CHAPTER › 16

Digestion and Absorption

NEET KEY NOTES

- The basic requirement of all living beings is food. The major components of food are **carbohydrates, fats** and **proteins**. **Vitamins**, **minerals** and **water** are also required but in small quantities.
- **Digestion** is the process by which the complex food substances are broken down and converted into simpler forms through hydrolysis then absorbed by mechanical and biochemical methods in the digestive system.

Digestive System

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

I. Alimentary Canal

The anterior opening of alimentary canal is **mouth** and the posterior opening is the **anus**. Alimentary canal consists of different structures which are described below

1. Oral Cavity

- It is the cavity which opens through mouth and contains teeth and a muscular tongue.
- **Teeth** are for grasping and mastication of food. In humans these are described as follows
  - **Thecodont** as each tooth is embedded in a socket of jaw bone.
  - **Diphyodont** as two sets of teeth appear during life, milk or deciduous teeth and permanent or adult teeth.
  - **Heterodont** as different types of teeth are present in the dentition. These are differentiated into **incisors**, **canines**, **premolars** and **molars**. These enable mastication of food. Dental formula of teeth in human is $\frac{2123}{2123}$.
- **Tongue** is a muscular movable organ attached to the floor of the buccal cavity through an attachment called **frenulum**. Small projections called **papillae** are present all over the surface of the tongue. Some of the papillae bears taste buds.

2. Pharynx

- The buccal or oral cavity is followed by the pharynx, which serves as the common passage of **air** and **food**.
- During swallowing, the entry of food into the opening of windpipe, i.e. glottis is prevented by epiglottis.

3. Oesophagus

- The oesophagus is a thin and long tube which opens into a J-shaped structure, i.e. the stomach and this opening is regulated by gastro-oesophageal sphincter.

4. Stomach

- It is located in the upper left portion of the abdominal cavity. The four major parts of stomach are **cardiac, fundic, body** and **pyloric**.
- The cardiac portion receives the opening of oesophagus whereas the pyloric portion opens into the duodenum (first part of small intestine). This opening is guarded by the pyloric sphincter.

5. Small Intestine

- It has three regions, i.e. 'C'-shaped duodenum, middle jejunum and the highly coiled ileum, which opens into the large intestine.

6. Large Intestine

- It has a shorter length than the small intestine, but it is called large because it has a wider in diameter than the small intestine. It consists of the following parts

- **Caecum** It is the small blind sac which hosts symbiotic microorganisms. A vestigial organ, i.e. vermiform appendix arises from it.
- **Colon** It is divided into ascending, transverse, descending and sigmoid parts.
- **Rectum** It is the end portion of colon which opens into anus.

- The wall of alimentary canal from oesophagus to rectum possesses four layers which are as follows
  - **Serosa** It is made up of thin mesothelium and some connective tissues.
  - **Muscularis** It is formed by smooth muscles arranged as inner circular and outer longitudinal layer. Oblique muscles may be found at some regions.
  - **Submucosa** It is formed of loose connective tissues containing nerves, blood and lymph vessels and in some areas, glands.
  - **Mucosa** It is the innermost lining which forms irregular folds, rugae, in stomach and small finger-like foldings, **villi** in small intestine. The cells lining the villi produce **microvilli** which increase the surface area of small intestine. Villi of small intestine are supplied by capillaries and a large lymph vessel, lacteal.
    Mucosa possesses
    - mucus secreting goblet cells,
    - crypts of Lieberkuhn in intestine.

II. Digestive Glands

The digestive glands associated with the alimentary canal are as follows

1. Salivary Glands

In humans, these are present in three pairs, i.e. the **parotids** (cheek), the **sub-maxillary/sub-mandibular** (lower jaw) and the **sublingual** (below the tongue) which secrete and pour salivary juice into the buccal cavity.

2. Liver

- It is the largest gland of the body weighing about 1.2-1.5 kg in an adult human. It is located in the upper right section of the abdominal cavity.
- It is divided into two lobes, i.e. right and left lobes separated by falciform ligament. Each lobe is further divided into hepatic lobules.
- The hepatic lobules are the structural and functional units of liver containing hepatic cells arranged in the form of cords. Each lobule is covered by a thin connective tissue sheath called the **Glisson's capsule**.
- The bile secreted by the hepatic cells passes through the hepatic ducts and is stored in the **gall bladder**.
- The bile duct and the pancreatic duct open together into the duodenum as the common hepatopancreatic duct which is guarded by a sphincter called **sphincter** of **Oddi**.

3. Gastric Glands

- These are microscopic, tubular glands formed by the epithelium of the stomach. These contain chief cells, oxyntic cells, mucous cells and endocrine cells (G cells and Argentaffin cells).

4. Pancreas

- It is a compound organ containing both exocrine and endocrine parts situated between the C-shaped duodenum. The **exocrine** part secretes an alkaline pancreatic juice containing enzymes and the **endocrine** part secretes hormones, i.e. insulin and glucagon.

Digestion of Food

It occurs by mechanical and chemical processes in various organs which are as follows

1. **Buccal cavity** Food is masticated and mixed with mucus in saliva to form **bolus**. It is passed down to the pharynx and oesophagus by **deglutition**.
   Chemical processing of food in buccal cavity
   - Salivary amylase presents in saliva hydrolyses carbohydrates (e.g. starch) into disaccharides (e.g. maltose) at pH 6.8.
   - Lysozyme in saliva is an antibacterial agent which prevents infections.
2. The food passses down through the **oesophagus**, by peristalsis, into the stomach.
3. **Stomach** Food is mixed with acidic gastric juice by churning movements of muscular walls so as to form **chyme**.
   Chemical Processing of Food in Stomach
   It can be summarised as

$$\underset{\text{(Proenzyme)}}{\text{Pepsinogen}} \xrightarrow{\text{HCl}} \underset{\text{(Active) enzyme}}{\text{Pepsin}}$$

$$\text{Proteins} \longrightarrow \text{Proteoses} + \text{Peptones}$$

Roles of other chemicals in stomach are tabulated below

Mucus and Bicarbonates	Lubricate and protect mucosal epithelium from excoriation by HCl.
HCl	Provides acidic pH (1.8) which is optimal for pepsin.
Renin	Helps in digestion of milk proteins in infants.
Lipase	Converts triglycerides to diglycerides.

4. **Small intestine** exhibits various movements which help in mixing up of food with intestinal secretions like pancreatic juice, bile and intestinal juice.
   - **Pancreatic juice** contains inactive enzymes like trypsinogen, chymotrypsinogen, lipases, nucleases, amylase and procarboxypeptidases.
     - All pancreatic enzymes are activated by trypsin, which itself is the activated form of trypsinogen

$$\underset{\text{(Inactive)}}{\text{Trypsinogen}} \xrightarrow{\text{Enterokinase}} \underset{\text{(Active)}}{\text{Trypsin}} \longrightarrow \text{Activate other Pancreatic enzymes}$$

   - **Bile** contains bile pigments (bilirubin and biliverdin), bile salts, cholesterol and phospholipids but does not contain any enzyme. It helps in the emulsification of fats and activation of lipases.
   - **Intestinal juice** or **succus entericus** is formed by the secretions of brush border cells of **mucosa** and **goblet cells**.
     - It contains enzymes like lipases, dipeptidases, disaccharidases, nucleosidases, etc.
     - Mucus, bicarbonates and submucosal, (Brunner's) gland protect intestinal mucosa and provide alkaline pH 7.8 for enzymatic activities.

Major Enzymes Involved in Digestion of Carbohydrate, Protein, Fat and Nucleic Acids

Site of action (Enzyme)	Substrate (Food)	Main breakdown product
Carbohydrate Digestion		
• Mouth –Salivary glands (Salivary amylase)	• Polysaccharides	• Disaccharides
• Small intestine – Pancreas (Pancreatic amylase)	• Polysaccharides	• Disaccharides
• Small intestine (Disaccharidases, e.g. maltase)	• Disaccharides	• Monosaccharides (e.g. glucose)
Protein Digestion		
• Stomach – Stomach mucosa (Pepsin)	• Proteins	• Peptide fragments
• Small intestine – Pancreas (Trypsin and chymotrypsin)	• Proteins and polypeptides	• Peptide fragments
• Small intestine – Pancreas (Carboxypeptidase)	• Peptide fragments	• Amino acids
• Small intestine – Intestinal mucosa (Amino peptidase)	• Peptide fragments	• Amino acids
Fat Digestion		
• Small intestine – Pancreas (Lipase)	• Triglycerides	• Free fatty acids and monoglycerides
Nucleic Acid Digestion		
• Small intestine – Pancreas (Pancreatic nucleases)	• DNA and RNA	• Nucleotides
• Small intestine – Intestinal mucosa (Intestinal nucleases)	• Nucleotides	• Nucleotide bases and monosaccharides

   - The simple substances are absorbed in the jejunum and ileum.
   - The undigested substances are passed on to the large intestine.
5. **In large intestine,** absorption of water, minerals and certain drugs occurs.
   - Mucus is secreted to adhere the waste particles together and lubricate it for easy passage.
   - Faecal matter enters into the caecum through ileo-caecal valve and is then defecated through anus.

Regulation of Digestion Process

- The activities of the gastro-intestinal tract are under neural and hormonal control.
- Salivary, gastric and intestinal secretions are stimulated by neural signals.
- The muscular activities of different parts of alimentary canal are also moderated by neural mechanisms, both local and through CNS.
- Local hormones produced by gastric and intestinal mucosa further control the secretion of digestive juices.

Calorific Fuel Value

- It is the amount of energy liberated during complete combustion of 1 g of food.
- It is measured in bomb calorimeter (a closed metal chamber filled with O_2).
- For carbohydrates, gross energy or per gram calorific value is 4.1 kcal/g.
- For fats, the gross calorific value is 9.45 kcal/g.
- For proteins, gross calorific value is 5.65 kcal/g.
- According to these calorific values of different nutrients, fats have the highest calorific fuel value.

Absorption of Digested Food

- Absorption is the process by which end products of digestion pass through the intestinal mucosa into the blood or lymph.
- The various mechanisms by which absorption occur have been tabulated below

Process	Absorbed substances
Simple diffusion	Monosaccharides (glucose) amino acids, electrolytes (chloride ions)
Facilitated transport through carrier proteins	Glucose, amino acids
Osmosis	Water
Active transport	Glucose, sodium ions, amino acids

- Fatty acids and glycerol are absorbed after being incorporated into micelles which are reformed into small protein coated chylomicrons and are transported into the lacteals of the villi.

Summary of Absorption in Different Parts of Digestive System

Digestive Parts	Absorption
Mouth	Certain drugs coming in contact with the mucosa of mouth and lower side of the tongue are absorbed into the blood capillaries lining them.
Stomach	Absorption of water, simple sugars and alcohol, etc., takes place.
Small Intestine	Principal organ for absorption of nutrient. The digestion is completed here and the final products of digestion such as glucose, fructose, fatty acids, glycerol and amino acids are absorbed through the mucosa into the blood stream and lymph.
Large Intestine	Absorption of water, some minerals and drugs takes place.

