

Class 9th Biology — Unit 5

Tissues, Organs & Organ Systems

Complete Study Booklet

- ✓ 31 Solved MCQs with Answer Key
- ✓ Descriptive (Long) Questions & Answers
- ✓ Short Answer Questions

taleemzone.com

Part 1 — Multiple Choice Questions

1. A higher level of organization exhibits emergent properties when:

- (A) Its parts function independently.
- (B) The sum of its parts is greater than the whole.
- (C) The individual parts are more important than the whole.
- (D) ✓ Its parts interact to perform more functions.

2. Which of the following demonstrates the levels of organization from simplest to most complex?

- (A) Cell → Organ → Tissue → Organelle → Organ system
- (B) ✓ Organelle → Cell → Tissue → Organ → Organ system
- (C) Tissue → Cell → Organelle → Organ → Organ system
- (D) Organ system → Tissue → Cell → Organelle → Organ

3. At which level of organization does gas exchange occur between the body and the environment?

- (A) Organelle level in mitochondria
- (B) Cellular level in alveolar cells
- (C) Tissue level in epithelial tissues
- (D) ✓ Organ system level in the respiratory system

4. The epithelial tissue in the stomach wall is responsible for producing:

- (A) Mucus
- (B) Pepsinogen
- (C) Hydrochloric acid
- (D) ✓ All of these

5. In the wall of the stomach, which tissue also contains blood vessels and nerves?

- (A) Epithelial
- (B) Muscle
- (C) ✓ Connective tissue
- (D) Phloem

6. In a leaf, which tissue is primarily responsible for photosynthesis?

- (A) Xylem
- (B) ✓ Mesophyll

- (C) Epidermis
- (D) Phloem

7. What is the primary function of the xylem tissue in a leaf?

- (A) To transport sugars to other parts
- (B) ✓ To transport water to parts of the leaf
- (C) To synthesize chlorophyll
- (D) To control the opening and closing of stomata

8. Which of these is a function of the human skeletal system?

- (A) ✓ Storing minerals and producing blood cells
- (B) Removing carbon dioxide from blood
- (C) Filtering blood to remove waste products
- (D) Breaking down food for energy

9. Which structures are responsible for the transport of food in the plant body?

- (A) Xylem tissue
- (B) Palisade mesophyll
- (C) ✓ Phloem tissue
- (D) Spongy mesophyll

10. In a plant, which of the following is responsible for regulating gas exchange?

- (A) Xylem tissue
- (B) Phloem tissue
- (C) Facilitating reproduction through pollination
- (D) ✓ Stomata (gas exchange regulation)

Additional Multiple Choice Questions**11. The table shows three functions of cells. Which row is correct? (Absorption / Support / Transport)**

- (A) Red blood cell / Muscle cells / Root hair cell
- (B) ✓ Root hair cell / Xylem vessel / Red blood cell
- (C) Muscle cell / Red blood cell / Xylem vessel
- (D) Xylem vessel / Root hair cell / Muscle cell

12. If tissue level is not developed in the levels of organization, which of the next level will not be formed?

- (A) Molecular level
- (B) Atomic level
- (C) ✓ **Organ level**
- (D) Organelle level

13. Following diagram shows levels of organization in a rat. Which one is the organ level? *(This question refers to a diagram not included in the source material. According to the answer key, the intended answer is option C.)*

14. Which of the following lists the levels of body organization from smallest to largest?

- (A) Organism, organ system, organ, tissue, cell
- (B) Tissue, cell, organ, organ system, organism
- (C) Organ, organ system, organism, tissue, cell
- (D) ✓ **Cell, tissue, organ, organ system, organism**

15. Which structure is at a different level of organization from the other three?

- (A) Kidney
- (B) Liver
- (C) ✓ **Neuron**
- (D) Lung

16. Biological organization means:

- (A) Study of different organisms
- (B) Study of different branches of biology
- (C) Study of all the subjects of science
- (D) ✓ **Study of biology at different levels**

17. The level represented by the heart of a frog is:

- (A) ✓ **Organ**
- (B) Tissue
- (C) Organism
- (D) Cell

18. You can observe spongy mesophyll and xylem in the cross-section of a leaf. These are part of the same:

- (A) Cell and organism
- (B) Organ and organism
- (C) Cell and tissue
- (D) ✓ Tissue and organ

