

Textbook of
SCIENCE
Grade

6



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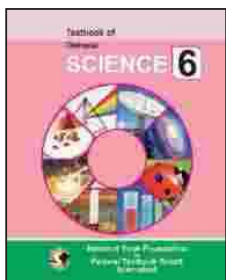
OUR MOTTO

○ Standards ○ Outcomes ○ Access ○ Style

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Textbook of General Science Grade - 6



Advisor

Muhammad Rafique Tahir
(Joint Educational Advisor)

Ministry of Federal Education & Professional Training.

Review Committee Members :

1. Ms. Riffat Zaiba
2. Ms. Sumaira Anwar
3. Ms. Samra Latif
4. Mr. Anwar Iqbal Saifi

Authors :

1. Ms. Ruqayya Shaikh
2. Ms. Fouzia Nawaz
3. Mr. Amirullah
4. Ms. Rubina Kausar

Designing/Composing :

M/S Mahmood Brothers, Rawalpindi

Desk Officer, NCC :

Ms. Zehra Habib, Assistant Education Advisor

Management :

Ishtiaq Ahmad Malik, Secretary NBF

Incharge Textbooks :

Muhammad Rafique, Assistant Director, NBF

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Preface

Rapid developments in science and technology have revolutionized our lives. Advancement in the field of science have led to many benefits manifested in increased yields of crops for human consumption, genetically modified animals, faster means of communication and transportation and more life saving drugs, to name a few. These developments have been coupled with leaps in technological advancements, which have brought communication and information to the palms of a vast majority of the population through smart phones and many other portable devices. Within this age of technological sophistication it is imperative to have learners develop understanding and conceptual clarity in science to provide a strong foundation for future learning in this field. Such an outlook is particularly important for developing nations to bringing their population at par with the trends in the global community.

This textbook of General Science Grade 6 has been developed according to the Revised Curriculum 2017, in the light of standards for quality textbooks. It has been developed with the aim of providing a strong foundational basis of general science concepts upon which subsequent learning of the students will be built. Offering an improved design with attractive graphics, comprehensive content and interactive elements, this textbook aims to make learning for students of grade VI an interesting and rewarding activity. The material has been developed with a keen eye to establishing real life links for the learners so that their education process enriches them through better conceptual understanding and the ability to apply their learning. The increased emphasis on activities and project work is for steering children away from rote memorization to developing critical thinking and analytical skills.

This textbook has been aligned with TIMSS (Trends in International Mathematics and Science Study) and review exercises have been added to practice its methodology. Constructed Response Questions (CRQs) are included in each chapter exercise. These questions are internally used to assess student's reasoning, analyzing and problem solving skills.

The National Book Foundation is always striving for improvement in the quality of its books. The present book features an improved design, better illustration and interesting activities relating to real life to make it attractive for young learners. However, there is always room for improvement and the suggestions and feedback of students, teachers and the community are most welcome for further enriching the subsequent editions of this book.

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

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Contents

Units	Title	Page No.
1	Basic Science Skills	5
2	Cells, Tissues and Organs	19
3	Senses and Sense Organs	36
4	Life Cycle	49
5	Elements and Compounds	58
6	Matter as Particles	71
7	Mixture and Solution	79
8	Energy	93
9	Light and Colour	105
10	Solar System	119
11	Glossary	132

01

BASIC SCIENCE SKILLS



Learning Outcomes

- Recognize that science is a study of the nature.
- Understand that scientific knowledge is subject to change as new evidence become available.
- Use appropriate instruments for measuring temperature, time, volume, mass and length.
- Identify and label the parts of a simple microscope.
- Identify some common laboratory hazard warning symbols.
- Understand and observe the laboratory safety rules.

How can we observe tiny organisms like amoeba?

Why is it important to measure things?

What kind of measurement do you need to make when you bake a cake?



Key Concept

Basic Science skills help us to understand our surroundings in a better way. Observation and measurement are basic scientific skills that are important for everyone to make sense of their daily activities.

Science is all about asking questions, testing ideas and trying to explore the world around us. This involves trial and error i.e. trying, failing and trying again. It does not provide all the answers but scientists continue to research and discover the secrets of the world around us. With time the tools and machines for scientific discovery have



improved and become more precise. For example the forecasting of weather has become more sophisticated because of the scientific tools like radars and computers which result in more accurate forecasting.

In science, you study about Life, Earth Space and Energy and so much more. Science

always begins with the natural world that you observe and wonder about. Scientific skills like observation, prediction and measurement help us to investigate our surroundings and make scientific conclusions.

Science is defined as a process of knowing the world around us using observation, prediction and measurement.

Do you know?



- Prediction is making a forecast of what a future observation may be. It is based on what you already know.
- Observation is an active information gathering using our five senses. It involves recording data using scientific instruments.

- a way of doing daily life activities
- observing and recording
- asking questions
- putting idea to test i.e. experiment
- collection of evidences
- drawing conclusions



Scientists are constantly making observations and then drawing conclusions based on their observations. Due to which scientific knowledge is durable and robust, but open to change. For example, scientists used to believe that dinosaurs were most closely related to reptiles, but they now believe they are more closely related to birds.

What process helped scientists to change their views?



Have you ever bought milk from the milkman? How does he measure the quantity of milk? Do you know that petrol is measured in liters? Can you think of any other way to measure the quantity of liquid? Measurement is one of the most fundamental concepts in science. It helps us in making correct calculations. Without measurement, scientists cannot conduct experiments. It has importance in farming, engineering, construction, manufacturing, commerce, and numerous other occupations and activities. Why do we need to be able to measure things?

Hands on Activity



The diagram illustrates the process of osmosis through two scenarios, I and II, involving three beakers labeled A, B, and C. Beaker A contains water, and beaker B contains a sugar solution. A curved arrow indicates the movement of water from A to C, where C is a vertical tube containing sugar solution. In scenario I, the water level in C is lower than in B. In scenario II, the water level in C is higher than in B, indicating that water has moved from B to C.

Is the level of water same in both containers (A and C)?

Why does one of the containers have more height of water than the other?

Measurements are made up of a number and a unit. For example, your height might be 190 centimetres. Centimetres is the unit used for measuring length. Without the units, the number has no meaning.

Let us discuss five physical quantities along with their instruments and common units for measurement.

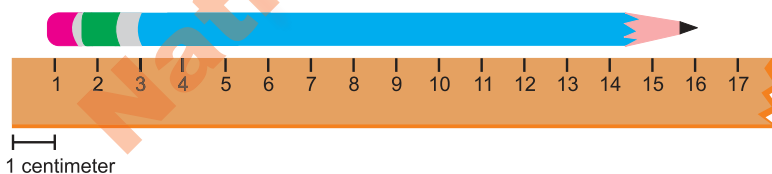
Science Tidbits



- A description in words, such as the colour of a toy or the smell of a rotten food item is known as qualitative measurement.
- A description in numbers, such as 190 cm height is known as quantitative measurement.

Quantity	Instrument	Common Units	
Length	Metre ruler or Measuring tape	millimeter (mm) centimetre (cm) metre (m) [SI unit] kilometer (km)	
Mass	Balance	gram (gm) kilogram (kg) [SI unit]	
Time	Watch or Clock	second (s) [SI unit] minutes (min) hours (h)	
Temperature	Thermometer	degree Celsius ($^{\circ}\text{C}$) degree Fahrenheit ($^{\circ}\text{F}$)	
Volume (liquids)	Measuring Cylinder	milliliters (ml) liters (l) [SI unit]	

Common Measuring Instruments and their scale



Measurement of length

Scale: 1 m = 100 cm
1 m = 1000 mm
1 km = 1000 m

How does a carpenter measure the length of wood?



Do you know?



Metric units are sometimes called SI units. SI stands for System International because these units are used around the world.

What is the other kind of clock you have seen on a computer or a mobile?



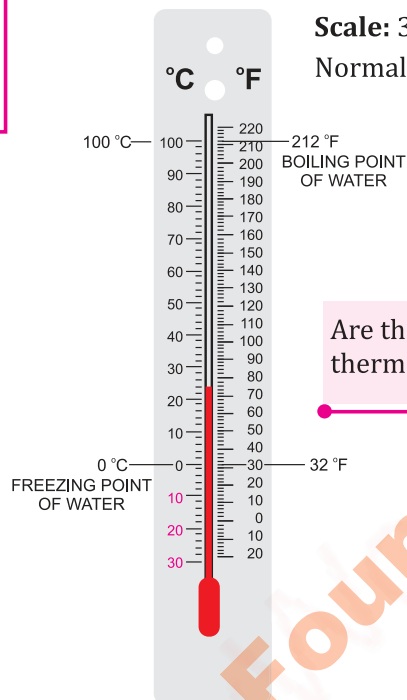
Measurement of Time

Scale: 1 hr = 60 min

1 min = 60 s

Measurement of Temperature

Scale: $37^{\circ}\text{C} = 98.6^{\circ}\text{F}$,
Normal human body temperature



Are there different types of thermometers used by Scientists?

Have you observed a fruit seller measuring the vegetables or fruits in the market?



Measurement of Mass

Scale: 1 kg = 1000 gm

What instrument does a milkman use to measure milk?



Measurement of Volume

Scale: 1 l = 1000 ml

Microscope

Microscope is an instrument designed to produce magnified images of objects which are not visible to the naked eye.

Familiarize yourself with its main parts and their functions of the microscope.

Do you know?



Anthony Van Leeuwenhoek (1632-1723), was a Dutch draper and scientist who invented a simple microscope, which had a single lens and was hand-held.



Fig. 1.1: A Microscope

Hands on Activity



Observe any prepared slide e.g. amoeba under the microscope in your laboratory.

Common Laboratory apparatus

In the science laboratory, you will find different apparatus. Some of them are given below:



Beaker is a cylindrical glass or plastic vessel used for holding chemicals or liquids.

Conical flask is used for mixing, heating, and stirring liquids.



Tripod stand is used to support and hold various flasks, beakers and other glassware during experiments.

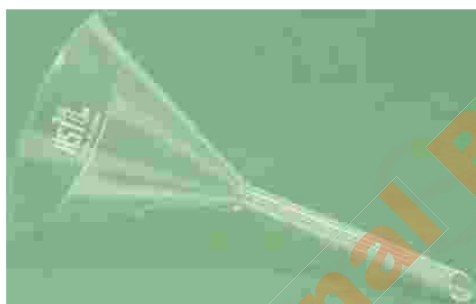
Wire gauze is used to protect glassware from the flame of Bunsen burner during heating.





Test tube is a relatively slim glass vessel with a rounded bottom. It is used to hold small quantities of chemicals for heating it.

Bunsen burner provides adjustable heat for experiments.



Funnel is used to pour liquids or grainy substances into containers of small openings.

China dish is also known as an evaporating dish and is used to evaporate a liquid from a solution.



Hands on Activity



What apparatus did you observe in your school science lab? Match your observations with the apparatus mentioned above.

Common Laboratory Hazards & their Symbols

The best part of science is the doing of experiments in the laboratory. To get most out of your experiments staying safe is very important. You must get familiar with safety symbols so you can avoid laboratory hazards.



Corrosive

attacks and destroys living tissues, such as skin and eyes

Poisonous

can cause death if swallowed, breathed in or absorbed by skin



Flammable

catches fire easily

Laboratory Safety Rules

Laboratory is a place of doing experiments. Safety should always be our priority. Whenever we visit a science lab, the following precautions need to be followed.

1. Never touch any apparatus in the laboratory unless you are told to use it.
2. Do not eat or drink in the laboratory.
3. Always walk; never run.



4. Wear a laboratory coat and safety glasses whenever required.
5. Never taste or inhale anything such as chemicals, gases and fumes etc.
6. Keep all of your belongings such as books, paper and clothing etc. away from flames and chemicals.
7. Report all accidents and breakages to your teacher.
8. Clean all the apparatus after it is used and put it back in its place. Clean and dry your workbench.

Hands on Activity



Design a poster to illustrate laboratory rules which you followed in the science laboratory. Display your poster in the class and discuss your ideas.



Key points

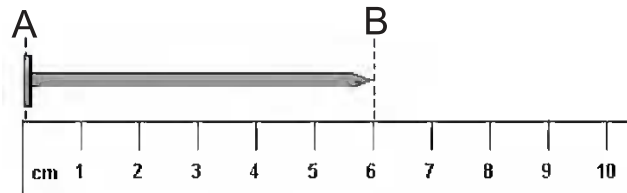
- Science is all about asking questions.
- Scientists build on the work of others to add to better understanding
- Measurements are quantitative observations, and they are made up of a number and a unit.
- Microscope helps us to view small objects, which cannot be seen with a naked eye.
- To avoid laboratory hazards we need to become familiar with their symbols before going to a laboratory



Exercise

A Choose the correct option.

1. Which unit would you use to measure the quantity of medicine in a tea-spoon?
(a) meter (b) milliliter (c) liter (d) gram
2. What is the length of the nail between the point A and B?



- (a) 3 cm (b) 5 cm (c) 4 cm (d) 6 cm
2. Safety glasses are worn during science experiments
(a) to improve vision
(b) protect your eyes from chemicals, heat or sediments
(c) to avoid eye strain
(d) only if you do not have glasses
 3. Apparatus commonly used to measure volume of liquid is
(a) measuring cylinder (b) measuring tape
(c) thermometer (d) measuring ruler
 4. Amount of 1 litre contains
(a) 100 ml (b) 1000 ml (c) 10 ml (d) 1 ml
 5. 2000 grams are equal to
(a) 1 kg (b) 2 kg
(c) 3 kg (d) 4 kg
 6. The objective lense is the one
(a) closest to the eye (b) closest to the specimen
(c) at the base of the microscope (d) at the base of the stage
 7. 37°C is equal to:
(a) 99.6°F (b) 98.6°F (c) 97.6°F (d) 96.8°F
 8. The two knobs used for focusing the image include fine adjustment knob and?
(a) course adjustment knob (b) stage
(c) objective lens (d) eyepiece lens

9. Razia went to watch her brother in a game. The game started at 11:30am and ended at 1:15pm. How long(in hours and minutes) is the duration of the game?