- The absorbed substances finally reach the tissues where the nutrients are to be utilised and this process is called **assimilation**.
- The digestive waste gets solidified in the rectum and is egested outside through the anal opening by mass peristaltic movement.

Disorders of Digestive System

These are divided into following two types, i.e. deficiency diseases and digestive disorders.

Description of Nutritional and Digestive Disorders

Disorders	Description
Protein Energy Malnutrition (PEM)	• **Kwashiorkor** (usually observed in children of the age group of 1-5 years). Symptoms include thin limbs, retarded growth of body and brain, swelling of legs due to the retention of water (oedema), reddish hair, pot belly and diarrhoea. • **Marasmus** (it usually affects infants below age of one year). Symptoms include impaired growth and replacement of tissue proteins, thin limbs and prominent ribs (very less fat in the body), wrinkled (dry) and thin skin, diarrhoea.
Jaundice	• It is also known as **icterus**, i.e the yellowness of the skin, mucosa membranes and eyes. This happens due to abnormal functioning of the liver which causes accumulation of excess quantity of bilirubin in the blood.
Vomiting	• Ejection of stomach content through mouth, controlled by vomit centre in medulla.
Diarrhoea	• Abnormal frequency of bowel movement with increased liquidity of faecal discharge that reduces absorption of food.
Constipation	• Retention of faeces in rectum with irregular bowel movement.
Indigestion	• Improper digestion of food leading to the feeling of fullness caused due to inadequate enzyme secretion, anxiety, food poisoning, overeating, etc.

Mastering NCERT

MULTIPLE CHOICE QUESTIONS

TOPIC 1 ~ *Digestive System*

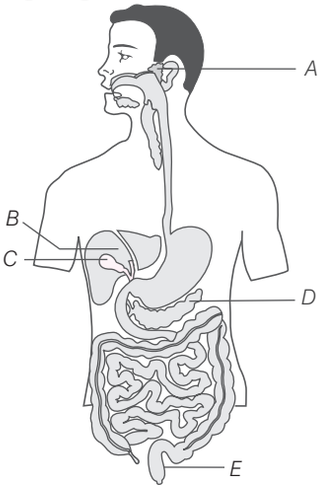
(Alimentary Canal and Digestive Glands)

1 All the listed components of food are required in major quantity except
(a) vitamins (b) carbohydrates
(c) proteins (d) fats

2 The process of digestion in our digestive system involves
(a) conversion of complex substances into simpler form
(b) absorption of monomers by the body
(c) conversion of monomers into polymers
(d) absorption of water and food

3 Digestion in the digestive system of humans is accomplished by
(a) mechanical and chemical processes
(b) chemical processes only
(c) mechanical processes only
(d) None of the above

4 Refer to the figure given below.



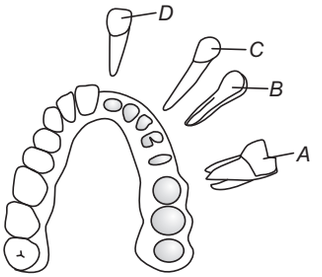
Select the option which correctly identifies *A, B, C, D* and *E*.

(a) A–Parotid gland, B–Pancreas, C–Gall bladder, D–Stomach, E–Anus
(b) A–Parotid gland, B–Liver, C–Pancreas, D–Stomach, E–Anus
(c) A–Parotid gland, B–Liver, c–Gall bladder, D–Pancreas, E–Rectum
(d) A–Parotid gland, B–Gall bladder, C–Pancreas, D–Stomach, E– Rectum

5 Which one of the following terms describes human dentition? ***NEET 2018***

(a) Pleurodont, Monophyodont, Homodont
(b) Thecodont, Diphyodont, Heterodont
(c) Thecodont, Diphyodont, Homodont
(d) Pleurodont, Diphyodont, Heterodont

6 The given schematic diagram depicts heterodont teeth and its thecodont arrangement. Find the correct labelling for *A-D* from the options given below.



(a) A–Incisor, B–Canine, C–Premolar, D–Molar
(b) A–Molar, B–Premolar, C–Canine, D–Incisor
(c) A–Incisor, B–Premolar, C–Canine, D–Molar
(d) A–Molar, B–Premolar, C–Incisor, D–Canine

7 A baby boy aged two years is admitted to play school and passes through a dental checkup. The dentist observed that the boy had twenty teeth. Which teeth were absent? ***NEET 2017***

(a) Incisors (b) Canines
(c) Premolars (d) Molars

8 The primary dentition in human differs from permanent dentition not having one of the following type of teeth. ***CBSE-AIPMT 2015***

(a) Canine (b) Premolar
(c) Molar (d) lncisor

9 What is the dental formula of human being?

(a) $\frac{2123}{2123}$ (b) $\frac{2213}{2213}$ (c) $\frac{2114}{2114}$ (d) $\frac{2122}{2122}$

10 How many deciduous teeth are present in humans?

(a) 22 (b) 24 (c) 20 (d) 18

11 The hard chewing surface of teeth is made up of

(a) dentine (b) enamel
(c) teeth (d) bone

12 Frenulum is

(a) the fold by which tongue is attached to the floor of oral cavity
(b) an adenoid present on pharyngeal wall
(c) a tonsil-like structure on the lateral walls of palate
(d) a V-shaped furrow which divides the surface of tongue

13 Small projections found on the upper surface of tongue are called

(a) frenulum (b) taste buds
(c) sulcus terminals (d) papillae

14 Which one serves as a passage for both food and air?

(a) Larynx (b) Pharynx
(c) Gullet (d) Glottis

15 During intake of food, the entry of food into the glottis (opening of windpipe) is prevented by

(a) Glottis itself
(b) air present in windpipe
(c) annular rings of pharynx
(d) epiglottis

16 Length of oesophagus is ***JIPMER 2019***

(a) 25 cm (b) 55 cm
(c) 33 cm (d) 45 cm

17 Opening of oesophagus into 'J'-shaped, bag-like structure is regulated by

(a) pyloric sphincter
(b) sphincter of Oddi
(c) ileocaecal sphincter
(d) gastro-oesophageal sphincter

18 What is the another name of gastro-oesophageal sphincter?

(a) Pyloric sphincter (b) Gastro-duodenal sphincter
(c) Cardiac sphincter (d) Sphincter of Oddi

19 Except the body of stomach, its three major parts, starting from oesophageal end to intestinal end are

(a) cardiac, fundic, pyloric (b) fundic, cardiac, pyloric
(c) pyloric, cardiac, fundic (d) pyloric, fundic, cardiac

20 Name that part of small intestine in which the pyloric region of stomach opens?

(a) Duodenum (b) Ileum
(c) Jejunum (d) Glomerulus

21 Peyer's patches are present in ***JIPMER 2018***

(a) iIeum (b) jejunum
(c) duodenum (d) sacculus rotundus

22 Which part of small intestine opens into large intestine?

(a) Glomerulus (b) Jejunum
(c) Ileum (d) Duodenum

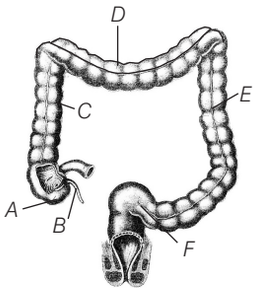
23 Which one is not a part of large intestine?

(a) Rectum (b) Caecum
(c) Ileum (d) Colon

24 A blind sac in large intestine from which a vestigial organ arises is

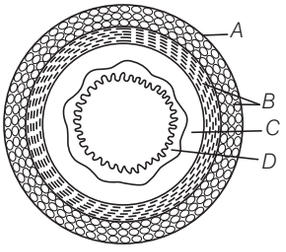
(a) vermiform appendix (b) ileum
(c) caecum (d) colon

25 Diagram of large intestine is given below. Identify the parts *A, B, C, D, E* and *F*. ***AIIMS 2018***



(a) A–Sigmoid colon, B–Vermiform appendix, C–Ascending colon, D–Transverse colon, E–Descending colon, F–Caecum
(b) A–Caecum, B–Vermiform appendix, C–Sigmoid colon, D–Ascending colon, E–Transverse colon, F–Descending colon
(c) A–Caecum, B–Vermiform appendix, C–Ascending colon, D–Transverse colon, E–Descending colon, F–Sigmoid colon
(d) A–Sigmoid colon, B–Vermiform appendix, C–Descending colon, D–Transverse colon, E–Ascending colon, F–Caecum

26 Given below is the diagram of the transverse section of alimentary canal. Label it correctly and choose the correct option accordingly.



(a) A–Muscularis, B–Serosa, C–Submucosa, D–Mucosa
(b) A–Muscularis, B–Serosa, C–Mucosa, D–Submucosa
(c) A–Serosa, B–Muscularis, C–Mucosa, D–Submucosa
(d) A–Serosa, B–Muscularis, C–Submucosa, D–Mucosa

27 Choose the incorrect pair with respect to the composition of alimentary canal's layers.

(a) Serosa — Thin mesothelium
(b) Muscularis — Smooth muscles (circular and longitudinal)
(c) Submucosa — Perforated myothelium
(d) Mucosa — Rugae/villi/microvilli

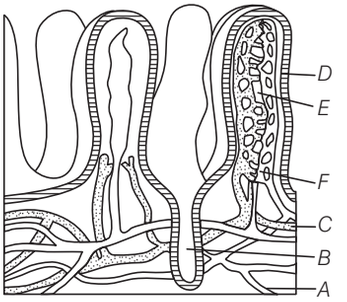
28 Out of the four layers of the alimentary canal, which one forms villi, (finger-like projections)?

(a) Serosa (b) Mucosa
(c) Submucosa (d) Muscularis

29 The innermost layer of human gut forms irregular folds in the stomach, which are known as

(a) lumen (b) villi
(c) rugae (d) Both (b) and (c)

30 Label the given diagram of transverse section of mucosa of small intestine showing small finger-like projections. Choose the correct option accordingly.



