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B.Sc. (Hons), M.Sc.

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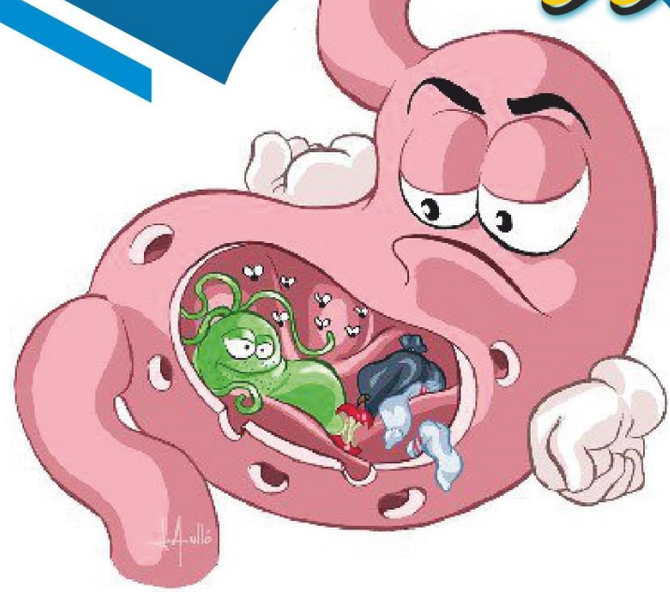
Biology

ENGLISH MEDIUM



UNIT 05

Animal Form and Function

Animal Nutrition 2

SAMPATH LANKADHEERA
B.Sc. (Hons), M.Sc.

Live Biology

Biology

New Syllabus

SAMPATH LANKADHEERA

Unit 05 Animal Form and Function
Nutrition 2

ADVANCED LEVEL

Biology

Unit - 05

Animal Form and Function

- Nutrition 2

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37. Undigested carbohydrates/ matter passes to large intestine.
38. And to rectum and.
39. Passes out (through anus) (38 x 4 = 152) (Maximum 150)

Essay answer 2

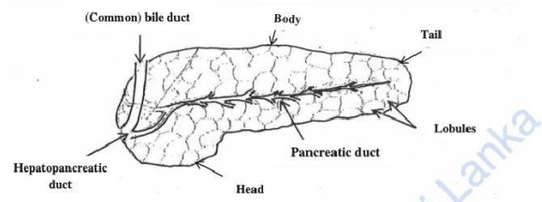
Write short notes on the following: Pancreas

1. The pancreas is a pale grey gland which consists of
2. a broad head,
3. a body and
4. a narrow tail.
5. Head is in the curve of the duodenum
6. Pancreas is both an exocrine
7. and endocrine gland.
8. The exocrine part consists of a large number of lobules
9. made up of small acini,
10. Each lobule formed of number of small alveoli.
11. the walls of which consist of secretary cells.
12. Each lobule is drained by a tiny duct
13. and these unite eventually to form the pancreatic duct
14. which joins with bile duct to form hepato pancreatic duct
15. and opens into the duodenum at its midpoint.
16. Exocrine part of the pancreas secretes pancreatic juice.
17. The components of the pancreatic juice are bicarbonate,
18. carbohydrate digesting enzymes (pancreatic amylase),
19. pancreatic lipase,
20. Carboxypeptidase,
21. nucleases and
22. inactive form of protein digesting enzymes (trpsinogen and chymotrypsinogen).
23. These inactive enzymes are converted to active enzymes (trypsin and chymotrypsin)
24. upon secretion into the lumen of the duodenum.
25. Lobules drained by small ducts
26. Unites to form pancreatic duct
27. Endocrine part of the pancreas is the islets of Langerhans,
28. which consist of group of specialized cells.
29. They do not have ducts.
30. Islets of Langerhans secrete hormones,
31. Formed of α and β cells
32. α cells secretes glucagons
33. β cells secretes insulin.
34. glucagan and
35. insulin which are involved in glucose homeostasis.

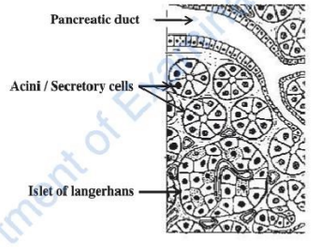
Essay answer 3

Write short notes on gastric juice.

1. Secreted by the gastric glands Contains
2. Water
3. Mineral slats
4. Hydrochloric acid
5. Pepsinogen



Correct diagram of gross structure of the pancreas
Fully labelled correct diagram : 7 marks
(1 mark for each label)
Unlabeled diagram : no marks



Correct diagram of Histological structure
Fully labelled correct diagram : 3 marks
(1 mark for each label)
Unlabeled diagram : no marks

Essay answer 1.
Describe what happens to a carbohydrate meal ingested by man.
In the buccal cavity of man;

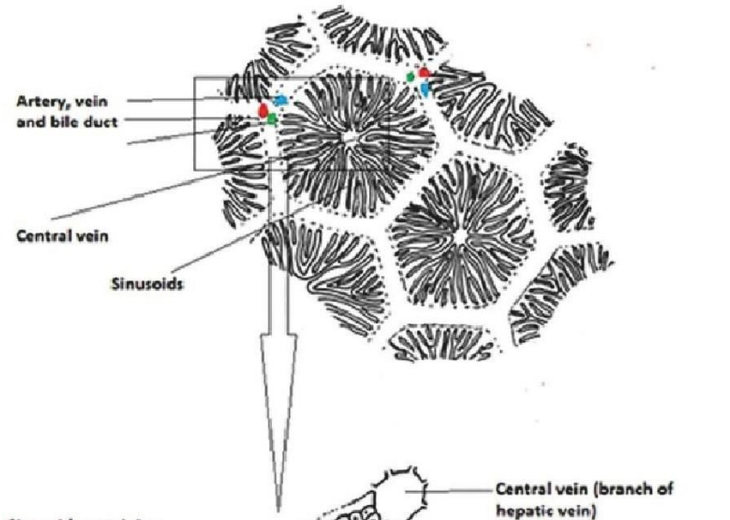
1. Food is chewed (by teeth) and mechanical brake down
2. mixed with saliva.
3. Digestion of (cooked) starch.
4. By salivary amylase/ ptyalin.
5. Food bolus is formed and
6. is passed to pharynx.
7. Bolus is swallowed.
8. Involuntarily.
9. Passes to esophagus and.
10. Then passes to the stomach.