- (a) 1 hour and 10 minutes (b) 1 hour and 15 minutes
(c) 1 hour and 45 minutes (d) 2 hours and 45 minutes

10. Which of the following is an example of a quantitative observation?

- (a) It has a sweet smell (b) The mass of one leaf is 5 grams
(c) I would like green apples (d) The leaves are waxy and smooth

B True or False (correct the statement if it is False).

1. Celsius is a measure of length.

2. Measurements are quantitative and qualitative.

3. Laboratory work can be started immediately upon entering the laboratory even if the teacher is not yet present.

4. Science can give answer to our questions, which will not change.

5. Study and practice of science is impossible without process skills

C Answer the following questions briefly.

1. Differentiate between quantitative and qualitative observations. Give one reason for your response.

- (a) The gas has an odour like rotten eggs.
(b) This soft drink can contains 500 ml.
(c) The ant has six legs.
(d) This rock contains large pink crystals.
(e) The magnet does not attract the nails.
(f) The maximum temperature is 38 °C.
(g) The water froze overnight.
(h) The bubbles lasted about 10 seconds.

2. What unit does each of these symbols represent?

mm km ml kg cm

3. Why is wearing a lab coat important in the science laboratory?

4. What is the use of a microscope?
5. What will be your safety plan for measuring the boiling point of water in a laboratory?

E Answer the following questions in detail.

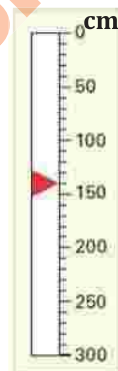
1. Why is it important to use measuring instrument? Can we make accurate observations without using any instrument? Give reason for your response.
2. What are five physical quantities discussed in this chapter and their SI units?

Constructed Response Question

1. How to read a scale given in cm?

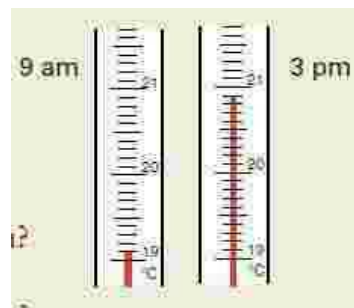
Observe the scale and answer the questions that follow (as shown in the figure)

- (a) Decide which way the scale reads — up, down, or left to right.
- (b) What one division on the scale stands for?
- (c) Find the closest numbered division before the pointer (as shown in the figure)



2. Ali measured the temperature at 9 am and at 3 pm, as shown in the figure.

- (a) What was the temperature at 9 am?
- (b) What was the temperature at 3 pm?
- (c) What was the difference in temperature between 9 am and 3 pm?
- (d) What was the average of the two temperatures?



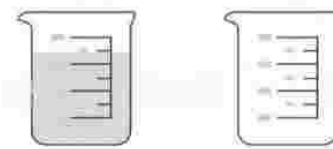
3. Rozina found the mass of a beaker of water. She then tipped out the water and found the mass of the empty dry beaker.

Here are her results:

Full beaker = 418 g

Empty beaker = 112 g

- (a) What was the mass of water in the beaker?
- (b) What would the total mass be if Rozina added 100 ml of water to the empty beaker?



Hint: 1 ml of water has a mass of 1 g.

4. Convert the following from one unit to another.

Solve the Riddles

S.No.	Riddle	Laboratory Apparatus
1	I am a glass container for small amounts of material. What am I?	
2	I am placed on top of a tripod stand to spread the heat. What am I?	
3	I am used for picking up small amounts of solids. What am I?	
4	I am a glass container with a pouring lip. What am I?	
5	I am made up of porcelain glass and is used for evaporate excess water from the solution. What am I?	



Project

Calculate body mass index (BMI)

Objective

To investigate the health of students of a class based on the Body Mass Index (BMI).

Description

Measure the height of 5 students in your class.

Measure their weight in kg.

Establish the relationship between height and weight for 5 students.

Record your observation and calculate BMI.

S. No.	Student name	Height in meter (m)	Weight in kilogram (kg)	BMI
1				
2				
3				
4				
5				

Calculate the BMI the mass (kg) of the person is divided by the square of his height (m)

$$\text{BMI} = \frac{\text{mass (kg)}}{\text{height} \times \text{height (m}^2\text{)}}$$

A person with a BMI of 25 or above is considered obese. Find out your BMI. Are you obese?

Conclusion

How many of the students are obese and how many are not obese?

Further Inquiry

Find out the reasons of obesity. Can it be prevented? How?

Science Tidbits



The Body Mass Index (BMI) is used to determine if a person is obese, under weight or normal.

02

CELLS, TISSUES AND ORGANS



Learning Outcomes

- Recognize a cell as the basic unit of living things.
- Identify major cell structures.
- State the function of a cell wall, cell membrane, nucleus, chloroplast, vacuole and mitochondria
- Recognize that cell wall, vacuole and chloroplast differentiate plant cells from animal cells
- Describe plant and animal tissues and organs
- Explain that tissue, organs and organ systems are formed from group of cells with specialized functions
- Identify the structure and function of major human organs (lungs, stomach, liver, brain, kidneys, heart)

Do all living things have cells?

How many cells are present in unicellular organism?

What is the smallest living part of any living organism?



Key Concept

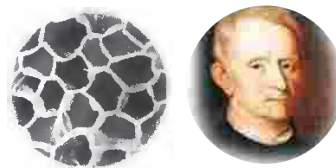
Plants and animals, including humans are made of specialized cells, tissues and organs that are organized into systems.

CELL

Do you know that your body is made up of trillions of tiny living units? In every given minute many of these units are formed, some die and many continue to do their jobs. Do you know what they are called?

Cells are the building blocks of our bodies. All living things are made of these tiny living units, called cells. A cell is so small in size that you cannot look at it with a naked eye.

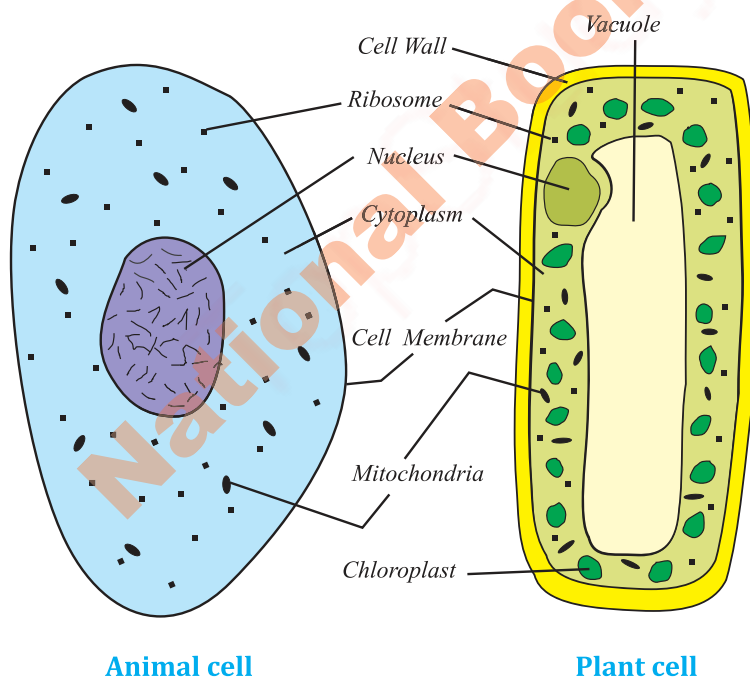
Organisms like bacteria and amoeba are unicellular. Most animals and plants are made up of many cells and are, therefore, called multicellular organisms.



Cells were discovered after the invention of microscope. The cell was first discovered and named by Robert Hooke in 1665. He observed a thin slice of a cork plant under a microscope and noticed small boxes surrounded by walls, which he named as cells.

Cell Structure

All living things are made up of basic units i.e. cells. Here we will learn about the cells present in animals and plants. If we look at an animal and a plant cell under a microscope, we can see similarities and differences between them.



Animal cell

Plant cell

Figure 2.1: An Animal and a Plant cell

Do you know?



All living things share seven life processes:

- They need food to get energy
- They need oxygen for respiration
- They grow and change with time
- They produce wastes and remove them by excretion
- They can move
- They are sensitive to changes in their surroundings and they respond to these changes
- They reproduce for the continuity of life

Similarities between an Animal and a Plant Cell

Many parts of the cell are the same in both animals and plants. Both have a cell membrane, cytoplasm and a nucleus. (as shown in figure 2.1)

Cell membrane is a thin, protective layer around a cell. It holds all parts of the cell together. It is the boundary with gates to control what moves in and out of the cell.

Nucleus acts as the control center of the cell. It contains all information of the cell in its thread like structures called chromosomes.

Cytoplasm is a watery gel which fills the space between the cell membrane and the nucleus. All essential functions of the cell are performed in the cytoplasm. Cytoplasm contains many small structures called organelles.

Cell organelles perform different jobs for the cell. There are many types of organelles in a cell. Some are common in both animal and plant cells. For example mitochondria (singular: mitochondrion) and ribosomes. Mitochondria break down the food to release energy and are therefore called the power house of the cell. Ribosomes are very small organelles which are the factories of protein.

Differences between an Animal and Plant Cell

A plant cell has some unique features including:

Cell wall is present outside the cell membrane of a plant cell. It is a hard and dead layer made up of cellulose. Cellulose is a large molecule which we cannot digest. It is a natural fiber found in plants. When we eat plants, the fiber acts like a broom to clean our intestines. Cell wall gives the plant cell a fixed shape.

Chloroplast is a special organelle for photosynthesis, found in the green parts of a plant. It contains a green pigment called chlorophyll. Chloroplast uses sunlight energy, carbon dioxide and water to make food and oxygen.



Do you know?

- ★ Your body has about 75 trillion cells.
- ★ Some of your nerve cells can live throughout your life.
- ★ Some white blood cells and intestine cells live only for 3 days.
- ★ Ostrich egg is the largest cell in the world.
- ★ It would take about 200 of your cells to fit on a full stop.



Point to ponder

What would happen if a cell membrane is damaged?

Vacuole stores different types of substances like water and salts in abundance. Plant cells have a large central vacuole. A fluid filled vacuole provides support from inside to the plant cell. It increases in size during plant growth.

Types of Plant Cells

There are many types of plant cells. Only a few are discussed below:



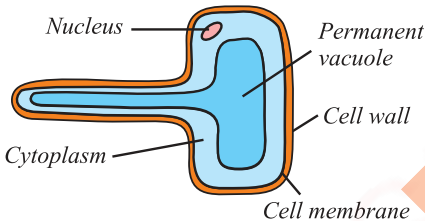
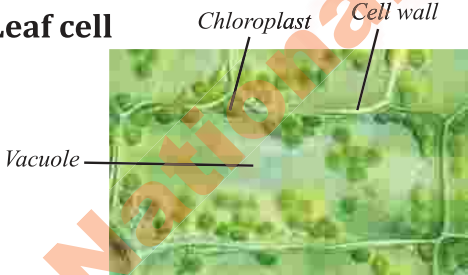
Point to ponder

How is a cell similar to a factory? Think, discuss in pairs and share with your class.

Hands on activity



Make a model of animal or plant cell, using materials of your choice. Label its parts.
(Group work)

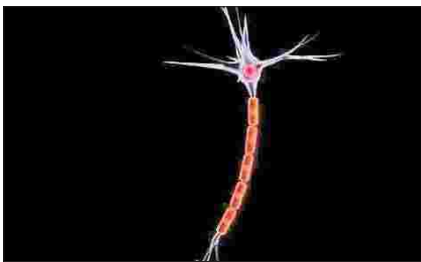
Plant cells	Function	Special features
Root hair cell 	to absorb water and minerals	• long and thin • large surface area for absorption • chloroplast is absent
Leaf cell 	to perform photosynthesis	• large surface area to trap solar energy • large number of chloroplasts

Animal Cell

Animal cell is flexible because there is no cell wall surrounding it. It needs already prepared food as it is without chloroplast. Small vacuoles are dispersed in the cytoplasm.

Types of Animal Cells

There are many types of animal cells. A couple of examples are discussed here.

Animals cells	Function	Special features
Red blood cell 	carries oxygen in the blood to different parts of the body	• large surface area for oxygen to pass through • contains haemoglobin, which combines with oxygen
Nerve cell 	to carry messages around the body	• very long and thin • connections at each end • can carry messages in the form of electrical signals

TISSUE

A group of similar cells performing a specific function is called a tissue.

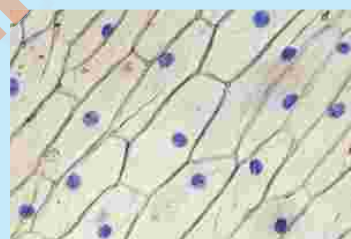
Animal Tissues	Function	Where it is found
Epithelial Tissue	covers, protects and secretes	skin, lining of tubes and organs
Connective Tissue	connects, transports and supports	bone, blood, cartilage, fats, loose connective tissue etc.
Muscular Tissue	moves body parts	heart, muscles
Nervous Tissue	carries messages around the body	brain, spinal cord and nerves

Plant Tissues	Function	Where it is found
Epidermal Tissue	covers and protects	surface of leaves, stem and roots
Photosynthetic Tissue	makes food	green leaves
Supporting Tissue	supports and strengthens	wood of stem and root
Vascular Tissue	moves water and food	vascular bundles

Hands on activity



Prepare a slide of onion epidermal tissue. Carefully cut an onion piece and peel its thin epidermal tissue. Put a piece of this tissue on the glass slide, add a drop of Methylene blue solution to it. Methylene blue is a stain that helps to observe cells. Cover it with a cover slip. Observe under microscope. Draw and label what you see.



ORGAN

Tissues join with other tissues to form an organ. Different tissues of an organ work together to do a special job. For example, stomach is an organ to digest food. Epithelial tissue, muscle tissue, blood tissue and nerve tissue join to form the stomach.