(a) A–Vein, B–Crypt, C–Artery, D–Villi, E–Lacteal, F–Capillaries
(b) A–Artery, B–Crypt, C–Vein, D–Villi, E–Capillaries, F–Lacteal
(c) A–Vein, B–Artery, C–Crypt, D–Villi, E–Capillaries, F–Lacteal
(d) A–Villi, B–Lacteal, C–Capillaries, D–Artery, E–Crypt, F–Vein

31 Identify the cells whose secretion protects the lining of gastrointestinal tract from various enzymes.

(a) Goblet cells (b) Oxyntic cells ***NEET 2019***
(c) Duodenal cells (d) Chief cells

32 Which cell is found in mucus secreting organs?

(a) Goblet cells (b) Paneth cells ***AIIMS 2019***
(c) Oxyntic cells (d) Peptic cells

33 Crypts of Lieberkuhn are found

(a) in large intestine
(b) in the rugae of stomach
(c) at the tip of villi in small intestine
(d) at the base of villi in small intestine

34 Which cells of 'Crypts of Lieberkuhn' secrete antibacterial lysozyme? ***NEET 2017***

(a) Argentaffin cells (b) Paneth cells
(c) Zymogen cells (d) Kupffer cells

35 Salivary glands are located in

(a) cheeks and upper jaw
(b) lower jaw, cheeks and below the tongue
(c) below the tongue and behind the wisdom tooth
(d) below the tongue and upper jaw

36 Which one is not associated with the secretion of saliva in human being?
(a) Parotid glands
(b) Sublingual glands
(c) Zymogenic cells
(d) Submaxillary glands

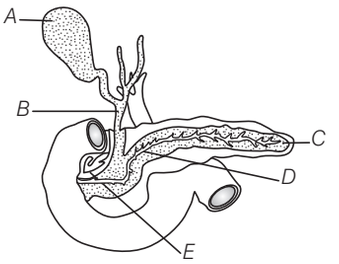
37 Salivary glands pour their secretion into
(a) stomach
(b) blood
(c) buccal cavity
(d) intestine

38 Which is the largest gland of human body?
(a) Gastric gland
(b) Pancreas
(c) Liver
(d) Salivary gland

39 Bile juice is stored in which organ of human body?
(a) Gall bladder
(b) Liver
(c) Kidney
(d) Pancreas

40 Common bile duct is formed by the fusion of
(a) pancreatic duct and cystic duct
(b) pancreatic duct and hepatic duct
(c) pancreatic duct, hepatic duct and cystic duct
(d) hepatic duct and cystic duct

41 The diagram given below represents the duct system of the pancreas, liver and gall bladder. Label the diagram from *A* to *E*.



(a) A–Gall bladder, B–Common bile duct, C–Hepatopancreatic duct, D–Pancreas, E–Pancreatic duct
(b) A–Gall bladder, B–Bile duct, C–Hepatopancreatic duct, D–Pancreatic duct, E–Pancreas
(c) A–Gall bladder, B–Bile duct, C–Pancreatic duct, D–Pancreas, E–Hepatopancreatic duct
(d) A–Gall bladder, B–Common bile duct, C–Pancreas, D–Pancreatic duct, E–Hepatopancreatic duct

42 Which of the following guards the opening of hepatopancreatic duct into the duodenum? ***NEET 2016***
(a) Ileocaecal valve (b) Pyloric sphincter
(c) Sphincter of Oddi (d) Semilunar valve

43 The exocrine portion of pancreas secretes
(a) pancreatic juice (b) insulin
(c) glucagon (d) somatostatin

TOPIC 2 ~ *Digestion of Food*

44 Masticated food particles mixed with saliva form
(a) succus entericus (b) bolus
(c) chyme (d) Both (b) and (c)

45 Name the process by which swallowed food is conveyed to pharynx and oesophagus.
(a) Deglutition (b) Peristalsis
(c) Ingestion (d) Succus entericus

46 Choose the most appropriate option to describe the composition of human saliva.
(a) Amylase, hydrolase
(b) Electrolytes, amylase, lysozymes and mucus
(c) Amylase/Ptyalin, mucus
(d) Ptyalin only

47 The biomolecule which is hydrolysed by the enzyme salivary amylase is
(a) protein (b) lipid
(c) carbohydrate (d) nucleic acid

48 Which food component gets 30% hydrolysed in mouth ?
(a) Starch (b) Protein
(c) Fats (d) Nucleic acids

49 What is the pH of human saliva?
(a) 7.0 (b) 7.5
(c) 6.8 (d) 6.0

50 By the action of salivary amylase, the starch gets converted to
(a) glucose (b) fructose
(c) cellulose (d) maltose

51 Lysozyme, one of the constituents of the saliva of human beings acts like
(a) antibacterial agent (b) zymogen
(c) amylase (d) lipase

52 In the stomach, gastric acid is secreted by the ***NEET 2016***
(a) parietal cells
(b) peptic cells
(c) acidic cells
(d) gastrin secreting cells

53 The gastric glands which secrete proenzyme pepsinogen are
(a) mucus neck cells (b) chief cells
(c) parietal cells (d) oxyntic cells

54 Which of the following gastric cells indirectly help in erythropoiesis? ***NEET 2018***

(a) Goblet cells (b) Mucous cells
(c) Chief cells (d) Parietal cells

55 What name would you suggest for a thoroughly mixed food with the gastric juices by the churning movements of the muscular stomach wall?

(a) Bolus (b) Chyme
(c) Either bolus or chyme (d) None of these

56 Pepsinogen (inactive form) is converted into active form of enzyme pepsin with the help of which of the following compounds?

(a) Proenzyme (b) Hydrochloric acid
(c) Electrolyte (d) Bicarbonates

57 HCl is highly acidic (1.5-2.0 pH) in the stomach. However, the epithelium of the mucosa remains unaffected/undissolved. Why?

(a) Mucus continues to lubricate the inner lining
(b) Bicarbonates present in the gastric juices protect the linings
(c) Both (a) and (b)
(d) None of the above

58 Which enzyme is responsible for the digestion of milk in infants?

(a) Pepsin
(b) Trypsin
(c) Rennin
(d) Various proteolytic enzymes

59 Gastric juice of infants contains ***CBSE-AIPMT 2015***

(a) maltase, pepsinogen, rennin
(b) nuclease, pepsinogen, lipase
(c) pepsinogen, lipase, rennin
(d) amylase, rennin, pepsinogen

60 The initial step in the digestion of milk in humans is carried out by ***CBSE-AIPMT 2014***

(a) lipase (b) trypsin (c) rennin (d) pepsin

61 The secretions released into the small intestine are

(a) bile and pancreatic juice
(b) succus entericus only
(c) pancreatic juice, bile and intestinal juice
(d) pancreatic juice and intestinal juice

62 The enzyme enterokinase secreted by intestinal mucosa helps in the conversion of

(a) caseinogen into casein
(b) trypsinogen into trypsin
(c) pepsinogen into pepsin
(d) proteins into polypeptides

63 All the inactive enzymes of the pancreatic juice are activated by

(a) trypsin (b) cholecystokinin
(c) bilirubin (d) pepsin

64 What is the composition of bile?

(a) Bile pigments and bile salts
(b) Bile pigments and cholesterol
(c) Cholesterol and phospholipids
(d) All of the above

65 Bile is composed of bile salts and bile pigments which are

(a) sodium glycocholate, taurocholate and bilirubin, biliverdin, respectively
(b) bilirubin, biliverdin and sodium glycocholate, taurocholate, respectively
(c) sodium glycocholate, taurocholate and bilirubin, respectively
(d) sodium glycocholate, taurocholate and biliverdin, respectively

66 Succus entericus is composed of secretions of

(a) goblet cells and brush border cells
(b) parietal cells and peptic cells
(c) goblet cells and chief cells
(d) oxyntic cells, peptic cells and goblet cells

67 The enzyme that is not present in succus entericus is ***CBSE-AIPMT 2015***

(a) maltase (b) nucleases
(c) nucleosidase (d) lipase

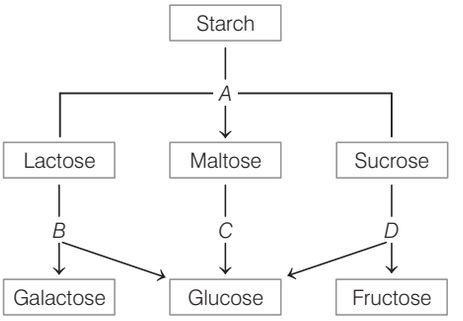
68 The enzymes present in succus entericus are

(a) functional in acidic medium (pH 2.3) provided by HCl secreted by oxyntic cells
(b) functional regardless of pH of the medium
(c) functional in alkaline medium (pH 7.8) provided by mucus and bicarbonates from pancreas
(d) functional at neutral pH 7.0 only

69 Which hormones do stimulate the production of pancreatic juice and bicarbonate? ***NEET 2016***

(a) Angiotensin and epinephrine
(b) Gastrin and insulin
(c) Cholecystokinin and secretin
(d) Insulin and glucagon

70 The following is a scheme showing the fate of carbohydrates during digestion in the human alimentary canal. Identify the enzymes acting at stages indicated as *A, B, C* and *D*. Choose the correct option.



(a) A–Amylase, B–Maltase, C–Lactase, D–Sucrase
(b) A–Amylase, B–Maltase, C–Invertase, D–Lactase
(c) A–Amylase, B–Invertase, C–Maltase, D–Lactase
(d) A–Amylase, B–Lactase, C–Maltase, D–Sucrase

71 Hydrolysis of maltose gives rise to
(a) two molecules of glucose
(b) two molecules of galactose
(c) one molecule of glucose and one molecule of galactose
(d) one molecule of glucose and one molecule of fructose

72 Enzyme sucrase hydrolyses sucrose into
(a) glucose and galactose (b) glucose and fructose
(c) two molecules of glucose (d) two molecules of fructose

73 The enzyme and intermediate molecule formed by the breakdown of fats into monoglycerides are
(a) Lysozyme; Polyglycerides
(b) Lysozyme; Diglycerides
(c) Lipase; Diglycerides
(d) Lipase; Polyglycerides

74 Which one of the following enzymatic reaction is incorrect?
(a) Nucleic acids $\xrightarrow{\text{Nucleotidase}}$ Nitrogeous base + Pentose sugar
(b) Fat (Emulsified) $\xrightarrow[\text{Lipase}]{\text{Pancreatic}}$ Diglycerides + Fatty acids
(c) Starch $\xrightarrow[\text{Pancreatic}]{\alpha\text{-amylase}}$ Maltose + Isomaltose + α-dextrins
(d) Proteins $\xrightarrow{\text{Pepsin}}$ Peptones + Proteose

75 Which one of the following equation matches correctly with the action of enzymes on the given substrate and regarding the end product of the reaction?
(a) Stomach — Fats $\xrightarrow{\text{Lipase}}$ Micelles
(b) Small intestine — Proteins $\xrightarrow{\text{Pepsin}}$ Amino acids
(c) Small intestine — Starch $\xrightarrow{\text{Amylase}}$ Disaccharides
(d) Duodenum — Triglycerides $\xrightarrow{\text{Trypsin}}$ Monoglycerides

76 Hydrolysis of milk sugar gives rise to
(a) two molecules of lactose
(b) two molecules of glucose
(c) one molecule of glucose and one molecule of fructose
(d) one molecule of glucose and one molecule of galactose

77 The breakdown of biomacromolecules and their subsequent absorption, respectively occur in
(a) small intestine and large intestine
(b) duodenum; jejunum and ileum
(c) duodenum and jejunum; ileum
(d) stomach and small intestine

78 Which one of the following options contains the correct pair of the substances absorbed and secreted by large intestine?

