

NUTRITION IN LIVING BEINGS

Jan (or John) Ingenhousz or Ingen-Housz (8th December 1730 - 7th September 1799) was a Dutch-born British biologist, physiologist, and chemist.

He is famous for discovering photosynthesis by showing that light is necessary for the process to take place in which green plants absorb carbon dioxide and release oxygen. Ingenhousz discovered that, in the presence of light, plants give off bubbles from their green parts while, in the shade, the bubbles eventually stop. He identified the gas as oxygen. He also discovered that, in the dark, plants give off carbon dioxide. He realised that the amount of oxygen given off in the light is more than the amount of carbon dioxide given off in the dark. He also discovered that just like animals plants also have cellular respiration.



CONCEPT MAP

(The process of taking in food by an organism and its utilisation by the body for various life processes is nutrition)

Mode of Nutrition

- Autotrophic
(All green plants are autotrophic. These organisms make their own food)

- Heterotrophic
(Organisms obtain their food from other organisms e.g. Animals, human beings etc.)

- Other modes of nutrition in plants are
 - Parasitic mode
 - Insectivorous mode
 - Saprophytic mode
 - Symbiotic mode

CONCEPT 1.1

Introduction:

All the plants and animals are alive or living things. The most important criterion to decide whether something is alive or not is the movement. The movements in animals are fast and can be observed easily but the movements in plants are slow and observed with difficulty.

Animals can move from one place to another, or they can move their body parts. The plants can only move parts of their body such as leaves, flowers, roots and shoots. All the organisms on Earth use one of two sources of energy—sunlight or potential energy stored in food.

A Living organism using sunlight as a source of energy is called a **Phototroph**. A living organism extracting energy from chemical molecules is called a **Chemotroph**. Among chemotrophs you find lithotrophs using inorganic molecules as fuel, and organotrophs that extract energy from organic molecules.

To obtain carbon for building biomolecules autotrophs fix carbon dioxide, while heterotrophs rely on organic molecules.

Life Processes:

The basic functions performed by living organisms to maintain their life on this earth are called life processes.

Basic life processes common to all living organisms are:

Basic life processes	Function
Nutrition	Taking of food inside the body and converting it into smaller molecules which can be absorbed by the body.
Respiration	The process which releases energy from the food absorbed by the body.
Transport	The process in which a substance absorbed or made in one part of the body is moved to other parts of the body.
Excretion	The process in which the waste materials produced in the cells of the body are removed from the body.
Control and Coordination	A process which helps the living organisms to survive in the changing environment around them.
Growth	The process involves the changes from a smaller organism to a big organism.
Movement	The organism either moves from one place to another or moves its body parts.
Reproduction	The process involves the making of more organisms from the existing ones.

All the living organisms need energy to perform various life processes. They get this energy from food. Food is a kind of fuel which provides energy to all the living organisms.

Organisms need food because:

Food contains - Energy and essential nutrients required for:

- i) Important activities to stay alive
- ii) Growth
- iii) Repair of damaged body parts
- iv) Protection from diseases

Example: Carbohydrates and fats are the nutrients which are used by the organism mainly as a source of energy. Proteins and mineral salts are nutrients used by organism for the biosynthesis of its body constituents like skin, blood, building tissues, muscles and maintaining immune system strong.

Nutrition::

Nutrition refers to the process of consuming essential nutrients (such as carbohydrates, fats, proteins, minerals, vitamins, and water) and utilizing them for growth, energy production, and maintenance of bodily functions.

Different modes of nutrition:

The mode of nutrition describes the method by which an organism obtains its food. There are two primary types:

- 1. Autotrophic mode of nutrition
- 2. Heterotrophic mode of nutrition

Autotrophic nutrition:

Autotrophic nutrition is that mode of nutrition in which an organism makes (or synthesizes) its own food from the simple inorganic materials like carbon dioxide and water present in the surroundings (with the help of sunlight energy).

Those organisms which can make their own food from carbon dioxide and water are called **autotrophs**. Autotrophs make their food by **photosynthesis**.

Example: All green plants and autotrophic bacteria.

Heterotrophic nutrition:

Heterotrophic nutrition is that mode of nutrition in which an organism cannot make (or synthesizes) its own food from simple inorganic materials like carbon dioxide and water, and depends on other organisms for its food.

Those organisms which cannot make their own food from inorganic substances like carbon dioxide and water, and depends on other organisms for their food are called heterotrophs.

Example: All the animals (man, dog, cat, lion, etc.), most bacteria and fungi.



CLASSROOM DISCUSSION QUESTIONS

MARK YOUR ANSWERS WITH PEN ONLY. Time Taken Minutes

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CONCEPT 1.2

Types of Heterotrophic Nutrition:

Heterotrophic mode of nutrition is of three types:

1. Saprotrrophic nutrition
2. Parasitic nutrition
3. Holozoic nutrition

1. Saprotrrophic nutrition:

Saprotrrophic nutrition is that nutrition in which an organism obtains its food from decaying organic matter of dead plants, dead animals and rotten bread, etc.

The organisms having saprotrophic mode of nutrition are called Saprophytes. Saprophytes are the organisms which obtain food from dead plants (like rotten leaves), dead and decaying animal bodies, and other decaying organic matter.

You may have observed umbrella-shaped structures growing on decaying matter these are saprophytic organisms.

Additionally, black and white spots often appear on bread, pickles, or other moist food items. These spots result from the growth of fungi.

Example: Fungi (such as bread mold), mushrooms, and various bacteria.

2. Parasitic nutrition:

Parasitic nutrition is a mode of nutrition in which an organism derives its food from another living organism, known as the host, without causing its immediate death. The organism that depends on the host for nourishment is called a parasite. Parasites can be plants or animals and rely on their host for survival.

Insectivorous plants – It may seem surprising, but some plants are capable of consuming insects. These plants primarily synthesize their own food through photosynthesis but supplement their nutrition by capturing and digesting insects. Their leaves are specially adapted to trap insects, enabling them to fulfill their nitrogen requirements. Since they are green in color, they can still manufacture their own food through photosynthesis.



Parasitic Organisms: Some animals, such as Plasmodium (which causes malaria) and roundworms, depend on a host for survival.

Parasitic Plants: Cuscuta (also known as Amarbel) is a total stem parasite, whereas Mistletoe is a partial parasite.

Other Parasites: Several fungi and bacteria also exhibit parasitic nutrition.

3. Holozoic nutrition:

Holozoic nutrition is a process where organisms consume complex food materials through ingestion. The food is then digested into simpler substances, followed by absorption into body cells for energy and growth.

Examples: This type of nutrition is found in humans and most animals.

Holozoic Nutrition in Organisms: Many organisms, from unicellular Amoeba to multicellular humans, follow holozoic nutrition.

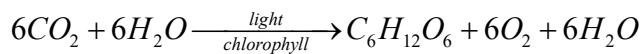
Holozoic Nutrition in Amoeba: Amoeba engulfs food through phagocytosis. Inside the cell, a food vacuole forms, where digestive enzymes break down food into smaller, usable nutrients. These nutrients provide energy and support growth.



Nutrition in plants (autotrophic nutrition):

Green plants are autotrophic and synthesize their own food by the process of photosynthesis. The process, by which green plants make their own food from carbon dioxide and water by using sunlight energy in the presence of chlorophyll, is called **photosynthesis**.