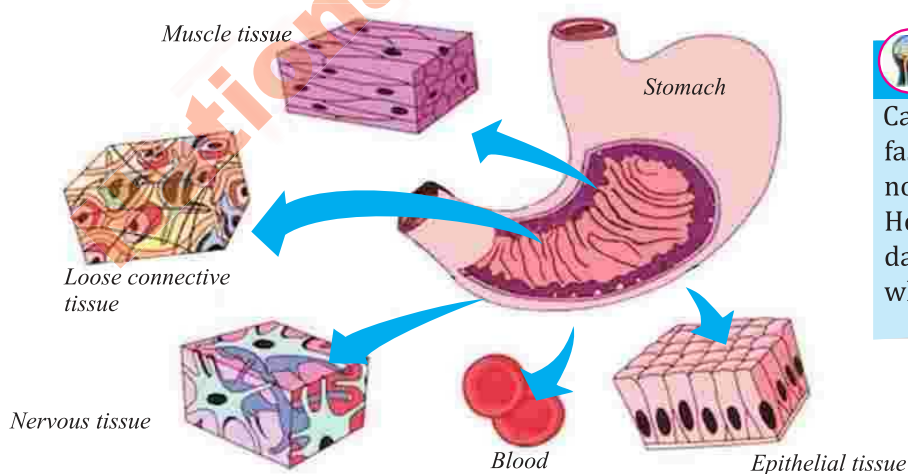


Figure 2.2: Stomach and its tissues



Point to ponder

Cancer cells grow at a fast rate, but they are not a part of any organ. How can cancer cells damage the organ in which they grow?

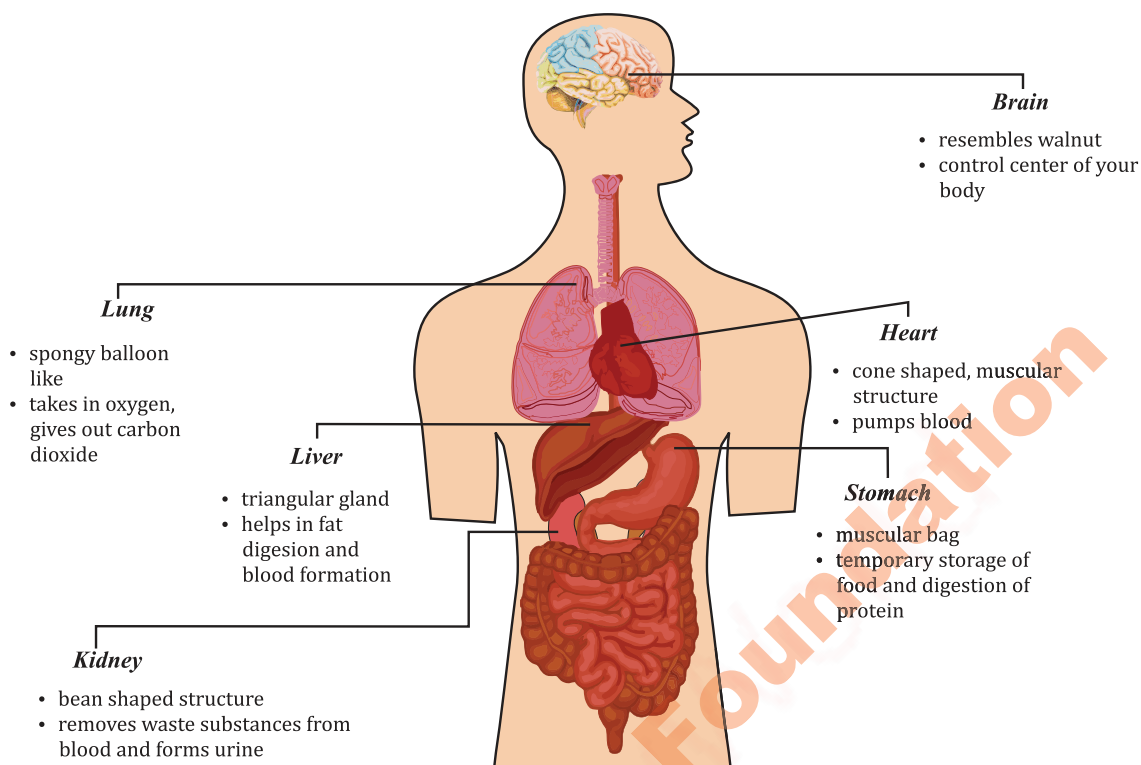


Figure 2.3: Major Human Organs

Similarly, leaf is an organ of the plant that makes food. Epidermal, photosynthetic and vascular tissues join together to form a leaf.

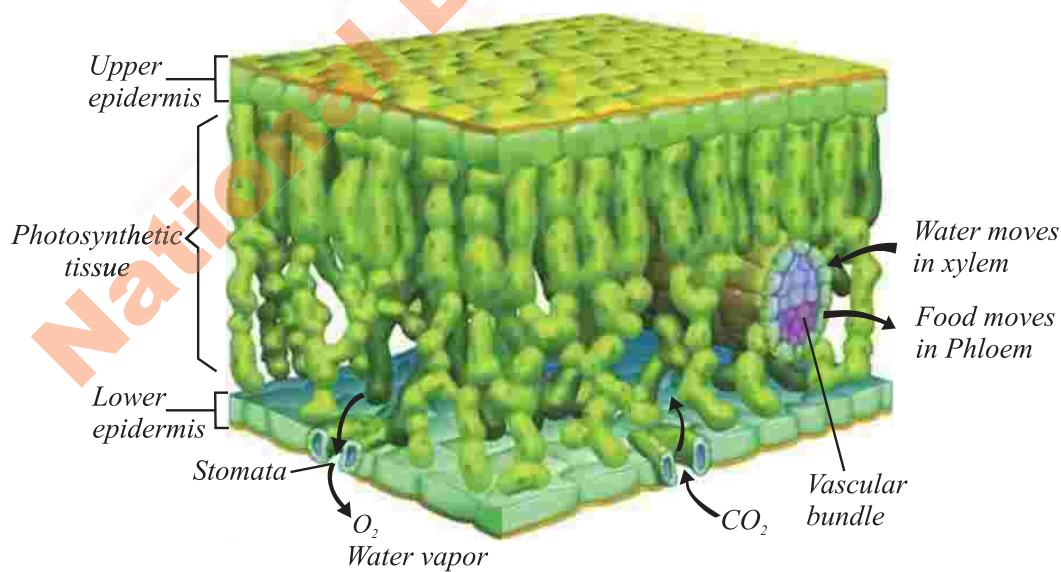


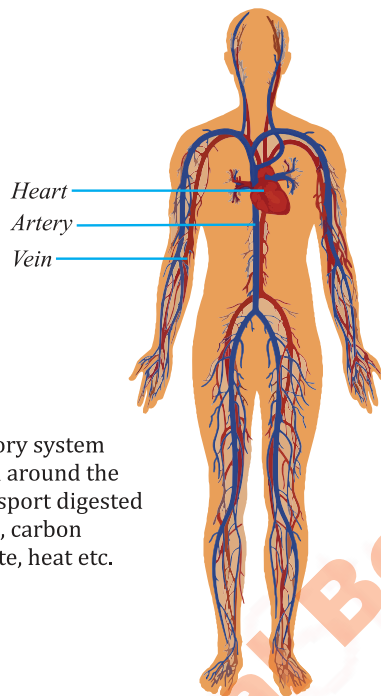
Figure 2.4: Internal Structure of Leaf

ORGAN SYSTEM

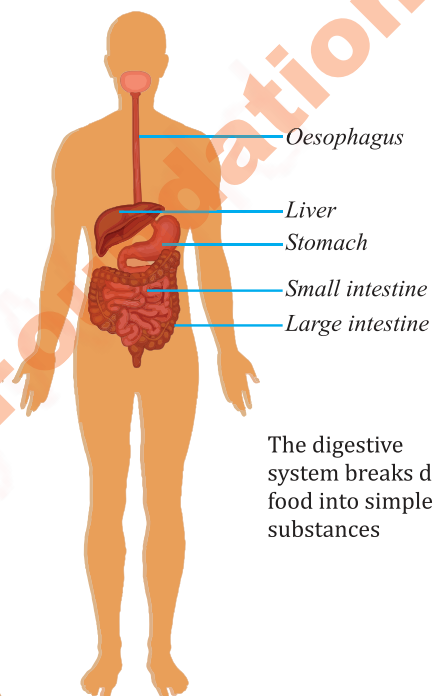
A group of organs work together to carry out a life process. For example, in your body more than 200 bones make up the skeletal system. This system provides support to your body, protects your internal organs and helps you in movement.

Human Organ Systems

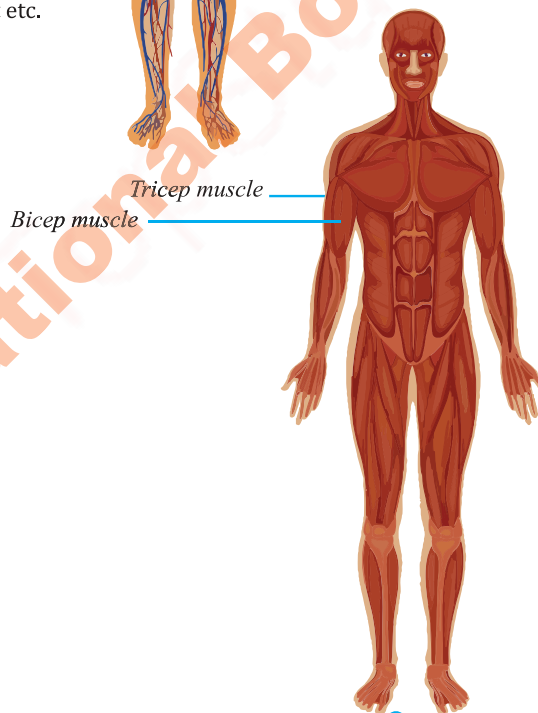
The human body is made up of 11 organ systems including the following systems.



The circulatory system moves blood around the body to transport digested food, oxygen, carbon dioxide, waste, heat etc.



The digestive system breaks down food into simpler substances



The muscular system works with bones to help the body move

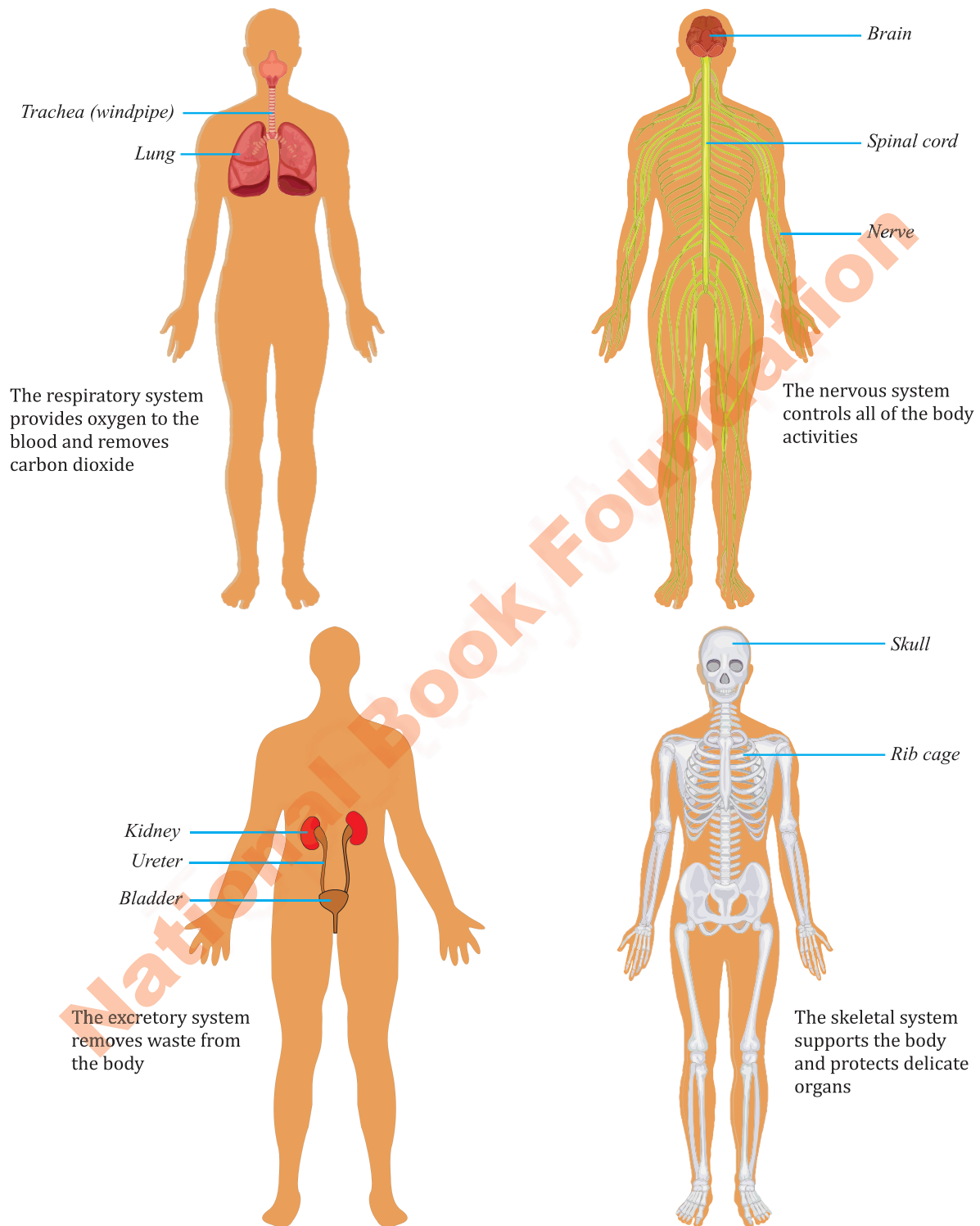


Figure 2.5: Major organ systems

Plant Organ Systems

Plants have only two systems i.e. Root system and shoot system.

Root system anchors the plant, absorbs minerals and water.

Shoot system has stem, leaf, flower and fruits.

The stem supports leaves and transports substances between the root and the shoot.

Leaves are the kitchen of a plant and make food by photosynthesis.

