

SCIENCE

Class - VI

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Foreword

The Government of Andhra Pradesh has unleashed a new era in school education by introducing extensive curricular reforms from the academic year 2020-21. The Government has taken up curricular reforms intending to enhance the learning outcomes of the children with focus on building solid foundational learning and to build up an environment conducive for an effective teaching-learning process. To achieve this objective, special care has been taken in designing the textbooks to achieve global standards.

As a part of the curricular reform, in order to ensure quality transaction of textbooks, handbooks are given to teachers with elaborate lesson plans for better pedagogical techniques. For the practice of the students, workbooks are given which will reinforce the learning in the classroom. Parental handbooks are prepared to impart awareness regarding the teaching-learning process to the parent community. QR codes are incorporated in the beginning of each lesson to enable learning outside the classroom.

In this textbook, twelve lessons have been incorporated on the themes like Food, Natural Phenomena, Living World, Natural Resources, How things work and Materials. In order to reinforce the concepts, several projects and activities are given to inculcate scientific temperament. Questions are framed for each lesson to recapitulate the conceptual understanding and to achieve competencies required for project works, drawings and model makings. Each lesson is provided with eye catching illustrations to engage the children. The key concepts of the lessons are included under key words and the salient features of the lessons are given under the title "What we have learnt" for the review of the important concepts. An effort has been made to relate the scientific concepts with the real-life events thereby developing and promoting scientific temperament.

We are grateful to Honourable Chief Minister Sri. Y.S. Jagan Mohan Reddy for being our source of inspiration to carry out this extensive reform in the education department. We extend our gratitude to Dr. Adimulapu Suresh, Honourable Minister of Education for striving towards qualitative education. Our special thanks to Sri. Budithi Rajsekhar, IAS, Principal Secretary, School Education, Sri. Vadrevu Chinaveerabhadrudu, IAS, Commissioner, School Education, Ms. Vetriselvi.K, IAS, Special Officer for their constant motivation and guidance.

We convey our thanks to the textbook writers who studied curriculum from Chicago to Singapore and recommended best practices across the globe to reach global standards. Our heartfelt thanks to NCERT, SCERT of Kerala, Tamil Nadu and Karnataka in designing the textbooks. We also thank our textbook writers, editors, artists and layout designers for their contribution in the development of this textbook. We invite constructive feedback from the teachers and parents in further refinement of the textbook.

Dr. B. Pratap Reddy

Director

SCERT – Andhra Pradesh

Instructions to the Teachers

- ☛ Children should understand and adjust with their environment. For this, they have to observe and explore their environment by participating in different activities which helps them to acquire process skills. Hence, the text book at high school level is given the title ‘General Science’.
- ☛ The syllabus and lessons are written according to the conditions of our Andhra Pradesh State and the themes based on the learning outcomes of the National Council of Educational Research and Training (NCERT).
- ☛ The contents of the lessons are prepared on the themes like Food, Natural Phenomena, Living World, Natural Resources, How things work, Materials.
- ☛ There are Twelve lessons under seven themes. Each lesson is enriched with colourful pictures to make children to understand the concepts in a better manner.
- ☛ Every lesson starts with either a real life situation or child experiences. It give opportunity to hands on experience.
- ☛ Children are encouraged to talk about the concepts and their experiences in the classroom.
- ☛ Activities are designed in such a way that the children observe and explore their surroundings, discuss with their friends, family members, elders and collect the information, tabulate the data, do experiments, participate in activities and projects.
- ☛ This textbook focusses mainly on the processing skills. Hence whole classroom, groups or individual activities, logos and QR codes are also given to specify the different activities. Teaching learning process should be carried out with the help of proper teaching learning material. So the teacher should prepare required TLM and utilize virtual, digital classes effectively.
- ☛ Exercises are given not only to know what children have learnt, but also to exhibit and express their creativity, experiences and thoughts. So all children should be given a chance to participate in the activities.
- ☛ In each lesson there is an activity ‘Let us do’, to give scope for children to explore. Children should do these activities either individually or in a group.
- ☛ There is another activity by the title ‘Think and Discuss.’ A scope is provided for the children to think and discuss them with classmates, teachers or elders. Children should identify them independently. If 80% of the children can do this, then only the next lesson should be taken up.
- ☛ ‘Key words’ are given at the end of each lesson. These are the important concepts of the lesson. Children’s conceptual understanding should be evaluated with the key words. Salient features of the lesson are given by the title ‘What we have learnt’. Children should be made to read these features. These are given to review the concept.
- ☛ In each and every lesson, the activities are incorporated keeping in view the Continuous and Comprehensive Evaluation (C.C.E).
- ☛ Teacher should note down the progress of children based on the competencies achieved.

Our National Anthem

- Rabindranath Tagore

*Jana-gana-mana-adhinayaka jaya he
Bharata-bhagya-vidhata
Panjaba-Sindhu-Gujarata-Maratha
Dravida-Utkala-Banga
Vindhya-Himachala-Yamuna-Ganga
uchchala-jaladhi-taranga
Tava Subha name jage, tave subha asisa mage,
gahe tava jaya-gatha.
Jana-gana-mangala-dayaka jaya he
Bharata-bhagya-vidhata.
Jaya he, Jaya he, Jaya he,
jaya jaya jaya jaya he.*

Pledge

- Pydimarri Venkata Subba Rao

India is my country. All Indians are my brothers and sisters.
I love my country and I am proud of its rich and varied heritage.
I shall always strive to be worthy of it.
I shall give my parents, teachers and all elders respect,
and treat everyone with courtesy. I shall be kind to animals.
To my country and my people, I pledge my devotion.
In their well-being and prosperity alone lies my happiness.

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Teacher Corner



Student Corner

Learning Outcomes - Academic Standards

S.No.	Academic Standard	Explanation
1.	Conceptual understanding	Children are able to explain, classify, analyze, cite examples, give reasons, and give comparison and differences, explain the process of given concepts in the textbook
2.	Asking questions and making hypothesis	Children are able to ask questions to understand, to clarify the concepts and to participate in discussions. They are able to make hypothesis on given issues.
3.	Experimentation and field investigation	Children are able to do experiments on their own to understand given concepts in the textbook. They are able to participate in field investigation and making reports on them.
4.	Information skills and Projects	Children are able to collect information (by using interviews, internet etc.) and analyse systematically. They are able to conduct their own project work.
5.	Communication through drawing and model making	Children are able to explain their conceptual understanding by drawing figures and making models.
6.	Appreciation and aesthetic sense and values	Children are able to appreciate man power and nature, and have aesthetic sense towards nature. They are also able to follow constitutional values.
7.	Application to daily life and concern to biodiversity	Children are able to utilize scientific concept to face their daily life situations. They are able to show concern towards biodiversity.

CHAPTER - 1

The Food we Need



Learning outcomes

Pupils will be able to..

- give examples of different food items and their ingredients.
- ask questions to understand the different food sources.
- explain the methods of food preparation and preservation.
- prepare and preserve food.
- appreciate different food sources.
- minimize the wastage of food.



Keerthana and her brother Abhishek lives in a village. One day, they went to an exhibition. There, they saw food stalls and bought some of their favourite food items.

Variety of Food



Look at the following food items in the stall:



Rice



Fishcurry



Bamboo Chicken



Ice Cream



Sprouts



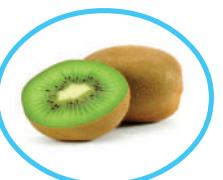
Kheer



Vada



Pottikkalu



Kiwi



Potato Sticks



Ragi Sangati



Rose Milk



Jack fruit



Gulabjamun



Laddu



Apples

Table: 1 - Write the names of the above food items in the table given below.



I like to eat	I don't like to eat	I have never eaten before	I have never seen before

Activity: 2

What did you eat yesterday? Make a list. Ask your classmates what they ate yesterday and write in the table below.

Table: 2

S.No.	Name of the Student	Food Eaten
1)	Keerthana	Dosa, Chutney

- ⌚ Did all the students eat the same type of food ?
- ⌚ Are there any common food items in the above list?
- ⌚ Prepare menu chart of the food served for a week during mid-day meal in your school?

We take different types of food every day. But some food items like rice, dal and vegetables are common. On special occasions, we eat a variety of food items. What are the food items made of?



World Food Day is celebrated every year across the world on 16th October. It's an annual celebration in the honour of the founding date of the F.A.O [Food and Agriculture Organization] launched by the United Nations in the year 1945. The aim of celebration of this day is to promote worldwide awareness and action for those who suffer from hunger and for the need to ensure food security and nutritious diets for all. World food day adopts a different theme each year.



Food Ingredients:

Activity: 3

Sasi wanted to eat something special on Sunday. He asked his mother to make Pulihora. He wanted to know what materials are required to make Pulihora. He asked his mother to list out the materials required to make Pulihora. Here is the list.

Rice, oil, salt, tamarind, chillies, turmeric, asafoetida, etc.

Sasi was surprised to know that to cook boiled rice, we need only two materials - raw rice and water. But to make Pulihora, we need many other things. To prepare different kinds of food items, we need different materials. The materials that are required to prepare food are known as **ingredients**.

List out some food items and mention the ingredients required to prepare them in the table given below.

Table: 3 - Ingredients of some food items

S.No.	Food items	Required Ingredients

When you buy packed food like biscuits, cool drink, etc., you will find their ingredients written on the wrappers.

Do You Know?

According to the UNDP [United Nations Development Programme] up to 40% of the food produced in INDIA is wasted.

According to FAO [Food and Agriculture Organisation] estimates in “The state of Food security and nutrition in the World, 2018” report, 195.9 million people are undernourished in INDIA.

Sources of Food Materials (Ingredients) :

Have you ever thought where do we get these ingredients from? We get them from plants, animals and other sources.

Ingredients from plants: vegetables, fruits, cereals and pulses etc.

Ingredients from animals: eggs, milk, meat, etc.

Ingredients from other sources: salt.

Is there any other source you can think of?

Some food items and its ingredients have been listed below. Write the source of each ingredient in table 4.

Table: 4 - Ingredients used to prepare food items and their sources

S.No.	Food Item	Ingredients	Sources (Plant, Animal, Others)
1)	cooked rice	raw rice	plant
		water	
2)	payasam	vermicelli/semiya	
		dry fruits	
		sugar	
3)	chutney	milk	
		groundnut/coconut	
		oil	
		chillies	
4)		salt	
5)			

Try to increase this list by adding more food items as much as you can in the above Table. You know that we get milk from cow and buffalo, mutton from goat and sheep, chicken from hens, pork from pig and eggs from birds. We get butter, cheese, ghee and curd from milk. Honey is also a good ingredient obtained from honey comb. It is clear that we get a variety of food ingredients from animal sources. Can you elaborate this list?

Similarly, different parts of plant like leaves, flowers, fruits, etc. serve as very useful ingredients to make our food. Stems like sugarcane, onion, garlic, turmeric, ginger, etc are also used in the preparation food. Although the leaves, roots, seeds and fruits of plants are widely used in the preparation of food, stems and flowers are also used. Thus, we use various parts of plants as our food. Salt is an important ingredient that we get from the sea.

Can you identify which part of the plants in table-5 is edible? You can also discuss with your friends and write the names of the edible parts of the plant in the table given in next page.

Table: 5 - Plant Parts as Food

S.No.	Name of the Plant	Parts that we eat
1)	Mango	Fruit
2)	Mint (Pudina)	
3)	Sugar Cane	
4)	Potato	
5)	Onion	
6)	Cauliflower	
7)	Groundnut	
8)	Tomato	
9)	Rice	
10)	Greengram	
11)	Cabbage	
12)	Apple	

- ⇒ Which parts of the plants do we generally eat?
- ⇒ Do we also use flowers as food?

We need several ingredients to cook different types of food. Whatever may be the source of the ingredients – plants, animals, water, we take some of them in large quantities whereas the others in small quantity. Why is it so?

We eat a variety of food items everyday. Do we prepare them in the same way. What are the different methods in the preparation of food?

Different Methods of Preparing Food

Food is very useful for the growth and survival of life. Preparation of food is an art. It is prepared in different ways. Some of the processes in preparing the different food items have been given in Table 6. Write the food items opposite to each of the processes in the table.



“INDIAN SPICES”

Spices are aromatic parts of tropical plants traditionally used to add flavour to the food. Spices come from the bark or roots of certain plants, leaves, flowers or stems of plants primarily used for flavoring, colouring or preserving food. Spices are included in a variety of Indian dishes: cardamom, black pepper, curry leaves, fenugreek, fennel, ajwain, bay leaves, cumins, coriander seeds, turmeric, cloves, ginger, nutmeg and cinnamon.



Table: 6 – Making Food

S.No.	Method of Preparing Food	Food Items
1)	Boiling	Rice, Dal, _____, _____
2)	Steaming	_____, _____, _____
3)	Fermentation	Bread, _____, _____
4)	Roasting	Chicken, _____, _____
5)	Cutting and Mixing	_____, _____, _____
6)		
7)		

Add any other process/es of making food in the above table, which you know.

Tasty Food

We generally say that the food is tasty. But how does food get its taste? The taste of food depends on its ingredients and the method of preparation. Do you know any method of preparation of a food item?

Now let us prepare a tasty food – **Upma**.

Activity: 4

1. Aim : To prepare upma.
2. What do you need ? : Upma ravva, Onion, Green chillies, Oil, Tomato, Salt, Water, Mustard seeds, Curry Leaves, Pan, etc.,
3. How to do ? : Chop the clean vegetables into pieces. Place a pan on the flame. Pour three spoons of oil and add mustard seeds, onions, chillies, chopped vegetables, etc. and fry them. Pour sufficient water and add salt to it. Let it boil for sometime. Then, add ravva when the water gets boiled. Stir it well.
4. What do you see? : After a few minutes it become thick, the tasty upma is ready
- 5.What do you learn? : Using different ingredients we can make tasty upma (dish)

Prepare your favourite food item and write the procedure in preparing it.

Do You Know?

Some people make different types of designs and decorations with vegetables and fruits. This is called vegetable carving.



Preservation of Food

The discussion about food will be incomplete if we do not talk about food preservation. Food preservation is the process of treating and handling food to stop or slow down spoilage. If food is not preserved properly, it can be attacked by germs and get spoiled. Eating such spoiled food causes food poison. Eating such poisonous food causes abdominal pain, diarrhoea, vomiting, etc. and may eventually lead to death. Spoiling the food may lead to food shortage and pollute the environment also. Hence, it is very essential to preserve food properly.

How is the food preserved at your home? Do you know why the green mangoes, vegetables and meat are pickled? Why fish are dried or smoked? Why do we keep certain fruits in sugar syrup or honey? These are all the certain methods of preserving food.

The materials or substances that we use in preserving food are called 'preservatives'. Salt, oil, turmeric powder, sugar, honey etc.. are the natural preservatives that are commonly used at our home. Some chemicals such as Benzoates, Nitrates, Sulphates are also used as preservatives. But, some of the chemical preservatives are harmful to our health, so we should be careful while using the preserved foods bought from the market.

Let us Store Food



List out different preservatives used at your home and discuss in groups about the different preservative methods. Ask your parents the other ways of preserving the food they follow and fill in the Table-7 given below.

Table: 7 - Preserve Food

S.No.	Types of Preservatives	Examples
1)	Adding Salt, Chilli Powder & Oil	Pickles,
2)	Adding only Salt	
3)	Adding Sugar Syrup	
4)		
5)		
6)		

- When you buy any food item in the market, don't forget to read the manufacturing date and expiry date. Eating the food material after the expiry date may spoil your health.



Think & Discuss

Now a days, we see lot of food getting wasted in all places. Food wastage is happening in our houses, schools and other places (Hostels, Hotels...etc.,) on daily and special occasions. What are the ways to avoid wastage of food? Discuss with your teacher.

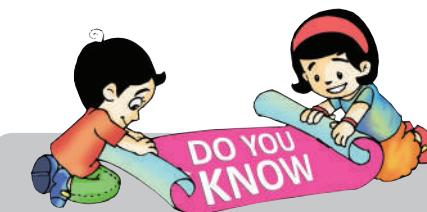
How do people develop food habits?

People living in one region usually share common food habits. You might have seen paddy fields near your village. In our state geographical and climatic conditions are more suitable for growing paddy. Farmers cultivate various types of food crops other than paddy in our state. Rice is the main food for us. A variety of food items are prepared by using rice.

We eat more rice and rice products as compared to other cereals like wheat or maize. We have to eat other cereals like Finger millets (Raagulu), Pearl millets (Sajjalu), Great millets (Jonnalu), Foxtail millets (Korralu) and Proso millets (Samalu) which are good for our health.

Many times, we hear people saying that "I eat this food only" or, "I don't eat that food". This is not a good habit. In order to be healthy and energetic eating all varieties of food is good, except junk food or fast food. Home made food is always good, healthy and hygienic.

Most of the people in our society are starving without food, but at the same time many people are wasting the food by cooking in large quantities and throwing away during functions even in our day to day life. So, it's our duty as a responsible citizen to avoid wastage of food.



Say NO to Junk Food

Pizza, Burgers, Chips, Fried Fast Food, Noodles, Samosa, French Fries etc.. are junk foods. Eating junk food causes obesity, digestion issues and loss of appetite. It may cause drowsiness and are harmful to health.



Think & Discuss

Does every one around you get enough food to eat ?
If not, why not?

KEY WORDS

Ingredients, Sources, Preservatives, Spices, Boiling, Steaming, Fermentation, Recipe



What we have Learnt?

- ◆ We eat a variety of food in our day to day life.
- ◆ For cooking food, we need different types of ingredients.
- ◆ We get food ingredients from plants, animals and other sources.
- ◆ We get food ingredients like milk, meat, egg etc., from animals.
- ◆ We use different parts of plants like stems, roots, leaves, fruits and flowers as food.
- ◆ Some of the food ingredients like water and salt are obtained from other sources.
- ◆ The taste of food is based on its ingredients, method of preparation.
- ◆ Boiling, steaming and fermentation are some of the methods of preparing food.
- ◆ We use preservatives to preserve food for some time.
- ◆ Pickling, drying, smoking, addition of chemicals adding salt are some of the methods of preservation of food.



Improve Your Learning

Fill in the Blanks.

1. Salt is obtained from.....
2. The materials which are required to prepare food are known as.....
3. We useto preserve food for some time.
4. Eating foods after the expiry date may damage our.....

Choose the correct Answer.

1. The method of preparing idly is..... []
A) Roasting B) Fermentation C) Steaming D) Boiling
2. The source of sugar is..... []
A) Plant B) Animal C) Sea D) All of these

Match the Following words from Group “A” with “B”.

Group-A

- A) Raagulu () 1. Pearl millet
- B) Sajjalu () 2. Proso millet
- C) Jonnalu () 3. Foxtail millet
- D) Korralu () 4. Finger millet
- E) Samalu () 5. Great millet

Group-B



Answer the Following Questions.

1. Write some examples of animal and plant food materials.
2. Find out the ingredients of the given food items:
a) Potato curry b) Coconut chutney c) Gulabjamun d) Pongali
3. How does food get spoilt? Write its effects on human health?
4. If you have a chance to meet a chef, what questions you will ask about preparing tasty foods?
5. Write down the process of making any food item, which you like?
6. Draw some fruit and vegetable diagrams which you like.
7. Prepare slogans on ‘Wastage of Food’.
8. Suppose fish / raw mango / lemons are given to you, how would you preserve them ?



Activities and Projects

1. Collect any wrapper of packaged food. Read the information in detail and answer the following questions.
 - (a) When was it manufactured and how long can we use it?
 - (b) What ingredients does it contain, name them?
2. List out the names of some plants that grow in your village. Which parts of it are used as food?
3. With the help of your teacher form groups of 5 or 6 students of your class. Make a fruit chat or vegetable salad and eat it. How did you feel? Write few lines about your experience.
4. Find out from your parents about the various methods of preserving food and write notes on it.
5. Collect information about the main food habits of different states of India. Refer in your school, library books and discuss with your teacher and write a report on it.
6. Collect information regarding ‘our traditional food’ from your grandparents.

CHAPTER - 2



Knowing about Plants



Learning outcomes

Pupils will be able to..

- identify parts of a plant such as, root, leaf, stem, flowers.
- differentiate tap root and fibrous root.
- draw labeled diagrams showing parts of leaves.
- make efforts to protect environment by taking care of plants.



What kind of plants do you find at home, in your surroundings or in the park?

- Are all the plants you see similar?
- What are the similarities among them?

Let us get to know more about plants, especially about their parts and functions.

Parts of plants

We know that we have different parts in our body. In the same way plants also have different parts. Do you know them? Here is a plant. Try to name the parts of the plant you see in the picture.

In this chapter, let us try to understand about different parts of plants through activities. Divide the class into groups. Each group will collect 5 to 6 different types of plants along with their roots from the school garden or a nearby place (do not pluck plants individually).

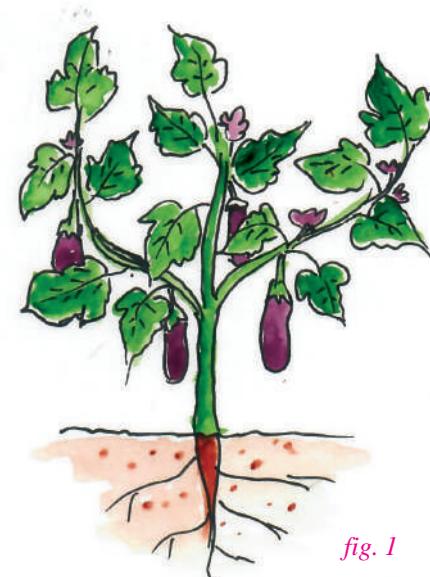


fig. 1



Activity: 1

Identification of plant parts

Observe the collected plants and try to identify their parts. Take the help of Fig. 1 and write your observations in Table 1. Let us discuss the following questions.

Table: 1

S.No.	Name of the plant	Root Yes/No	Stem Yes/No	Leaves Yes/No	Flower Yes/No

- Did you find any plant which does not have roots?
- Are the leaves of all the plants similar in size?
- Is there any plant without flowers?
- What are the common parts that you observe in all plants?

There are variations in the size and shape of plants but generally all plants have roots, stems and leaves. Have you ever thought about the importance of leaf, stem and roots in plants? What is the role of the different parts of the plants? Let us try to understand these things.

Root

The underground part of the main axis of a plant is known as **root**.

There are two types of root systems in plants.

1. Tap root system

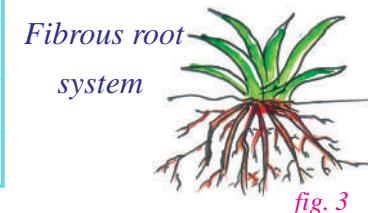
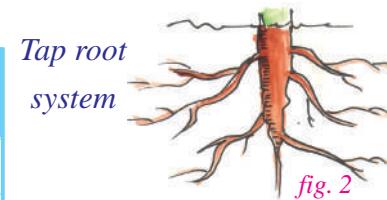
2. Fibrous root system

- Observe the roots of the plants you collected. How are they?
- Do all plants have similar type of root?
- Is there any difference?

Compare the roots of your sample plants with pictures provided. Write either Tap root or Fibrous root, in the column 'Type of root system' according to your observations.

Table: 2

S.No.	Name of the plant	Type of root system
1	Tridax Plant	
2		
3		
4		
5		



- In the Tap root system, how does the middle root look like?
- Compare this middle root with the remaining roots in the tap root system.
- Do you find any such main root in fibrous root system? How are the roots of this plant?
- Do you find any other differences between tap root system and fibrous root system?

By this we can understand that the Tap root system consists of a single root, called **Taproot**, which grows straight down into the ground and the smaller roots called **Lateral Roots** arise from the taproot. However, **Fibrous root** system consists of a cluster of roots arising from the base of the stem. They are thin and uniform in size.

Activity: 2

Take two paper cups. Fill them with fertile soil. Sow two or three bean seeds in a cup and few finger millets (Ragulu) in another cup. Sprinkle water over them. Then place them by the window. After a couple of days, you will see them sprout. Observe the newly emerging leaves.

- How many leaves have emerged from the bean seed?
- How many leaves have emerged from the finger millet seed?

The first leaves emerging from the seed during germination are known as seed leafs. The seed leaf within the seed is called the **cotyledon**. Upon germination, these cotyledons emerge as the first leaves of a seedling. Plants are classified as Monocots or Dicots based on the number of cotyledons. Bean seed has two cotyledons so it is a Dicot plant. Finger millet has only one cotyledon. So, it is a Monocot plant.

Now again sprinkle water over the seedlings. Take out the plants out of the soil carefully along with their roots. Observe the roots.