1. Oxygen is released during photosynthesis.
2. The process of photosynthesis can be represented as:



3. The process of photosynthesis takes place in the green leaves of a plant.

4. The food is prepared by the green leaves of a plant in the form of a simple sugar called glucose.
5. The extra glucose is changed into another food called starch. This starch is stored in the leaves of the plant.
6. The green plants convert sunlight energy into chemical energy by making carbohydrates.

The photosynthesis takes place in the following three steps:

- a) Absorption of sunlight energy by chlorophyll.
- b) Conversion of light energy into chemical energy, and splitting of water into hydrogen and oxygen by light energy.
- c) Reduction of carbon dioxide by hydrogen to form carbohydrates like glucose by utilizing the chemical energy.

Conditions necessary for photosynthesis:

1. Sunlight	2. Chlorophyll
3. Carbon dioxide	4. Water

How the plants obtain carbon dioxide?

The surface of plant leaves contains a large number of tiny pores known as stomata. These stomata play a crucial role in the exchange of gases, allowing carbon dioxide to enter the leaves for photosynthesis. Each stomatal pore is surrounded by a pair of guard cells, which regulate its opening and closing. When water enters the guard cells, they swell, become curved, and cause the stomatal pore to open, facilitating gas exchange. Conversely, when guard cells lose water, they shrink, become straight, and result in the closure of the stomatal pores, preventing excessive water loss. This dynamic regulation of stomata helps the plant efficiently manage both photosynthesis and transpiration.

How the plants obtain water for photosynthesis?

1. The water required by the plants for photosynthesis is absorbed by the roots of the plants from the soil through the process of osmosis.
2. The water absorbed by the roots of the plants is transported upward through the xylem vessels to the leaves where it reaches the photosynthetic cells.
3. Plants also require additional raw materials such as nitrogen, phosphorus, iron, and magnesium for their growth and development. These essential nutrients are absorbed from the soil. Nitrogen, in particular, plays a crucial role in the synthesis of proteins and other vital compounds needed for the plant's overall functioning.
4. Photosynthesis takes place in chloroplasts, which contain chlorophyll. Chloroplasts are found in the mesophyll cells of green leaves, where they have more chlorophyll than other plant cells, making them the primary site for photosynthesis.



CLASSROOM DISCUSSION QUESTIONS

CDQ
1.2

- What is saprotrophic nutrition?**
 - (A) Obtaining food from another living organism without killing it
 - (B) Obtaining food from decaying organic matter
 - (C) Absorbing nutrients from the host organism's body
 - (D) Making food through photosynthesis
- Which organisms exhibit saprotrophic nutrition?**
 - (A) Green plants
 - (B) Fungi and bacteria
 - (C) Animals
 - (D) Parasites
- What is parasitic nutrition?**
 - (A) Making food through photosynthesis
 - (B) Obtaining food from decaying organic matter
 - (C) Deriving food from another living organism without killing it
 - (D) Feeding on dead organisms
- Which structures do parasitic plants possess to absorb nutrients from their host?**
 - (A) Chloroplasts
 - (B) Xylem vessels
 - (C) Haustoria
 - (D) Guard cells
- What is holozoic nutrition?**
 - (A) Obtaining food from decaying organic matter
 - (B) Making food through photosynthesis
 - (C) Feeding on another living organism
 - (D) Absorbing nutrients from the host organism's body
- Where does photosynthesis primarily occur in plants?**
 - (A) Roots
 - (B) Stems
 - (C) Leaves
 - (D) Flowers
- What is the main product of photosynthesis?**
 - (A) Oxygen
 - (B) Carbon dioxide
 - (C) Glucose
 - (D) Starch
- What are the raw materials for photosynthesis?**
 - (A) Sunlight, carbon dioxide, water, and chlorophyll
 - (B) Oxygen, water, starch, and chloroplasts
 - (C) Sunlight, glucose, nitrogen, and water
 - (D) Oxygen, carbon dioxide, nitrogen, and phosphorus
- How do plants obtain carbon dioxide for photosynthesis?**
 - (A) Through their roots
 - (B) By absorbing it from the air through stomata
 - (C) From organic matter in the soil
 - (D) By extracting it from water
- How do plants obtain water for photosynthesis?**
 - (A) By ingesting it through their leaves
 - (B) Through their flowers
 - (C) By absorbing it from the air
 - (D) By absorbing it from the soil through their roots

MARK YOUR ANSWERS WITH PEN ONLY. Time Taken Minutes

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CONCEPT 1.3

Nutrition in Animals:

The animals depend upon other plants and animals for their food.

Animal nutrition comprises the mode of taking in the food in the body, nutritional requirements of the body and how animals can utilize their food.

Digestion - It is a process by which animals break down complex food substances in simpler substances.

Different ways of taking the food:

Name of animal	Kind of food	Mode of feeding
Snail	Grass	Chewing
Ant	Insects	Scrapping
Eagle	Flesh	Swallowing
Humming bird	Nectar	Sucking
Lice	Blood	Sucking
Mosquito	Blood	Sucking
Butterfly	Nectar	Sucking
Housefly	Decaying matter	Brewing

Depending upon the food habit, animals are classified into different categories:

Animals are heterotrophic in nutrition as they cannot make their own food. Euglena is an exception. It has chlorophyll and is capable of synthesizing food. But in the absence of light, it feeds on dead organic matter and is a saprophyte. Animals are also holozoic because they swallow or ingest food. Examples of some holozoic method of intake of food by heterotrophic animals:

- Herbivores**- These animals feed on plants and plant products, e.g cow, goat, horse, deer.
- Carnivores**- These are also called meat eaters, e.g snakes, lions, tigers, eagle, frog etc.
- Omnivores**- They feed on both plants and animal flesh. Man is an omnivore. e.g pigs, bears, crow, etc.
- Parasites**- These live on or inside the body of other living organisms
 - Ectoparasite- These live on the body of the host. These are blood Sucking parasites, e.g lice, bedbugs, ticks, leeches etc
 - Endoparasite- These live inside the body of the host. Example: Tapeworm, hook worm, malarial parasite lives inside mosquito and man.
- Saprotrophs** - These feed on dead organic matter, e.g earthworm.

Nutrition in Living beings

6. Scavengers - They feed on flesh of dead matter, e.g vulture.

Some animals feed on food masses, and they usually have organs for seizing, chewing, and consuming food. Herbivores are animals that eat only plants, while carnivores are animals that eat only other animals. Omnivores, which consume both plants and animals.

Teeth:

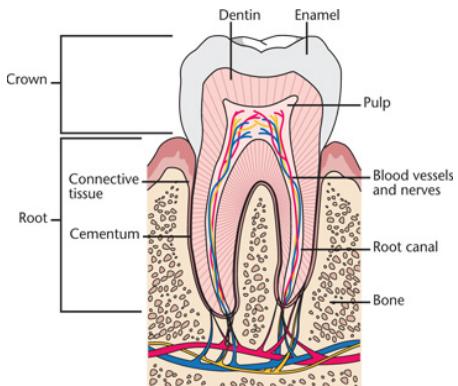
Teeth, present in the mouth cavity, play an important role in biting and chewing the food. In adult human being, there are four types of teeth - Incisors, Canines, Premolars and Molars.

Structure & function of teeth:

A tooth consists of enamel, dentin, cementum and pulp tissue. The portion of a tooth exposed to the oral cavity is known as the dental crown, and the portion below the dental crown is known as the tooth root.

Types of Teeth (Man):

An adult human being has 32 teeth, 16 in each jaw. Each tooth is rooted in a separate socket in the gums. Our teeth vary in appearance and perform different functions, so different names have been given to the teeth according to their structure and function they perform.