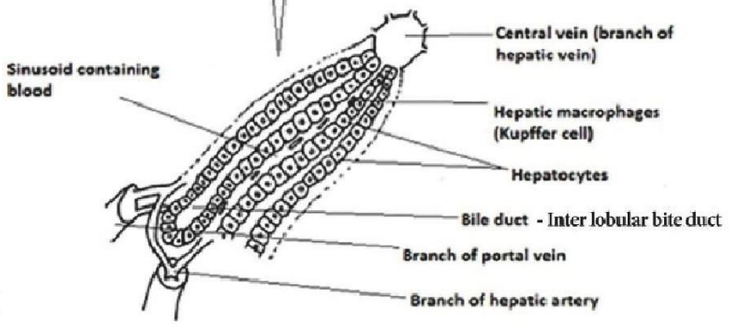
In the stomach

11. Bolus is broken and
12. Mixed with gastric juices.
13. Digestion of starch stops
14. Due to low pH.
15. Food stored temporarily and
16. Passes to small intestine /duodenum.

In the duodenum/Small intestine.

17. Food (Chyme) is mixed with intestinal juice.
18. and pancreatic juice.
19. pH is increased.
20. Starch is digested/ Broken down to maltose
21. By pancreatic amylase.
22. Intestinal disaccharidases catalyze the conversion of disaccharides into monosaccharides.
23. Maltose is digested / broken down to glucose
24. by maltase.
25. Sucrose is digested / broken down to glucose and fructose.
26. By sucrose.
27. Lactose is digested / broken down to glucose and galactose
28. By lactase.
29. Monosaccharides absorbed into the cell of the epithelium of the small intestine.
30. Actively
31. or passively
32. by carriers.
33. Some disaccharides are absorbed into epithelial cells.
34. and digested to monosaccarides (within cells).
35. These monosaccharides pass into stream/ blood capillaries villi.
36. These are then used for metabolism/ to release energy / for respiration / converted to glycogen.





ADVANCED LEVEL

Biology THEORY

in English Medium

New Syllabus

Unit 05 **Animal Form and Function**

Animal Nutrition 2

Smart Note

SAMPATH LANKADHEERA

B.Sc. (Hons), M.Sc.

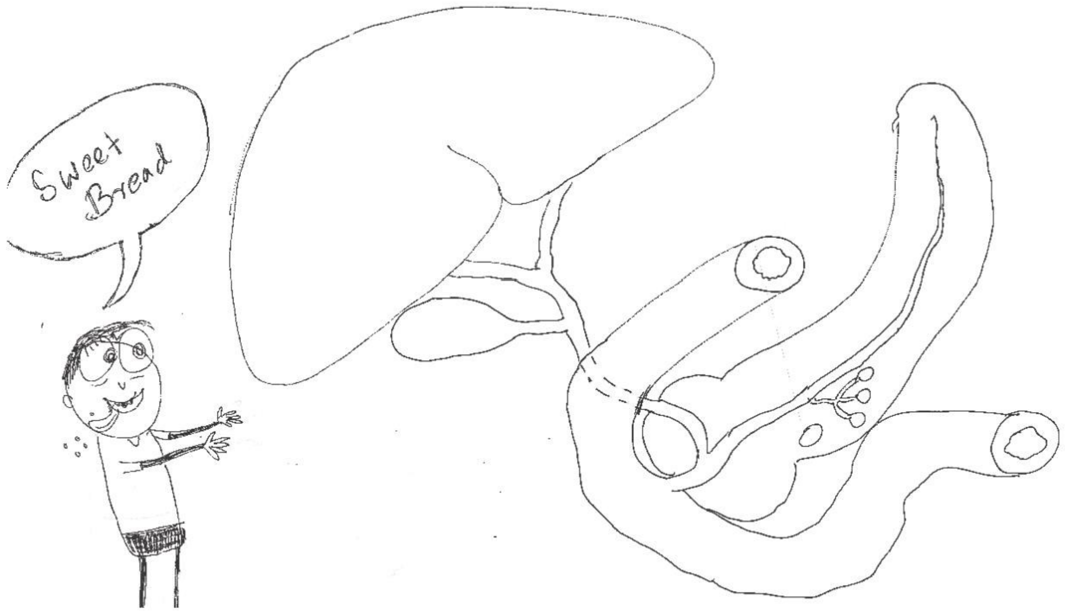
Exhilarating experience of delving in to Biology

Associated glands

Pancreas/2005

Histological structure of pancreas

- The pancreas is a ……………………. gland which consists of a …………………………., a body and a narrow tail. Head is in the curve of the duodenum Pancreas is both an exocrine and endocrine gland.
- The exocrine part consists of a large number of lobules made up of ……………………….., the walls of which consist of secretary cells. Each lobule is drained by a tiny duct and these unite eventually to form the pancreatic duct which joins with bile duct to form hepato pancreatic duct and opens into the duodenum at its midpoint. ………………………………. part of the pancreas secretes pancreatic juice. The components of the pancreatic juice are ………………………..., …………………………



Essay Aid

1. **Describe what happens to a carbohydrate meal ingested by man.** **(AL/2000)**
2. **Write short notes on the following: Pancreas**
3. **Write short notes on gastric juice.**
4. **(a) Briefly describe the histological structure of the human liver.**
   (b) Briefly explain its functions.
5. **(a) Describe the structure of human pancreas.**
   (b) Explain the role of human pancreas in digestion of food. **(AL/2022)**

14. Which one of the following statements regarding vitamins is correct?
(1) No vitamin can be synthesized in humans.(2) Cereals are a rich source of vitamin A.
(3) Deficiency of vitamin D causes bone softening in children. (4) Vitamin E acts as an antioxidant.
(5) In humans, presence of an intrinsic factor is essential for vitamin B_6 absorption. (AL/2014/12)

