrete glucagon and  $\beta$  cells secrete insulin.
- iv. Both these hormones together control the blood sugar level.
- v. They also consist of delta ( $\delta$ ) cells which secrete somatostatin hormone, which decreases glucagon and insulin secretion.

### Q.21. Sketch and label T.S. of intestine.

Ans:





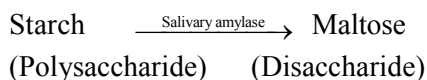
T. S. of Intestine

## 12.2 : Physiology of digestion :

**Q.22. Write a short note on digestion in the mouth.**

**Ans: Digestion in mouth (buccal cavity):**

- i. The food is broken down into small particles by mechanical activities like mastication, chewing, etc.
- ii. The tongue mixes the food with saliva secreted by the salivary glands.
- iii. Saliva is watery, it converts the food into a paste.
- iv. The saliva contains enzyme like salivary amylase or ptyalin. It acts on starch so as to convert it into maltose.
- v. A round food ball called bolus is formed which is then pushed into the oesophagus by the action of the tongue. The tongue presses food against the palate and pushes the bolus into the pharynx. This is called swallowing or deglutition.



**Q.23. What is peristalsis? How does it help in digestion?**

- Ans:**
- i. Peristalsis is a rhythmic wave of contractions and relaxation moving from pharynx and passing downwards into the oesophagus.
  - ii. It pushes the food downwards in the part of alimentary canal.
  - iii. It is produced by involuntary contraction of circular muscles preceded by contraction of longitudinal muscles and relaxation of circular muscles lining the gut.

**Q.24. What is responsible for vomiting?**

**Ans:** Reverse spasmodic peristalsis is responsible for vomiting.

**Q.25. Explain the process of digestion of food in the stomach of man.**

**OR**

**Describe the process of digestion of protein in stomach.**

**Ans: Digestion in stomach:**

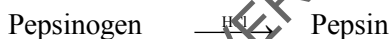
- i. The stomach chums the food by strong peristaltic movements. This is physical digestion. Food gets properly mixed with the gastric juice produced in the stomach.
- ii. The gastric glands start producing gastric juice as soon as the food enters the stomach.
- iii. Gastric juice contains dilute HCl, mucous and inactive protein digesting enzyme called pepsinogen.
- iv. HCl performs the following functions:
  - a. It stops the action of salivary amylase.
  - b. Provides the acidic medium required to convert inactive pepsinogen to active pepsin.
  - c. It kills the germs that may have come along with the food.
  - d. It helps to soften the food.

- v. Pepsin acts on proteins and converts them into simpler forms like peptones and proteoses.
- vi. Mucous forms a protective layer on the mucosa of the stomach to prevent the action of HCl.
- vii. Secretion of gastric juice is controlled by the sight, smell and taste of food.
- viii. After digestion in the stomach, food is converted into a semisolid mass called chyme. Acidic chyme travels into the duodenum through the pyloric sphincter.

**Q.26. Describe in detail the process of digestion which takes place in the small intestine.**

**Ans: Digestion in the small intestine:**

- i. In the duodenum, the secretions of the liver and pancreas are poured.
- ii. Secretion of liver is bile and secretion of pancreas is pancreatic juice.
- iii. Bile makes chyme alkaline by neutralization.
- iv. Bile juice is a yellowish green liquid.
- v. It contains water, cholesterol, bile salts and bile pigments.
- vi. Bile salts bring about emulsification of fats.
- vii. Bile pigments bilirubin and biliverdin are produced, as a result of breakdown of haemoglobin.
- viii. They give colour to faecal matter.
- ix. Bile also helps to neutralize the acidic chyme.

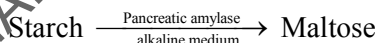


(inactive 'enzyme') (active enzyme)

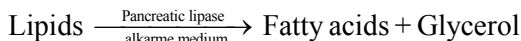


Pancreatic juice contains water, sodium salts and various enzymes. The action of various enzymes present in the pancreatic juice is as follows:

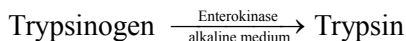
- i. Amylase acts on the starch to form maltose.