	Absorbed substances	Secretion
(a)	Water, minerals and drugs	Mucus
(b)	Water	Drugs and minerals
(c)	Mucus and minerals	Water
(d)	Water and mucus	Drugs

79 Which action of digestive enzyme is/are correct regarding its site of action, substrate and the end product?

	Enzyme	Site of action	Substrate	End product
I.	Rennin	Adult stomach	Starch	Maltose
II.	Pepsin	Human's stomach	Proteins	Two or more molecules of amino acids
III.	Nuclease	Small intestine	Nucleosides	Nucleosides and iPO_4
IV.	Enterokinase	Small intestine	Trypsinogen	Trypsin

(a) All actions are correct
(b) Actions I, II and III are correct
(c) Actions I, II and IV are correct
(d) Only action IV is correct

TOPIC 3 ~ *Absorption of Digested Products*

80 The energy content of food is expressed in terms of
(a) ATP (b) respiration
(c) heat (d) productivity

81 The gross calorific values of carbohydrate, protein and fats in kcal/g are
(a) 2, 6, 8, respectively
(b) 7.2, 6.4, 11.1, respectively
(c) 3.2, 1.4, 5.5, respectively
(d) 4.1, 5.65, 9.45, respectively

82 Simple diffusion helps in the absorption of
(a) chloride ions (b) small amount of glucose
(c) amino acids (d) All of these

83 In facilitated transport,
(a) substances are transported against concentration gradients
(b) carrier proteins are required
(c) ATP is required
(d) All of the above

84 Choose the incorrectly matched pair.
(a) Water – Osmosis
(b) Electrocytes – Simple diffusion
(c) Carrier protein – Facilitated transport
(d) Release energy – Active transport

85 Which form of fats is absorbed into the intestinal cells?
(a) Micelles (b) Chylomicrons
(c) Fatty acids (d) Both (a) and (b)

86 Small protein coated fat globules are
(a) micelles (b) chylomicrons
(c) fatty acids (d) Both (a) and (b)

87 A large lymph vessel present in the villus of small intestine is called
(a) crypts
(b) lacteal
(c) Peyer's patches
(d) valve of Kerckring

88 Select the correct match of the digested products in humans given in Column I with their absorption site and mechanism in Column II. ***NEET 2013***

	Column I	Column II
(a)	Glycine and glucose	Small intestine and active absorption
(b)	Fructose and Na^+	Small intestine passive absorption
(c)	Glycerol and fatty acids	Duodenum and move as chiylomicrons
(d)	Cholesterol and maltose	Large intestine and active absorption

89 Absorption of glycerol, fatty acids and monoglycerides occurs in the
(a) wall of the stomach
(b) wall of the duodenum
(c) lymph vessels within the villi present in the small intestine
(d) capillaries present within the villi

90 Alcohol absorption mainly occurs in
(a) mouth (b) stomach
(c) small intestine (d) large intestine

91 In the alimentary canal, drugs are absorbed by
(a) stomach (b) small intestine
(c) mouth and large intestine (d) All of these

92 The process by which absorbed food are utilised by the tissues in the living being for energy, growth and maintenance is termed as
(a) absorption (b) assimilation
(c) catabolism (d) digestion and absorption

93 The accumulation of faeces in the rectum and distension of the rectal wall initiates the feeling of defecation due to
(a) defecation reflex
(b) deamination
(c) irregular movement of bowl
(d) None of the above

94 In an infant, the process of defecation occurs by
(a) reflex action without voluntary control
(b) reflex action with voluntary control
(c) voluntary relaxation of external anal sphincter
(d) involuntary relaxation of internal anal sphincter

95 Carrier proteins facilitate the absorption of substances like
(a) glucose and fatty acids (b) amino acid and glucose
(c) fatty acids and glycerol (d) fructose and glycerol

96 Select the option which shows the correct sequence in which the process of digestion occurs.
(a) Digestion → Ingestion → Assimilation → Absorption → Egestion
(b) Digestion → Assimilation → Ingestion →Absorption → Egestion
(c) Ingestion → Digestion → Absorption → Assimilation → Egestion
(d) Ingestion → Assimilation → Degestion → Absorption → Egestion

TOPIC 4 ~ *Disorders of Digestive System*

97 Why do the eyes of the patients turns yellow during jaundice?
(a) Due to the deposition of bile pigments
(b) Due to the ejection of stomach content through mouth
(c) Due to the stomach malfunctioning
(d) Due to the excessive vomiting

98 Vomit centre which controls the reflex action of vomiting is located in
(a) medulla (b) cortex
(c) cerebellum (d) cerebrum

99 The abnormal frequent movement of the bowel and increased liquidity of the faeces is called
(a) vomiting (b) indigestion
(c) constipation (d) diarrhoea

100 Faeces are retained within colon in
(a) diarrhoea (b) constipation
(c) marasmus (d) vomiting

101 Which of the following is not a cause of indigestion?
(a) Overeating (b) Anxiety
(c) Jaundice (d) Food poisoning

102 Which of the following is a protein-energy malnutrition related disorder?
(a) Kwashiorkor
(b) Marasmus
(c) Both (a) and (b)
(d) Xerophthalmia

103 Marasmus is caused by the deficiency of
(a) proteins and calories
(b) carbohydrates
(c) minerals
(d) All of the above

104 Symptoms of marasmus include
(a) Thin limbs and dry, wrinkled skin
(b) Impaired brain and mental faculty
(c) Declined growth rate and body weight
(d) All of the above

105 Kwashiorkor disease is due to ***NEET 2019***
(a) simultaneous deficiency of proteins and fats
(b) simultaneous deficiency of protein and calories
(c) deficiency of carbohydrates
(d) protein deficiency not accompanied by calorie deficiency

NEET

SPECIAL TYPES QUESTIONS

I. Assertion and Reason

■ **Direction** (Q. No. 106-115) *In each of the following questions, a statement of Assertion (A) is given followed by corresponding statement of Reason (R). Of the statements, mark the correct answer as*

(a) If both A and R are true and R is the correct explanation of A
(b) If both A and R are true, but R is not the correct explanation of A
(c) If A is true, but R is false
(d) If A is false, but R is true

106 **Assertion** (A) Small intestine of the human gut is the longest part of the digestive system.
Reason (R) Different types of food like proteins, fats and carbohydrates are digested completely in the longest part of human alimentary canal.

107 **Assertion** (A) HCl present in the gastric juices, maintains a strong pH (1.5 - 2.5) in the stomach, but does not digest the walls of stomach and duodenum.
Reason (R) Protection to intestinal wall and stomach from the actions of HCl is provided by the mucus secreted by goblet cells, bicarbonates from pancreas, mucus and bicarbonates from Brunner's gland.

108 **Assertion** (A) Gastrin is a hormone that is released from the gastrointestinal tract and helps in digestion.
Reason (R) It promotes secretion of HCl and trypsinogen. ***AIIMS 2019***

109 **Assertion** (A) Cholecystokinin is released by duodenum.
Reason (R) It activates pepsinogen and bile juice.

110 **Assertion** (A) Liver is the largest digestive gland of our body.
Reason (R) Pancreas is considered a mixed gland as it function both as exocrine and endocrine. ***AIIMS 2019***

111 **Assertion** (A) No significant digestive activity occurs in the large intestine.
Reason (R) Absorption of some water, minerals and certain drugs occurs in the large intestine.

112 **Assertion** (A) Hormonal control of secretions of the digestive juice is carried out by local hormones.
Reason (R) Gastric and intestinal mucosa produce local hormones.

113 **Assertion** (A) Fatty acids are incorporated into micelles before being absorbed into intestinal mucosa.
Reason (R) These are insoluble molecules.

114 **Assertion** (A) The action of bile on fats is non-enzymatic.
Reason (R) Bile lacks digestive enzymes.

115 **Assertion** (A) Na^+, amino acids and glucose move against the concentration gradient.
Reason (R) Absorption of Na^+, amino acids and glucose is by active transport.

II. Statement Based Questions

116 Which of the following statement correctly describes the process of nutrition?
(a) A process to obtain necessary energy and growth substances
(b) A process to obtain energy from foods
(c) A process to supply the necessary nutritive elements to body
(d) The sum total of processes which provides the necessary nutritive element for growth, maintenance and to meet the need of energy

117 Which of the following statement is the befitting definition of dental formula?

(a) An arrangement of teeth in mouth in the order of I, C and Pm, M

(b) An arrangement of teeth in each half of the upper and lower jaw in the order of I, C, Pm, M

(c) An arrangement of teeth in upper jaw in the order to I, C, Pm, M

(d) An arrangement of teeth in the lower jaw in the order to I, C, Pm, M

118 Read the following statements regarding the digestive system and select the correct statement.

(a) Oesophagus passes through neck, thorax and diaphragm and opens into the stomach

(b) Stomach is located in the upper right portion of the abdominal cavity

(c) Stomach, a J-shaped organ is the narrowest organ of alimentary canal

(d) Caecum, a small blind sac is a part of small intestine and host symbiotic bacteria

119 Choose the incorrect statement regarding human digestive system with reference to a normal person.

(a) Human saliva is slightly acidic

(b) In human being, four pairs of salivary glands secrete saliva

(c) The quantity of saliva in adult man may be 1-1.5 L day

(d) Enzyme amylase present in saliva is responsible for the breakdown of starch into simple sugar

120 Which of the following statement is correct about pancreas?

(a) Pancreatic juice is secreted by acinar cells of endocrine part of pancreas

(b) pH of pancreatic juice is ~ 6

(c) Secretin and CCK hormones inhibit the secretion of pancreatic juice

(d) Pancreatic juice contains trypsinogen, chymotrypsinogen, procarboxy-polypeptidases, nucleases, amylopsin and steapsin, etc

121 Which of the following statement is not correct?

CBSE AIPMT 2015

(a) Brunner's glands are present in the submucosa of stomach and secrete pepsinogen

(b) Goblet cells are present in the mucosa of intestine and secrete mucus

(c) Oxyntic cells are present in the mucosa of stomach and secrete HCl

(d) Acini are present in the pancreas and secrete carboxypeptidase

122 Which statement is correct about the absorption of food?

(a) It is the process by which the end products of digestion pass through the intestinal mucosa into the blood or lymph

(b) It is the process of transportation of digestive food from the human alimentary canal to blood and lymph

(c) It is the process to utilise the absorbed food substances

(d) Absorption is a process by which nutrients are absorbed from the large intestine into the blood and lymph through its mucous membrane

123 Which one statement is incorrect regarding the process of digestion and absorption in humans?

(a) Small intestine is the major site for the absorption of all nutrients

(b) Around 40% of the total absorption of nutrients takes place in the small intestine

(c) Drugs, alcohol, little water and salt are absorbed in the stomach through the mucous membrane

(d) Large intestine is the site of absorption for water and products of bacterial digestion

124 Choose the incorrect statement regarding the functions of the large intestine.

(a) Large intestine absorbs the products of bacterial digestion

(b) It is the main site of absorption of electrolytes, water and some amino acids

(c) Mucous lubricates faecal matter

(d) Faeces are temporarily stored in the rectum

125 Which of the following statement regarding chylomicrons is not true?

(a) Chylomicrons are protein coated fat globules

(b) These are transported into the lacteals in the villi

(c) These play a significant role in the digestion of fats

(d) These are produced from the cells of the intestinal mucosa

126 Read the statements given below and select the incorrect one.

(a) Chewing helps in digestion process by increasing the surface area of food

(b) Stomach stores food for 4-5 hours

(c) The digestive enzymes secreted by oesophagus help in the digestion of starch

(d) The mucosa of stomach has gastric gland

127 Which of the following statement is incorrect?

(a) Frenulum is the fold by which tongue is attached to the floor of mouth or oral cavity

(b) Pharynx is the common passage for food and air

(c) Sphincter of Oddi guards and regulates the opening of stomach into duodenum

(d) Caecum host some symbiotic microoganisms

128 Study the given statements and choose the one which gives false information.

(a) Muscularis layer of alimentary canal possess inner circular and outer longitudinal muscle layer

(b) Mucosa forms gastric glands in the stomach and crypts in betwcen the bases of villi in intestine

(c) Cells lining the villi has brush border or microvilli

(d) All the four basic layers in the wall of gut never show modification in different parts of the alimentary canal

129 Study the following statements thoroughly and identify which one of the following is incorrect?

(a) Bile salts present in bile are responsible to emulsify the fats in small intestine

(b) Bicarbonates of sodium, potassium, glycocholate and taurocholate of sodium are bile salts

(c) The pH of hepatic bile is 8.6, while pH of gall bladder is 7.6 or 7.5

(d) The flow of bile from liver takes place through hepatic duct, common bile duct, hepatopancratic ampulla and finally to the first part of small intestine

130 Go through the following statements and select the one which is correct regarding starch digestion?

(a) Digestion of starch starts from the stomach

(b) Around 30% of the starch is digested in the stomach

(c) Digestion of food requires the action of pancreatic juices

(d) During absorption, end products are passed through stomach into the small intestine

131 Consider the following statements.

I. In thecodont dentition, each tooth is embedded in a socket.

II. Diphyodont dentition indicates that humans bear only one set of teeth in their lifetime.

Select the correct option.

