NCERT Archive

SOLUTIONS BOOK

CLASS 8

Science · Curiosity

CHAPTER 2

The Invisible Living World: Beyond Our Naked Eye

Complete Questions and Activities Solutions

In-text Questions | Keep the curiosity alive | Discover, design, and debate

Contents

Class 8 Science · Curiosity · Chapter 2 — The Invisible Living World: Beyond Our Naked Eye

2.1 In-text Questions — 30 questions · Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10 Q11 Q12 Q13 Q14 Q15 Q16 Q17 Q18 Q19 Q20 Q21 Q22 Q23 Q24 Q25 Q26 Q27 Q28 Q29 Q30 — 3

2.2 Keep the curiosity alive — 9 questions · Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 — 29

2.3 Discover, design, and debate — 4 questions · Q1 Q2 Q3 Q4 — 38

Every question is followed by its answer. Question numbers above are clickable and the PDF bookmarks panel lets you jump to any exercise set or question. Figures are reproduced from the NCERT textbook (© NCERT) for educational use.

NCERT ARCHIVE

2.1

CLASS 8 SCIENCE · CHAPTER 2

In-text Questions

Solutions · 30 questions

Directions (Questions 1–30): These are the questions and activities that appear inside the chapter (Probe and ponder, Activities, Be a scientist and the discussion questions), numbered in the order in which they appear. Where an activity needs a practical result, the expected observation is given with the explanation; you may add your own observations.

QUESTION 1 *Probe and ponder · p. 8*

Have you ever wondered what you might see if the invisible world around you became visible?

ANSWER

We would see a world full of tiny living beings, called microorganisms, living in water, soil, air, on plants and animals, and even inside our own bodies.

a What we would see

- In pond or stagnant water: tiny organisms such as *Amoeba* and *Paramecium* (protozoa) and green algae, many of them moving about.
- In soil: moulds and other fungi, algae and bacteria of different shapes (spherical, comma, spiral or rod-shaped).
- On rotting food, on leaves, stems and roots, and even in our gut, where bacteria help in digestion.
- All of them are made of cells, which are too small to be seen with the naked eye but are visible under a microscope.

Therefore, the invisible world around us is full of microorganisms that become visible only through a microscope.

NCERT ARCHIVE

QUESTION 2 *Probe and ponder · p. 8*

How do you think your observation of this hidden world might change the way you think about size, complexity, or even what counts as ‘living’?

ANSWER

Seeing the hidden world shows that a living being can be extremely small, can consist of a single cell, and still carry out all the functions of life.

Idea	How observation changes it
Size	Living beings range from tiny microorganisms to really big organisms; many cannot be seen without a microscope.
Complexity	A single cell of bacteria or *Amoeba* carries out all the functions necessary for survival; a cell is not just a simple bag of liquid but a complex structure with many parts.
What counts as ‘living’	Bacteria, protozoa, algae and fungi are living organisms, though invisible to us. Viruses are microscopic and acellular and multiply only when they enter a living cell, which makes us think about what we call living.

Therefore, observing the invisible world changes our ideas of how small, how simple and how varied living beings can be.

QUESTION 3 *Probe and ponder · p. 8*

Have you thought how these tiny living beings interact with each other?

ANSWER

Microorganisms interact with other living beings and with each other in many ways, some helpful and some harmful.

NCERT ARCHIVE

- **Decomposers:** fungi and bacteria in soil break down dead plants and animals and return nutrients to the soil.
- **Partners of plants:** *Rhizobium* bacteria live in root nodules of legumes and trap nitrogen from the air for the plant.
- **Inside our body:** bacteria in the intestine help in digestion.
- **In food:** yeast and *Lactobacillus* bring about fermentation, as in bread and curd.
- **Harmful:** some microbes cause diseases in plants and animals, including humans (the next chapter).

Therefore, microbes live together with plants, animals and each other, and many of these interactions are useful to us.

QUESTION 4 *p. 9*

Have you ever noticed the smallest organism around you that is visible to the naked eye? Think about it: how small a thing can your eyes actually see?

ANSWER

The naked eye can see only objects above a certain size; anything smaller needs a magnifying tool.

- Examples of small organisms we can see around us are ants, mosquitoes, tiny flies and small seeds or plants; your own list may differ.
- The human eye can see only objects that are above a certain size (nearly 0.1 mm, as you will learn in higher classes). Organisms smaller than this, such as bacteria and *Amoeba*, cannot be seen by the naked eye.
- For a long time, people could not see these tiny organisms and so did not know about them.

Therefore, organisms smaller than the limit of the eye can be seen only with the help of a lens or microscope.

NCERT ARCHIVE

QUESTION 5 *p. 9*

You might have seen some people using reading glasses. How does it help them see better? Or what happens when we use a magnifying glass to observe something?

ANSWER

Reading glasses and magnifying glasses contain lenses. A lens is curved glass, thick in the middle and thin at the edge, which makes small things look bigger.

- The word **lens** comes from the lentil seed, because the glass was shaped like it: thick in the middle and thin at the edge.
- Reading glasses use lenses that make the letters appear bigger and clearer, so the person can read them easily.
- A magnifying glass makes an object look larger, so we can see more details of it, such as the body of an ant.

Therefore, a lens makes small objects look bigger and helps us see details our eyes could not.

QUESTION 6 *Activity 2.1 · p. 9*

Let us observe. Take a round-bottom flask made of glass, fill it with water, close its mouth with a cork, place it on an open book and look at the letters through it. Do you notice something interesting? Now use a real magnifying glass to look at small organisms, like an ant. Were you able to see the details of its body more clearly?

ANSWER

The letters appear larger when seen through the water-filled flask, because the flask filled with water acts like a magnifying glass.

NCERT ARCHIVE



Fig. 2.1: Round-bottom flask

a Observations

Step	Observation and reason
Flask filled with water placed on a book	The letters seen through the flask appear larger. The water-filled flask acts like a lens, so it magnifies.
Ant seen through a magnifying glass	Yes. The details of its body, such as its legs and head, are seen more clearly than with the naked eye.

Therefore, a water-filled flask and a magnifying glass both make objects appear larger.

QUESTION 7 *p. 9*

So, how did we finally discover this invisible world? Do you know which scientific discovery helped us see the tiny world for the first time?

ANSWER

The invention of the microscope opened up the hidden world of tiny living creatures.



