DAY NINETEEN

Digestion and Absorption

Learning & Revision for the Day

- Human Digestive System
- Mechanism of Digestion
- Disorders of the Digestive System

Digestion is a process which involves breakdown of complex food substances by hydrolysis into smaller molecules that can be absorbed through the epithelium of the gastrointestinal tract. Humans and other animals have holozoic nutrition, i.e. they intake solid or liquid form of food.

Human Digestive System

The human digestive system consists of the alimentary canal and the digestive glands.

1. Alimentary Canal

The anterior opening of alimentary canal is mouth and posterior is the anus.

Alimentary canal consists of different structures which are described below

(i) **Oral cavity** is the cavity which opens through mouth, it contains teeth and muscular tongue.

- **Teeth** Each tooth is embedded in a socket of jaw bone. This condition is called as **thecodont.**
  - Humans and majority of mammals have two sets of teeth during their lifetime, a set of temporary teeth and a set of permanent teeth. This type of dentition is called **diphyodont.**
  - Adult human has 32 teeth with heterodont dentition. The arrangement of teeth in each half of the upper and lower jaw is represented by dental formula. The arrangement order is, `Incisors (I), Canine (C), Premolar (Pm) and Molar (M). The dental formula in human is

$$\frac{\text{I-2, C-1, Pm-2, M-3}}{\text{I-2, C-1, Pm-2, M-3}} = \frac{2123}{2123} \times 2 = 32$$

  - Elephant tusks are modified incisors, tusks of nabus are modified canines.

- **Tongue** is the muscular organ which is attached to the floor of oral cavity by the frenulum. It has small projections called papillae on its upper surface, some of them contain taste buds.

(ii) **Pharynx** the oesophagus and the trachea open into the pharynx which is a common passage for food and air.

- The oesophagus is a thin, long tube which extends posteriorly passing through the neck, thorax and diaphragm and leads to a J-shaped bag-like structure called stomach.
- A muscular gastro-oesophageal sphincter regulates the opening of oesophagus into the stomach.

(iii) **Stomach** is located in the upper left portion of the abdominal cavity and has three major parts, i.e. a cardiac portion, a fundic portion and a pyloric portion.

(iv) **Small intestine** It is distinguishable into three regions, i.e. a U-shaped duodenum, a long coiled middle portion jejunum and a highly coiled ileum. Duodenum is the widest, shortest and most flexed part of small intestine. Ileum opens into the large intestine.

(v) **Large intestine** is shorter but, it is called large because it is wider in diameter than small intestine. It consists of following parts

- **Caecum** It hosts some symbiotic microorganisms.
- **Colon** It is divided into three parts, i.e. an ascending, a transverse and a descending part.
- **Rectum** The wall of alimentary canal from oesophagus to rectum possesses four layers, i.e. serosa, muscularis, submucosa and mucosa.

Histology of Alimentary Canal

- The innermost layer lining the lumen of the alimentary canal is the mucosa. This layer forms irregular folds in the stomach and small finger-like foldings called **villi** in the small intestine. The cells lining the villi produce numerous microscopic projections called microvilli giving a brush border appearance.
- Mucosa also forms glands in the stomach and crypts in between the bases of villi in the intestine (crypts of Lieberkuhn).

2. Digestive Glands

The digestive glands are mentioned below

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

(ii) **Liver** is the largest gland of the body weighing about 1.2-1.5 kg in an adult human.

- 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 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**.

(iii) The **pancreas** is a compound organ (both exocrine and endocrine) situated between the U-shaped duodenum.

The exocrine part secretes an alkaline pancreatic juice containing enzymes and the endocrine portion secretes hormones, insulin and glucagon.

(iv) **Brunner's glands** are branched, tubuloalveolar submucosal glands in the duodenum, whose, secretion is rich in bicarbonate ions and alkaline glucoproteins, hence it neutralises the acidic chyme entering the duodenum from the stomach.

Mechanism of Digestion

Digestion is the process by which large macromolecules of food are broken down into smaller usable molecule with the help of enzymes. It takes place in following four steps

1. Ingestion

The food is taken through buccal cavity. It is masticated by teeth and swallowed. Ingestion takes place in buccal cavity.