- What kind of root system do you find in the bean plant?
- What kind of root system do you find in the finger millet plant?

From the above activity we have learnt that Dicot plants have tap root system where as Monocot plants have fibrous root system.

Observe the plants in your surroundings and find out whether all the Dicot plants have taproot system.

Activity: 3

Water absorption by Root

Aim: To observe absorption of water by root.

What you need: A carrot, a glass of water and blue ink.

What to do: Place a carrot in a glass of water with a few drops of blue ink. Leave the carrot in water for two to three days. Then cut the carrot into half, length-wise and observe.

What do you see: Blue colour appears in the carrot.

What do you learn: The blue colour indicates that water moved upwards in the carrot showing that root conducts water.

Functions of the Root

- Fixes the plant to the soil.
- Absorbs water and minerals from the soil.
- Stores food in some plants like carrot and beet root.

Do You Know?

Modification of Roots

Some plants store food in their roots and stems. Some plants like radish, carrot, beetroot store food materials in their roots. These roots bulge out and are called tuberous roots. Can you give some examples?



fig:4

Do you find roots always underground?

Observe the fig-4. Which part of the plant does that boy hold to swing?

In order to perform some additional functions, in some plants roots grow above the ground. Such roots are called “Aerial roots”. They give additional support to the plants like banyan tree, sugarcane and maize. They are helpful in respiration in mangroves.

Stem

The aerial part of the plant body above the ground is known as the **shoot system**. Main axis of the shoot system is called the **stem**. The shoot system consists of stem, leaves, flowers and fruits. The stem grows above the soil, and it grows towards the sunlight. It has nodes and internodes. **Nodes** are the parts of stem, where the leaf arises. The part of the stem between two successive nodes is called the internode. The bud at the tip of the stem is known as the **apical or terminal bud**, and the buds at the axils of the leaves are called **auxiliary buds**.

Activity: 4



Conduction of water

Aim:-To observe conduction of water by a stem.

What you need? A small twig of balsam plant, a glass of water and a few drops of red ink

What to do? Place the small twig in the water with red ink.

What do you see? The stem turns reddish.

What do you learn? This is because red ink is taken and transported by the stem upwards.

Functions of the stem

The stem,

- supports the branches, leaves, flowers and fruits.
- transports water and minerals from roots to upper aerial parts of the plant.
- transports food from leaves to other parts through stem.
- stores food as in the case of sugarcane.

Do You Know?

Modification of STEM

Some plants like potato, turmeric, garlic, ginger and sugarcane store food material in the stem due to which the stem bulges in size. Generally we think that these are all tubers or roots. Actually they are modified stems.



Leaf

Leaves are another important part of plants. Most plants that we see in our surroundings have different types of leaves.

Observe the given picture of a leaf and its parts.

- Where is the leaf attached to the stem?
- What is the flat portion of the leaf called?
- What do you call the small line like structure in the flat portion of the leaf?
- Which part connects leaf lamina with the stem?

A leaf contains leaf base, a stalk like structure called petiole and lamina.

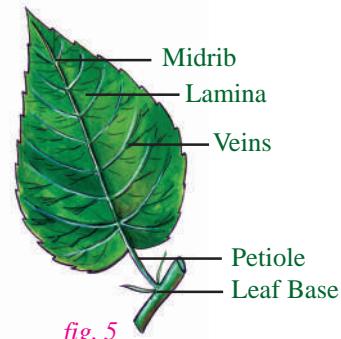


fig. 5

Activity: 5

Are all leaves the same?

Observe the leaves of the plants that you collected in activity 1. How are they? Are all the leaves of the same size and shape?

Compare the leaves of the plants, collected in activity 1, write your observations in the table. You can also draw what you see in the 'shape' and 'edge' columns if describing is difficult.

Table: 3

S.No.	Name of the plant	Leafbase Yes/No	Petiole Yes/No	Lamina Yes/No	Shape of the leaf	Edges of the leaf
1						
2						
3						
4						
5						

- What are the common parts that you observe in all the leaves?
- Do all the leaves have the same shape?

Venation

Observe the leaf lamina carefully. What do you see? You may see some thin-line like structures spread over the leaf.

Activity: 6

The leaf lamina usually consists of a midrib, veins and veinlets arranged in the form of a network. To understand this venation let us do an activity. Put a leaf under a white sheet of paper or a sheet in your notebook. Hold the tip of a pencil flat and rub it on the paper.

Did you get any impression?

Is this pattern similar to that on the leaf ?

The lines on the leaf are called **veins**. The long veins that are present in the middle of the lamina are called **midrib**. The branches arising from the midrib are called veins and the even finer divisions are **veinlets**. The arrangement of veins in the lamina is called **venation**. Venation acts as a skeleton of the leaf and gives it a shape and support.

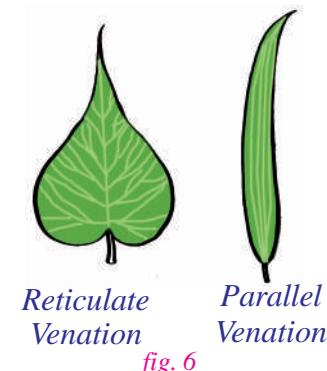
Activity: 7

Types of Venation

Observe the venation of the leaves that you collected in activity 1. If this design is net - like on both sides of midrib, the venation is reticulate. If the veins are parallel to one other, the venation is parallel venation. Record your observations in table 4.

Table: 4

S.No.	Name of the plant	Venation (Reticulate / Parallel)
1		
2		
3		
4		
5		



Now compare the results obtained in table 2 with table 4.

- What type of roots are there in plants having parallel venation in their leaves?
- What type of roots are there in plants having web-like venation in their leaves?
- Is there any relation between venation and root system?

You will see that the plants with tap root system have leaves with web-like or reticulate venation and plants with fibrous roots have parallel venation.

Activity: 8

Stomata Observation

Take a fleshy leaf. Peel the outer layer of the leaf and place it on a slide.

Put a drop of water on it and observe it under a microscope. Try to find some bean-shaped parts.

Compare what you see under the microscope with Fig.7

The bean-shaped part that you see in the leaf acts like our nose. These are called **stomata**. They are useful in the exchange of gases between the plant and atmosphere.



Activity: 9

Transpiration

Do you know that excess water is removed in the form of vapours from the leaf surface? To understand this let us do the following activity. Choose a bright, summer day to do the activity. Select a well watered plant that has been growing in the sun. Enclose a leafy branch of the plant in a polythene bag (Fig.8) and tie its mouth. Take another polythene bag of same size and tie its mouth without keeping any plant. Keep both the polythene bags in the sun. After a few hours observe the inner surface of the bags.



Transpiration
fig. 8

What do you see?

Are there any droplets of water in any of the bags?

Which bag has droplets?

How do you think they are formed there?

Plants release excess water in their body through stomata and some other parts as well. This process of releasing water in the form of vapour by leaves is called **transpiration**. These vapours condense and are seen as droplets in the polythene bag. Think, what will happen if transpiration does not take place in plants?

Another leaf function is the preparation of food for the plant by the process of **photosynthesis**. We will discuss more about this in the next classes.

Functions of the leaf

Leaves play an important role in the life of plants .They

- help in respiration.
- carry out transpiration.
- prepare food by the process of photosynthesis.

Do You Know?

Pottikkalu

Pottikkalu is a traditional food of Konaseema of Godavari districts. Leaves of jack fruit tree are used in its preparation. They make cups with these leaves and fill them with batter made of black gram and rice ravva/idly ravva. These cups are steamed to get pottikkalu. They can be taken with any chutney like that of idly. They are healthy and delicious with jack fruit flavour.



Most plants around us have roots, leaves, stems and flowers. All parts of the plants carry out some functions, essential for the whole plant. There are diverse forms of plants in nature and plants adapt themselves to the different conditions in nature in different ways. For example, while stems usually support the plant body, in some plants they adapt and store food.

The **flower** is another important part in the plant. The flower has colourful parts called **petals**. They attract insects for pollination and produce fruits. We grow plants for colourful flowers which give beauty to nature. We will learn more about flowers in the next classes.

KEY WORDS

Tap root, Fibrous roots, Monocots, Dicots, Node, Terminal bud, Auxiliary bud, Leaf, Petiole, Lamina, Reticulate venation, Parallel venation, Stomata, Transpiration, Photosynthesis



What we have Learnt?

- ◆ The important parts of a plant are root, stem and leaves.
- ◆ Tap root system and fibrous root system are two types of root system seen in plants.
- ◆ Dicot plants have tap root system whereas Monocot plants have fibrous root system.
- ◆ Roots help to fix the plant to the soil, absorbs water and minerals.
- ◆ The stem bears branches, leaves, flowers and fruits.
- ◆ The stem transports water and minerals from roots to upper plant parts and food from leaves to other parts.
- ◆ Leaf base, petiole and lamina are all parts of a leaf.
- ◆ Reticulate and parallel venation are found in leaves.
- ◆ Leaves are involved in preparing food. They also help in exchange of gases and transpiration.



Improve Your Learning

Fill in the blanks

1. Tap root system is present in _____ plants.
2. The bud at the tip of the stem is known as _____.
3. Part of the leaf that helps in exchange of gases is _____.
4. Primary organs of photosynthesis are _____.

Choose the correct Answer:

1. The important function of stomata is ()
A) Conduction B) Transpiration C) Photosynthesis D) Absorption
2. Part of plant that helps in absorption of water and minerals ()
A) Root B) Stem C) Leaf D) Flower
3. Part of the stem from where leaves arise is called ()
A) Node B) Bud C) Cotyledon D) Internodes

Answer the following:

1. What are the important parts of a plant?
2. How does the stem help the plant?
3. What is the relation between the type of root system and venation?
4. Rajani said “Respiration takes place in leaves”, is she correct? How can you support this statement?
5. What will happen if a plant doesn't have any leaves?
6. How can you show that plants absorb water through their roots?
7. Explain the various parts of a plant with the help of a diagram.
8. Explain the parts of a leaf with the help of a diagram.
9. John has no sufficient place around his house to grow plants. But he wants to grow vegetables like tomato or brinjal. Suggest him some ways to grow plants.



Activities and Projects

1. Collect any plant from your surroundings. Draw its root structure. What can you say about its root system?
2. Collect the leaves of various plants and prepare a herbarium. Write a brief report on their shapes, size and venation.
3. Prepare a greeting card with dry leaves.
4. Observe a plant which has healthy green leaves and beautiful flowers. Write your feelings about the plant in your notebook.



CHAPTER - 3



Animals and their Food



Learning outcomes

Pupils will be able to..

- explain the food habits of different animals.
- classify the organisms based on their food habits.
- differentiate modes of getting food by different animals.
- relate different phenomenon based on adaptation of animals with their Food habits.
- explain the inter relations of plants and animals through food chain and food webs.



Do you have a pet or cattle that you take care of such as a dog, cat, buffalo or a goat? You will then surely be aware of the food that the animal eats. What about other animals? Have you ever observed what a squirrel, pigeon, lizard or a small insect may be eating as their food?

Activity: 1

Some animals are listed in the given Table-1. For some the animals, the type of food they eat is also given. Fill the blanks in Table-1.

Table: 1

Name of the animal	Food the animal eats
Buffalo	Grass, oilcake, hay, grains
Cat	Small animals, Birds, Milk
Rat	
Lion	
Tiger	
Spider	
House Lizard	
Cow	
Human Beings	
Butterfly	
Crow	
Others	

Answer the following questions based on the table -1

1. List the animals that depend only on plants and their products for food.

.....

2. List the animals that depend only on animals and their products for food.

.....

3. List the animals that depend on both plants and animals for food.

.....

Animals that depend only on plants for food are called **Herbivores**.

Animals that depend only on animals for food are called **Carnivores**.

Animals that depend on both plants and animals for food are called **Omnivores**.

Do You Know?

Frugivorous Animals

These animals feed mostly on raw fruits, succulent fruits-like vegetables, roots, shoots, nuts and seeds. Frugivore can be any type of herbivore or omnivore where fruit is a preferred food type. Because approximately 20% of all mammalian herbivores eat fruit, frugivory is common among mammals



How do Animals Eat?

Plants and animals are the main sources of food in our surroundings. Like us, animals also depend on these sources for food. Every animal has its own style of getting food. They track down, collect, grab or hunt and then use various parts of their body to take food into the mouth finally.

Most animals feed regularly. But first, they must trace out the food. To do this, they use a wide range of senses – smell, sight, hearing, taste and touch. Some animals rely more on one sense than the other and it can therefore be highly developed in them. Many animals have specialized parts of the body such as mouth, hands or feet that help them to collect their food most efficiently. Let us do an activity to understand it better.

Activity: 2

Write the parts of the body animals that are used to collect or capture food in table-2

Table - 2

S.No.	Animal	Sense used in tracking food	Body parts used in taking food
1	Dog	Smell	Sharp teeth, Tongue
2	Cow		
3	Hen		Beak
4	Frog		
5	Snake		
6	Bat		
7	Lizard		
8	Vulture		
9	Lion		Legs, Claws, Mouth...
10	Humming Bird		

From the above activity we came to know that animals use some senses more strongly than others to find their food. For example, dogs use the sense of smell while vultures use vision. Bats depend more on hearing while some reptiles, on taste.

If you go near a pond, observe the pond skaters there. Observe how quickly they move from one side of the pond to other to catch an insect that falls in water. Pond skaters (an insect which feeds on other insects) detect ripples produced in water by any other insect trapped on the water surface. They compare the ripples on the opposite side of the pond, caused by the legs of the insect struggling to move out, calculate the distance and set out to grab it!



From the table-2, we came to know that animals have specialized parts of the body for their food collection. Do all the animals use similar parts in taking in food?

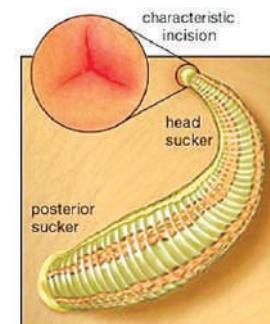
- Name some animals which use similar parts in taking in food?
- Compare the parts of dog to that of frog. Note down the similarities as well as differences observed by you.

- Compare the parts of hen and sparrow in eating food. Note down the similarities as well as differences you observed.
- What are the similarities between a dog and a lion in the parts involved in taking in food?
- What are the similarities and differences between a vulture and a lion in their mode of taking in food?

You will see that the same part may be used in different ways by different animals. For example, tongue may be used by a dog in a different manner as compared to a frog. The dog licks with its tongue while the frog captures and swallows food with it. Also, different parts may be used to take in the same type of food, like, hens use their beaks to pick insects while frogs use their tongues for the same purpose. The same part in a similar group of animals may be used in ways that can be largely different. For example, beaks of different birds are used to eat different types of food. Let us take some specific examples to observe how animals eat their food. The type of food and the ways in which an animal collects it, form the food habit of the organism.

How leeches get their food ?

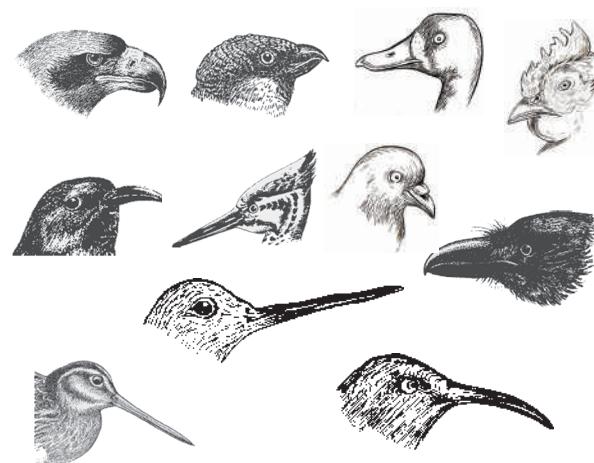
People in rural areas are familiar with leeches. While rearing cattle near water they find leeches on the skin of animals. Leeches stick on to the skin and suck the blood of cattle as well as humans. They have special structures called suckers in their mouth to do this. Do snails and earthworms also suck something from the ground? Discuss this with your teacher and your friends.



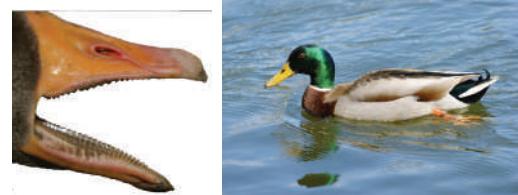
Activity: 3

How birds get their food

Look at the picture. Different birds have different beaks. Do you know why they are different? Yes. The beaks are different because the birds eat different kinds of food. Woodpeckers have a long and strong beak. By using this beak they remove layers of bark and eat ants and pests which lie under the bark. The crane has a long beak to catch fish in water. Have you ever seen vultures? They have strong hooked beaks to tear flesh of animals. The parrot, which eats



fruits and cracks nuts, has a hooked beak, while the crow doesn't have it. Not only the beak, there are other parts as well, that are different to suit the type of food eaten by a bird. Vultures would need sharp claws along with strong hooked beaks to tear flesh, while the humming bird that sucks nectar would need a long thin beak and does not need sharp claws.



It is very interesting to watch how a duck catches its food. Ducks have teeth, but they are not like the teeth of a cow or lion. They are not useful in grinding food. They act as filters to get food from water. Similarly, fish too have teeth which are used for the same purpose as that of ducks.

Do You Know? **Natural Scavengers**

Crows and vultures that live in our surroundings usually eat waste, rotten food material, dead animals etc. They keep our surroundings clean in this manner.



How does a frog get its food?

It is very interesting to watch a frog get its food. A frog throws out its sticky tongue towards an insect. The insect gets stuck on the frog's tongue. Then the frog swallows it.



Activity: 4

- Observe how a lizard catches its food. Write down your observations.
- Find out the differences between a frog and a lizard's way of taking in food.
- How do these animals use their tongue?

How does a cow get its food?

We know that many animals like the cow depend on plants for food. They are herbivores. Animals like cow, goat, buffalo, sheep, giraffe, camel, elephant, deer etc. eat different parts of plants like green/dry grass, leaves and branches.



Activity: 5

Observe a cow or buffalo while eating its food. Write your observations in your note book.

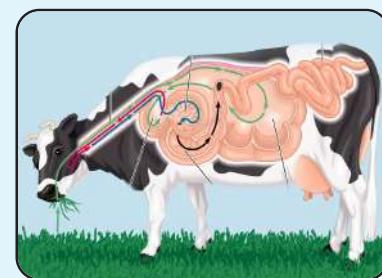
- How does a cow find its food?

- Note the parts of the body involved in it.
- What mouth parts of the cow are involved in eating its food?
- Do cows have teeth? Do they have teeth on both jaws? (ask someone who tends a cow to find this).
- In what way can you justify it is a herbivore?
- You may have observed cows and buffaloes sitting under the trees and moving their jaws. Do you know why they do that?

Do You Know?

Ruminants

Animals like cow, buffalo, camel etc., chew food very quickly, swallow and store it in a part of their stomach. After sometime they take food material back from the stomach to the mouth and chew it again. This process is called **rumination**. These animals are called ruminants.



How a Hunting animal like Lion gets its food

Did you ever see how a lion hunts a deer on TV? What do you feel about its concentration and actions while hunting?

Wild animals like lion, fox, wolf, and tiger hunt other animals for their food. They have strong legs to run, sharp claws to catch and sharp teeth to tear flesh.



Activity: 6

How a dog gets its food

Observe a dog in your surroundings. How does it get its food? Write your observations.



- What does it do to find food?
- Which parts are involved in taking in food?
- How does a dog eat meat?
- How does a dog drink water?
- Is there any difference in using its tongue when compared with a frog or a cow?

Write in the space provided below.

Animal

Use of tongue

Frog

.....

Cow

.....

Dog

.....

Food Chain

Living organisms need food to perform their life processes. Some organisms can produce their own food, while some depends on other organisms to obtain their energy. We can therefore identify different feeding types based on how the organism gets its food. They are **producers and consumers**.

Producers make their own food. Plants are producers. Any living thing that uses the energy of the Sun to make its own food is a producer. A **consumer** is an organism that eats living plants or animals. All animals are consumers because they do not make their own food.

What will happen if all animals ate plants? To maintain a balance in nature animals follow their food habits. Basing on their food habits there are different types of consumers. We can classify them into specific groups.

Primary Consumers:

They eat producers. They include herbivores such as some insect, rabbit, cow etc.

Secondary Consumers:

They eat primary consumers. They include carnivores such as many birds, frog, fox etc.

Tertiary Consumers:

They eat secondary consumers. They include carnivores that feed on other carnivores. They include snakes, lions etc.

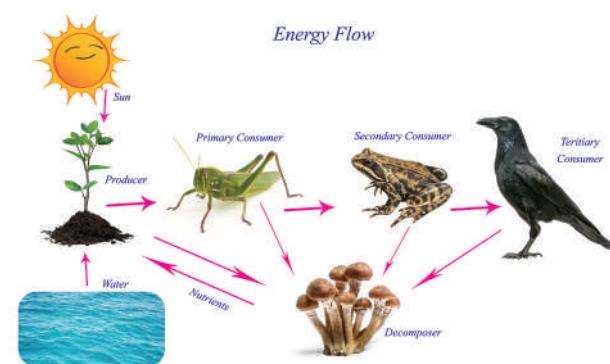
In a forest, the deer eats grass and in turn we know tiger eats deer. In any ecosystem there is a chain like relationship between the organisms that live there. **This sequence of who eats whom is called as food chain.** It describes how organisms get energy and nutrients by eating other organisms. A food chain shows the relationship between producers (e.g. grass) and consumers (e.g. deer, goats, cows and tiger). Food chain explains the interdependence of diverse organisms in nature.



Activity: 7

Energy flow in a food chain

Study the pictures.



- What is the source of energy in a food chain?
- How does grasshopper get its energy?
- What happens to the crow, if the frog was removed from this food chain?
- What is the role of mushroom in the given picture?

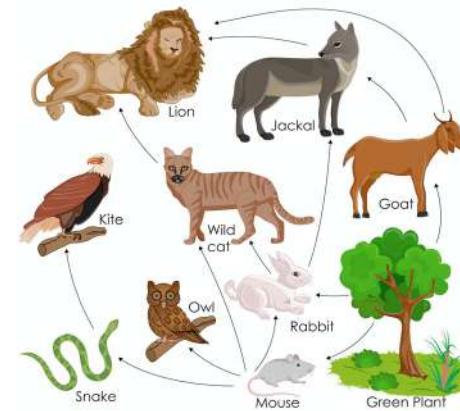
Bacteria and Fungi such as mushrooms get energy by the break down of dead plants and animals. They are called decomposers. They break complex substances into simple substances that goes into the soil and are used by plants. Thus they help in cycling of materials between producers, consumers and soil. So they are also called as recyclers.

Food Web

Food chains cannot always be represented by a straight line. They can be branched with several food chains connected to each other to form a web. This system of inter connected food chains is called **Food Web**.

Animal colonies and food

There are many animals that live in colonies - from huge elephants to tiny ants.



The wonder world of ants

Ants do a lot of things. Their colony has large ant forces to do work. There are mainly workers, soldiers, female and male ants. The workers collect and maintain food stock for others in the colony along with several other duties. Just as we keep cows for milk, ants keep a type of insect called aphids for honeydew. Like us ants are good farmers as well. They cut leaves into pieces and create a bed to grow a type of fungus which they eat!



Think! What can we learn from ants? Write your opinion in your notebook.

KEY WORDS

Food habit, carnivore, herbivore, omnivore, rumination, food chain, producers, consumers, decomposers food web



What we have Learnt?

- ◆ Different types of animals that live in our surroundings have their own food habits (way of taking in food and type of food taken).
- ◆ Sucking, licking, pecking, chewing, peeling, swallowing are all the ways by which animals take in their food.
- ◆ Animals are divided into three types on the basis of their food. They are carnivores, herbivores, omnivores.
- ◆ Beaks of birds differ from one another depending upon the type of food they eat.
- ◆ Food chain is the connection between animals on the basis of their food habits.
- ◆ Food chain explains the interdependence of diverse organisms in nature.
- ◆ The system of interconnected food chains is called **food web**.



Improve Your Learning

Fill in the blanks

1. The butterfly uses _____ to suck honey from flowers.
2. Tiger is a _____ because it eats only meat
3. Decomposers are also called _____

Choose the correct answer

1. The source of energy for a food chain is ()
A) Producers B) Consumers C) Sun D) Decomposers
2. Identify the omnivore from the following ()
A) Lion B) Cow C) Dog D) Tiger
3. At which position of the food chain would you place a human being ()
A) Primary consumer B) Secondary consumer
C) Tertiary consumer D) All the above

Answer the following

1. List some animals in your surroundings which have the same kind of food habit.
2. Compare the legs and nails of a dog and hen and say why they are different.
3. Name some animals which use tongue as a tool for taking in food.