Fig. 2.2(b): Microscope of Robert Hooke



Fig. 2.2(c): Cork cells as published in the Micrographia

NCERT ARCHIVE

a Two early scientists

Scientist	Contribution
Robert Hooke (1665)	Published the book *Micrographia* with detailed drawings. His microscope made things look 200 to 300 times bigger. He saw a thin slice of cork made of many small empty spaces like a honeycomb and called each a **cell**, the first use of the word in science.
Antonie van Leeuwenhoek (1660s)	A Dutch scientist who made better lenses and built more useful microscopes. He was the first to clearly see and describe tiny living things such as bacteria and blood cells, and is called the Father of Microbiology.

Therefore, the microscope, improved from simple lenses, let us see cells and microorganisms for the first time.

QUESTION 8 *Activity 2.2 · p. 11*

Let us study a cell (teacher demonstration activity). Prepare an onion peel slide and observe it under a microscope. Compare it with Fig. 2.3c. What similarities do you find in Fig. 2.3c and Fig. 2.3d?

ANSWER

The onion peel cells look like nearly rectangular units, closely arranged without any space between them, just like the bricks in a wall.

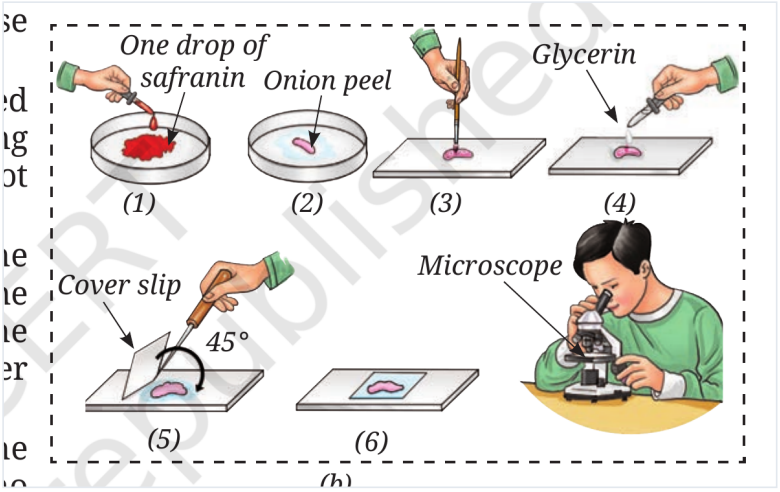


Fig. 2.3(b): Mounting the onion peel in glycerin using a needle

NCERT ARCHIVE

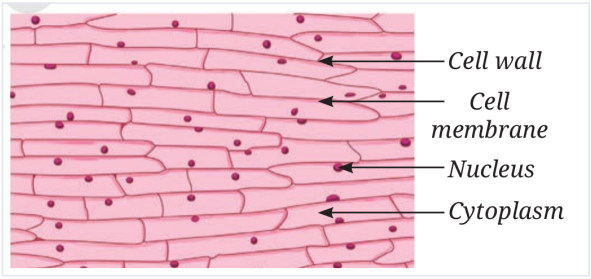


Fig. 2.3(c): Structure of onion peel under the microscope

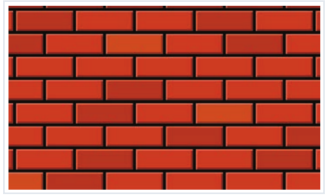


Fig. 2.3(d): A wall made of brick

a Steps and their purpose

Step	Purpose
Wash an onion bulb, cut it vertically and pull out the thin transparent inner layer with forceps	This layer is the onion peel
Place the peel in a few drops of safranin for 30 seconds, then rinse in water with a thin brush	Safranin gives a pinkish colour to the cells so they are seen clearly; the extra stain is removed by rinsing
Put the peel on a glass slide and add a drop of glycerin	Glycerin prevents drying of the cells and improves clarity
Lower a coverslip slowly with a needle; wipe extra glycerin with blotting paper	Prevents air bubbles from being trapped and keeps the slide clean
Observe under a microscope	A simple foldable paper microscope will also do

b Similarity between Fig. 2.3c and Fig. 2.3d

In both, nearly rectangular units are arranged closely, in rows, without any space between them. A **cell** is like a brick: just as bricks make up a wall, cells make up the onion peel.

Therefore, onion peel cells are rectangular and closely packed, like bricks in a wall.

QUESTION 9 *p. 11*

What do you think the body of an animal is made of?

ANSWER

The body of an animal is also made of cells. You can confirm this by observing human cheek cells (Activity 2.3).

NCERT ARCHIVE

- Try observing the peels of leaves of different plants around you; you will find that all plants are made up of cells.
- All living beings, whether plants or animals, are made up of cells. Animal cells differ in some features from plant cells, for example they have no cell wall.

Therefore, animals, like plants, are made up of cells.

QUESTION 10 *Activity 2.3 · p. 12*

Let us investigate. Scrape the inside of your cheek gently with the blunt end of a toothpick, spread it on a slide with a drop of water, add methylene blue, then glycerin, and place a coverslip. Observe it under a microscope and draw what you see. What did you observe?

ANSWER

You will see polygon-shaped cells, as in Fig. 2.4. These are cheek cells, which form the inner lining of the mouth.

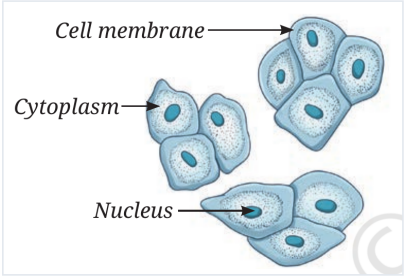


Fig. 2.4: Mount of human cheek cells

a Procedure and purpose

- Rinse the mouth with clean water first, and use the blunt end of a clean toothpick to scrape the inside of the cheek gently.
- **Methylene blue** (a blue stain) improves the visibility of the material by increasing contrast.
- **Glycerin** is added after one minute to prevent the cells from drying; the extra glycerin is removed from the edges of the coverslip with blotting paper.

NCERT ARCHIVE

b **Observation**

Polygon-shaped, bluish cells, each with an outer cell membrane, a darker round nucleus in the middle and cytoplasm in between (Fig. 2.4).

Therefore, cheek cells are polygon-shaped cells with a cell membrane, cytoplasm and a nucleus.

