

Right Science

6

***Teacher's
Resource Book***

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Chapter 1: Cell and Cellular Organization of Plants and Animals

Learning Objective:

In this lesson we will learn about

- Animal Cell and Plant Cell
- Cell Structure and functions
- The difference between animal and plant cell
- The organs and organ system of plant and animals
- Microscope and its parts

Teacher Starter:

You can start your class by asking students, about how different types living things they observe around them. Give them a brief description of living and non-living things. Also help them to understand by giving suitable examples about the micro-organisms such as cells and bacteria, and make them understand that not only humans or animals are living beings. Also enlighten them about plants and their living mechanisms. Broaden their concept and understanding about living things.

Teaching:

Try to make the lesson as convenient and understandable by explaining things mention in the chapter. You may ask questions, in order to understand how much they grasp the concept of the chapter. Tell them about cellular organisms, the living beings, their internal organs and the organ system. Also enlighten them about different functions and important organs of the human body.

Also explain them the mechanism of plants, how the plants circulate the water and other nutrients, in what ways the plants are different to animals. Try to give them a microscopic view of the cross section of any stem of the plant.

Exercises

Answer the following questions

1. What do you know about cell?
 - Cells are the basic building blocks of all living things. Cells come in thousands of shapes and sizes. Cells carry of the biological tools necessary to keep a living being alive. A cell takes nutrients and converts them into energy. Cells mostly have three main components; the cell membrane, the nucleus, and the cytoplasm. These tiny structures present inside a cell are called organelles.
2. How many types of cells are there?
 - There are mainly two types of cells: Prokaryotic Cells (Unicellular) and Eukaryotic Cells (Multi-cellular).

3. Is there a difference between animal and plant cells? Support your answer with labeled diagram of both types of cells?

- Plant and animal cells are almost similar. They both have nucleus, cytoplasm and cell membrane. But some components like cell wall, vacuoles and chloroplast are only present in the plant cell.

Note : Students will draw a labeled diagram of Plant and animal cells by themselves.
with the help of book

4. What part do tissues play in a cell structure?

- A tissue is a group of similar cells working together to perform their specific job. Some animal and plant tissue with their functions and locations are listed below in the table.

Plant Tissue	Location	Function
Vascular Tissue	In stem, roots and leaves	Transport water and sugar
Photosynthetic Tissue	Leaves and other green parts of plant	Makes food and stores food
Epidermal Tissue	Outer layer of stem, leaves and roots	Protect plant tissues and prevents water loss

Animal Tissue	Location	Function
Epithelial Tissue	Surface, cavities and glands of animal body	Protects the structure below
Connective Tissue	Throughout the animal body	Supports and connects other tissues
Muscle Tissue	Attached to bones and in the walls of some organs	Contract and expand to help and animal's body move

5. What do you understand with the term Organ System? Give two examples of human organ systems.

- Tissues work together to make an organ, and many organs make an organ system. Organ systems make an organism. Humans are an organism. The human body is made up of several organ systems that work together as one unit. Organ system fits between the hierarchal levels of organ and the organism. Digestive system and Respiratory system are the two important example of organ system.

6. Is there an organ system present in plants? What are the major organs of plant?

- Yes, there is an organ system in plants too. Plants have the same way of forming an organ system as human or animals. The main organs of a plant are flowers, stem, leaves and roots.

Flowers: Flowers are the reproductive organ of a plant. They reproduce by pollination.

Stem: It is the supportive organ of a plant. Stem grows above the ground. It supports leaves and flowers and connects them with roots. It also transports water and nutrients.

Leaves: Leaves prepare the food that a plant needs. They use the process of photosynthesis to make food.

Roots: Roots are the hidden organ of the plants. They absorb and store water, minerals and salts from the ground.

7. How can we see the things which cannot be seen by the naked eye?
- With the use of Microscope, we can see very tiny things which are not seen able to the naked eyes. Microscope is an optical device which enlarges the image of small objects to a large size. It uses several lenses to make small things look bigger and clearer.
8. Draw a labeled diagram of microscope. Specify the functions of different parts of a microscope.
- Note :** Students will draw the diagram of microscope by themselves with the help of book

Functions of different parts of Microscope

Parts	Functions
Arm	Supports the tube and connects it with the base
Base	The bottom of the microscope, support the system
Eyepiece	Where you look to see the image of your specimen
Body tube	Connects eye piece to the objective lens
Revolving Nose Piece	It carries 3 or 4 lenses of different magnification to see the object
Stage	The place where you put your slide to see
Clips	Hold the slide in place
Fine Focus	Small knob makes fine adjustments to the focus
Coarse Focus	Large Knob focuses the specimen
Diaphragm of Iris	Controls the amount of light that strikes the slide

Write the correct answers in the blank spaces

1. Reproductive
2. Oxygen
3. Stem
4. Nucleus
5. Chlorophyll
6. Photosynthetic
7. Prokaryotic
8. Cell wall
9. Microscope
10. Magnification

Reasoning Questions

1. Cell wall is a thick wall built around the cell membrane of a plant cell.
 - Cell wall is a thick wall providing plant cell more strength. These walls are made up of cellulose. They make the plants stiff and help them in growing up straight.

2. Cells are called building blocks of being because
- Because cells are like bricks, many cells join together to make a tissue. Tissues work together to make an organ and many organs make an organ system. Organ systems make an organism. Cells are many tiny part of any living organism.
3. Animal cells are tougher
- Animal cell membrane has chemical called cholesterol. This chemical makes their cell membrane tougher.

State whether the statement is True or False.

1. False
2. True
3. False
4. True
5. True
6. True
7. True
8. False

Overview

For the chart below, place a check in the box if the cell has that component.

Organelle	Plant Cell	Animal Cell
Vacuole	Yes	No
Chloroplast	Yes	No
DNA	Yes	Yes
Mitochondria	Yes	Yes
Cell Wall	Yes	No
Cell Membrane	Yes	Yes

Chapter 2: Sense and Sense Organs

Learning Objectives:

In this lesson we will learn about

- our senses and sensory organs
- The mechanism of eyes, nose, ears, tongue and skin
- structure of these sensory organs

Teacher Starter:

You can start by letting them aware about the senses we use in our routine, you can give them suitable examples which highlights the importance of every sense in our daily life.

Let them explore their sensory organs. Let them ask something about any of the particular sense. also tell them the importance of this particular sense in their life. Make them realize how vital the senses are for the understanding of the external world. You can do that by enabling and disabling their senses one by one, ask them how they feel if they do not have any of the sensory organs? And then ensure the dignity and respect for those who are deprived of any of these senses.

Teaching:

Try to make the lesson as convenient and understandable by explaining things mention in the chapter. You may ask questions, in order to understand how much they grasp the concept of the chapter. Thoroughly explain about the five different senses (i-e sight, hear, smell, taste and touch) you can also explain how the different organs work with some labeled diagrams mentioned in the chapter, and give them what harmony these senses give to all of us, and how vital these are for our survival and wellbeing.

Exercise

Answer the following questions

1. Can you name basic senses with their related organs?
 - We have five primary sensory organs: eyes, ears, nose, tongue, and skin.
 - Through our eyes; we see things around us.
 - Through our ears; we hear sounds.
 - Through our nose; we smell things.
 - Through our tongue; we taste food.
 - Through our skin; we feel things.
2. Why these senses are important for us?
 - Our sense organs make us aware of the world around us. The power of the sense organs to detect reality is known as the human senses. We will not be able to see, hear, smell, taste or feel the world without these senses. Outer world become meaningless for us.
3. Draw a labeled diagram of a human eye and write the functions of any two parts.

Note : Students will draw the diagram of microscope by themselves with the help of book.

- **Retina**

Retina is a screen at the back of your eye. In other words, light falls on the retina to form an image of what the eye sees.

- **Optic Nerves**

Light sensitive cells present on the retina turn these light rays into electrical signals. These signals are then transmitted to the brain through the optic nerves.

4. Write a detailed account of the hearing process?

- The ear is composed of three main parts; the outer ear, the middle ear, and the inner ear. The outer ear looks like a funnel. It collects all the sound waves from the air and directs them towards the eardrum. The eardrum vibrates when sound waves strike it. This starts a chain reaction. Vibrations move from eardrum to the cochlea through the ossicle, which is a bone in the middle ear. Fluid and tiny hair-like nerve endings present in the cochlea vibrate when vibrations from ear drum strike them. Vibrations of the hair cells generate the signal and send it to the brain through the auditory nerve. The brain then makes sense of the sound and tells us what we are hearing

5. Which is the fastest and largest sensory organ of our body? Explain in detail how it works?

- Skin is the largest and the fastest-acting sensory organ. On an average, a person has nearly 1.8 m² of skin on the body. The skin has millions of different types of receptors all over it. They make us feel different things like pain, temperature, pressure and touch. Pain receptors are evenly present all over the body. They are present in skin, muscles, bones, blood vessels and some organs. They detect pain caused by burn, cut, chemicals and other material. Temperature receptors are of two types; cold and hot. They are found in the dermis and are used to detect difference in temperature. Touch and pressure receptors detect the pressure and texture of objects. They tell whether the object is soft or hard. Mostly, touch and pressure receptors are present in the skin of fingertips and tongue.

Fill in the blanks

1. Tongue
2. Sour, sweet, salty, bitter
3. Receptors
4. Stimuli

MCQs

Circle the correct answer:

1. Iris
2. Tongue
3. 7cm
4. Dead cells
5. Hearing

State whether True or False

1. True
2. True
3. False
4. True
5. False
6. False

Activity

- Note: Help students in this regard. And also push them to do this activity by themselves)

Reasoning Questions

1. Skin is the largest and fastest sensory organ. How?
 - Your epidermis is the top part of your skin, and your skin is your body's largest and fastest-growing organ. Skin is your body's coat. It protects you. It helps you stay warm when it's cold, and cool when it's hot.
2. How our tongues recognize different tastes? Support your answer with examples.
 - This is because the taste buds can only detect flavor when food is properly mixed with saliva. Glossodynia, a condition characterized by a burning sensation on the tongue, is also linked to loss of taste in some cases.
3. Semicircular canals present near the top of cochlea are there for balance. Which balance and why?
 - Semicircular canals present near the top of cochlea to help you keep your balance. These canals are filled with fluid, when you move your head the fluid inside the canal also moves. Movement of the fluid causes sensory cells to bend. This produces an electrical signal which tells the brain that the body is moving. The brain sends signals to your muscles so that they help to ensure balance regardless of the position of your body.
4. Why some people cannot see properly? Elaborate with examples.
 - In some people's eyes, the lens cannot focus light properly onto the retina. It could be because their lens controlling muscles are weak or the lens has become misshapen due to some reason. When light does not fall properly onto the retina, they see a blurred image.
5. Senses enable us to survive in this challenging world. Give reasons to support your answer.
 - You have 5 senses: sight, smell, sound, taste and touch. Each one of them is really important in your everyday life. Your senses work together to let your brain know what is going on around you. They help to keep you safe by warning you of any danger.