Salivary glands lubricate the food and bind the food particles together to form bolus. Salivary glands have starch digesting enzyme ptyalin.

2. Digestion

It is carried out in the following steps

(i) **Digestion in buccal cavity** In buccal cavity, salivary amylase acts on starch.

$$\underset{\text{(Polysaccharide)}}{\text{Starch}} \xrightarrow[\text{pH 6–8}]{\text{Ptyalin}} \underset{\text{(Disaccharide)}}{\text{Maltose}}$$

(ii) **Digestion in stomach** The food passes down through the oesophagus into stomach. Now, food is mixed with gastric juice and hydrochloric acid, which disinfect the food and create acidic medium. Pepsin digests proteins and converts them into peptones and proteoses. Rennin converts milk to curd. Digested food now is called **chyme.** Cellulose is not digested in humans.

(iii) **Digestion in small intestine** Chyme moves to duodenum where it gets mixed with bile (liver) to breakdown fats into smaller globules. Trypsin acts upon proteins and breaks them into dipeptides. Amylase converts starch into simple sugar. Lipase converts fats into fatty acids and glycerol. Food passes into ileum and mixes with intestinal juice. Maltase converts maltose into glucose. Lactase converts lactose into glucose and galactose. Sucrase converts sucrose into glucose and fructose. Dipeptidase digests the dipeptides into amino acids.

- The end products of digestion are monosaccharides (from complex carbohydrates), amino acids (from complicated proteins), free fatty acids, monoglycerides (from lipids) cholesterol, nitrogenous bases and pentose sugars.

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

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

These hormones are involved in the regulation of digestive secretions. Some of them are given in the table below

Digestive Hormones

Hormone	Target organ	Action
Gastrin	Stomach	Stimulates gastric glands to secrete and release the gastric juice. It also stimulates gastric mobility.
Enterogastrone (Gastric Inhibitory Peptide or GIP)	Stomach	Inhibits gastric secretion and motility (slows gastric contraction).
Secretin (first hormone discovered by scientists)	Pancreas, liver and stomach	Releases bicarbonates in the pancreatic juice. Increases secretion of bile. Decreases gastric secretion and motility.
Cholecystokinin-Pancreozymin (CCK-PZ)	Gall bladder and pancreas	Stimulates the gall bladder to release bile and pancreas to secrete and release digestive enzymes in the pancreatic juice.
Duocrinin	Duodenum	Stimulates the Brunner's glands to release mucus and enzymes into the intestinal juice.
Enterocrinin	Small intestine	Stimulates the crypts of Lieberkuhn to release enzymes into the intestinal juice.
Somatostatin (SS)	Pancreas and gastrointestinal tract	Inhibits the secretion of glucagon by alpha cells and insulin by beta cells. It also inhibits absorption of nutrients from the gastrointestinal tract.
Pancreatic Polypeptide (PP)	Gastrointestinal tract pancreas	Supresses the release of hormones from the digestive tract. Inhibits the release of pancreatic juice from the pancreas.

3. Absorption

- It is the process by which the end products of digestion pass through the intestinal mucosa into the blood or lymph.
- It is carried out by passive, active or facilitated transport mechanisms. Transport of water depends upon the osmotic gradient.
- Active transport occurs against the concentration gradient and requires energy. Nutrients like amino acids, monosaccharides like glucose, electrolytes like Na^+ are absorbed into the blood by this mechanism.
- Absorption of water, simple sugars and alcohols takes place in stomach.

End products which are absorbed in small intestine are

(i) **Carbohydrates** All the carbohydrates are absorbed into the blood capillaries. In this glucose and galactose are absorbed by active transport. While fructose is absorbed by facilitated diffusion. Sodium pumps of cell membrane play supportive role in their absorption.

(ii) **Amino acids** These are also absorbed in blood stream. These also involve active transport coupled with active sodium transport.

(iii) **Lipids** These are absorbed in lymph capillaries (lacteals) present within the villi. These are first incorporated, into small spherical and water soluble droplets called **micelles**. Micelles are formed with the help of bile salts and phospholipids in intestinal lumen. From these micelles, fatty acids, glycerides, sterols and fat soluble vitamins are absorbed into the intestinal cells by diffusion. The lacteals after absorption of lipids contain white coloured liquid inside them. This white coloured liquid is called **chyle**.