4. Identify which of the following statements are wrong and give reasons.

- (a) All the animals living in water feed only on plants.
- (b) Elephants and deer are herbivores living in the forest.
- (c) Birds' beaks are designed to suit their food habits.
- (d) Sharp claws are useful for hunting.
- (e) Most of the food chains end with herbivores.



5. Write the importance of the food chain.

6. Arrange the following in a correct sequence and form a food chain

- 1. Rabbit → Carrot → Eagle → Snake
- 2. Human → Insect → Algae → Fish

7. If you want to understand more about food chain what questions would you like to ask?

8. What happens if there are no decomposers on the earth?

9. Draw a food chain of your choice.

10. How can you appreciate the role of producers in a food chain ?



Activities and Projects

1. Go to a nearby pond where cranes are usually seen. Observe how they catch fish. Write about the process of catching fish. (Take care of yourself when you are near water places.)
2. Collect one or two earthworms and put them in a bottle containing wet soil. Close it with a lid which has holes. Observe how earthworms get their food. Record your observations.
3. Fill up the following table

Body part used to collect food	Examples
Beak	Hens, ...
Tongue	
Teeth	
Sucker	
Strong legs with claws	

4. Make your own food chain and display it in your class room.
5. Prepare a scrap book of animals and separate them into carnivores, omnivores and herbivores.

CHAPTER - 4



Water



Learning outcomes

Pupils will be able to..

- recognise the source and availability of water.
- understand the importance of water.
- explain the process of water cycle.
- draw labelled diagram of water cycle.
- apply learning of scientific concepts in day-to-day life by suggesting ways to cope with heavy rain/drought, etc.
- understand the importance of wastage of water, rain water harvesting.

Hai Friends, I am Sujatha from Akkalareddypalle of Kadapa District. The woman in the picture is my mother. She carries drinking water for us from the stream which is away from our village. It is very difficult to walk all the way by carrying the water pots. It takes lot of time but it is very essential for us as we can't do anything without water. So we use water preciously.



- What do you think after listening to Sujatha's story?
- For what purpose do we need water?
- Where do we get water from ?
- Is it necessary to take care of water resources ?

Come, let us learn something regarding water in this chapter

Do You Know?

783 million people do not have access to clean water on the globe.

We need water to perform several day to day activities like cooking food, washing clothes, cleaning utensils etc. We can't survive without water even a single day.

Activity: 1

Water and its uses

Divide the class into groups. Let them discuss the uses of water in their daily life. Ask them to make a list. Now classify the uses as i) Domestic use ii) Agricultural use and iii) others



Do You Know?

Our body uses water to regulate its temperature and maintain other bodily functions. On an average, the human body requires 2 – 3 litres of water per day for proper functioning. Water helps in digestion of food and removal of toxins from the body. This is the reason why water bells are introduced in our schools.

Measuring the volume of water

Arjun used buckets of water to bathe and to wash his clothes. He said that he had used four buckets of water. Is bucket a measure of the volume of water used? How do we measure the volume of water? We can keep water in different vessels. Often, we say, a glass of water, a bucketful of water, a bottle of water etc.

Do you know any specific unit of measurement of volume?

Water and other liquids as well, are measured in litres. You will learn about this in later classes. Now let us estimate how much water we use daily.

Activity: 2

How much water do we use daily?

We use water for different purposes. Can you estimate how much water your family uses in a day? Record your estimates in the table. Also think how you could reduce the amount of water used and write how much water you can save.

To estimate the amount of water used, take 1 litre bottle and find out how many bottles of water are needed to fill a bucket, a glass, a mug used in a whole day by you and your family. Also, calculate the amount of water you and your family were able to save. You have a rough idea of how much water your family uses in a day. With this information you may be able to calculate the approximate quantity of water required for your colony/village/town/city. For this, you will need to know the population as well. Ask your teacher about population.

Approximate quantity of water used per day by a person.....

Number of people in the colony/village etc.....

Approximate quantity of water used per day in the colony/village etc.....

Approximate quantity of water used per month in the colony/village.....

Approximate quantity of water per year in the colony/village etc.....

Imagine how much water is needed across the world!

Where do we get water from?

We get water from different water sources in our surroundings. In most villages wells, canals, tanks, ponds, rivers, etc., are the main water sources.

- List the sources from where you get water in your village/ town.
- Are the sources from where you get water for your daily needs, and for crops the same or not? Give your reasons.

Do You Know?

Water is not only available from sources such as the rivers, lakes and ponds but also present in certain fruits and vegetables. Fruits like watermelon and vegetables like cucumber contain a lot of water. Can you suggest some other examples? Our body also contains 70% of water by weight. Think, why we take juicy fruits in summer.

Activity: 3

How is a well dug?

Go to a nearby village and look at a well from where people get drinking water. Can you estimate the approximate volume of water in the well? Collect information from elders in the village about the level of water in the well over the years. Is the water level constant or has it changed? How was the well dug? Have you seen a bore-well being dug? Write the process in your notebook. Tapping of ground water by digging a well or bore-well is a tough job. Many people put in a lot of hard work in this process. We need to appreciate this and preserve water.

Water on the earth

There are different sources of water on the earth. We know that nearly 3/ 4th of the surface of the earth is occupied by water. Is this water useful for us?

- Can we drink the water available in the sea?

Sea-water is salty but water used by us in our daily purposes is not salty. It is known as fresh water. Water in ponds, puddles, rivers, tube-wells and our taps at home is usually fresh water. Of the water available on the earth, only 3% is fresh water. To understand this let us do a small activity.

Activity: 4

Relative amount of water at various vessels

Take a 20 litre bucket, a 500 ml mug, a 150 ml tumbler and a 1 ml spoon. If the capacity of the bucket is 20 litre, then it represents the total amount of water present on the Earth. Now, transfer a mug of water from the bucket to a 500 ml mug. Mug represents the total amount of fresh water present on the Earth. The water left in the bucket represents seas and oceans. This water is not fit for human use. Now transfer 150ml of water from the mug to the tumbler. It represents the total amount of ground water. Finally, take 1/4th of water from the mug into spoon. The remaining water in the mug represents fresh water which is present in frozen form on snow-covered mountains, glaciers and polar ice-caps. This water is also not readily available for human use. Water in the spoon represents the total amount of surface water which is available in all the rivers, lakes and ponds of the world. It can be taken as potable water. When such a small amount of potable water is available, then we should be more cautious in handling water. Is it not?



You have read about the different types of water sources in our surroundings. The water level in them depends upon rainfall. Generally, we observe that the water levels in wells or other water sources go up in rainy season and down during the summer season.

Rain is a common phenomenon like air and sunlight in our daily life. We generally get more rains in the rainy season. Our general observation is that if the sky is cloudy then there is a possibility of rain. But clouds do not lead to rains every time. Sometimes we witness sudden rains.

- Why do clouds cause rain?
- What is the relation between rains and clouds?
- Why don't all clouds cause rain?

To understand about clouds and rains we need to know first something about water.

Forms of Water

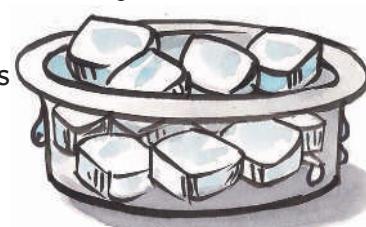
All of us know that water is available naturally in three forms

Solid Form

We call solid form of water as ice. Snow occurs naturally.

Can we convert water into ice?

Explain what should we do.



Liquid Form

What happens if ice is kept in the open air?

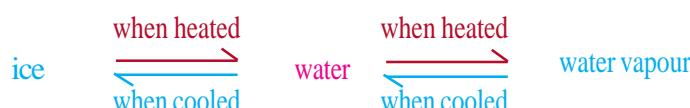
If we heat ice, it will change into water.

Water in liquid form is present in oceans, seas, lakes, rivers and even underground.



Gaseous Form

What happens when water is heated? The gaseous form of water is water vapour which is present in the air around us. We know that when ice is heated it converts into water and if water is heated it turns into water vapour. Similarly when water vapour is cooled we can get back water. If water is cooled further we will get ice. So, we understand that these three forms of water are interchangeable.



Evaporation and formation of clouds

Activity: 5

Spread a piece of wet cloth in the sunlight. Observe after some time. Where has the water in the wet cloth gone? The water evaporates into the atmosphere due to the heat of the sun.

When we want to dry clothes quickly we wave them or keep them under a fan.

- Does the water in wet clothes dry up only due to sunlight or due to other reasons?

You must have seen that water on wet roads, roof tops and some other places dries up after some time though there is no sunlight.

- Where does this water go after drying up?

If you heat water kept in a bowl by using a stove, you may notice water vapour coming from the bowl. Thus, when water is heated, it gets converted to vapour and mixes with the air. This is what happens to the water in wet clothes also.

The process of water changing into water vapour is called “evaporation”

If water is gently heated, it will become warm. Some vapour is produced. If it is heated more, it starts boiling. If we heat it further, it evaporates and converts completely into water vapour. We know that the amount of heat absorbed by water affects its evaporation. If water is heated more, it will evaporate faster.

- You might have observed evaporation in many situations in day to- day life. Discuss them with your friends and prepare a list.

Evaporation is a natural process which takes place on the Earth. Water evaporates continuously from the surfaces of water bodies like seas, oceans, rivers, ponds etc. and changes into water vapour due to the heat supplied by sunlight.

- Where does this water vapour go after evaporation?



The water vapour formed due to evaporation becomes a part of air and cannot usually be seen. The water vapour which enters into air through the process of evaporation forms clouds in the sky.

- What is a cloud?
- How are clouds formed?

Condensation

It is our common experience that on cold winter mornings when we speak, we observe smoke-like vapour coming out of our mouth.

- Why does smoke-like vapour comes out of our mouth in winter?
- Do we experience this in summer as well?

In winter, the air in our atmosphere is very cool as compared to the air coming out from our mouth. Water vapour present in the air coming out from our mouth gets cooled suddenly to form very tiny droplets. These tiny droplets concentrate in a limited area, appear like smoke or a small cloud near our mouth.

You might have observed that in the mornings during winter, some fog is formed and small dew-drops appear on grass and leaves of plants etc.

- From where do these water-drops come on the leaves and grass?



Activity: 6

Take some water in a glass. Add pieces of ice to it. Observe for a few minutes.

- What changes do you observe on the outer surface of the glass?

You would observe the formation of small drops of water on the outer surface of the glass.

- Why are these drops formed?
- Do they form if there is no ice in the glass?



Ice-cold water in the glass cools its surface. Air around the glass contains water vapour which is warmer than the surface of the glass.

Due to the cold glass, air close to its surface will also become cooler. This changes the water vapour in the air around the surface of the glass into water and forms small drops on the outer surface of the glass.

Have you ever observed in your daily life where water vapour changes into water? List them out.

The process of conversion of water vapour into water is called “condensation”.

Clouds and rains

On a warm day, the sun heats up the ground as well as the water in seas, oceans, rivers, ponds etc. This water converts into water vapour by the process of evaporation. This

Water

water vapour rises up into the atmosphere. As we move away from the surface of the earth, the air becomes cooler. Hence, when water vapour reaches higher levels it condenses due to contact with cool air and forms small drops or water droplets. These tiny droplets remain floating in the air at higher levels of the atmosphere and appear as clouds.

The clouds formed on the surface of the different water bodies do not stay there. They start to move from one place to another in the direction of winds. As more clouds come together they become laden with water vapour. Winds bring the clouds from the sea to the land. The colder air in the upper layers of the atmosphere cools the cloud.

- Have you observed the colour of a cloud before it rains?
- How do clouds convert into rain?

We all know that without clouds, it will not be possible to get rains and that all clouds do not cause rains. Some changes take place in the clouds before they cause rain.

- What changes do you notice in the sky and in the atmosphere before it rains?
- What changes take place in the clouds before raining?

The clouds moving in the air are generally at higher levels. Sometimes the cool breeze coming along with the air makes the clouds cooler. This leads to water droplets present in the clouds to condense and form large water-drops. Further cooling of clouds increases the size of their water drops and clouds become heavy and descend towards the earth. The colour of such clouds changes from white to grey giving us the feeling of dark clouds gathering. When the size of the water-drops increases further it becomes difficult for the cloud to hold them and water drops begin to fall. This is called “**rain**”.

In our daily life, we observe that before raining, clouds descend towards the earth’s surface and we experience a cool breeze before rainfall. In very cold conditions, the drops of water turn into crystals of ice and fall as snow. Sometimes big drops of water solidify into ice and fall as pieces of ice known as **hailstones**.

This kind of weather condition where rain, snow, sleet, or hail fall from the sky is called **Precipitation**.

Do You Know?

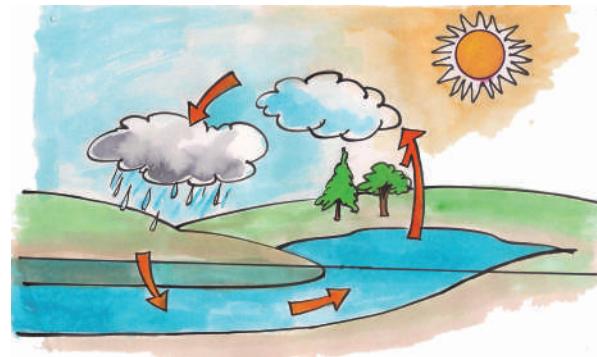
Generally, we get rains in some particular months during the year. In our state, rains occur normally from June to September. During that season you might have observed in the sky that clouds are moving along with the winds blowing from western direction (South West side). These winds are called “**South West monsoon**”. Similarly, we observe in the months of November and December rains occur due to movements of clouds in the direction of winds blowing from Eastern side (North East side). These winds are called “**North East Monsoon**”. Now-a-days we are not getting timely rains and seasons are also changing slightly. Think, why is it happening so?

Water cycle

When it rains ponds, lakes etc., are filled with water. Water that comes from rainfall runs down as small streams. These small streams join together and make bigger streams. These bigger streams join the rivers. The rivers flow down to seas and oceans. Some of this rain water seeps into the ground and becomes ground water.

As it is very hot during summer, large quantity of water evaporates from seas, lakes, rivers etc. and converts into water vapour. This goes up into the air to form clouds. These clouds again cool and give rain. The circulation of water between earth surface and air is called “Water Cycle”. It is also called the **Hydrological cycle**. This water cycle can be summarized as follows.

There are four main stages in the water cycle.



1. Evaporation: Liquid changes to gas.

Cause: Sun heats up water bodies.

Effect: Liquid water becomes water vapour (gas).

2. Condensation: Gas becomes liquid.

Cause: Vapour rises into air, and cools.

Effect: Water vapour (gas) changes into liquid water (clouds).

3. Precipitation: Water or frozen water falling to Earth.

Cause: Cloud droplets become too heavy. They fall.

Effect: Precipitation (rain, snow, sleet, hail)

4. Collection and Runoff: Water soaks into the ground.

Cause: Water collects on Earth's surface. Sometimes it flows off before collecting.

Effect: Lakes, ponds, oceans, rivers, streams

Deforestation and pollution from factories are now causing global warming. So, the atmospheric conditions are not favourable for clouds to get cooled. Consequently, there is a decrease in rainfall. This disturbs the water cycle and causes either less rainfall or too much rainfall.

- What happens if there is less rainfall or too much rainfall?

Do You Know?

There are four main types of precipitation. They are rain, sleet, snow, and hail. Each type begins as either water droplets or ice crystals in clouds. The temperature of the lower atmosphere determines which form the precipitation will take as it falls.

Rain falls when the air temperatures are above freezing.

Sleet occurs when raindrops fall through freezing air near Earth's surface. The drops turn into pellets of ice.

Snow falls when water vapour passes through air that is very cold. As a result, the water vapour crystallizes and builds into snowflakes.

Hail forms when thunderstorm winds push water back up into the atmosphere. The water which turns into ice, is coated with more water, and pushed up to freeze again. This process repeats until the hailstone is heavy enough to fall.



Activity: 7

Droughts - Water Scarcity

Form groups of 4 to 5 students and discuss the following topics in each group. Prepare and submit a group report. The topics to be discussed are:

Group-1: What will happen if rainfall this year is less than last year?

Group-2: What would happen if there was no rainfall for five years?

Group-3: What could be the possible reason for water scarcity in a particular place?

Group-4: What problems can arise due to water scarcity in a particular place?

In our region, if there is no rain for a long period (4 to 5 years), it may cause droughts. During this period, it is very difficult to get food and fodder; drinking water is scarce. People need to travel long distances to collect water. Soil becomes dry, agriculture and cultivation becomes difficult. Many people who depend on farming for their livelihood, migrate to other places in search of jobs. In our state, Anantapur, Kadapa and Kurnool districts are drought prone.



Activity: 8

Drought affects our life

Here is a letter written by Ramanna for you. Try to understand how drought affects our lives. Discuss the following points

Dear Firoz,

I hope you are fine there. Nowadays, we are facing severe problems due to drought. For the last five years we have no rains. All our fields have dried and there are cracks in them. We fail to grow any crop. My father invested money on bore wells with no results. Now we get water, after a great struggle from the bore-well which is five kilometers from our village. The days have become very bad. Several people have sold their cattle and migrated to Hyderabad and Bengaluru. My family also wants to do so. I request you to ask your parents to search for a job for my father at your place. My father may have been a well-known, rich farmer here but he is willing to do any kind of job there.

Yours loving friend
Ramanna

- What problems did Ramanna face?
- How can Firoz help him?

Water scarcity is a problem in some districts of our state, as mentioned earlier. Here rainfall is less and farmers are largely dependent on irrigation using underground water to raise crops.

- What will happen if a farmer grows crop that require more water in these districts?

If several bore wells are dug and underground water is tapped constantly, what will happen to the source of ground water?

Discuss with your friends the reasons that can cause reduction of ground water.

Activity: 9

Floods a natural hazard

Usually, during the rainy season, you may have come across pictures of this type in newspapers (Fig. 1). Discuss the following.



fig. 1

- What does the picture tell us?
- Does excessive rainfall in certain areas of our country lead to such a condition?
- Are there any other reasons that can lead to this situation?
- Have you ever faced or heard about floods? Based on your personal experience or from the knowledge of news articles, write few sentences on floods.

Do You Know?

National Disaster Relief Force (NDRF), State Disaster Relief Force, Local Fire, Health, Police and Revenue departments, work in co-ordination during floods and natural disasters. Military also participate in relief activities wherever necessary.

Think: Air and water are freely available in nature but now people have to pay for water along with other commodities. Find out from your parents and grandparents whether they also paid for water. Think why the demand for water is increasing day-by-day.

The main reasons for water scarcity are 1. Population explosion, 2. Uneven distribution of rainfall, 3. Decline of ground water table, 4. Pollution of water and 5. Careless use of water. We should use water judiciously to prevent scarcity of water. Otherwise, it is impossible for organisms to live on the earth. The only method of preventing scarcity of water is conservation of water. Saving water for the future generations by using water judiciously helps in conservation of water.

Methods of water conservation

Mainly, two methods can be followed for the conservation of water.

1. Water management

Water management consists of the following factors:

- a. Bringing awareness about the bad effects of throwing wastes into the water bodies
- b. Recycling of water by separating pollutants.
- c. Minimizing the use of chemical fertilizers in agriculture. It reduces the pollution of underground water.
- d. Controlling deforestation
- e. Adopting drip irrigation and sprinkler irrigation in agriculture. In this way lesser amount of water can be used for irrigation

2. Rain water harvesting

Direct collection and use of rain water is called rain water harvesting.

There are two types of rainwater harvesting.

a. Collecting water from where it falls.

(e.g.): Collecting water from the roof tops of the houses or buildings (Roof water harvesting).

b. Collecting flowing rain water

(e.g.): Collecting rainwater by constructing ponds with bund.

We can't live a single day without water. Arjun decided that water is precious. Let us not waste even a single drop of water. We must preserve water not only for us but also for future generations.

KEY WORDS

Water sources, Evaporation, condensation, Precipitation, water cycle, cloud, water vapour, atmosphere, stream, droplets, dew, rain, hails, breeze, wind, drought, floods, migration



What we have Learnt?

- ◆ We need water for domestic, agriculture, industrial purposes.
- ◆ We get water from sources like ponds, lakes, rivers etc.
- ◆ Of the water available on the earth, only 3% is fresh water.
- ◆ We depend on rains for water.
- ◆ Water on the Earth can exist in three forms: ice (solid form), water (liquid form) and water vapour (gaseous form).
- ◆ The process of changing of water into water vapour is called evaporation.
- ◆ Evaporation of water from the surface of seas, lakes, ponds etc. is part of cloud formation.
- ◆ Clouds are formed from tiny droplets of water vapour.
- ◆ The process of conversion of water vapour into water is called condensation.
- ◆ The cycle of evaporation and condensation of water, present on the Earth's surface, causes rain.
- ◆ Rain, snow, sleet, or hail — any kind of weather condition where something's falling from the sky is called Precipitation.
- ◆ The conversion of water into water vapour, water vapour to clouds and clouds to rain is known as water cycle.
- ◆ Long periods of less rainfall usually causes droughts and famines.
- ◆ Floods are natural disasters that affect human life.
- ◆ The amount of usable water on earth is limited, so it needs to be used carefully.



Improve Your Learning

Fill in the blanks:

1. The process of changing water into its vapour is called _____.
2. The water cycle is also called as _____.
3. No rainfall for a year or more may lead to _____ in that region.
4. Excessive rains may cause _____.

Choose the correct answer

1. The nature of sea water is ()
A) Salty B) Tasteless C) Odourless D) Sweet
2. Which of the following is not a part of water cycle? ()
A) Evaporation B) condensation C) rain D) distillation
3. Which of the following processes add water vapour to the atmosphere? ()
A) Solidification B) Precipitation C) Condensation D) Evaporation

Answer the following

1. List out the activities in our daily life where we use water.
2. How are clouds formed? Explain?
3. Which of the following days is more suitable for drying of washed clothes? Explain why.
(a) Windy day (b) Cloudy day
4. Why do we experience cloud like smoke near our mouth while we speak during the winter season?
5. Why does the driver of a vehicle wipe the glass inside, even if the wiper is working on the outer surface of the glass when he drives in rain?
6. What is water cycle? Explain its main parts briefly.
7. Revanth blew air from his mouth onto the mirror while he was getting ready to go to school. He observed that the image in the mirror was not clear. Do you know, why? Prepare questions to get clarity.
8. If we use water in the same way what will happen in future?
9. How can you demonstrate condensation of water by using a glass, water and pieces of ice?
10. Draw the diagram showing water cycle.
11. How do you appreciate the contribution of water cycle in making water available for various needs of plants and animals?
12. Write your suggestions to prevent water wastage.
13. If people are suffering due to severe floods, what would you do to help them?

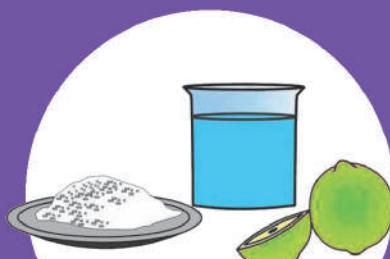


Activities and Projects

1. Prepare a map of your village showing different water sources.
2. Make a pamphlet on "Don't waste water." Display it on wall magazine
3. Collect information about water related games and make a scrap book.
4. Justify the statement "droughts and floods are a result of actions made by man." Investigate your reasons.
5. Conduct a seminar on drought control activities.
6. Collect information from your grandparents and their experiences about the drought they experienced.

CHAPTER - 5

Materials - Separating Methods



Learning outcomes

Pupils will be able to..

- understand the making of objects.
- identify the different states of materials.
- utilize separating methods in daily life.
- explain separating methods with suitable examples.

Siri was sitting in her room and studying. Suddenly she heard a loud sound from the kitchen. Siri went to the kitchen and saw a cat running away.

- **Can you guess what could have happened?**

Write it down in your note book.

Siri saw that many objects had fallen on the floor. Some of them were broken and some were not. Can you guess which objects might have broken and which might not have broken? Fill in table 1.



fig:1

Table 1

Objects that would have broken	Cup, ...
Objects that would not have broken	Stainless steel plate, ...

- Can you tell why some objects break and some don't?

In our day to day life, we use several objects for different activities. These objects are made of different materials.

For example, body of your pen is made of plastic, where as its clip is made of iron.

Activity: 1

Finding the materials used to make different objects

A list of things in a house are given in table 2. Name the materials from which each object may possibly be made of :

(If you don't know which material the object is made of, discuss with your friends and find out.)