Chapter 3: Photosynthesis and Respiration in Plants

Learning Objectives

In this lesson we will learn about

- Photosynthesis
- Respiration
- Factors affecting Respiration
- Factors affecting Photosynthesis
- Structure of leaves and Plants

Teacher Starter

You can start by letting them aware about food, ask them how they eat food and how it is being made? wait for their replies, enlighten them about importance of food for living beings. Also broaden their scope by asking them about the plants, and tell them how plants make their food, and then its easy for you to start the topic of photosynthesis.

Teaching

Try to make the lesson as convenient and understandable by explaining things mention in the chapter. You may ask questions, in order to understand how much they grasp the concept of the chapter. Tell the students how food is being made in plants (i-e photosynthesis), the importance of leaves in making food for plants, also highlight other factors such as sunlight, carbon dioxide and water. Let them understand how photosynthesis enables the plant to make sugars. These sugars are then used by plants and other living beings. Enlighten the students about how vital the Sun is for living beings in order to take survive and thrive and the main source of energy for life.

Exercise

Answer the following questions

1. What do you know about photosynthesis?
 - The word photosynthesis is a mash up of two Greek words; 'photo' and 'synthesis.' Photo means light and synthesis means putting together. Collectively it means putting together things using light. Photosynthesis is the process by which plants capture sunlight, which they use to change carbon dioxide and water into glucose. In other words, photosynthesis is the conversion of light energy into chemical energy.
2. Write about the parts of plant which take part in making food.
 - **Xylem and Phloem**
They take in water and minerals from the ground through the roots and transport to the whole plant, including the leaves.

Stomata

Leaves take in carbon dioxide from the air through the tiny pores. These pores are called stomata (singular: 'stoma'). They are like doors for the gases, as carbon dioxide and oxygen move in and out of the leaves through them.



Chloroplast

Inside leaf cells there is a structure called chloroplast. This contains green chemical called chlorophyll.

3. What are the factors which affect the process of photosynthesis?

- Main factors that affect the process of photosynthesis are water, light, concentration of carbon dioxide and temperature.

Water

Water scarcity decreases the rate of photosynthesis.

Light

The rate of photosynthesis increases when light gets brighter.

Temperature

Photosynthesis is a chemical reaction and most chemical reactions speed up when temperature is high.

Carbon dioxide

Carbon dioxide is used to make glucose in the photosynthesis reaction. Increase in the concentration of carbon dioxide speeds up the process of photosynthesis.

4. What is respiration and what is its importance?

Respiration

Respiration is the opposite of photosynthesis. It involves taking in oxygen from the air and releasing carbon dioxide into it. Plants use respiration to convert nutrients obtained from soil into energy. This energy powers their cellular activities. The only exchange of gases between the plant and the atmosphere is the effect of the respiration - oxygen taken in and carbon dioxide given out.

Important features of respiration

- Burns sugar for energy
- Energy is released
- Occurs in most cells
- Oxygen is used
- Water is produced
- Carbon dioxide is produced
- Occurs both in dark and light

5. Why photosynthesis is important for the plant?

- Photosynthesis is the basis of all life – it is so important for life on Earth that most living beings including humans cannot survive without it. Photosynthesis is the basis of food chain. If plants do not do the process of photosynthesis, whole life on earth, including plants will die.

6. Write some differences between photosynthesis and respiration.

Photosynthesis	Respiration
Produces sugar from energy	Burns sugar for energy
Energy is stored	Energy is released
Occurs only in cells with chloroplasts	Occurs in most cells
Oxygen is produced	Oxygen is used
Water is used	Water is produced
Carbon dioxide is used	Carbon dioxide is produced
Requires light	Occurs both in dark and light

Fill in the blanks:

1. Herbivores and Omnivores animals gain their energy from eating plants.
2. The word photosynthesis is a mash up of two Greek words photo and synthesis.
3. Respiration is the opposite of photosynthesis.
4. Plants can do photosynthesis only when they have sun light.
5. A leaf is made up of three layers.

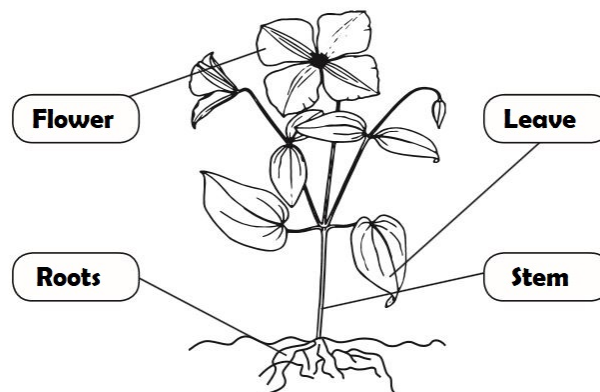
MCQs

Circle the correct answer

1. b) Bryophyllum
2. b) glucose and oxygen
3. c) in visible obtained from any source
4. d) 13
5. d) it is building up process
6. b) photosynthesis
7. b) respiration
8. a) plant

Label the picture

Label the picture and show the process of photosynthesis.



Chapter 4: The Environment and its Interaction

Learning Objectives

In this lesson we will learn about

- environment and its interaction
- the components of environment
- biotic and abiotic factors
- components of biotic factor i.e. producer, consumer and decomposer
- the food chain and its importance to carry lives
- the components of abiotic factors
- Interaction of different Organisms
- the ecosystem

Teacher Starter

You may start the lesson by asking children where they live and with whom they live. Upon the answers of children, ask them how many non-living components surrounds them. What is their routine interaction with these non-living components?

Then enlighten them about the environment and its features, also give an idea how important an environment is,

Letting them tell you what they think about food chain. Brief them how the food chain keeps the balance.

By giving some examples, give them a basic idea of environmental features for different animals. Give them the concept of a habitat, develop their understanding that animals and human need certain environmental features or habitat to live. Discuss the various types of habitat, components of habitat, and adaptations in class.

Teaching

Thoroughly read the chapter in the class and make it as understandable and convenient for the kids to understand well. Ask different questions during or by the end of the topic in order to ensure that each and every concept should be clear to the students. Emphasize more on environment, food chain and habitats and adaptations. Tell students about habitat, its types, and its components. Point to the pictures given in the unit.

Exercise

Answer the following questions

1. What is environment? Elaborate your answer with examples.
 - The environment consists of everything around us: Air, water, soil, trees, flowers, insects, birds, animals, fishes and people. People like mothers, fathers, siblings, and friends are all part of the environment. So are all the pet and farm animals. The green grass below and the fluffy clouds above all make the environment.

2. How can we divide environment? Write in detail about all the spheres of the environment.
 - The environment is divided into four components called spheres. Each sphere is named after its defining physical feature. These spheres are:
 - Atmosphere** - Made of all of Earth's gases
 - Lithosphere** - Made up of all of Earth's solid material like stones, soil etc.
 - Hydrosphere** - Made up of all the water on Earth.
 - Biosphere** - Made up of all the living beings present on Earth.There is another way of dividing environment, and that is between non-living and living things. It is called abiotic and biotic environments.
3. What are biotic factors? Explain.
 - All living things present in an environment are called biotic factors. Plants, animals, humans, bacteria, fungi and more are biotic factors. Biotic Factors are divided into three different components: Producers, Consumers, and Decomposers
 - Producers** are organisms that produce their food by photosynthesis. They are also known as autotrophs.
 - Consumers** cannot make their food; therefore depend upon producers for sustenance.
 - Decomposers** break down complex dead material (such as fallen tree, dead animals, etc.), returning the nutrients to the soil.
4. What do you understand by the terms carnivores and herbivores? Give examples.
 - **Herbivores**
Consumers that eat plants directly are called herbivores. They are also known as primary consumers. This includes rabbit, deer, horses, pandas, elephants, etc. These consumers only eat plants.
 - Carnivores**
Consumers that indirectly depend on producers are called carnivores. A rabbit eats a plant, and a wolf eats a rabbit. The wolf is a carnivore or a secondary consumer.
5. Write a note about ecosystem?
 - An ecosystem refers to the interactions of organisms with one another and their environment in which they live. Every living being present in a given area, interacting with each other and also with their non-living environment like atmosphere, soil, temperature, the sun, etc. makes up an ecosystem.
In an ecosystem, every organism has its part to play. As an example, consider a small puddle. In it, you may find every living thing from microorganisms to insects and plants. These may depend upon nonliving things like sun, water, temperature and nutrients in water for their life.

6. What are the differences between a tropical forest and a desert?

Desert	Tropical Rain Forest
Little rainfall. They receive from 0.5 centimetre to 25 centimetres of rain in a year	High rainfall. They receive 150 to 400 centimetres of rain annually
Less than 5000 species of plants are found in the desert	Plants of all kind are present, including almost 12,000 species of trees and flowering plants
A few animals, mostly those who are active at night and rest under shelters during daytime	Warm temperature and plenty of rain make rainforests an ideal place for animals to live
Very high temperature during the day but cold at night	Warm temperature all the time
Sources of water are very few and may be 150 km apart	They have many streams and rivers

MCQs

Circle the correct answer

1. c) Prey
2. a) Survive
3. b) Physical environment
4. c) Ecosystem
5. d) All of them
6. d) Detritivores

Fill in the blanks

1. Deserts are areas that receive an annual rainfall of less than 25 centimetres.
2. Competition is an interesting type of interaction between organisms.
3. The organism that hunts is called the predators.
4. Temperature affects the growth rates, size, and colouring of different animals and plants.
5. Desert and tropical rain-forest are two examples of different environments.
6. Oxygen is the most important abiotic factor.

Give Reasons

1. Plants and animals depend on each other.
 - Plants provide shelter for animals and they make oxygen for the animals to live. When animals die they decompose and become natural fertilizer for plants. Plants depend on animals for nutrients, pollination and seed dispersal. Plants are also useful for animals' home because many animals live around plants
2. Different living things need different habitats.
 - A habitat is a place where living things live and how they survive in that area. Animals have basic needs for air, water, food, shelter, and space. Plants, animals, and even humans

choose habitats for many different reasons, depending on their needs. Animals live in habitats all over that are suited for them.

State whether True or False

1. True
2. True
3. True
4. False
5. True

Label the picture

- Do as directed

Chapter 5: Atoms, Molecules, Mixtures and Compound

Learning Objectives:

In this lesson we will learn about

- Atoms and molecules
- mixtures and compounds
- elements and their symbols
- brief introduction of Periodic Table
- the Metals and Non-Metals
- methods of separating mixtures (i-e filtration and distillation)

Teacher Starter

Start by bringing some elements mixtures and compounds into the class room. Place various elements around the classroom e.g. iron, carbon, some day to day things of use, like needles, pin paper.

Ask students to record their appearance and state of matter. Give them a brief concept of these elements, enlighten their physical properties, such as their state etc. help them in order to locate their place in the periodic table. You can also help them to link their position on the periodic table and their physical properties,

Help them understanding, where metals and non-metals lies in the periodic table? Where are shiny things located? they will enjoy this more than you might think!