- ii. Lipase converts lipids into fatty acids and glycerol.



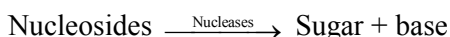
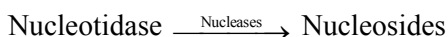
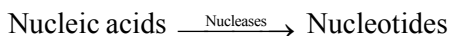
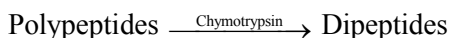
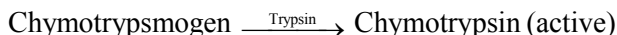
- iii. Inactive trypsinogen is converted to trypsin by enterokinase from intestinal juice.



- iv. Trypsin acts on proteins, peptones and proteoses to form polypeptides.



- v. Chymotrypsinogen is converted into active chymotrypsin by trypsin.



Intestinal juice or Succus entericus is secreted by the intestinal glands.

It contains many enzymes which act as follows:

- i. Enterokinase converts trypsinogen to trypsin and Chymotrypsinogen to chymotrypsin.
- ii. Maltase acts on maltose to form glucose.



- iii. Sucrase acts on sucrose to form glucose and fructose.



- iv. Lactose  $\xrightarrow{\text{lactase}}$  Glucose + Galactose



- v. Dipeptidase acts on dipeptides to form amino acids.  
 Dipeptides  $\xrightarrow{\text{Dipeptidase}}$  Amino acids
- vi. Emulsified fats are converted into fatty acids and glycerol by lipase.  
 Emulsified fats  $\xrightarrow{\text{lipase}}$  Fatty acids + Glycerol

At the end of digestion, chyme is converted into a liquid form called chyle which contains amino acids, glucose, fructose, fatty acids and glycerol. All these are the digested forms of carbohydrates, proteins and fats.

**Q.27. State the role of pancreatic juice in the digestion of proteins.**

**Ans:** Pancreatic juice, enzymes, substrates and the products:

Digestive Juice	Enzymes	Substrate	Product(s)
Pancreatic Juice	(a) Amylases	Starch, glycogen	Maltose
	(b) Trypsin	Proteins	Peptides
		Chymotrypsinogen (inactive)	Chymotrypsin (active)
	(c) Chymotrypsin	Casein (milk)	Paracasein (curd)
	(d) Lipase	Triglycerides	Monoglycerides, fatty acids
	(e) DNAase	DNA	Deoxyribonucleotides
	(f) RNAase	RNA	Ribonucleotides

**Q.28. Name the bile pigments produced after breakdown of haemoglobin.**

**Ans:** Bilirubin and biliverdin are the two bile pigments produced after breakdown of haemoglobin.

**Q.29. Bile juice contains no digestive enzymes, yet it is important for digestion. Why?**

**Ans:** Bile juice is the secretion of liver. It does not contain enzymes, but it helps in digestion in the following ways:

- It prepares food for action of pancreatic juice.
- It emulsifies fats.
- It neutralises the acidity of food and makes it alkaline.

**Q.30. Write a short note on Bile.**

- Ans:**
- Bile is a yellowish green liquid secreted from liver.
  - It is made up of water, cholesterol, bile salts and bile pigments.
  - Bile helps to neutralize the acidic chyme.
  - Bile salts bring about emulsification of fats.
  - Bile pigments, bilirubin and biliverdin are produced as a result of breakdown of haemoglobin.
  - Bile pigments give colour to the faecal matter.

**Q.31. State the functions of the following: Bile, HCl, Saliva, Insulin, Pepsin.**

**Ans: i. Bile:**

- Bile helps to neutralize acidic chyme.
- Bile salts bring about fat emulsification.
- Bile pigments give colour to the faecal matter.

**ii. HCl:**

- HCl stops the salivary amylase action.
- HCl provides acidic medium required to convert inactive pepsinogen to pepsin.
- It kills the germs that may have come along with the food.
- HCl softens the food.