19. Which structure is NOT an organ?

- (A) Artery
- (B) Flower
- (C) Spinal cord
- (D) ✓ Xylem

20. Which description of xylem is correct?

- (A) A cell used for absorption
- (B) An organ system used for conduction
- (C) ✓ A tissue used for transport
- (D) An organ used for transport

21. What is the primary function of the root system in plants?

- (A) Photosynthesis
- (B) Gas exchange
- (C) ✓ Absorbing water and minerals
- (D) Reproduction

22. Which part of the plant is primarily involved in photosynthesis?

- (A) Root
- (B) Stem
- (C) ✓ Leaf
- (D) Flower

23. Which tissue transports water in plants?

- (A) ✓ Xylem
- (B) Phloem
- (C) Epidermal
- (D) Mesophyll

24. What are the functions of xylem and phloem in green plants? (Xylem / Phloem)

- (A) Support and transport of sugars / Transport of water

- (B) Transport of sugars / Support and transport of water
- (C) ✓ **Support and transport of water / Transport of sugars**
- (D) Transport of water / Support and transport of sugars

25. Which organ system is responsible for circulating blood in humans?

- (A) Digestive
- (B) Nervous
- (C) ✓ **Circulatory**
- (D) Respiratory

26. What type of tissue lines the inner surface of the stomach?

- (A) Muscular
- (B) ✓ **Epithelial**
- (C) Connective
- (D) Nervous

27. What is the main function of the nervous system?

- (A) Digesting food
- (B) Circulating blood
- (C) ✓ **Controlling and coordinating body activities**
- (D) Protecting organs

28. This statement about homeostasis is INCORRECT:

- (A) Because of this, the fluctuations of the internal environment are of an extremely narrow range as compared to that of the external environment.
- (B) ✓ **There is one system regulating the homeostatic activities.**
- (C) Homeostatic mechanisms keep the internal environment constant despite wide changes in the external environment.
- (D) Homeostasis is necessary for the survival of cells.

29. Which of the following statements best describes homeostasis?

- (A) Keeping the body in a fixed and unaltered state.
- (B) Dynamic equilibrium
- (C) ✓ **Maintaining a near-constant internal environment**
- (D) Altering the external environment to accommodate the body's needs.

30. Organisms have the ability to change and modify their internal conditions according to the environment through:

- (A) Osmoregulation
- (B) Excretion
- (C) Thermoregulation
- (D) ✓ All of the above

31. What is homeostasis?

- (A) A type of hormone
- (B) Digestive process
- (C) ✓ The body's way of maintaining a stable internal environment
- (D) A respiratory function

taleemzone.com

Answer Key — MCQs

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	D	8	A	15	C	22	C	29	C
2	B	9	C	16	D	23	A	30	D
3	D	10	D	17	A	24	C	31	C
4	D	11	B	18	D	25	C		
5	C	12	C	19	D	26	B		
6	B	13	C	20	C	27	C		
7	B	14	D	21	C	28	B		

Part 2 — Descriptive Questions

Q.1 Explain the levels of organization in a multicellular organism. How does each level contribute to the overall functioning of an organism?

Introduction: Organisms are built on a pattern of increasing complexity. The levels of organization in multicellular organisms begin with the smallest unit, the atom, and progress to the most complex level, the organism.

Levels of Organization

Level	Definition & Examples
1. Atom	Atoms are the smallest unit of matter that maintains the properties of an element. <i>Examples: Carbon, Hydrogen and Oxygen.</i>
2. Molecule	Atoms combine to form molecules, which can have entirely different properties than the atoms they contain. <i>Examples: Water, protein and nucleic acid.</i>
3. Organelle	Molecules combine in specific ways to make the subcellular level, i.e., organelles. Each organelle is specialized to do a particular function. <i>Example: Mitochondria are responsible for cellular respiration; ribosomes are specialized for protein synthesis.</i>
4. Cell	When organelles assemble and interact with each other, they make a cell — the smallest unit with the characteristics of life. Cells can carry out life activities and can also reproduce. <i>Example: Unicellular organisms are made of only one cell, while multicellular organisms are made of many cells.</i>
5. Tissue	In multicellular organisms, cells make tissues — a group of similar cells that work together to perform one or more specific functions. <i>In animals: epithelial tissue, muscle tissue. In plants: epidermal tissue, vascular tissue.</i>
6. Organ	An organ is a structure made up of related tissues working together to perform specific functions. <i>In animals: heart, lungs. In plants: leaves, roots.</i>
7. Organ System	An organ system consists of multiple organs that work together to perform related functions. <i>In animals: circulatory system, digestive system. In plants: root system, shoot system.</i>
8. Organism	An organism is a living entity that can function independently, with the proper functioning of its organ systems coordinated with one another. <i>Examples: Humans and trees.</i>