Teaching

Start by reading the chapter and make the chapter understandable and convenient by explaining things mention in the chapter. You may ask questions, in order to understand how much they grasp the concept of the chapter.

Tell the students about atoms, molecules, mixture and compounds, also describe the differences between them. Link the similarities of atom with cells. Make a short practical in the class room to make salt and sugar solution. You can also describe the filtration process by



separate sand and water in the class room or in the school lab. Point to the picture given in the chapter; tell them about importance of chemicals in our daily life.

Exercise

Answer the following questions

1. Define the terms Atom, Molecule, Mixtures.

- **Atom**

All the matter present in the universe is made up of tiny particles called 'atoms.' Atom is a Greek word which means 'indivisible' something that cannot be further divide. Atom is the smallest particle of an element that can exist. Atoms are the building blocks of everything. Atoms are so small that millions of them can fit on the tip of a needle.

- **Molecule**

When two or more atoms join, they form a molecule. Atoms are like the blocks and bricks and molecules are the stuff that we built from these blocks and bricks.

- **Mixture**

A mixture is a combination of two or more substances which are not chemically same and do not chemically react together. A mixture has the same properties as that of its components and can be separated.

2. What do you understand by the term Element? Explain with examples.

- Atoms of the same type combine to form an element. For example, if a small white ball is an atom than many balls of the same size, shape and colour put together form an element. Elements are the simplest pure substance. A pure substance is something that contains only one type of particle. Scientists have discovered over a hundred elements. Carbon, hydrogen, oxygen, sulphur, lead, gold and nitrogen are all elements.

3. Why the elements are represented by symbols? Write the symbols of any ten elements of your choice.

- Scientists gave each element a particular name and a letter symbol to represent it. These are a quick way of representing elements. Every element has a unique chemical symbol.

Symbols of some elements are:

Elements	Symbols
Oxygen	O
Nitrogen	N
Hydrogen	H
Iodine	I
Copper	Cu
Magnesium	Mg
Iron	Fe
Potassium	K
Aluminium	Al
Chlorine	Cl

4. How can we divide the elements? Write the differences between metal and non-metal elements?
- The elements found on Earth are classified into metals (iron, magnesium, copper, lead, titanium and gold) and non-metals (sulphur, iodine, sodium, hydrogen, chlorine). Let's study the major differences between the metal and non-metal elements.

Metal	Non-Metal
They are hard and strong	They are weak and brittle
They are shiny	They are dull
They are good conductors of heat and electricity	They are bad conductors of heat and electricity
They have high melting and boiling point	They have low melting and boiling point
They are solid at room temperature except for mercury which is a liquid	They may be liquid, solid or gas at room temperature
They have a high density	They have a low density
They are malleable and can be bent without breaking	They are not malleable
They can be drawn into wires	They cannot be drawn into wires
They make a sharp sound when they are hit by something	They do not make a sharp sound when they are hit

5. Write the names of five elements and their uses.

- Oxygen**

Oxygen is one of the most important elements on Earth. Almost all living things need it to survive. Plants use it during photosynthesis. In industries, oxygen is used to manufacture steel and plastic. Liquid oxygen is combined with liquid hydrogen to make rocket fuel. It is used in hospitals to help sick people breathe. It is also used in water filtration plants.

- Carbon**

Carbon is the element of life. It's a non-metallic solid. Carbon can combine with other carbon atoms and other substances to form an infinite number of compounds. Carbon black is a fine powder used in making inks and rubber products like car tyres. Carbon as graphite is used in pencils. Activated charcoal, which is a form of treated coal, is used for filtration.

- Hydrogen**

Hydrogen is the lightest, simplest and most common element found on Earth. It is used for the production of vegetable oil, butter, and margarine. It is used to make many important chemical compounds like ammonia, hydrochloric acid, and hydrogen peroxide. It is also used to make fertilizers.

- Copper**

Copper is an orange coloured metal and is not very reactive. Copper is mostly used in making electrical wires and cables because of its high electrical conductivity, corrosion resistance, and ductility. It is used in TV, radio, industrial machinery and in making coins.

Chlorine

Chlorine is a water soluble gas. It is used in the water purification process as an anti-bacterial agent. It is also used to manufacture important chemical compounds like hydrochloric acid. Chlorine is also used in dyes and paints. Polyvinyl chloride (PVC) is a plastic synthesized by chlorine.

6. What is meant by mixture? Support your answer with examples.
- A mixture is a combination of two or more substances which are not chemically the same and do not chemically react together. A mixture has the same properties as that of its components and can be separated.

Mixtures are always around us, whether we are at home or outside. They are an essential part of our lives. Few most common examples of mixtures are Ocean Water, Air, Cement, Milk and Petrol.

MCQs**Circle the correct answer**

1. Compound
2. Sugar
3. Hydrogen
4. Element
5. Sodium
6. Water
7. Carbon
8. An Element
9. Mg
10. A compound
11. A Mixture

Give the reasons

1. Atoms are like blocks and bricks because
 - All the matter present in the universe is made up of tiny particles called 'atoms.' Atom is a Greek word which means 'indivisible' something that cannot be further divide. Atom is the smallest particle of an element that can exist.
2. A mixture has the same properties as that of its components and can be separated
 - A mixture is a combination of two or more substances which are not chemically same and do not chemically react together. That is why a mixture has the same properties as that of its components and can be separated.

Fill in the blanks

1. Some solid substances change their state directly from solid to gas state on heating.
2. When two or more atoms join, they form a molecule.
7. Hydrogen is the lightest, simplest and most common element found on Earth's surface.
8. Brass is an alloy of elements Copper and Zinc.
9. A pure substance is something that contains only one type of particle.



10. There is a special kind of microscope to see atoms. It is called electron microscope.
11. Gold is used to make jewelry and other high-value objects.

State whether True or False

1. True
2. False
3. True
4. True
5. True

Which process is shown in the picture? Write its steps in your journal.**• First Picture: Filtration**

Pour the mixture of solid and liquid into a filter paper held in a funnel. Filter paper has small pores and acts like a sieve. It stops the large particle of solid from passing through the pores which are left as the residue while the liquid is collected as the filtrate.

• Second Picture: Distillation

To obtain pure water from a salt solution: The mixture of liquid is heated until the water starts boiling and then evaporates. Water vapours are then cooled and condensed inside the condenser to form a pure liquid.

Write which one is an atom, a compound, an element and a mixture?

- (a) Compound
- (b) Compound
- (c) Element (it could be a form of Mixture too)
- (d) Mixture

Chapter 6: All about Air

Learning Objectives

In this lesson we will learn about

- the air
- the composition of air i.e. gasses
- the properties of air
- discuss photosynthesis and respiration (chemically)
- most prominent gasses of our world
- discuss about greenhouse gases



Teacher Starter

Start by asking children to imagine a world without air? Tell them that air is the mixture of different gases. Give them an understanding how different gases present in the air are important to our life.

Ask them about oxygen and carbon dioxide. Tell them how vital oxygen is for living by giving any suitable example where they observe difficulty when there is little oxygen, Ask them what would happen if there is no oxygen left?

Teaching

Start with reading of chapter and translate them in what language they can understand well. Later on ask each and every student to read the chapter and understand carefully. Make sure that each and every concept should be clear to all students. Tell your students about importance of atmosphere and air. Teacher should have strongly emphasis on the importance of oxygen in respect to life on earth. Point to the picture given in the chapter; tell them about importance of other gasses. Also describe about greenhouse and its usefulness.

Exercise**Answer the following questions**

1. What do you know about air?

- Air is like a blanket that covers Earth in a layer over 600 km thick. Air is made up of approximately 78 percent nitrogen and 21 percent oxygen. Air also has a small amount of other gases such as carbon dioxide, neon, hydrogen, argon and other noble gases.

2. Write down the properties of air with a little description of each.

- Even though the air is invisible, it takes up space and has weight. Air has three main properties.
 - Air has weight
 - Air exerts pressure
 - Air occupies space

Air has weight

We cannot put air on a weighing scale to measure how much it weighs, but we can conduct an experiment to see if air has weight.

Air exerts pressure

Since air has weight, it also exerts pressure. It exerts pressure of 1 kg per square centimeter.

Air occupies space

A deflated balloon occupies less space, but if we fill it with air, it will occupy more space. This proves that air occupies space.

3. Why do the life processes need air? Elaborate.

- Air is required for several processes to take place like respiration, photosynthesis in plants, rusting of metals and combustion.

Respiration

All living organisms undertake the process of respiration to produce energy for their survival. Respiration uses oxygen and food to release energy. Then it removes the waste products, carbon dioxide and water, from the body.

Photosynthesis

It is the process through which plants produce their foods.

Rusting of Metals

Rusting is a process in which metals react with aerial oxygen in the presence of water and form a layer of oxide on their surface.

Combustion

Combustion is the process of burning in the presence of oxygen. Combustion always gives off light and heat energy.

4. Which gas do we need to live? Write how air provides us with this gas.
 - Oxygen is essential for life. It is the most abundant element on earth. It forms 21% of the atmosphere and 50% of the mass of the Earth's crust. The ozone layer surrounding our planet Earth is made up of 3 oxygen atoms. It is needed in many life processes like respiration, photosynthesis, combustion and rusting etc.
5. What is the role of Nitrogen in our life?
 - Nitrogen is used in the industrial manufacturing of ammonia, which is an important material for the manufacturing of nitric acid, fertilizers, and explosives. Liquid nitrogen is used as a coolant. Nitrogen gas is used to provide inert or non-reactive atmosphere to prevent bacterial growth. It is used in the packaging of food products like tin food, chips, and vegetables to avoid spoilage.
6. What is a greenhouse and how it works?
 - Greenhouses are used in winter by some gardening fans. They are small, glass rooms which are used to grow fruits and flowers in winter, even when it is too cold for plants to survive. When sunlight passes through the glass walls and ceiling of the greenhouse, it heats up the plants and the soil. Since glass is a bad conductor of heat, it prevents much of the heat from leaving; this keeps the greenhouse warm.

MCQs**Circle the correct answer**

- | | |
|-------------------|-------------|
| 1. Carbon dioxide | 5. Hydrogen |
| 2. Nitrogen | 6. Oxygen |
| 3. Air | 7. Oxygen |
| 4. Mixture | 8. Ozone |

Fill in the blanks

1. Air has no color and one can see through it. It is transparent.
2. Air is really not one substance but a mixture.
3. Air contains gas particles.



4. The component of air that supports burning is called oxygen.
5. The oxygen helps in breaking down the digested food in the body to release the energy.
6. Our Earth is surrounded by Ozone layer.
7. Nitrogen in the air is used on a large scale to manufacture ammonia.
8. Atmospheric air is used in tyres of vehicles.
9. Atmosphere is the place in nature for gaseous exchange.

State whether “True” or “False.”