There are four different types of teeth:.

Type of teeth	Total no. of teeth in each jaw	Structure	Function
Incisors	4	Chisel shaped	Biting and cutting
Canines	2	Sharp and pointed	Piercing and tearing
Premolars	4	Broad with flat surface	Crushing and grinding
Molars	6	Broad and strong with flat surface. They are larger than premolars	Crushing and grinding

Human beings have two set of teeth in their entire life. The first set is known as the milk teeth or primary teeth. These milk teeth start to fall when the child is 6 years of age and new teeth grow in their place. These new teeth are termed secondary or permanent teeth. Premolars are absent in primary set of teeth.

The white substance covering our teeth is the enamel which is the hardest substance in human body.

Example., Dental formula of adult man = $i\frac{2}{2}, c\frac{1}{1}, pm\frac{2}{2}, m\frac{3}{3}$

Human child = $i\frac{2}{2}, c\frac{1}{1}, pm\frac{0}{0}, m\frac{2}{2}$



CLASSROOM DISCUSSION QUESTIONS

CDQ
1.3

1. What is the process by which animals break down complex food substances into simpler substances called?
 - (A) Absorption
 - (B) Assimilation
 - (C) Digestion
 - (D) Excretion
2. Which of the following animals is an example of a herbivore?
 - (A) Lion
 - (B) Eagle
 - (C) Cow
 - (D) Snake
3. Animals that feed on both plants and animal flesh are known as:
 - (A) Herbivores
 - (B) Carnivores
 - (C) Omnivores
 - (D) Parasites
4. What are ectoparasites?
 - (A) Parasites that live inside the body of the host
 - (B) Parasites that feed on dead organic matter
 - (C) Parasites that live on the body of the host
 - (D) Parasites that scavenge on dead matter
5. Which type of teeth are used for tearing and crushing food?
 - (A) Incisors
 - (B) Canines
 - (C) Premolars
 - (D) Molars
6. What is the function of canines in the mouth?
 - (A) Grinding food
 - (B) Tearing apart food
 - (C) Crushing food
 - (D) Biting into food
7. How many types of teeth are typically found in an adult human?
 - (A) 2
 - (B) 3
 - (C) 4
 - (D) 5
8. What is the function of molars in the mouth?
 - (A) Biting into food
 - (B) Tearing apart food
 - (C) Crushing and grinding food
 - (D) Holding food in place
9. What is the portion of a tooth exposed to the oral cavity known as?
 - (A) Dental crown
 - (B) Tooth root
 - (C) Dentin
 - (D) Pulp tissue
10. Which of the following animals is an example of a saprotroph?
 - (A) Lion
 - (B) Earthworm
 - (C) Vulture
 - (D) Cow

MARK YOUR ANSWERS WITH PEN ONLY. Time Taken Minutes Minutes 

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CONCEPT 1.4

Human Digestive System:

We take in the food through the mouth and then it passes through several organs and structures till it is digested and the undigested part is thrown out of our body. The digestive system of human beings consists of two main parts.

1. Alimentary canal
2. Digestive glands

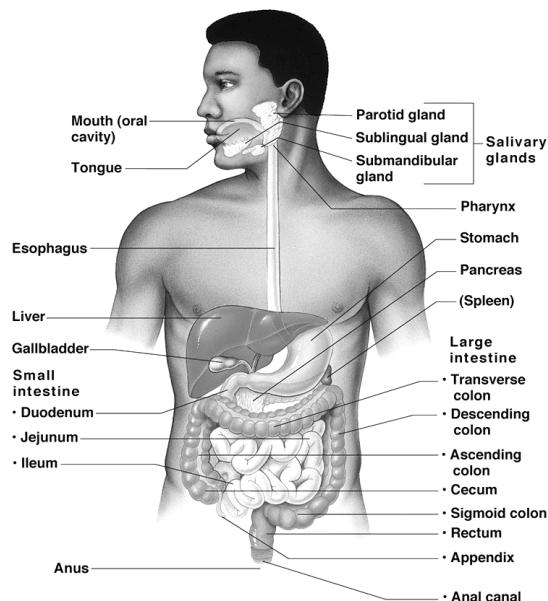
The alimentary canal is divided into different parts & their functions:

Name of the Organ	Function of the Organ
Mouth	Chewing
Salivary Glands	Saliva digests starch
Oesophagus	Carries food to stomach
Liver	Produces bile
Gall Bladder	Store bile
Stomach	Produces gastric juice, pepsin, HCl, etc.
Pancreas	Produces 3 digestive enzymes
Small Intestine	Produces digestive enzymes and also absorbs food which has been digested
Appendix	No known function
Large Intestine	Reabsorbs water
Rectum	Holds undigested food until elimination
Anal Opening or Anus	Opening through which undigested food is eliminated

The Digestive System - The alimentary canal and the digestive glands together form a system in the human body which is responsible for the digestion of food in the body. This system is called the Digestive System.

Digestion:

Digestion is the mechanical and chemical break down of food into small organic fragments. It is important to break down macromolecules into smaller fragments that are of suitable size for absorption across cell membranes. Large, complex molecules of proteins, polysaccharides, and lipids must be reduced to simpler particles before they can be absorbed by the digestive epithelial cells. Different organs play specific roles in the digestive process. The animal diet needs carbohydrates, protein, and fat, as well as vitamins and inorganic components for nutritional balance.

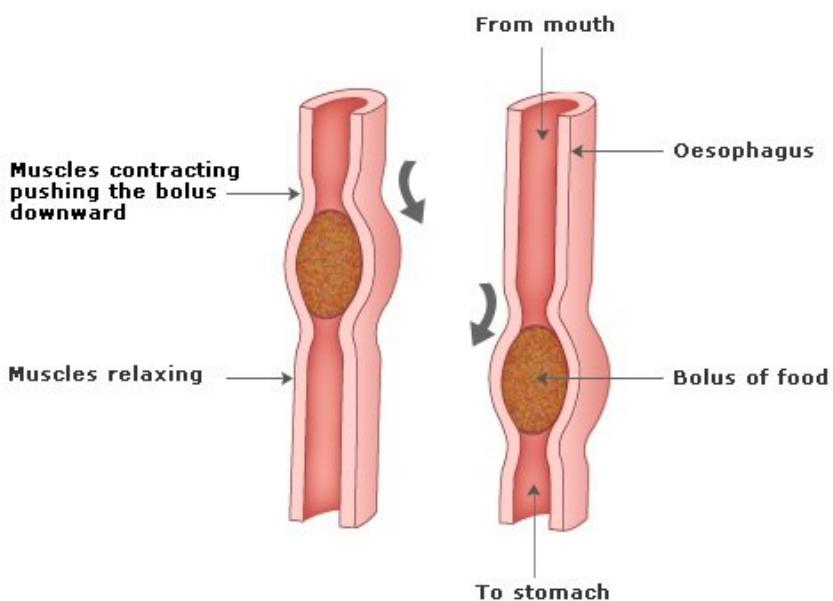


Mechanical and chemical digestion:

Stomach:

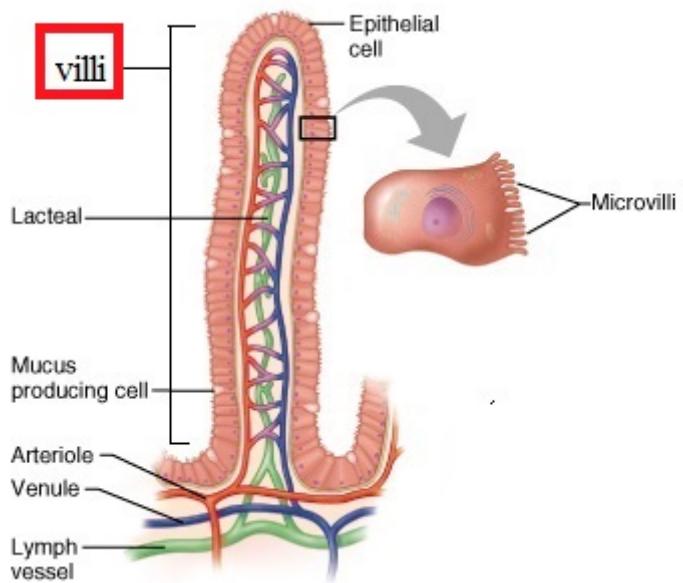
The stomach is a J-shaped, thick-walled bag. It is the widest part of the alimentary canal. One end of the stomach receives food from the food pipe and the other end opens into the small intestine.