QUESTION 11 *p. 12*

What similarities and differences did you observe between the cells of onion peel in Activity 2.2 and human cheek cells in Activity 2.3?

ANSWER

Both have a cell membrane, cytoplasm and a nucleus, but onion peel cells have an extra outer layer, the cell wall, and are rectangular.

Feature	Onion peel cell (plant)	Human cheek cell (animal)
Cell membrane, cytoplasm and nucleus	Present	Present
Cell wall	Present (extra outer layer)	Absent
Shape	Nearly rectangular	Polygon-shaped, thin and flat
Arrangement	Closely arranged without space between them	Form the protective inner lining of the cheek
Stain used	Safranin (pinkish)	Methylene blue (blue)

Therefore, plant and animal cells have the same three basic parts, but plant cells also have a cell wall.

NCERT ARCHIVE

QUESTION 12 *p. 12*

What is the importance of these structures in a cell? What functions do they perform? Are these functions important for the maintenance of life?

ANSWER

Each part of the cell has its own job. Together, these functions are important for the maintenance of life.

Part of the cell	Function
Cell membrane	Encloses the cytoplasm and nucleus and separates one cell from another. It is porous, so it allows the entry of materials essential for life processes and the exit of waste material.
Cytoplasm	Contains other components of the cell and compounds such as carbohydrates, proteins, fats and mineral salts. Most of the life processes take place within it.
Nucleus	Regulates all activities that occur within the cell and also regulates growth.
Cell wall (plant cells)	Provides rigidity and strength to plants, so cells are arranged compactly and look firm.

Yes, these functions are important for the maintenance of life: a cell must take in useful materials, remove waste, carry out life processes and grow under the control of the nucleus.

Therefore, the cell membrane, cytoplasm, nucleus and cell wall all help the cell to live and function.

QUESTION 13 *p. 13*

Do different animal cells also vary in their shape and structure? The muscle cell and the nerve cell of a human are shown in Fig. 2.6a and b. What are the similarities and differences you see in them?

ANSWER

Yes. Animal cells differ in shape and structure; the muscle cell is spindle-shaped and the nerve cell is very long and branched.

NCERT ARCHIVE



Fig. 2.6(a): Muscle cell



Fig. 2.6(b): Nerve cell

Point	Muscle cell (Fig. 2.6a)	Nerve cell (Fig. 2.6b)
Similarity	Both are animal cells of humans with a cell membrane, cytoplasm and a nucleus	Same
Shape	Shaped like a spindle	Very long and has branches
Function	Contract and relax, e.g. in the food pipe and stomach wall	Nerve cells (neurons) carry messages in the body

Similarly, some cells are round, while others are long and thin. The number of cells also varies in different organisms.

Therefore, different animal cells vary in shape and structure.

QUESTION 14 *p. 13*

Why do cells look so different from each other? Does the shape and structure of a cell relate to its function?

ANSWER

Yes. The unique shape, size and structure of cells help them carry out their specific functions.

NCERT ARCHIVE

Cell	Shape and structure	How it helps the function
Cheek cell	Thin and flat	Forms a protective lining on the inner surface of the cheek
Nerve cell (neuron)	Elongated and branched	Reaches different parts of the body and passes messages quickly
Muscle cell	Thin, flexible, spindle-shaped	Contracts and relaxes in a wave-like manner, pushing food down the food pipe to the stomach
Plant cells	Rectangular, elongated, oval or tube-like	Some form long tubes that carry water throughout the plant

Therefore, the shape and structure of a cell are related to the function it performs.

QUESTION 15 *2.2 · p. 14*

What are the levels of organisation in the body of a living organism?

ANSWER

The body of a living organism is organised as: cell → tissue → organ → organ system → organism.

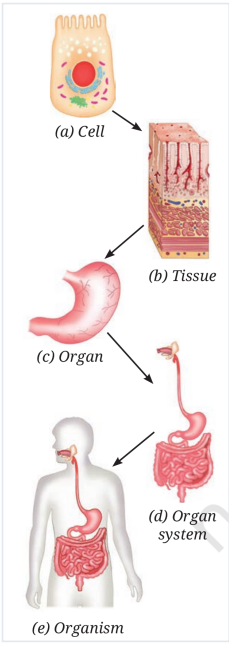


Fig. 2.7: Levels of organisation of life

NCERT ARCHIVE

a Levels with an example from the digestive system

Level	Meaning	Example (Fig. 2.7)
Cell	Basic unit of life, like a brick is the basic unit of a wall	A single cell
Tissue	A group of similar cells	Tissue of the stomach
Organ	Different tissues organised together	Stomach
Organ system	Several organs working together for a major function	Digestive system
Organism	All organ systems together make a complete living being	A human being

The life of complex organisms begins with a single cell, the ‘egg’, which divides repeatedly to form a living being of many cells, called a **multicellular organism**. Animals including humans, and plants, are multicellular.

Therefore, cells make tissues, tissues make organs, organs make organ systems, and organ systems make the organism.

QUESTION 16 *2.3 · p. 15*

What are microorganisms? What do their cells look like? Are they like the plant and animal cells we just learnt about, or are they different?

ANSWER

Microorganisms are organisms made of just one or very few cells, so small that they cannot be seen with the naked eye. Their cells have the same basic parts but also some differences.

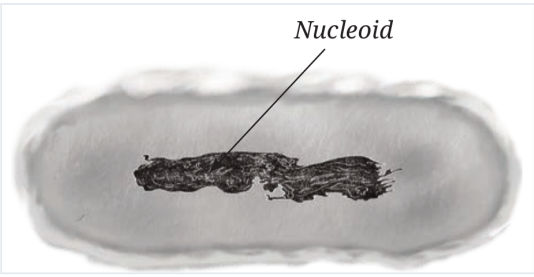


Fig. 2.13: A bacterial cell showing the nucleoid region

NCERT ARCHIVE

a Microorganisms

- Some are **unicellular** (one cell), such as bacteria and *Amoeba*; others, such as some fungi and algae, are **multicellular**.
- They are found all around us: in water, soil, air and even inside our body.
- To observe their cells we need a microscope, or a low-cost foldable paper microscope, which gives less detail than a high-powered laboratory microscope but makes the microscopic world accessible to many people.

b Comparison with plant and animal cells

- Like animal and plant cells, the cells of microorganisms are surrounded by a **cell membrane**.
- Cells of fungi also have a **cell wall** but no chloroplasts, so they cannot make their own food by photosynthesis.
- Bacteria have no well-defined nucleus or nuclear membrane; they have a **nucleoid** instead (Fig. 2.13).