**iii. Saliva:**

- Saliva is watery, it converts food into a paste.

- b. Saliva contains enzymes like salivary amylase or ptyalin, maltase.
- c. These enzymes act on carbohydrate component of food, i.e. starch.
- d. Ptyalin acts on starch and converts it into maltose.
- e. Mucus in saliva binds to food and makes it slippery.

**iv. Insulin:**

- a. Insulin controls blood sugar level of the body.

**v. Pepsin:**

- a. Pepsin acts on proteins and converts it to Peptones and Proteoses.

**Q.32. What would happen if HCl is not secreted in the stomach?**

- Ans.** i. In the absence of HCl, pepsinogen is not activated and converted into pepsin.  
 ii. Hence, no protein digestion takes place in stomach.  
 iii. Carbohydrate digestion continues.  
 iv. Bacteria in the stomach will not be killed.

**Q.33. What are gastrointestinal hormone?**

**Ans:** Gastrointestinal hormones are the hormones secreted by the endocrine cells found scattered in the mucosa of stomach and intestine.

**Q.34. Mention the gastrointestinal hormones and their effects.**

**Ans:**

No.	Hormone	Effects
i.	Gastrin	i. Increases secretion of HCl from gastric glands. ii. Increases secretion of pepsinogen.
ii.	Secretin	i. Stimulates secretion of water and bi-carbonate ions to form pancreatic juice.
iii.	Gastric inhibitory peptide (GIP)	i. It inhibits gastric secretion. ii. It inhibits motility of GI tract.
iv.	Cholecystokinin (CCK)	i. It stimulates contraction of gall bladder to release bile. ii. It stimulates secretion of bile from liver lobes.

## 12.3 : Absorption and assimilation :

**Q.35. Explain the process of absorption of food.**

- Ans:** i. The digested forms of food enter the blood in the inner lining of the digestive tract. This is called absorption.  
 ii. Water, inorganic salts and some glucose is absorbed by the inner wall of the stomach.  
 iii. Rest of the absorption is done by the small intestine.  
 iv. The villi increase the area of absorption.  
 v. Glucose and fructose are absorbed into the blood vessels.  
 vi. They are absorbed by osmosis, diffusion and active absorption.  
 vii. Amino acids are absorbed by the blood vessels.  
 viii. Fatty acids and glycerol are absorbed in the lymph capillaries or lacteals.  
 ix. They enter the lacteals and get absorbed in the lymph. From lacteals, they are carried to blood vessels.

**Q.36. What is egestion?**

**Ans:** Egestion is the process for removal of undigested semi-solid wastes, known as faeces from the body through the anus.

## 12.4 : Calorific value of nutrients :

**Q.37. Explain calorific value.**

- Ans:** i. Gross calorific value is the amount of energy which can be liberated either as heat or work by complete combustion of 1 g. food in a bomb calorimeter.
- ii. The actual energy produced by 1g of food is called as its physiological value.
- iii. Calorific value of carbohydrates, proteins and fats are as follows:

No.	Food component	Gross calorific value (K. cal/g)	Physiological value (K. cal/g)
i.	Fats	9.45	9.0
ii.	Proteins	5.65	4.0
iii.	Carbohydrates	4.1	4.0

## 12.5 : Nutritional Disorders :

**Q.38. What are deficiency diseases?**

- Ans:** i. If diet containing an inadequate amount of a nutrient is taken for a long time, deficiency of that nutrient appears-in the form of some disorder in the body.
- ii. The deficiency disorder affects the structure and function of the body parts which depend on that nutrient directly or indirectly.
- iii. These disorders produced by inadequate nutrients in the diet are called deficiency diseases.

**Q.39. What is Kwashiorkor?**

**Ans: Kwashiorkor:**

- i. It is a disease caused due to protein deficiency (both in quality and quantity).
- ii. It is the most widely spread kind of malnutrition.
- iii. It commonly affects infants and children between 1 to 3 years of age.