Mucous, hydrochloric acid and digestive juices are secreted by the inner lining of the stomach. The mucous protects the lining of the stomach, the acid kills any bacteria that may enter along with the food and makes the medium in the stomach acidic. This helps the digestive juices to act. The digestive juices breakdown the proteins into simpler substances.



Small Intestine:

The small intestine is 7.5 meters long highly coiled tube. It receives secretions from the liver and the pancreas. The wall of the small intestine also secretes juices. In the upper part of the abdomen on the right side is a reddish-brown gland known as the liver. It is the largest gland in the body. It secretes bile juice that is stored in a sac called the gall bladder. Bile plays an important role in the digestion of fats. The pancreas is a large gland located just below the stomach. The pancreatic juice acts on carbohydrates, fats, and proteins and changes them into simpler forms.



a) Duodenum b) Jejunum c) Ileum

- a) **Duodenum** is the widest and shortest, 'U' shaped part of the small intestine receives the pancreatic and bile juice.
- b) **Jejunum** is the middle part of the small intestine and opens into ileum.
- c) **Ileum** is the longest part of the small intestine opens into the caecum of large intestine.

Finger like projections of inner layer of ileum are called 'Villi', which shows, microscopic invaginations called microvilli. Villi and microvilli increases the surface area of digestion and absorption.

Small intestine is the main region of digestion and absorption where the digestion is completed.

Large Intestine:

It is shorter and wider than the small intestine. Its length is about 1.5 meters in length. Its function is to absorb water and some salts from undigested food material. The leftover waste passes into the rectum and remains there as semi-solid faeces. Anus removes the faecal matter from time to time. This is called egestion.

a) Caecum b) Colon c) Rectum

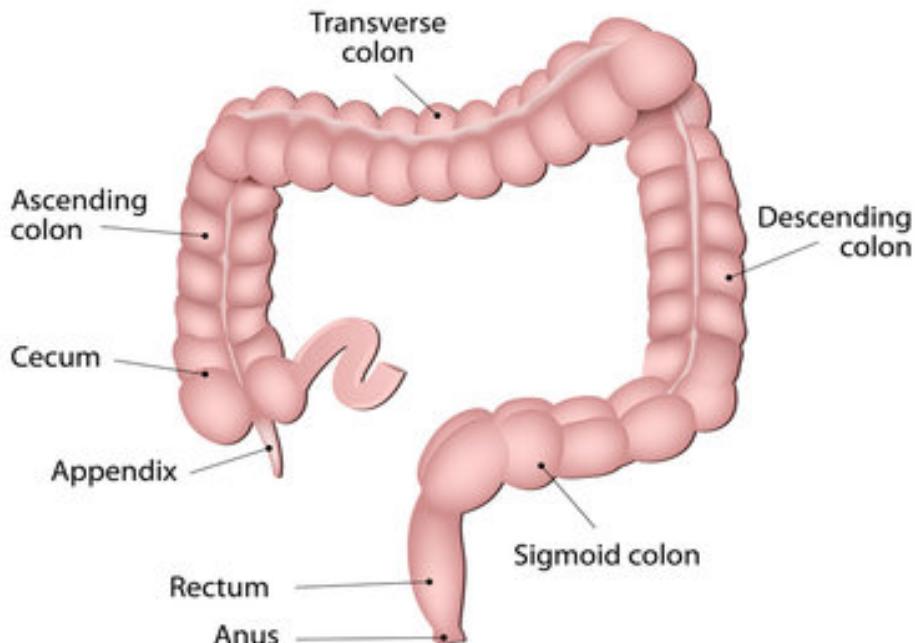
Caecum is a sac like structure ends into a tubular appendix. Both are vestigial in man and are not involved in cellulose digestion.

Intestinal juices:

Food mixed with bile juice and pancreatic juice enters the small intestine. Here, the food is acted upon by intestinal juice that contains various enzymes that help break down food particles and digest them.

In the small intestine:

- i) Proteins and amino acids are broken down by bile juice
- ii) Fat, fatty acids and glycerol are broken down by intestinal juice.
- iii) Simple sugars are broken down by pancreatic juice.



The enzymes in the intestinal juice and their functions are:

Amylase: Acts on the starch which remains undigested by the salivary amylase, converting it into maltose.

Trypsin: Converts proteins into peptides.

Lipase: Converts fats into fatty acids and glycerol.

The semi-digested food then enters the next part of the small intestine called the ileum. In ileum, the digestive process is completed



CLASSROOM DISCUSSION QUESTIONS

CDQ
1.4

1. Which organ in the human body is responsible for chewing food?
 (A) Salivary Glands
 (B) Stomach
 (C) Mouth
 (D) Oesophagus
2. What is the function of the salivary glands in digestion?
 (A) Producing bile
 (B) Storing bile
 (C) Digesting starch
 (D) Carrying food to the stomach
3. What is the function of the liver in digestion?
 (A) Produces gastric juice
 (B) Produces bile
 (C) Produces digestive enzymes
 (D) Absorbs water
4. Which organ stores bile?
 (A) Liver
 (B) Stomach
 (C) Pancreas
 (D) Gall Bladder
5. What is the function of the stomach in digestion?
 (A) Produces bile
 (B) Produces digestive enzymes
 (C) Absorbs water
 (D) Mixes food with gastric juice
6. What enzyme digests proteins into peptones and proteoses in the stomach?
 (A) Pepsin
 (B) Amylase
 (C) Lipase
 (D) Trypsin
7. Which part of the small intestine receives secretions from the liver, pancreas, and intestinal glands?
 (A) Duodenum
 (B) Colon
 (C) Caecum
 (D) Rectum
8. Where does water absorption primarily occur in the digestive system?
 (A) Stomach
 (B) Small Intestine
 (C) Large Intestine
 (D) Oesophagus
9. What are the three regions of the large intestine?
 (A) Duodenum, Jejunum, Ileum
 (B) Caecum, Colon, Rectum
 (C) Stomach, Liver, Pancreas
 (D) Mouth, Oesophagus, Stomach
10. What do intestinal juices contain to help break down food particles in the small intestine?
 (A) Gastric juice
 (B) Bile juice
 (C) Pancreatic juice
 (D) Digestive enzymes

MARK YOUR ANSWERS WITH PEN ONLY. Time Taken Minutes 

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CONCEPT 1.5

Absorption:

Absorption is the process by which the products of digestion are carried into the blood to be supplied to the rest of the body.