Therefore, microbial cells have a cell membrane like other cells, but bacteria have a nucleoid and fungi have a cell wall without chloroplasts.

QUESTION 17 *Activity 2.4 · p. 15*

Let us observe pond water or stagnant water. Collect pond or stagnant water, place a drop on a microscope slide, cover it with a coverslip and observe it under the microscope. Observe the tiny organisms found.

ANSWER

You will see tiny organisms, mostly moving, such as *Amoeba*, *Paramecium* and green algae (Table 2.1).

a Procedure

1. Collect pond or stagnant water in a container with the help of your teacher or elder(s).

2. Place a drop of the water on a slide with a dropper and put a coverslip over it.

3. Observe it under the microscope.

NCERT ARCHIVE

b Observations

- Many tiny organisms that cannot be seen with the naked eye are found in the water.
- Typical ones are *Amoeba* (a single cell of irregular shape), *Paramecium* (a single moving cell) and green algae (single cells that look green because of a green pigment).

Therefore, pond or stagnant water contains many microorganisms that are visible only under the microscope.

QUESTION 18 *Activity 2.5 · pp. 15–16*

Let us observe soil suspension. Mix moist soil in a beaker with water, let it settle, place a drop from the top layer on a slide, cover it with a coverslip and observe it under the microscope.

ANSWER

You may observe small moving organisms similar to those seen in Activity 2.4, which shows that soil suspension also contains a variety of tiny creatures.

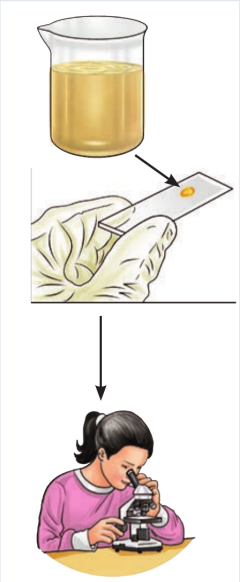


Fig. 2.8: Observation of soil suspension under the microscope

NCERT ARCHIVE

a Procedure and precautions

- Do not touch the soil with bare hands; use a spoon or gloves.
- Pour water into the beaker and stir with a glass rod. The dirty-looking liquid has very fine particles of soil and is called **soil suspension**. Keep it aside to settle.
- Take a drop of water from the top layer with a dropper, put it on a slide, cover with a coverslip and observe.

The tiny creatures that cannot be seen with the naked eye are called **microorganisms** (*micro* means very small) or **microbes**.

Therefore, soil also contains many microorganisms.

QUESTION 19 *Activity 2.6 · p. 16*

Let us study. A group of students performed Activities 2.4 and 2.5, recorded the data in Tables 2.1 and 2.2 and identified the microorganisms as protozoa, algae, fungi and bacteria. Record if you find any of these categories of organisms.

ANSWER

The recorded data of the students, and the category of each microorganism, are summarised below.

a Table 2.1: Organisms present in pond water

S.No.	Microorganism	Recorded data
1.	*Amoeba* (Protozoa)	Single cell, moving, irregular shape
2.	*Paramecium* (Protozoa)	Single cell, moves from one place to another with the help of specialised structures
3.	Algae	Single cell, looks green because of the green pigment, moves with the help of specialised structures

NCERT ARCHIVE

b Table 2.2: Organisms present in soil suspension

S.No.	Microorganism	Remarks
1.	Bread mould (Fungi)	Branched filament without chlorophyll having sac-like structure
2.	Mould (Fungi)	Branched filament without chlorophyll having brush-like structure
3.	Algae	Spherical, presence of chlorophyll, a green pigment
4.	Bacteria	Spherical, comma, spiral or rod-shaped; one long hair-like structure and many small hair-like projections around the cell

So the microorganisms belong to four categories: **protozoa, algae, fungi and bacteria**.

Therefore, pond water and soil suspension contain protozoa, algae, fungi and bacteria.

QUESTION 20 *p. 17*

Did you also observe any of these microorganisms or something different? Record in your notebook and discuss in your class.

ANSWER

What you see depends on your sample, but you will find some of the groups already listed. Record each one in a table like the one below.

Sample	Microorganism seen	Shape and movement	Green or not	Category
Pond water	e.g. *Amoeba*, *Paramecium*	Irregular or elongated; moving	Not green	Protozoa
Pond water	e.g. a green cell	Single cell; moves	Green	Algae
Soil suspension	e.g. mould	Branched filaments	Not green	Fungi
Soil suspension	e.g. bacteria	Spherical, comma, spiral or rod-shaped	Not green	Bacteria

Microorganisms are everywhere and can be seen only with a microscope, a device that magnifies them 100 to 400 times. Though small, they play an important role in our lives.

Therefore, record what you actually see and discuss it in class; the common groups are protozoa, algae, fungi and bacteria.

NCERT ARCHIVE

QUESTION 21 *2.4 · p. 18*

Have you ever seen a lemon, tomato, orange or any other food item rot after being left outside? You may have noticed a powdery or cotton-like growth on it (Fig. 2.9). Where did these microbes come from? How did they come in contact with the food?

ANSWER

Microorganisms are found everywhere, so they reach food from the water, soil and air around it.



Fig. 2.9: Fruit with microorganism growing on it

- Microorganisms can be found everywhere: in water, soil, air and even in some food items.
- When food is left outside, microbes from the surroundings reach it, infect it and grow on it, giving the powdery or cotton-like growth and making the food rot.
- You can use a microscope to explore the surfaces of leaves, stems, roots or any other part to see them.

Therefore, the microbes on rotting food come from the water, soil and air around us.

QUESTION 22 *p. 18*

But why do microorganisms not infect the pickles and murabbas?

ANSWER

Pickles and murabbas contain a high concentration of salt or sugar, along with spices, which act as preservatives.

NCERT ARCHIVE

- Many spices are added with salt or sugar, and these act as **preservatives**.
- A high concentration of salt or sugar does not allow these organisms to grow on them, so the pickles and murabbas stay fresh for a long time.

Therefore, salt, sugar and spices act as preservatives and stop microorganisms from growing in pickles and murabbas.

QUESTION 23 *p. 18*

How does the diversity of microorganisms play a role in our daily life? How do they help clean the environment?