Table 2

S.No	Object	Material
1	Door	Wood, metal, rubber, paint.
2	Towel	
3	Eraser	
4	Knife	
5	Mirror	
6	Shoes	
7	Water bottle	
8	Pot	

- Which objects are made of only one material?
- Which objects are made of more than one material?
- How many types of materials can be used for making chairs?



fig. 2

List them in the space given below.

There are many objects in our surroundings such as chairs, tables, cycles, bullock carts, utensils, clothes, tyres, water bottles, stones etc. We see that different objects are made of different materials. Some objects are made of more than one material. Think of some objects made of more than one material.

Activity: 2

Finding the objects made from different materials

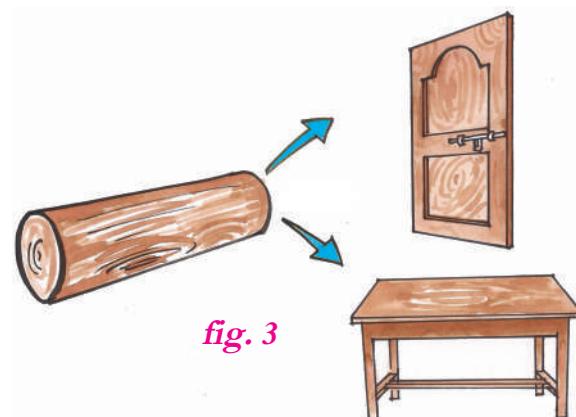
Name as many things/objects as you can, made using the materials given in table 3.

Table 3

S. No.	Material	Things/Objects
1	Metal	Utensils,
2	Plastic	Bag,
3	Glass	Mirror,
4	Wood	Table,
5	Cotton	Cloth,
6	Leather	Shoes,
7	Ceramic	Cup,
8	Rock	Idols,

We see that the same material can be used to make different objects (Fig.3). Each object is used for a special purpose. So we need to know the properties of materials as well as the properties of the objects to decide which material should be used for making an object. Some materials are soft and some are hard. Similarly some are shiny whereas some are non-shiny. Depending on these properties, materials are used for different objects.

We use different materials for different purposes based on their properties.



State of the materials

In the chapter on **water** you have studied the relationship between ice, water and water vapour, the three states of water. You would have noticed that when ice is added to a glass of lemon juice, the ice begins to melt and after some time all of it becomes water and the outer surface of the glass becomes wet.

If we heat the water in a vessel, we notice that after some time water vapour is produced. If heating is continued, more and more vapour is produced in the form of steam and the quantity of water in the vessel keeps decreasing.

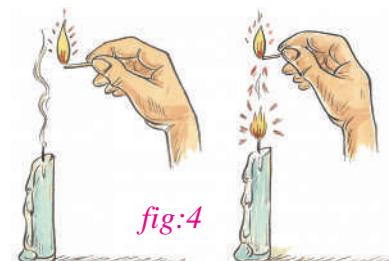
Some materials change their state from solid to liquid, liquid to gas on being heated and from gas to liquid, liquid to solid on being cooled. We sort materials as solids, liquids or gases based on their state at normal temperature.

Can you say names of materials other than ice that goes from solid to liquid, liquid to gas (vapour)?

Activity: 3

Light a candle

You may have lit a candle with a matchstick many times, holding the burning matchstick to touch the wick of the candle until the wick catches fire. But, can you light the candle without touching the wick with a burning matchstick? Do you think this is impossible? Let us see how it can be done.



Place a candle in a safe place and light it. The first time, the candle cannot be lit without touching the wick with the burning matchstick. So do just that the first time. Let the candle burn for some time. After about two minutes, hold a burning matchstick in one hand and blow the candle out. What did you notice? Did you see a column of white smoke rising from the wick as soon as you extinguished the flame? Now quickly bring the burning matchstick close to this smoke, but do not touch the wick with it. What happens?

- Did the candle catch fire from a distance?
- Discuss with your friends how and why the candle got lit from a distance.
- Does the white smoke represent candle wax in the state of gas?

How can you know the different states of materials?

We observe that certain materials can change their shape according to the shape of the containers they are put into, while some retain their shape. Those materials which change shape are mainly **liquids** such as water, milk, oil, kerosene, etc. Those materials which do not change shape are **solids** such as wood, rock, brick, plastic objects and vegetables etc.

Activity: 4

Classification of Materials

Think of different solids, liquids and gases around you and group them in table 4.

Table 4

Solids	Liquids	Gases
Stone	Milk	Smoke

Discuss with your friends and find out who had the longest list. Can you list their properties? For example, liquids take the shape of the container they are put into. Write all possible properties of solids, liquids and gases in your notebook. Discuss about them with your friends and teachers.

A Sweet Dilemma

While thinking about properties of solids, a group of students in class 6, put sugar in a glass, in a bowl and in a vessel. They observed that sugar takes the shape of the container. Since they know that liquids take the shape of the container, they concluded that sugar is a liquid. The second group in the class disagreed with the first group. What do you think? Is sugar a solid or a liquid? How will you decide? Parveen, a student from the second group came up with an idea. She took a single crystal of sugar and one drop of water and declared that sugar is a solid while water is a liquid. The first group also had to agree with her argument. Discuss with your friends and find out why sugar is a solid although it takes the shape of the container.

- Is common salt a solid or a liquid?



Sinking or Floating in Water

Let us assume that a tomato, brinjal, potato, iron nail, sponge, wood, stone, leaf, piece of chalk and paper are given to you. Predict which of these will sink or float in water. Record your predictions in table 5.

Table 5

Prediction	Object
Sinks	Stone ...
Floats	

Now try to test whether your predictions are correct or wrong by dropping the above objects in a beaker of water one by one. What do you find? Record your observations in the following table.

Object	Prediction	Finding



fig. 5

For which of these objects your prediction is wrong? Why?

Now, add a lot of salt to the water in the beaker. Try this same activity with water which is excessively salty.

- What do you observe?
- Do you get the same result? Discuss.



Do iron objects float?

Take some water in a wide mouthed bowl. Put an iron nail in it. What do you observe? Put an empty iron tin in that bowl. What do you observe?

Also try to observe whether a wooden piece floats on water. What happens when a wooden bowl is dipped in water?

What do you conclude from this activity? Some materials in one shape will sink in water but float on water when they are in another shape. The materials that can sink can be made to float, but all the materials that float cannot be made to sink.

Activity: 7

Soluble or insoluble in water

Take five beakers with water. Take small quantities of sugar, salt, chalk powder, sand and saw dust. Add each material to separate beakers and stir. Observe the changes and record your observations in table 6.

Table 6

S. No.	Material added	Dissolves (Yes/No)
1.	Sugar	
2.	Salt	
3.	Sand	
4.	Saw dust	
5.	Chalk powder	

We observe that certain materials dissolve when mixed with water. These materials are said to be **soluble** in water. The materials that do not dissolve are said to be **insoluble**. Repeat the activity with different liquids like vinegar, lemon juice, coconut oil and kerosene and add them to water. What do you observe? Discuss with your friends.

Do You Know?

A solvent is a liquid that dissolves other substances in it. Water can dissolve more substances than any other solvents. So it is called Universal Solvent

Mixtures

Have you observed tea being prepared? What substances are used for preparing tea? List them in table 7 and also list out the different substances that are used to make the items given in table 7.

Table 7

Item	Substances
Tea	Milk, ...
Laddu	
Lemon Juice	
Concrete	
Soil	



The above items are **mixtures** as they contain more than one substance. Combination of more than one substance forms a mixture. Some mixtures are natural like soil. Some mixtures are man-made like laddu, lemon juice etc.

Write in table 8 some mixtures that you know and their components. Also mention whether they are natural or man-made.

Table 8

Mixture	Components	Natural / Man made
Lemon water	Lemon juice, sugar, water	Man-made

Methods of Separation

We will discuss some simple methods of separating substances that are mixed together. You may come across some of these methods being used in your day to day life.

Hand Picking

How are stones separated from pulses or rice? Stones are separated by **hand picking** from rice and pulses (see fig. 7).

Hand picking is a method of separation where substances are separated from their mixture by picking with hand. This is possible only when their sizes are sufficiently large

Try to give some more examples where the hand picking method is used.

1.
2.
3.

Can you separate salt from sand in this manner?

Winnowing

When farmers thresh their crops, they get a mixture of husk and grain. How do the farmers separate the husk from the grains?

On a windy day, a farmer stands on a high platform and allows the mixture of grain and husk to drop slowly from the flat pan. The wind carries the husk forward and the grains fall vertically downward. A separate heap of grain is formed (Fig.8) This method of separation is called winnowing.

- What property helped in separating the husk from grain?

Husk is very light as compared to the grains, and farmers use this property.



Activity: 8

Sedimentation and Decantation

Take a mixture of soil and water in a glass tumbler and keep it undisturbed for sometime. What do you observe? You will find that the sand and the mud particles in the soil settle down at the bottom of the glass tumbler (Fig 9(a)). These are called sediments. This process of separation of mud and sand is called **sedimentation**.

After sedimentation, the tumbler is gently lifted. The tip of the tumbler is inclined on the edge of another tumbler without disturbing the sediments (Fig. 9 (b)). The water gets separated from the sediment(mud). This process is called **decantation**.

- Why did mud particle settle at the bottom of the tumbler?

Sedimentation and decantation are used in your home while cleaning rice and pulses for cooking.

- Think of other examples where we use this method of separation and list them.

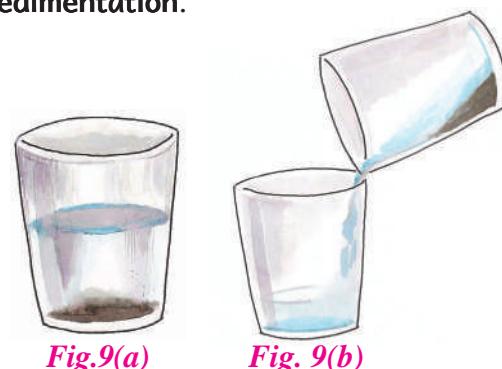


Fig. 9(a)

Fig. 9(b)

Sieving and Filtration

- How will you separate the tea-leaves from tea?

Tea-leaves are separated from tea using a strainer. Which property helped in separation of tea-leaves from tea?

You must have seen flour being sieved in the kitchen (Fig. 10). The flour particles are very fine and pass through the holes of a sieve, but the husk particles being large are left on the sieve.

Do you find any difference between tea stainer and sieve used to separate flour and husk? Have you observed separation of sand from gravel at building constructions? Do the sieve used there is similar to the sieve we use in our kitchen?



fig. 10

Do You Know?

Farmers separate grains which are bigger in size from the smaller ones by sieving. The bigger grains are then used as seeds or sold at higher price

Can you separate mud from muddy water using a sieve? How small should the pores of the sieve be to do this? Use a cloth as a sieve and try to do this.

- Is the water clear after sieving?
- Can you filter mud water with a filter paper?
- After using the filter paper to filter water what do you find?
- What do you see left behind on the paper?
- What is obtained in the beaker?

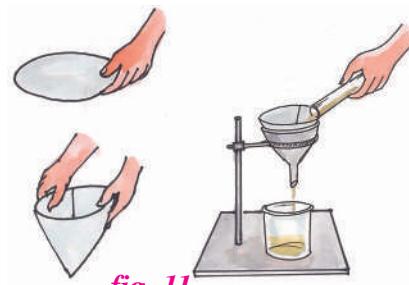


fig. 11

Filter Paper

Filter paper is a sieve made of paper which has very fine holes. We can filter very small particles using this type of sieve.

Activity: 9

Why can't we filter salt from salt water ?

- Take water in a beaker. Dissolve some salt in it. Filter this mixture with a filter paper. Were you able to separate the salt from the salt water?
- Why could you not filter the salt from salt water?

The pores in a filter paper are so minute that we cannot see them with our naked eyes. Think, how small the particles of salt dissolved in water are if they are to pass through filter paper!

Activity: 10

Crystallization

Aim: To separate salt from salt water.

What you need? Salt, water, beaker, glassrod, tripod Stand, bunsen burner, wire guage.

What to do? Heat some salt water in a beaker, over a flame. Stir the solution with a glass rod. Continue heating till all the water in the beaker has evaporated.

What do you see? Crystals of salt remains in the beaker.

What do you learn? Salt can be separated from salt water by heating (Crystallization). Some dissolved substances can be separated from the liquids by heating. On heating water evaporates and dissolved substances will form their crystals. This method of separation is called Crystallization.

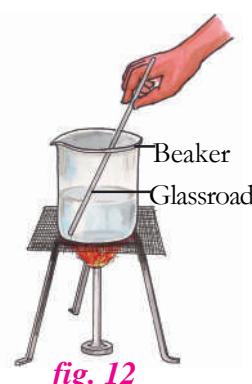


fig. 12

Distillation

Before administering injections to patients, doctors mix injection powder with some liquid. What is it? Is it water or any other liquid? This is water and it is known as distilled water. Where does this distilled water (pure water) come from?

- Do you know the process of distilling water?

Activity: 11

Get your own Distilled Water

Aim:- To get distilled water from normal water.

What you need? Water, 2 conical flasks, 2 one holed rubber cork, delivery tube, bunsen burner, stand.

What to do? Fill a conical flask with water, close it with a cork having a hole. Take another conical flask with a cork having a hole. Connect both flasks with a delivery tube. Now heat the flask containing water using a burner.

What do you see? After some time, water vapour goes into the second conical flask through the delivery tube. The water vapour will slowly turn to water. This water is called a distilled water. It is free from impurities.

What do you learn? Impurities can be removed from water by distillation.

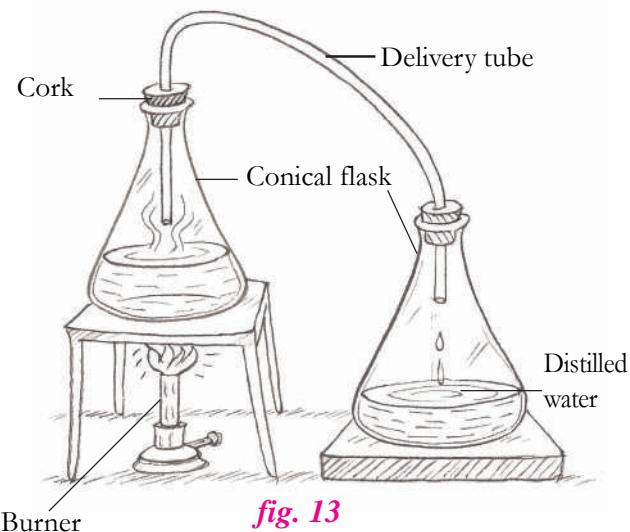


fig. 13

Sublimation

- Can we use these features for separating mixtures of powdered salt and camphor?

Activity: 12

Sublimation of camphor

Aim:- To understand the process of sublimation.

What you need? Mixture of camphor and powdered salt, china dish, funnel, cotton, stand burner.

What to do? Take a mixture of camphor and powdered salt in a china dish and cover it with a funnel. Close the tube of the funnel with cotton. Place the dish on a stand and heat it with a burner.

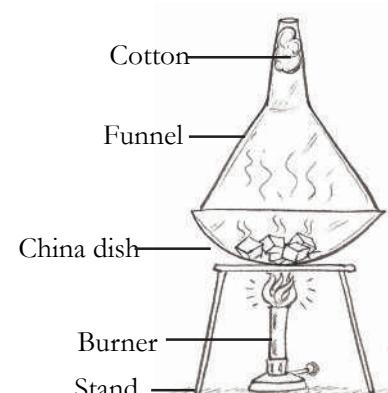


fig. 14

What do you see? When camphor is heated, it transforms to gaseous form without changing into liquid leaving the salt powder in the dish. On reaching the cotton it cools, the gaseous form of camphor changes directly into a solid without going to the liquid state.

What do you learn? The process in which a substance changes directly from solid to gaseous form and vice-versa is called **sublimation**.

Chromatography: A novel method of separation

Can we separate colours from a mixture of colours? Let us do an interesting activity.

Activity: 13

A chalk with different colours

Aim: To separate colours from a mixture of colours (ink).

What you need: stick of white chalk, ink, plate, water

What to do: Take a whole stick of white chalk. Around the curved surface of the chalk put an ink mark with blue or black ink. Now pour some water in a plate and keep the piece of chalk in the water. Ensure that the water in the plate is very little and does not touch the ink mark. Observe the colour patterns that form on the piece of chalk after some time. Remove the chalk before the water reaches its top.

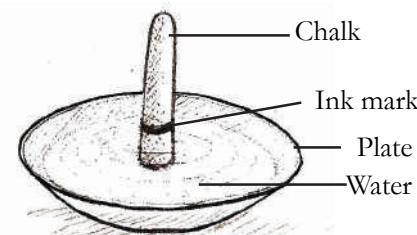


fig. 15

What do you see: Different colours are formed around the chalk from the bottom to top.

What do you learn: The ink appears to be made of a single colour but it is actually a mixture of many colours hidden in it. Those colours are separated by this method. It is an example of chromatography. Try to do chromatography with different inks and find out which colours they contain.

- Where do we use the chromatography method?

We know that a leaf is green in colour. Try to find whether the leaf consists of only one colour or more than one colour.

Separation of substances is a very important scientific activity and is also important in our daily life. We are using different types of separation techniques for various purposes to get desirable qualities material.

KEY WORDS

Material, object, metal, solid, liquid, gas, sink, float, soluble, insoluble, Mixture, separation, handpicking, winnowing, sedimentation, decantation, sieving, filtration, crystallization, distillation, sublimation, chromatography



What we have Learnt?

- ◆ Objects around us are made of a large variety of materials.
- ◆ Based on their properties, we use different materials for different purposes.
- ◆ Materials can exist in three important states; solids, liquids and gases.
- ◆ Some materials sink in water and some materials can float on water.
- ◆ Some materials are soluble in water and some materials are insoluble in water.
- ◆ Materials are grouped together on the basis of similarities and differences in their properties.
- ◆ Substances can be separated from a mixture.
- ◆ Hand picking is used to separate substances when their sizes are sufficiently large.
- ◆ If mixtures have light and heavy substances, winnowing can be used for separation.
- ◆ An insoluble substance in a liquid can be separated by sedimentation and decantation.
- ◆ Sieving can be used for separating larger and smaller substances in a mixture.
- ◆ Crystallization is used for separation of dissolved substances from a liquid.
- ◆ Distillation is used to remove impurities from water.
- ◆ More than one method of separation can be used to separate the components of some mixtures.



Improve Your Learning

Fill in the blanks

1. Combination of more than one substance forms a _____
2. The method used to separate stones from rice is _____
3. The process in which a substance changes directly from solid to gaseous form and vice-versa is called _____

Choose the correct answer

1. Which of the following does not change its shape ()
A) Solid B) Liquid C) Gas D) none of these
2. This method is useful for the separation of dissolved substances from a liquid ()
A) Sedimentation B) Chromatography C) Crystallization D) Filtration
3. Chromatography is the method used to separate ()
A) Mud from Water B) Colours
C) Impurities from water D) Husk from grains

Answer the Following

1. List five things which we can make using each of the following materials :
a) glass b) metal c) plastic d) wood
2. Why is hand picking necessary after winnowing?
3. Which separation process is used when one component is in a mixture
 - a. Heavier than the other?
 - b. Bigger than the other?
 - c. Different shape and colour from the other?
 - d. One is soluble in water and the other is not?
 - e. One floats and the other sinks in water?
4. Siri saw a ship travelling on a sea. She knows that iron nail sinks in water. She has many doubts. What are her doubts? Write them.
5. We use so many wooden items in our daily life. Is it good to use wood? What happens by excessive use of it? What is the reason? Is there any alternative for this?
6. How can you get your own distilled water in laboratory?
7. Draw a labelled diagram showing experimental setup required for sublimation of camphor?
8. We know that a ship, even though it is made up of tonnes of iron, floats on water. How do you feel about the scientists who found the scientific principles and efforts in making a ship?

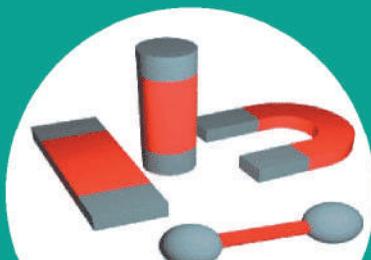


Activities and Projects

1. Drop an egg in a beaker of water. Now drop the same egg in another beaker of water in which excessive salt is added. Write your observation.
2. Do the following activities. Write down your observations. What do you conclude.
 - a. Mix chalk powder in water.
 - b. Place a piece of candle in water.
 - c. Add some oil drops to a beaker of water.
3. Make a list of items from your kitchen like utensils, food ingredients etc. classify them as sinks / floats and soluble / insoluble.
4. Is it possible to separate sugar mixed with wheat flour? If yes, how will you do it? If powdered sugar is mixed with wheat flour, how do you separate them?



CHAPTER - 6



Fun with Magnets

Learning outcomes

Pupils will be able to..

- recognize the magnets.
- know about the discovery of magnets.
- identify Magnetic and Non Magnetic Materials.
- distinguish between North and South poles.
- list out the properties of magnets.
- conduct simple investigations to seek answers to queries like “Does a freely suspended magnet align in a particular direction?”.
- apply learning of scientific concepts in day-to-day life using compass needle for finding directions.
- explain the uses of Magnets.



You might have seen magnets and have even enjoyed playing with them. Have you seen stickers that remain attached to iron surfaces like almirahs or the doors of refrigerators? In some pin holders, the pins seem to be sticking to the holder. In some pencil boxes, the lid fits tightly when we close it even without a locking arrangement. Such stickers, pin holders and pencil boxes have magnets fitted inside. If you have any one of these items, try to locate the magnets hidden in these. Have you ever enjoyed playing with magnets?



fig.1

Fun with Magnets

Activity: 1

Take a steel glass. Put a magnet in it. Take a needle through which thread is passed. Press the thread with a finger near the eye of the needle as shown in the figure 2 and raise the glass upward slowly.

What happens?

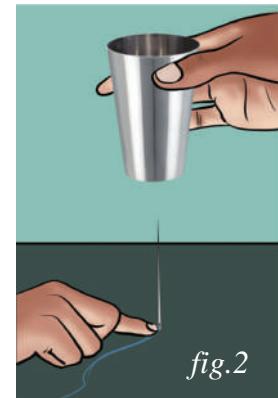
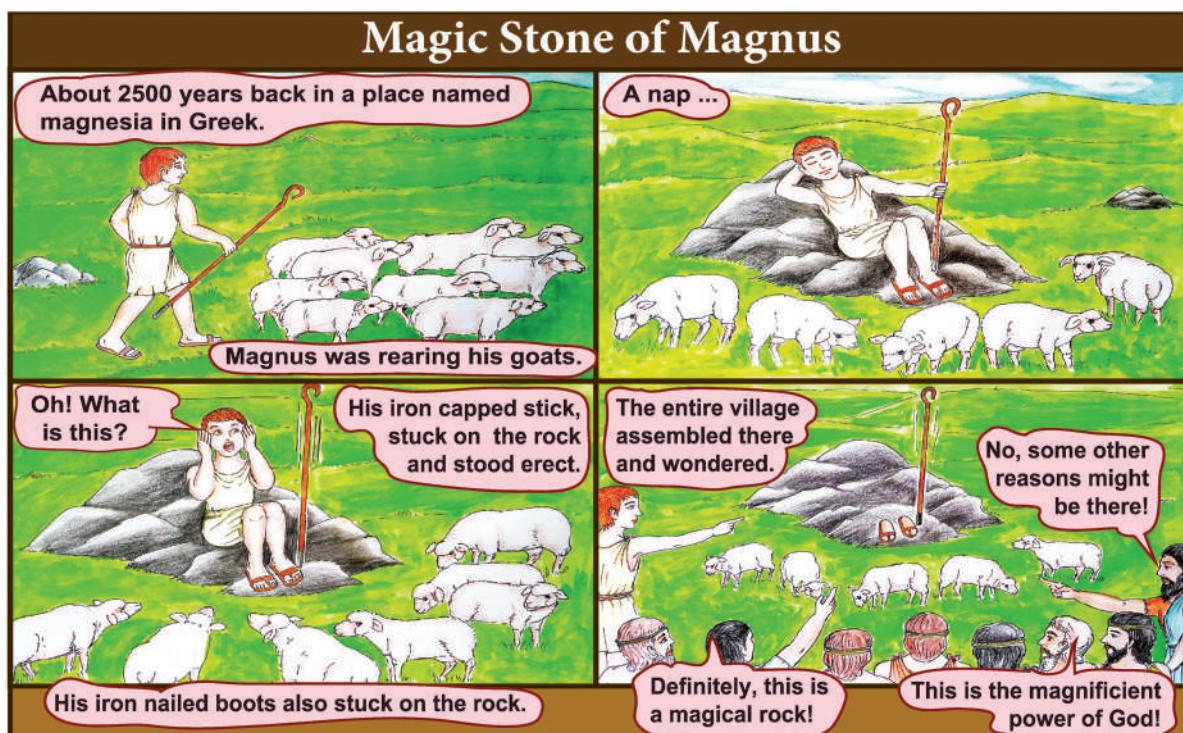


fig.2

Does the needle stand vertically up without touching the glass? Why does this happen?