**Q.40. Give the common symptoms of kwashiorkor.**

**Ans: Symptoms:**

- i. The common symptoms of Kwashiorkor are underweight, stunted growth, poor brain development, loss of appetite, anaemia, protruding belly, slender legs and bulging eyes.
- ii. Oedema of lower legs and face, change in skin and hair colour may also occur in Kwashiorkor.

**Q.41. What are the causes of the disease Kwashiorkor?**

- Ans:** i. The basic cause of the disease is protein deficiency or inadequate diet due to ignorance and poverty.
- ii. Infectious diseases such as diarrhoea, measles, respiratory infections, intestinal worms which weaken the child can also cause Kwashiorkor.
- iii. There are some contributory factors for the disease like ill-spacing of children, large family, poor maternal health, early termination of breast feeding, late introduction of supplementary diet and adverse practices of child rearing such as the use of over-diluted cow's milk.

**Q.42. What is marasmus? Enlist the causes and symptoms of marasmus.**

**Ans:** Marasmus is the form of prolonged protein-energy malnutrition (PEM).

It affects infants under one year of age.

**Causes:**

- i. Marasmus is caused by simultaneous deficiency of proteins and total food calorie value that is deficiency of all nutrients.
- ii. It affects the infant, if mother's milk is replaced too early with foods having low protein content and caloric value.
- iii. This often happens when the mother conceives before her infant is ready for weaning.

**Symptoms:**

- i. Due to protein deficient diet, stored fats and tissue proteins are used as sources of energy. This impairs physical growth and retards mental development.
- ii. Subcutaneous fat disappears, ribs become very prominent. Fingers become thin and skin becomes dry, thin and wrinkled.
- iii. There is emaciation (extreme leanness) and loss of weight.
- iv. Digestion and absorption of food stops due to atrophy of digestive glands and intestinal mucosa. This leads to diarrhoea.
- v. There is no oedema observed.
- vi. Severe malnutrition impairs immune system and makes the victim very susceptible to respiratory and gastrointestinal infection. (eg. causing diarrhoea)
- vii. Severe wasting of muscles of a child.

**Q.43. Distinguish between Kwashiorkor and Marasmus.**

**Ans:**

No.	Kwashiorkor	Marasmus
i.	It is caused due to insufficient amount of proteins.	It is caused due to deficiency of fats, proteins and carbohydrates.
ii.	Oedema, fatty liver, lethargy are symptoms.	No oedema is observed. Thinning of limb is observed.
iii.	Loss of appetite is observed.	Infant is hungry in this disease.
iv.	It is observed in children of growing age.	It is observed in infants.

**Q.44. Define indigestion.**

**Ans:** Indigestion is a non-specific term that includes a variety of upper abdominal complaints including heart burn, regurgitation and dyspepsia.

**Q.45. Enlist the causes and treatment of indigestion.**

**Ans: Causes:**

- i. It occurs, as a consequence of acid reflux into the oesophagus from the stomach. This may occur due to a large meal or acid hypersecretion.
- ii. Some other factors include physical position, such as lying down, bending over, increased pressure on the stomach (tight clothes, obesity) and loss of lower oesophageal sphincter tone.

**Treatment/Prevention:**

Indigestion can be prevented by:

- i. avoiding large meals, smoking, alcohol and fatty food
- ii. reducing weight and
- iii. taking antacids.

**Q.46. Define constipation.**

**Ans:** Constipation is the decrease in the frequency of stools to less than one per week or difficulty in defecation which may result in abdominal pain, distortion and rarely perforation.

**Q.47. Enlist the causes and treatment of constipation.**

**Ans: Causes:**

- i. Some contributory factors may include inactivity, low fiber diet, etc.
- ii. It is also caused because of affected colonic mobility due to neurological dysfunction. e.g. Diabetes mellitus, spinal cord injury.

**Treatment/Prevention:**

Constipation may be prevented by:

- i. increased dietary fibres
- ii. increased fluid intake and
- iii. exercises

**Q.48. Write a short note on jaundice.**

**Ans:** Jaundice is a sign of abnormal bilirubin metabolism and excretion.

Eyes appear yellow because of build-up of a yellow brown pigment called bilirubin in the blood and skin. Bilirubin produced by the breakdown of haemoglobin, is usually conjugated. Bilirubin is water soluble and can be excreted.