15. Which of the following statements is/are correct regarding human pancreatic juice?
(A) It is an acidic secretion. (B) It emulsifies fats. (C) Its secretion is stimulated by secretin.
(D) It contains inactive precursors of proteolytic enzymes.
(E) Its secretion is decreased by parasympathetic stimulations. (AL/2014/42)

16. Anemia is a deficiency syndrome of which of the following vitamins?
(1) A, D, Thiamin (2) B_{12}, B_6, Folic acid (3) K, B_1, Biotin (4) B_5, B_3, B_1 (5) B_1, B_2, Pantothenic acid
(AL/2016/11)

17. Three enzymes that digest the ingested food in the buccal cavity, stomach and small intestine of man in correct sequence are
(A) ptyalin, pepsin and aminopeptidase. (B) salivary amylase, pepsin and lactase.
(C) ptyalin, pepsin and enterokinase (D) salivary amylase, pepsin and nucleotidase.
(E) ptyalin, pepsinogen and amylase. AL/2020 Old

18. Mineral elements mainly required for maintaining acid base balance, nerve functioning and formation of bones in man in correct sequence are
(1) Mg, Fe and P. (2) P, K and Cl. (3) K, Na and I. (4) Na, K and C1. (5) Cl, Ca and P. AL/2020 New

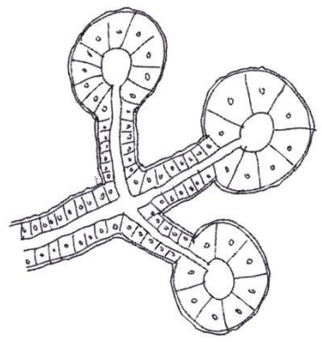
19. In which of the following. will the release of (i) result in the stimulation of (ii)?
A : (i) Gastrin (ii) Production of gastric juice
B (i) Cholecystokinin (ii) Secretion of gastric juice :
C : (i) Secretin (ii) Release of bicarbonate ions from pancreas
(1) In A only. (2) In C only. (3) In A and B only. (4) In A and C only. (5) In B and C only. AL/2021

20. In man, synthesis Of vitamin B, recovery of ions and fermentation of undigested material take place respectively in
(1) rectum, duodenum and cecum. (2) small intestine, colon and rectum. (3) colon, stomach and small intestine
(4) small intestine, gall bladder and large intestine. (5) colon, small intestine and cecum. AL/2022

19. Select the pair/pairs where an increase in
(i) causes an increase in (ii).
X : (i) Stretching of the stomach wall
(ii) Release of gastrin
Y : (i) Fat content in chyme
(ii) Food digestion in stomach
Z : (i) Amino acid content in chyme
(ii) Release of bicarbonate ions from pancreas
(1) X only. (2) Y only. (3) Z only (4) X and Y only. (5) X and Z only. AL2023

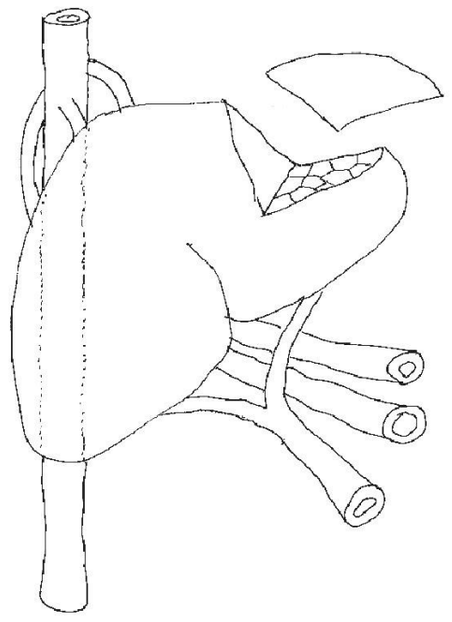
(pancreatic amylase), ……., ……... and inactive form of protein digesting enzymes (…….. and …….). These inactive enzymes are converted to active enzymes (…… and ……) upon secretion into the lumen of the duodenum.

- Endocrine part of the pancreas is the ……..., which consist of group of specialized cells. They do not have ducts. Islets of Langerhans secrete hormones glucagan and insulin which are involved in glucose homeostasis



Liver

- Liver is the largest gland in the body. Its ……..and …….. surfaces are smooth and …… Its posterior surface is ……..…….



MCQ

1. Identify the disorder associated with deficiency of vitamin B_3
   (1) Deficient steroidogenesis and anemia (2) confusion, diahorrea (3) Fragility of RBC and annemia
   (4) bone softening in adults and rickets (5) Anorexia nervosa

2. Vitamin B_2 is also called
   (1) Pantothenic acids (2) Riboflavin (3) Thiamine (4) Phylloquinone (5) Trocopherol

3. Identify the correctly matched vitamin with its common name.
   (1) Pantothenic acid - Vitamin B_2 (2) Riboflavin - Vitamin $\mathbf{B_3}$ (3) Thiamine - Vitamin K
   (4) Ascorbic acid - Vitamin C (5) Trocopherol - Vitamin A

4. Identify the gastrointestinal hormone which facilitates emptying of gall bladder and pancreatic juice?
   (1) Secretin (2) Rennin (3) Cholecystokinin (4) Gastrin (5) Carboxypeptidase

5. Which of the following statements is correct regarding the human liver?
   (1) It is the largest organ of the body. (2) It lies mainly in the upper left region of the abdomen.
   (3) It synthesizes haemoglobin. (4) It plays a role in the digestion of food.
   (5) It is not involved in temperature regulation. (AL/2001)

6. Which one of the following is an **incorrect** statement regarding human liver?
   (1) It is the largest gland in the body. (2) It is the main storage centre of the body.
   (3) It aids in the digestion of lipids. (4) It is involved in temperature regulation.
   (5) The secretion of bile from it is stimulated by cholecystokinin. (AL/2006)