No absorption takes place in the mouth or stomach. Practically all food is absorbed in the small intestine. Very little remains to be absorbed by the time the contents reach the large intestine.

Assimilation: It is the movement of digested food molecules into the cells of the body and their utilization.

For example, glucose is used in respiration to provide energy. Amino acids are used to build new proteins.

Egestion (= Defecation):

The elimination of faeces from the alimentary canal is called egestion or defecation. The faeces is waste matter discharged from the alimentary canal.

Nutritional Requirements of Humans:**(i) Energy yielding nutrients:**

Carbohydrates and lipids (fats) are chief energy giving nutrients. Proteins can also give energy.

(ii) Body building nutrients:

Proteins are chief body building nutrients.

(iii) Metabolic regulators:

E.g., vitamins, water and mineral salts.

(iv) Hereditary substances:

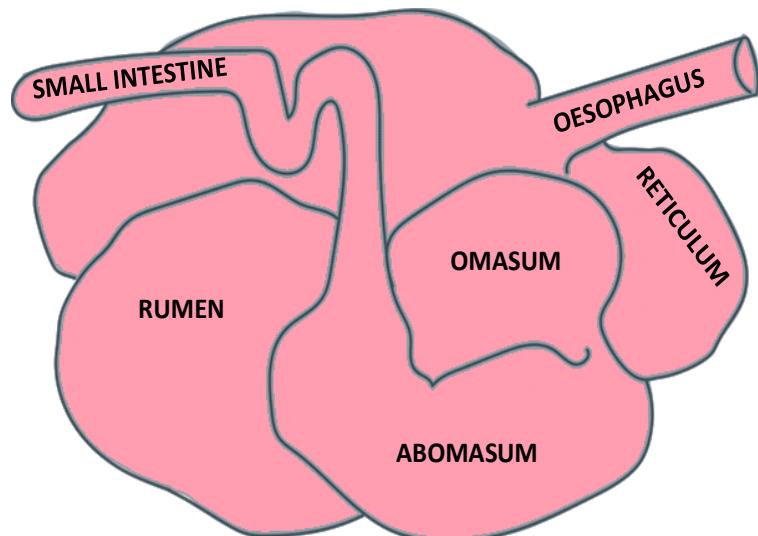
E.g., Nucleic acids (DNA and RNA).

Besides carbohydrates, proteins, fats, vitamins, minerals and water, roughage is also essential in diet.

Ruminants Digestive system:

Grass eating animals (herbivores) like the cow, deer, ox, buffalo and sheep swallow the food without chewing. After feeding, they bring the food from the stomach back into the mouth and chew it. This process is

called rumination, and such animals are called ruminants. Though their main diet is plants, they are unable to digest, because of lack of cellulose breaking enzymes. For this they maintain a symbiotic relation with microorganisms. Microbe's helps in breaking down of cellulose (constituent of plant cell wall). Ruminants have one stomach with four compartments or chambers for digestion of food.



Rumen (First chamber):

The largest organ, that allows for bacterial and chemical breakdown of fibre.

Reticulum (Second chamber):

Called as the “honeycomb” because of the honeycomb appearance of its lining. It collects smaller particles and moves them into the omasum, while the larger particles remain in the rumen for further digestion. It also traps any foreign material that the animal may picks up. It stores foreign objects and prevents the damaging items enters into digestive tract.

Omasum (Third chamber):

Helps in the absorption of water, magnesium, and the volatile fatty acids produced by rumen fermentation, that have not been absorbed into the bloodstream yet.

Abomasum (Fourth chamber):

This is called true stomach, most similar to a stomach in a non-ruminant. Majority of chemical breakdown of food material occurs here with the help of digestive enzymes (pepsin, rennin, bile, etc.) and hydrochloric acid. The abomasum secretes mucous to protect its wall from acid damage.



CLASSROOM DISCUSSION QUESTIONS

CDQ
1.5

1. Where does most absorption of nutrients take place in the human digestive system?
 - (A) Stomach
 - (B) Mouth
 - (C) Small Intestine
 - (D) Large Intestine
2. What structures in the small intestine increase the surface area for absorption?
 - (A) Folds
 - (B) Capillaries
 - (C) Villi
 - (D) Lacteals
3. What is the process by which digested food molecules enter the cells of the body and are utilized?
 - (A) Digestion
 - (B) Absorption
 - (C) Assimilation
 - (D) Egestion
4. Which nutrients are considered energy-yielding nutrients?
 - (A) Carbohydrates and lipids
 - (B) Proteins
 - (C) Vitamins
 - (D) Water
5. What is the main function of the rumen in the ruminant digestive system?
 - (A) Absorption of water
 - (B) Bacterial and chemical breakdown of fiber
 - (C) True stomach for chemical breakdown
 - (D) Storage of foreign objects
6. Which chamber of the ruminant stomach is most similar to the stomach in non-ruminant animals?
 - (A) Rumen
 - (B) Reticulum
 - (C) Omasum
 - (D) Abomasum
7. What is the term for the elimination of waste matter from the alimentary canal?
 - (A) Absorption
 - (B) Assimilation
 - (C) Egestion
 - (D) Digestion
8. What role do microorganisms play in the digestion of cellulose in ruminants?
 - (A) They produce enzymes that break down cellulose
 - (B) They provide nutrients to the ruminant
 - (C) They aid in the absorption of water
 - (D) They protect the stomach lining
9. Which chamber of the ruminant stomach helps in the absorption of water and volatile fatty acids?
 - (A) Rumen
 - (B) Reticulum
 - (C) Omasum
 - (D) Abomasum
10. What is the primary function of the reticulum in the ruminant stomach?
 - (A) Absorption of water
 - (B) Trapping foreign material
 - (C) Chemical breakdown of food
 - (D) Storage of foreign objects

MARK YOUR ANSWERS WITH PEN ONLY. Time Taken Minutes

1	(A) (B) (C) (D)	2	(A) (B) (C) (D)	3	(A) (B) (C) (D)	4	(A) (B) (C) (D)	5	(A) (B) (C) (D)
6	(A) (B) (C) (D)	7	(A) (B) (C) (D)	8	(A) (B) (C) (D)	9	(A) (B) (C) (D)	10	(A) (B) (C) (D)

CONCEPT 1.6

Vitamins:

Vitamins are organic compounds which are only required in traces in our diet and have no energy value. Absence of vitamins from the diet leads to diseases called deficiency diseases.

VITAMIN	SOME SOURCES	IMPORTANCE IN THE BODY	DEFICIENCY DISEASES
Fat soluble			
A	Liver, fish-liver oil, milk, dairy products, green vegetables, carrots	Provides resistance to diseases, protects eyes, helps to see in the dark	Infections, poor vision in dim light (night blindness)
D	Fish-liver oil, milk, butter, eggs; It is made by the body in the presence of sunlight	Helps the body to absorb calcium from food, hence helps in forming strong bones and teeth.	Rickets in children (bones become soft and out of shape), brittle bones in adults
E	Milk, egg yolk, wheat germ, green vegetables	Antioxidant, protects vitamins A, C, D, K and polyunsaturated fatty acids	Poorly understood in humans, causes sterility in rats
K	Green vegetables, egg yolk; produced by bacteria in gut	Helps the blood to clot	Spontaneous bleeding; takes long to clot
Water soluble			
B₁	Whole cereals, wheatgerm, yeast, milk, meat	Helps body to oxidize food to release energy	Beri-Beri, nervous disorders
B₂	Fish, eggs, milk, liver, meat, yeast, green vegetables	Helps body to oxidize food to release energy	Dry skin, mouth sores, poor growth
B₆	Eggs, meat, potatoes, cabbage	Helps to digest protein	Anaemia (deficiency of RBCs)
B₁₂	Meat, milk, yeast	Helps in the formation of red blood cells	Pernicious anaemia
C	Oranges, lemons and other citrus fruits, green vegetables, potatoes, tomatoes	Helps to bond cells together, helps in the use of calcium by bones and teeth	Scurvy (bleeding gums and internal organs)