(iv) **Water** This takes place from the small intestine as well. It is associated with the absorption of electrolytes. Also, along with water, the water soluble vitamins except vitamin-B_{12} is also absorbed. Vitamin-B_{12} requires CIF for its absorption. Products of bacterial digestion (amino acids, vitamin-B complex and vitamin-K) are absorbed in large intestine.

4. Egestion

Egestion of undigested food occurs after the digested food passes through large intestine. Large intestine cannot absorb food, but it absorbs much of the water. The remaining semi-solid waste is called faeces and is passed into rectum.

The digestive wastes, solidified into coherent faeces in the rectum initiate a neural reflex causing an urge or desire for its removal. It is expelled out through the anus.

NOTE High temperature shuts off the appetite centre that is why one does not feel like taking meals during high fever.

Calorific Fuel Value

- It is the amount of energy liberated during complete combustion of 1 g of a substance.
- It is measured by bomb calorimeter.
- For carbohydrates, gross energy or per gram calorific value is 4.1 kcal.
- For fats, the calorific value is 9.45 kcal.
- For proteins, gross energy or per gram caloric value is 4.64 kcal.
- According to these calorific values of different nutrients, fats have the highest calorific fuel value.

Disorders of the Digestive System

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

1. **Deficiency diseases** These are caused by the lack of some particular nutrient in a person's diet. Some of them are given below

Deficiency of Nutrients and their Symptoms

Deficient nutrients	Name of deficiencies	Deficiency symptoms
Protein (PEM)	Kwashiorkor (usually observed in children of the age group of 1-5 years)	Thin limbs, retarded growth of body and brain, swelling of legs due to the retention of water (oedema), reddish hair, pot belly and diarrhoea.
Protein and calorie (PEM)	Marasmus (it usually affects infants below age of one year)	Impaired growth and replacement of tissue proteins, thin limbs and prominent ribs (very less fat in the body), wrinkled (dry) and thin skin, diarrhoea.
Vitamin-A	Nyctalopia (night blindness)	Difficulty to see in night due to the deficiency of retinol.
Vitamin-D	Rickets	Pigeon breast, bow legs, knock knee due to the low calcification of developing bones.
Vitamin-E	Macrocytic anaemia	Increased fragility and haemolysis of RBCs.
Vitamin-K	Hypoprothrombinemia	Deficiency of prothrombin in blood.
Vitamin-B_1 (thiamine)	Beri-beri	Retarded growth, degeneration of bones and muscles.
Vitamin-B_2 (riboflavin or Vitamin-G)	Dermatitis	Rough, dry and scaly skin.
Vitamin-B_3 (niacin)	Pellagra	Also known as 3D disease as its symptoms include dermatitis, diarrhoea and dementia.
Vitamin-B_5	Achromotrichia	Premature graying of hairs.
Vitamin-B_7 (vitamin-H)	Acne vulgaris	Appearance of pimples and boils in young people.
Vitamin-B_{10} (vitamin-M or folic acid)	Sprue	Ulceration of mouth, diarrhoea, etc.

Deficient nutrients	Name of deficiencies	Deficiency symptoms
Vitamin-B_{12}	Pernicious anaemia	Large, oval and fragile RBCs formation in bone marrow.
Vitamin-C (ascorbic acid)	Scurvy	Swelling and bleeding of gums.

2. **Digestive disorders** These are usually ailments of the gastrointestinal tract. Some of them are given below

Description of Digestive Disorder

Disorders	Description
Heart burn	Discomfort or pain caused by stomach contents travelling up into the gullet due to the faulty stomach muscle.
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 feeling of fullness caused due to the inadequate enzyme secretion, anxiety, food poisoning, over-eating, etc.
Ulcers	Erosion of stomach or duodenal lining by the stomach acid, caused by smoking, alcohol, certain drugs and also by the presence of *Helicobacter pylori* bacterium.
Cholelithiasis (gall stones)	Inflammation caused by formation of deposits in gall bladder, leads to disturbed ratio of cholesterol and bile salts resulting in indigestion, intolerance to fats, jaundice, etc.