7. Which one of the following statements is incorrect regarding human pancreas?
   (1) It functions both as an exocrine and endocrine gland.
   (2) Pancreatic juice contains two proteolytic enzymes.
   (3) Pancreatic juice helps to neutralize acidity of chyme.
   (4) Damage to Langerhan islets may lead to diabetes mellitus.
   (5) Secretin regulates functioning of the pancreas. (AL/2007)

8. Which one of the following is not contributory factor for gastritis?
   (1) Consumption of alcohol (2) Skipping breakfast (3) Tuberculosis (4) Mental stress
   (5) Consumption of diets deficient fibers (AL/2011)

9. The deficiency of which of the following vitamins contributes to bleeding of gums?
   (1) A (2) B_6 (3) C (4) E (5) K (AL/2001)

10. Ingestion of heavy doses of antibiotics may lead to deficiency of which of the following vitamins?
    (A) Biotin (B) Vitamin K (C) Vitamin C(D) Folic acid (E) Vitamin A (2011/old)

11. A child shows the following symptoms of vitamin deficiency.
    (a) Fatigue (b) Anaemia (c) Delay in wound healing
    Which of the following indicates the vitamins he is deficient of?
    (1) Pantothenic acids, folic acid and ascorbic acid (2) Thiamin, niacin and riboflavin
    (3) Riboflavin, vitamin B12 and biotin (4) Vitamin A, vitamin D and vitamin C
    (5) Vitamin B2, Vitamin E and Vitamin K (AL/2012/8)

12. Which of the following statements regarding vitamins is incorrect?
    (1) They are essential for normal metabolism and health.
    (2) Vitamin is synthesized within the human body
    (3) Absorption of vitamin B_{12} requires an intrinsic factor produced by the stomach.
    (4) Vitamin C is required for the synthesis and maintenance of collagen in humans.
    (5) Deficiency of folic acid can cause anemia in humans. (AL/2012/old/16)

13. Which of the following statements is/are correct regarding human liver?
    (A) Hepatocyte is the functional unit of live (B) It synthesizes urea. (C) It stores vitamin B6
    (D) It inactivates sex hormones. (E) It is involved in phagocytosis of bacteria. (AL/2012/old/59)

(b) .....

(iii) Name the vitamin which is essential for the clotting of blood in man.

.....

(iv) Name a disorder of the digestive system in man resulting from insufficient fibre in the diet.

.....

AL 2019 New

(C) (i) (a) Where is the caecum located in the human alimentary canal?

.....

(b) Name the type of cells in gastric glands of man that secretes pepsinogen.

.....

(ii) What is the main function of buffers present in saliva?

.....

(iii) State whether the following substances are transported actively or passively across epithelium of intestinal villi.

.....

.....

(iv) (a) Name the main blood vessel formed by converging blood capillaries of the intestinal villi.

.....

.....

AL 2020 New

(iii) (a) Calculate the body mass index of a person who is 153 cm tall and weighs 50 kg.

.....

.....

.....

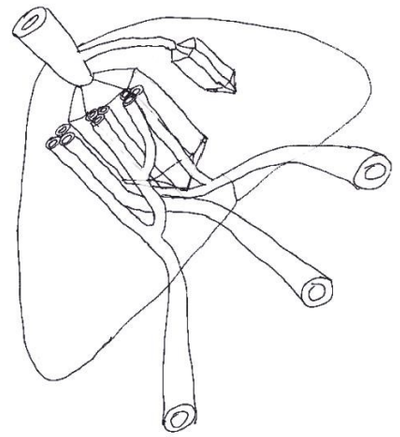
(b) According to the World Health Organization criteria, what is the minimum weight this person should have in order to consider him as non—malnourished? (Give your answer in kg to the first decimal)

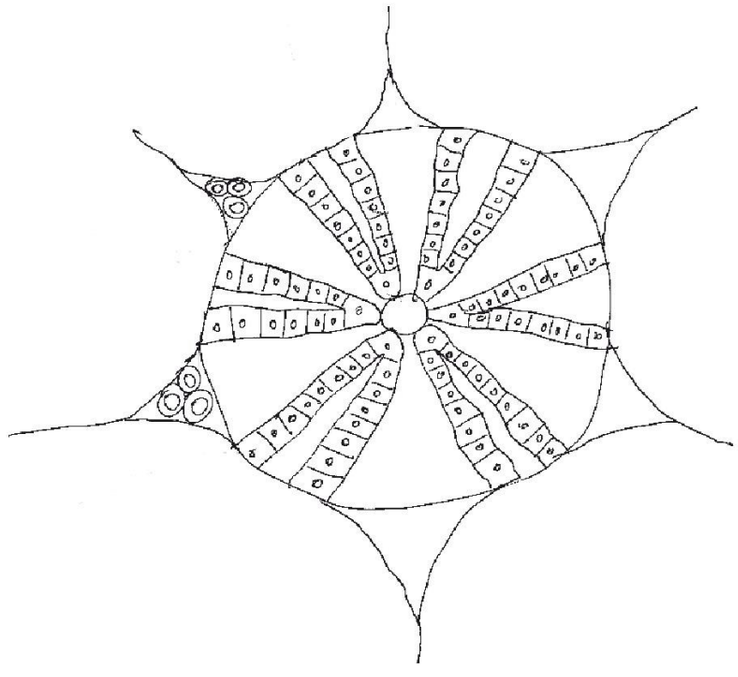
(iv) Name a fat soluble vitamin that acts as an antioxidant.