Unconjugated bilirubin is fat soluble and has a toxic effect on the brain cells.

Serum bilirubin may rise to 40 to 50  $\mu\text{mol/l}$  before the yellow colouration of skin and conjunctiva is seen. (Normal value is 3 to 13  $\mu\text{mol/l}$ ),

**Causes:** Jaundice is not a disease but a condition.

Jaundice develops when there is

- i. an abnormality at some stage in the metabolic sequence caused by excess haemolysis of red blood cells with the production of more bilirubin than the liver can deal with.
- ii. obstruction to the flow of bile from the liver to the duodenum.
- iii. abnormal liver function.

**Effects:**

Effects of raised bilirubin include

- i. pruritus (itching) caused by the irritating effects of bile salts on the skin
- ii. pale face and
- iii. dark urine and whitish stool

**Treatment/Prevention:**

There is no specific drug to prevent jaundice. The treatment involves supportive care, bed rest and treatment of cause.

**Q.49. Write a short note on vomiting.**

**Ans:** i. Vomiting is the forceful expulsion of substances of stomach and upper intestinal tract through mouth.

ii. It is controlled by non-vital vomiting centre of medulla.

iii. Before vomiting, there is salivation, sweating, increased heart rate and feeling of nausea.

**Q.50. What are the causes and effects of diarrhoea?**

**Ans:** Diarrhoea is loose, watery stools. It is a serious problem, if diarrhoea continues for more than 2 days.

**Causes:**

- i. Acute diarrhoea is caused by bacterial, viral or parasitic infection.
- ii. Chronic diarrhoea is caused due to functional disorders such as irritable bowel syndrome or some intestinal disease.

**Effects:**

- i. Diarrhoea causes dehydration.
- ii. It causes lack of enough fluids and electrolytes (chemicals in salts including sodium, potassium and chloride) to function properly.

**Additional Theory Questions :**

Q.1. Define - digestion and assimilation. Refer Q.3. (ii) and (iv).

Q.2. Sketch and label the digestive system of man. Refer Q.4.

Q.3. State the function of the following:

- i. Teeth Refer Q.4. (ii) (b)
- ii. Tongue Refer Q.4. (ii) (a)
- iii. Rectum Refer Q.4. (viii) (2)

Q.4. Name the different types of teeth and their number in an adult human. Refer Q.14.

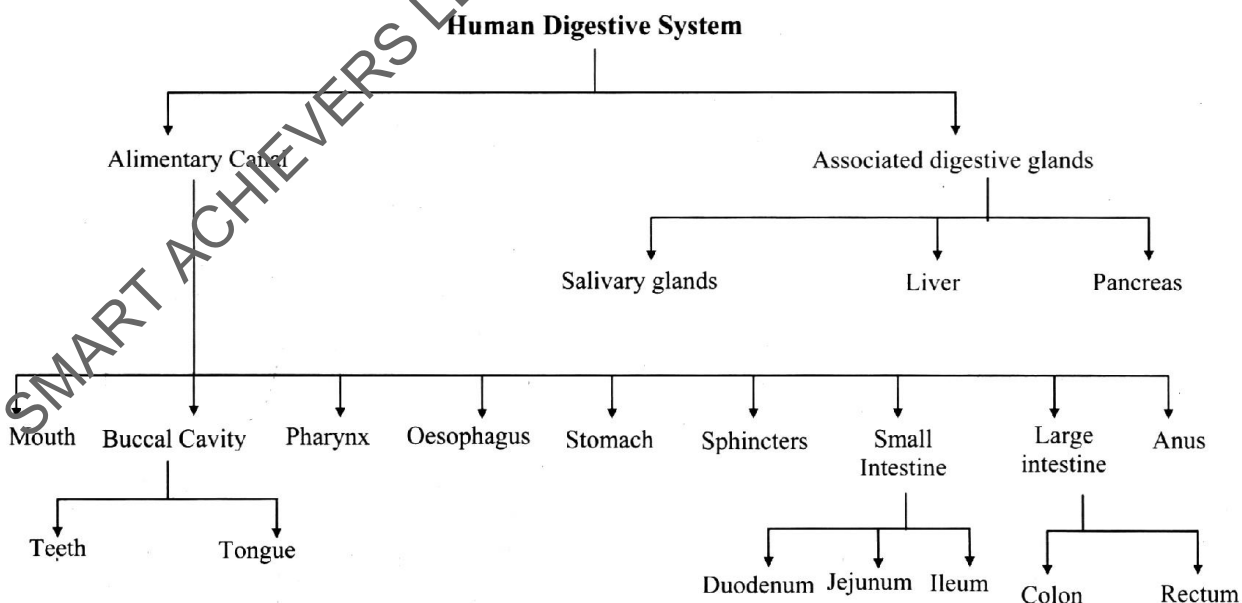
Q.5. Give dental formula of human beings. Refer Q.14.