DAY PRACTICE SESSION 1

FOUNDATION QUESTIONS EXERCISE

1 Digestion is
(a) absorption of digestible food
(b) absorption of water
(c) throwing out of non-digestible food substances
(d) conversion of complex food substances into simple absorbable form

2 Teeth of most reptiles and amphibians are
(a) acrodont (b) thecodont
(c) heterodont (d) diphyodont

3 Which type of teeth is found in humans?
(a) Acrodont (b) Thecodont
(c) Polyphyodont (d) Monophyodont

4 Bunodont teeth occur in
(a) elephant (b) sheep (c) carnivores (d) humans

5 Teeth of carnivores are
(a) solenodont (b) secodont
(c) lophodont (d) pleurodont

6 Dental formula of adult man is
(a) $\frac{2122}{2122}$ (b) $\frac{2123}{2123}$
(c) $\frac{2123}{2132}$ (d) $\frac{2123}{2124}$

7 Crown of teeth is covered by
(a) dentine (b) enamel
(c) Both (a) and (b) (d) None of these

8 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

9 Wisdom tooth are
(a) last molars (b) last premolars
(c) incisors (d) canines

10 The primary dentition in human differs from permanent dentition in not having one of the following types of teeth? ➞ CBSE-AIPMT 2015
(a) Canine (b) Premolars (c) Molars (d) Incisors

11 Chewing is required for
(a) solubilisation of food
(b) enjoying the taste of food
(c) decreasing surface area of food
(d) increasing surface area of food

12 Transverse rugae occur on
(a) hard palate (b) soft palate
(c) tongue (d) stomach

13 Epiglottis is meant for protecting
(a) oesophagus from entry of air
(b) nasal chambers from entry of food
(c) larynx from entry of food
(d) teeth from caries

14 Glottis is opening in the floor of
(a) diaphragm (b) buccopharyngeal cavity
(c) trachea (d) None of these

15 Frenulum is
(a) adenoid present on pharyngeal walls
(b) tonsil found on lateral walls of soft palate
(c) V-shaped sulcus dividing tongue into pharyngeal and oral parts
(d) fold attaching tongue

16 Part of tongue that gives feeling of sweetness is
(a) tip (b) lateral edges
(c) middle part (d) posterior part

17 Which among the following is absent in upper one-third part of oesophagus?
(a) Aurebach's plexus (b) Meissner's plexus
(c) Submucosa (d) All of these

18 In an empty stomach, the mucosa is thrown into folds called
(a) rugae (b) villi
(c) alveoli (d) None of these

19 In the stomach, gastric acid is secreted by the ➞ NEET-I 2016
(a) parietal cells (b) peptic cells
(c) acidic cells (d) gastrin secreting cells

20 Pepsin is secreted by
(a) zymogen cells (b) epithelial cells
(c) liver (d) pancreas

21 Which of the following gastric cells indirectly help in erythropoiesis? ➞ NEET 2018
(a) Goblet cells (b) Mucous cells
(c) Chief cells (d) Parietal cells

22 Chamber of ruminant stomach, where food is mixed with gastric juice is called
(a) abomasum (b) omasum
(c) psalterium (d) rumen

23 In ruminant stomach, the rumen is the
(a) largest chamber
(b) chamber having cellulose fermenting microorganisms
(c) chamber having villi with cornified surface
(d) All of the above

24 The middle part of small intestine is
(a) duodenum (b) jejunum
(c) ileum (d) pyloric region

25 The small intestine is held to the posterior abdominal wall by the
(a) mesentery (b) falciform ligament
(c) greater omentum (d) lesser omentum

26 Which of the following, guards the opening of hepatopancreatic duct into the duodenum? ➞ NEET-I 2016
(a) Ileocaecal valve (b) Pyloric sphincter
(c) Sphincter of Oddi (d) Semilunar valve

27 The secretion of brush border cells of intestinal mucosa along with secretion of goblet cells constitute
(a) succus entericus (b) chyme
(c) gastric juice (d) chylomicrons