(a) I is true, II is false

(b) Both I and II are true

(c) I is false, II is true

(d) Both I and II are false

132 Read the following statements and select the correct option.

I. Deglutition starts as a reflex and then continues by voluntary action.

II. Oesophagus has smooth muscles in the beginning and striated muscles in the rest of its wall.

(a) Both statements I and II are correct

(b) Statement I is correct but statement II is incorrect

(c) Statement I is incorrect but statement II is correct

(d) Both statements I and II are incorrect

133 Consider the following statements.

I. In duodenum, glands are found in the submucosa layer of the alimentary canal.

II. Lacteal and network of capillaries are present in the rugae found in stomach.

Select the correct option.

(a) I is true, II is false

(b) Both I and II are true

(c) I is false, II is true

(d) Both I and II are false

134 Read the following statements thoroughly and identify whether they are true and false.

Choose the correct option.

I. Bile is produced and stored in the liver and gall bladder, respectively.

II. Common bile duct is formed by the fusion of all the right and left hepatic ducts and cystic ducts.

III. Hepatopancreatic duct opens into the ileum, posterior part of the small intestine.

IV. Pancreas consists of two parts, i.e. exocrine and endocrine, which secrete insulin and glucagon hormone and pancreatic juices containing enzymes, respectively.

V. Pepsinogen, a secretion of chief cells is activated by hydrochloric acid.

VI. Peptides are converted into dipeptides by the action of carboxypeptidase.

(a) All statements are true

(b) All statements are false

(c) Statements I, III, IV and V are true, while II and VI are false

(d) Statements I, II, V and VI are true, while III and IV are false

135 Go through the following statements and identify whether they are true or false.

Choose an appropriate option from the codes given below.

I. Hepatic lobules are the structural and functional units of liver containing hepatic cells.

II. Hepatic lobules are covered by a thin connective tissue sheath called Glisson's capsule.

III. Proteinases, also known as proteases, are released in the active form because the proteins, either cellular or extracellular, all are hydrolysed by them in the absence of food.

IV. Hydrolases and cholecystokinin are secreted by the exocrine part of pancreas.

(a) All statements are true

(b) All statements are false

(c) Statements III and IV are true, while I and II are false

(d) Statements I and II are true, while III and IV are false

136 Choose true and false statements regarding the humans pancreas.

I. Pancreas is a compound gland as it possesses both exocrine and endocrine parts.

II. Exocrine part is rudimentary and does not perform any function.

III. Endocrine part secretes hormones like insulin and glucagon.

IV. It is situated between the limbs of duodenum.

Choose the correct option.

(a) I, III, IV are true, while II is false
(b) I, II, III are false, while IV is true
(c) All statements are true
(d) All statements are false

137 Read carefully the following statements regarding the absorption of nutrients. Find the incorrect statements and choose the correct option from the codes given below

I. Absorption of carbohydrates takes place in the stomach and small intestine.
II. The water fat and soluble end products of food can reach the blood and lymph directly, respectively.
III. Stomach is the principal organ of absorption of nutrients.
IV. Glucose and Na^+ are absorbed by simple diffusion only.

(a) I, III and IV (b) I, II and IV
(c) I and II (d) III and IV

138 Consider the following statements.

I. The bolus passes down through oesophagus by deglutition.
II. Mastication of food is done by teeth and tongue with the help of saliva.

Select the correct option.

(a) I is true, II is false (b) Both I and II are true
(c) I is false, II is true (d) Both I and II are false

139 Go through the following statements regarding the absorption of nutrients. Identify whether they are true or false, then choose the correct option accordingly.

I. Absorption of monosaccharides, alcohol, some water and medicines like asprin occurs in the stomach.
II. Fatty acids cannot be absorbed directly.
III. Glycerol can be absorbed into the blood in stomach.
IV. Maximum absorption of water takes place in the large intestine.
V. Large intestine and mouth are not the site of absorption.

(a) I, II and IV are true, while III and V are false
(b) I, II, III are true, while IV and V are false
(c) II, III and IV are false, while I and V are true
(d) I and II are false, while III, IV and V are true

140 Go through the following statements regarding the disorders of the digestive system. Choose the correct statements and select appropriate option from the given below.

I. Indigestion is caused by the poor supply of digestive enzymes, overeating, a lot of junk food and anxiety.
II. Constipation, an irregular movement of bowel is caused due to poor habits, fibreless diet, emotional stress and certain drugs.
III. Marasmus often happens if the mother has a second pregnancy or childbirth when older infant is too young.

(a) All statements are correct
(b) All statements are incorrect
(c) I and II statements are correct
(d) III and IV statements are correct

141 Consider the following statements regarding digestion and absorption in mammals. Identify whether they are true or false and select the correct option accordingly.

I. Both Kupffer's cells and Glisson's capsule are the characteristic of mammalian liver.
II. The muscular activities of alimentary canal are controlled by local neural signals and through CNS.
III. The physiologic values of proteins and fats are 9.0 kcal/g and 4.0 kcal/g, respectively.
IV. Zymogens (inactive form of enzymes) are not the secretions of the peptic cells.

(a) All statements are true
(b) All statements are false
(c) I and II are true, while III and IV are false
(d) III and IV are true, while I and II are false

142 Consider the following statements.

I. The undigested and unabsorbed faeces enter into rectum from small intestine through ileocaecal valve.
II. Gastric and intestinal secretions are stimulated by neural signals.

Select the correct option.

(a) Both I and II are true (b) I is true, II is false
(c) I is false, II is true (d) Both I and II are false

143 Consider the following statements.

I. Gross calorific value is the amount of heat liberated from complete combustion of 1g food in a bomb calorimeter.
II. The actual amount of energy combustion of 1g food is the physiologic value of food.

Select the correct option.

(a) Both I and II are true (b) I is true, II is false
(c) I is false, II is true (d) Both I and II are false

III. Matching Type Questions

144 Match the following columns.

Column I (Structure)		**Column II** (Location/Function)
A. Cardiac sphincter	1.	Guards hepatopancreatic duct
B. Pyloric sphincter	2.	Joins gall bladder to common bile duct
C. Sphincter of Oddi	3.	Opening of stomach into duodenum
D. Cystic ducts	4.	Opening of oesophagus into stomach

Codes

	A	B	C	D		A	B	C	D
(a)	4	3	1	2	(b)	4	3	2	1
(c)	3	4	1	2	(d)	2	1	3	4

145 Match the following columns.

	Column I		Column II
A.	Hepatic lobule	1.	Submucosal glands
B.	Brunner's glands	2.	Base of villi
C.	Crypts of Leiberkuhn	3.	Glisson's capsule
D.	Sphincter of Oddi	4.	Hepatopancreatic duct

Codes

	A	B	C	D		A	B	C	D
(a)	3	1	2	4	(b)	4	3	1	2
(c)	3	1	4	2	(d)	1	3	4	2

146 Match the following columns.

	Column I		Column II
A.	Gastric juice	1.	Enterokinase
B.	Parietal cells	2.	Intestinal juice
C.	Intestinal mucosa	3.	pH = 1.8
D.	Crypt of Leiberkuhn	4.	HCl

Codes

	A	B	C	D		A	B	C	D
(a)	3	4	1	2	(b)	3	1	4	2
(c)	2	4	3	1	(d)	4	3	2	1

147 Match the following columns.

	Column I (Cells)		Column II (Substances released)
A.	Neck cells	1.	HCl, intrinsic factor
B.	Peptic/Chief cells	2.	Mucus
C.	Parietal/Oxyntic cells	3.	Pepsinogen
D.	Hepatocyte	4.	Bile

Codes

	A	B	C	D		A	B	C	D
(a)	2	3	1	4	(b)	3	2	1	4
(c)	4	2	3	1	(d)	2	4	3	1

148 Match the following columns.

	Column I (Substances)		Column II (Characteristic)
A.	Bile	1.	Released into small intestine through hepatopancreatic duct
B.	Pancreatic juice + bile	2.	Inactive enzymes in pancreatic juice
C.	Vitamin-B_{12}	3.	Absorbed by intrinsic factor secreted by oxyntic cells.
D.	Amylase and nuclease	4.	Do not contain enzyme but activate lipase

Codes

	A	B	C	D		A	B	C	D
(a)	3	1	4	2	(b)	2	3	1	4
(c)	4	1	3	2	(d)	1	4	2	3

149 Match the following structures with their respective location in organs. ***NEET 2019***

	Column I (Structures)		Column II (Location)
A.	Crypts of Lieberkuhn	1.	Pancreas
B.	Glisson's capsule	2.	Duodenum
C.	Islets of Langerhans	3.	Small intestine
D.	Brunner's glands	4.	Liver

Codes

	A	B	C	D		A	B	C	D
(a)	2	4	1	3	(b)	3	4	1	2
(c)	3	2	1	4	(d)	3	1	2	4

150 Match the following columns.

	Column I		Column II
A.	Ileocaecal valve	1.	Helps in defecation
B.	Mass peristalsis	2.	Prevent backflow of faces
C.	Defaecation	3.	Reduced absorption of food
D.	Diarrhoea	4.	Egestion of faeces through anus

Codes

	A	B	C	D		A	B	C	D
(a)	4	3	1	2	(b)	2	1	4	3
(c)	3	4	2	1	(d)	1	2	3	4

151 Match the items given in Column I with those in Column II and choose the correct option. ***NEET (Odisha) 2019***

	Column I		Column II
A.	Rennin	1.	Vitamin-B_{12}
B.	Enterokinase	2.	Facilitated transport
C.	Oxyntic cells	3.	Milk proteins
D.	Fructose	4.	Trypsinogen