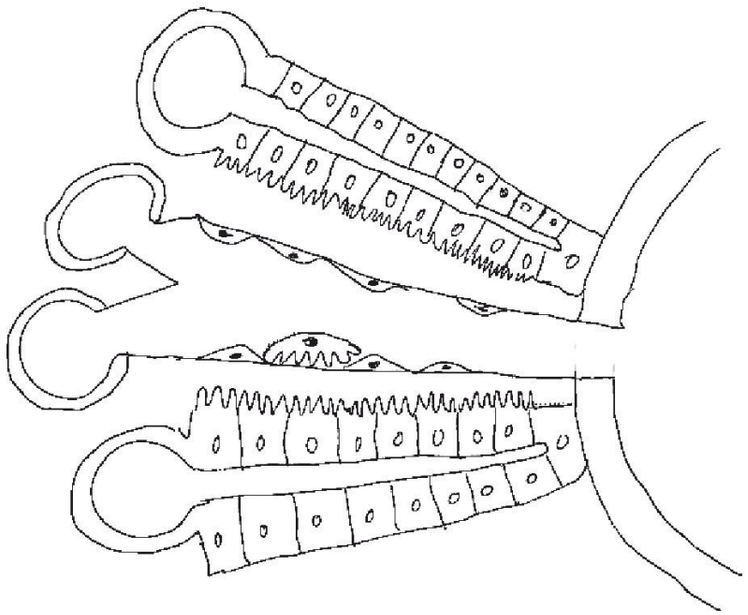
.....

(v) Name two hormones that are secreted by the digestive tract of man and have functions antagonistic to each other.

.....







(b) How does commensalism differ from mutualism?

……

……

(iii) (a) State two functions of fiber in the human diet.

……

……

……

……

(b) What are vitamins?

……

……

(c) Deficiency of what vitamin is responsible for each of the following disorders of man?

Blindness - ……

Cracking of skin around mouth - ……..

(iv) (a) What is peristalsis?

……

……

(b) Name two digestive enzymes found only in enterocytes of the human villi.

……

……

1999 Zoology

4. (B) (i) Name the sites in the human small intestine where the following enzymes act.

Enzyme	**Site**
Maltase	……
Nucleotidase	……

(ii) Which one of the enzyme to activate remaining pepsinogen?

……

(iii) What is the main function of lipase?

……

(iv) What is meant by emulsification of fat ?

……

(v) What causes the emulsification of fat in the human intestine?

……

(C) (i) What are the two main inorganic nutrients required by man

(a) …… (b) ……

(ii) Name two water soluble vitamins.

(a) ……

……

D. (i) What is meant by essential amino acids?

……

……

(ii) Name three proteolytic enzymes in the pancreatic juice of man.

……

……

……

(iii) What are the functions of amino-peptidases in the intestinal juice?

……

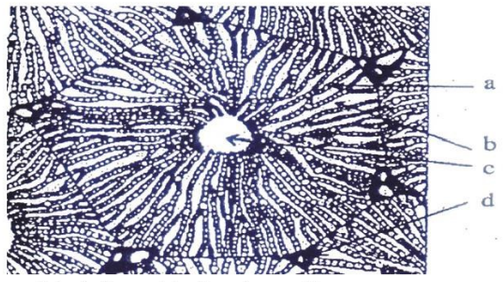
……

(iv) Name two substances found in the bile are not found in other secretions of human alimentary canal.

……

2012 AL Paper

2. A) (i) Identify the histological structure of man shown in the following diagram.



(ii) Name the structures labeled a – d in the above diagram.

(iii) State where the following take place in the human alimentary canal.

Digestion of polysaccharides - ……

Digestion of polypeptides - ……

Digestion of fats - ……

Absorption of nutrients - ……

Absorption of water - ……

2014 AL Paper

3. (A) (i) (a) What is nutrition?

……

(b) What is the main difference between autotrophs and heterotrophs?

……

……

……

(ii) (a) What is commensalism?

……

Liver contains four lobes. Each lobe is made up of tiny …….. shape lobules which are the …….... These lobules are made up of cuboidal cells called …….... which are arranged in pairs of columns radiating from a central vein. Between two pairs of column of cells there are ……... (blood vessels with incomplete walls) containing mixture of blood from the tiny branches of the portal vein and hepatic artery. This arrangement allows ……. (high concentration of nutritional materials) to mix with …….. and come into close contact with liver cells. ……... (Kupffer cells) are found in the lining of the sinusoids. Blood drains from the …….. into ……... which joins with veins from the other lobules, forming larger veins and eventually the hepatic vein. ……... run between columns of liver cells. Canaliculi join up to form larger bile canals. In the comer of the …….. a branch of hepatic artery, a branch of the hepatic portal vein and inter lobular bile duct can be found. Liver is a vital organ that performs many important functions ……...

……

……

……

Function of liver related to digestion

- ……

  ……

  ……

  ……

  ……

  ……

  Excess glucose is stored as glycogen in the liver cells. Glycogen deposition and break down in the liver cells are regulated by insulin and glucagon hormones.
- Fat soluble Vitamins (A, D, E and K) and some water soluble vitamins (B12), iron and copper are also stored in liver.

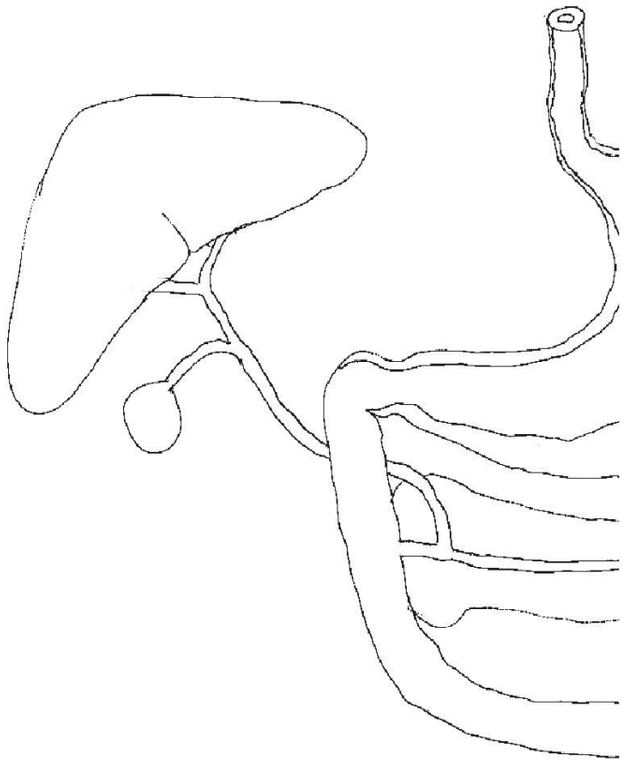
Regulation of digestion in man

- ……

  ……

  For example nervous reflex stimulates the release of saliva when food reach the mouth. Arrival of food in the stomach trigger churning and release of ……... Endocrine system plays a critical role in digestion especially in the stomach and small intestine.
- When food arrives the stomach, the stomach wall is …….. This triggers to release the hormone ……..... Gastrin circulates via the ……. and arrives the stomach. Then gastrin stimulates the production of gastric juice at the stomach.