28 The large intestine lacks
(a) goblet cells (b) epiploic appendages
(c) plicae circulares (d) haustra

29 Where do certain symbiotic microorganisms normally occur in human body?
(a) Caecum
(b) Oral lining and tongue surface
(c) Vermiform appendix and rectum
(d) Duodenum

30 The hepatic flexure of the large intestine occurs between the
(a) transverse colon and descending colon
(b) caecum and ascending colon
(c) ascending colon and transverse colon
(d) descending colon and rectum

31 Ampulla of vater is a common passage for
(a) bile and pancreatic duct
(b) trachea and oesophagus
(c) laryngo pharynx and oropharynx
(d) jelly filled pockets

32 Bile pigments are
(a) haemocyanin (b) biliverdin
(c) bilirubin (d) Both (b) and (c)

33 Insulin is secreted by
(a) α-cells of pancreas (b) β-cells of pancreas
(c) γ-cells of pancreas (d) acini of pancreas

34 Particulate matter from portal circulation is removed by
(a) Peyer's patches (b) Argentaffin cells
(c) Rugae (d) Kupffer cells

35 Food after getting churned in stomach is called
(a) bolus (b) chyle
(c) chyme (d) None of these

36 The duct of gall bladder (cystic duct) along with the hepatic duct from the liver forms
(a) pancreatic duct
(b) common bile duct
(c) common hepatopancreatic duct
(d) None of the above

37 Duodenum has characteristic Brunner's glands, which secrete two hormones called
(a) kinase and oestrogen
(b) secretin and cholecystokinin
(c) prolactin and parathormone
(d) oestradiol and progesterone

38 Identify the correctly matched structure and its secretion.
(a) Brunner's glands – Salivary amylase
(b) Intestinal mucosa – Insulin
(c) Gall bladder – Bile
(d) Salivary gland – Lysozyme

39 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

40 The food after its passage through the small intestine forms an alkaline fluid emulsion called

(a) faecus (b) chyme (c) bolus (d) chyle

41 Most digestion and absorption of food takes place in

(a) stomach (b) small intestine
(c) caecum (d) large intestine

42 Gastric juice of infants contains ➞ CBSE-AIPMT 2015

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

43 Epithelial cells of the intestine involved in food absorption have on their surface

(a) pinocytic vesicles (b) phagocytic vesicles
(c) zymogen granules (d) microvilli

44 Fructose is absorbed into the blood through mucosa cells of intestine by the process called ➞ CBSE-AIPMT 2014

(a) active transport (b) facilitated transport
(c) simple diffusion (d) co-transport mechanism

45 Which is incorrectly matched?

(a) Rennin-liver (b) Ptyalin-mouth
(c) Pepsin-stomach (d) Trypsin-intestine

46 Castle's intrinsic factor helps in

(a) absorption of vitamin-B_{12} in ileum
(b) absorption of vitamin-B_7 in jejunum
(c) digestion of proteins
(d) digestion of carbohydrates and fats

47 Absorption of vitamin-B_{12} in human requires *'P'* glycoprotein secreted from '*Q*'. The correct choices of *P* and *Q* are

(a) *P*–Extrinsic factor and *Q*–stomach
(b) *P*–Intrinsic factor and *Q*–stomach
(c) *P*–Intrinsic factor and *Q*–small intestine
(d) *P*–Exopolysaccharide and *Q*–small intestine

48 G-cells stimulate

(a) the release of gastric juice
(b) gastric mobility
(c) release of digestive enzymes in the gastric juice
(d) Both (a) and (b)

49 Which 'enzyme' initiates the digestion of proteins?

(a) Trypsin
(b) Pepsin
(c) Amino peptidase
(d) Carboxypeptidase

50 Find out which one is an incorrect match.

(a) Endopeptidase – Pepsin-like enzyme
(b) Exopeptidase – Amylopsin
(c) Pancreatic lipase – Steapsin
(d) Nucleases – Ribonuclease

51 The enzyme that is not present in succus entericus is ➞ CBSE-AIPMT 2015

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

52 Which one of the following is the correct matching of the site of action on the given substrate, the enzyme acting upon it and the end-product?