Codes

	A	B	C	D		A	B	C	D
(a)	3	4	2	1	(b)	4	3	1	2
(c)	4	3	2	1	(d)	3	4	1	2

152 Match the following columns.

	Column I (Types of cell)		Column II (Secretion)
A.	β-cells	1.	Mucus
B.	Mast cells	2.	Histamine
C.	Paneth cells	3.	Insulin
D.	Acinar cells	4.	Pancreatic enzymes

Codes

	A	B	C	D		A	B	C	D
(a)	3	1	2	4	(b)	4	1	2	3
(c)	3	2	1	4	(d)	1	2	3	4

NCERT Exemplar

MULTIPLE CHOICE QUESTIONS

153 Select what is not true of intestinal villi among following?
(a) They possess microvilli
(b) They increase the surface area
(c) They are supplied with capillaries and the lacteal vessels
(d) They only participate in digestion of fats

154 Hepatopancreatic duct opens into the duodenum and carries
(a) bile (b) pancreatic juice
(c) Both (a) and (b) (d) saliva

155 One of the following is not a common disorder associated with digestive system.
(a) Tetanus (b) Diarrhoea (c) Jaundice (d) Dysentery

156 A gland not associated with the alimentary cannal is
(a) pancreas (b) adrenal (c) liver (d) salivary glands

157 Match the following columns.

	Column I		Column II
A.	Biomacromolecules of food	1.	Alimentary canal and associated gland
B.	Human digestive system	2.	Embedded in jaw bones
C.	Stomach	3.	Outer wall of visceral organs
D.	Thecodont	4.	Converted into simple substances
E.	Serosa	5.	J-shaped bag-like structure

Codes

	A	B	C	D	E
(a)	2	1	5	3	4
(b)	4	1	5	2	3
(c)	1	2	3	4	5
(d)	1	3	2	4	5

158 Match the following columns.

	Column I (Parts)		Column II (Features)
A.	Duodenum	1.	A cartilaginous flap
B.	Epiglottis	2.	Small blind sac
C.	Glottis	3.	U-shaped structure emerging from the stomach
D.	Caecum	4.	Opening of windpipe

Codes

	A	B	C	D
(a)	1	2	3	4
(b)	4	3	2	1
(c)	3	1	4	2
(d)	2	4	1	3

159 Match the following columns.

	Column I (Enzymes)		Column II (Acts upon)
A.	Lipase	1.	Dipeptides
B.	Nuclease	2.	Fats
C.	Carboxypeptidase	3.	Nucleic acids
D.	Dipeptidases	4.	Proteins, peptones and proteoses

Codes

	A	B	C	D
(a)	2	3	1	4
(b)	3	4	2	1
(c)	3	1	4	2
(d)	2	3	4	1

160 Dental formula of monophyodont teeth of humans is
(a) $\frac{3223}{3223}$
(b) $\frac{2123}{2123}$
(c) $\frac{0021}{0021}$
(d) $\frac{2233}{2233}$

161 Liver is the largest gland and is associated with various functions, choose one which is not correct?
(a) Metabolism of carbohydrate
(b) Digestion of fat
(c) Formation of bile
(d) Secretion of hormone called gastrin

162 Mark the correct statement among the following.
(a) Trypsinogen is an inactive enzyme
(b) Trypsinogen is secreted by intestinal mucosa
(c) Enterokinase is secreted by pancreas
(d) Bile contains trypsin

Answers

› Mastering NCERT with MCQs

1 (a)	2 (a)	3 (a)	4 (c)	5 (b)	6 (b)	7 (c)	8 (b)	9 (a)	10 (c)
11 (b)	12 (a)	13 (d)	14 (b)	15 (d)	16 (a)	17 (d)	18 (c)	19 (a)	20 (a)
21 (a)	22 (c)	23 (c)	24 (c)	25 (c)	26 (d)	27 (c)	28 (b)	29 (c)	30 (a)
31 (a)	32 (a)	33 (d)	34 (b)	35 (b)	36 (c)	37 (c)	38 (c)	39 (a)	40 (d)
41 (d)	42 (c)	43 (a)	44 (b)	45 (a)	46 (b)	47 (c)	48 (a)	49 (c)	50 (d)
51 (a)	52 (a)	53 (b)	54 (d)	55 (b)	56 (b)	57 (c)	58 (c)	59 (c)	60 (d)
61 (c)	62 (b)	63 (a)	64 (d)	65 (a)	66 (a)	67 (b)	68 (c)	69 (c)	70 (d)
71 (a)	72 (b)	73 (c)	74 (a)	75 (c)	76 (d)	77 (b)	78 (a)	79 (d)	80 (c)
81 (d)	82 (d)	83 (b)	84 (d)	85 (a)	86 (b)	87 (b)	88 (a)	89 (c)	90 (b)
91 (c)	92 (b)	93 (a)	94 (a)	95 (b)	96 (c)	97 (a)	98 (a)	99 (d)	100 (b)
101 (c)	102 (c)	103 (a)	104 (d)	105 (d)					

› NEET Special Types Questions

106 (a)	107 (a)	108 (c)	109 (c)	110 (b)	111 (a)	112 (a)	113 (a)	114 (a)	115 (a)
116 (d)	117 (b)	118 (a)	119 (b)	120 (d)	121 (a)	122 (a)	123 (b)	124 (b)	125 (c)
126 (c)	127 (c)	128 (d)	129 (b)	130 (c)	131 (a)	132 (d)	133 (a)	134 (d)	135 (d)
136 (a)	137 (d)	138 (c)	139 (a)	140 (a)	141 (c)	142 (c)	143 (a)	144 (a)	145 (a)
146 (a)	147 (a)	148 (c)	149 (b)	150 (b)	151 (d)	152 (c)			

› NCERT Exemplar Questions

153 (d)	154 (c)	155 (a)	156 (b)	157 (b)	158 (c)	159 (d)	160 (b)	161 (d)	162 (a)

Answers & Explanations

1 (*a*) Food is one of the basic requirements of all living organisms.The major components of food are carbohydrates, proteins and fats. Vitamins and minerals are also required but in small quantities.

2 (*a*) Digestion involves the breakdown of complex organic substances of food like carbohydrates, proteins and fats (macronutrients) into simple, soluble inorganic substances. This enables easy absorption of nutrients.

3 (*a*) Process of digestion is carried out by mechanical and chemical means. Mastication of food and swallowing the masticated food are the two major mechanical functions of the buccal cavity. Masticated food is partially digested by salivary amylase and gets transformed into bolus.

It is transferred to the pharynx and then to oesophagus by deglutition. Finally, it reaches into the stomach for chemical digestion, which is carried out by various enzymes.

5 (*b*) The terms, thecodont, diphyodont and heterodont describe human dentition. In humans, two types of teeth are found, milk or deciduous teeth and permanent teeth. Thus, they are diphyodont. The teeth are remain embedded in the sockets of the jaw bones and hence are thecodont. Humans have four types of teeth; incisors, canine, premolars and molars, i.e. they have heterodont teeth.

6 (*b*) In the given figure, A represents Molar, B represents Premolar, C represents Canine and D represents Incisor.

Incisors teeth have chisel-like edge thus, also called as cutting teeth, while canines are pointed and lie behind the cutting teeth.

These are used for cutting and tearing. Premolar and molar are called check teeth. They are broad and are used to crush the food.

7 (*c*) In human beings, after birth, the first set of teeth that develops are deciduous teeth or temporary teeth. The dental formula of a child is 2102/2102.

Thus, they have 2 incisors, 1 canine, 0 premolars and 2 molars. Therefore, the baby boy would not have premolars.

10 (*c*) In humans, 20 milk or deciduous teeth occur. These include 8 incisors, 4 canines and 8 molars. Premolars are not present in deciduous or primary dentition.

11 (*b*) A tooth consists of three regions, i.e. crown, neck and root. The exposed part, i.e. the crown is surrounded by the hardest material of the body called enamel and which serves as the hard chewing surface.

12 (*a*) Frenulum is the tissue fold by which the tongue, a freely movable muscular organ is attached to the floor of the oral cavity.

13 (*d*) The upper surface of the tongue has several small projections. These projections are termed as papillae.

15 (*d*) During swallowing of food, epiglottis (a leaf-like cartilaginous flap) prevents the entry of food into glottis.

16 (*a*) The length of oesophagus is nearly 25 cm.

Oesophagus is a hollow muscular tube found in vertebrates through which food is transferred from pharynx to stomach. Peristaltic contractions of oesophageal muscles facilitate the passage of food through it.

17 (*d*) A muscular sphincter called as the gastro-oesophageal sphincter lies at the opening between the oesophagus and the stomach. The opening of the oesophagus into the stomach is regulated by this sphincter.

18 (*c*) Gastro-oesophageal sphincter is also called as the cardiac sphincter as it is present at the cardiac part of stomach, which in turn lies near the heart.

19 (*a*) Stomach is located in the upper left part of the abdominal cavity. Apart from the body it has three parts, a cardiac portion into which the osesophagus opens, a fundic portion and a pyloric portion, which opens into the proximal part of the small intestine.

21 (*a*) Peyer's patches are present in ileum. These are organised lymphoid follicles. These form an important part of the immune system by monitoring intestinal bacteria populations.

22 (*c*) Small intestine of alimentary canal consists of three parts, namely duodenum, jejunum and ileum. Duodenum (proximal part) is some what C-shaped, the middle jejunum is coiled part and the distal or lower part, ileum is highly coiled and opens into the large intestine.

23 (*c*) Large intestine is composed of three parts, namely caecum, rectum and colon. Ileum is not a part of the large intestine, but is a coiled part of the small intestine which opens into the large intestine.

24 (*c*) Caecum is a blind sac in the large intestine, which host symbiotic microorganisms. A finger-like tubular projection called vermiform appendix, a vestigial organ arises from the caecum.

27 (*c*) Option (c) contains the incorrect pair. It can be corrected as

Submucosa of alimentary canal is made up of loose connective tissues containing nerves, blood and lymph vessels.

Rest pairs are correct.

28 (*b*) Mucosa, the innermost layer of the alimentary canal which lines the gut forms irregular folds called villi (small finger-like projection) in the small intestine.

29 (*c*) The innermost layer of human gut is mucosa. This layer forms many irregular folds in the stomach, which are known as rugae (in intestine it is called villi). These folds are prominent in empty stomach, and disappear when the stomach is distended with food. Loss of these rugae is one of the primary symptoms of stomach cancer.

31 (*a*) Secretions of the goblet cells protect the lining of the gastrointestinal tract from various enzymes. These cells secrete mucus which along with bicarbonate ions helps in the lubrication and protection of the mucosal epithelium from excoriation by the highly concentrated HCl.

34 (*b*) The crypts present in between the bases of villi of small intestine called Crypts of Lieberkuhn contain paneth cells, which secrete antibacterial lysozyme.

36 (*c*) Saliva is mainly produced by the three pairs of salivary glands, which are the parotids (cheek), the submaxillary (lowe jaw) and sublingual (below the tongue).

Zymogenic cells are a type of cells present in the epithelium of the gastric glands. These secrete zymogens or proenzyme – pepsinogen and prorennin along with, a small amount of gastric lipase and amylase.