- | | |
|----------|-----------|
| 1. True | 7. False |
| 2. True | 8. True |
| 3. True | 9. False |
| 4. False | 10. True |
| 5. True | 11. True |
| 6. True | 12. False |

Chapter 7: Solutions and Suspensions

Learning Objectives

In this lesson we will learn about

- Solutions and suspensions
- the saturated, unsaturated and supersaturated solutions
- solubility and its factors
- Later on we will study about water as a universal solvent
- We also differentiate between solute, solvent and solution in this chapter

Teacher Starter

Start by asking children what they know about solution as we have discussed in earlier chapters? Tell them the importance of solutions in our daily life. Also ask them how they differentiate solution and suspension, any idea? Ask them that ever they experience to add something in water if yes so how the experience was and what they got? Ask them what will they do if there is no water left? How they manage their daily life?

Teaching

Start with reading of chapter and translate them in what language they can understand well. Later on ask each and every student to read the chapter and understand carefully. Make sure that each and every concept should be clear to all students. Tell your students about solutions and suspensions. Recall the chapter of mixture and compound what they discussed earlier. Differentiate the difference between solute, solvent and solution. Point to the picture given in the chapter. Briefly discuss water as universal solvent.

Exercise**Answer the following questions**

- What do you understand by the term “solution”?
 - A combination of two or more substances in which one substance is dissolved into another is called a solution. For instance, if you mix salt in water you can make a salt solution.
- Define these terms: a) aqueous b) dilute c) concentrated solutions

- Aqueous**

When a solute is dissolved in water, the solution formed is called aqueous solution. The symbol (aq) is used with the chemical formula. Rooh Afza, Tang, Limo Pani, sugar in water, carbon dioxide in water all are examples of aqueous solution.

- Dilute Solution**

Dilute solution contains higher concentration of solvent than the solute. A solution made in any solvent can be a dilute solution. Tap water is an example of dilute solution.

- Concentrated Solution**

Concentrated solution is the opposite of dilute solution. It contains higher concentration of solute than the solvent. Soft drinks, syrups, dish soaps are all concentrated solutions.

- Write the difference between saturated and unsaturated solutions.

Saturated Solution	Unsaturated Solution
A saturated solution cannot dissolve any more of the solute and adding more solute results in undissolved particle of solute at the bottom	A solution is unsaturated if it is capable of dissolving more solute: You can keep adding solute to it and it retains its ability to make that solute dissolve.

- Why water is called the universal solvent? Support your answer with examples.
 - Water is called the ‘universal solvent’ because it is capable of dissolving more chemical substances than any other solvent. Due to its polarity and tendency to form hydrogen bond, water makes an excellent solvent, meaning that it can dissolve much different kind of molecules.

Other properties that make water a universal solvent are;

- It is easy to find.
- It’s a cheap solvent to work with.
- It is nontoxic and is eco-friendly.
- It’s a stable molecule; it does not burn or combust readily.

We use water to cook food, dissolve sugar, spices and salts. We use it to make tea. Water is also used for washing clothes as it can dissolve detergents. Water is also used in all industries, to make food, fabric, medicine, detergents, drinks, juices cement, concrete, etc.

- Which factors affect the solubility of a solvent?
 - The ability of a substance to dissolve is called its solubility. There are several factors that affect solubility:

Temperature

If the solute is solid, increasing the temperature will increase its solubility. But if the solute is gas then increasing the temperature will drive gases out of the solution.

Pressure

The solubility of solids and liquids does not change by changing the pressure. But increased pressure increases the solubility of gases.

Movement

Stirring the solution facilitates the dissolution or solubility of a substance.

Surface Area

Larger surface area helps increase the solubility of solids into liquids. Surface area is increased by breaking down a solid into smaller pieces.

6. What is the difference between solution and suspension?

Solution	Suspension
Solutions are homogeneous or uniform mixtures of solute and solvents	A suspension is formed when water is mixed with some non-dissolved material
Solution is stable	Suspension is not stable
The solute and solvent do not change or separate due to gravity.	The mixture separates on standing
The solute particles are so tiny that they cannot be separated by filtration	Components of suspension can be separated by filtration
Solute and solvent particles cannot be seen in a solution	The undissolved material either sink to the bottom of the container or float on the surface of water

MCQs**Circle the correct answer**

1. Distillation
2. Due to its polarity and small molecular size
3. Solute
4. A saturated solution
5. Water and sugar
6. Homogeneous solution
7. Brass
8. Picture B

Give Reasons

1. Water is a universal solutions
 - Water is called the 'universal solvent' because it is capable of dissolving more chemical substances than any other solvent. Due to its polarity and tendency to form hydrogen bond, water makes an excellent solvent, meaning that it can dissolve much different kind of molecules.

Other properties that make water a universal solvent are;

- It is easy to find.
- It's a cheap solvent to work with.
- It is nontoxic and is eco-friendly.
- It's a stable molecule; it does not burn or combust readily.

We use water to cook food, dissolve sugar, spices and salts. We use it to make tea. Water is also used for washing clothes as it can dissolve detergents. Water is also used in all industries, to make food, fabric, medicine, detergents, drinks, juices cement, concrete, etc.

2. Temperature increases the saturation

- If you increase the temperature the undissolved solute at the bottom will dissolve. Temperature increases movement and energy of the particles of solvent which increases its capability to dissolve more solute, means it increases its solubility. You can then add more solute until the solution becomes saturated at that temperature. The solution has become supersaturated.

Fill in the blanks

1. Suspension
2. Gaseous Solution
3. Non-aqueous solution
4. Suspensions
5. Solubility
6. Unsaturated
7. Pollutants
8. Dilute solution

State whether True or False

1. True
2. False
3. True
4. False
5. True
6. True
7. True

A) Write the procedure of making a solution

- Take a beaker with water
- Dissolve sufficient amount of sand (solute) in the beaker with water (solvent)
- A solution of sand water is ready.
- It is basically a mixture of sand and water

B) Write the steps of filtration with the help of the picture

- Take an empty beaker
- Put filter funnel on it with the filter paper
- Pour sand water mixture
- Sand in the form of residue will remain on filter paper and water will separate in the filtrate form in beaker



Chapter 8: Energy

Learning Objectives

In this lesson we will discuss about

- Energy
- Different forms of energy
- renewable and non-renewable energy sources
- effects of renewable , non-renewable energy sources on Earth

Teacher Starter

With an introduction to the ideas of energy, you can start a discussion on specific energy types and practical energy sources. Help them identify energy types in their surroundings and enhance their understanding of the concept of energy. Also discuss how energy is so important for us, enlighten them about the importance of energy in our everyday life.

Teaching

Start with reading of chapter and translate them in what language they can understand well. Later on ask each and every student to read the chapter and understand carefully. Make sure that each and every concept should be clear to all students. Tell your students about the energy and its conversion. Point to the picture given in the chapter. Tell them about the energy resources and its importance. After that ask them count energy resources around them.

Exercise

Answer the following questions:

1. What is energy and what is its importance?
 - Energy is the ability to do work. It is anything that helps to carry out an action or maintain a process. We need energy for everything we do. When you eat food, your body digests that food and gives you the energy to do work and play.
2. How many types of energy are there? List them and write in detail about any two with pictures.
 - There are many types of energy. Names of them are below
 - Kinetic Energy
 - Potential Energy
 - Heat Energy
 - Electric Energy
 - Light Energy
 - Sound Energy

Kinetic Energy

Kinetic energy acquired by an object due to its motion. Since it is moving, therefore, it has kinetic form of energy. Kinetic energy depends upon two things, the mass of an object and its velocity. Greater object have greater kinetic energy due to its greater mass. Kinetic energy increases exponentially when the velocity of an object is increased.

Example: at same speed, cricket ball hit more than table tennis ball because of its greater mass but if you increase the speed the speed of tennis ball, it will hit more because of its increased velocity.

Key Feature of Kinetic Energy

- It is the energy possessed by a moving object.
- It depends upon the state of other objects in its surrounding.
- It can be transferred between objects by a collision.
- It depends on the mass and velocity of the object.

Potential Energy

An object can acquire energy and store it as the result of a change in its position. This energy, which is due to its relative position to other objects is called Potential energy.

When you pull sling of a slingshot, it acquires potential energy due to your pulling action. When you release the sling the potential energy is converted to kinetic energy as it is transferred to the pebble, giving motion to the pebble. Potential energy is converted to kinetic energy the moment an object starts moving. A moving object has no potential energy. Since the pebble is moving, this shows its potential energy has converted to kinetic energy

Key Features of Potential Energy

- If an object is at rest and is not doing anything, then it has potential energy.
- It is independent of its surrounding.
- It cannot be transferred.
- It depends on the mass and height of the object. Higher you move the object, higher potential energy it will store.

3. What is the ultimate source of energy? Elaborate.

- Sun is the ultimate source of energy on earth. Sun is a star present in the of our solar system that provides us with light and heat energy. Sun is the mandatory component in the earth's climate system. Without the sun, Earth would be a dark, frozen world with no life.

4. How many energy resources are there? Write the function of water as a source of energy.

There are seven popular energy resources. Name of them are:

1. Energy from the Sun
2. Energy from the Water
3. Energy from the Wind
4. Energy from the Waves
5. Energy from the Living things (biomass)
6. Energy from the Earth (Geothermal energy)
7. Nuclear Energy

Energy from the Water

Flowing and falling water has a lot of energy. Hydroelectric power plants built on dams and rivers use this water energy to turn turbine which generates electricity.

5. What is meant by renewable and non-renewable sources energy? Write in detail.

- **Renewable Resources**

Renewable energy resources like sun, wind, waves and the heat of Earth are resources that cannot run out. They can be used forever. They are clean as they do not produce pollution. Their only disadvantage is that they are not concentrated source and can only be used in certain places where the conditions are suitable.

- **Non-Renewable Resources**

Most of the energy we use comes from fossil fuels like coal, petroleum, oil and Natural gas. They are called non-renewable resources because you cannot make any more of them and they will eventually run out. Around 80% of world's energy is generated from burning fossil fuel. The advantage of using fossil fuel to produce energy is that it can be used anywhere and it has a lot of chemical energy stored in it. The main disadvantage of burning fossil fuel is that it produces greenhouse gases like methane and carbon dioxide which cause global warming.

Reasoning Questioning

1. Energy has to be converted from one form to another.
 - Energy cannot be created nor can it be destroyed. It simply changes from one form to other or moves from one place to another. When you use energy, it does not disappear. It just converts into some other form. Energy has to be converted or changed from one form to another to make things happen. Everything we do needs some energy conversion.
2. The most useful energy is electrical energy.
 - Electrical energy is generated when these electrons are made to move from one atom to the other. The movement of electrons through a wire from a power plant to homes and factories is called current or electricity. The faster current moves, the higher its power is. Electricity or electrical energy is the most useful form of energy compared to all other forms of energy. It can be converted into any other form of energy quickly and cheaply. Electrical energy has become an essential part of our lives.

MCQs

Circle the correct answer

1. Fossil fuel
2. Sun
3. Methane
4. Space heating in buildings
5. Sun can be taken as an in-exhaustible source of energy
6. Potential energy possessed by stored water is converted into electricity
7. Sun
8. Thermal energy

Fill in the blanks

1. Coal and petrol have energy stored in them. They are called potential energy.
2. The source of energy in a car is fossil fuel.