Q.2 What are emergent properties? Give examples of how lower levels create higher levels.

Introduction: In organisms, the components at each level do not work in isolation — instead, they interact with each other. These interactions create new functions called **emergent properties**: abilities present at a higher level of organization but not possible from the individual components alone.

Examples of Emergent Properties

From Level → To Level	Emergent Property
Organelles → Cells	Individual organelles have specific functions. When they interact within a cell, they create a complex system capable of carrying out cellular processes such as metabolism, protein synthesis and energy production.
Cells → Tissues	Individual cells do not have properties present in the tissue they make. For example, muscle cells combine to form muscle tissue, which can contract and generate force.
Tissues → Organs	An organ performs complex functions that its individual tissues cannot perform alone. For example, the heart is composed of muscle, connective and epithelial tissues, whose coordinated interaction allows it to pump blood.
Organs → Organ Systems	Multiple organs working together form organ systems that carry out vital functions. For example, the digestive system (mouth, esophagus, stomach, intestines, liver) enables digestion and absorption of nutrients, which no single organ can do alone.
Organ Systems → Organisms	The interactions of various organ systems bring emergent properties such as consciousness, thinking, and the ability to adapt to the environment — complex behaviours not present in any single organ system.

Q.3 Explain the functions of various plant organs. Explain organs and organ systems in plants.

Introduction: Organs are made of two or more types of tissues organized to serve a particular function. Organs that perform related functions work together to make an organ system.

Organs in Plants

Organ	Function
Roots	Usually found underground; anchor the plant in the soil and absorb water and essential minerals. Roots also store nutrients used for growth.
Stems	Above-ground structures that support leaves, flowers and fruits. Contain vascular tissues (xylem and phloem) that move water, minerals and nutrients between roots and leaves.
Leaves	The primary sites of photosynthesis and transpiration (loss of water vapor through stomata).

Organ	Function
Flower	The reproductive part of the plant; plays a crucial role in sexual reproduction.

Leaf as an Organ: In plants, the leaf is a complex organ made of various related tissues.

Major Tissues of a Leaf

Tissue	Description & Function
1. Epidermal Tissue	The outermost layer of the leaf. The upper epidermis is usually covered by a waxy cuticle that reduces water loss and provides protection; the lower epidermis often contains guard cells enclosing stomata. <i>Function: reduces water loss, provides protection, and regulates gas exchange and water vapour loss through stomata.</i>
2. Mesophyll Tissue	Lies between the upper and lower epidermis; consists of cells rich in chloroplasts. <i>Function: site of photosynthesis.</i>
i. Palisade Mesophyll	Located just beneath the upper epidermis; tightly packed, elongated cells. <i>Function: contains abundant chloroplasts for maximum light absorption.</i>
ii. Spongy Mesophyll	Present below the palisade mesophyll; loosely arranged cells with air spaces between them. <i>Function: air spaces facilitate diffusion of gases throughout the leaf.</i>
3. Vascular Tissue	Arranged in the midrib and veins of the leaf; a complex tissue consisting of xylem and phloem. <i>Function: transport of water, minerals and nutrients.</i>
i. Xylem	Conducts water and dissolved minerals from the stem's xylem to leaf cells. <i>Function: transports water and minerals to leaf cells.</i>
ii. Phloem	Transports the products of photosynthesis (sugars) from leaf cells to the stem's phloem. <i>Function: transports sugars (food) to other parts of the plant.</i>

Organ Systems in Plants: The organ system level in plants is less complex than in animals; still, plants exhibit organization in terms of tissues and structures working together for specific functions.