Flower and fruit are responsible for reproduction in plant.

Hands on activity



Make a 3D model of human organ system or plant organ system, using material of your choice. Label its parts. (Group work)

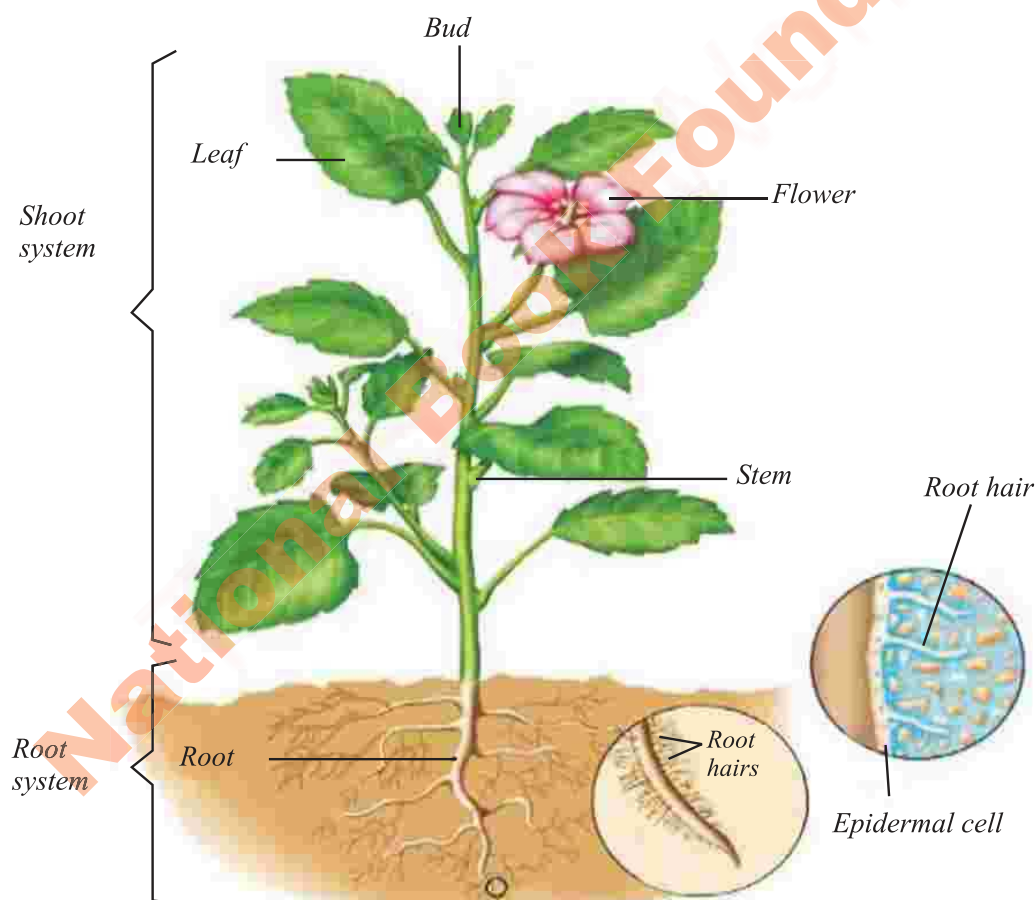


Figure: 2.6: Organ Systems of Plant

ORGANISM

All organ systems work together to make a complex organism. An organism is able to survive on its own.

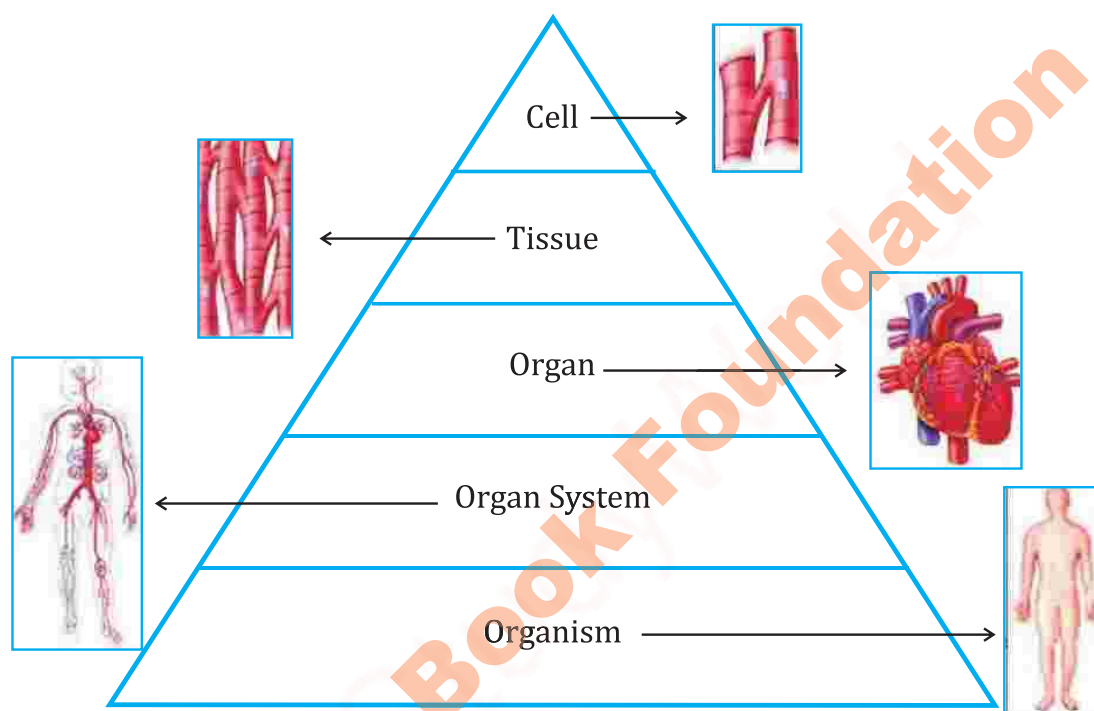


Figure 2.7: Levels of organization



Points to remember

- Cell is the structural and functional unit of living things.
- Some structures are common in a plant and an animal cell e.g. cell membrane, nucleus, cytoplasm, mitochondria and ribosome.
- Some structures are present only in plant cell e.g. cell wall, chloroplast and large central vacuole.
- Cells form tissue, tissues form organs, organ form system and organ systems form an organism.
- All organ systems work in coordination with each other to perform the life processes.



Exercise

A Choose the correct option.

- One of the following is absent in an animal cell.
(a) protein (b) water (c) salts (d) cellulose
- What is the main difference between a plant and an animal cell?
(a) plant cell has a nucleus, it is absent in animal cell
(b) plant cell has a cell wall which is absent in the animal cell
(c) animal cell is larger than the plant cell
(d) plant cell has no chlorophyll
- All plant cells do not contain chloroplast. A plant cell without chloroplast is
(a) red blood cell (b) leaf cell
(c) root hair cell (d) nerve cell
- Which of the following is responsible for carrying the genetic information inside the nucleus?
(a) chromosome (b) cell membrane
(c) ribosome (d) vacuole
- Which one of the following traps sunlight energy for the process of Photosynthesis?
(a) cytoplasm (b) vacuole
(c) cellulose (d) chlorophyll
- What would happen to you if you had no bones?
(a) wastes will increase in your blood
(b) your food will not digest
(c) your blood will have more carbon dioxide
(d) you would be floppy
- One of the following is the correct pathway of organization.
(a) cell → organ system → organ → tissue
(b) tissue → organ → cell → organ system
(c) organ system → cell → organ → tissue
(d) cell → tissue → organ → organ system
- The liver is included in which organ system?
(a) digestive system (b) circulatory system
(c) respiratory system (d) nervous system

9. Which structure controls the function of all others?

- (a) cytoplasm (b) cell membrane (c) nucleus (d) vacuole

10. Layers of flat cells that cover and protect the plant parts are grouped to form

- (a) epidermal tissue (b) photosynthetic tissue
(c) supporting tissue (d) vascular tissue

B True or False (correct the statement if it is False).

1. Leaves prepare food for plants and they are example of plant tissue.

2. Mitochondrion is the power house of energy and provides energy to the cell.

3. Tissues are a group of organisms with shared structure and function.

4. The control unit of a cell is the cell wall.

5. Nervous system provides support and protection.

C Answer the following questions briefly.

1. What would happen to a plant cell if it had no cell wall?

2. How does a cell get water and nutrients?

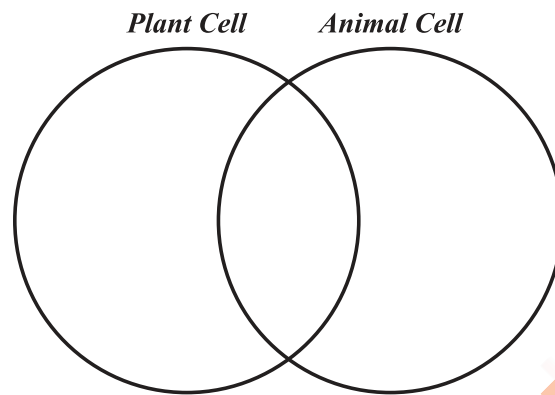
3. Do unicellular organisms have tissues?

4. What does specialization of cells mean?

5. Why do plant cells need both chloroplast and mitochondria?

D Give detailed answer of the following questions.

1. In the Venn diagram below, compare plant cells and animal cells.



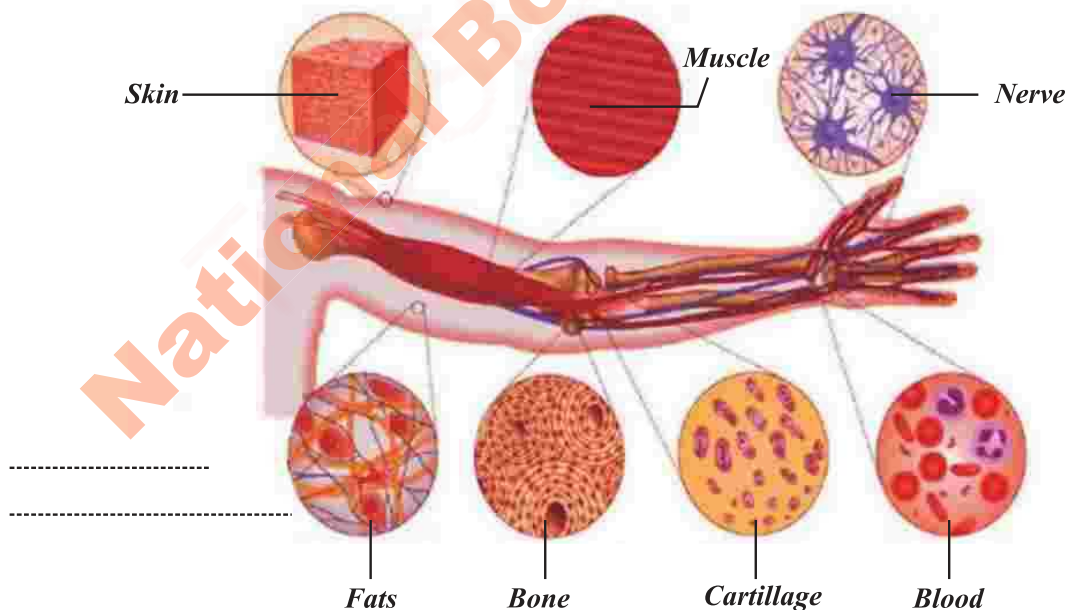
2. What are human organ systems? How are human organ systems important?
3. Different parts of your arm are shown in the diagram. Identify tissues shown in these parts. Write functions of each.

Epithelial tissue

.....

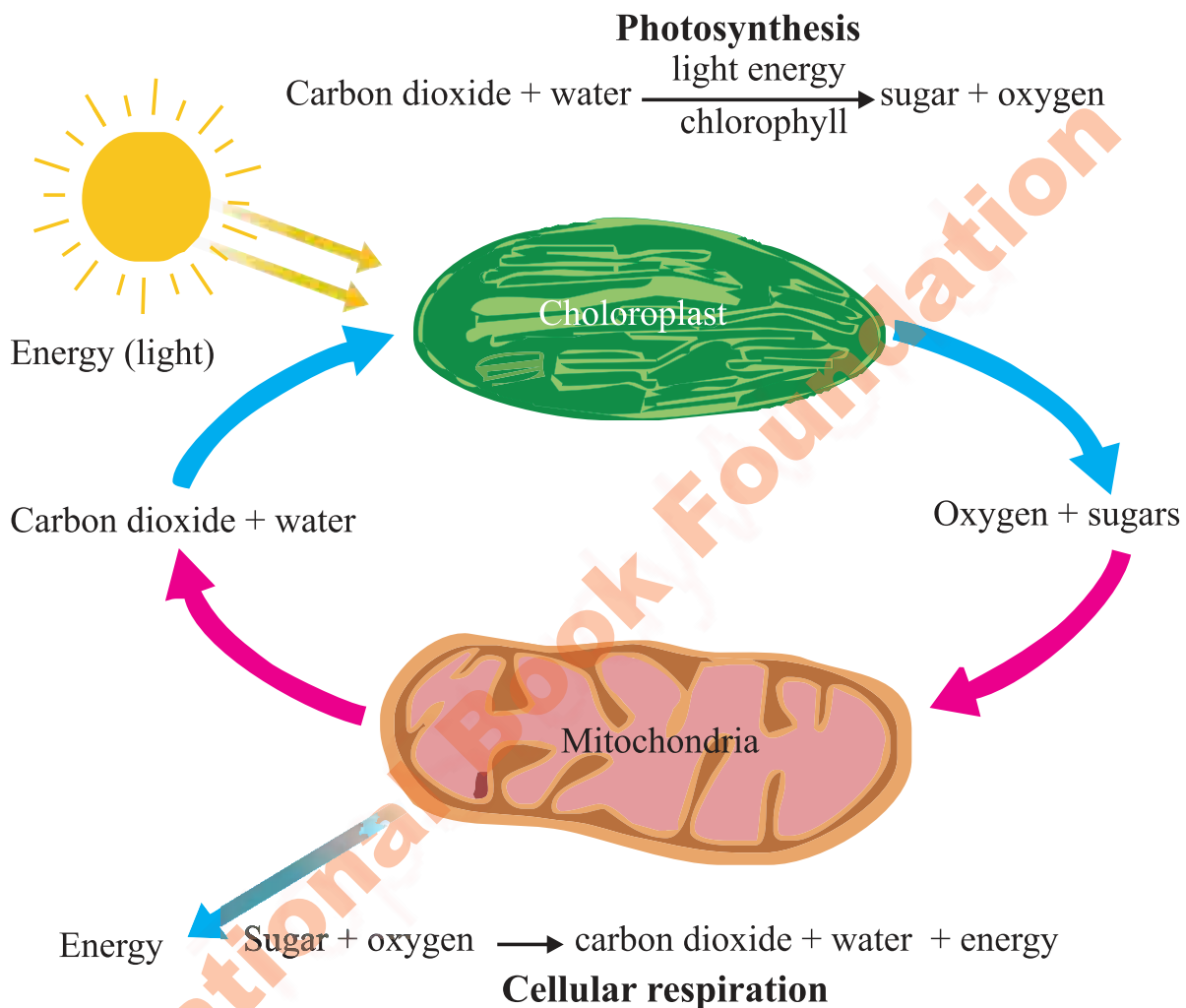
Covers, protects and secretes

.....