…… or …… in the chyme trigger the release of …… and …… from the duodenum. Cholecystokinin Stimulates triggers release of bile from the gall bladder and digestive enzymes from the pancreas. Secretin stimulates the release of …… from the pancreas. Bicarbonate neutralize the chyme received from the stomach.

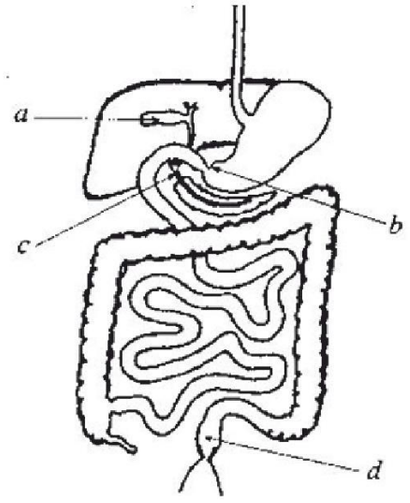


(iii) How are the contents in the stomach prevented from entering the oesophagus in man?
……
……

(iv) State three functions of the human gastric juice other than digestion.
1 ……
2 ……
3 ……

C) (i) Name the parts labeled as a, b, c and d in the above diagram and state the main function of each of these parts

	Part	**Main function**
a	……	……
b	……	……
c	……	……
d	……	……



(ii) How is the surface area for absorption increased in the small intestine of man?
……
……
……

(iii) What is peristalsis?
……
……

(iv) What is the effect of stimulation of parasympathetic nervous system on peristalsis?
……

PRACTICAL NO.17

Study the basic histological structure of the alimentary canal of man and relates the major variations in different regions to their functions.

Expected Learning Outcomes

1. Observes the gross structure and various parts of the alimentary canal of man.
2. Observes the position of each part of the alimentary canal and their position in relation to other organs.
3. Identifies the common features of the basic histological structure of the alimentary canal.
4. Highlights the functions of each part to its structure.
5. Uses the transverse sections to study the histology of the different parts of the alimentary canal.

Materials and Equipment

- Chart / model/computer illustration showing clearly the entire alimentary canal in situ
- Chart / diagrams /computer illustrations showing gross external morphology and internal anatomy of the various parts of the alimentary canal
- Prepared slides of the T.S of stomach ,T.S. of small intestine, T.S. of liver and T.S. of large intestine
- Microscope

Instructions

- Provide students with wall charts/ models/computer illustrations to observe the major parts of the alimentary canal.
- Let students observe the position of each part of the alimentary canal with respect to other organs.
- Ask the students to observe the prepared slides and identify the four layers.
- Direct students to examine the gross external morphology and internal structure of the stomach, small intestine, large intestine and rectum.
- Let students to observe charts/slides/ models /computer illustrations of T.S of stomach, T.S of small intestine, T.S of liver and T.S of large intestine.
- Instruct students to make appropriate notes and illustrative sketches in respect of all above observations.
- Direct them to make line diagrams to show the histology of the wall of different parts of the alimentary canal of man using charts/models/microscopic slides.
- Provide students with prepared slides of the T.S of stomach , small intestine to identify four basic layers that form the wall of the stomach / small intestine.
- Guide them to identify different types of tissues that form each of the four layers.

2007 AL Paper

1. A. (iii) What is a balanced diet?

……

……

(v) What is the function of amylase present in human saliva?

……

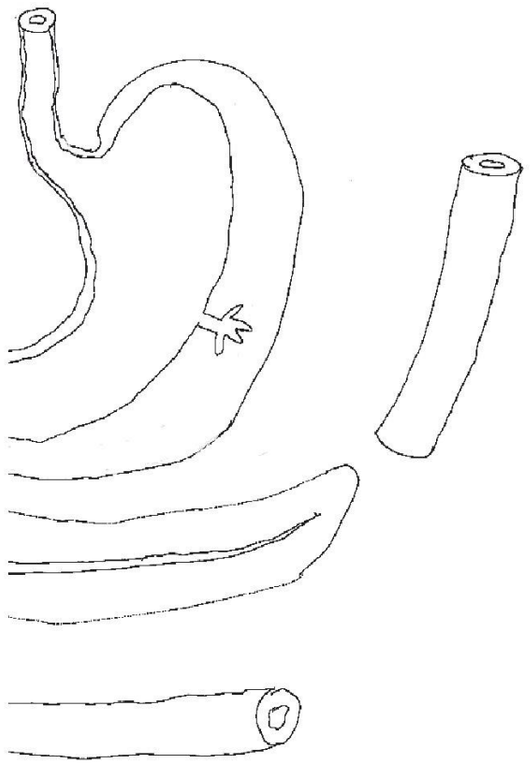
B. (i) In which part of the human alimentary canal are smooth muscle layers most developed?

……

(ii) Name the main type of tissue found in the submucosa of the human alimentary canal.

……

- When the chyme is rich in fat, food …… …….. due to high levels of Cholecystokinin and Secretin secreted by duodenum. These hormones act on the stomach and inhibit peristalsis and gastric juice secretion. Thereby slowing digestion.



Balanced Diet

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Essential components of the balanced diet contain carbohydrates, proteins. lipids, fibers, minerals, vitamins and water. Carbohydrates and lipids supply energy. Energy requirements vary with age, sex, body size and activity. Twenty amino acids are needed to synthesize proteins in the body. Most of these amino acids are synthesized within the body. They are known as non essential amino acids (e.g. Alanine, cystine, etc). Other amino acids (e.g. lysine and histidine, etc.) must be obtained from the diet as they can't be synthesized within the body. They are called essential amino acids. Animal proteins contain all the essential amino acids in proper proportions. However most plant proteins lack one or more essential amino acids. Therefore vegetarian based diet requires several sources of plant proteins to obtain all the essential amino acids.