Organ Systems in Plants

Organ System	Components & Function
Root System	Roots. <i>Function: anchors the plant and absorbs water and nutrients.</i>
Shoot System	Stems, leaves, and reproductive structures like flowers. <i>Function: supports the plant, conducts photosynthesis, and enables reproduction.</i>

Q.4 Describe organs and organ systems in humans.

Various organs are present in the human body, each with specific functions. Here are a few of the most important organs:

Organs in the Human Body

Organ	Function
Heart	A muscular organ that pumps blood throughout the body; essential for delivering oxygen and nutrients to cells and removing waste products.
Lungs	Responsible for breathing — the exchange of oxygen and carbon dioxide between the body and the environment.
Brain	The control center of the body, responsible for thoughts, emotions and movements.
Liver	Performs many vital functions, including filtering blood, producing bile, and storing glucose.
Kidneys	Responsible for filtering waste products from the blood and producing urine.
Stomach	A muscular organ that breaks down food using digestive enzymes.
Intestines	Long, tubular organs that absorb nutrients from food.
Pancreas	Produces digestive enzymes and hormones, such as insulin and glucagon.

Stomach as an Organ: The stomach breaks down proteins through mechanical and chemical processes and stores food. It is composed of the following tissues:

Tissue Composition of the Stomach

Tissue	Description & Function
1. Epithelial Tissue	The inner wall is glandular and secretes mucus, which lines and protects it from acids. It also secretes gastric juice containing pepsinogen (for protein digestion) and hydrochloric acid (which activates pepsinogen to pepsin and kills germs).
2. Connective Tissue	Lies beneath the epithelial tissue; provides structural support and contains blood vessels, nerves and lymphatics.
3. Muscle Tissue	Three layers of smooth muscle (outer longitudinal, middle circular, inner oblique) that churn and mix food (mechanical digestion).
4. Outer Connective Tissue	The outermost layer that encircles and supports the stomach.

Organ Systems in the Human Body: Following are a few examples of organ systems that form the human body:

Organ Systems in the Human Body

Organ System	Parts & Function
1. Skeletal System	Bones, cartilage and tendons. <i>Function: provides structure, support and protection; a framework for muscle attachment; stores minerals and produces blood cells.</i>
2. Digestive System	Mouth, esophagus, stomach, small intestine, large intestine. <i>Function: breakdown and absorption of nutrients from food.</i>
3. Respiratory System	Lungs, trachea (windpipe), bronchi (air tubes). <i>Function: exchange of oxygen and carbon dioxide between the body and environment.</i>
4. Muscular System	Skeletal muscles, which attach to bones and contract to produce movement. <i>Function: allows movement and provides structural support.</i>
5. Nervous System	Brain, spinal cord, nerves. <i>Function: coordinates and controls body functions through nerve impulses.</i>
6. Blood Circulatory System	Heart, blood vessels (arteries, veins, capillaries), and blood. <i>Function: transports oxygen, nutrients, hormones and waste products throughout the body.</i>

Q.5 Define homeostasis and its importance. Discuss how different organ systems work together to maintain homeostasis.

Introduction: The organs and organ systems of the body work in coordination to maintain a stable internal environment — this is called **homeostasis**: the body's ability to maintain a stable internal environment despite changes in the external environment.

Examples: Regulating temperature, blood pressure, blood sugar, and pH levels.

Importance of Homeostasis: Homeostasis plays a vital role in supporting overall health and well-being, as shown below:

Examples of Homeostatic Responses

Situation	Homeostatic Response
Each cell functions only when extracellular conditions such as temperature, pH and concentrations of salts, glucose and oxygen are kept in the normal range.	The body maintains optimal conditions for cellular function.
When we do hard work, our muscles produce heat that raises body temperature.	The temperature-regulating centre (hypothalamus) in the brain sends a message to sweat glands; sweating occurs to cool the body down.
When body temperature falls.	The temperature-regulatory centre sends a message to muscles; shivering occurs to generate heat.
When we drink juice, blood glucose level rises.	Special glands (pancreas) release the hormone insulin into the blood, which lowers the blood glucose level to normal.