(a) Duodenum–Triglycerides $\xrightarrow{\text{Trypsin}}$ Monoglycerides
(b) Small intestine–Starch $\xrightarrow{\alpha\text{-amylase}}$ Disaccharide (maltose)
(c) Small intestine–Proteins $\xrightarrow{\text{Pepsin}}$ Amino acids
(d) Stomach–Fats $\xrightarrow{\text{Lipase}}$ Micelles

53 Which part of our body secretes the hormone secretin?

(a) Ileum (b) Stomach
(c) Duodenum (d) Oesophagus

54 Cholecystokinin is a digestive hormones. It is secreted in

(a) oesophagus (b) ileum
(c) duodenum (d) pyloric stomach

55 Name a peptide hormone which acts mainly on hepatocytes, adipocytes and enhances cellular glucose uptake and utilisation. ➞ NEET-II 2016

(a) Insulin (b) Glucagon (c) Secretin (d) Gastrin

56 When the body is engaged in long-duration low-intensity exercise, the principal energy source is

(a) carbohydrates (b) fats
(c) proteins (d) glycogen

57 A person suffering from the deficiency of the visual pigment rhodopsin is advised to take more of

(a) radish and potato (b) apple and grapes
(c) carrot and ripe papaya (d) guava and ripe banana

58 Which one of the following is the correct matching of a vitamin, its nature and its deficiency disease?

(a) Vitamin-A — Fat soluble — Night blindness
(b) Vitamin-K — Fat soluble — Beri-beri
(c) Vitamin-A — Fat soluble — Beri-beri
(d) Vitamin-K — Water soluble — Pellagra

59 The disease that occurs in mature adult human being due to deficiency of calciferol is

(a) keratomalacia (b) osteomalacia
(c) glossitis (d) pernicious anaemia

60 Pernicious anaemia results due to deficiency of

(a) vitamin-B_1 (b) Vitamin-B_{12}
(c) vitamin-A (d) iron

61 Kwashiorkor and beri-beri are

(a) communicable diseases (b) infectious diseases
(c) deficiency diseases (d) None of these

62 Disease which is caused by the presence of *Helicobacter pylori* bacterium is

(a) gall stones (b) diarrhoea
(c) ulcers (d) heartburn

63 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 and passive absorption.
(c)	Glycerol and fatty acids	Duodenum and move as chylomicrons.
(d)	Cholesterol and maltose	Large intestine and active absorption.

64 Column I contains names of the sphincter muscles of the alimentary canal and Column II contains their location. Match them properly and choose the correct answer.

	Column I		Column II
A.	Sphincter of an internus	1.	Opening of hepatopancreatic duct into duodenum
B.	Cardiac sphincter	2.	Between duodenum and posterior stomach
C.	Sphincter of Oddi	3.	Guarding the terminal part of alimentary canal
D.	Ileocaecal sphincter	4.	Between oesophagus and anterior stomach
E.	Pyloric sphincter	5.	Between small intestine and bowel

Codes

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

Directions (Q. Nos. 65-67) *In each of the following questions a statement of Assertion is given followed by a corresponding statement of Reason just below it. Of the statements, mark the correct answer as*

(a) If both Assertion and Reason are true and Reason is the true explanation of Assertion
(b) If both Assertion and Reason are true, but Reason is not the true explanation of Assertion
(c) If Assertion is true, but Reason is false
(d) If both Assertion and Reason are false

65 **Assertion** Thick layers of muscles are present in the wall of alimentary canal.

Reason These muscles help in the mixing of food materials with the enzymes coming from different glands in the alimentary canal.

66 **Assertion** The stomach mucosa is not digested by its own secretions.
Reason Mucin coats the mucosa of stomach.

67 **Assertion** In alcoholic drink, the alcohol is converted into glucose in liver.

Reason Liver cells are able to produce glucose from alcohol by back fermentations.