Components of foods and their functions

1. Carbohydrates
2. Proteins
3. Lipids
4. Vitamins
5. Mineral elements
6. Water
7. Fibers

Carbohydrates

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- During digestion most carbohydrates are broken down into monosaccharides which are absorbed into blood stream.

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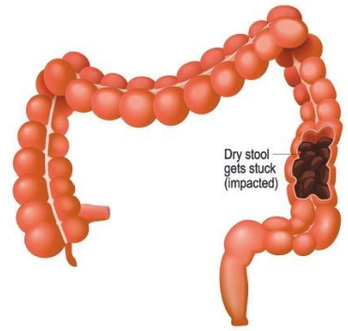
- Due to the damages of mucosa layer of the stomach, blisters can be formed. Prolonged starvation and mental stress are one of the reasons for the secretion of excess HCl.
- Some drugs like aspirin can also induce gastritis conditions.
- Longer lasting gastritis conditions is usually associated with the infection by the acid tolerance bacterium *Helicobacter pylori.*
- As prolonged starvation is one of the reasons for developing gastritis proper food habits should be practiced to control this condition.

Constipation/Costiveness, or **Irregularity**



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Control

- Constipation can be controlled by developing behavioral adjustments to carry out defecation properly.
- Intake of adequate fiber in the diet can help prevent constipation.

Food for healthy life:

- For a healthy life diet should contain correct proportions of carbohydrates, proteins, lipids, water, fiber, essential mineral elements and vitamins. Dietary deficiencies can have negative impact on health. When food intake exceeds daily energy requirements especially in inactive individuals can lead to ill health conditions specially diabetes mellitus and heart diseases. Some individuals develop allergic reactions to foods such as pineapple, peanuts and tomatoes. Such individuals should avoid these types of foods. Antioxidants present in the food material (e.g. vitamin C and vitamin E) are also important in avoiding disorders in the alimentary canal and maintaining a healthy life. As humans cannot synthesize all the required antioxidants some of them should be obtained from the diet

Malnutrition:

- Malnutrition can arise due to failure of obtaining an adequate nutrition when the diet lacks one or more essential nutrients or consistently supplies less chemical energy than the energy required by the body. According to the WHO if, body mass index (BMI) is less than 18.5 is said to be malnutrition. BMI of a person is calculated as follows,

$$BMI = \frac{Weight\ (kg)}{[Height(m)]^2}$$

Obesity:

- Obesity arises when energy expenditure of a person is much less than the energy intake. According to the WHO criteria, if the BMI is at 30.0 or over it is known as obesity. This condition is a growing issue worldwide. Obesity can lead to many diseases such as diabetes mellitus, cardiovascular diseases, some cancers etc.

Common disorders in the alimentary canal

Gastritis:

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Functions of digestible carbohydrates

- Provide energy and heat: breakdown of carbohydrates provides ATP for body functions and generates heat.
- Act as an energy stores. e.g. excess carbohydrates are converted into glycogen and fat
- Facilitates protein sparing- proteins are not used to get energy when there is an adequate carbohydrates in the food

Proteins

- Proteins are made up of amino acids during the digestion, proteins are broken down into amino acids and absorbed into the blood stream.
- The amino acids are grouped into two groups as essential amino acids and non essential amino acids. These essential amino acids cannot be synthesized in the body, therefore they should be obtained into the body through the diet. The non essential amino acids can be synthesized within the body. Therefore it is not necessary to obtain them through the diet.

Functions of proteins in the diet

- The amino acids which are supplied from proteins are used for growth and repair of body cells and tissues are used for synthesis of plasma proteins, enzymes, antibodies and some hormones.
- Act as an energy source for body functions

Lipids

- Lipids in the diet are mainly composed of fats and oils. Fatty acids are composed of fats and oils. Fatty acids can be grouped as essential and non essential fatty acids. Essential fatty acids cannot be synthesized within the body while the non essential fatty acids can be synthesized within the body. Therefore essential fatty acids should be obtained through the food.

Functions of lipids in the diet

- Provide energy and heat (on weight basis fats and oils provide more energy compared to carbohydrates and proteins)
- Help in transport and storage of fat soluble vitamins such as Vitamin A, D, E and K
- Store energy as fat in the adipose tissues
- Help to synthesize steroid hormones from cholesterol.
- Provide insulation: (Eg: fat found in subcutaneous layer in the skin reduces heat loss, constituents of myelin sheath of neurons)

Vitamins

- Vitamins are organic compounds required in small amounts for the maintenance of normal health and metabolism. Vitamins cannot be produced in the body and therefore should be provided in the diet. If the vitamins are insufficiently taken into the body, that may lead to the deficiency diseases.

- Vitamins are two types they are fat soluble vitamins (Vitamin A, D, E and K) and water soluble vitamins (Vitamin B and C).

Main Functions of Vitamins

- Vitamin A - form visual pigments in the eye, epithelial tissue maintenance, promotion of growth and immunity
- Vitamin B - components of coenzymes such as FAD and NAD, promote red blood cell production
- Vitamin C - act as an antioxidant, used in collagen synthesis
- Vitamin D - aids in absorption and use of Calcium and Phosphorous
- Vitamin E - act as an antioxidant
- Vitamin K - important in blood clotting