38 (*c*) Liver is the largest gland of the body, weighing about 1.2-1.5 kg in an adult human. It is situated in the abdominal cavity, just below the diaphragm and has two lobes.

39 (*a*) Bile juice or simply bile is produced by the hepatocytes of the liver. It is then transported through the hepatic duct into gall bladder for storage. Gall bladder is a pear-shaped thin, muscular sac found attached to the posterior surface of the liver.

40 (*d*) The right and left hepatocytic ducts combine to form common hepatic duct from the liver and this common hepatic duct join to the duct arising from gall bladder (cystic duct) which then join to form the common bile duct. The later joins the pancreatic duct and the combination is called as hepatopancreatic duct or ampulla.

42 (*c*) Sphincter of Oddi guards the opening of hepatopancreatic duct opening into the duodenum. Hepatopancreatic duct brings the secretion of liver as well as of pancreas to the duodenum.

43 (*a*) The exocrine part of the pancreas secretes an alkaline pancreatic juice containing enzymes and the endocrine portion secretes hormones, insulin and glucagon.

The pancreas is a compound organ containing both exocrine and endocrine parts and is situated between the U-shaped duodenum.

44 (*b*) The teeth and tongue with the help of saliva masticate and mix up the food throughly. Mucus in saliva helps in lubricating and adhering the masticated food particles to form bolus.

45 (*a*) The bolus is conveyed into the pharynx and then into the oesophagus by the process of swallowing or deglutition.

Bolus passes down through the oesophagus be successive waves of muscular contraction called peristalsis.

46 (*b*) Option (b) best describes the chemical composition of saliva. Chemically, saliva is a mixture of water, mucus and electrolytes (Na^+, K^+ Cl^-, HCO_3^-). Some enzymes like, salivary amylase and lysozyme (an antibacterial agent), are also found in human saliva.

48 (*a*) Digestion of starch (polysaccharides) starts from the mouth. About 30% of starch converts into disaccharide in oral cavity by the action of amylase enzyme.

50 (*d*) The action of salivary amylase on starch yields a diasaccharide, i.e. maltose.

52 (*a*) In the stomach, the gastric acid (HCl) is secreted by the parietal cells of the gastric gland. It makes the medium of food in stomach acidic for the stimulation of the proteolytic enzymes.

54 (*d*) Parietal cells (oxyntic cells) secrete hydrochloric acid and castle's intrinsic factor. HCl converts iron (in diet) from ferric to ferrous form which can be easily absorbed and used during erythropoiesis (formation of RBCs). Thus, parietal cells indirectly help in erythropoiesis.

55 (*b*) The food mixes thoroughly with the acidic gastric juice present in the stomach by the churning movements of its muscular walls to form chyme.

56 (*b*) Proenzymes (inactive form of enzyme) or zymogens secreted by the chief cells or zymogenic cells of gastric glands are activated by the HCl secreted by the oxyntic or parietal cells of the gastric glands. Thus, the inactive pepsinogen gets converted into its active form pepsin by the action of HCl.

57 (*c*) The mucus and bicarbonates present in the gastric juice play an important role in lubrication and protection of the mucosal epithelium from excoriation by highly concentrated hydrochloric acid.

58 (*c*) The enzyme, rennin is responsible for the digestion of milk protein in infants. Rennin is secreted as an inactive precursor, i.e. Prorennin in the young ones of mammals or HCl secreted by parietal cell, converts prorennin into rennin.

$$\text{Prorennin} \xrightarrow{\text{HCl}} \text{Rennin}$$

Rennin is then responsible for converting casein protein of milk to calcium paracaseinate, i.e. helps in curdling of milk.

$$\text{Casein} \xrightarrow{\text{Rennin}} \text{Ca Paracaseinate}$$

59 (*c*) Gastric juice of infants contains pepsinogen, lipase, rennin. Rennin is a proteolytic enzyme synthesised by stomach which coagulates milk.

Lipase enables breakdown of fats into monoglycerides. Pepsinogen gets converted to its active form pepsin which enables breakdown of proteins into smaller peptides.

60 (*d*) In humans, milk protein digesting enzyme is pepsin. In the initial step of milk digestion, pepsin acts on water soluble 'caseinogen (milk protein) to form soluble 'casein'. This combines with calcium salts to form insoluble calcium paracaseinate, which gets readily digested by enzymes.

64 (*d*) Bile is a watery fluid, composed of bile salts (Na glycocholate and Na taurocholate), bile pigments (bilirubin and biliverdin), sodium bicarbonate, cholesterol, phospholipid, mucin, lecithin fats, etc.

67 (*b*) Nuclease enzymes are present in the pancreatic juice and enable the breakdown of nucleic acids into nucleotides.

Succus entericus or intestinal digestive juice contains a variety of enzymes like disaccharides, e.g. maltase, lipase, dipeptidases, nucleosidases but not nuclease.

69 (*c*) Cholecystokinin (CCK) and secretin are the peptide hormones which stimulate the production of pancreatic juice and bicarbonates within the alimentary canal. Secretin acts on the exocrine part of the pancreas and stimulates the secretion of water and bicarbonate ions.

CCK acts on both pancreas as well as gall bladder and stimulates the secretion of pancreatic enzymes and bile juice, respectively.

71 (*a*) Maltose is a disaccharide and gives rise to two molecules of glucose on hydrolysis in the presence of maltase enzyme. This reaction occurs in the small intestine.

72 (*b*) Sucrose is hydrolysed into one molecule of glucose and one molecule of fructose by the action of the enzyme sucrase or invertase.

$$\text{Sucrose} \xrightarrow{\text{Sucrase}} \text{Glucose} + \text{Fructose}$$

73 (*c*) The enzyme involved and the intermediate molecule formed by the breakdown of fats into monoglycerides are lipase and diglycerides, respectively. It can be explained by the reaction given below

$$\text{Fat} \xrightarrow{\text{Lipase}} \text{Diglycerides} \xrightarrow[\text{Lipase}]{\text{Pancreatic}} \text{Monoglycerides} + \text{Fatty acid}$$

74 (*a*) The reaction given in option (a) is incorrect. It can be corrected as

Digestion of nucleic acids takes place in the small intestine. The enzymes present in pancreatic and intestinal juices act on various substrates containing nucleic acids in the following manner

$$\text{RNA} \xrightarrow[\text{Pancreatic juice}]{\text{RNase}} \text{Ribonucleotides}$$

$$\text{Ribonucleotides (Nucleotides)} \xrightarrow{\text{Nucleotidases}} \text{Nucleosides} + iPO_4$$

$$\text{Nucleosides} \xrightarrow{\text{Nucleosidases}} \text{Nitrogenous base} + \text{Pentose sugar}$$

Rest reactions are correct.

75 (*c*) Option (c) contains the correct match. Other options can be corrected as

- Stomach–Fats $\xrightarrow{\text{Lipase}}$ Diglycerides $\rightarrow$ Monoglycerides
- Stomach–Proteins $\xrightarrow{\text{Pepsin}}$ Peptones, Proteoses
- Duodenum–Proteins/peptones $\xrightarrow{\text{Trypsin}}$ Dipeptides

76 (*d*) The milk sugar is lactose. The enzyme lactase hydrolyses lactose into glucose and galactose in the small intestine.

$$\text{Lactose} \xrightarrow{\text{Lactase}} \text{Glucose} + \text{Galactose}$$

79 (*d*) Option IV is correct. Rest options are incorrect and can be corrected as

- Rennin found in infant's stomach helps in the digestion of milk proteins.
- Pepsin converts proteins to peptones and proteoses.
- Nuclease in pancreatic juice acts on nucleic acids to break them down to nucleotides.

83 (*b*) In facilitated transport, carrier proteins are required for the transport of glucose and amino acids across the intestinal mucosa into the blood or lymph. It occurs along the concentration gradient and therefore, ATP is not required.

84 (*d*) The pair in option (d) is incorrectly matched. It can be corrected as

Active transport occurs against the concentration gradient and hence, energy (ATP) is utilised in this process instead of being released.

Rest options contain correctly matched pairs.

87 (*b*) Each villus in the small intestine is covered with an epithelium and contains abundant lymph vessels called lacteal and blood capillaries.

88 (*a*) Option (a) contains the correct match. Rest matches are incorrect and can be corrected as

Fructose and Na^+	–	Small intestine and active transport
Glycerol and fatty acids	–	Absorbed by lacteals as chylomicrons
Cholesterol and maltose	–	Cholesterol absorbed as micelles in the small intestine and maltose breaks into glucose then absorbed in the small intestine.

89 (*c*) Fatty acids and glycerol being insoluble, are first incorporated into micelles and are moved to the small intestine. These are then absorbed in the intestinal cells by diffusion.

92 (*b*) Assimilation can be defined as the process by which the absorbed food nutrients are utilised by the tissues in living beings for energy, growth and maintenance'. When nutrients from the food are absorbed, they are transferred into the blood circulation. From the blood, these nutrients are transported to different body cells and tissues, where these nutrients become an integral part of the living protoplasm and provide energy, stimulate growth and repair injured tissues of the body.

93 (*a*) The defecation reflex induces peristalsis movement in the sigmoid portion of the colon and rectum, which forces faecal matter towards the egestion pore, i.e. anus. Colon is the site of water absorption from undigested and unabsorbed food (faeces). When the pellet of faeces from the sigmoid portion of the colon enters into the rectum, distension of the rectal wall initiates the feeling for defecation due to the defecation reflex.

94 (*a*) In an infant, defecation is not under voluntary control and it takes place by reflex actions, i.e. process of defecation occurs by the reflex action without any voluntary control on the the external anal sphincter muscles.

98 (*a*) The reflex action during vomiting is controlled by vomit centre located in the medulla. The feeling of nausea precedes vomiting.

99 (*d*) The abnormal frequent movements of bowel along with increased volume, fluid content or liquidity of faeces is called diarrhoea. Frequent diarrhoea can result in the loss of water (dehydration) and salts or electrolyte imbalance.

101 (*c*) Indigestion is caused by inadequate enzyme secretion, anxiety, food poisoning, overeating, etc. Jaundice is caused due to deposition of bile pigments in liver.

102 (*c*) Protein-Energy Malnutrition (PEM) disorder is most common in young children below 8 years of age. It is of two types, kwashiorkor and marasmus. Marasmus is observed in infants below one year in age. Kwashiorkor is commonly seen in the children more than a year in age.

105 (*d*) Kwashiorkor disease is caused due to protein deficiency not accompanied by calorie deficiency in the children of more than one year.

Its symptoms are weak muscles, thin limbs, retarded growth of the body and brain, swelling of legs due to retention of water (oedema), reddish hair, pot belly, etc.

106 (*a*) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Small intestine of the human gut is the longest part of the digestive system. Due to its small diameter, it is called the small intestine. Its length is about 22 feet in human. Such a length increases the scope of food absorption as it is the major site of digestion and absorption of different types of food.

107 (*a*) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Hydrochloric acid present in the gastric juices maintains a strong pH in stomach. But the wall of stomach is not digested by its action because goblet cells secrete mucus which continuously lubricates the innermost layer in the stomach and intestine. The wall is also protected by the bicarbonates secreted by pancreatic juices and Brunner's gland.