Discovery of Magnets: There is an interesting story of how magnet was discovered.



People wondered about this incident, each and every one expressed their views. What might be the reason for the stick to get stuck on the rock?

Yes, you are right. That is a magnetic rock. People found it attracting not only the stick of Magnus, but also all other materials made of iron. The more rocks of these kinds were found worldwide. These magnetic rocks were named '**Magnets**' and the ore is called as '**Magnetite**' after the name of the boy Magnus. The name is also supposed to

come after the name of the place (Magnesia) in which it was found. Magnetite was the ore with the attracting property found in that region.

Types of Magnets

Magnetites are **natural magnets**. They are called magnetic stones. Natural magnets do not have a definite shape. Since, they are used for finding direction, they are also called '**leading stones**' or '**lode stones**'. After learning the method of changing the piece of iron into magnet (magnetization), we have been making and using several kinds of magnets. Such man-made magnets are called **artificial magnets**. The magnets we see and use in our daily life possess different shapes. Some of the usual shapes of magnets are shown in Fig - 3.



fig. 3

Magnetic and Non Magnetic Materials

Activity: 2

Finding materials attracted by magnets

Take a bar magnet, nail, jump-clip, plastic scale, a piece of glass, key, paper, iron bolt, pen, blade, pencil, knife, stainless steel spoon, piece of chalk, wood and touch the magnet to each item. Does the magnet attract every object? Observe and record your observations duly mentioning the name of the material of which the object is made in table-1

Table 1

Name of the object	Material of which the object is made (Iron / Plastic / Aluminium / Wood / Glass / any other)	Attracted by Magnet (Yes / No)
Jump Clip	Iron	Yes
Scale	Plastic	No

Which materials are attracted by a magnet?

Which materials are not attracted by a magnet?

The materials that are attracted by magnets are called **magnetic materials**.

The materials that are not attracted by magnets are called **non-magnetic materials**.

- Give your own examples for magnetic materials.

- Give your own examples for non-magnetic materials.

Magnets have the property of attracting materials like Iron. This property is used to separate some mixtures.

In the experiments with magnets you need to use iron filings again and again. You can do this by placing a magnet in a pile of sand and turning it around in the sand. The small pieces of iron present in the sand will stick to the magnet. If you cannot find sand you can look for iron pieces in clay soil as well. If you don't have iron filings, you can collect small pieces of iron and they will serve the purpose as well.



fig.4

Properties of Magnets

To understand the properties of magnets let us do some activities.

Poles of a Bar Magnet

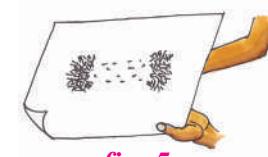


fig. 5

Spread some iron fillings uniformly on a sheet of paper. Place a bar magnet below this sheet.

- What do you observe?
- Does the property of attracting iron filings remain same for all parts of a bar magnet?
- Do you observe any change in the pattern of iron filings spread over the sheet?

You will notice that the uniformly spread iron filings come close and get concentrate at two points of the paper sheet. At some distance you will find some scattered iron filings between these two points. This change in the spread of iron filings on the sheet of paper is due to the magnet present below it. The iron filings move towards its ends because of this magnet. Thus the ends of the bar magnet attract more iron filings than the middle part of the magnet. By this activity we can conclude that every bar magnet always has two ends whose attracting capacity is more than its other parts. These ends are called **poles** of the magnet.

Activity: 4

Attraction and Repulsion between Two Magnets

Take two similar magnets, place them in four different ways as shown in Figure and record your observations.

- What do you observe?

- When do the magnets attract each other?

- When do the magnets repel each other?

You notice that **like poles repel each other and unlike poles attract each other.**

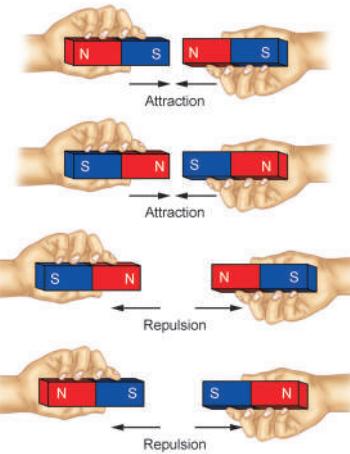


fig. 6

Activity: 5

Finding directions with a bar magnet.

Suspend the bar magnet freely with the help of a thread tied around its center as shown in Fig-7.

- Does the magnet remain stationary?

- Wait for some time. What do you find now?

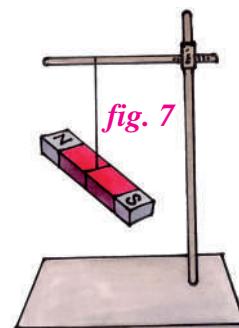


fig. 7

You will notice that the magnet finally takes a position in the North-South direction. Mark the end points towards the North with some colour. Now disturb the magnet and again wait for some time.

- Where does the coloured portion come to rest?

- Repeat this experiment at another place. What do you observe?

Magnets always come to rest in the North-South direction. In each case the marked end points towards North. This end is known as North pole of the magnet. The other end, which points towards the South is known as South pole of the magnet. This property of magnets is called **directional property**. This property is exhibited only by magnets which is very useful for us.

For centuries, travellers have been making use of this property of magnets to find directions. It is said that in olden days, travellers used to find directions by suspending natural magnets with a thread, which they always carried with them. Later on, a device was developed based on this property of magnets. It is known as the compass.

A compass is usually a small box with a glass cover on it. A magnetized needle is pivoted inside the box, which can rotate freely. The compass also has a dial with directions marked on it. The compass is kept at the place where we wish to know the directions. Its needle indicates the North-South direction when it comes to rest. The compass is then rotated until the North and South marked on the dial are at the two ends of the needle. To identify the North-pole of the magnetic needle, it is usually painted in a different colour. A compass is used to find directions. It is mostly used in ships and airplanes. Mountaineers and army people also carry a compass with them so that they do not lose their way in an unknown place.

Note: Don't place compass and magnets together.



Making Magnet

There are several methods of making magnets. Let us learn the simplest one. Take a nail / a piece of Iron and place it on a table.

Now take a bar magnet and place one of its poles near one edge of the nail / piece of iron and rub from one end to another end without changing the direction of the pole of the magnet. Repeat the process for 30 to 40 times. Bring a pin or some iron filings near the nail / piece of iron to check whether it has become a magnet. Does the nail/ piece of iron attract the pin / iron filings? If not, continue the same process for some more time.



fig. 8



fig. 9

Activity: 7

Make your own magnetic compass

Take a magnetized needle. Attach the needle with a tape to a light cork. Float the cork in a glass of water as shown in Fig. 10. Add a little detergent to the water to help the cork float freely. In which direction does your magnetized needle point? It points in North- South direction. Thus it acts as a magnetic compass.



fig. 10

Activity: 8

Magnetic Induction

Take a safety pin and bring it close to an alpin. Does it attract the alpin? Why? Bring the safety pin close to one pole of a bar magnet and see how it gets attached to the magnet. Now bring an alpin and touch it to the safety pin as shown in Fig.11. Does the safety pin attract the alpin? Why? In the above two cases, we notice that the safety pin acts as a magnet when it is in contact with another magnet. Magnetic property is induced in the safety pin due to the presence of a magnet near it, is called magnetic induction.

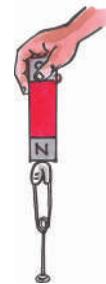


fig. 11

- If the safety pin is not in contact with the bar magnet, can it attract the alpin?
- What happens if we place the bar magnet very close to the safety pin but not touching it?

Let us find out: Take a bar magnet in one hand and a safety pin in the other hand, hold them in such a way that they are close to each other but not in contact as shown in Fig.12. Ask your friend to bring an alpin and touch the safety pin. You will notice that the alpin will stick to the safety pin. This shows that due to magnetic induction safety pin acts as a magnet.



fig. 12

Activity: 9

Finding out whether the given object is a magnet or not.

You have been given three objects of the same size, shape and colour and a bar magnet. You have to decide which one among them is a magnet, which is not a magnet but made up of a magnetic material or a non-magnetic material. Bring three objects one after the other close to one pole of the bar magnet and observe whether they get attracted, repelled or not attracted. Record your observation in table 2. After that bring those objects close to the other pole of the bar magnet in the same way and record your observations.

Table: 2

Observation	Object - 1 Attracted / Repelled / Not Attracted	Object - 2 Attracted / Repelled / Not Attracted	Object - 3 Attracted / Repelled / Not Attracted
Changes observed when brought close to one pole of the bar magnet.			
Changes observed when brought close to other pole of the bar magnet.			

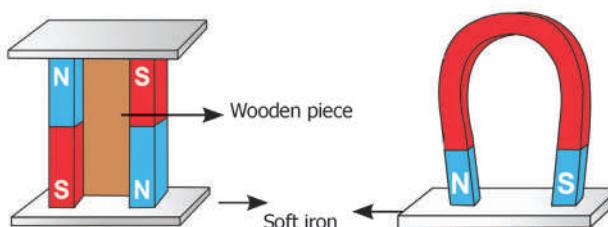
What do you conclude by comparing the recorded observations? By the above observations we conclude the following:

If an object is attracted by one pole of the bar magnet and repelled by its other pole, then you can say that it is a magnet.

If an object is attracted by both the poles of a bar magnet and not repelled by any pole, then you can say that it is not a magnet but a magnetic substance. If an object is neither attracted by magnet nor repelled by it, then you can say that it is neither a magnet nor a magnetic substance.

Do magnets lose their properties? When?

Magnets lose their properties if they are heated or dropped from a height or hit with a hammer. Magnets lose their properties when they are placed near Cell phone, Computer, DVDs. These objects will also get affected by magnetic field. Improper storage can also cause magnets to lose their properties. To keep them safe, bar magnets should be kept in pairs with their unlike poles on the same side. They must be separated by a piece of wood and two pieces of soft iron should be placed across their ends. For a horse-shoe magnet a single piece of soft iron can be used as a magnetic keeper across the poles.



When heated



When dropped



When hammered

Usage of Magnets:

We use various equipments with magnets in our day to day life. Discuss with your friends about the usage of the magnets in the following instances.



In speakers



In small electric motors



In some door locks



Bags



In some toys



In compasses

fig. 14



In pencil boxes



Stickers on refrigerators



Phone covers



Pin holders



Magnetic crane

Science Today – Bullet Trains

We know that like poles of the magnet repel each other. Keep two bar magnets as shown in the Figure 15.

What do you observe?



fig. 16

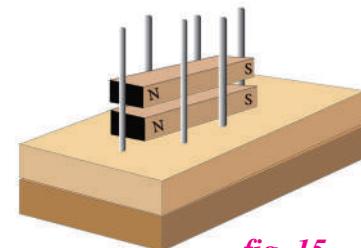


fig. 15

By using repulsion we can levitate a magnetic object. Electromagnetic train work on the same principle. Have you heard about it? An Electromagnetic train is called a suspension train and also a flying train. It does not require either diesel or petrol. This technology uses the property of magnetic attraction and repulsion to run

these super fast electromagnetic trains. Ask your teacher to know more about how an electromagnetic train works.

KEY WORDS

Magnet, magnetic material, non-magnetic material, North pole, South pole, Magnetic compass, like poles, unlike poles, attraction, repulsion, magnetic induction



What we have Learnt?

- ◆ Lode stone is a natural magnet.
- ◆ Magnets are of different shapes i.e. bar magnets, horse shoe magnets, ring type magnets, etc.
- ◆ The materials that are attracted by magnets are called magnetic materials. The materials that are not attracted by magnets are called non-magnetic materials.
- ◆ A bar magnet always has two ends whose attracting capacity is more than the other parts of it. The poles of the magnet lie at these ends.
- ◆ Each magnet has two magnetic poles: North and South.
- ◆ Like Poles (N-N, S-S) repel each other and unlike poles (N-S, S-N) attract each other.
- ◆ A freely suspended magnet always aligns in the North-South direction.
- ◆ A compass is an instrument which is used to find directions.
- ◆ Magnetic property possessed by a magnetic substance due to the presence of a magnet near to it, is called magnetic induction.
- ◆ Magnets lose their properties if they are heated or dropped from a height or hit with a hammer



Improve Your Learning

Fill in the Blanks

1. The materials which are attracted towards a magnet are called_____.
2. Paper is not a _____ material.
3. In olden days, sailors used to find direction by suspending a piece of _____.
4. A magnet always has _____ poles.

Choose the appropriate answer

1. Which of the following object is attracted by magnet. ()
a. wooden piece b. plain pins c. eraser d. a piece of paper
2. A freely suspended magnet always comes to rest in the direction ()
a. North - east b. South - west c. East - west d. North - south

3. Magnets lose their properties when they are ()
a. used b. stored c. heated d. cleaned

Answer the following

1. List the magnetic and non magnetic materials in your class room.
2. If you have two similar bars, one a magnet and another a piece of iron. Can you find out which one of these is a magnet? Explain the process.
3. The teacher said that the Earth is a magnet. But Sreevidya has some doubts and she asked her teacher some questions. What may be the questions?
4. Does the Earth behave as a magnet? How do you prove it?
5. Predict which of the following materials are magnetic and non-magnetic. Test with a bar magnet and check your predictions. What do you say after testing all materials?
Plastic, Iron, Stainless steel, Wood, Aluminum, Gold, Silver, Copper, Paper, Cloth.
6. Draw a bar magnet and locate the poles.
7. Surya was wonderstruck to know that Earth is a big magnet and appreciated efforts of scientistis to discover this. Do you notice any such things in magnets to appreciate? Explain.
8. Mention some situations where you use magnets in your day to day life?



Activities and Projects



1. Think and say, in which directions your house is facing? Use the compass and find out the exact direction of your house and compare it with your prediction. Similarly predict and find out in which direction you keep your head while sleeping at night, the directions you face while you are reading, eating etc.
2. Prepare a toy using magnets and write the procedure of preparation briefly.
3. Think and say where the poles will be located in a ring magnet? Try to find out its poles using a bar magnet and check your prediction.
4. Magnetize a needle using a bar magnet. Make a compass with that needle by following the process explained in activity.
5. Kiran wants to prepare a toy using some magnets to make people understand the slogan "Reject bad food and accept only good food". Can you help him to prepare the toy? If yes, how?

CHAPTER - 7



Let us Measure



Learning outcomes

Pupils will be able to...

- identify different measuring instruments.
- utilize different instruments at different situations of life.
- understand the standard units of measurements.
- measure physical quantities and express in standard units.
- take necessary precautions while measuring.

Rasheed went to a cloth shop with his mother to buy clothes. The cloth merchant used a metal rod to measure the length of cloth. Rasheed asked his mother what that metal rod was and why the merchant used it. Mother told him that the metal rod was a metre scale that was used to measure lengths. Later, both of them went to a flower market and purchased a string of jasmine flowers.

While cutting the jasmine flower string, the woman selling the flowers measured its length with her hand.

Rasheed was confused and started thinking :

- Why was a metre scale used to measure the length of cloth?
- Why did the woman use her hand to measure the length of the jasmine flowers' string?
- Which method is correct?



fig. 1

- How can we decide the correct method of measurement?

You might have observed many situations of measurement of length as in the above examples, where sometimes we use instruments and sometimes hands, foot, palms etc.

Write some more examples where we use instruments to measure the lengths and some examples where we don't use any instruments, but use foot, hand-span, palms etc. to measure the length.

Discuss with your friends which method is correct and why you think so.



fig. 2



Measuring Lengths

Measure the length of one side of a table using your hand-span (Fig. 3). Ask your classmates to do the same. Record the length of the table in terms of number of hand-spans in table 1 :

Do all of you get the same number of hand-spans for the length of the table?

- Who got more number of hand-spans?
- Why is there a difference in number of hand spans, though you measured the same table?

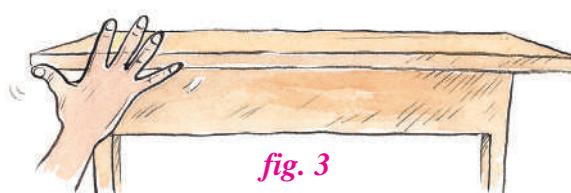


fig. 3

Table: 1

S.No	Name of the Student	Number of Hand-spans
1		
2		
3		
4		
5		

Now find the length of your classroom using your foot-span. Enter your observations in terms of number of foot-spans in table 2 :

- Is the number of foot-spans same when different students measure the length of the same class room?

Table: 2

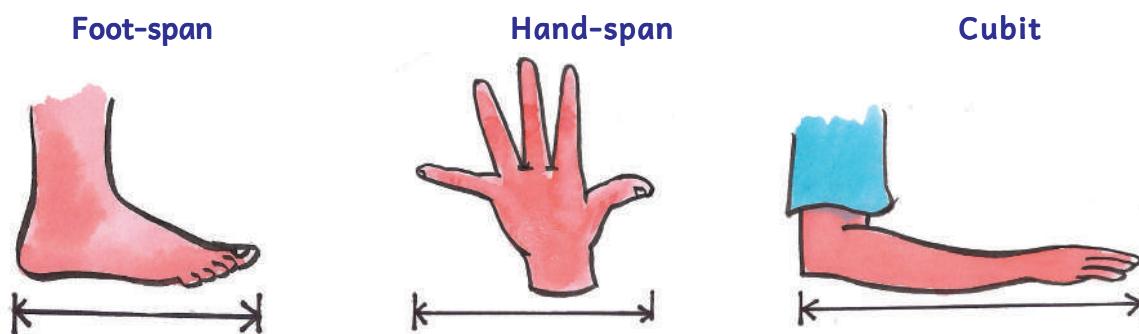
S.No	Name of the Student	Number of Foot-spans
1		
2		
3		
4		
5		

- Who got the most number of foot-spans? Why?
- Who got the least number of foot-spans? Why?

We do not get the same measurements in two cases mentioned above because the hand-spans / foot-spans are not same for each one of us.

We often use these types of conventional methods to measure certain lengths. For

example, cubits for the length of a string of flowers and length and breadth of a playground using strides. Similarly, we use this system of measurement while playing 'sirra gona', (gilli danda), where the length of the stick is used as the unit to measure the desired distance.

*fig. 4*

The story of the scale

Many hundred years ago, people used to measure distances with their hand-spans, strides or foot-spans. One day a very tall man went to a shop to buy some cloth. He asked for three-and-a-half arms length of cloth. The shopkeeper measured three arm lengths of cloth and then added approximately another half-arm length.

The man felt that the shopkeeper had cheated him. So he measured the cloth with his arms and found that the cloth was not even three arm lengths. He told the shopkeeper that the length of the cloth was less than three-and-a-half arms when he measured with his own arm. The shop keeper replied that his own arm was the standard for measuring. They both argued about whose arm was to be taken as standard measure. In those days, people arguing over measuring the length of fields, ropes, and hundreds of other things must have been a familiar fight. How should one measure a half or a quarter arm length?

Finally, some sensible people got together and decided to have a scale of a fixed length. In order to measure subunits, they marked this scale with several smaller but equal divisions. They then decided that everyone would measure lengths with this scale. They used wood and metal to make scales of the same length.

At one place, people decided to use the distance between the nose and the tip of the middle finger of their king as a measure (Fig. 5). They called this distance **one yard**. They used wood and metal to make scales of this length and called this distance **one yard**. This yard was divided into three equal parts and each part was called a foot. They then divided each foot into twelve equal parts called inches. They even divided each inch into smaller segments!

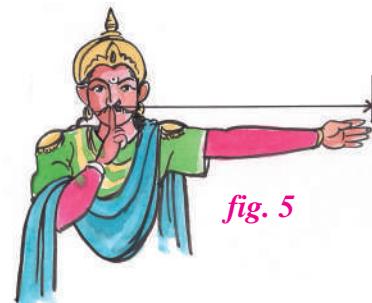


fig. 5

Other countries in the world also made their own scales. Because each country had its own scale which differed from others, it led to a lot of problems in trade and commerce. There was always a chance of quarrels breaking out.

Finally in France, it was decided that a certain length of rod made of a special material (Platinum-Iridium) would be called a metre. The metre was divided into 100 equal parts called centimetre. Each centimeter was further divided into ten equal parts called millimetre. Now we are using this as a standard measurement for length in most part of the world. This original scale is preserved in a museum in France.

The story explains the need of standard instruments to measure lengths. The meter scale is internationally accepted instrument for measuring lengths. One metre is a standard unit of length. We use metre as a unit of length and subsequently, centimetres and millimetres as smaller units of length.

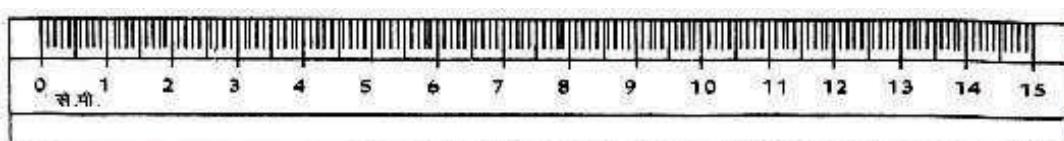


fig. 6

$$1 \text{ metre} = 100 \text{ centimetres}$$

$$1 \text{ centimetre} = 10 \text{ millimetres}$$

In our daily life, we use different instruments like plain tape, rolled tape, centimetre scale of different sizes, made up of wood, metal or plastic.

- How do you select a suitable instrument to measure length?

If you want to measure the thickness of an eraser, which of the instruments shown in Fig. 7 is more suitable and why?

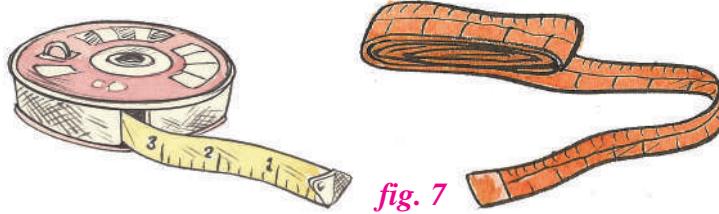


fig. 7

Sometimes we may need to measure long distances like length and breadth of school play ground or agricultural fields or distance between our house and school, distance between one town and other town, and even longer distances such as those between one country and another country.

- Can we measure these lengths using the instruments shown in Fig. 7?
- If not, how are these distances measured?
- What instruments are used?
- Is there any other way to measure very large distances?

Discuss with your friends, parents, and teachers to know the answer.

Metre is not a convenient unit for measuring large distances. We need to define a larger unit to measure larger distances. We use kilometre as a larger unit of length. One kilometre is 1000 times longer than a metre.

$$1 \text{ kilometre} = 1000 \text{ metres}$$

$$1 \text{ Km} = 1000 \text{ m}$$

Activity: 2

How do we measure?

- How do you measure the height of your classmate using a meter scale?

Ask your classmate to stand with his/her back against a wall. Make a mark on the wall exactly above his/her head. Now measure the distance, from the floor to this mark on the wall, with a scale. Let all other students measure this length in a similar way. Record your observations in your notebook. Study carefully the measurements reported by different students. Do you all have the same readings of measurements? If not, what could be the reason for the differences? In the above activity, though the measurement was done using a standard scale, results may be close to each other but not exactly equal. The difference in reading is due to some errors in measurement.



fig. 8

For example :

- Not marking the point exactly at the top of the head.
- Not using the metre scale in a proper manner.

To measure the lengths accurately using the standard measuring instruments like meter scale, centimeter scale and tape etc., we should take some precautions.

How to measure length accurately with a meter scale

In our day to day work, we use a wooden/plastic scale to measure lengths. It is marked or graduated in centimetres and millimetres. Suppose we are asked to measure the length of a table. We will take a metre scale. The zero mark on the scale is made to coincide with one end of the table and the reading at the point which is coinciding with the other end of the table is taken. Since a metre scale has some thickness, we may make an error if the eye is not correctly positioned. The correct position of the eye is "B" (Fig. 9) which is vertically above the end where the reading is to be taken.