DAY PRACTICE SESSION 2

PROGRESSIVE QUESTIONS EXERCISE

1 Obstruction of the common bile duct by gall stones would most likely affect the digestion of
(a) carbohydrates (b) fats
(c) proteins (d) nucleic acids

2 Which one of the following terms describe human digestion?
(a) Pleurodont, Monophyodont, Homodont
(b) Thecodont, Diphyodont, Heterodont
(c) Thecodont, Diphyodont, Homodont
(d) Pleurodont, Diphyodont, Heterodont

3 Intrinsic factor is required for
(a) production of gastric juice
(b) absorption of vitamin-B_{12}
(c) peristalsis
(d) feeling of hunger

4 The muscle associated with lip is called
(a) philtrum (b) orbicularis oris
(c) palatoglossal (d) lingual

5 Cud chewing animals are known as
(a) frugivores (b) sanguivores
(c) ruminant (d) cannibals

6 The important salts of bile are
(a) sodium carbonate (b) sodium glycocholate
(c) sodium taurocholate (d) All of these

7 Regurgitation of food from stomach is prevented by
(a) pyloric sphincter
(b) cardiac sphincter
(c) circular muscle
(d) muscularis mucosae

8 Which of the following is not a major gastrointestinal hormone?

(a) Epinephrine (b) Secretin
(c) Gastrin (d) Cholecystokinin

9 Paneth cells are found in

(a) crypts of Lieberkuhn (b) Peyer's patches
(c) islet of Langerhans (d) gastric glands

10 Which of the following is an essential fatty acid in mammals?

(a) Stearic acid (b) Acetic acid
(c) Palmitic acid (d) Gamma linolenic acid

11 Stellate reticuloendothelial cells of liver are

(a) mast cells (b) hepatocytes
(c) Kupffer's cells (d) All of these

12 If we take food rich in lime juice, then action of ptyalin on starch

(a) is enhanced (b) is reduced
(c) is unaffected (d) stops

13 Meckle's diverticulum occurs in

(a) rectum (b) appendix (c) ileum (d) pylorus

14 Antixerophthalmic vitamin is

(a) vitamin-A (b) vitamin-D (c) vitamin-E (d) vitamin-K

15 Deglutition is controlled by

(a) cerebellum
(b) cerebrum
(c) medulla oblongata and pons Varolii
(d) pons Varolii

16 Infraorbital salivary glands are absent in

(a) dogs and cats (b) humans and rabbits
(c) frogs and reptiles (d) horses and cows

17 Which is the largest part of stomach?

(a) Cardiac ventriculi (b) Corpus ventriculi
(c) Fundus or fornie ventriculi (d) Pyloric antrum

18 The important anionic element phosphorus

(a) is a part of energy carriers
(b) constitutes bones, teeth and biomembranes
(c) helps in the maintenance of body buffers
(d) All of the above

19 One of the following compounds does not directly provide energy, but is still required by the body in little quantity.

(a) Antigen (b) Antibody
(c) Vitamin (d) Carbohydrates

20 Cholecystokinin pancreozymin is secreted by

(a) epithelium of stomach (b) epithelium of small intestine
(c) hepatocytes (d) cells lining the pancreas

21 Which one of the following pairs is characterised by swollen lips, thick pigmented skin of hands and legs and irritability?

(a) Iodine – Goitre (b) Protein – Kwashiorkor
(c) Thiamine – Beri-beri (d) Nicotinamide – Pellagra

22 Which hormones stimulate the production of pancreatic juice and bicarbonate?

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

23 Continued consumption of a diet rich in butter, red meat and eggs for a long period may lead to

(a) vitamin-A toxicity
(b) kidney stones
(c) hypercholesterolemia
(d) urine laden with ketone bodies

24 In the following process of digestion, the enzymes at location '*X*' and '*Y*' are respectively,

$$\text{Proteins} \xrightarrow{X} \text{Protease and Peptones} \xrightarrow{Y} \text{Dipeptides}$$

Choose the correct option.

(a) Chymotrypsin and pepsin (b) Pepsin and trypsin
(c) Ptyalin and pepsin (d) Trypsin and dipeptidase

25 Identify the statement which is incorrect about lipoic acid.

(a) Cereals and germ oil are a rich source of this vitamin
(b) It works as coenzyme for decarboxylation of pyruvic acid to α-ketoglutaric acid
(c) It helps in normal growth of body
(d) It is also termed as oxidative factor

26 The cells of pancreas are not autodigested by their enzymes as

(a) cells are covered by mucus
(b) enzymes are produced only when required
(c) enzymes do not have coenzymes
(d) enzymes are secreted in inactive form

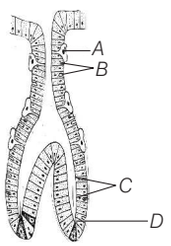
27 Which part among the following prevents the passage of air into oesophagus during breathing?