ANSWER

Like plants and animals, microorganisms show great diversity, and many of them are useful in our daily life and in cleaning the environment.

a Diversity of microorganisms

- They vary in shape, size and structure: spherical, rod-shaped or irregular.
- Some live in extreme climatic conditions such as hot water springs and snow-cold zones, as well as at moderate temperatures.
- Some live inside our bodies; the bacteria in our intestine help in digestion.

b Role in cleaning the environment

Microorganisms break down (decompose) dead plants and animals and other waste, so they clean the environment and return nutrients to nature (see the next questions).

Therefore, microorganisms are diverse and play useful roles in our daily life and in cleaning the environment.

NCERT ARCHIVE

QUESTION 24 *Activity 2.7 · pp. 18–19*

Let us do. Fill an empty container halfway with garden soil, add fruit and vegetable peels, cover with a layer of soil and leave it aside. After 2–3 weeks observe the changes. Do you observe any difference in the contents? But how did the peels of fruits and vegetables turn into manure?

ANSWER

The peels turn into a dark-coloured material called manure, which is rich in nutrients and increases soil fertility. Microorganisms in the soil make it.



Fig. 2.10: Recycling of nutrients by making manure

a Observation

The peels of fruits and vegetables have turned into a dark-coloured material. This is **manure**, which is rich in nutrients and helps increase the fertility of the soil.

b How the peels turn into manure

- Soil contains various kinds of microorganisms (Activity 2.6).
- Fungi and bacteria act on the plant waste and slowly break it down into simpler, nutrient-rich manure.
- Manure formation occurs at an optimal temperature and an appropriate moisture level.

Therefore, soil microorganisms break down the peels into nutrient-rich manure.

NCERT ARCHIVE

QUESTION 25 *p. 19*

You may have seen gardeners in your school or in a field near your house collecting dry leaves and plant waste and putting them into pits. Do you now understand why they do this?

ANSWER

Yes. They do it to make natural manure.

- In the pits, microorganisms such as fungi and bacteria decompose the dry leaves and plant waste.
- The nutrient-rich manure that results is put back into the soil, so plants grow better without depending only on chemical fertilisers.

Therefore, gardeners collect plant waste in pits to make natural manure with the help of microorganisms.

QUESTION 26 *p. 20*

Now, think what would have happened if microorganisms did not exist on Earth?

ANSWER

Waste would not be cleaned up, nutrients would not go back to the soil, and many foods and benefits we get from microbes would be lost.

NCERT ARCHIVE

- Fallen leaves, dead plants and the bodies of dead animals would not decompose, so waste would pile up.
- Nutrients would not return to the soil, and plants would not grow as well; there would be no manure.
- *Rhizobium* bacteria would not trap nitrogen for legumes, so more chemical fertilisers would be needed.
- We would not get foods such as bread, cakes, idli, dosa and curd, which depend on yeast and *Lactobacillus*.
- Microalgae produce more than half of the Earth's oxygen supply; without them the oxygen balance would be disturbed.

Therefore, life on Earth would be difficult without microorganisms.

QUESTION 27 *Be a scientist · p. 20*

Ananda Mohan Chakrabarty developed a bacterium that could break down oil spills. What are the other problems which you think can be solved with the help of microorganisms?

ANSWER

Besides cleaning oil spills, microorganisms can help to manage waste, produce fuel and manure, improve soil and clean water.

a About Ananda Mohan Chakrabarty

Ananda Mohan Chakrabarty (1938–2020) studied bacteria. In 1971 he developed a special bacterium that could break down oil spills, which helps clean the environment. His discovery received a **patent** in 1980; a patent is given to a person so that no one else can copy, use or sell his or her invention without permission.

NCERT ARCHIVE

b Other problems that microorganisms can help to solve

Problem	How microorganisms help
Plant and kitchen waste	Bacteria and fungi decompose it into manure (decomposition)
Need for fuel	Bacteria decompose plant and animal waste in an oxygen-free environment and release biogas, rich in methane, used for cooking, heating, electricity and vehicles
Need for nitrogen fertilisers	*Rhizobium* in legume roots traps nitrogen from the air
Polluted water	Microalgae help in cleaning water and are used to make biofuel
Food production and shelf life	Yeast and *Lactobacillus* are used to make bread, curd, idli and dosa

Therefore, microorganisms can help solve problems of pollution, waste, fuel, fertilisers and food.

QUESTION 28 *2.4.2 · p. 20*

How does the diversity of microorganisms help in our kitchen?

ANSWER

Different microorganisms help us make different foods: yeast makes bread and cakes soft and fluffy, and bacteria such as *Lactobacillus* make curd and ferment batter.

Microorganism	Food	What it does
Yeast (a fungus)	Bread, cakes, pastries	Releases carbon dioxide, which makes the dough soft and fluffy
Lactobacillus (bacterium)	Curd	Ferments milk and makes lactic acid, which gives curd its sour taste
Lactobacillus and other fermenting microbes	Batter for idli and dosa; dough for *bhatura*	Help in fermentation of the batter or dough

Some of this is studied in Activities 2.8 and 2.9 below.

Therefore, yeast and bacteria help us in the kitchen by fermentation.

NCERT ARCHIVE

QUESTION 29 *Activity 2.8 · pp. 20–21*

Let us perform. Take two bowls A and B with 200 g flour and a pinch of sugar each; add yeast powder to bowl A only; knead both with warm water, cover with a damp cloth, keep in a warm place and observe after 4–5 hours. Did you find any change? Why does this happen? What is the role of yeast? Why did we add sugar and warm water to the flour?

ANSWER

The dough in bowl A, where yeast was added, rises, becomes fluffy and smells different. The dough in bowl B does not.



Fig. 2.11(a): Dough in bowl A



Fig. 2.11(b): Dough in bowl B

a Observation

Bowl	With yeast?	After 4–5 hours
A	Yes	Dough has risen slightly, become fluffy, and has a different smell
B	No (for comparison)	No such change

NCERT ARCHIVE

b Explanation

- **Role of yeast:** yeast is a microorganism that belongs to the group of fungi. Like other organisms, yeast respires and breaks down food to release energy for its growth and life processes.
- During this process **carbon dioxide** is released, which forms bubbles that make the dough soft and fluffy. Yeast also produces a small amount of **alcohol**, which gives the dough a slightly different smell.
- **Sugar and warm water:** sugar serves as food for the yeast, and yeast grows well in warm conditions.
- Bowl B has no yeast and acts as the comparison (control).