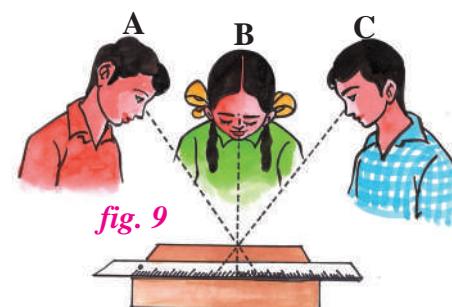


fig. 9

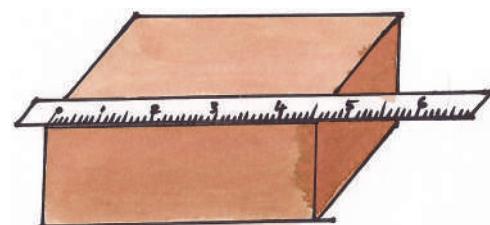


fig. 10

Precautions while using a metre scale

We must take the following precautions while using a metre scale for measuring length :

1. The scale should be placed exactly along the length to be measured.
2. Zero point on the scale should coincide with the starting point of the length to be measured.
3. Our eye must be vertically above the point of coincidence of scale where the measurement is to be taken.
4. Ensure that the ends of the scale are not worn out.
5. Measure the length of an object more than two times and then take the average of these measurements for accuracy.

Think! What can you do to know if a scale is accurate or not?

How can we measure a small thickness?

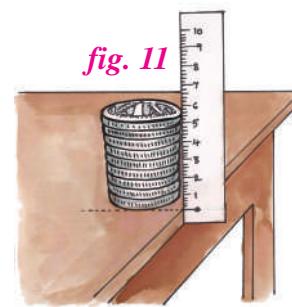
Can you accurately measure the thickness of the cover page of your text book or a coin using the scale? If we want to measure the thickness of a page of notebook or a coin it is not possible to directly use a scale. Let us look at the method to measure the thickness of a coin.



Activity: 3

Measuring thickness of a coin

Take about 10 one rupee coins of same size and place them one upon the other as shown in Fig. 11. Measure the total thickness with a scale and then divide it by the number of coins to get the thickness of one coin.



In the same way, try to measure the thickness of a page of your text book. We generally use a scale to measure the lengths which are in a straight line like the length of a room, length of a table etc. There are certain situations where the lengths are in curved line like the perimeter of bucket, perimeter of a tava or kadai etc. Can we measure these curved lengths with a metre scale? If not why?



Activity: 4

Measuring the length of a curved path

Fix pins at the ends of the curved line to be measured as shown in the Fig. 12. Now tie a knot with cotton thread at the first point A of the pin A and move the cotton thread along points B, C, D, E etc.

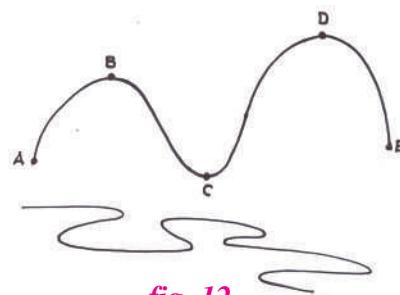


fig. 12

Care should be taken that the thread is neither too tight nor too loose and see that the thread coincides with the curve at each point while moving along the path. When the thread reaches the extreme end of the curved path, cut it at that point. Remove the thread from A and then place it straight along the length of a metre scale, and measure its length. The length of the thread is the measure of the length of the curved path.

Measurement of area

Ramu and Ravi's father brought two drawing sheets for them. After taking these sheets from their father, Ramu and Ravi started quarrelling with each other, each one claiming that his sheet was shorter than the others.

Which sheet is smaller? Which sheet is bigger? How can we decide?



Activity: 5

See Fig. 13. Can you decide which is the bigger and which is the smaller sheet by observing them? If not, what method do you adopt to decide the bigger one or smaller one?

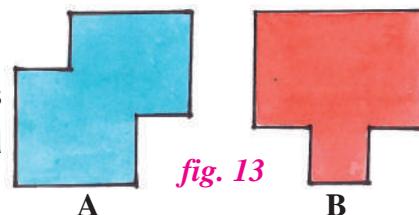


fig. 13

Take two sheets of A4 paper and cut them in the shapes of shown in Fig. 13. Now take some empty matchboxes of equal size and keep them on the sheet. Starting from one corner of the sheet, count how many matchboxes are needed to cover the entire surface of the sheet. Similarly repeat the process for the second sheet also and record the findings in your notebook.

- Which sheet needs more number of matchboxes? Which is bigger in size?

You may find that one of the sheets needs more number of matchboxes which shows that one sheet is bigger in size than the other. Thus, we need to measure the surface of an object to decide whether it is bigger or smaller. Area is the measure of the extent of plane surface occupied by an object. In the above activity, a matchbox is taken as a unit to measure area but it is not a standard unit. We need a standard unit to measure the area.

What is the standard unit to measure area?

Observe Fig. 14. In each figure, vertical and horizontal lines divide the surface into certain number of parts.

- Which figure has more area and why?
- Are all the parts in both figures equal?
- What is the shape of the smaller part in each diagram?
- Is the length and breadth of each smaller part equal?
- Measure the length and breadth of any one part of each diagram. What do you notice?

You may notice that the small parts in each diagram have equal lengths and breadth, one centimeter each. Area of each part is equal to one square centimetre and it is written as cm^2 .

- Since Fig. 14 (a) and 14 (b) have same number of squares, of area 1 cm^2 each, both the figures have a total area of 16 cm^2 each. Thus, these figures have different shapes but equal areas.

Square centimetre (cm^2) is a standard unit to measure the area of a surface. We use m^2 (square metre), mm^2 (square millimetre), foot^2 (square foot), etc., also to measure the areas according to need and requirement of the situation.

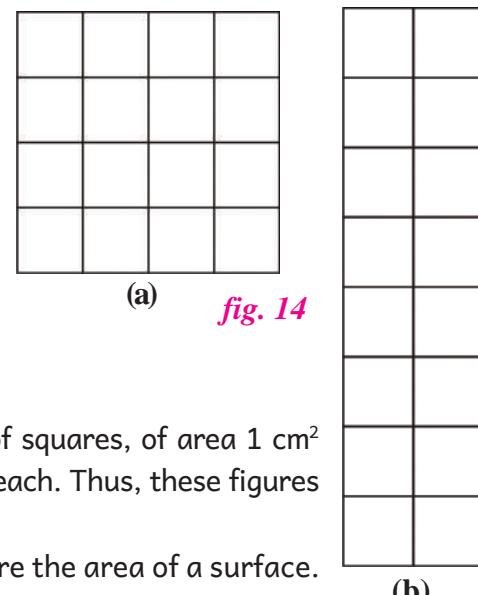


Table: 3

Units of measurement

S.No.	Units of Length	Symbol	Units of Area	Symbol
1	Metre	m	Square metre	m^2
2	Centimetre	cm	Square Centimetre	cm^2
3	Millimetre	mm	Square millimetre	mm^2
4	Feet	ft	Square feet	ft^2

Measuring the area of a regular surface

Cut a cardboard into a shape of rectangle having length 4 cm and breadth 2 cm as shown in Fig. 15. Let us measure its area. The convenient unit to measure the area of given cardboard would be cm^2 . Take a centimetre graph paper. Each small square on this graph paper has a side equal to 1 cm. The area of each small square on this graph paper is 1 cm^2 . Place the cardboard on the centimetre graph paper (Fig. 15) and draw its outline with the help of a sharp pencil. Now remove the cardboard and mark the shape as PQRS. Count the number of squares inside the outline. The number of squares is 8. Area of the cardboard is equal to the area covered by PQRS on the graph paper.

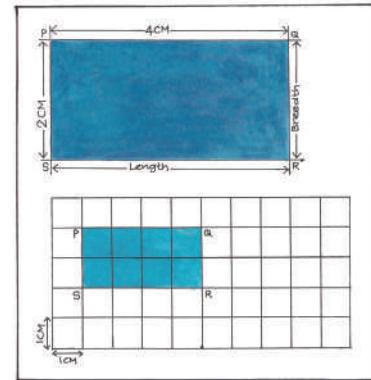


fig. 15

$$\begin{aligned}\text{Area of PQRS} &= \text{Total area of unit squares inside the PQRS} \\ &= 8 \times \text{area of 1 unit square} \\ &= 8 \times 1\text{cm}^2 \\ &= 8 \text{ cm}^2\end{aligned}$$

In this case, the cardboard we used has a regular shape - rectangle.

- Can you relate the measured area to some formula of finding area?

Activity: 6

Measurement of irregular plane surface

Let us find out the area of a surface, say a banana peel or a leaf, which has irregular shape. Place the leaf on a graph paper as shown in Fig. 16. Mark the boundary of the piece of leaf on the graph paper with a pencil. Now remove the leaf to find the outline or boundary of the leaf on graph paper. Count the number of complete squares (each of 1 cm^2 area) inside the boundary. Also count those squares, inside the boundary, which are half or greater than half. Add this to the number of complete squares. This total number of squares inside the boundary gives the area of the leaf. If there are 'n' squares inside the boundary, the area of the leaf becomes $n \text{ cm}^2$. Neglect those squares, inside the boundary, which are less than half. This process will give us the value of area which is close to the actual area.

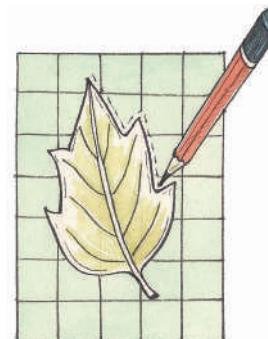


fig. 16

- How can you use the graph paper to get a more accurate answer?

Measurement of volume

- How do you find the volume of a solid?

Mrs. John is constructing a house. She needs sand and enquired about prices. The supplier informed her that two tractor loads of sand costs Rs. 4000/- and one lorry load of sand costs about Rs. 4000/-.

- Which deal is cheaper for Mrs. John? A lorry or a tractor?
- How can you decide which load has more quantity of sand?

To decide the quantity contained either in a lorry or tractor, we need to know the volume of the body of lorry as well as that of the body of tractor. Volume is a measure of the extent of space occupied by a body.

Measurement of volume of liquids

- How can you measure the volume of kerosene?
- How do you decide the volume of milk?

We use some measuring cylinders to measure the volumes of liquids such as kerosene, milk, oils, water, etc. The volume of liquids is expressed in liters (l) or millilitres (ml)

Measuring cylinder

It is cylindrical in shape, with graduations marked on its body. Measuring cylinders are available in different sizes. They are used in laboratories to measure a certain volume of a liquid and to measure milk, oils, etc by shop keepers. We can fill it with the liquid to be measured and then read the marking at the lowest point of the concave surface of liquid. We must bring our eyes in line with this level of liquid and then read it.

Apart from measuring the volumes of liquids, we also measure the volumes of solids, for example, loose solids like sand, clay, and ready mix of cement.

- What is the standard unit of measuring the volume of solids?
- Are you able to measure the volume of loose solids?
- How can you decide a standard unit of volume of a solid?

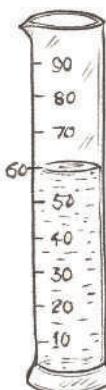


fig. 17

Look at Fig. 18. There are certain number of identical cubes of length, breadth and height 1 cm each, and a cardboard box of length 3 cm, breadth 2 cm, and height 2 cm.

Place three cubes in a line so as to cover the entire length. Along the side of this line, place another line of three cubes so as to completely cover the base of the box (Fig. 19). How many cubes have you used so far? How many cubes do you need to cover the entire empty space in the box?

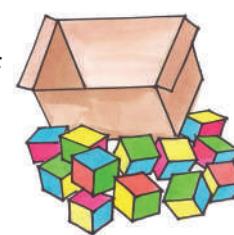


fig. 18

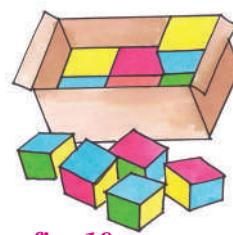


fig. 19

Place more cubes over this set of blocks; so that the total space is occupied by the blocks. Calculate the number of cubes occupying the rectangular box.

- How many cubes occupy the rectangular box?
- Can you guess volume of rectangular box.

Since each cube has measurement of 1 cm length, 1 cm breadth, and 1 cm height, the volume of one cube is equal to $1\text{cm} \times 1\text{cm} \times 1\text{cm} = 1\text{cm}^3$ which is known as 1 cubic centimetre and written as 1 cm^3 . Cubic centimetre is a standard unit for measurement of volume of solids.

Therefore the volume of the rectangular cardboard box is equal to the total number of cubes occupying it. Therefore volume of rectangular cardboard box = $12 \times 1\text{ cm}^3 = 12\text{ cm}^3$. However, if we multiply length, breadth and height, it would be $3\text{ cm} \times 2\text{ cm} \times 2\text{ cm} = 12\text{ cm}^3$. Therefore, we can say volume of a box = length \times breadth \times height

Do You Know?

You must have noticed that the volumes of liquids are written in ml while those of solids are written in cm^3 . Do you know the relation between these two units? The two units are related as follows: $1\text{ ml} = 1\text{ cm}^3$

Activity: 7

Measurement of volume of irregular solids using a measuring cylinder

Take a measuring cylinder and fill almost half of it with water.

Record the volume of water (Fig. 20). Let us assume it is "a" cm^3 (or "a" ml).

Now tie a small irregular solid (stone) with a fine cotton thread. Put the solid gently into the water in the cylinder so that it is completely immersed in water.

What changes do you notice in the water level of the cylinder? You may notice that the level of water in the measuring cylinder rises as the stone displaces water equal to its own volume. Record the new volume of water. Let us assume that it is "b" ml.

Now the volume of stone will be the difference between the second volume and the first volume i.e volume of the stone = $(b - a)\text{ cm}^3$.

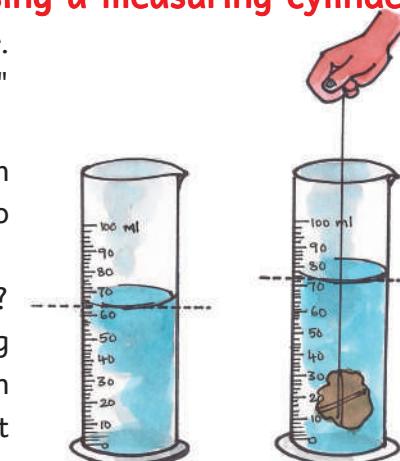


fig. 20

KEY WORDS

Measure, standard unit area, volume, regular surface, irregular surface, rectangular body, measuring cylinder, graph paper



What we have Learnt?

- ◆ We use some conventional ways like hand-span, foot - span, cubit, etc. for rough measurements in our daily life.
- ◆ We need standard instruments to measure lengths accurately.
- ◆ Metre scale is a standard instrument to measure length.
- ◆ Metre is the standard unit for measuring length. Larger distances can be measured in kilometers.
- ◆ Area is a measure of the extent of the plane surface occupied by an object.
- ◆ Generally we measure area in square metres or square centimetres etc.
- ◆ Volume is a measure of the extent of space occupied by a body.
- ◆ Volume of solids is measured in cubic metres, cubic centimetres, etc.
- ◆ Volume of liquids is measured in litres or millilitres. $1\text{cm}^3 = 1\text{ml}$



Improve Your Learning

Fill in the blanks

1. Millimetre is a unit for measuring _____
2. For measuring long distances we use _____ as a unit.
3. The measure of the extent of a plane surface occupied by an object is called _____

Choose the correct answer

1. The smallest distance that you can measure with a centimetre scale is ()
A) Centimetre B) Millimetre C) Metre D) Micro Metre
2. Volume of solids is measured in ()
A) Metres B) Square Metres C) Cubic Metres D) Centimetres
3. This is used to measure the area of a irregular plane surface ()
A) Thread B) Graphpaper C) Measuring Cylinder D) Scale

Answer the following

1. A school hall measures 20 m in length and 15 m in breadth. Find its area.
2. Ramu's father had a rectangular plot of length 60 ft. and breadth 50 ft. He built a house occupying length 40 ft. of the plot and breadth 40 ft. and in the remaining area he planned a garden. Can you help Ramu to find out the area of his garden?

- What questions do you ask a mason to know how he is taking measurements, while constructing the building?
- How can you measure the thickness of a metal wire? Explain?
- How can you measure the length of a banana? Explain?
- How can you measure the area of your palm using graph paper? Explain.
- A carpenter who makes wooden furniture, needs accuracy in measurements. Do you ever notice how he measures? How would you appreciate him?
- The distance between numbers in a clock is accurately the same. List out the things that you observe in your surroundings with accurate distance between them.



Activities and Projects

- Measure the volume of "Kalakanda" (sugar crystal) and piece of "Patika" (alum). Record your measurements.
- Make a visit to panchayat office and collect information how VRO measures areas of agricultural lands in your village. Prepare a questionnaire for this.
- Collect any invitation card with envelope. Find out the difference between measurements of card and cover. Write down the process that you follow.
- Try to imagine the area of CD, sim card, mobile phone then find out the area of the above by using graph paper. Compare the values of your guess with graph paper measurement. Which thing is closely related to your guess?



CHAPTER - 8



How Fabrics are Made

Learning outcomes

Pupils will be able to..

- give examples of different types of fabrics.
- ask questions on what fabrics are made of.
- explain characteristics of natural and artificial fabrics.
- explain the making of cotton and jute yarns.
- appreciate the skill of man power in making fabrics.
- utilize seasonal clothes in daily life.



Janu lives in a small village. Her father is a salesman at a cloth shop. One Sunday she went there along with him. She was amazed to see so many varieties of cloth (fabrics). Her father and other salesmen were showing different types of fabrics to the customers. They were telling customers about their smoothness, thickness, colour and shrinking property. They were also talking of how to take care of the fabrics, whether they were washable or needed to be dry-cleaned. She also noticed that some materials are of less cost than the others. On the way back home she asked her father many questions. Why was there a difference in the price? How are these fabrics made? What materials are these fabrics made of? Is the process of making fabrics the same for all types? Let us try to find the answers to Janu's questions.

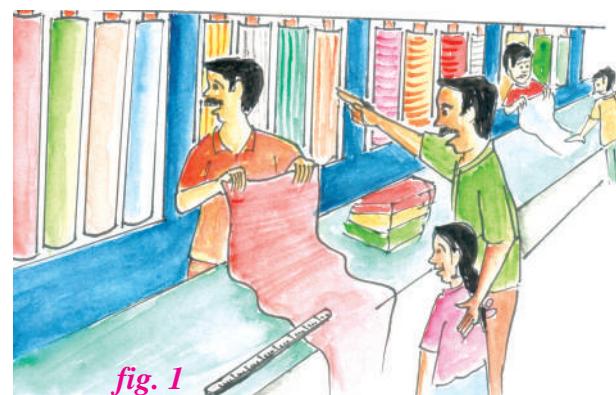


fig. 1

Types of Fabrics

People dress up according to the season. The earth's revolution is responsible for the changing seasons.

Complete the following table

Table: 1

S.No	Seasons	Months	Climate	Clothes we wear
1.	Rainy			
2.	Winter			
3.	Summer			

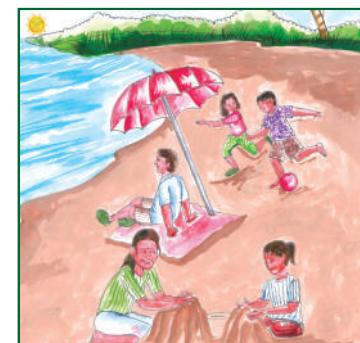


fig. 2

We can say that we use fabric as a shield to protect ourselves from different weather conditions. Along with protection, clothes can also be a symbol of beauty and status. Choice of fabric may vary from person to person. Some may like to wear clothes made up of light, thin, shiny fabrics. Others may like to wear clothes that are brightly coloured and made of coarse fabrics. Fabrics for casual and formal wear may be different. Personal choice, personality of the owner and the cost of fabric are all-important factors in the selection of the perfect fabric. Our purpose and the properties of a fabric together determine which type of fabric can be used for each purpose. Coarse fabrics can be used for mopping and making gunny bags but not for making clothes. Some other properties will have to be considered for choosing curtain fabrics.

Do You Know?

The material used for making school bags is also a kind of fabric. Fabrics are not only used for making clothes; they are also used in making banners, flags, shoes, curtains, in book binding etc. Calico is a type of fabric used in book binding.

Activity: 1

List the fabric items in your house and state what type of fabric they are made of. Classify them into cotton, silk, wool, polyester, terylene, etc. Try to enrich the list as much as you can. For identifying the fabrics, you can take the help of your elders and teachers.

Table: 2

S.No	Type of Fabric	Fabric Items
1.	Cotton	
2.	Silk	Kurta, Saree,...
3.	Wool	
4.	Polyester	
5.	Linen	Trousers,...

- Which kind of fabric is mostly used in your house?
- How can you identify the type of fabric?

Cotton fabrics are somewhat thicker than polyester fabrics. Coarse cotton clothes are heavier. After washing, cotton clothes wrinkle. Silk fabric is smooth to touch whereas woollen clothes are somewhat heavier than silk fabrics.

- Try to find out the properties of each type of fabric (cotton, wool, polyester, etc.).

Fibre

When you look at any fabric, it appears to be a single, continuous piece. Now look at it closely; what do you notice?

Activity: 2

Take a piece of fabric. With the help of a magnifying lens, observe how the fabric is. Pull out threads one by one from the fabric. Observe these threads. What did you observe? Take one thread. Scratch its end. Observe it through a magnifying lens.

Are you able to see the fine structure of thread?

Take a needle and try to insert this thread into the eye of the needle.

Can you? Isn't it difficult? Have you ever seen what people do to overcome this problem?

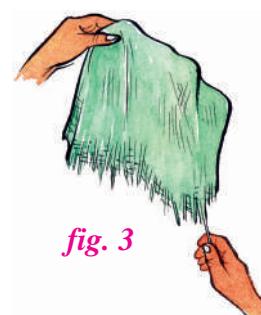


fig. 3

Generally when we are not able to put thread into the eye of the needle, either we twist the end of the thread or we wet the end using saliva. There are thread-like structures in the fabric. These threads are also called yarn. So fabric is made up of yarn. The end of the yarn is separated into thin strands. This thin strand of thread is made up of thinner strands. These thinner strands are called fibres. Every fabric is made up of yarn. If it is cotton fabric, it is made up of cotton yarn which is derived from cotton fibre.

Fibre → Yarn → Fabric

Types of fibres

We know that there are different kinds of fibres like cotton, wool, silk, polyester etc. The fibres of some fabrics such as cotton, jute are obtained from plants. Silk and wool are obtained from animals. The fibres that are derived from plants and animals are **natural fibres**. Nowadays, clothes are also made up of chemically developed yarn like polyester, terylene, nylon, acrylic etc. These are all called **artificial fibres**.

Do You Know?

Human beings in ancient times used leaves and skins of animals as clothes. Clothes were also made from metal. Warriors used to wear metal jackets during wars. You can see clothes like these in historical museums or in television shows.



Characteristics of Fabrics

Activity: 3

Collect some natural and artificial fabrics and observe the following characteristics. Record your observations in table 3.

S.No	Character	Natural Fabric	Artificial Fabric
1.	Water absorbing nature		
2.	Time taken to dry		
3.	Smell while burning		
4.	Result after burning		
5.	Stretching capacity of yarn		
6.	Smoothness		

- Which type of fabrics are smooth in nature?
- Which type of fabrics dry in a short time?

- Do you find any relation between smoothness and time to dry?
- Which fabrics give ash when they are burnt?

Silk fabrics are slippery and shiny in nature, whereas cotton fabrics may be coarse as well as smooth. When we burn fabric made up of artificial fibres it gives a pungent smell.

Natural Fibres

Cotton, jute, wool and silk are some common examples of natural fibres. In this section, we will discuss cotton and jute in detail. Cotton is obtained from cotton bolls or cotton fruits. Usually cotton plants are cultivated in black soil. In our state, cotton crop is widely grown in districts like Prakasam and Guntur .

- Look at the Andhra Pradesh map and list out the places where cotton is grown.

Activity: 4

Making cotton yarn

Collect cotton bolls from nearby houses or cotton growing fields (Fig. 4). Remove seeds from the cotton bolls and separate cotton. Take a small piece of cotton; observe it using a magnifying lens or under a microscope. What do you observe? You will see small hairy structures. These are the fibres of cotton. After maturing, cotton bolls burst and open.

Then we can see white coloured strands of cotton fibre. Cotton is usually picked by hands. Cotton wool is separated from seeds. This process is called ginning. Cotton fibre is collected after removing the seeds from the cotton boll. This cotton fibre is cleaned, washed and combed. This fine cotton fibre is used to make cotton yarn.



fig. 4 - Cotton field

Activity: 5

Spinning yarn

Take a cotton boll and remove the seeds from it. Take some cotton in one hand and gently start pulling out cotton by using thumb and forefinger (Fig. 5(a)). Continuous twisting of the fiber will make yarn. Is it strong or not?