(a) Ventriculus
(b) Corpus
(c) Cricopharyngeal sphincter
(d) Cardiac sphincter

28 Examination of blood of a person suspected of having anaemia, shows large, immature, nucleated erythrocytes without haemoglobin. Supplementing his diet which of the following is likely to alleviate these symptoms?

(a) Thiamine
(b) Folic acid and cobalamin
(c) Riboflavin
(d) Iron compounds

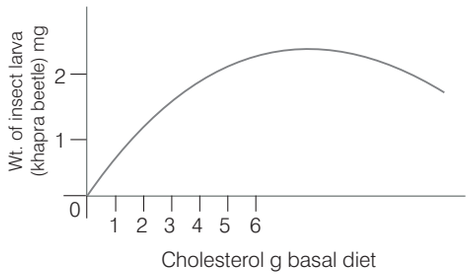
29 Refer to the given figure of gastric gland and select the incorrect statements.



I. *A* is oxyntic cell which secretes hydrochloric acid.
II. *C* are chief cells which secrete pepsin.
III. *B* are mucous cells which secrete mucus.
IV. *D* is argentaffin cell which produces insulin.

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

30 In an experiment, freshly hatched larvae of an insect (khapra beetle) were reared on a basal diet (complete diet without cholesterol) with increasing amount of cholesterol. Result obtained are shown in the graph given.

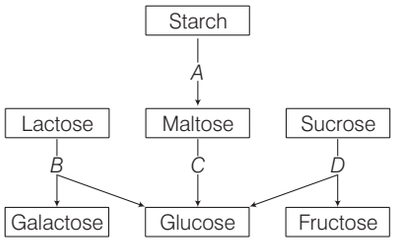


The graph indicates

(a) cholesterol is an essential dietary requirement of khapra beetle
(b) growth of khapra beetle is directly proportional to cholesterol concentration
(c) cholesterol concentration of 2 μg/g diet is the optimum level
(d) growth of khapra beetle is inhibited, when cholesterol concentration exceeds 5 μg/g diet

31 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 from those given below:



(a) *A*–Amylase, *B*–Maltase, *C*–Lactase, *D*–Invertase
(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*–Invertase

Directions (Q. Nos. 32 and 33) *In each of the following questions a statement of Assertion is given followed by the corresponding statement of Reason just below it. Of the statements, mark the correct answer as*

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

32 **Assertion** An elephant's tusk is a modified upper incisor.
Reason Tusk of elephant is used in food uptake.

33 **Asseriton** Digested material is absorbed in the intestine through the process of diffusion.
Reason Diffusion is a very fast process of absorption.

ANSWERS

SESSION 1

1 (d)	**2** (a)	**3** (b)	**4** (d)	**5** (b)	**6** (b)	**7** (b)	**8** (c)	**9** (a)	**10** (b)
11 (d)	**12** (a)	**13** (c)	**14** (b)	**15** (d)	**16** (a)	**17** (d)	**18** (a)	**19** (a)	**20** (a)
21 (d)	**22** (a)	**23** (d)	**24** (b)	**25** (a)	**26** (c)	**27** (a)	**28** (c)	**29** (a)	**30** (c)
31 (a)	**32** (d)	**33** (b)	**34** (d)	**35** (c)	**36** (b)	**37** (b)	**38** (d)	**39** (c)	**40** (d)
41 (b)	**42** (c)	**43** (d)	**44** (b)	**45** (a)	**46** (a)	**47** (b)	**48** (d)	**49** (b)	**50** (b)
51 (b)	**52** (b)	**53** (c)	**54** (c)	**55** (a)	**56** (b)	**57** (c)	**58** (a)	**59** (b)	**60** (b)
61 (c)	**62** (c)	**63** (a)	**64** (c)	**65** (a)	**66** (a)	**67** (c)			

SESSION 2

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