Food nutrients - functions, sources and daily needs:

Nutrient in food	Roles/Functions	Sources	Daily needs
Carbohydrates (Energy-providing foods)	Main source of energy	Wheat, Rice, Maize, Potato, Bread, Honey, Common sugar, Milk, Banana	Adult person doing light work needs 600g.
Proteins (Body-building foods)	(i) For body building (ii) For digestion (iii) Growth (iv) Energy (iv) Body protection from infections	Pulses (peas, soyabean), Egg, Meat, Paneer, Cheese, Groundnut, Milk, Fish	Adults require 1 g for every 1 kg of body weight, children, require 1.46 g for every 1 kg of body weight; women during pregnancy and lactation period also require more proteins.
Fats (Energy-providing foods)	(i) Energy source (ii) Taste and flavour (iii) Reserve food source	Butter, Cheese Vegetable oil (coconut oil, Groundnut oil, Sunflower oil), Nuts, Milk, Animal fat from meat	Adults require 70 - 80 g
Water	(i) Medium for body reactions (ii) Transport of substances (iii) Digestion (iv) Waste removal (v) Maintenance of constant body temp.	Drinking water Cucumber (96%) Spinach (92%) Tomatoes (94%) Watermelon (96%) Grapes (90%) Carrot (90%)	6 to 8 Glasses
Roughage	(i) Being rich in fibre, it absorbs water and helps in food movement inside the intestine (ii) Helps in bowel movement by preventing constipation	Spinach, cabbage, beans, peas, cereals, wheat, lady's-finger	12.8 to 14.8 grams

Balanced Diet:

It is not sufficient that our food contains all the nutrients. Our body requires balanced quantities of different nutrients — proteins, carbohydrates, fats, vitamins, and minerals — for proper growth and maintenance. Deficiency of any one of these nutrients in the food can lead to poor health and make the body prone to diseases.

For example, in India, our daily meals generally consist of chapattis, rice, curd or buttermilk (lassi), dal, vegetables, and salad. These food items provide us with all the nutrients required by the body.

Carbohydrates and proteins are supplied by chapattis and rice.

Dal and milk provide proteins.

Curd or buttermilk supply carbohydrates, proteins, minerals, and vitamins.

Vegetables and salads provide minerals, proteins, carbohydrates, and fibre.

Thus, the food we consume provides us with all the necessary nutrients. The problem arises when we eat only rice, or only chapattis or bread. No single food item supplies all the essential nutrients in the amounts needed by the body. Wrong food habits can result in malnutrition, where the food taken is lacking or deficient in essential nutrients. Malnutrition simply means faulty nutrition.

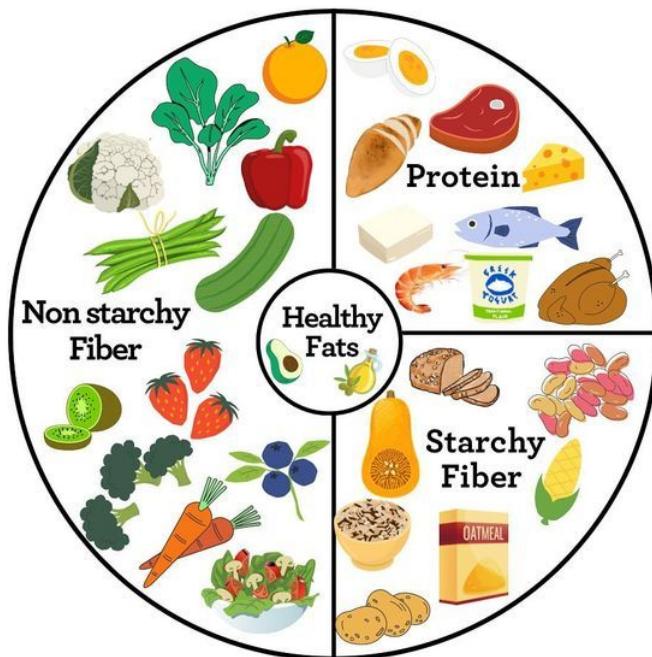
Poverty in our country is another cause of nutritional deficiency, leading to a condition called undernutrition or malnutrition, which is due to inadequate intake of food in terms of quantity.

A mixed diet containing all the essential nutrients in the right quantities is necessary for the body's proper growth. Such a diet is known as a balanced diet. In a balanced diet, energy-giving foods, body-building foods, and protective foods are present in correct proportions.

A balanced diet provides the body with:

- a) All the essential nutrients
- b) All the materials necessary for proper growth and repair of the body
- c) The energy required by the body to carry out its life activities

Overeating may also lead to diseases. Obesity is one such disease. It often leads to other problems like heart disease and high blood pressure.





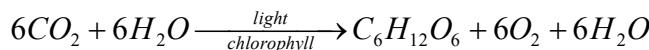
CLASSROOM DISCUSSION QUESTIONS

CDQ
1.6

1. **What are vitamins primarily responsible for in the body?**
 - (A) Providing energy
 - (B) Supporting growth
 - (C) Regulating metabolism
 - (D) Preventing deficiency diseases
2. **What term describes the absence of one or more essential nutrients in the diet?**
 - (A) Malnutrition
 - (B) Obesity
 - (C) Balanced diet
 - (D) Overeating
3. **Which of the following nutrients is NOT considered to have energy value?**
 - (A) Carbohydrates
 - (B) Proteins
 - (C) Fats
 - (D) Vitamins
4. **What is the primary purpose of a balanced diet?**
 - (A) Providing only energy
 - (B) Providing all essential nutrients in correct proportions
 - (C) Eliminating all fats
 - (D) Promoting overeating
5. **Which type of nutritional disorder is primarily caused by inadequate intake of food in terms of quantity?**
 - (A) Malnutrition
 - (B) Obesity
 - (C) Undernutrition
 - (D) Overeating
6. **What are the three main components of a balanced diet?**
 - (A) Carbohydrates, proteins, and fats
 - (B) Vitamins, minerals, and fiber
 - (C) Energy-giving foods, body-building foods, and protective foods
 - (D) Sugars, salts, and oils
7. **Which disease is associated with consuming excessive amounts of food leading to an unhealthy increase in body weight?**
 - (A) Malnutrition
 - (B) Anemia
 - (C) Obesity
 - (D) Osteoporosis
8. **What is the main consequence of overeating and obesity?**
 - (A) Increased energy levels
 - (B) Improved metabolism
 - (C) Risk of heart diseases and high blood pressure
 - (D) Enhanced physical fitness
9. **What is the term for a dietary disorder characterized by an excessive accumulation of body fat?**
 - (A) Malnutrition
 - (B) Obesity
 - (C) Undernutrition
 - (D) Anorexia
10. **What can poverty contribute to in terms of nutrition?**
 - (A) Overeating
 - (B) Balanced diet
 - (C) Undernutrition
 - (D) Malnutrition

MARK YOUR ANSWERS WITH PEN ONLY. Time Taken Minutes **1** A B C D**2** A B C D**3** A B C D**4** A B C D**5** A B C D**6** A B C D**7** A B C D**8** A B C D**9** A B C D**10** A B C D