Situation	Homeostatic Response
When we do hard exercise, our muscles need more oxygen.	Rate of respiration and heartbeat increase, supplying more oxygen and food to the muscles for continuous work.

Role of Organ Systems in Homeostasis: Several organ systems work together to maintain homeostasis:

Role of Organ Systems in Homeostasis

Organ System	Role in Homeostasis
1. Nervous System & Endocrine System	Regulate and coordinate activities such as heart rate, respiration, metabolism, and response to stress.
2. Respiratory System	Ensures the body receives enough oxygen for cellular respiration and expels excess carbon dioxide.
3. Cardiovascular System	Regulates body temperature and pH levels; ensures all cells receive necessary substances for proper function.
4. Digestive System	Works for proper distribution of nutrients to cells for energy, growth and repair.
5. Muscular & Skeletal Systems	Help maintain body posture, support and movement.
6. Urinary System	Eliminates waste products; regulates water and salt balance; maintains blood volume, blood pressure, and pH levels.
7. Integumentary System	Acts as a barrier to protect the body from external factors; helps regulate temperature through sweating.

Q.6 Describe the structure and function of the plant root system.

Structure of the Plant Root System: The root system consists of two main structures: the root cap and the primary root. The primary root is characterized by the root meristem, the meristematic region, the region of elongation, and the maturation region. Lateral roots grow from the primary root.

Functions of the Plant Root System: This system has three major jobs:

Functions of the Plant Root System

Function	Description
i. Absorbing water and minerals	Roots absorb water and essential minerals from the soil.
ii. Anchoring and supporting the plant	Roots anchor the plant firmly in the soil.
iii. Storage site for food	Roots store nutrients that the plant uses for growth.

Q.7 Describe how the respiratory and circulatory systems work together to maintain homeostasis of oxygen and carbon dioxide levels in the body.

Working of Organ Systems: The respiratory system and the circulatory system work closely together to deliver oxygen to cells and remove the carbon dioxide these cells produce. The circulatory system picks up oxygen in the lungs and drops it off in the tissues, then performs the reverse function for carbon dioxide. The lungs expel carbon dioxide and bring in new oxygen-containing air. Only when both systems work together can oxygen and carbon dioxide be successfully exchanged between cells and the environment.

Role in Oxygen–Carbon Dioxide Homeostasis

System	Role
Respiratory System	Brings in oxygen-containing air and expels carbon dioxide.
Circulatory System	Picks up oxygen in the lungs and drops it off in the tissues; picks up carbon dioxide from tissues and delivers it to the lungs.

Q.8 Describe the roles of the digestive system and urinary system in homeostasis.

Role in Homeostasis

Organ System	Role
Digestive System	Works for proper distribution of nutrients to cells for energy, growth and repair.
Urinary System	Eliminates waste products from the body. Maintains blood volume, blood pressure, and pH levels.

Part 3 — Short Answer Questions

Q.1 Enlist the levels of organization from cells to organ systems.

- 1 Cell
- 2 Tissue
- 3 Organ
- 4 Organ system

Q.2 What are the major roles of the epithelial tissue present in the stomach?

The inner wall is made up of epithelial tissue. It is glandular in nature and secretes mucus, which lines the inner wall and protects it from acids. This tissue also secretes gastric juice that contains the enzyme pepsinogen (for protein digestion) and hydrochloric acid (for activating pepsinogen to pepsin).

Q.3 How do the smooth muscles contribute to the stomach's function?

- 1 Churning and mixing food with stomach acid.
- 2 Producing chyme by contracting and relaxing in a coordinated manner, which helps digestion and propels partially digested food into the small intestine through a process called peristalsis.
- 3 Facilitates the movement and mechanical breakdown of food within the stomach.

Q.4 What is the function of the palisade mesophyll in the leaf?

The palisade mesophyll is responsible for photosynthesis. It consists of tightly packed, elongated cells with a large number of chloroplasts to absorb light and produce food for the plant.

Q.5 What is the role of the shoot system in plants?

The shoot system consists of two portions: the vegetative (non-reproductive) parts of the plant, such as the leaves and stems, and the reproductive parts, which include flowers and fruits. The shoot system generally grows above ground, where it absorbs the light needed for photosynthesis.