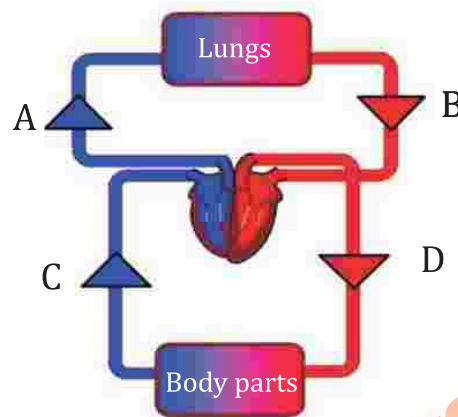
E Constructed Response Questions.

1. The following diagram shows the two processes taking place in the plant cell i.e. photosynthesis and cellular respiration.



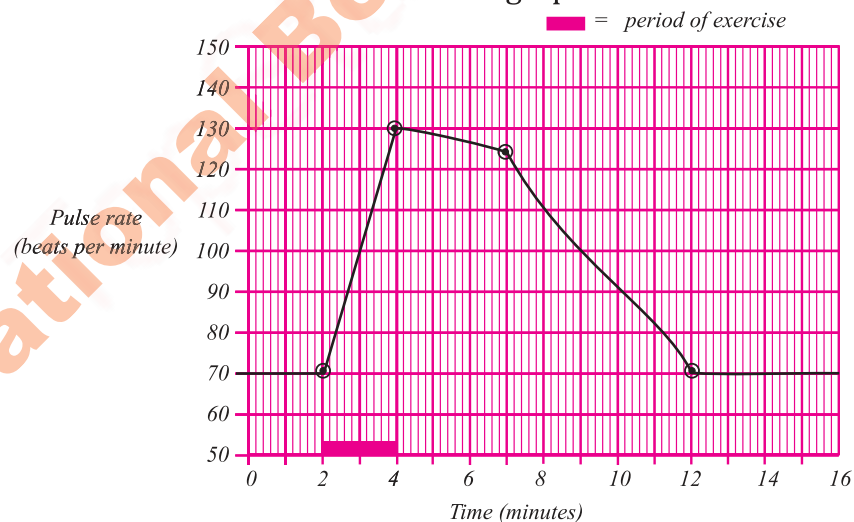
1. Which process takes place only in green parts of the plant?
2. Which process takes place in all living cells, at all times?
3. Which process only takes place during the day time?
4. Which process can help to reduce carbon dioxide level in the air?
5. Which structure acts as a solar panel?

2. The circulatory system works closely with the respiratory system to provide oxygen to all cells of the body. Heart pumps the blood. Lungs add oxygen in the blood as well as remove carbon dioxide from the blood.



Which blood pipes have:

- (a) high level of oxygen
 - (b) high level of carbon dioxide
 - (c) low level of oxygen
3. Anum measures her pulse rate before she exercises. It is 70 beats per minute. She exercises for two minutes and measures her pulse rate again. She then measures it every minute for several minutes. She draws a graph to show her results.



- (a). Why does her pulse rate keep on increasing during exercise?
- (b). After how many minutes does her pulse rate return to normal?
- (c). What can be concluded from her results?



Project

Working model of the lungs

Materials:

- ★ Plastic bottle
- ★ Two balloons (one small, one large)
- ★ Tape
- ★ A pair of scissors

Procedure:

1. Remove the bottom portion of the plastic bottle carefully, with a pair of scissors.
2. Cut the neck of large balloon and fix it on the bottom end of the plastic bottle, with the help of tape.
3. Attach the small balloon on the top of the bottle and push it inside.
4. Pinch the large balloon and pull it downwards.
5. Observe the change in size and shape of the small balloon.

Inquiry Question:

Can this model be related with how the human lungs work?



03

SENSES AND SENSE ORGANS



Learning Outcomes

- Relate our sense organs to different types of senses produced.
- Describe the structure and function of the following sense organs:
 - Eye (sight)
 - Ear (hearing)
 - Tongue (taste)
 - Nose (smell)
 - Skin (temperature, pressure, touch, pain).

How can bats move in dark caves without hitting the rocks?

Are some areas of your skin more sensitive than others?

Why do we have two ears, one on each side of the head?



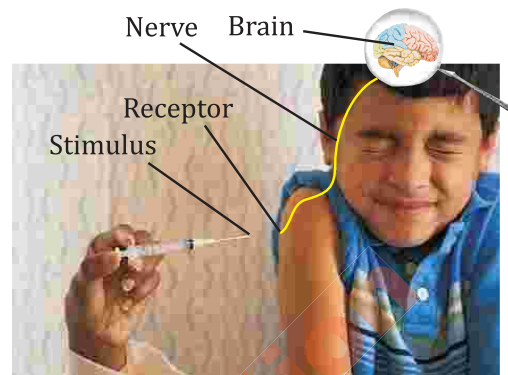
Key Concept

Sense organs are a collection of sensory receptor cells that receive particular stimuli and send messages to the brain.

SENSES

Are you afraid of injections? Are they painful? How does your brain know that you are getting a needle prick?

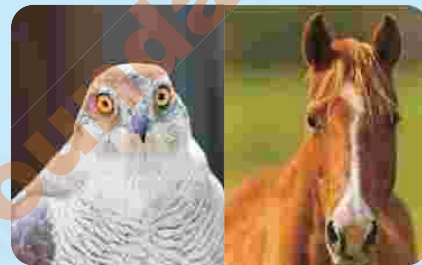
The things you react to are called stimuli. Your senses detect these stimuli with the help of specialized sensory cells. These cells are called receptors which are grouped together to form sense organs.



Do you know?



Like humans, some animals have eyes placed close together that allow for improved depth of perception, others have eyes on opposite sides of their head as in horses, to allow for a greater field of view and early warning against predators.



Sight

Sight is the sense that lets you know the size, shape, colour and motion of an object.

- When light falls on an object, (for example a leaf) the light is reflected and directed to your eyes.
- The light passes through the cornea, pupil and lens.
- The lens sharpens the image and inverts it (turns it upside down).
- An image is formed on the retina.
- The retina sends a message to the brain through the optic nerve.
- The brain erects the image and helps you to identify the object.

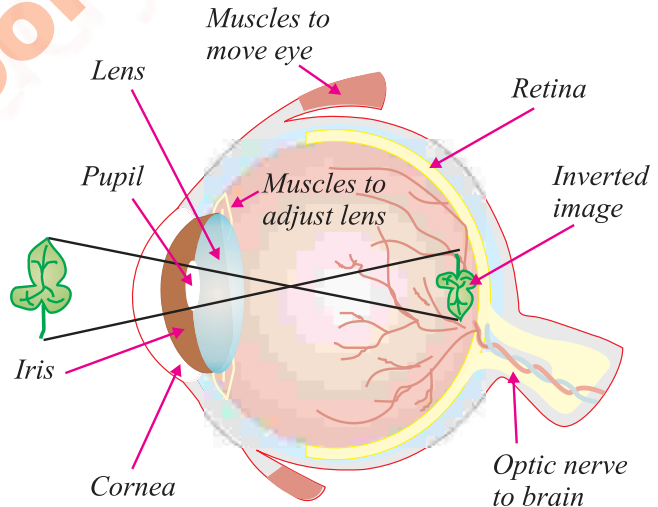


Figure 3.1: Internal Structure of Human eye

Rods and cones

The retina is made up of two types of photoreceptors i.e. rods and cones. Rods are sensitive to dim light. They are important for night vision and for seeing black and white. Cones are sensitive to bright light. They let you see colours and fine details.

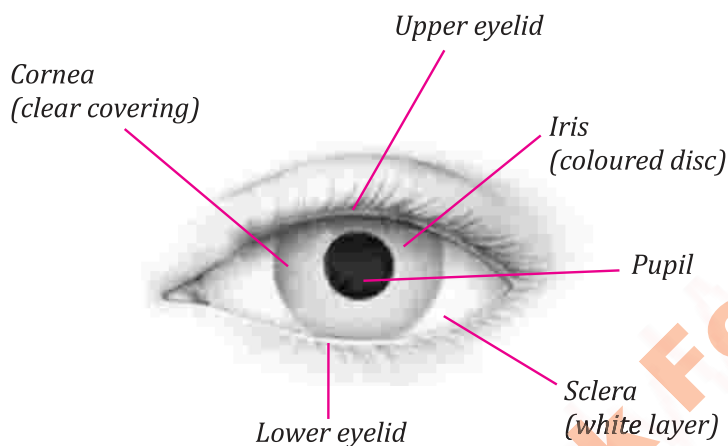


Figure: 3.2: Outer Structure of human eye



Science Tidbits

- ★ Your eyes have the resolution of 576 megapixels.
- ★ Your eyes can distinguish almost 10 million colours.
- ★ Your eyes can detect a candle flame 2.85 km away.
- ★ Your eye consists of more than 2 million working parts.

Do you know?



Eyes are priceless and deserve to be treated with care and respect.

Eyes are damaged by:

- Injuries
- Unbalanced diet and smoking
- Sun rays and solar eclipse
- Laser pointer
- Diseases like diabetes and hypertension

Eye strain is bad for the eyes, especially for developing kids. Eyes are strained by:

- Focusing on screen for hours
- Reading in dim light and while traveling
- Using a bright screen in a dim room
- Using glasses of a wrong number
- Rubbing your eyes
- Looking at objects from too close

Hearing

When things vibrate, they produce sound. Sound waves travel through air and reach our ears. Ears are the organs used for hearing. Your ear has three main parts, outer, middle and inner ear.

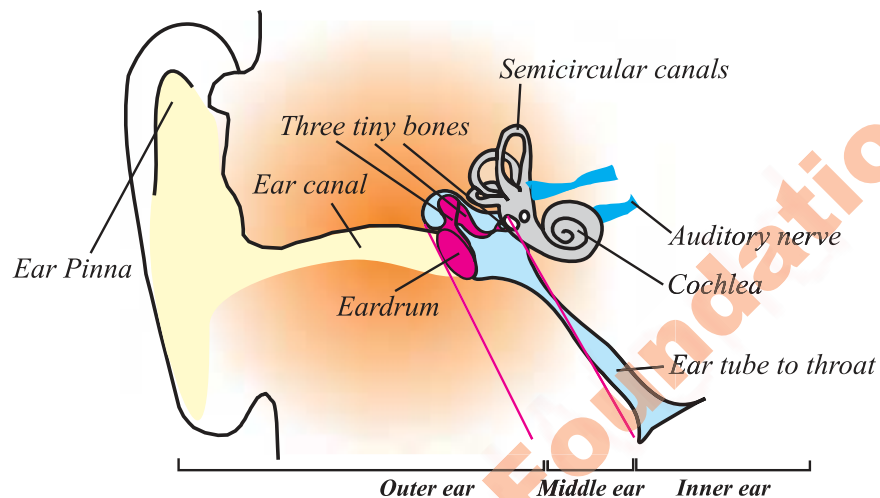


Figure 3.3: Internal Structure of human ear

- The outer ear is like a funnel that directs sound waves to the ear canal.
- When these waves reach middle ear they vibrate the ear drum.
- The ear drum converts sound waves to vibrations and passes them to three tiny bones.
- These bones increase the vibrations upto 20 times.
- One of these bones vibrates the cochlea.
- Cochlea is a snail like part of inner ear. It is filled with a fluid and sound vibrations make waves in this fluid.
- These waves are detected by receptor cells in the walls of cochlea.
- Receptor cells send messages to the brain through the auditory nerve.
- Brain interprets these signals as the sounds you hear.

Do you know?



Your ear canal produces ear wax, which helps to protect the ear and keeps it clean.



Science Tidbit

Bats, whales and dolphins produce sound waves and listen to the echo. These animals find their way, catch their prey, communicate and move with echolocation. Radar is a man made echolocation device.



Science Tidbit

- ★ You can never “turn off” your ears.
- ★ Your inner ear semicircular canals help to maintain body balance.
- ★ Your middle ear has the smallest bones in your body.
- ★ Crickets have hearing organs in their knees.
- ★ Frogs can hear with their lungs and snakes hear through their skin.
- ★ Elephants have the largest ears and hear sounds from a distance of 6 km away.

Hands on activity



Make a model of the ear drum by stretching a piece of plastic wrap over a container. Place 20-30 grains of uncooked rice on the top of plastic wrap. Make noise near plastic wrap by banging different objects. Watch the rice grains jump.



Taste

Taste is the sense that lets you detect flavours. Have you looked at the surface of your tongue? Your tongue is covered with tiny bumps called taste buds. Taste buds have taste receptors. Taste receptors can detect four basic tastes; sweet, sour, salty and bitter. These receptors send messages to the brain which interprets them as a particular taste.