3. Around 80% of world's energy is generated from burning fossil fuel.
4. Energy converters are devices that can change the forms of energy.
5. The main disadvantage of burning fossil fuel is that it produces green house gases.
6. Sound energy is produced by vibrations.
7. Kinetic energy depends upon two things, the mass of an object and its velocity.
8. Plants convert light energy into chemical energy when they prepare their food by photosynthesis.

Name the following:

1. Heat energy
2. Light energy
3. Electrical energy
4. Solar energy

Worksheet on different types of energy

Energy Source	Source always available	Good Points	Bad Points	When/where is the source worth exploiting?
Solar	Yes	Renewable and available almost everywhere	Required high investment on installation	When sun is readily available
Wind	Yes	Renewable and available almost everywhere	Needs lot of land space. Make land useless for other purposes	When readily available and plain areas
Wave	No	Renewable	Not useful if air is not blowing	In coastal areas
Biomass	Yes	Lots of energy, cheap investment	Pollution, deforestation	where animals are domesticated and farmed
Geothermal	No	Cheap investment	Limited availability	In volcanic areas
Hydropower	No	Cheap source	Environmental hazards	In riverine areas
Coal	No	Cheap investment	Pollution, green house effect, global warming, climate change	When it is cheap to exploit
Oil	No	Easily available in market	Pollution, green house effect, global warming, climate change	In oil rich areas
Natural Gas	No	Cheap source of energy	Pollution, green house effect, global warming, climate change	In gas rich areas
Nuclear Power	No	One time investment with high yield	Radiation hazards	When technology and initial investment is available

Chapter 9: Forces and Machines

Learning Objectives

In this chapter we will learn about

- Force, Machines
- how force works
- different types of machines and their specifications
- gear system and its functioning
- how machines make the work easier

Teacher Starter

Start by asking children how can they imagine a world without machine? Tell them the importance of machines in our everyday life. Also ask them what they know about the machines in general and what around them? Ask students to make a list of simple machines what they use in their homes. Ask them that ever they experience to do something hard manually? Ask them what will they do if there will be no machines in the world? Conclude all the answer in a leading way to the chapter.

Teaching

Start with reading of chapter and translate them in what language they can understand well. Later on ask each and every student to read the chapter and understand carefully. Make sure that each and every concept should be clear to all students. Tell your students about forces and machines and its different types with specifically working style. Point to the picture given in the chapter; tell them about importance of machines in our daily and productive life. Teacher should also do a great emphasis on the usage of machine in industrial sector.

Exercise

Answer the following questions

1. What is a force and explain how it works?

- In physics, a force is any interaction that, when unopposed, will change the motion of an object. A force can cause an object with mass to change its velocity (which includes to begin moving from a state of rest), i.e., to accelerate. Force can also be described intuitively as a push or a pull.

Force can move an object, change its shape, stop a moving object, or change its speed and direction. Pushing the shopping cart, lifting weights at the gym, eating, standing and many other things involve the use of force.

2. What are machines? Give names of some simple machines and draw their pictures.

- Anything that makes work easier is a machine. Machine reduces the amount of energy, power and the time we need for getting something done. Machines come in different shapes, forms and sizes. Some machines are very simple while others are complex. There are six different types of simple machines that we use every day lever, ramp, wedge, screw, pulley, wheel, and axle.

3. Write a few lines about: a) Pulley b) Axle c) Wheel

Pulley

A pulley is a machine that consists of a wheel, and a rope stretched across it. Often, there is a groove in the wheel in which the rope fits in. One end of the rope is wrapped around the load, and the other end of the rope is where you apply the force. Pulleys can be used to lift heavy load and change the direction of the force you are using. There are three types of pulleys: Fixed pulley, Movable pulley and Combined pulley.

- **Fixed Pulley:** The simplest of pulleys are called fixed pulleys.
- **Movable Pulley:** It is called a movable pulley because it moves with the load.
- **Combined Pulley:** This type of pulley is the combination of both fixed and moveable pulley. It is also called a compound pulley.

Wheel and Axle

Wheel and axle is a simple machine that is used to make an object mobile. It consists of a wheel and a rod in the middle called axle. Wheels roll or turn on the axles and the axles move with it. They work together to help move heavy objects. Using wheel reduces the friction between the load and the ground.

4. Give some information about gears.

- Gears are another important simple machine. Gears are wheels that have teethes or cogs around the edges. The cogs of one gear fit into the cogs of the other gear. Since moving big gear slowly takes less energy than moving small gear quickly, gears save you energy and make work easier.

Types of Gears

Gears are of many types. They are used in different machines for various purposes. We see many objects every day that uses a gear system. Below are given some major ones.

- Super Gears
- Bevel Gears
- Worm Gears
- Rack and Pinion Gears

5. Name some complex machines. Write about any two of them.

- A crane is a complex machine which uses multiple simple machines to make the job easier. Tower cranes and derrick cranes are two different designs of the cranes.

Tower Crane

Tower crane has three basic parts; a base made of concrete to support the tower structure of the crane, a tower which gives the crane its height, a slewing unit at the top of the tower. The slewing unit has a long working arm that carries the load, a short machinery arm which contains the crane's motor, counterweights made of concrete, and a cabin for crane's operator. Counterweights are present to provide balance while lifting a load.

Derrick Crane

Derrick Crane is usually a fixed crane. It is assembled and disassembled at the location where it is used. It is characterized by its long, fixed length tower. These cranes are typically used on shipping platforms and construction sites. Crane is brought to the top of the

building and assembled on the roof. In shipping use, the crane remains in a fixed position on the platform.

MCQs

Circle the correct answer

1. Force
2. Work
3. Second
4. Wheel barrow
5. Effort
6. Load
7. Pulley
8. Move the fulcrum closer to the load
9. Wheel and axle
10. Wedge
11. Pulley
12. Lever, screw, wheel

Reasoning Questions

1. Pulleys may be used to raise or lower flags and also to raise and lower elevators. How?
 - A pulley is a machine that consists of a wheel, and a rope stretched across it. Pulleys can be used to lift heavy load and change the direction of the force you are using. Pulleys may be used to raise or lower flags and also to raise and lower elevators. If you put two or more pulleys together and run a rope around them, you have created an incredible lifting machine. By increasing the number of pulleys, you increase the mechanical advantage, and it becomes very easy to lift heavier objects.
2. Simple machines do not function on their own. Elaborate with examples.
 - Simple machines are the tool, devices or objects with few moving parts that help us to do work. They do not use electricity. These machines do not function on their own. They allow us to do work with less effort. We use simple machines to help us do work every day. Every time you open a door or a bottle or even just climb stairs you are using simple machines.

State whether True or False

1. True
2. False
3. True
4. True
5. True
6. False
7. True
8. True

Fill in the blanks

1. Simple machines are used to make work easier .
2. A complex or compound machine has two or more simple machines working together to make work easier.
3. A lever is a simple machine used to move a load and consists of a rigid bar or rod resting on a plane.
4. A machine is any device that helps us do work.
5. Machines can change the direction of a force.
6. A single fixed pulley does not give a person any mechanical advantage but it change the direction of the force which can be helpful.
7. Levers can make work easier and give people a mechanical advantage.

Find the following words in the word puzzle.

			W	O	R	K			C							
			H						O						L	
			E						M	A	C	H	I	N	E	S
S			E			W			P					V		
I	N	C	L	I	N	E	D	P	L	A	N	E			E	
M		O				D			E						R	
P		M				G	A	X	E	L				G		
L		P	U	L	L	E	Y			S	C	R	E	W		
E		O												A		
	F	U	L	C	R	U	M							R	O	D
		N												S		
		D														

Correctly label the six simple machines

Note: Answer (according to the diagram)

- | | | |
|-------|----------------|----------------|
| Screw | Pulley | Wheel and Axle |
| Wedge | Inclined Plane | Lever |



Chapter 10: Light and the color of Life

Learning Objectives

In this lesson we will learn about

- Light and its importance in life
- How light travels
- Behavior of light among different materials
- reflection of light
- laws of reflection
- Mirror and its types with their usage.
- Devices that use different types of mirror
- Telescope

Teacher starter

Start by asking children how can they imagine a world without light? Tell them the importance of light in our everyday life. Also ask them what they know about the mirror and its types and how many types of mirror they have used until now? How they do comb or tooth brush? Ask them that ever they experience darkness or they afraid of it?

Teaching

Start with reading of chapter and translate them in what language they can understand well. Later on ask each and every student to read the chapter and understand carefully. Make sure that each and every concept should be clear to all students. Tell your students about importance of light and its reaction after interact with different materials. Point to the picture given in the chapter. Tell them about mirror and brief that why they are able to see themselves in the mirror. Ask them that are they able to touch or exchange anything with the image of him? Why? Briefly discuss mirror and all its types with little experiments with magnifying glass.

Exercise

Answer the following questions

1. Why do we need light and what it is made up of?
 - We cannot see in the dark, but if we turn on the light, we can see the stuff around us. Without light, we would not be able to see anything. We see things because light bounces off the object and enter our eyes. Light is a form of energy that is made of electromagnetic waves. These electromagnetic waves are made of tiny particles called photons.
2. Define the terms: a) Transparent b) Opaque c) Translucent
 - **Transparent**
The objects which let light pass through them are called transparent objects. This includes water, glass, mirror, etc.

Opaque

Some objects like wood, stone do not let light pass through them. These objects are called opaque. Trees and walls are opaque. Humans are opaque too.



Translucent

Some objects like frosted glass windows and butter paper let some amount of light pass through. These types of objects are called translucent objects.

3. What are the different behaviours of light? Explain them briefly.

- The three behaviours of Light: Absorption, Transmission, and Reflection

Absorption

Objects absorb all or a portion of light striking them. This is called Absorption. Absorption of light by an object does not depend on the thickness of the object but on its colour. Black coloured objects absorb all the light striking them. The absorbed light is transformed into heat energy, and the object becomes hot.

Transmission

Transmission is when the light goes through a surface or an object. There are two types of transmission; direct transmission and diffuse transmission.

Direct Transmission

If light passes through an object and no change in its direction or quality takes place then it is called direct transmission. Transparent objects like glass and air allow direct transmission of light.

Diffuse Transmission

If light passes through an object and some of the light is transmitted, and some of it is scattered then it is called diffuse transmission. Objects like butter paper and frosted glass allow diffuse transmission.

Reflection

Light bounces back, when it hits something. This bounce back by the light is called reflection. Reflection of light is the reason we can see things around us because light from the sun reflects off them into our eyes. The light rays that bounce back after hitting that object are called reflected rays. Reflection of light can happen in two different ways: Regular reflection and Diffused reflection.