Therefore, yeast breaks down sugar and releases carbon dioxide, which makes the dough rise.

QUESTION 30 *Activity 2.9 · p. 21*

Let us prepare. Take two small glass bowls A and B. Pour lukewarm milk in A and cold milk in B, add a small spoonful of curd to each, cover them, keep A in a warm place and B in a cool place for a few hours or overnight. Write your predictions and observations in Table 2.4.

ANSWER

Milk turns into curd in bowl A but not in bowl B, because the bacteria in curd grow well in warm conditions.

a Table 2.4 (model entries)

	Appearance: Bowl A	Appearance: Bowl B	Colour: A and B	Possible reason
Prediction	Milk will turn into curd	Milk will not curdle	No marked change	Bacteria in curd need warmth to grow
Observation	Milk has turned into curd and is a little sour	Milk has not curdled, but may be a little sour	No marked change	*Lactobacillus* in the warm milk multiplied and fermented it

NCERT ARCHIVE

b Why this happens

- The curd contains several types of bacteria; one of them is *Lactobacillus*.
- It feeds on the sugar in milk (lactose), multiplies and ferments the milk to form curd.
- Instead of alcohol (like yeast), these bacteria produce **lactic acid**, which makes curd sour.
- These bacteria grow well in warm conditions; that is why curd forms in bowl A and not in bowl B.

Therefore, *Lactobacillus* turns lukewarm milk into curd by fermentation, and warmth helps it grow.

NCERT ARCHIVE

2.2

CLASS 8 SCIENCE · CHAPTER 2

Keep the curiosity alive

Solutions · 9 questions

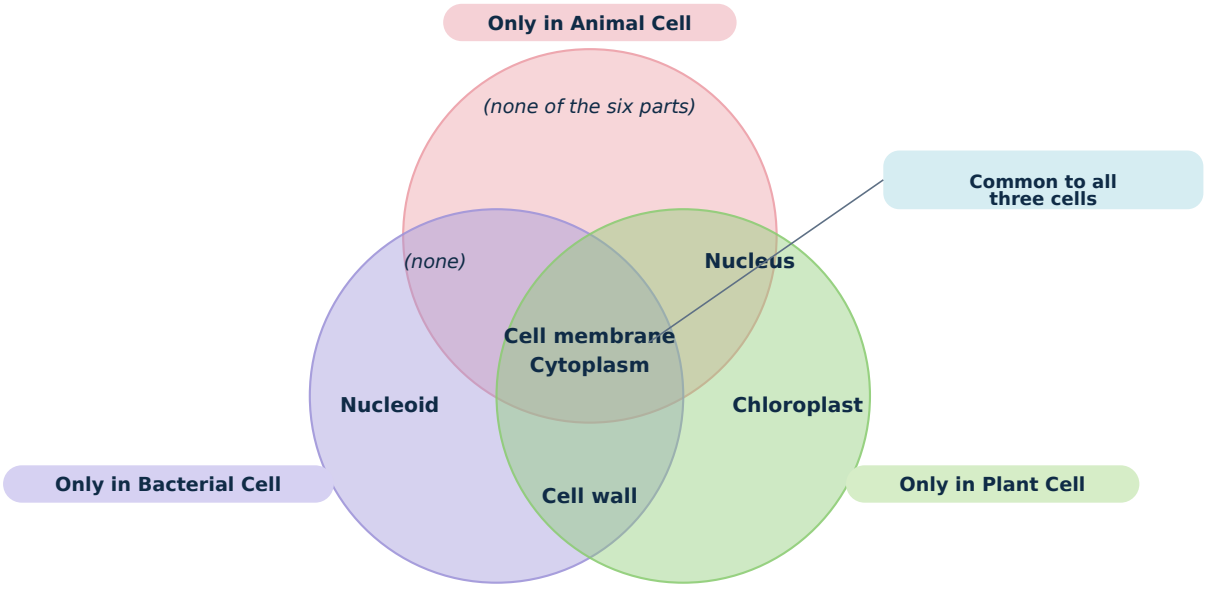
Directions (Questions 1–9): These are the questions of Keep the curiosity alive at the end of the chapter (pages 25–26). Each question is reproduced in full and answered step by step; the correct option is given where options are provided.

QUESTION 1

Various parts of a cell are given below. Write them in the appropriate places in the following diagram (Venn diagram: Only in Animal Cell, Only in Bacterial Cell, Only in Plant Cell, Common to all three cells). Parts: Nucleus, Chloroplast, Cell membrane, Cytoplasm, Cell wall, Nucleoid.

ANSWER

Cell membrane and cytoplasm are common to all three cells; the nucleoid is only in bacterial cells and the chloroplast only in plant cells.



NCERT ARCHIVE

a Reasons

Part	Found in	Reason
Cell membrane, Cytoplasm	Animal, plant and bacterial cells	Every cell is bounded by a cell membrane and filled with cytoplasm
Cell wall	Plant and bacterial cells	Plant, fungal and bacterial cells have an extra covering, the cell wall, around the cell membrane; animal cells have none
Nucleus	Animal and plant cells	Bacteria lack a well-defined nucleus
Nucleoid	Only bacterial cells	Bacteria have a nucleoid instead of a nucleus and nuclear membrane
Chloroplast	Only plant cells (of the three)	Contains chlorophyll and helps in photosynthesis

Therefore, the common region has cell membrane and cytoplasm, the bacterial region has nucleoid and the plant region has chloroplast.

NCERT ARCHIVE

QUESTION 2

Aanandi took two test tubes and marked them A and B. She put two spoonfuls of sugar solution in each of the test tubes. In test tube B, she added a spoonful of yeast. Then she attached two incompletely inflated balloons to the mouth of each test tube. She kept the set-up in a warm place, away from sunlight. (i) What do you predict will happen after 3–4 hours? She observed that the balloon attached to test tube B was inflated. What can be a possible explanation for this? (a) Water evaporated in test tube B and filled the balloon with the water vapour. (b) The warm atmosphere expanded the air inside the test tube B, which inflated the balloon. (c) Yeast produced a gas inside the test tube B which inflated the balloon. (d) Sugar reacted with warm air, which produced gas, eventually inflating the balloon. (ii) She took another test tube, 1/4 filled with lime water. She removed the balloon from test tube B in such a manner that the gas inside the balloon did not escape. She attached the balloon to the test tube with lime water and shook it well. What do you think she wants to find out?