Q.6. Name various types of digestive glands and mention their functions. Refer Q.16.

- Q.7. Write a short note on salivary glands. Refer Q.16. (i)  
 Q.8. What are the functions of liver? Refer Q.16. (ii)  
 Q.9. How does pepsinogen change into its active form? Refer Q.25. (v)  
 Q.10. What is digestion? Explain the process of digestion in the mouth cavity and stomach. Add a note on peristalsis. Refer Q.3. (ii), Q.22, 25 and Q.23.  
 Q.11. How are polysaccharides and disaccharides digested? Refer Q.22 and Q.26.  
 Q.12. Enlist the hormones of gastro-intestinal tract. Refer Q.34.

### Quick Review :

- Food provides energy to human beings.
- Nutrition involves several stages in which food is taken in (Ingestion), digested (digestion), absorbed (Absorption), utilized (Assimilation) and elimination of undigested food (egestion).
- The Human digestive system is represented by the chart given below:



- Each organ of the alimentary canal performs specified roles.
- The digestive glands secrete digestive juices, and enzymes which act on the food.
- There are several nutritional disorders seen in human beings. These include Marasmus, Kwashiorkor, Indigestion, Constipation, Jaundice, Diarrhoea and Vomiting.

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### Multiple Choice Question's

- The roof of buccal cavity is called
  - lingua
  - tongue
  - palate
  - maxilla
- How many canine teeth are there in a normal human adult?
  - 2
  - 3
  - 4
  - 1 or 2
- What is the human dental formula?
  - 1- 2/2, C - 1/1, PM - 2/2, M - 3/3
  - 1- 3/3, C - 2/2, PM - 1/1, M - 3/3
  - 1- 1/1, C - 3/3, PM - 2/2, M - III
  - 1- 2/2, C - 2/2, PM - 2/2, M - 3/3
- The common passage of air and food is called
  - pharynx
  - larynx
  - oesophagus
  - trachea
- The long, thin and narrow tube connecting pharynx to the stomach is called
  - Stomach
  - Alimentary canal
  - Oesophagus
  - Duodenum
- The length of small intestine is
  - 15 metres
  - 6 metres
  - 2 metres
  - more than 30 metres
- Many projections on the inner wall of small intestine function to
  - secrete digestive enzymes
  - increase surface area of absorption
  - hold products of digestion so they do not enter the large intestine
  - hold mucus so ulcers do not form
- Which of the following is a part of the large intestine?
  - Anus
  - Rectum
  - Ileum
  - Sphincter
- Main function of rectum is
  - absorption of water from the undigested matter
  - digestion and absorption of fats
  - temporary storage of undigested matters
  - both a) and c)
- Reabsorption of water takes place in the
  - stomach
  - large intestine
  - small intestine
  - oesophagus
- Vestigial organ of human body is
  - caecum
  - ileum
  - appendix
  - rectum
- Find the odd one out.
  - Parotid
  - Sub - lingual
  - Sub - maxillary
  - Acinar
- The name of salivary glands present in front of ear is
  - parotid
  - sub maxillary
  - sub lingual
  - parietal
- The largest gland of the human body is
  - pancreas
  - liver
  - salivary glands
  - thyroid
- Emulsification of fats is done by
  - saliva
  - gastric juice
  - bile
  - intestinal juice
- Kupffer cells are found in
  - Liver
  - Pancreas
  - Buccal cavity
  - Pharynx
- The cells present in pancreas secrete somatostatin hormone.
  - Alpha
  - Beta
  - Delta
  - Omega
- Salivary amylase brings about the digestion of
  - proteins
  - fats
  - carbohydrates
  - vitamins
- The enzyme in saliva that digests starch is
  - pepsin
  - amylase
  - rennin
  - maltase
- Gastric juice contains
  - $H_2SO_4$
  - HCl
  - ptyalin
  - bile
- \_\_\_\_\_ stops the activity of salivary amylase.
  - $H_2SO_4$
  - HCl
  - Pepsin
  - Protease
- Proteins are broken down into Peptones by the action of
  - Pepsin
  - Proteases
  - Trypsin
  - Peptidase
- Digestion in the small intestine occurs in
  - acidic medium
  - alkaline medium
  - neutral
  - isotonic solution
- \_\_\_\_\_ is produced as a result of breakdown of haemoglobin.
  - Bilirubin
  - Biliverdin
  - Chyme
  - Both a) and b)
- Acidic medium of chyme is made alkaline by
  - succus entericus
  - pancreatic juice
  - bile
  - all of these