4. Define the term Law of Reflection with a diagram.

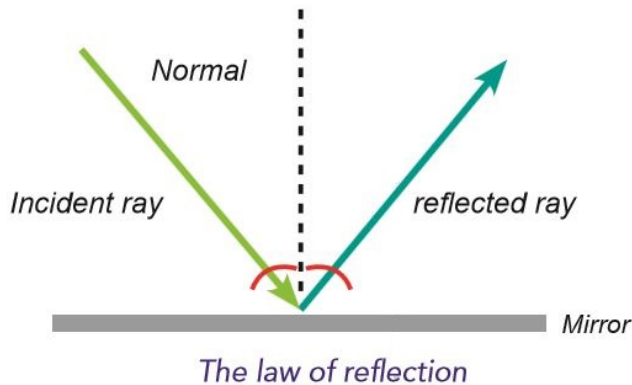
- **Law of Reflection**

Reflection occurs when the light hits an object and bounces off. This response or action of light is predictable. When light rays reflect off a surface, they obey the law of reflection which states that 'no matter which direction a light ray hits a smooth surface from, the light ray will bounce back off the surface at an equal angle.' It bounces back off from the midline called a normal line of the surface and reflects on the opposite side of the midline. As shown in the diagram at right.

The normal is the line drawn perpendicular to the surface. The incoming ray is incident ray making an angle of incidence with the normal line. And the reflected ray of light is making an angle of reflection with the normal line. So, according to law of reflection angle of incidence will be equal to the angle of reflection.

The law of reflection applies to objects of all types. It is valid for rough surfaces too. It predicts that light rays incident on a rough surface at a slightly different angle are reflected

in various directions because the normal line to the surface varies from point to point in rough materials.



5. Identify different kinds of mirrors and write about their uses.

- There are two basic types of mirrors: Plane mirror and Spherical mirror

Plane Mirror

The plane mirror is a piece of glass painted on the back with a thin layer of silver metal. This gives the glass a bright surface that reflects light rays. Plane mirror has a flat and reflective surface; it makes the image of things present in front of it. It is the simplest image-forming device. The image formed by a plane mirror is always virtual.

Images produced by plane mirrors have a number of properties including:

- The image formed is upright
- The image is the same size as the object
- The image is at the same distance from the mirror as the object appears to be
- The image is virtual.

Spherical Mirrors

A spherical mirror has the shape of a piece cut out of a spherical surface. The reflecting surface of spherical mirrors can be curved inwards or outwards. It is like a hollow sphere of glass. One side of the mirror is well polished and can reflect light, but the other side of the mirror is opaque. There are two types of spherical mirrors

- Concave mirror
- Convex mirror

Concave Mirrors

The reflecting surface of a concave mirror is curved inwards. It's a bowl-shaped mirror, like the surface of the spoon curved inwards. It is also known as converging mirror because it can make the reflected light rays to join or converge. If the object is placed close to the concave type of mirror, the image formed in the mirror will appear to be larger than the object.

If the object is close to a concave mirror the image formed will be:

- Virtual
- Upright
- And bigger than the object

If the object is placed at a distance from a concave mirror, the image formed will be:

- Real
- Inverted
- And larger than the object

Uses of Concave Mirror

People, who cannot see distant objects, use concave mirrors spectacles to bring distant objects into focus. Concave mirrors are used by dentists to examine teeth of patients closely as they make teeth look bigger. Concave mirrors are also used as shaving mirrors and as makeup mirrors. They are also used as reflectors in headlight of cars and buses etc.

Convex Mirror

A spherical mirror whose reflecting surface is curved outwards is called a convex mirror. It's like the surface of a spoon bulged outwards. Convex mirrors are also known as diverging mirrors as they make the reflected light rays to spread out or diverge. Convex mirrors produce a smaller image of the object placed in front of it. They are wide range mirrors.

The image formed by a convex mirror has following properties:

- It is upright.
- The image is virtual as it cannot be captured on the screen.
- The image formed is smaller than the object.

Uses of Convex Mirror

Convex mirrors are used as reflectors in street lights. It is used as a rear view mirror in automobiles. A convex mirror is also a good security device. They are employed in stores to help detect shoplifters.

6. What is a Periscope? For which purpose it is used?

- A periscope is an optical instrument that is used for seeing over obstacles. It is mostly used by submerged submarines to observe ships on the surface. It uses a system of prisms, lenses, or mirrors to reflect images through a tube. Only flat mirrors are used by the simple periscope.

Reasoning Questions:

1. Transparent objects like glass and air allow direct transmission of light. Why?
 - Transparent objects like glass and air allow direct transmission of light because there is no absorber or diffuser in it. Light goes without any barriers.
2. The Hubble Space Telescope is one of the most famous telescopes. How?
 - One of the most famous telescopes in the world today is Hubble space telescope. This telescope was put into 570 km high orbit around Earth in April 1990 by Space Shuttle. It is 13.2 metres long, and 4.2 metres wide. It weighs over 11,000 kg. It receives its energy from the sun through two 11.4 metre solar panels. It is a reflecting telescope. Being above Earth's atmosphere means it can see the sky more clearly than any telescope on the ground, because the atmosphere blurs starlight before it reaches Earth.

MCQs**Circle the correct answer**

1. Both air and vacuum
2. Focal point
3. Regular reflection
4. Straight line
5. Microscope
6. Luminous object
7. Reflection
8. Virtual and erect
9. Concave mirror
10. Virtual
11. Plane mirror
12. A translucent

State whether true or False

1. True
2. False
3. False
4. True
5. True
6. False
7. True
8. False
9. True
10. False

Fill in the blanks

1. Hubble Space Telescope
2. Convex
3. Spherical
4. Periscope
5. Kaleidoscope
6. Normal
7. Light
8. Diffuse

Light Sources**Make a list of ten things in your house that give light**

1. Cell phone
2. Bulb
3. Television
4. Computer
5. Refrigerator



6. Tube Light
7. Generator
8. Smart Watch
9. Torch
10. Lighter

Make a list of objects or materials in your house for each category

Transparent	Translucent	Opaque
Window Glass	Shower Glass	Wall
Aquarium	Jug	Cupboard
Book Shelf	Butter paper	Wooden Door
Kitchen Cabinet	Tissue Paper	Stand Fan
Drinking Glass	Thin Fabric	Furniture
Water Bottle	Dark Goggles	Roof

Chapter 11: The Nature of Sound

Learning Objectives

In this chapter we will discuss about

- Sound
- How sound travels
- Speed of sound
- Different characteristics of sound
- Human ear and how it works

Teacher Starter

Start by asking children how can they imagine a world without sound? Tell them the importance of sound in our everyday life. Ask them what they know about the sound and how many types of sound they have heard before. Ask them that ever they experience some unpleasant sound? How it feels? Do a little experiment in your class room. Ask all students to close their eyes and just try to listen voices around them. Then ask them what voices they heard? Also differentiate voice and noise.

Teaching

Start with reading of chapter and translate them in what language they can understand well. Later on ask each and every student to read the chapter and understand carefully. Make sure that each and every concept should be clear to all students. Tell your students about sound and its speed, feature and characteristics. Point to the picture given in the chapter. Tell students about the human ear and its autonomy. There is little experiment in this chapter too, a joyful



experiment. Student will learn and enjoy with this experiment. Every child must be involved in this experiment.

Exercise

Answer the following questions

1. What is sound and what are some of its characteristics?

- Sound is vibration traveling through different mediums in the form of molecular waves. Sound waves are mechanical waves. They start with a mechanical movement like clapping of hands. transfer of vibration from one molecule to another is called the sound wave. Sound waves can travel through different medium like air, solid and liquid. They move through a medium by compressing and decompressing the molecule, as an earthworm does to its body. Sound waves are longitudinal waves which mean they move in the direction of vibration. Sound waves are also called pressure waves because they exert pressure on the molecules they are moving through.

The characteristics of sound

The characteristics of sound include pitch, loudness, and quality.

- Pitch (sharpness or dullness of sound): A function of Frequency

Pitch (sharpness or dullness) of a sound depends on the frequency of sound waves. Frequency is determined by how fast the sound producing objects vibrate.

- Loudness or Volume: A function of Amplitude

The volume of sound is the measure of its loudness. The loudness depends on sound's energy

- Timbre or sound quality

Sound "quality" or "timbre" describes those characteristics of sound which allows the ear to distinguish sounds which have the same pitch and loudness. Hence, timbre is a general term for the distinguishable characteristics of a sound.

2. How do we hear sound?

- When something vibrates, it moves back and forth really fast; in fact so fast that our eyes often cannot discern it. But other parts of our body like ears can sense these vibrations.

The vibration puts pressure on the air molecules nearest to it. This pressure causes the air molecule to vibrate. This, in turn, puts pressure on the next molecule which begins to vibrate and so on until this chain reaction reaches your ears. The molecules themselves do not travel; they stay in their place and only vibrate and transfer their vibration to the next molecule. If your ears are within the range of vibrations, you hear the sound.

Our ears are shaped like a funnel to catch even very low sound. The relatively simple outer structure is in contrast to the complex inner structure. In the middle of our inner ears, there are tiny bones called ossicles and a membrane called eardrum. When sound waves strike these, vibration of waves causes these bones and eardrum to vibrate. These vibrations then go into a fluid-filled chamber called the cochlea, which looks like a spiral-shaped snail shell. The cochlea is lined with tiny hairs that are connected to the auditory nerve. These hairs move and shake when the sound waves hit them; sending messages to our brain that we hear a sound. All this happens in a split second!

3. How is sound measured? Elaborate your answer with examples.

- The volume of sound is the measure of its loudness. The loudness depends on sound's energy i.e. how loudly the words have been spoken, or the sound has been made. Loudness is expressed as the height of the sound wave and is called amplitude. The greater the energy, the louder the sound and greater the amplitude (height) of the sound wave. The loudness of a sound is measured in decibels (dB).

The decibel (dB) is used to measure sound level, but it is also widely used in electronics, signals, and communication. The dB scale is not a linear scale but a logarithmic one. It squares with every increase.