Large taste buds

Small taste buds

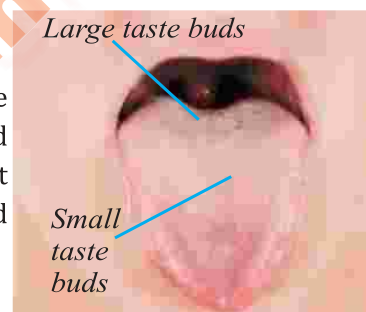


Figure 3.4: Taste buds on tongue

Hands on activity



Dry your tongue with a paper towel and attempt to taste dry sugar or salt. Dry food on dry tongue is tasteless, find out why? Share your findings with your class.



Point to ponder

It is a myth that different tastes come from different areas of the tongue. So where are tastes detected on the tongue?

Do you know?



- ★ Children have more taste buds than adults.
- ★ Dogs and cats use their tongues to clean their fur and body.
- ★ Flies and butterflies taste with their feet, as their taste receptors are there.
- ★ Blue whale has the largest tongue. It weighs about 2.7 tons.



Teaching Point

Food molecules attach with taste receptors when they dissolve in saliva or water

SMELL

Things have a smell because they give off particles called molecules. When you sniff something, these molecules travel up to the top of your nose and attach with the receptors. The smell receptors then send a message to your brain, which recognizes it or remembers it if it is a new smell.

Hands on activity



Hold a piece of onion near your nose and eat apple at the same time. Take a deep breath from your nose and chew. What do you notice? Share with your class.

Do you know?



- Flavour is a combination of taste and smell. 80% of what you think is taste is actually smell. If food smells great, you love its taste.
- Spicy is not a taste. It is a combination of pain and hot sensation. These receptors are present on skin, in nose, mouth, eyes etc., that is why you feel burning if chillies touch any of these parts.

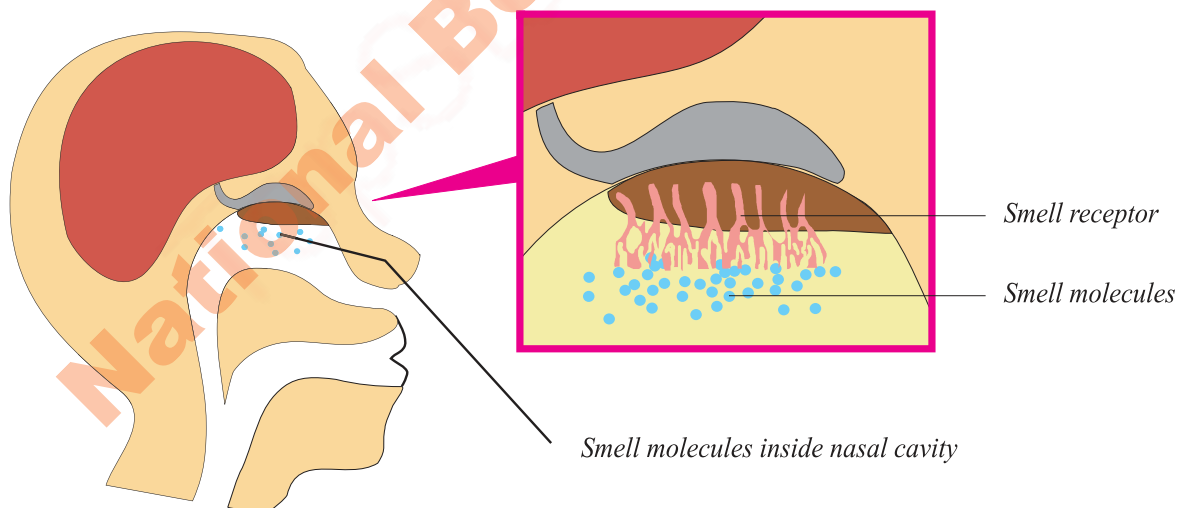


Figure 3.5: Smell receptors in nasal cavity

Touch

When you touch something, tiny touch receptors in your skin send a message to your brain. The three main types of touch receptors are mechanoreceptors, thermoreceptors and pain receptors.

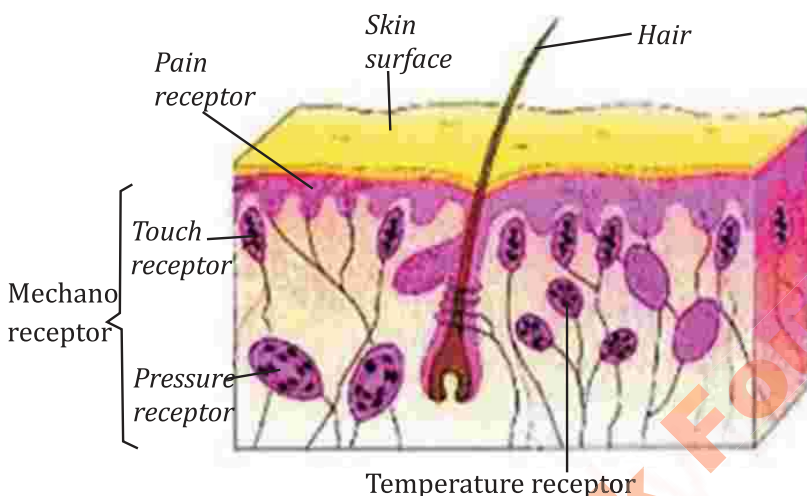


Figure 3.6: Receptors in human skin

Do you know?



People who are blind can use their sense of touch to read Braille. It is a kind of writing that uses a series of bumps to represent different alphabets and numbers.



Points to remember

- Stimuli are the changes in the environment detected by the receptors of sense organs. All sense organs send messages to the brain.
- Eyes respond to light rays. A small, inverted image is formed on the retina.
- Ears respond to sound waves. Ear has three main parts i.e. outer, middle and inner ear.
- The tongue gives us the sense of taste. There are taste buds on the upper surface of the tongue.
- Nose can detect smell molecules with its receptors.
- Skin is the largest organ. It responds to pain, touch, pressure, heat and cold.



Exercise

A Choose the correct option.

- Which senses of your body are similar in their function?
(a) sight and hearing (b) smell and taste
(c) touch and balance (d) sight and pain
- You do not taste your food properly when you are suffering from a cold because
(a) you are sneezing all the time (b) Your nose is running
(c) cold blocks your taste receptors (d) cold blocks your smell receptors
- Ear drum is a stretched membrane that separates the
(a) outer ear and middle ear (b) middle ear and inner ear
(c) outer ear and inner ear (d) inner ear and brain
- Pain sensation tells us that something is wrong with our body. Where are these receptors located?
(a) on the skin only (b) inside the body only
(c) on every part of the body (d) on the skin and inside the body
- When light enters the eye, it passes through cornea, pupil, lens and fluids of the eye. All these parts are
(a) opaque (b) transparent
(c) translucent (d) reflective
- Your receptors become dull if you overuse them. Your taste receptors will work more efficiently if you eat
(a) hot and spicy food (b) sweets and chocolates
(c) too much salty food (d) mild tasting foods
- Astronauts cannot talk to each other directly in space. They use radio signals to communicate because in the space
(a) tongue is not working
(b) ears are not working
(c) sound waves cannot travel
(d) auditory nerve is damaged
- Cats and many mammals are more active at night, so the retina of their eyes contain
(a) more rods (b) more cones
(c) equal number of rods and cones (d) no rods or cones

9. Your ears will keep on hearing properly for a longer part of your life, if you:

- (a) insert sharp objects in your ears
- (b) listen to high volume sounds, music or noise
- (c) get hit on your head and ear region
- (d) avoid all of the above

10. A table tennis player loses the ability to see with one eye, in an accident. Her second eye is working normally. When she starts playing again, the effect will be that:

- (a) she cannot judge how far the ball is
- (b) the ball looks smaller
- (c) she cannot see the colour of the ball

B True or False (correct the statement if it is False).

1. Thermoreceptors are present on skin, in nose, mouth and eyes.

2. Optic nerve carries signals from the ear to the brain.

3. The hole in the middle of lens is called pupil.

4. Closely placed eyes give a greater field of view.

5. Without stimuli, your receptors can not perform their function.

C Answer the following questions briefly.

1. Stimuli are changes in the surrounding, which are detected by your sense organs. The following table shows stimuli, receptors and sense organs. Complete the table.

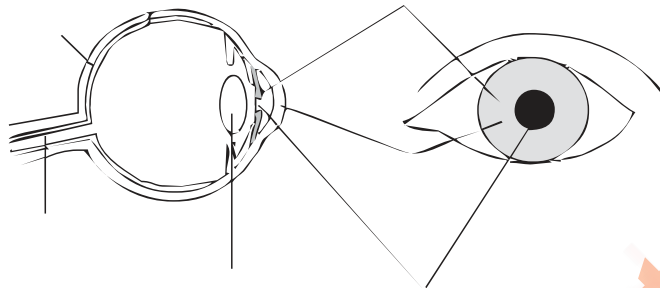
Stimuli	Receptors	Sense organs
Dim light	Rods	
	Cones	
	Cochlea receptor cell	
Taste		
		Nose
Touch and pressure	Mechanoreceptors	
Hot and cold	Thermoreceptors	
Pain		

2. There are four types of taste receptors on your tongue. How can you detect hundreds of tastes and flavours?
3. Why are some areas of your skin more sensitive to touch than others?
4. Your ears are working all the time, but you do not hear things while you are sleeping. How is this possible?
5. Colour blind people are unable to differentiate between different colours. Which receptors are not working in their eyes?

D Answer the following questions in detail.

1. Your sense organs send messages to the brain about what is happening around you. Your brain then orders your body systems to respond. Create a story to describe any event of your life in which sense organs, brain and many body systems worked as a team.
2. In rare conditions, humans do not feel any pain. Is it dangerous for that person? Explain.

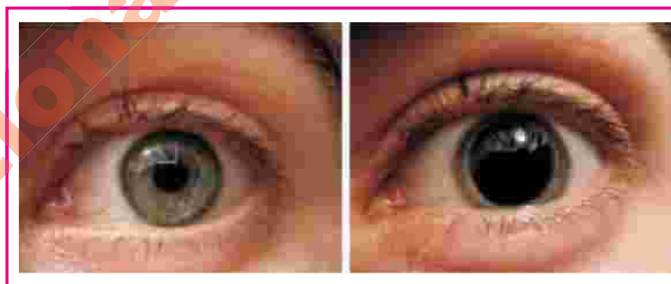
3. Label the parts of the eye shown in the diagram.



- (a) Which part changes its shape to focus properly?
- (b) Which part changes its size to control the amount of light entering in the eye?
- (c) Where is the image formed?
- (d) Which part changes its shape to focus the image?

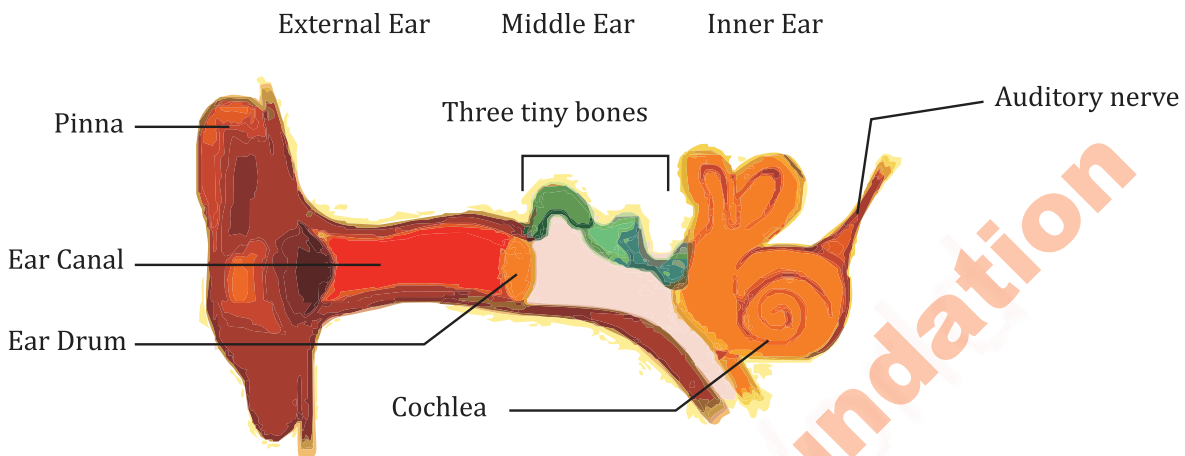
E Constructed Response Questions.

1. Iris muscles control the size of the pupil. The amount of light entering the eye depends on the size of the pupil. Light intensity and your emotions effect the size of your pupils.



- (i). What is the size of your pupil when you are excited or frightened?
- (ii). What is the size of your pupil when you are bored, tired or sleepy?
- (iii). How will your pupil size change when you go out of a dark area to a well lit area?

2. Your friend is whispering in your ear. How are you listening to that whisper? Draw arrows in this diagram to show how the message is moving in the ear.



Complete the following sequence.

Sound from source → _____ → _____ → _____ →
_____ → _____ → _____ → Brain receives the signal

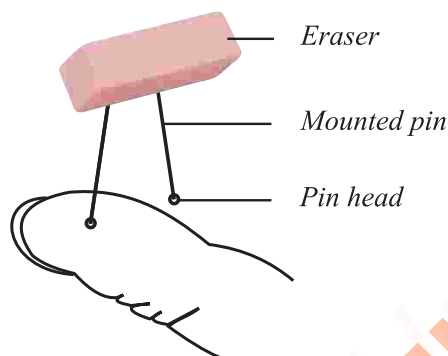
3. Some actions of your body are rapid and happen without you thinking about them. You cannot control these actions. Such actions are called reflex actions. Which of the following actions of your body are reflex actions?
- (a) When somebody suddenly claps his/her hands in front of your face, you blink your eyes.
 - (b) When a sharp pin pricks your skin, you call your mother loudly.
 - (c) When food or water enters your wind pipe, you start coughing.
 - (d) When you are hungry, the smell or sight of food results in watering of your mouth.
 - (e) When someone slaps you, you slap that person in return.
 - (f) When your body becomes cold, you start shivering.