26. Secretions of pancreas help to digest  
a) proteins                      b) fats  
c) carbohydrates              d) all of these
27. Glucose is stored in the form of glycogen in  
a) stomach                      b) intestine  
c) liver                          d) pancreas
28. Succus entericus is the name given to  
a) a junction between ileum and large intestine  
b) intestinal juice  
c) swelling in the gut  
d) appendix
29. End product of fat digestion is  
a) fatty acids only  
b) glycerol only  
c) fatty acids and glycerol  
d) none of these
30. One gram of fat produces  
a) 4.1 k.cal/g of chemical energy.  
b) 9.45 k.cal/g of chemical energy  
c) 7.0 k.cal/g of chemical energy  
d) 5.0 k.cal/g of chemical energy
31. Protein deficiency in children causes  
a) kwashiorkor                  b) gigantism  
c) dwarfism                      d) jaundice
32. Protruding belly is a characteristic symptom of  
a) Marasmus                    b) Diarrhoea  
c) Jaundice                      d) Kwashiorkor
33. Among the following, which is a symptom of constipation?  
a) Loose motion  
b) Difficulty in defecation  
c) Vomiting  
d) Yellowing of eyes
34. Jaundice is caused due to  
a) abnormal bilirubin metabolism  
b) abnormal carbohydrate metabolism  
c) abnormal biliverdin metabolism  
d) abnormal protein metabolism
35. Normal value of serum bilirubin in a healthy person is  
a) 1-1313  $\mu\text{mol/l}$               b) 2-132  $\mu\text{mol/l}$ .  
c) 6-12  $\mu\text{mol/l}$                   d) 3 to 13  $\mu\text{mol/l}$
36. Vomiting is caused due to  
a) peristalsis  
b) reverse epistasis  
c) reverse spasmodic peristalsis  
d) osmosis
37. Gastric juice contains  
a) pepsin, lipase and rennin  
b) trypsin, lipase and rennin  
c) trypsin, pepsin and lipase  
d) trypsin, pepsin and rennin

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### Answer Keys

1. c)	2. c)	3. a)	4. a)	5. c)	6. b)	7. b)	8. b)	9. d)	10. b)
11. c)	12. d)	13. a)	14. b)	15. c)	16. a)	17. c)	18. c)	19. b)	20. b)
21. b)	22. a)	23. b)	24. d)	25. d)	26. d)	27. c)	28. b)	29. c)	30. b)
31. a)	32. d)	33. b)	34. a)	35. d)	36. c)	37. a)			



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