1. Nutrition is the science that interprets the interaction of nutrients and other substances in food in relation to maintenance, growth, reproduction, health and disease of an organism. It includes food intake, absorption, assimilation, biosynthesis, catabolism and excretion.
2. Carbohydrates and fats are the nutrients which are used by the organism mainly as a source of energy.
3. Proteins and mineral salts are nutrients used by organism for the biosynthesis of its body constituents like skin, blood, etc.
4. Saprotrrophic nutrition is that nutrition in which an organism obtains its food from decaying organic matter.
5. Organisms which can make their own food from carbon dioxide and water are called **autotrophs**. Autotrophs make their food by **photosynthesis**.
6. Organisms which cannot make their own food from inorganic substances like carbon dioxide and water and depends on other organisms for their food are called heterotrophs.
7. A parasite is an organism (plant or animal) which feed on another living organism called its host.
8. The holozoic nutrition is that nutrition in which an organism takes the complex organic food materials into its body by the process of ingestion.
9. The process of photosynthesis can be represented as:



10. All the animals can be divided into three groups on the basis of their food habits. They are Herbivores (Plant eaters), Carnivores (Flesh eaters) and Omnivores (Both plant and flesh eaters).
11. There are five major types of nutrition of animals. They are Ingestion, digestion, absorption, assimilation and egestion.
12. The process of taking food into the body is called ingestion.
13. The process in which the food containing large, insoluble molecules is broken down into small, water soluble molecules is called digestion.
14. The process in which the digested food passes through the intestinal wall into blood stream is called absorption.
15. The process in which the absorbed food is taken in by the body cells and used for energy, growth and repair is called assimilation.
16. The process in which the undigested food is removed from the body is called egestion.

ADVANCED WORKSHEET



LEVEL 1

Single Correct Answer Type (S.C.A.T)

- Living organisms spend energy as they perform various activities. They derive their energy from:**
 - Food
 - Clothes
 - House
 - None
- Food is required by the body for the purposes like:**
 - For energy and growth
 - For repair of damaged body parts.
 - For protection from diseases and infection
 - All the above.
- The main source of our food is:**
 - Plants
 - Animals
 - Both (A) & (B)
 - None of the above.
- The parts of the plant which can be used as source of food are:**
 - Root
 - Stem & flowers
 - Seeds
 - All the above.

5. Seeds of mustard are used as:

- Oil
- Ghee
- Soap
- Detergent.

6. Lack of Roughage in our diet results in:

- Constipation.
- Lack of consciousness.
- Bleeding of Gums.
- Dental Decay.

7. What do you call carrot pudding?

- Suji halwa
- Kulfi
- Gajar ka halwa
- Kheer

8. What is the source of 'Rice'?

- Air
- Plant
- Animal
- River

9. What is the source of 'Egg'?

- Air
- Animal
- Plant
- Water

10. Animals provide us which of the following?

- Egg and Vegetables
- Vegetable and rice
- Spices and meat
- Egg, milk and Meat

11. Which part of mustard plant gives 'oil'?

- Roots
- Flowers
- Stems
- Seeds

12. Animals that feed on plants only are known by which name?

(A) Herbivores (B) Carnivores
(C) Omnivores (D) Scavengers

13. Animals that feed on flesh only are known by which name?

(A) Omnivores (B) Carnivores
(C) Herbivores (D) Scavengers

14. Animals that feed on plant and animal flesh both are known by which name?

(A) Carnivores (B) Herbivores
(C) Omnivores (D) Scavengers

15. Bees collect which of the following for 'Honey'?

(A) Fruit
(B) Root
(C) Nectar
(D) Pollen grains

16. Which part of 'Pumpkin plant' do we eat?

(A) Fruit (B) Root
(C) Stem (D) All of these

17. Which one of the following is true about food?

(A) Food is essential for our survival
(B) Food is essential for keeping us healthy and fit
(C) Food is essential for our growth
(D) All of these

18. Which one of the following statements is true?

Statement 1: Animals depend on plants for their food.

Statement 2: Plants depend on animals for their food.

(A) Statement 1
(B) Statement 2
(C) Both statements are true
(D) Both statements are false

19. The animals that eat dead and decaying organic substances are called:

(A) Herbivores (B) Carnivores
(C) Omnivores (D) Scavengers

20. Choose the food substance from the following which is animal product.

(A) Pulses (B) Rice
(C) Honey (D) Fruits

21. Choose the omnivores from the following.

(A) Tiger shark (B) King cobra
(C) Horse (D) Ant

22. Look at the following statements:

Statement 1: The living organisms which can prepare their own food are called producers

Statement 2: The living organisms which consumes the food prepared by plants are called consumers.

Which of the above statements is correct?

- (A) Statement 1 is correct
- (B) Statement 2 is correct
- (C) Both statements are correct
- (D) Both statements are incorrect

23. The correct equation for photosynthesis is

- (A) $CO_2 + H_2O \rightarrow C_6H_{12}O_6 + 6O_2 + 6H_2O$
- (B) $6CO_2 + 6H_2O \xrightarrow[\text{chlorophyll}]{\text{light}} C_6H_{12}O_6 + 6O_2 + 6H_2O$
- (C) $7CO_2 + 8H_2O \rightarrow C_6H_{12}O_6 + 5O_2 + 6H_2O$
- (D) $5CO_2 + 10H_2O \xrightarrow[\text{chlorophyll}]{\text{sun light}} C_6H_{12}O_6 + 6O_2 + 7H_2O$

24. Green plant use which of the following to prepare food?

- (A) Carbon dioxide
- (B) Sunlight
- (C) Water
- (D) All of these

25. The process, by which green plants prepare their own food is known as:

- (A) Photosynthesis
- (B) Respiration
- (C) Symbiosis
- (D) None of these

26. The green colour pigment in the leaves is:

- (A) Chlorophyll
- (B) Anthocyanin
- (C) Protoplast
- (D) Chloroplast

27. Animals cannot carry out photosynthesis because they:

- (A) Lack chlorophyll
- (B) Lack cellulose
- (C) Cannot use oxygen
- (D) Cannot absorb mineral salts

28. Which gas is released during photosynthesis?

- (A) Helium
- (B) Nitrogen
- (C) Carbon dioxide
- (D) Oxygen

29. Grains, legumes and eggs are considered as dietary sources of:

- (A) Carbolic acid
- (B) Proteins
- (C) Citric acid
- (D) Carboxylic acid

30. Nutrients that are required by living organisms in smaller quantities are considered as:

- (A) Micronutrients
- (B) Macronutrients
- (C) Mega nutrients
- (D) Chemical nutrients

31. Problems related to nutrition of nutrients is called:

- (A) Malnutrition
- (B) Solubility of nutrition
- (C) Insolubility of nutrition
- (D) Balancing of nutrition

32. Minerals that are important for heart function, muscle contraction and nerve impulse transmission are:

- (A) Sodium, potassium and chloride
- (B) Zinc, nickel and iron
- (C) Boron, copper and zinc
- (D) Sulphur, iron and calcium

33. Disease in children which is caused by deficiency of vitamin D is:

- (A) Scurvy
- (B) Anaemia
- (C) Rickets
- (D) Insomnia

34. Diet which contains required essential nutrients in right proportions is:

- (A) Opsin diet
- (B) Insoluble diet
- (C) Balanced diet
- (D) Soluble diet



LEVEL 2

Analytical Approach Type (A.A.T)