Vitamin/ Mineral	Main dietary sources	Deficiency symptoms
Fat soluble vitamins		
Vitamin A (retinol)	Dark green vegetables, orange vegetables and fruits, dairy products	Blindness, skin disorders, immunity impairment
Vitamin D	Egg yolk, dairy products	Bone deformities (rickets) in children, bone softening in adults
Vitamin E	Vegetable oils, nuts, seeds	Nervous system degeneration
Vitamin K	Green vegetables, tea, produced by colon bacteria	Defective blood clotting
Water soluble vitamins		
Thiamine (Vitamin B1)	Legumes, peanuts, whole grains, pork	Beriberi (characterized by tingling, poor coordination, susceptibility to infection, reduced heart function)
Riboflavin (Vitamin B2)	Dairy products, meats, vegetables, enriched grains	Skin lesions (cracks at corners of mouth)
Niacin (Vitamin B3)	Grains, nuts, meats.	Pellagra (characterized by lesions in skin, mental confusion and diarrhea)
Pantothenic acid (Vitamin B5)	Dairy products, fruits, vegetables, grains	Fatigue, numbness, tingling of hands and feet
Pyridoxine (Vitamin B6)	Whole grains, Meats, vegetables	Irritability, anemia
Biotin (Vitamin B7)	Meats, legumes, vegetables	Neuro- muscular disorders, scaly skin inflammation
Folic acid (Vitamin B9)	Green vegetables, whole grains	Anemia, birth defects
Cobalamin (Vitamin B12)	Dairy products, eggs, meats	Loss of balance, numbness, anemia
Ascorbic acid (Vitamin C)	Citrus fruits, broccoli, tomatoes	Scurvy (characterized by degeneration of skin and teeth) , delayed wound healing

Minerals

- Minerals are inorganic substances and they are also important for normal health and many body functions.
- Major mineral elements needed by humans are Ca, P, S, K, Cl, Na, Mg, Fe, F and I.
- In addition minerals needed in trace amounts include Co, Cu, Mn, Mo, Se and Zn.

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- BMR of humans averages for adult males 1,600-1,800 kcal per day and 1,300- 1,500 kcal for adult females.

Energy budget

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C = M + U + F + P

- Where
  C = Energy content in the food sources taken in
  M = Energy spent for metabolic activities
  U = Energy associated with urinary loss
  F = Energy associated with fecal loss
  P = Production (Energy available for growth and reproduction)
- In energy budgets, energy content in the food intake is compared with energy expenditure which includes energy spent for basal metabolism and extra activities (M), energy associated with excretory products namely urinary loss (U) and fecal loss (F).
- The energy differences between the energy intake and the energy expenditure for metabolism and excretion are available for production which includes growth and reproduction.
- Energy budget can be calculated for each animal based on energy measurements from field and laboratory. Energy budgets are useful for estimating energy available for growth and reproduction.

Fibers/2014 AL

- Dietary fibers (non starch polysaccharides) are made up of indigestible polysaccharides in the diet. Fibers are rich in fruit, vegetable and cereals. Cellulose, hemicelluloses and pectin are the main fibers present in food.

Functions of dietary fibers

- Provide bulk to the diet and satisfy the appetite.
- Prevent constipation by attracting water to increase faecal bulk and stimulating peristalsis leading to defecation.
- Adequate fibers in the diet protect against some gastro-intestinal disorders such as cancers in the colon and rectum.

Essential nutrients

- Essential nutrients are the substances that cannot be synthesized in the body from simple precursors and must therefore be taken through the diet. These essential nutrients include essential amino acids, essential fatty acids, vitamins and minerals. Essential nutrients have key functions in bio synthetic reaction in the body cells. If these essential nutrients are not supplied in correct proportions in the diet that will lead to malnutrition. Therefore it is essential to obtain them in correct amounts.

Essential amino acids:

- Essential amino acids are the amino acids that must be obtained from the food since they cannot be synthesized within the body from organic precursor molecules. Of the 20 amino acids required to make proteins in the body 8 amino acids are essential amino acids. Examples for essential amino acids are leucine and methionine. The animal protein products (e.g. eggs, meat, cheese, etc.) will provide all essential amino acids in correct proportions required for body functions. Most plant proteins are “incomplete” as they are deficient in one or more amino acids. Therefore vegetarian diet should contain a variety of plant proteins in order to obtain all the essential amino acids required.

Essential fatty acids:

- Essential fatty acids are the fatty acids that should be obtained from the diet since they cannot be synthesized in the body from organic precursors. Seeds, grains and vegetables provide enough amounts of essential fatty acids.

Basal metabolic rate (BMR)

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Main functions of minerals include

- Ca - form bones and teeth, helps clotting blood and nerve and muscle function
- P - form bones and teeth, help maintain in acid base balance
- S - components of some amino acids
- K - help maintain in acid base balance and water balance, nerve function
- Cl - help maintain in acid base balance, maintain osmotic balance, nerve function
- Na - help maintain in acid base balance and water balance, nerve function
- Mg - act as enzyme cofactor
- Fe - components of hemoglobin and electron carriers, act as an enzyme cofactor
- F - maintenance of tooth structure
- I - component of thyroid hormone

Minerals		
Calcium (Ca)	Dairy products, dark green vegetables, legumes	Loss of bone mass, impaired growth
Iron (Fe)	Whole grains, green leafy vegetables, legumes, meats, eggs	Anemia, weakness, impaired immunity
Phosphorus (P)	Rice, bread, milk, dairy products, fish, red meat	Decaying of teeth and bones, weakness
Potassium (K)	Fruits, vegetables, meat , dairy products, grains	Muscle weakness, nausea , paralysis, heart failure
Iodine (I)	Sea foods , vegetables, iodized salt	Goiter (enlarged thyroid glands)
Sulfur (S)	Foods containing proteins	Fatigue, Impaired growth, swelling
Chlorine (Cl) and Sodium (Na)	Table salt	Reduced appetite, muscle cramps
Magnesium (Mg)	Green leafy vegetables, grains	Disturbance in nervous system
Fluorine (F)	Tea, sea food, drinking water	Tooth decay

Water

- Water accounts for around 60% of the body mass in humans.
- Normally water is lost through urine, sweating and feces. Therefore amount of water in the body should be balanced within the body.
- This water can be taken in to the body by drinking and via foods.

Functions of water in human body

- Provides the moist internal environment for all living cells.
- Major component of blood and tissue fluid therefore helps to transport materials around the body and to exchange materials between blood and tissues and body cells.
- Regulate body temperature mainly through evaporative cooling.
- Dilute waste products and toxins and provide a medium for their excretion.
- Moisten the food and that make easier to swallow.