4. Draw a labeled diagram of a human ear.

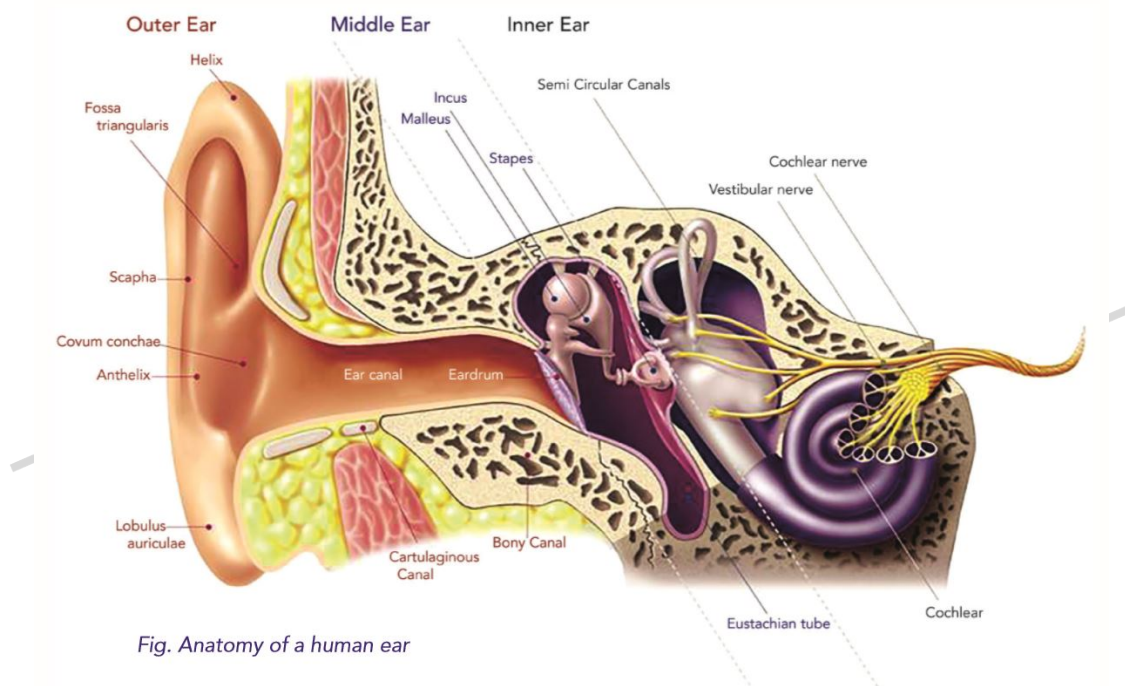


Fig. Anatomy of a human ear

5. What do you know about the speed of sound?

- Sound travels at different speed through various objects or medium. Overall it does not travel fast, but still, it is pretty speedy. It is difficult for sound waves to move fast in a medium in which particles are far from each other like air. Within a medium too, the speed of sound depends upon the density of the medium. Another twist on the speed of sound is heat. The higher the temperature of the medium the faster the speed of sound is. Molecules vibrate faster at higher temperatures because they have more energy.

At sea level, sound travels through the air at a speed of 431 metres per second. In liquid its speed is about 1,482 metres per second; that's over four times faster than the speed in air. Sound travels fastest in solids, a scorching 5,960 metres per second. That is 17 times faster compared to speed in the air!

Reasoning Questions

1. Some airplanes break the sound barrier.
 - The speed of sound is also called Mach 1. When an object goes faster than the speed of sound, it's called breaking the sound barrier. Almost all fighter jets are capable of moving faster than Mach 1. When they break the sound barrier, the condensation is moved off the airplane. This creates a white halo (see the picture above). When planes break the sound barrier, they also create a sonic boom. This is a very loud noise that is generated when a number of sound waves are forced together as the plane travels faster than sound.
2. Sound cannot travel through vacuum
 - Sound always travel in mediums. Either it is solid, liquid or gas. But in vacuum there is no medium so sound could not be travel in vacuum.

MCQs**Circle the correct answer**

1. Quality
2. Echo
3. Hearing
4. Frequency
5. Higher
6. Pitch
7. Vibrates
8. Compression
9. Energy is transferred in a periodic manner
10. Vibrate along the direction of wave propagation
11. The maximum distance moved by the medium molecule on either side of the mean position
12. Vacuum
13. Properties of the medium

Fill in the blanks

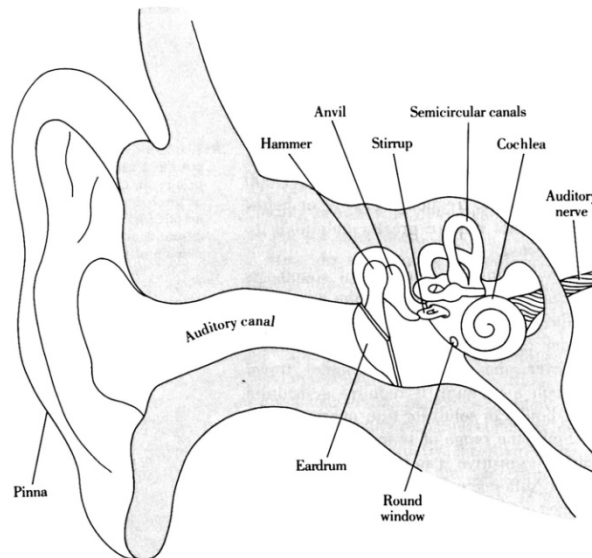
1. Sound
2. Decibel
3. Timbre
4. Material
5. Sound energy
6. Material
7. Frequency
8. Solid
9. Mechanical movement
10. Sound barriers

State whether true or false

1. False
2. True
3. False
4. True
5. True
6. True
7. True
8. True

Perform the experiments and write your observations

(Note: Help students to do this experiment. First teachers do it in front of students then ask them to do with themselves and write observations on note book)

Label the given diagram

Chapter 12: Exploring our Neighbourhood in Space

Learning Objectives

In this lesson we will learn about

- Space
- The stars and briefly about how stars formed
- the solar system
- components of solar system like planets, moons, asteroids, meteoroids, comets etc

Teacher Starter

Start by asking children ever they see sky? Ever they experience some luminous objects high on the sky? Ask students that are they remember childhood poem twinkle twinkle little star? Then tell them about the fact that Earth is round and sky is not end but it is our sight limits. Give them a concept of many worlds in the universe.

Teaching

Start with reading of chapter and translate them in what language they can understand well. Later on ask each and every student to read the chapter and understand carefully. Make sure that each and every concept should be clear to all students. Tell your students about stars. Clear their concept of stars and tell them sun is also a star. Give a detailed introduction of planets and differentiate planets with stars and moon. Tell them about the movements of Earth alongside with other planets and objects present in solar system. Point to the picture given in the chapter. Tell them how day and night and seasons changed.

Exercise

Answer the following questions

1. What is space? What is it populated with?
 - There are innumerable things in space, some very, very strange indeed like the Black Holes and the Quasars. Space is populated with an uncountable number of stars. According to a very rough estimate, there are 1000 trillion stars in the observable universe! That is 1 followed by 24 zeros. Our sun is one of these stars.
2. What are the primary objects in space? Describe how they are formed with reference to the Sun?
 - A star is a massive sphere of very hot, glowing gases which are mainly hydrogen and helium. Stars produce their light and energy by a process called nuclear fusion. Stars come in a variety of sizes and colours. Our Sun is an average sized yellowish star. The creation of our sun took place almost five billion years ago. Scientists believe that the sun and the rest of the planets were born from a giant cloud of dust and smoke called nebula. There were smaller clumps of dust and gas that were also collapsing. These smaller clumps turned into planets, dwarf planets, moons, asteroids, and comets.

3. What is Solar System? Write a detailed note about it.

- The sun and all those bodies, big or small, which revolve around it make up a system. Since this system is due to the sun, it is called Solar System, which means a system of the sun. Our solar system is an exciting place. It is filled with planets, moons, comets, asteroids, dwarf planets and other fascinating objects.

In our solar system, there are eight known planets: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune.

Astronomers often divide these planets into two groups — the inner planets and the outer planets. The inner planets are smaller and rockier and are closer to the Sun. The outer planets are much more distant, larger and composed largely of gas. The inner planets from the Sun are; Mercury, Venus, Earth, and Mars. After an asteroid belt comes the outer planets; Jupiter, Saturn, Uranus, and Neptune

4. Write short notes on the following: a) moon b) asteroid c) meteor d) comets

- **Moon**

A natural satellite is a natural object that revolves around another larger natural object other than the sun. The moon is a natural satellite because it revolves around Earth. Mostly, the larger the planet, the more moon it has. All except two planets (Mercury and Venus) in our solar system have moons.

- **Asteroid**

Asteroids are made up of iron and rock like the four inner planets, but they are much smaller. Due to their smaller size, they do not have enough gravity to pull themselves together into the shape of a ball. Therefore they have irregular shapes.

- **Meteor**

Meteoroids are small chunks of rock and debris that are found in space. When they enter a planet's atmosphere and burn up, they are then seen as meteors or shooting stars. Sometimes the chunk of rock is big enough that it does not all burn up while entering the atmosphere and hits the ground. These rocks that hit the ground are called meteorites.

- **Comets**

Comets are big chunks of ice, rock, and gas, kind of like a dirty snowball. They originate from two different places: One is Kuiper belt, and the other is called the Oort cloud. The main claim to fame of comets is, of course, their tails. But their tail only forms when they come near the sun. In their own neighbourhood, the comets are tailless.

5. What can we find in the outer region of the solar system? Write their names and describe them precisely.

- **Asteroids:**

Asteroids are made up of iron and rock like the four inner planets, but they are much smaller. Due to their smaller size, they do not have enough gravity to pull themselves together into the shape of a ball. Therefore they have irregular shapes.

- **Meteoroids:**

Meteoroids are small chunks of rock and debris that are found in space. When they enter a planet's atmosphere and burn up, they are then seen as meteors or shooting stars.

Sometimes the chunk of rock is big enough that it does not all burn up while entering the atmosphere and hits the ground. These rocks that hit the ground are called meteorites. There are three main types of meteorites, stony, iron, and stony-iron (a mixture of both). A study shows that most meteorites come from Asteroid belt, but a very small percentage are rocks that were once part of the Moon or Mars.

Asteroid Belt:

The Asteroid Belt is a collection of billions upon billions of asteroids, that is, most of the asteroids of the solar system. It is located between the orbits of Mars and Jupiter. It is between 2.2 and 3.2 astronomical units (AU) from the Sun and has a height of about 1 AU. The asteroid belt is divided into an inner belt and an outer belt. The inner belt is made up of asteroids that are within 400 million km of the sun. These asteroids are made of metal. The outer belt includes the asteroids that are 400 million km beyond the sun. These asteroids are dark in colour and are rich in carbon.

Kuiper Belt:

Beyond Neptune, the last planet of the Solar System lies a region of space filled with icy bodies. Known as the Kuiper Belt. This vast expanse holds trillions of objects, remnants of the early solar system. The existence of this belt was predicted by astronomer Gerard Kuiper in 1951. It was first observed in 1992 and was named after him.

Dwarf planets:

Dwarf planets are similar to regular planets in all respect except one.; a planet has cleared other objects in the area of its orbit while a dwarf planet has not.

Comets:

Comets are big chunks of ice, rock, and gas, kind of like a dirty snowball. They originate from two different places: One is Kuiper belt, and the other is called the Oort cloud.

Oort Cloud

Jan Oort a Danish astronomer theorized in 1950 that comets reside in an area far beyond the orbit of Pluto. This came to be known as the Oort Cloud. Statistics imply that it may contain as many as a trillion comets. However, since the individual comets are too small and so far away, there is no direct evidence that Oort Cloud actually exist.

Reasoning Questions:

1. Gravity has made life possible. Elaborate
 - Gravity is very important to us. We could not live on Earth without it. The sun's gravity keeps Earth in orbit around it, keeping us at a comfortable distance to enjoy the sun's light and warmth. It holds down our atmosphere and the air we need to breath. Earth is well equipped as a planet and ideally placed in our solar system and galaxy to support life as we know it. The product of some 4.6 billion years of cosmic construction, our planet is flush with life thanks to a fortuitous set of conditions. Earth is tilted with respect to the sun, and teeters as it spins. Gravity plays very important and vital role in this regard.
2. Of all the inner planets besides Earth, Mars is the most likely ever to have had life. Why?
 - Because the distance of these planets from the sun is very ideal, Neither very hot nor very cold.