Project

Conduct an experiment to determine touch sensitivity in different parts of the skin

Divide the class into groups of three students. Make a device using eraser and two common pins, to test the response of the skin to touch, as shown in the figure.



Conduct an experiment on the skin of your class fellow who is not allowed to look at the pins when they touch his/her skin. Touch his/her skin lightly either by one pin head only or by both pin heads together. Take ten readings on different body parts.

Record the number of correct responses in the following table, and find the average.

Student	Number of correct responses			
	Finger tip	Palm of hand	Back of hand	Back of neck
A				
B				
C				
Total				
Average				

Draw a bar graph to show the average number of correct responses for each part of the body.

Note: Within a group of three students, one student will act as a subject, the second one will perform the experiment on the subject and the third student will record the correct responses in the table. Students will take turns to complete the task.

04

LIFE CYCLES



Learning Outcomes

- Describe the different ways of growing up.
- Define reproduction.
- Demonstrate vegetative reproduction in plants.
- Compare the life cycles of the following organisms (insect, fish, frog and bird) through diagram.

Can you grow new plants from a leaf or stem?

How have you changed since your birth?

What is the relationship between a caterpillar and a butterfly?



Key Concept

Life is a cycle. Young organisms change as they grow and produce their next generation by reproduction.

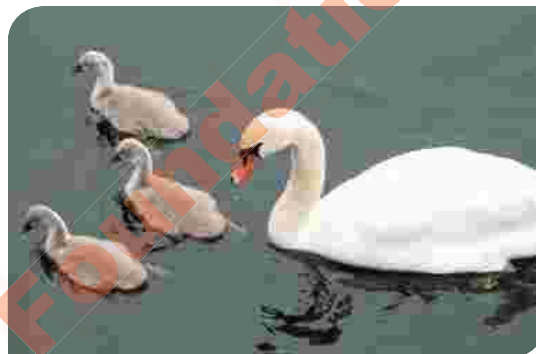
GROWTH

A seed looks small and dry but when you sow it in the soil, it grows into a seedling. After some years it can become a big tree. A plant grows best if it gets the right amount of light, water, air, warmth and minerals.

The young ones of animals require food, water, air, warmth, protection and care as well. In the animal world, many young animals are very different from their parents.



This caterpillar grows into a ladybird beetle.



White swan babies are grey ducklings.



A camel's baby is humpless.



Giant panda cub is pink, blind, tiny and hairless.

Point to ponder



The trunk of a tree becomes thicker because of its growth from the middle out. One ring of new wood builds up each year, making the trunk thicker. Based on this information how would you find out the age of a tree?



REPRODUCTION

Asexual reproduction

New organisms are formed from vegetative parts of the organisms

Sexual reproduction

New organisms are formed by the fertilization of gametes

Do you know?



Asexual reproduction produces organisms identical to their parents, called Clones. While sexual reproduction creates new varieties.

Vegetative propagation

Vegetative propagation is asexual reproduction in plants. By this process, new plants can be grown without seed.

Tuber

It is a swollen, underground stem. Each bud can be cut and planted to grow into a new potato plant.

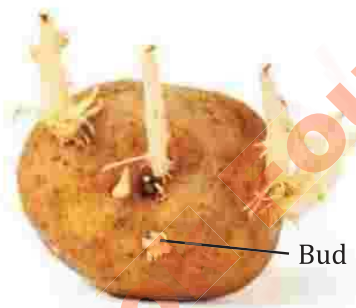


Figure 4.1: Potato tuber

Do you know?



A bud is a small swelling that can grow into new branches, leaves or flowers. In vegetative propagation, roots and shoots grow from buds. New plants are formed by these buds.

Runner

Runners are plant stems that grow along the ground. New strawberry plants grow from the buds along the runners of the parent strawberry plant.



Figure 4.2: Runner of strawberry



Teaching Point

Clones are genetically identical organisms. Vegetative propagation produces natural clones in the form of crops quickly, easily, at low cost and with less water requirement.

Bulb

A bulb is a type of an underground stem with thick, fleshy leaves that store food. It produces smaller buds which grow into new plants.



Cutting

A stem cutting from a rose plant will grow roots and form a new plant. Root and leaf cuttings can also be grown.



Plantlets

Succulent plants like Bryophyllum have buds at the margins of their leaves. Each bud develops into a new plant.

Do you know?



Bryophyllum (Zakhm e hayat) leaves are applied on the skin to treat wounds, boils and insect bites.

LIFE CYCLES

The changes that take place in a living thing during its life is called its life cycle. Different organisms have life cycles of different time spans and stages.

Do you know?



The instructions in your cells that tell your body how to grow, are called genes. You receive half of your genes from your father and half of your genes from your mother.

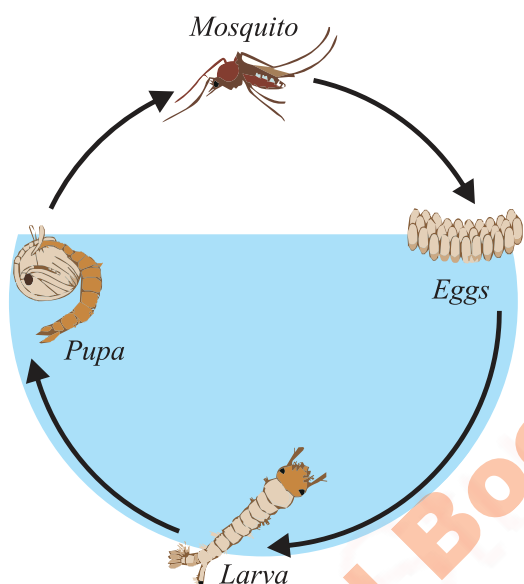


Figure 4.3: Life cycle of mosquito

Caterpillar is the larva of insect that eats a lot and moves. Pupa is a resting stage in a protective shell called Chrysalis. The caterpillar's old body dies and a new body forms inside the shell.

Newly hatched fish with a food sac attached is a larva. A very small fish without a food sac is a fry. When fish reach the size of a finger and develop fins and scales they are called fingerlings.

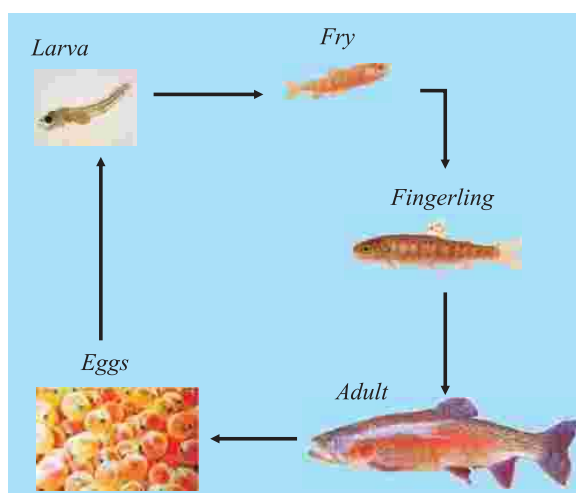


Figure 4.4: Life cycle of fish

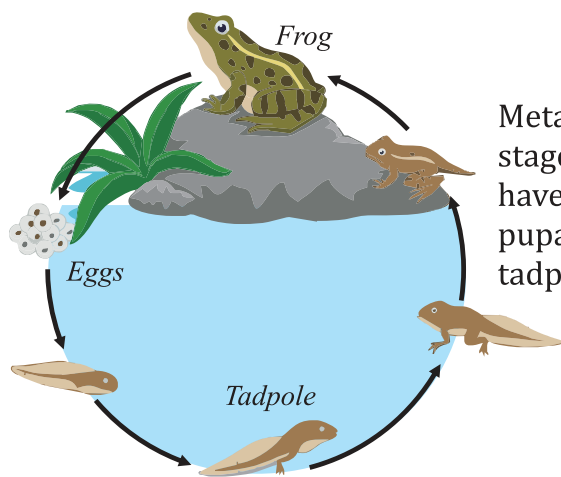


Figure 4.5: Life cycle of frog

Metamorphosis is the change of shape at each stage during an animal's life cycle, e.g. insects have four stages of metamorphosis (egg, larva, pupa and adult) and frogs have three (egg, tadpole and adult).

Hatchlings of sparrow are helpless, featherless and weak. Fledglings can jump out of nest and learn to fly.

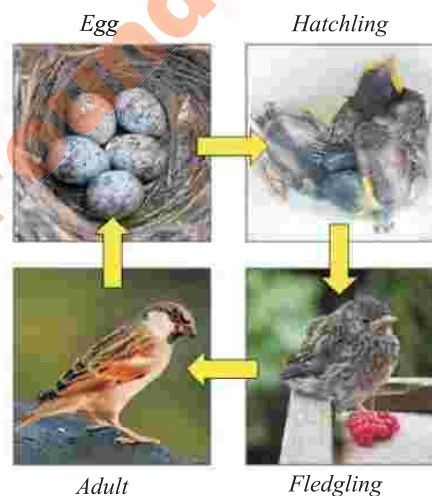


Figure 4.6: Life cycle of sparrow



Points to remember

- Organisms change as they grow i.e. they increase in size and complexity.
- Reproduction is of two types: sexual reproduction involves gamete formation and fertilization while in asexual reproduction these two processes are absent.
- Vegetative propagation is asexual reproduction in plants. It increases the number of identical plants in a short period of time.
- Tubers, runners, bulbs, cuttings and plantlets can be used for vegetative propagation.
- Mosquito, fish and frog develop from eggs in the water. They undergo many stages of metamorphosis.
- Bird eggs develop on land. Hatchlings need parental care.



Exercise

A Choose the correct option.

1. A potato can be grown from its seeds, but mostly farmers cut pieces of potato tubers and bury them in soil because
 - (a) it needs more water
 - (b) it is a quick way
 - (c) potato pieces are useless
 - (d) it is the habit of farmers
2. Finger prints are unique for everyone because human beings
 - (a) are clones
 - (b) have variations
 - (c) eat different types of food
 - (d) use their fingers in different ways
3. Which one of the following is not a process involved in vegetative propagation?
 - (a) cutting
 - (b) tuber
 - (c) runner
 - (d) fertilization
4. Sexual reproduction is a big advantage to a group of organisms because it provides a lot of
 - (a) variation in organisms
 - (b) identical organisms
 - (c) energy for organisms to survive
 - (d) similar copies of parents
5. An onion plant produces a new plant without the formation of seeds this type of reproduction is called
 - (a) budding
 - (b) fragmentation
 - (c) fission
 - (d) vegetative propagation
6. Tulips, lilies, daffodils and onions can be reproduced by
 - (a) bulbs
 - (b) tubers
 - (c) cuttings
 - (d) runners
7. A stem is the part of a shoot system which grows in the air. Sometimes stem can be underground in plants like
 - (a) rose and jasmine
 - (b) mango and orange
 - (c) strawberry and mint
 - (d) potato and onion
8. Potato tubers have depressions called eyes. For vegetative propagation, you have to cut pieces of potato in such a way that each piece has at least one eye. If a piece is without an eye it will not grow into a new plant because eyes
 - (a) have seeds
 - (b) have buds
 - (c) can grow branches
 - (d) can grow roots
9. The number of mosquitoes in a natural ecosystem is controlled by
 - (a) snakes and birds
 - (b) virus and bacteria
 - (c) lizards, frogs and spiders
 - (d) rats and mice

10. The process of metamorphosis converts a tadpole into an adult frog. The changes

- (a) increase the size of frog
- (b) decrease the strength
- (c) are reversible
- (d) make it possible for frog to live on land

B Match the columns.

	Column A		Column B
1	Bulb	a	Formation of new organisms without gametes
2	Runner	b	Swollen underground stem with buds
3	Tuber	c	Fertilization of gametes
4	Sexual reproduction	d	Underground stem with thick fleshy leaves
5	Cutting	e	Piece of stem, root or leaf
6	Plantlets	f	Stems growing along the ground
7	Asexual reproduction	g	Buds at margins of leaves

C Answer the following questions briefly.

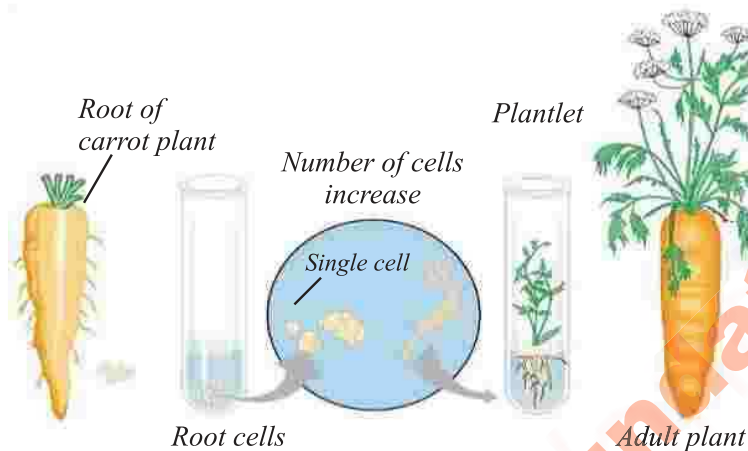
- Why do organisms reproduce? What will happen if a group of organisms is unable to reproduce?
- What are buds? What are the different structures formed from buds?
- Why do we seldom see potato seeds while we see many potatoes around us?
- In which stages of its life cycle, can a frog live only in water?

D Answer the following questions in detail.

- Small birds like sparrows lay smaller eggs while larger birds like hens lay bigger eggs. Relate the size of the eggs with appearance, feathers and activity of their hatchlings.
- Describe the life cycle of any animal in your own words.
- You have studied life cycles of different animals. Compare these life cycles according to:
 - (i) Water requirement
 - (ii) Seasonal requirement
 - (iii) Food requirement
 - (iv) Parental care requirement

E Constructed Response Questions.