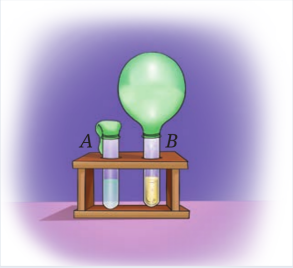


Fig. 2.14: Experimental set-up

ANSWER

The correct explanation is option (c): yeast produced a gas inside test tube B, which inflated the balloon.

a (i) Prediction and explanation

- Test tube A has only sugar solution (no yeast), so no gas is formed and its balloon stays as it was.
- In test tube B the yeast breaks down the sugar, respires and releases **carbon dioxide**, so the balloon inflates. Hence option **(c)**.
- Option (a) is wrong because both tubes are in the same warm place, but only B inflated; (b) is wrong because warm air would expand the air in tube A also; (d) is wrong because sugar does not react with warm air to produce gas.

NCERT ARCHIVE

b **(ii) What she wants to find out**

She wants to find out whether the gas released by yeast is **carbon dioxide**. Carbon dioxide turns lime water milky, so if the lime water turns milky on shaking, the gas is carbon dioxide.

Therefore, yeast released carbon dioxide gas in test tube B, and the lime water test checks for this gas.

QUESTION 3

A farmer was planting wheat crops in his field. He added nitrogen-rich fertiliser to the soil to get a good yield of crops. In the neighbouring field, another farmer was growing bean crops, but she preferred not to add nitrogen fertiliser to get healthy crops. Can you think of the reasons?

ANSWER

Bean plants are legumes whose roots have nodules containing *Rhizobium* bacteria, which supply nitrogen to the plant.



Fig. 2.12: Root nodules of Cowpea plant which contain Rhizobium

NCERT ARCHIVE

- Roots of legumes such as beans, peas and lentils have swollen regions called **nodules** that contain *Rhizobium* bacteria.
- These bacteria trap nitrogen from the air and make it useful for the plant, so bean plants grow well without chemical nitrogen fertiliser.
- Wheat is not a legume and has no such nodules, so the first farmer adds nitrogen-rich fertiliser.
- Farmers also grow legumes in rotation with other crops, which naturally increases nitrogen in the soil and keeps it healthy for the next crop.

Therefore, the bean farmer does not need nitrogen fertiliser because *Rhizobium* bacteria in the root nodules provide nitrogen.

QUESTION 4

Snehal dug two pits, A and B, in her garden. In pit A, she put fruit and vegetable peels and mixed it with dried leaves. In pit B, she dumped the same kind of waste without mixing it with dried leaves. She covered both the pits with soil and observed after 3 weeks. What is she trying to test?

ANSWER

She is testing whether mixing dried leaves with the waste affects the formation of manure by microorganisms.

- The only difference between the two pits is the **dried leaves**; everything else (the kind of waste, soil cover, time) is the same.
- In both pits, microorganisms such as fungi and bacteria decompose the waste into manure. Manure formation depends on conditions such as optimal temperature and moisture.
- After 3 weeks she compares how much manure has formed in A and B, to find whether mixing with dried leaves helps decomposition.

Therefore, Snehal is testing the effect of dried leaves on the decomposition of kitchen waste into manure.

NCERT ARCHIVE

QUESTION 5

Identify the following microorganisms: (i) I live in every kind of environment, and inside your gut. (ii) I make bread and cakes soft and fluffy. (iii) I live in the roots of pulse crops and provide nutrients for their growth.

ANSWER

The microorganisms are bacteria, yeast and *Rhizobium*.

Clue	Microorganism	Reason
(i)	Bacteria	They live in all kinds of environments, and bacteria in the intestine help in digestion
(ii)	Yeast (a fungus)	It releases carbon dioxide, which makes dough soft and fluffy
(iii)	*Rhizobium* (a bacterium)	It lives in root nodules of legumes and traps nitrogen for the plant

Therefore, (i) bacteria, (ii) yeast and (iii) *Rhizobium*.

QUESTION 6

Design an experiment to test that microorganisms need optimal temperature, air, and moisture for their growth.

ANSWER

Use slices of bread, which grow visible mould, and change one condition at a time while keeping the others the same.

NCERT ARCHIVE

a Set-up

Set	Condition tested	How to set it up
1	Control (all conditions favourable)	Slightly moist bread in an open plate in a warm place
2	Temperature	Same slightly moist bread kept in a refrigerator
3	Moisture	Dry bread kept in a warm place (with air)
4	Air	Moist bread sealed tightly in a container or bag, with as little air as possible, kept in a warm place

b Procedure and expected result

- Use slices of the same kind of bread, label each set, and observe daily for about 3 to 5 days, noting the powdery or cotton-like growth.
- Expected: growth is greatest in set 1; sets 2, 3 and 4 show little or no growth, showing that microorganisms need optimal temperature, moisture and air.
- Keep the sealed bag closed when observing, and do not smell or touch mouldy bread.

Therefore, changing one condition at a time shows that growth needs warmth, moisture and air.

QUESTION 7

Take 2 slices of bread. Place one slice in a plate near the sink. Place the other slice in the refrigerator. Compare after three days. Note your observations. Give reasons for your observations.

ANSWER

The slice near the sink develops a powdery or cotton-like growth of microorganisms; the slice in the refrigerator shows little or no growth.

NCERT ARCHIVE

Slice	Observation after three days	Reason
Near the sink	Mould (powdery or cotton-like growth) appears	Warm, moist place with air is suitable for microorganisms such as moulds, which come from the air and grow on the bread
In the refrigerator	Little or no growth	The cold temperature does not suit growth of microorganisms

Therefore, microorganisms grow well in warm, moist places and poorly in the cold.

QUESTION 8

A student observes that when curd is left out for a day, it becomes more sour. What can be two possible explanations for this observation?

ANSWER

The bacteria in curd continue to grow and produce more lactic acid when curd is left out in a warm place.

1. *Lactobacillus* in the curd keeps feeding on the sugar (lactose) and multiplies in the warm surroundings, and produces more **lactic acid**, which makes the curd sour.
2. Because bacteria grow well in warm conditions, the longer the curd stays out, the more bacteria and the more lactic acid there are. Other microorganisms from the surroundings may also get in and grow in it.