35. Which of the following are the edible stem parts?

- i) Potatoes
- ii) Sugarcane
- iii) Ginger
- iv) Radish

- (A) (i) & (ii)
- (B) (ii) & (iii)
- (C) (i) & (iii)
- (D) (i), (ii) & (iii)

36. Which of the following are edible flowers?

- i) Broccoli
- ii) Cauliflower
- iii) Banana
- iv) Hibiscus

- (A) (i) & (ii)
- (B) (ii) & (iii)
- (C) (i) & (iii)
- (D) (i), (ii) & (iii)

37. We get edible oil from the seeds:

- i) Groundnut
- ii) Sunflower
- iii) Sesame
- iv) Castor oil

- (A) (i) & (ii)
- (B) (ii) & (iii)
- (C) (i) & (iii)
- (D) (i), (ii) & (iii)

38. Which of the following are called and used as dry fruits?

- i) Almond
- ii) Cashew nut
- iii) Peanut
- iv) Coconut

- (A) (i), (ii) & (iii)
- (B) (ii) & (iii)
- (C) (i) & (iii)
- (D) All of these

39. Which of the following fruits are used as vegetables?

- i) Brinjal
- ii) Tomato
- iii) Pumpkin
- iv) Papaya

(A) (i) & (ii)
 (B) (ii) & (iii)
 (C) (i) & (iii)
 (D) (i), (ii) & (iii)



Matrix Matching Type (M.M.T.)

SET-I

Column - I

40. Omnivores
41. Herbivore
42. Sanguivore
43. Carnivore

Column - II

(A) Lion
(B) Leech
(C) Bear
(D) Cow
(E) Crow

SET-II

Column-I

44. Vitamin - A
45. Vitamin - C
46. Vitamin - D
47. Vitamin - B

Column-II

(A) Anaemia
(B) Rickets
(C) Night blindness
(D) Scurvy

SET-III

Column-I

48. Protein
49. Carbohydrate
50. Fat
51. Vitamin

Column-II

(A) Sugar
(B) Amla
(C) Fish
(D) Sunflower seeds

Knowledge Recall Type (K.R.T.)

52. You can find fats abundantly in which of the following food substances?

(A) Wheat, rice, sugar and potatoes
 (B) Ghee, oil, milk and cheese
 (C) Soyabean, fish and meat
 (D) Carrots, mangoes and lemon fruits

53. Proteins are essential:

- (A) For growth and repair of body tissues
- (B) To provide energy for our daily activities
- (C) For keeping our body fit and healthy
- (D) For strong bones and teeth

54. Pranay does not like to eat fruits and vegetables which of the following deficiency diseases may Pranav suffer from?

- (A) Protein deficiency disease
- (B) Carbohydrate deficiency
- (C) Vitamin deficiency disease
- (D) Fat deficiency disease

55. Ravi observed swelling in his neck region. What could be the disease he is suffering from?

- (A) Anaemia
- (B) Marasmus
- (C) Scurvy
- (D) Goitre

56. Which of these stimulates peristalsis and prevents constipation?

- (A) Ghee
- (B) Sprouts
- (C) Oil
- (D) Milk

57. Which activity helps our body to produce vitamin D?

- (A) Jogging and exercising
- (B) Standing in the Sun
- (C) Consuming more fruits
- (D) Practising yoga

58. Iron, a biological nutrient, is found in human body in:

- (A) Bones
- (B) Blood
- (C) Hair
- (D) All of these

59. We consider eating fish to be healthy as compared to flesh of other animals because fish contains:

- (A) Essential vitamins
- (B) Essential fatty acids
- (C) More carbohydrates and proteins
- (D) All the nutrients of food

60. Food rich in roughages are:

- (A) Fried foods
- (B) Pulses
- (C) Noodles
- (D) Fruits and vegetables

61. A person takes more food than his requirement. He is too fat. He may be suffering from which one of the following diseases?

- (A) Anaemia
- (B) Beri-Beri
- (C) Scurvy
- (D) Obesity

62. Stunted growth, swelling face, discolouration of hair, skin diseases and diarrhoea are the symptoms of:

- (A) Protein deficiency
- (B) Fat deficiency
- (C) Imbalanced diet
- (D) Both (A) & (C)

Statement Type (S.T.)

- (A) Statements (i) and (iii) are correct but (ii) is incorrect
- (B) Statements (i) and (ii) are correct but (iii) is incorrect
- (C) All statements are correct
- (D) All statements are incorrect

63. Read the following three statements carefully and choose the correct option.

- (i) Raw vegetables are rich in roughages.
- (ii) Children need more food as they grow fast.
- (iii) Cooking makes food free of germs.

64. Read the following two statements carefully and choose the correct option.

- (i) Over-eating makes the body more strong to fight with diseases
- (ii) Vitamins - do not produce any energy

65. Read the following two statements carefully and choose the correct option.

- (i) Roughages absorb large amount of water and retain it in our body
- (ii) A diet, which contains all the nutrients required by our body and that too inadequate quantities is called balanced diet

Previous Question (P.Q.)

66. 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?

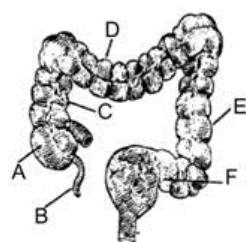
- i) Stomach: Fats — Lipase → micelles
- ii) Duodenum: Triglycerides — Trypsin → monoglycerides
- iii) Small intestine: Starch — (A) Amylase → Disaccharide (Maltose)
- iv) Small intestine: Proteins — Pepsin → Amino acids

- (A) (i) & (iii)
- (B) (ii) Only
- (C) (iii) Only
- (D) (iv) Only

67. Which one of the followings is not part of the large intestine?

- (A) Rectum
- (B) Colon
- (C) Cecum
- (D) Duodenum

68. The diagram of large intestine of man is given below. Identify the parts labelled A, B, C, D, E and F.



(A) A = Caecum, B = Vermiform appendix, C = Sigmoid, D = Ascending colon, E = Transverse colon, F = Descending colon.

(B) A = Sigmoid, B = Vermiform appendix, C = Ascending colon, D = Transverse colon, E = Descending colon, F = Caecum.

(C) A = Sigmoid, B = Vermiform appendix, C = Descending colon, D = Transverse colon, E = Ascending colon, F = Caecum.

(D) A = Caecum, B = Vermiform appendix, C = Ascending colon, D = Transverse colon, E = Descending colon, F = Sigmoid.

69. Gastric juice of infants contains:
[AIPMT 2015]

(A) Amylase, Renin, Pepsinogen

(B) Maltase, Pepsinogen, Renin

(C) Nuclease, Pepsinogen, Lipase

(D) Pepsinogen, Lipase, Renin

70. Choose the correct pair:
[CBSE 1996]

(A) Renin - Casein

(B) Protein - Amylase

(C) Carbohydrate - Lipase

(D) Maltase - Lactose

71. Gastric juice contains:

[KCET- 2010]

(A) Pepsin, Lipase and Renin

(B) Trypsin, Lipase and Renin

(C) Trypsin, Pepsin and Lipase

(D) Trypsin, Pepsin and Renin

72. In human beings, carbohydrates is stored as glycogen in:

[Odissa 2003]

(A) Liver and muscles

(B) Liver

(C) Spleen

(D) Muscles

73. Where is protein digestion accomplished:

[AIIMS 1996]

(A) Stomach

(B) Ileum

(C) Rectum

(D) Duodenum