108 (*c*) Assertion is true, but Reason is false and it can be corrected as

Gastrin hormone, released from the gastrointestinal tract and stimulates the gastric glands to secrete and release gastric juices. It also stimulates gastric mobility.

109 (c) Assertion is true, but Reason is false and Reason can be corrected as

Cholecystokinin is released by duodenum. It acts on pancreas and gall bladder and stimulates the secretion of the pancreatic enzymes and bile juice.

110 (*b*) Both Assertion and Reason are true, but Reason is not the correct explanation for Assertion.

Liver is the largest digestive gland in human body, weighing about 1.2-1-5 kg in an adult. Pancreas is a mixed (compound) gland. It lies inferior to the stomach. It has both exocrine and endocrine parts. Digestive juices are secreted by the exocrine part, which get poured into the small intestine.

111 (*a*) Both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

This can be explained as

No digestive enzyme is present in the large intestine and all the major nutrients are absorbed in the small intestine as it is the principal organ for absorption of nutrients. Thus no significant digestive activity occurs in the large intestine, only absorption of some water, minerals and certain drugs takes place here. Large intestine mainly secrete mucus which helps in adhering the undigested particles together and lubricating it for an easy passage during defaecation.

112 (*a*) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Local hormones are produced by the gastric and intestinal mucosa. These hormones control the secretions of various digestive juices. For example, hormone gastrin is secreted by the G-cells of pyloric gland and duodenum which stimulates the secretion of gastric juice.

113 (*a*) Both Assertion and Reason are true and the Reason is the correct explanation of Assertion.

Fatty acids being insoluble cannot be absorbed directly by the blood. These are first incorporated into small droplets called micelles which are then absorbed into the intestinal mucosa.

114 (*a*) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Bile secreted by the liver and has no digestive enzymes. Its main role in digestion is emulsification of fats, i.e. breaking down of fats into very small micelles. Thus, action of bile on fats is non-enzymatic.

115 (*a*) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Na^+, amino acids and glucose are absorbed by active transport, which occurs against the concentration gradient and requires energy.

116 (*d*) The statement in option (d) correctly describes the process of nutrition.

Nutrition can be defined as 'the sum total of process which provides necessary nutritive elements for growth, maintenance and to meet their energy need'. Food or Diet is composed of necessary nutrients, which provides the basic requirements of life, i.e. energy and raw materials.

117 (*b*) The statement in option (b) is the correct definition of dental formula.

Dental formula is the arrangement of teeth in each half of the upper and lower jaw in the order of incisors (I), canines (C), premolars (Pm) and molars (M). These are 2, 1, 2, 3, respectively in number in case of human beings.

118 (*a*) The statement in option (a) is correct.

Rest statements are incorrect and can be corrected as

- Stomach is located in the upper left portion of abdominal cavity.
- Stomach is the J-shaped structure and is the widest organ of alimentary canal or human gut.
- Caecum, a small blind sac host symbiotic microbes and it is a part of large intestine.

119 (*b*) The statement in option (b) is incorrect and can be corrected as

There are three pairs of salivary glands in human beings, namely parotid gland, sublingual gland and submaxillary gland. All of the three pairs secrete saliva into the buccal cavity through their ducts.

Rest of the statements are correct.

120 (*d*) The statement in option (d) is correct. Rest statements are incorrect and can be corrected as

- Pancreatic juice is secreted by acinar cells of exocrine part of pancreas.
- Pancreatic juice is alkaline with pH 8.4.
- Secretin hormone increases secretion of bile and releases bicarbonates in pancreatic juice. CCK (cholecystokinin) stimulates the gall bladder to release bile and the pancreas to secrete and release digestive enzymes in the pancreatic juice.

121 (*a*) The statement in option (a) is incorrect and can be corrected as

Brunner's glands are compound tubular submucosal glands found in the portion of duodenum, which is above the hepatopancreatic sphincter (sphincter of Oddi).

Rest of the statements are correct.

122 (*a*) The statement in option (a) is correct about absorption of food.

The end products of digestion are absorbed through the intestinal mucosa into the blood. Therefore, absorption, can be defined as

The process by which the end products of digestion enter the blood or lymph (circulatory system) through the intestinal mucosa.

123 (*b*) The statement given in option (b) is incorrect and can be corrected as

Maximum absorption occurs in the small intestine.

About 80% of the ingested food, electrolytes and 90% of water are absorbed in the small intestine.

Rest of the statements are correct.

124 (*b*) The statement in option (b) is incorrect and can be corrected as

About 90% of the total water is absorbed in the small intestine, while the remaining 10% are absorbed in the stomach and large intestine. Large intestine also absorbs some minerals, drugs and products of bacterial digestion like amino acids and vitamin-B complex and vitamin-K. Rest of the statements are correct.

125 (*c*) The statement given in option (c) is not correct regarding chylomicrons. It can be corrected as

Chylomicrons play a significant role in the absorption of fatty acids and glycerol which are the end products of fat digestion.

Rest of the statements are correct.

126 (*c*) The statement given in option (c) is incorrect and can be corrected as

Starch is converted into maltose by the enzyme salivary amylase which is present in the saliva, secreted in the oral cavity. It hydrolyses starch into maltose.
Oesophagus is the part of alimentary canal which does not secrete any digestive enzyme.

Rest of the statements are correct.

127 (*c*) The statement given in option (c) is incorrect and can be corrected as

Opening of stomach into duodenum is guarded by pyloric sphincter, while Oddi sphincter guards the opening of hepatopancreatic duct into the duodenum.

Rest of the statements are correct.

128 (*d*) The statement given in option (d) is incorrect and can be corrected as

Four basic layers of human alimentary canal exhibit different modifications in different parts of alimentary canal.

Rest of the statements are correct.

129 (*b*) The statement given in option (b) is incorrect and can be corrected as

Bile salts are mainly salts of taurocholic acid and glycochloic acid.
Rest of the statements are correct.

130 (*c*) The statement given in option (c) is correct regarding starch digestion. Rest statements are incorrect and can be corrected as

- Process of starch digestion starts in the mouth.
- In buccal cavity or oral cavity, 30% of polysaccharides (starch) present in the food is digested into disaccharides (maltose). Rest 70% of carbohydrates are completely digested in the small intestine.
- Absorption is the process by which end products of digestion pass through intestinal mucosa into blood or lymph.

131 (*a*) Statement I is true, II is false and can be corrected as

Human dentition is diphyodont, i.e. they bear two sets of teeth during their lifetime.

These are the deciduous or milk teeth and permanent or adult teeth. Presence of four types of teeth indicate heterodont dentition.

132 (*d*) Both statements I and II are incorrect and can be corrected as

- Deglutition or Swallowing starts as a reflex by medulla oblongata and continues by involuntary action causing progressive contraction of the pharyngeal muscles.
- Oesophagus has striated muscles in the beginning and smooth muscles in the rest of its wall

133 (*a*) Statement I is true, II is false and can be corrected as

Lacteal and network of capillaries are present in the villi found in the small intestine of humans. They help in the transportation of fat globules called chylomicrons from intestinal mucosa to blood stream.

134 (*d*) Statements I, II, V and VI are true, while statements III and IV are false and can be corrected as

- The hepatopancreatic duct opens into the duodenum and its opening is guarded by the sphincter of Oddi.
- Pancreas is a mixed gland. Its exocrine part secretes pancreatic juices, while insulin and glucagon are secreted by the endocrine parts.

135 (*d*) Statements I and II are true, while statements III and IV are false and can be corrected as

- Protein hydrolysing enzymes are called peptidases or proteases. A majority of protein hydrolases are secreted in inactive forms called proenzymes as their active forms can digest cellular or extracellular proteins of individuals itself.
- Hydrolases, secretin and cholecystokinin are secreted by the duodenum of intestine and epithelium of the entire small intestine, respectively.

136 (*a*) Statements I, III and IV are true, while statement II is false and can be corrected as

The secretions of pancreas, i.e. pancreatic juice containing various enzymes are secreted by the exocrine portion of the pancreas.

137 (*d*) Statements I and II are correct, while statements III and IV are incorrect and can be corrected as

- In human body, small intestine is the principal organ of absorption of nutrients. The process of digestion is completed here after which the final products of digestion are absorbed by various means.
- Glucose and Na^+ are majorly absorbed through active transport. A small amount of glucose is absorbed passively by simple diffusion and facilitated transport.

138 (*c*) Statement I is false, II is true and can be corrected as

The bolus passes down through the oesophagus into stomach by successive wave of muscular contraction called peristalsis. Deglutition is process by which bolus is conveyed into the pharynx and the oesophagus from the buccal cavity.

139 (*a*) Statements I, II and IV are true, while statements III and V are false and can be corrected as

- Glycerol is absorbed through the mucosa of small intestine into the blood and lymph.
- Mouth helps in the absorption of certain drugs coming in contact with mucosa of mouth and lower side of tongue. Large intestine absorbs water, minerals and drugs.

141 (*c*) Statements I and II are true. Statements III and IV are false and can be corrected as

- The physiologic values of proteins and fats is 4.0 kcal/g and 9.0 kcal/g, respectively.
- Zymogens or Proenzyme are secreted by the zymogenic cells or peptic cells or chief cells.

142 (*c*) Statement I is false, statement II is true. Statement I can be corrected as

The undigested, unabsorbed substances called faeces enters into the caecum from small intestine through the ileocaecal valve.

153 (*d*) Option (d) is not correct about intestinal villi and it can be corrected as

Intestinal villi do not participate in the digestion of fats, but help in their absorption and in the absorption of various other food substances also such as water, mineral, salts, amino acids, vitamins, etc.

154 (*c*) The duct of gall bladder along with the hepatic duct from the liver forms the common bile duct. The common bile duct and the pancreatic duct open together into the duodenum as the common **hepatopancreatic duct**, which carries both bile and pancreatic juice into the duodenum.

155 (*a*) Tetanus is the condition which is characterised by prolonged contraction of the skeletal muscle fibres. It is not a disorder of the digestive system.

156 (*b*) Adrenal glands are found at the apex of kidney and these produce hormones like adrenaline, cortisol, etc. These are not associated with the alimentary canal.

160 (*b*) An adult human has 32 permanent teeth which are of four different types, namely Incisors (I), Canine (C), Premolar (Pm) and Molar (M).

Monophyodont teeth include premolars and molar and they appear once in life. They are 2 and 3 in number in each jaw. Thus, the dentat formula of monophyodont teeth of humans is 2123/2123.

161 (*d*) The function given in option (d) is not associated with liver and therefore is incorrect. It can be corrected as

Liver is not associated with the secretion of gastrin. Gastrin is secreted by the G-cells present in the pyrolic region of stomach. It stimulates gastric glands to secrete and release gastric juices.

162 (*a*) The statement in option (a) is correct. Rest statements are incorrect and can be corrected as

- Trypsinogen is an inactive pancreatic enzyme that is activated, by enterokinase enzyme secreted by the intestinal mucosa.
- Active form of trypsinogen is called trypsin, which in turn activates other enzymes present in the pancreatic juice. Trypsin is not contained in bile.