1. The diagram shows tissue culture technique in a simple way.



- (i) How is this tissue culture technique different from the normal reproduction of a carrot plant?
 - (ii) Normally carrot root cells store food only. What is the other function that these cells perform by tissue culture technique?
 - (iii) How many plantlets can be produced from one carrot by using the tissue culture technique?
2. Female mosquitoes feed on vertebrate blood before laying eggs. As they suck blood, these mosquitoes can transmit diseases like malaria and dengue fever from infected to healthy persons.
- (i) Will every mosquito bite make you sick?
 - (ii) Can we control the spread of malaria and dengue fever?
 - (iii) You have studied the life cycle of a mosquito. Think about ways to control mosquitoes in the air and water. Apply them to your surroundings.



Project

Growing crops by vegetative propagation

Divide the students in your class into five groups. Each group has to grow a crop by vegetative propagation method (tuber, runner, bulb, cutting and plantlet). Students can use a ground patch in the school or a large pot.

05

ELEMENTS AND COMPOUNDS



Students Learning Outcomes

- Describe the structure of matter in terms of particles (i.e., atoms and molecules).
- Describe molecules as combination of atom (e.g., H_2O , O_2 & CO_2).
- Understand that compounds are formed by elements joining together chemically forming a new substance.
- Distinguish between elements and compounds.
- State the names and symbols for some common elements.
- Classify elements into metals and non-metals based on their physical properties.
- Identify and explain examples of common elements and compounds from their daily life experiences.

Which harmful compound is increasing in the environment day by day and which natural machinery helps to reduce it?

What do you have in common with a flower, goat, lake, computer and everything else in this universe?

Which element is known as the magic element on earth?



Key Concept

Atom is the basic unit of everything in the universe. Atoms are joined together in different ways to form molecules. An element is a substance which cannot be broken into simpler substances and atoms from different elements combine together to form compounds.

ATOM AND ELEMENT

Look around you. What are all the things you see made up of?

Anything which you can feel, see or touch is called matter. All the matter in this universe is made up of tiny building blocks called atoms. An atom is defined as the smallest particle of an element which can exist.

Element

If you break an iron nail into smaller pieces, would the smaller parts be different from the iron nails? An element is a pure substance that is made up of one type of atoms. It cannot be broken down into simpler substance by chemical reactions. There are more than 100 types of elements and this means there are more than 100 types of atoms. For example, gold is made up of only gold atoms and silver is made up of only silver atoms.



Democritus was a Greek philosopher who was the first person to use the term atomos (atomos: meaning indivisible).



Gold bar



Silver bar

Atom

An atom is so small that we cannot see it with an ordinary microscope. Therefore a Scanning Tunneling Microscope (STM) is used to observe atoms. An atom is made up of different types of particles that are called proton, neutron and electron.

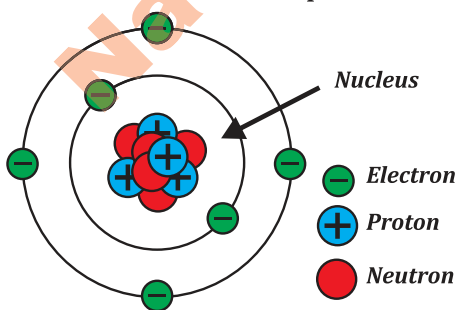


Image of atom from STM

Do you know?



- 118 elements have been discovered so far.
- 96 elements are naturally occurring and 24 are human made.
- Elements found on Earth and Mars are exactly the same.
- Hydrogen is the most common element found in the universe.

Symbols of Elements

Each element is represented by a chemical symbol. A symbol is a kind of chemical shorthand recognized all over the world. The name of an element can be different but its symbol remains the same throughout the world. Every chemical symbol consists of either the first letter or two letters of its chemical name. The first letter is always capital and the second letter is small. Some elements are represented by first letter (e.g. Sulphur) or two letters of their name (e.g. Cobalt) while some elements are named in Latin or German. For example, the Latin name of copper is 'Cuprum' and chemical symbol is Cu.

Hands on Activity



Collect a few everyday objects and make a list. Find out what elements make these objects and record your observation on a piece of paper. Share with your class.

Elements	Symbol	Elements	Symbol
Nitrogen	N	Potassium (Kalium)	K
Sodium (Natrium)	Na	Copper (cuprum)	Cu
Chlorine	Cl	Hydrogen	H
Carbon	C	Iron (Ferrum)	Fe
Cobalt	Co	Phosphorus	P
Aluminum	Al	Mercury (Hydrargyrum)	Hg
Gold (Aurum)	Au	Sulphur	S
Silver (Argentum)	Ag	Fluorine	F
Oxygen	O	Helium	He

Classification of Elements

Look at the pictures carefully. What do you notice?



Lead



Mercury



Chlorine

By looking at the pictures, observe the physical properties of the elements

Element with symbol	Solid / Liquid/ Gas	Shiny/Not shiny	Color
Chlorine (Cl)			
Lead (Pb)			
Mercury (Hg)			

Elements have different appearances and properties at room temperature. On the basis of their properties elements are divided into two groups; metals and non-metals.



Metals

Metals have the following general properties:

- Shiny surface
- High melting and boiling point
- Ductile (can be drawn into wires)
- Good conductors of heat and electricity
- Malleable (flexible/can be hammered into thin sheets)
- Sonorous (when beaten, produce sound)
- Hard except Sodium and Potassium

Do you know?



Many things are made up of mixtures of one metal with other metals or non-metals. These are called alloys. For example, steel is a mixture of iron and carbon. Try to find out names of some other alloys.

Non-Metals

Non-metals have the following general properties:

- i) Dull appearance except graphite and iodine
- ii) Low melting and boiling point
- iii) Brittle
- iv) Poor conductors of heat and electricity
- v) Non-malleable (non-flexible)
- (vi) Non-sonorous (when beaten, do not produce sound)

Point to ponder



Which non-metals are found in gaseous state?

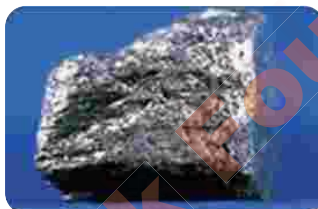
Do you know?



Phosphorus is highly flammable and reacts vigorously with oxygen present in air. It is stored in water because it is insoluble in it. It should be handled with forceps, as contact with the skin may cause severe burns.



Phosphorus



Carbon



Sulphur

Uses of Elements

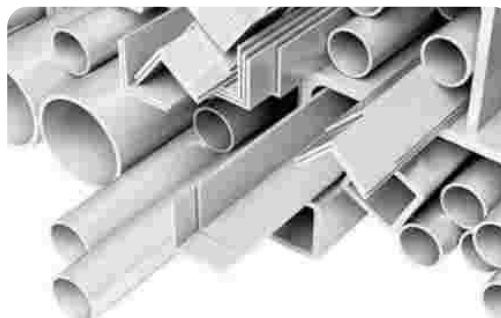
Elements are widely used in daily life. The uses of elements depends on their properties. For example, some metals are very good conductors of electricity and heat so these are used for making wires, cables and utensils.

- Helium is a very light and inactive gas. It is used to fill airships and balloons.
- Aluminium is used for making air craft, some sport equipments and windows.

Do you know?



Why is aluminum foil used for wrapping food and chocolate bar and for making windows?



- Lead is used for making batteries.
- Gold is used for making ornaments and jewelry. It is also used in dentistry and medicines.



MOLECULE

Atom is unstable and cannot exist independently in space except (noble gases), so they combine together in the form of a molecule.

Molecule is made up of two or more atoms which are chemically combined together. In this world everything is composed of either pure elements or combination of two or more different elements. For example, in hydrogen molecule (H_2), two atoms of hydrogen combine together to form a single hydrogen molecule. One atom of carbon and two atoms of oxygen are combined together to form a molecule of carbon dioxide (CO_2). In some cases three or more identical atoms combine to form a molecule. In Ozone, each ozone molecule is made up of three oxygen atoms (O_3). Molecules are of different shapes. Some are long and spiral while other are of pyramid shape.

Do you know?



A perfect diamond is a single molecule that is made up of carbon atoms.

Molecules of element	Diagram	Molecules of compound	Diagram
Hydrogen (H_2)		Water (H_2O)	
Oxygen (O_2)		Carbon dioxide (CO_2)	
Chlorine (Cl_2)		Methane (CH_4)	

Molecule of elements



Science Tidbit

- ★ 99 percent of the mass of the human body is made up of only six elements: oxygen, carbon, hydrogen, nitrogen, calcium, and phosphorus.
- ★ Every organic molecule contains carbon.
- ★ 65-90% of each body cell consists of water (by weight).
- ★ Oxygen and hydrogen are the major components of the human body.

Hands on activity



How to make a model of molecules

Make a model of different molecules by using any material. For example plasticine, table tennis balls or play dough, etc.



COMPOUND

A compound is formed by two or more elements joined together chemically forming a new substance. Molecules of compounds consist of a fixed number of two or more different type of atoms that are chemically combined together. For example, a water molecule is made up of one oxygen atom and two hydrogen atoms. Similarly carbon dioxide (CO_2) consists of two oxygen atoms and one carbon atom. The substances that we use in our daily life are mostly made up of different elements, e.g. sodium chloride (table salt) is made up of two different elements; sodium and chlorine. Other examples of compound are chalk, sugar and sand.

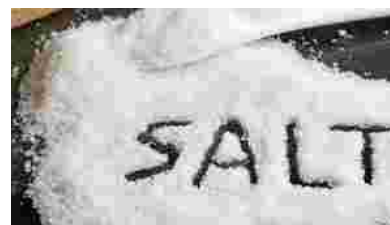


Sodium

+



Chlorine



Sodium Chloride



Chalk is made from calcium, carbon and oxygen



Sugar is made up of carbon, hydrogen and oxygen



Sand is a compound of silicon and oxygen

Main characteristics of Compounds

- i) They have atoms of different elements in a fixed ratio.
- ii) They have different properties from the elements of which they are made up of.
- iii) The components cannot be separated by physical means.

USES OF COMPOUND

Many substances we use in our daily life such as salt, sugar, chalk and sand are compounds. The uses of some compounds are given below:

Carbon dioxide is used to make fizzy drinks



Baking soda is used for cooking and baking



Plastic is used for making many domestic and commercial objects



Natural gas (methane) is used as fuel



Mouthwash is used for dental hygiene



Bleaching powder is used for cleaning purposes



Detergent is used for washing clothes



Vinegar is used as preservative and as seasoning in food



Differences between Elements and Compounds

Elements	Compounds
Elements have only one kind of atoms	Compounds have two or more different kinds of atoms.
Cannot be broken into simple substances	Can be broken down into simpler substances through chemical processes.
For example: H_2 , O_2 , C, Na etc.	For example: H_2O , CO_2 , NaCl etc.



Points to remember

- All matter is composed of tiny particles called atoms.
- Atoms of the same kind join together to form elements.
- There are 118 different elements.
- Each element has a specific name and symbol for example Carbon C, Hydrogen H.
- Elements are divided into metals and non-metals.
- Metals and non metals have different properties.
- A compound consists of two or more than two elements, which are chemically combined together.
- The properties of a compound are different from the elements, it is made up of.



Exercise

A Choose the correct option.

1. CO_2 is the chemical formula of carbon dioxide. What is the ratio of carbon and oxygen in carbon dioxide?
(a) 3:1 (b) 2:1 (c) 1:2 (d) 1:1
2. The symbol of Sodium is
(a) Ni (b) Ne (c) N (d) Na
3. Which of the following is an element?
(a) Carbon dioxide (b) Water (c) Copper (d) Salt
4. Glucose is ----- composed of ----- which are made up of -----
(a) Compound, atom, molecule (b) Compound, molecule, atom
(c) Atom, compound, molecule (d) Molecule, atom, compound
5. Which of the following is a compound?
(a) Cl (b) C (c) NaCl (d) O_2
6. Silicon and oxygen combine together to form
(a) sand (b) chalk (c) sugar (d) salt
7. Chalk, detergent and fertilizer, are all:
(a) elements (b) compounds (c) atoms (d) solutions
8. Copper wire is an example of:
(a) alloy (b) compound (c) mixture (d) element
9. The elements found in household bleach is:
(a) Cl (b) Co (c) Cu (d) Br
10. Which of these is a correct symbol for aluminum?
(a) Al (b) aL (c) AL (d) al
11. How many elements have been discovered so far?
(a) 100 (b) 118 (c) 112 (d) 114
12. The element used commonly in computer chips is
(a) Si (b) S (c) Sn (d) Sc

B Match the columns.

	Column A		Column B	C
1	A substance which cannot be broken into simpler form	a	Symbol	
2	When two or more elements join together chemically, forming a new substance.	b	Metal	
3	A substance is made up of two or more atoms	c	Element	
4	Have shiny surface	d	Compound	
5	One or two letters used to represent an element	e	Molecule	

C Answer the following questions briefly.

- Carbon is an element while carbon dioxide is a compound. Why?
- Classify the following substances into elements and compounds.
 (i) mercury (ii) sulphur (iii) sugar (iv) water
 (v) gold (vi) salt (vii) oxygen
- Give symbols of Sodium, calcium, cobalt, gold and mercury?
- Why is silver not used to make electrical wires?
- Is it not possible to break down an element into simpler substance?

D Answer the following questions in detail.

- Differentiate between elements and compounds. Elaborate your answer with examples
- Identify five compounds found at your home and write down their uses.
- Give the similarities and differences between metals and non-metals.



Project work

Metals and non-metals

Collect some metals, non-metals, compounds used in everyday life and display them in the form of a poster.

E Constructed Response Questions.

The table given below shows the amount of elements that are present in the human body. Most of them are nonmetals.

Element	Symbol	Percentage	Element	Symbol	Percentage
Oxygen	O	65.0	Potassium	K	0.4
Carbon	C	18.5	Sulphur	S	0.3
Hydrogen	H	9.5	Sodium	Na	0.2
Nitrogen	N	3.2	Chlorine	Cl	0.2
Calcium	Ca	1.5	Magnesium	Mg	0.1
Phosphorus	P	1.0	Copper	Cu	Less than 1

1. Which three elements are most abundant in our body?
2. Identify the metals and mention the ones that have the least and the most percentages in the human body.
3. Identify the non-metals.
4. From the table identify and list names of elements which exists in gaseous state.