The yarn that we make from cotton wool is not strong enough to be used for weaving. To get strong yarn from fibre, Spindle (Fig. 5 (b)) an instrument for spinning has been used since olden days.



fig. 5(a)

Making Yarn from cotton

Wheel (Fig. 6) is also used to make yarn. The process of making yarn from fibers is called spinning. Yarns are dyed and coated with chemicals. Then they become strong enough to make fabrics.

In the same way fibre is made from Red sorrel (Gongura) and Bamboo. Hemp and flax which are used in making clothes but in smaller quantities as compared to cotton.



fig. 5(b)

Spindle



fig. 6

Wheel

Do You Know?

In some parts of our state, cotton is widely grown. To pick up matured cotton bolls from cotton plants, children work in fields as child labour. Some voluntary organizations along with government are working to eradicate child labour. Think, why children are forced into labour? Give your own solutions to this problem.

Yarn to fabric

The yarn that is prepared from fibre is used to make fabric. Strands of yarn are arranged in vertical and horizontal rows in a loom to weave fabric.

Spinning of yarn on large scale is now done by using machines. Two sets of yarn arranged together to make fabric is called weaving. Weaving is done on looms. The looms that work with the help of man power are called handlooms (Fig. 7). Power looms are run by machines. (Fig.8)

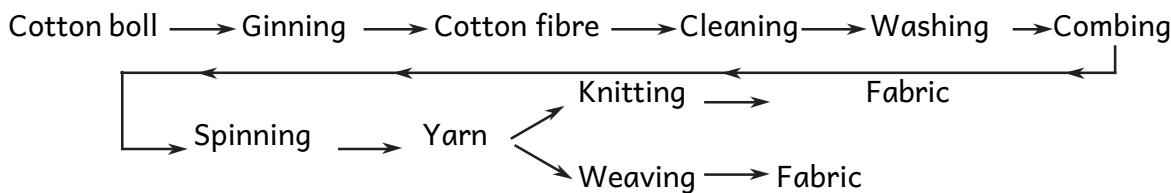


fig. 7 - Handloom



fig. 8 - Powerloom

Fibre to Fabric



The handloom industry is well developed in our state. Places like Uppada Venkatagiri, Dharmavaram, Pondhuru, Cheerala and Mangalagiri are famous for handloom industry. Kalamkari is a type of hand printed cotton textile. Machilipatnam, Pedana are famous for Kalamkari. Machilipatnam is also famous for its carpet industry.

Jute Yarn

- Have you seen gunny bags?
- Where do you see them?

Paddy, chilli and other commercial crops are packed in gunny bags. All bags of these types are made up of coarse jute fabric. These bags are suitable for carrying heavy material.

- Do you know how jute yarn is made?
- Is this process similar to that of cotton or is there any difference?



Like cotton, jute yarn is also useful in making fabric. It is also called golden fibre. Jute fabric is not the same as cotton fabric. It is harder, stronger and more rough.

Making of Jute Yarn

Jute fibre is obtained from stem of jute plant. The stem of the harvested plant is cut and immersed in water for some days. When the stem is soaked in water it becomes rotten and easy to peel. Then the fibres are separated from the stem to get jute yarn.

Activity: 6

How is jute yarn?

Collect gunny bags. Pull out the threads from the bag and observe under magnifying lens. You will see strands of yarn. Observe how the fibre looks like? Compare these fibers with cotton fibers.

Do You Know?

In India jute crop is majorly grown in 7 states –West Bengal, Assam, Odisha, Bihar, Uttar Pradesh, Tripura and Meghalaya.

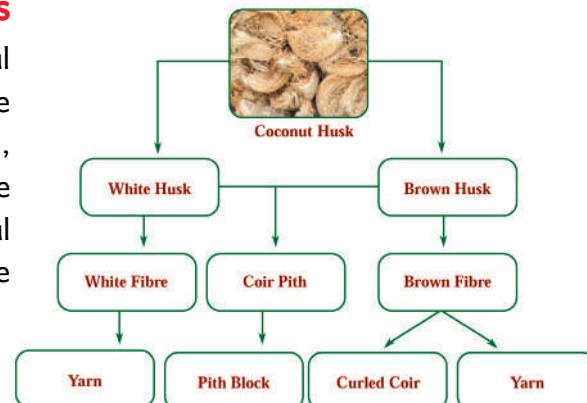
West Bengal alone accounts for over 50% of raw jute production.

Let us know about Coconut products

The **coconut coir industry** is one of the rural industry in India. It is located mainly in the states like Kerala, Tamilnadu, Karnataka, Andhra Pradesh and Odisha. It provides source of income to about 5 lakhs artisans in rural areas. Women constitute about 80% of the work force in coir industry.

Coir Products

The following are some coir products



Coir Fibre



Coir Pith



Coir Yarn

Coir Uses

Coir has come a long way from the ancient uses. It is still used for agricultural and domestic purposes and controlling landslide or soil erosion. Coir is also used as a substrate to grow mushrooms. Brown coir is used in brushes, doormats, mattresses and for making sacks.

Activity: 7

Mat Making

Take coconut leaves or two different colour paper strips. Cut and remove the middle vein of the leaf to get two halves. Now put these strips parallel to each other. Take one more strip and insert horizontally and alternately between the vertical strips. Finally you will get a sheet like structure. This is the way a mat is made. In the same manner, weave a paper sheet by using paper strips.



Do You Know?

We all use polythene bags for different purposes. Polythene is very difficult to decompose. To protect our environment, we should use cloth bags instead of polythene bags.



KEY WORDS

Fibres, Fabrics, Coarse fabric, Natural fibres, Artificial fibres, Ginning, Spinning, Yarn, Weaving, Handlooms, Powerlooms



What we have Learnt?

- ◆ Cotton, wool, silk, jute are all derived from plants and animals. They are called natural fibres.
- ◆ Fibres made of chemicals are called artificial or synthetic fibres.
- ◆ Tiny strand like structures are called fibres. These fibres are converted into yarn. Yarns are woven together to make a fabric.
- ◆ Cotton fibres are made from cotton ball.
- ◆ Jute fibre is obtained from the stem of a jute plant.
- ◆ The process of removing seeds from cotton wool is called ginning.
- ◆ Making yarn from fibre is called spinning.
- ◆ Handlooms or power looms are used in weaving fabrics.



Improve Your Learning

Fill in the blanks:

1. When we burn artificial fibres it gives a.....smell.
2. Fibre → → Fabric.
3. The process of removing seeds from cotton wool is called.....
4.fibre is called golden fibre.
5. An example of a natural fibre

Choose the correct answer

1. Artificial fibre is ()
A) Cotton B) Wool C) Acrylic D) Jute
2. An instrument for spinning ()
A) Needle B) Knife C) Spindle D) Scissor
3. Making fabric from cotton yarn is called ()
A) Spinning B) Ginning C) Weaving D) Cutting
4. Jute fibre is obtained from this part of a jute plant ()
A) Root B) Leaves C) Flowers D) Stem



Answer the following questions

1. Name the things you find in your home that are made of different fibres ?
2. Yarn is stronger than fibre. Why?
3. Write differences between the natural fabrics and artificial fabrics.
4. How do you get jute yarn? Write the process.
5. What will happen if a rain coat is made from cotton fabric ?
6. Make a flowchart showing the process of getting fabric from cotton plant?
7. Siri donated cloth bags to her school mates on her birthday, Why should we appreciate her?
8. Prepare some slogans to promote using natural fibre bags instead of polythene bags.

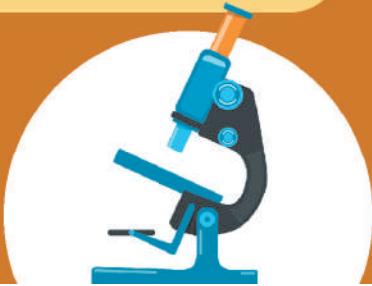


Activities and Projects

1. Prepare a bag using cloth. Collect pieces of fabric and make designs on your bag by using them. Display it in your school.
2. Make a scrap book containing pictures of different types of fabric and name them.
3. Discuss with your teacher or your parents and prepare chart showing spinning mills in our state.
4. Collect news items about handloom workers and cotton growers. Analyze one news item in your own way.
5. What did you do to know whether artificial fibers give pungent smell while burning. Write the steps of your experiment.
6. Observe these logos. What do they mean?
Collect information about this from your school library.



CHAPTER - 9



Organisms and Habitat



Learning outcomes

Pupils will be able to..

- explain the Characteristics of living things.
- differentiates materials and organisms, on the basis of their properties.
- classify organisms and components of habitat as biotic and abiotic.
- understand different habitats and organisms living there.
- take necessary steps to protect habitats.

Latha went on field trip to the village pond with her classmates and teacher. She enjoyed the several things she saw in the pond, different from what she could see around her house. Her teacher showed them eggs of all sorts of creatures. Right below the lotus leaf was the snail's egg, and within the leafy bushes at the side of the pond were eggs of a fish and many more. The several organisms found in the pond varied from very small to quite large ones. Her teacher explain that organisms were living things; along with these non-living things were also present in the pond.

- Now Latha expressed a doubt.



fig. 1

Activity: 1

Living things and Non-living things

List some living things. Don't forget to give reasons for why you think something is living.

- Chair and tables also have four legs like buffalo. But they can't move, why?
- Trees cannot move but they can produce seeds which give birth to new plants.
- How do we know whether some things are living and some others are non-living?

- You will notice that there are many characteristics of living things.
- Do all living things have common characteristics that make them different from non-living things?
- Do you know that you are a living being? How can you say that?

Activity: 2

Compare the characteristics

Some characteristics that are listed in Table-1 tells you that you are a living being. Compare these characteristics with plants, animals and rocks.

Table 1

S. No.	Characteristics	In you	In plants	In animals	In rocks
1	Growth	✓	✓	✓	✗
2	Movement				
3	Taking Food				
4	Breathing				
5	Getting rid of waste				
6	Respond to Heat				
7	Respond to touch				
8	Respond to light				
9	Giving birth to young ones				

- Do plants and animals possess the same characteristics as you do?
- In which way do the characteristics of plants differ from you or from other animals?
- What characteristics are same in plants and animals?
- Do you agree that you are the same as other animals?
- What characteristics do you observe in rocks?

The things around us that possess the characteristics listed above are known as living things. Those which do not possess these characteristics are known as non-living things.

Characteristics of living things

As we see in the above picture living things show different specific characters.

1. **Movement:** Most of the living things move from one place to another. They have the organs for movement like legs, wings, fins etc,. Certain living things such as plants do not move from one place to another as they are fixed to the soil.
2. **Food:** Acquiring food is also a character of living things. They acquire food for getting energy. Ask your teacher how the plants acquire their food.
3. **Growth:** Living things grow from time to time. Growth is a common phenomenon among them.
4. **Breathing:** All living organisms inhale and exhale air from their surroundings. Many organisms have specialized organs for it. Plants have a specialized organ called stomata for exchange of gases. You will learn about it in higher classes.
5. **Get rid of waste:** Both plants and animals produce waste materials during life processes. They get rid of it by a process called excretion.
6. **Giving birth to young ones:** All living organisms give birth to young ones. Among them some animals lay eggs and some give birth to young ones. Animals that lay eggs are called Oviparous and that give birth directly to young ones are called Viviparous. Plants produce seeds.
7. **Responding to stimulus:** The living things show response to the stimulus in their surroundings. A change in the surroundings that make organisms respond to it is called **stimulus**.



Response to stimulus

When you step on a sharp object what would you do? You will take back your feet. Is it not? Discuss with your friend how would we respond in the conditions given in table-2.

Table 2

Stimulus	Response
When you step on a sharp object	
Touch a flame or fire	
Touch a block of ice	
See a bright light	Blink, ...
Get bitten by an ant or mosquito	
When you hear the word 'ice-cream'	Mouth waters, ...

All living beings possess the characteristic feature of response to stimulus.

- Do other animals also respond to stimuli like us?
- Do plants respond to stimuli like animals?

Activity: 4

Mimosa (Atti-Patti)

It is very interesting to observe a touch-me-not (Atti-patti or mimosa) plant. Touch it. Record your observations.



fig. 2

- How does this plant respond when you touch it?
- How much time does it take to return to its previous position?

This observation explains that plants also respond to stimulus.

Activity: 5

Response to light by earthworms

Aim : To observe the response of earthworm to light.

What do you need: Glass jar, Black paper, torch, moist soil, Earthworm.

How to do : Get an earthworm from a nearby, moist soil. Take a glass jar. Cover half of the glass jar with black paper as shown in fig. 3. Put some soil in the jar and put the earthworm in the uncovered portion of the jar. Close the jar with a lid that contains small holes. Shed some light on the jar.

What do you see : The earthworm moves to the dark portion of the jar.

What do you learn : The earthworm shows response to the light (Stimulus).

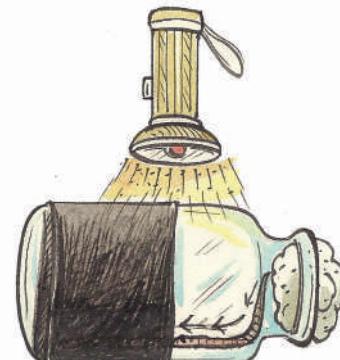


fig. 3



fig. 4

- What happens when a seed is sown in soil?

Seeds germinate and turn into a whole plant. So we can say that seed is a living thing. Can you think of a way of deciding whether dry seeds are living things or not?

Venkatesh noticed that growth, breathing, excretion, taking food, giving birth to young ones, response to stimulus, movement are some of the characteristics of living beings. He also observed that these are not common among all living organisms. But, non-living things do not possess these characters. He observed that people depend upon both living and non-living things. Generally we tell that the plant is dead when it has dry leaves and stem. If an animal doesn't show living characteristics, we can say that the animal is dead.

- Is a dead plant or a dead animal non-living?

Dead plants, animals or any other living beings decompose to form non-living constituents. So we can't say dead things are non-living things. They are intermediate things between living and non-living things.

Living things under a microscope

We cannot see all things around us with our naked eye. Because those things like the antenna of ants, yellow powder of flowers are very small. In the living world there are some things that are not visible. We cannot see them. We can see the small organisms under a microscope. Living beings that we can see only under the microscope are called micro-organisms. Let us try to understand about a microscope and then use it for observing some micro-organisms.

What is a microscope?

Microscope is an instrument with the help of which we are able to see minute things that we cannot see with our eyes. It works like a hand or magnifying lens but it is much more powerful. Basically, there are two components in a microscope -the structural component and the visual components. Structural components are the head/body, base and arm. Visual components are eye-piece, objective, nose-piece, coarse and fine adjustment knobs, stage, aperture etc. fig. 5 shows a labeled diagram of a compound microscope. Identify different parts of a microscope in your school with the help of fig.5. Now we want to see some micro-organisms. Where can we find them?

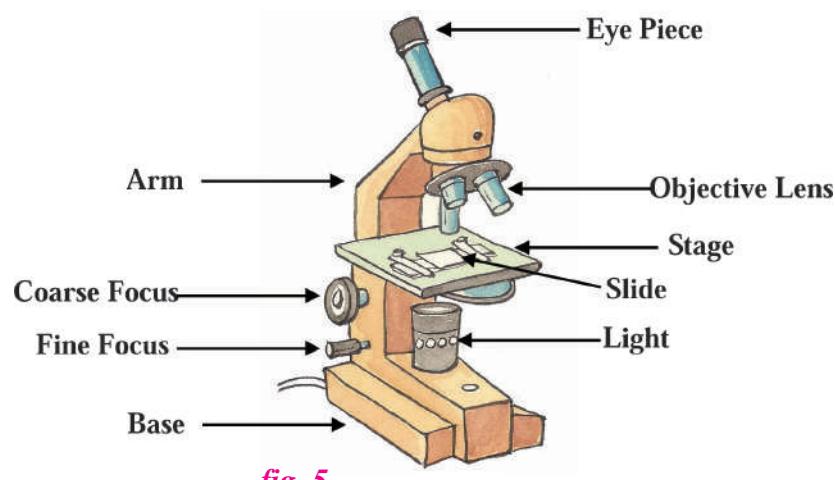


fig. 5

Activity:6

Micro organisms in water

Collect water samples from a pond, well, bore well.



fig. 6

Keep them separately. Put a drop of water on a slide.

Keep a cover-slip on it. Observe under the microscope. Draw what you have observed.

Describe the shapes of the micro-organisms.

- What type of micro-organisms do you see in water samples?
- Do all water samples have the same type of micro organisms?
- Is there any water without micro-organisms?
- Which water contains larger number of micro-organisms? Why?
- What kind of micro-organisms do you find in the water from a pond and borewell?

Thus we see that micro-organisms are present everywhere, although they are not visible to naked eyes. From our activities, we could see only a few of them. But there is a vast world of micro-organisms and they are also a part of the living world.

Activity:7

Who lives where

Here is a list of some organisms. Ant, human beings, elephant, lotus, wall spider, oyster, fish, rabbit, bee, sparrow, dung beetle, earthworm, murrel (korameenu), squirrel, rat, crab, snail, bat, pistia, water hyacinth, monkey, prawn (royyalu), tiger prawn. You may add the names of even more animals and plants that you see around you or remove those from the given list which are unfamiliar to you.

- Which organisms are found mostly in your area often?
- In table 3 write the names of the organisms in the appropriate box according to where they can be found. You could put the name of one organism in more than one column. If you put the organism in the column ‘some other place’, try to mention the place where you could find it. Some are filled in to help you. Copy the table 3 in your notebook. Try to enhance the list as much as you can.

Table 3

Under the ground	On the ground	In/on water	Some other place
snake	snake	snake	
earthworm			
	cat	lotus	
			Sparrow (in homes)

- How many organisms are present in more than one column? Why did you place them there?
- In which column will you put a frog?

We have seen that different organisms live in different places but many of them live in the same place. Living organisms have different needs. They usually stay in the places where most of their needs are met, that is, they get sufficient food, shelter and other conditions necessary for life. All organisms depend on their surrounding for their needs like food, water, air and shelter. The surrounding which meets the needs of a particular organism in the best manner is the habitat of that organism. In a habitat living and non living things are co existing. The living things are called Biotic components and Non living things are called Abiotic components. These two are interdependent. Plants, Animals and Micro-organisms are biotic components whereas soil, water, air, light, temperature, moisture etc., are abiotic components of a habitat.

Habitats can be broadly classified into two categories. **1) Aquatic habitat** and **2) Terrestrial habitat**. Now let us see what are the different habitats around us.

Pond as a habitat

There are several organisms in a pond. To study them more closely we need to see the different regions in the pond where communities of some organisms are present.

- Which animals and plants do you think would live on the surface of the pond?
- Which animals and plants do you think would live in mid water?
- Which animals and plants do you think would live in the pond margins?
- Which animals and plants do you think would live at the bottom of the pond?

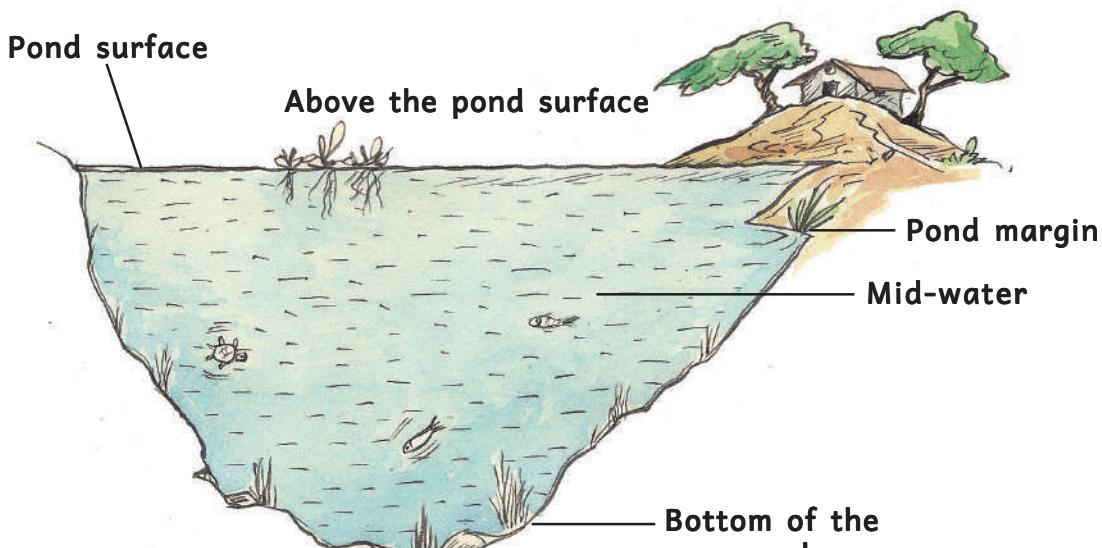


fig. 7



Activity:8

In the pond, we find that different organisms live in different regions. This is due to some conditions like availability of different amounts of food, air, light etc. Now let us study the table 4, showing organisms living in different regions of a pond and answer the questions.

Table-4

S.No	Region of the pond	Organisms living in that region
1	Above the surface	dragonfly, mayfly and kingfisher, hovering above the pond and then resting over a bamboo pole or a stick jutting out of the surface of the pond. They get food from the surface of the pond.
2	On the surface	whirling beetle, pond skater, larva of mayfly and dragonfly, Plants like pistia float on the surface completely while those like the lotus have roots going deep under. [Organisms on the surface are easily eaten up by others because there is little protection for them.] However, there is plenty of food and air. Fish usually come to the surface for food.
3	Pond margins	Several grasses, frogs, cranes, crabs etc. Fish usually lay eggs here.
4	Midwater	Great water boatman, leech and mosquito larva are found in this region. Fish and crabs also swim around this region.
5	Bottom of the pond	This region has plants like Hydrilla and animals like mussels, flatworms and some maggots (larvae of some insects). Light is minimum here, but food, in the form of dead and decaying matter is plenty.

- Name some organisms in the pond that can stay in different regions in the same pond? What makes them stay in different regions in the pond?
- Can different places in the pond also be called as habitat? Why? or why not?
- Is there any animal with legs in the pond?
- Do all animals in the pond have tails?
- Do all animals in the pond swim?
- What are the animals that share the surface of the pond as habitat?
- Are the leaves of all plants growing in a pond, similar? What is the difference between the leaves of a plant growing at the bottom (hydrilla) and that floating on the surface (lotus)? Try to think and write why we find such differences.

In all ponds we can see both plants and animals. The plants that we see in water are called aquatic plants and animals are called aquatic animals. This type of habitat is said to be an **aquatic habitat**. There are several aquatic habitats on earth, from very small ones like water tanks, ponds, small garden pools, pools that form after rain, to large ones like saltwater lakes, rivers, seas etc.

Tree as a habitat

Activity:9

Now, in the same way, let us study a plant or a tree as habitat. Birds, monkeys, squirrels, snakes, ants, spiders, caterpillars, moths, bees, wasps, small plants (mosses), mosquitoes are some organisms that you may find on a tree. Try to classify them in table 5 based on where you find them. Add some more examples that you know.

Table 5

At the base of the tree	ants, ...
On the trunk	
Between the branches	monkeys, ...
On or within leaves	

There are different types of trees in our surroundings. Tree is a place where different types of animals like birds, squirrels, ants, spiders etc., live. Some very small plants also grow on the barks of trees (you may have seen certain areas of the bark having green velvety growth especially in the rainy season). Trees are thus habitat for different organisms. Birds and squirrels come and go from a tree yet the tree is a habitat for them.

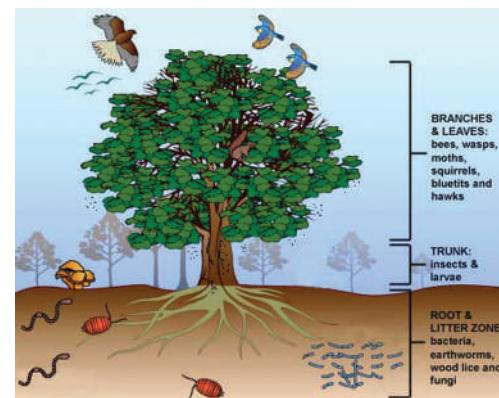


fig. 8

Our house as a habitat

We live in houses that protect us from heat and cold, rain etc. and are a shelter for us. We keep some animals and birds as pets in our houses. We also grow some plants which give us fruits and vegetables.

Activity:10

Discuss the different organisms that live in your house. List them.

- Can animals that are our pets live in other places as well? Name the animals and also write the places where they can live.