MCQs**Circle the correct answer**

1. Comet
2. Two
3. 8
4. Venus
5. Sun
6. Satellite
7. Planets
8. Outer Planets
9. Dwarf Planets
10. Comets

Fill in the blanks

1. Asteroids
2. Comets
3. Star
4. Universe
5. Meteorites
6. Meteors
7. Ceres
8. Mercury
9. Earth
10. Jupiter

State whether True or False

1. True
2. True
3. True
4. False
5. False
6. True
7. True
8. False
9. True
10. False

Project

(Note: Students will do it by themselves with the guidance of teacher)

Complete the worksheet

(Note: starts from upside)

- Neptune
- Uranus
- Saturn
- Jupiter
- Mars
- Earth
- Venus
- Mercury

Chapter 13: Man Goes Space-faring

Learning Objectives

In this chapter we will learn about

- How Humans steps out of the Earth
- the missions to moon, mars and other planets
- Spacewalk
- Astronauts and other scientists who make spacewalk possible

Teacher Starter

Start by asking children what they think that they can go near the moon or sun? ask them if they got a chance to go there, they will go or not and why?

Teaching

Start with reading of chapter and translate them in what language they can understand well. Later on ask each and every student to read the chapter and understand carefully. Make sure that each and every concept should be clear to all students. Tell your students about men efforts towards t occupy the space. Also tell them about the spacecrafts, astronauts and their histories. Point to the picture given in the chapter. Tell the students about the benefits of these missions and discuss them that how these expeditions help us in today's world especially in the case of communication, security and weather etc.

Exercise

Answer the following questions

1. Give a brief history of voyages to the moon in early phase.
 - Man has sent more than 90 missions to the moon as on June 30, 2017. Some of the Phase 1 missions are mentioned below.
 - 1950s Pioneer 4 (USA) launched in March 1959, was the first spacecraft to fly to the moon. It passed within 60,000 kilometres of the Moon and returned data on lunar radiation levels.
 - Luna 2 (USSR, September 1959) was the first spacecraft to land on moon.
 - Luna 3 (USSR, October 1959) was the first spacecraft to the moon which returned to Earth after concluding its mission.
 - 1960s Ranger 9 (USA, March 1965) had taken over 5,800 images of the lunar surface before it crash-landed on the moon.
 - Luna 9 (USSR, Jan-Feb 1966) became the first spacecraft to make a controlled landing onto the surface of another celestial body.
 - Apollo 8 (USA, December 1968) Astronauts Frank Borman, James Lovell, and William Anders were the first humans to orbit the Moon. They completed ten orbits and returned to Earth.

Man on Moon

- Apollo 11 (USA, July 1969) wrote history when it made the first successful manned lunar landing. Apollo 11 made its triumphant return to Earth on July 24, 1969, splashing down in the Pacific Ocean.
- Apollo 15 (USA, July-Aug 1971) was the first manned mission to carry a lunar rover.
- Apollo 17 (USA, December 1972) brought to a close, the human exploration of the Moon to date.

Exploring the moon remotely

- Luna 16 (USSR, September 1970) was the first robotic mission to land on the Moon, collected samples of dust and rock, and returned those samples to Earth. Luna 16 was also the first spacecraft to land on the dark side of the moon.
- Luna 17 (November 1970) was the first mission to the moon which carried a Rover.

2. How man explored the solar system? Give some related information.

• **Missions to Mars**

Dozens of missions have been launched to Mars to better understand this close neighbour to Earth. Some important missions are as follows:

Rovers

Curiosity was launched by NASA in November 2011 and landed on Mars in August 2012. Curiosity has made key discoveries such as the detection of organic material on Mars, raising the possibility of life there.

Orbiters

Mars Reconnaissance Orbiter (NASA, March 2006) is searching for; evidence of past water on Mars, landing sites for future rovers and landers and monitors Martian weather on a day-to-day basis.

2001 Mars Odyssey of NASA currently orbiting Mars, has detected massive deposits of subterranean water in Mars' near-polar regions.

Missions to other Inner Planets

Venus was one of the first planetary target of spacecraft, but many early missions ended in failure. However, more than 20 have been successful. Currently, an active mission is the Japanese probe Akatsuki, meaning dawn. A Mercury orbiter BepiColombo was launched jointly by Japan and Europe. It was launched in July 2016 and will enter Mercury's orbit in 2024. The mission will perform a comprehensive study of Mercury's magnetic field, interior structure, and surface.

Mission to Outer Planets, their Moons, Dwarf Planets and Kuiper Belt

Juno, a Jupiter polar orbiter, was launched by NASA in August 2011 and arrived at the gas giant in July 2016. Juno is studying Jupiter's interior from a polar orbit. New Horizons, a flyby spacecraft destined for Jupiter, Pluto and Kuiper Belt was launched in January 2006 and flew by Jupiter in January–May 2007.

Voyager 1, (Mission: Saturn and Jupiter flyby) and Voyager 2, (Mission: Jupiter, Saturn, Uranus, and Neptune flyby): Both the spacecraft were launched within 16 days of each other in August and September 1977. Both Voyager 1 and 2 are currently on Interstellar Missions and are the most distant objects from Earth made by man.

Cassini (Saturn Orbiter, and Titan flyby) was launched in October 1997, flew by Jupiter in December 2000 and entered its orbit in July 2004. Its probe descended on Jupiter's moon



Titan in January 2005. After 293 complete orbits of Saturn, Cassini's mission ended on September 15, 2017, with the spacecraft's plunge into the Saturn atmosphere.

Mission to Sun

Ulysses a solar polar orbiter of NASA and ESA was launched in October 1990. Ulysses was the first mission to study the sun from both poles.

Missions to asteroid belt and Ceres

Dawn was launched by NASA in September 2007 to visit 4 Vesta, an asteroid in the asteroid belt and Ceres, the Dwarf planet. Dawn is the first orbiter of a main-belt asteroid.

The Effort to Colonize the Orbit

The Soyuz programme (USSR/Russia, 1967–ongoing) was initiated by the Soviet Union in early 1967. Soyuz programme has made approximately 950 manned and unmanned flights in fifty years or so.

NASA's Space Shuttle (1981-2011) is the only spacecraft with wings. It made completely unpowered landings as a glider. Its missions involved carrying large payloads to low Earth orbits. A total of 355 astronauts (306 men, 49 women) from 16 countries flew 135 missions during the system's 20-year lifespan.

3. What expeditions were undertaken to explore moon? Elaborate.
- After Luna 26 by USSR in 1976, there was a 14-year hiatus when no missions to the moon were launched. The second phase of moon missions began with Hiten launched in 1990 by Japan. It successfully completed its mission. It was followed by 14 missions from five countries of which some are given below.
Lunar Reconnaissance Orbiter's mission is to capture high-resolution images of the entire surface of the Moon. It was launched in June 2009 by NASA.
Chang'e 2's (pronounced Chang-ee) ambitious mission is to orbit the moon, study Lagrange Points, and perform a flyby of an asteroid. It was launched in October 2010 and completed all its missions. The probe is now active in deep space; this will verify China's deep-space tracking and control capabilities.
Chang'e 3 is the first lunar rover of China. Its rover landed on the moon on December 14, 2013. The rover successfully took images of the lunar surface, but its mobility system failed, leaving the rover unable to move but still alive.

4. What do you understand by the term Satellite? Mention its types and use.
- Artificial satellites are human-built space-faring objects orbiting the Earth and other planets in the Solar System. Here we will concern ourselves with those artificial satellites that are in Earth orbit and provide a service for Earthlings. Currently, more than a thousand satellites are orbiting Earth that are active.

Types of satellites

Navigation satellites: These were developed in the 1950s. Modern navigation satellites enable small electronic receivers in receiving objects to determine object's location (longitude, latitude, and altitude/elevation) to within a few metres.

Communication Satellites: This type of satellite is used in sending live transmissions of radio, TV, telephone for communications anywhere in the world. Communications satellites occupy a geostationary orbit.

Weather Satellites: These satellites keep track of the weather, including movement of clouds, their density, rainfall, and temperature.

Earth Observation Satellites: Earth observation and monitoring satellites occupy polar orbits so that the satellite can scan the whole surface of Earth. They are used to photograph and image Earth.

5. Is there a progress in satellite development in Pakistan? Discuss.

- Currently there is one Pakistani satellite operational, a communications satellite called PAKSAT-1R. It is used for all types of communication; TV, telephonic and Internet by Pakistani and foreign companies. It was developed by China Academy of Space Technology according to specifications of SUPARCO and put into space in August 2011 by Chinese Long March rocket.

Pakistan also has launched two more satellites, Badr 1 and Badr 2. Badr 2 was lost somewhere in space.

6. Write notes on these topics. a) Lagrange points b) Gravity Assist c) Space Based Telescopes

- **Lagrange Points**

A Lagrange point is a location in space where the combined gravitational forces of two large bodies, such as Earth and the sun or Earth and the moon, equal the centrifugal force felt by a much smaller third body.

- **Gravity Assist**

When a spacecraft increases or decreases its speed or change direction with the help of gravity it is called Gravity assist. This takes place when a spacecraft flies past a planet or a large moon. This allows the planet's gravity to pull on the spacecraft and change its orbit. The direction of change depends on the angle at which the spacecraft is heading towards the celestial body. If the spacecraft passes in front of the planet, it will speed up, if it is behind it will slow down.

- **Space Based Telescope**

A space telescope or space observatory is an instrument located in outer space to observe distant planets, galaxies and other astronomical objects. Space telescopes avoid many of the problems of ground-based observatories, such as light pollution and distortion of electromagnetic radiation (scintillation).

Reasoning questions:

a) What are the three things that all space probes have in common?

- Computer system – to manage the satellite and all its systems
- Communication system – to communicate with ground stations
- Attitude control system – this system keeps a satellite pointed in the right direction.

b) What is the greatest reward of the space age and why?

- Artificial satellites are greatest reward of the space age because today we are able explore space, communicate globe and able to predict & keep records. It could be possible just because of artificial satellites. Here we will concern ourselves with those artificial satellites that are in Earth orbit and provide a service for Earthlings. Currently, more than a thousand satellites are orbiting Earth that are active

MCQs**Circle the correct answer**

1. Moons
2. Space probe
3. Yuri Gagarin
4. Neil Armstrong
5. A dog
6. Sputnik
7. Vostok 1
8. Luna 2
9. Apollo 11
10. BepiColombo
11. Curiosity
12. Voyager 1 & Voyager 2

Fill in the blanks

1. Space crafts
2. Satellite
3. Dwarf Planet or Ceres
4. Large Moon
5. Badr 1
6. No Blank
7. Space shuttle
8. Weather
9. Ulysses
10. BepiColombo

State whether True or False

1. False
2. True
3. False
4. True
5. True
6. False
7. True
8. True

Projects

(Note: Students will do by themselves with the help of teachers and parents)