Therefore, curd turns more sour because bacteria go on making lactic acid in warm conditions.

NCERT ARCHIVE

QUESTION 9

Observe the set-up given in Fig. 2.15 and answer the following questions. (i) What happens to the sugar solution in flask A? (ii) What do you observe in test tube B after four hours? Why do you think this happened? (iii) What would happen if yeast was not added in flask A?

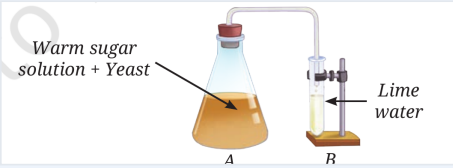


Fig. 2.15: Experimental set-up

ANSWER

In flask A the yeast ferments the warm sugar solution and releases carbon dioxide, which passes into the lime water in test tube B.

Part	Answer
(i)	The yeast breaks down the sugar in the warm solution to release energy, and gives out carbon dioxide gas (and a small amount of alcohol).
(ii)	The lime water in test tube B turns milky (cloudy). The carbon dioxide produced in flask A travels through the tube into the lime water, and carbon dioxide turns lime water milky.
(iii)	If no yeast is added, no gas is produced, so the lime water in B remains clear.

Therefore, yeast produces carbon dioxide that turns lime water milky; without yeast nothing happens.

NCERT ARCHIVE

2.3

CLASS 8 SCIENCE · CHAPTER 2

Discover, design, and debate

Solutions · 4 questions

Directions (Questions 1–4): These are the projects of Discover, design, and debate at the end of the chapter (page 27). Each is a project or survey, so a plan and model answers are given; add your own work and findings.

QUESTION 1 *Discover, design, and debate · p. 27*

India has a long history of biogas production. One of our oldest biogas plant was set up in late 1850s. Find out about the Biogas Program initiated by the Ministry of New and Renewable Energy, Government of India.

ANSWER

This is a project. A summary of the programme is given; check the Ministry's website for the latest details.

a Biogas Programme of MNRE

- The Ministry of New and Renewable Energy (MNRE) runs a biogas programme under its National Bioenergy Programme. Its main scheme is the **New National Biogas and Organic Manure Programme (NNBOMP)**.
- It aims to provide **clean cooking fuel** for kitchens, and fuel for lighting and other small energy needs of households, farmers and dairy farmers in rural and semi-urban areas, using small biogas plants of 1 to 25 cubic metre capacity.
- It also aims to improve the organic manure system through the **slurry** left from biogas plants, a manure that helps reduce the use of chemical fertilisers.

NCERT ARCHIVE

b Link with the chapter

Biogas is made when bacteria decompose plant and animal waste in an oxygen-free environment. It is a mixture of gases, mainly carbon dioxide and a high proportion of methane, used as fuel for cooking, heating, generating electricity and even running vehicles.

Therefore, the programme uses microorganisms to turn waste into clean fuel and manure.

QUESTION 2 *Discover, design, and debate · p. 27*

Fermented food items like fermented soya bean and fermented bamboo shoots are consumed as traditional food in some parts of India. With the help of your parents and teachers, list some traditional food items from your area that utilise the process of fermentation. Investigate the ingredients, the method of preparing them, the microorganism responsible, and the cultural and nutritional importance of the fermented food.

ANSWER

This is a survey project. Examples are given; fill in the foods of your own area in the same format.

Food	Main ingredient	Microorganism responsible
Curd	Milk	*Lactobacillus* (bacteria)
Idli and dosa batter	Rice and pulses (batter)	Bacteria such as *Lactobacillus* help in fermentation of the batter
Bhatura	Flour dough	Fermenting microorganisms in the dough
Kinema or hawaijar (north-east India)	Soya bean	Bacteria (mainly *Bacillus*)
Fermented bamboo shoot (e.g. soibum)	Bamboo shoots	Lactic acid bacteria

NCERT ARCHIVE

a What to record for each food

- Ingredients used and the method of preparation (including warm place, time of fermentation).
- The microorganism responsible and the change it brings about (for example gas formation or lactic acid).
- Cultural importance (festival or traditional use) and nutritional importance, as told by your parents and teachers.

Therefore, many traditional foods depend on fermentation by useful microorganisms.

QUESTION 3 *Discover, design, and debate · p. 27*

Study the different parts of a macro fungus mushroom using a magnifying glass and microscope. Take the help of students from senior classes and explore the internal structure of different parts of mushrooms under the microscope in your school laboratory.

ANSWER

This is a practical project. A plan and the parts to observe are given.

Part	With a magnifying glass	Under the microscope
Cap	Shape, colour and surface; the underside	Thin section of the cap to see the cells
Gills (under the cap)	Thin plate-like folds	Structure of the gills and tiny reproductive cells (spores), if present
Stalk	Length, thickness and texture	Thin section showing thread-like filaments
Base or threads in the soil	Fine white thread-like parts	Branched filaments

NCERT ARCHIVE

- Take the help of a senior student or teacher to cut thin sections and prepare slides (stain and coverslip as in Activity 2.2).
- Remember that fungi have cells with a cell wall but no chloroplasts, so they cannot make their own food by photosynthesis.
- Never eat wild mushrooms; some are poisonous.

Therefore, the mushroom can be studied from the outside with a magnifying glass and from inside with a microscope.

QUESTION 4 *Discover, design, and debate · p. 27*

Interact with an entrepreneur and learn the steps for cultivation of mushroom.

ANSWER

This is an interview project. Prepare questions beforehand and write down what the entrepreneur tells you.

a Questions to ask

- Which mushroom is grown, and what material (substrate) and starting material (spawn) are used?
- What temperature, moisture and air conditions are kept, and for how many days?
- How is the crop harvested, stored and sold, and what care is needed to keep it clean?
- What are the costs, income and difficulties of the business?

b Usual steps (to be checked with the entrepreneur)

1. Prepare and clean the growing material, such as straw.
2. Mix it with the spawn and keep it in a clean room.
3. Maintain suitable temperature, moisture and air so that the fungus grows.
4. Harvest the mushrooms when they are ready and keep the room clean to avoid unwanted microorganisms.

Therefore, mushroom cultivation needs the right temperature, moisture, air and cleanliness, and can be a source of livelihood.

NCERT ARCHIVE