Q.6 What is homeostasis and why is it important for organisms?

Homeostasis is defined as the body's ability to maintain a stable internal environment despite changes in the external environment.

Importance: Homeostasis is important for organisms because it regulates body temperature, blood pressure, blood sugar, and pH levels.

Q.7 How does the human body maintain a stable internal temperature?

High temperature is first detected by sensors — primarily nerve cells with endings in the skin and brain — and relayed to a temperature-regulatory control center in the brain. The control center processes the information and activates effectors, such as the sweat glands, whose job is to oppose the stimulus by bringing body temperature down.

Q.8 Differentiate between the following:

- i. Tissue and organ ii. Root system and shoot system iii. Epidermal and mesophyll tissue iv. Palisade and spongy mesophyll

i) Tissue and Organ

Tissue	Organ
In a multicellular organism, cells make tissue — a group of similar cells that work together to perform one or more specific functions. <i>Example: muscle tissue, epithelial tissue.</i>	An organ is a structure made up of related tissues working together to perform specific functions. <i>Example: stomach, heart and kidney.</i>

ii) Root System and Shoot System

Root System	Shoot System
Consists of two main structures: the root cap and the primary root. It anchors the plant and absorbs water and nutrients.	Consists of two portions: the vegetative and reproductive parts of the plant. Its components — stems, leaves and reproductive structures like flowers — work together to enable processes like photosynthesis and reproduction.

iii) Epidermal and Mesophyll Tissue

Epidermal Tissue	Mesophyll Tissue
The outermost layer of the leaf. The upper epidermis is usually covered by a waxy cuticle, which reduces water loss and provides protection. The lower epidermis often contains guard cells enclosing stomata, which regulate gas exchange and water vapour loss.	Lies between the upper and lower epidermis; consists of cells rich in chloroplasts. It is the site of photosynthesis, divided into two regions: palisade mesophyll and spongy mesophyll.

iv) Palisade and Spongy Mesophyll

Palisade Mesophyll	Spongy Mesophyll
Located just beneath the upper epidermis; consists of tightly packed elongated cells rich in chloroplasts, playing a major role in photosynthesis.	Present below the palisade mesophyll; composed of loosely arranged cells with air spaces between them, which facilitate the diffusion of gases throughout the leaf.

Q.9 How do different tissues form the stomach?

- (i) The stomach is an organ specialized for the digestion of proteins and storing food.
- (ii) The stomach has:
- **Epithelial (glandular) tissues** which secrete gastric juice.
 - **Muscular tissues** which perform contractions of the stomach walls for grinding food, mixing enzymes with food, and moving food to the posterior end.

Q.10 Sort the following examples into a table according to their levels of organization: Root system, Neuron, Protein, Nitrogen, Cat, Epidermis, Brain, Carbon dioxide, Zinc, Cilia, Rose plant, Xylem, Leaf, Guard cell.

Levels of Organization

Level	Examples
Atomic level	Zinc, Nitrogen
Molecular level	Carbon dioxide, Protein
Organelle level	Cilia
Cellular level	Neuron, Guard cell
Tissue level	Xylem, Epidermis
Organ level	Brain, Leaf
Organ system level	Root system
Organism level	Rose plant, Cat

Q.11 What is an organ system? Give examples.

In higher multicellular organisms, particularly animals, different organs performing related functions are organized together in the form of an organ system. For example, the digestive system carries out the process of digestion and consists of the oral cavity, esophagus, stomach, small intestine, large intestine, liver and pancreas.

Q.12 Define organelles with examples.

An enormous number of biomolecules become associated in a particular way to form organelles. Organelles are sub-cellular structures. *Examples: mitochondria, ribosomes.*

Q.13 What is the tissue level? Give one example.

A group of similar or different types of cells performing the same function. *Example: xylem and phloem in plants are composed of different types of cells, while nervous tissue is composed of the same type of cells.*

Q.14 A cell works as an open system. Comment on it.

A cell works as an open system, i.e., it takes in substances needed for its metabolic activities through its cell membrane. It takes up food, oxygen, water and salts for survival, growth and division, and energy for metabolic processes. Products and by-products are formed during metabolism; the cell either utilizes the products or transports them to other cells, while by-products are either stored or secreted out of the cell.