- Why do only certain types of animals and plants live along with us? We domesticate some types of animals and plants for our needs like food.

Thus we can say that our house is also a habitat, isn't it? Several animals like dogs, cats, goats, cows, birds (like hens, ducks, pigeons), spiders, ants, cockroaches live with us. Plants like the money-plant and some crotons are also kept inside our houses. We should take care of our pet animals. Most of the time we concentrate only on the milk a cow or buffalo gives, than on their needs. Keeping their sheds clean, supplying fodder and water to them is our responsibility. If we show concern for animals they become affectionate to us. You often notice that your pet dog licks your feet, wags its tail, sits near you and walks with you. Have you ever experienced the affection that a dog/cat shows towards you?

Do You Know?

"Live and Let Live"

Animals are partners of our habitat. They also have a right to live. We people are encroaching their habitats. If we cut a tree, birds that live on it lose their nests and fall in danger. We often see dogs, cows, monkeys suffering from lack of food and shelter. Some voluntary organizations work for animal rights and protection. We have to provide food and protect them. We should take it as our responsibility.

Orchard: A wonderful avenue

While travelling by bus or train, we can see different types of crop fields and orchards. Farmers grow mango, guava, sapota, banana, citrus (battai) trees in the villages. In orchards, farmers grow a single type of fruit plants for example, in a mango orchard there will only be mango trees. But we find several other smaller plants also growing. We also find different types of animals there.

- Are all plants that grow in an orchard the same as the plants in a forest? Why is it so?

Plants and animals that live in different places on the land like those living on trees in our houses, fields, forests etc are said to belong to terrestrial habitat. All habitats on land are collectively known as **terrestrial habitats**.

Now let us do a small activity to see the difference in the ways in which plants and animals adjust or adapt to their surroundings. A study of the difference between aquatic and terrestrial plants will help us to understand this better.

Do You Know?

Cactus, Acacia, Aloevera plants do not need much water. They are called Desert plants. We can see camels frequently in the desert. Desert plants and animals are suited to dry conditions and vast temperature differences. Different characteristics in the desert make up desert habitats.

Activity:11

Compare water [Aquatic] plants with land [Terrestrial] plants

Collect an aquatic plant like Hydrilla or Valisneria. Also collect any terrestrial plant.

Now compare the two and write your observations in table-6

Table-6

Parts	Terrestrial plant (tulsi)	Aquatic plant (Valisneria /Hydrilla)
Stem		
Leaf		
Root		
Others		

- On the basis of your observations write how the aquatic plant is suited to live in water?

Diversity of habitats in Andhra Pradesh

We can see diversified habitats in our state. We can see Coringa mangrove forest in Vishakapatnam and East Godavari districts. Seshachalam, Nallamala forests and Dry deciduous forests at Ramatheerdam of Rayalaseema, Grass lands on Simhachalam hills, valleys at Araku and Lambasingi of Uttarakostha, Papikondalu of Godavari districts, Kondapalli Reserve forests of Krishna district are the major terrestrial habitats of our State in addition to the plateau region. Kolleru fresh water lake located in Krishna and West Godavari districts, Pulicat salt lake located in Nellore district are the major aquatic habitats of our State in addition to the rivers and Bay of Bengal. These diversified habitats are providing shelter for a rich variety of plants and animals in our State.

Good Habitat - Good Life



Habitat-A



Habitat-B

- Which habitat do you like more? Habitat-A or Habitat-B. Why?

Suppose the doors of your house are destroyed somehow, how do you feel? We fail to accept even little changes in our house or surroundings. We feel disturbed. Do we feel the same way for others? We are dumping wastes in nearby ponds, lakes, rivers and grounds and destroying forests on a large scale to set up industries. Think what will happen to all the organisms living in these areas. What will be the result of all this? Don't we depend on different organisms? You have already studied about the interdependence of different organisms. Try to give your answer on the basis of that. If we harm them wouldn't we be harmed as well? Think how a good unharmed habitat leads to a better life for us.

Do You Know?

Different kinds of birds come from long distances to Kolleru and Pulicat lakes of our State. During the months of October to March, pelican birds appear on those lakes.

Generally we can see birds flying over long distances to find suitable conditions to reproduce. Animals like turtles and fish also move from place to place. Some kinds of turtles move away from coasts of West Bengal and Odisha to the coasts of Visakhapatnam.

- Have you heard about the Pulasa fish? Gather information about them. How and why do they change their habitat in some seasons.

KEY WORDS

Living things, Non living things, Growth, Breathing, Excretion, Stimulus, Response, Micro-organisms, Microscope, Habitat, Terrestrial habitat, Aquatic habitat, Orchard, Mangrove.



What we have Learnt?

- ◆ There are living and non-living things around us.
- ◆ Living things possess characteristics like growth, breathing, excretion, movement, response to stimulus and giving birth to young ones.
- ◆ Among living things, plants and trees can't move like animals.
- ◆ A change in the surrounding that make an organism respond to it is called Stimulus.
- ◆ We can see minute living things under a microscope. Those are called Micro-organisms.
- ◆ Dead thing is an intermediate stage between living and non-living things.
- ◆ Habitat is a dwelling place for plants and animals that gives them optimum conditions for life.

- ◆ Tree, pond, house are some examples of habitats.
- ◆ Temperature, moisture, air, water, food, shelter are the non-living components of a habitat.
- ◆ All habitats may be broadly grouped into terrestrial (land) and aquatic (water).
- ◆ Several kinds of plants and animals share the same habitat.
- ◆ Habitats shows the diversity of nature.
- ◆ Habitats are specific to the particular organism living there.
- ◆ Birds often change their habitat in search of better living conditions. For example, some birds change habitat before laying eggs.
- ◆ We must not destroy habitats of other organisms to satisfy our needs; rather we must try to protect them.



Improve Your Learning

Fill in the blanks

1. _____ is a dwelling place for plants and animals.
2. Soil is an _____ component of a habitat.

Choose the correct answer

1. Which of the following is not a character of a living thing ()
A) Reproduction B) Growth C) Breathless D) Excretion
2. Which of the following is a terrestrial habitat ()
A) Pond B) Garden C) Lake D) River

Answer the Following

1. What are the common characteristics of living things?
2. How can you say that a tree is living even though it doesn't move?
3. What is a habitat? How can you say our house is a habitat?
4. List out the organisms living in various regions of a pond?
5. "I am a living being. I have four legs. I live in water and also on land." Who am I? And who are there in my habitat along with me?

6. What questions do you ask to know more about micro organisms?
7. How do you prove that earthworm respond to stimulus?
8. Draw the diagram showing different regions of a pond.
9. What steps do you take to keep a habitat good?



Activities and Projects

1. Collect sweet potato, bottle, salt, and water. Take a bottle full of water and add salt, then put the sweet potato inside the bottle. Observe for a few days. What happens? Note your observations. How can you prove that sweet potato is also a living thing?
2. Identify the habitat in which the following live. More than one organism may be present in one habitat (use information given in the help box) Our intestine, pond margin, kitchen, garden, tree, underground, grass
3. Observe a spider in its web and write how a spider shares its habitat.
4. Collect a hydrilla plant. Put it in a glass of water and observe for a week how it grows.
5. Take a map of Andhra Pradesh and colour the areas where mangroves grow.
6. Write your experiences with your pet dog/cat/cow etc. that shows its affection on you.
7. Prepare a map that represents different habitats which exist in your school.
8. Prepare an article to deliver a speech in Literary Association meeting on “Animals also have right to live.”



CHAPTER - 10



Basic Electric Circuits



Learning outcomes

Pupils will be able to..

- identify basic electrical components.
- classify the materials as insulators and conductors.
- explain the differences between insulator and conductor.
- understand open and closed circuits.
- connect components in a circuit.

Niharika's father Ranganna had to go to the fields before sunrise. Watering the field in the night had become a usual practice for him. Ranganna walked out of the house and called Niharika asking for a torch-light. She took the torch and cells out from the cupboard and handed over the torch-light to her father after inserting the cells. He switched on the torch but it did not light up.

- What could be the problem?

Was there something wrong with the torch-light? Niharika took back the torch, opened it and realised her mistake. She had inserted the cells in a wrong way. She changed the position of the cells and handed over the working torch-light to her father.

- Why does the position of cells affect the working of a torch-light?
- What does a cell contain?



fig. 1

Activity: 1

Let us take a torch cell (Fig. 2) and observe it. Can you describe it?

Cell

The cell consists of a cylindrical metal can. Its heaviness suggests that it is filled with some chemicals. The protrusion on one end is due to a carbon rod in the centre. At the top of the cell a metal cap is fixed. The entire can is sealed. Have you seen (+) and (-) signs on a cell? These signs indicate the two terminals of a cell.



fig. 2

Note: Do not connect the two terminals of a cell with a single wire.

Bulb

Observe a torch-bulb or an electric bulb carefully (Fig. 3).

- What does it contain ?

A torch bulb consists of a glass chamber fixed on a metal base. Two metal wires are firmly fixed. One wire is attached to the metal cap and the other is attached to the base at the centre of the metal cap. (The arrangement in an electric bulb is different. In an electric bulb, two metallic wires are attached to the two terminals at the bottom of the metal cap) These wires act as two terminals. The two terminals do not touch each other.

The part of the bulb that glows is the **filament**, which is a thin spring like wire attached to the two metal wires inside the glass bulb.

- Why do bulbs and cells have two terminals?
- How does a bulb glow with the help of a cell?

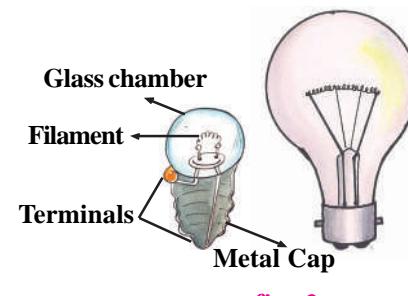


fig. 3

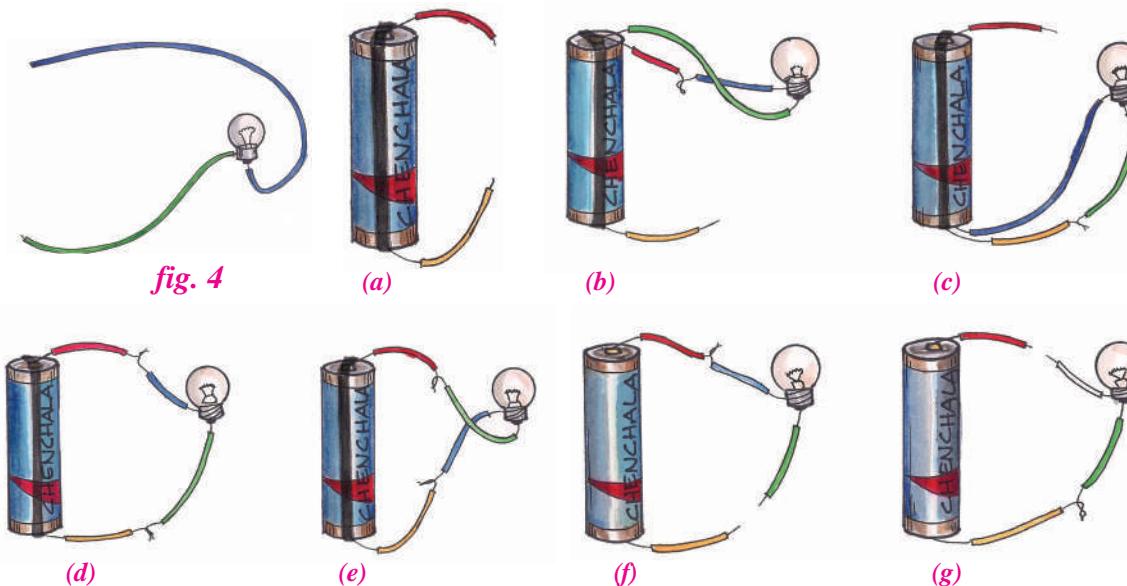
Activity: 2

Simple electric circuits

Take four wires of different colours, say blue, green, red and yellow, each about 15 cm long. Electric wires are often covered with plastic. First, remove about two centimetres of the plastic covering, from both ends of each wire. Now attach two wires (Blue and Green) to a bulb and two wires (Red and Yellow) to a cell with a cello-tape or cell-holder as shown in Fig. 4(a). We can use a cell-holder to hold the cells and wires together tightly.

[Take an old inner tube of a bicycle and cut it into narrow bands. Each band should be wide enough to cover the knob of the cell. This is your cell-holder.]

Now connect the wires in different forms as shown in Fig. 4(b) to 4(g). In each case, check whether the bulb glows or not. Record your observations in table 1



Connection	Does the bulb glow (Yes/No)
Fig 4(b)	
Fig 4(c)	
Fig 4(d)	
Fig 4(e)	
Fig 4(f)	
Fig 4(g)	

In which case does the bulb glow? Why?
 In which case the bulb does not glow? Why?
 You may observe that the bulb glows in connections shown in Fig. 4(d) and Fig. 4(e), but not in other cases.
 We observe that in Fig. 4(d) and Fig. 4(e) the connections form a closed path while in the remaining cases we find some gap in the path.

What is a circuit?

Fig. 5 shows a closed circuit. It consists of a cell (power source), a bulb, and connecting wires. An electric circuit provides a complete path for electricity to flow between the cell and the bulb. A similar circuit exists for an electric bulb which we use in our houses. The two electric supply wires (called **live and neutral**) are connected to the two terminals of the bulb through a switch.

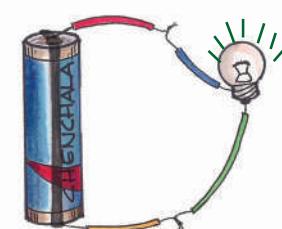


fig. 5
A simple electric circuit

When the switch is closed (put on) the circuit provides complete path for electricity. Many times in our houses we observe that though electricity is available, some bulbs glow and some don't glow. What could be the reason for that?

Observe a bulb which is not glowing. Do you find any difference in the filament of glowing bulb and the bulb that is not glowing?

The bulbs which don't glow are said to be fused. If we connect a fused bulb in a circuit the circuit remains open, and there is no closed path for the flow of electricity. Hence, the bulb doesn't glow.

Switch

We use switches to put **on** or put **off** the torch light. Similarly we use various switches in our house to put **on** or put **off** the electric bulbs, tubes, fans etc.

What is a switch? How does it work? Let us observe.



Electric Switch

Connect a circuit on a wooden plank or on a thermocol sheet as shown in Fig. 6. Insert two drawing pins at A and B. Insert a safety pin in between A and B, such that one end of the pin is completely in contact with B and the other end is left free. Now observe the bulb. What do you notice? Now touch the safety-pin to pin A and observe the bulb again. What happens? Why doesn't the bulb glow when the safety pin is left free at one end?

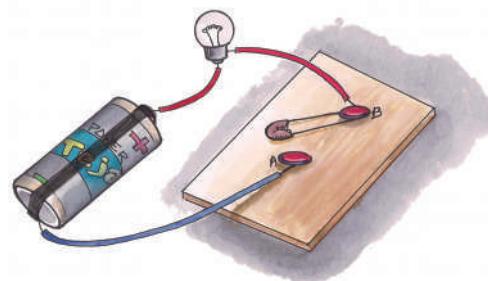


fig. 6 - Circuit with a switch

In the above activity, the safety pin is used to close /open the circuit. An electric switch is an arrangement to close or open (break) a circuit. The switch allows the flow of electricity when it is **on** and cuts off the flow of electricity when it is **off**. In this way, the switch is used to allow / stop the flow of electricity to the bulb or any other electrical device. The flow of electricity in a circuit is called a current.

Torch-light

- What does a torch consist of?
- What makes the torch bulb glow?

Take a torch and observe its internal parts (Fig. 7).

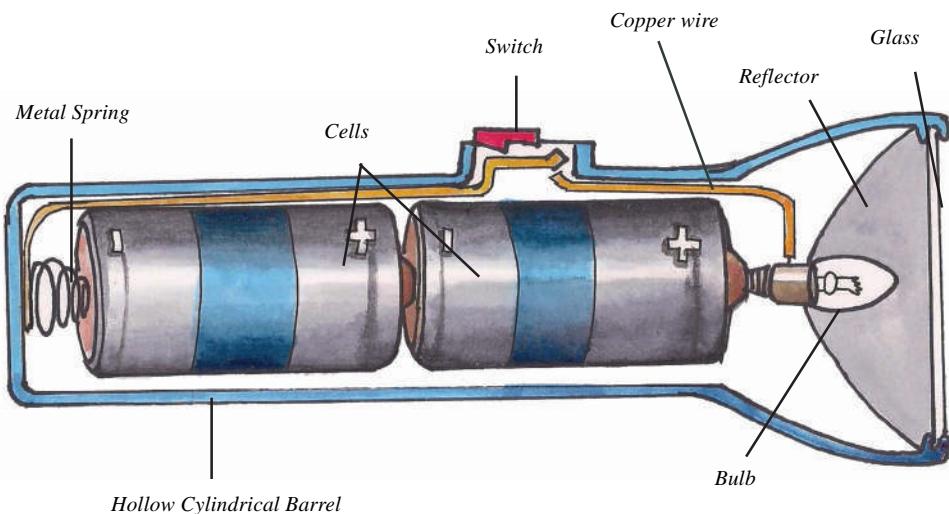


fig. 7 - Inside view of a torch-light

The torch-light is used as a source of light. The parts of a torch-light are a hollow cylindrical barrel, cells, a bulb, a switch, a glass cover and a metal spring. A torch consists of a hollow cylindrical barrel in which cells are fitted. At one end of it, there is a lid with a screw which can be opened and closed. When the lid is closed and the switch is **on**, the circuit is completed and current flows in the circuit which makes the bulb glow.

In Niharika's case, it was just the position of cells that made the bulb glow. Can you predict other reasons for the torch not working?

Activity: 4

Take a torch which has two cells. Arrange the cells in the torch in as many ways as you can. In which cases does the bulb glow and in which cases it doesn't? Draw pictures showing different positions of cells and glowing of bulb. Can you find out why the bulb glows only when cells are placed in a particular position?

Conductors and Insulators

In activity-2, we used wires after removing the plastic covering at both the ends. Why don't we use the wires without removing the plastic covering?

What material do you find in electric wires?

Why are we advised to wear rubber chappals while working with electricity? Let us find out.

Activity: 5

Identifying conductors and insulators

Take the circuit which we used in activity-3, as shown in Fig. 8. Remove the safety-pin

from the drawing pins so that you have two open terminals A and B. Insert different objects like a hair pin, safety pin, eraser, plastic scale, match stick, piece of a metal bangle, piece of a glass bangle, paper clip etc. in the gap between A and B. With each insertion, check whether the bulb glows or not. Record your observations in table 2 for each case.

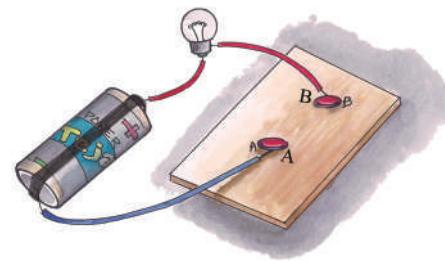


fig. 8 : An open electric circuit

Table: 2

S.No.	Object	Name of the Material	Does the bulb glow (Yes/No)
1.	Hair pin	Metal	Yes
2.	Pencil lead		
3.	Eraser	Rubber	
4.	Plastic scale	Plastic	
5.	Match stick		
6.	Divider from geometry box		
7.	Piece of paper		
8.	Iron nail		
9.	Piece of Metal bangle		
10.	Piece of Glass bangle		
11.	Paper clip		
12.	Piece of chalk		
13.	Safety pin		

If you look at table 2, after recording your observations you will find that the bulb glows in some cases and does not glow in other cases. Can you guess the reason?

- Substances which allow electric current to flow through them are known as **conductors** of electricity.
- Substances which do not allow electric current to flow through them are known as **insulators**.

Using the above definitions, can you group the objects you observed in your daily life as conductors and insulators? Make a list of objects and group them as conductors and insulators and write in table-3

Table: 3

Conductors	Insulators

The story of bulb

The story of the invention of a bulb is very interesting. We may think that a bulb is a very simple gadget, just press a switch and it lights up. But do you know that many scientists worked hard for many years before the first successful bulb was made? One of them was Thomas Alva Edison who ultimately succeeded in making the first bulb.

Since his childhood, Edison was of an inquisitive nature and he learned science by performing experiments himself. You will be amazed to know that in his lifetime he invented more than one thousand inventions. Even an intelligent scientist like Edison had to work hard for many years before he could make a bulb that worked. First of all, he passed electricity through a thin, thread-like platinum wire. He noticed that the wire did give out light after being heated, but it burned out after only a few seconds. Edison then thought that if the air surrounding the wire coil was removed then, perhaps, the wire would not burn out so quickly.

He made a glass casing and fitted a filament of platinum wire in it. He then removed all the air from within the glass casing. He passed an electric current through the wire and, to his delight; the bulb lit up and did not burn out for eight minutes long. He began experimenting with different materials while searching for a better choice of filament. He tried cotton thread coated with soot. This filament burned continuously for 45 hours. He tried different kinds of thread. One summer day he saw a man fanning himself with a bamboo fan. An idea struck his curious mind - "Well, why not try bamboo fiber as a filament?" He executed his idea and amazingly the bamboo filament burned continuously for a number of days. Finally he succeeded in making a cotton filament that was even better than the bamboo one.

Today we use the same kind of bulbs as were first made by Edison. The only difference is that our bulbs have a filament made of a metal called **Tungsten**.

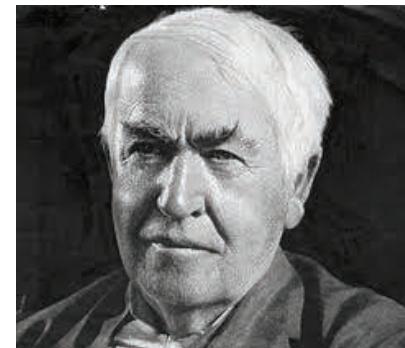


fig. 9 - Thomas Alva Edison

KEY WORDS

Electricity, cell, bulb, fused bulb, terminals, filament, switch, circuit, conductor, insulator, tungsten



What we have Learnt?

- ◆ The cell is the source of electrical energy in a torch-light.
- ◆ The cell has two terminals, (+) and (-).
- ◆ The bulb, consists of a filament which gives light and two terminals.
- ◆ Electricity requires a closed path for it to flow.
- ◆ A switch helps us to allow or break the flow of electricity in a circuit.
- ◆ A torch-light consists of a cell, a bulb and a switch.
- ◆ Substances which allow the flow of electricity are known as conductors of electricity
- ◆ Substances which do not allow the flow of electricity are known as insulators.
- ◆ The electric bulb was invented by Thomas Alva Edison.



Improve Your Learning

Fill in the blanks

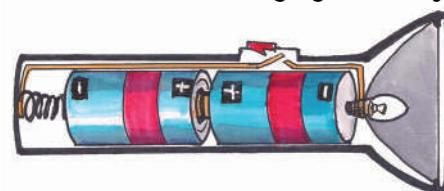
1. The flow of electricity in a circuit is called _____
2. A _____ helps us to allow or break the flow of electricity in a circuit
3. Substances which allow electricity to pass through them are known as _____
4. The electric bulb was invented by _____

Choose the correct answer

1. In a bulb the part which gives us light is ()
A) Metal Base B) Glass Chamber C) Filament D) Terminals
2. Which of the following is a insulator ()
A) Hair pin B) Iron Nail C) Plastic Scale D) Pencil Lead
3. The metal used in making filaments of present day bulbs is ()
A) Iron B) Copper C) Tungsten D) Cotton

Answer the following

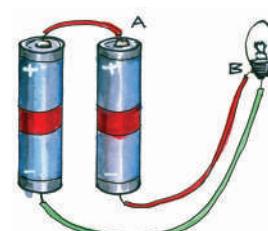
1. What is an electric circuit? Explain with a diagram.
2. What are the parts of a torch-light?
3. Classify the following into conductors and insulators :
Water, Plastic pen, Pencil lead, Dry cotton cloth, Wet cotton cloth, Dry wood, Wet wood
4. What will happen if the cells in a torch are arranged as shown in the following figure? Why?
5. Niharika observed an electrician repairing a street light wearing gloves on his hand. She asked him some questions. What would be those questions?
6. A circuit is connected with a cell, bulb and a switch, but the bulb is not glowing. Write all possible reasons for this.
7. How do you test the materials given to you, to know whether they are conductors or insulators?
8. Draw a circuit diagram showing a cell, switch and a bulb.
9. If you put the switch on, a light will glow, a fan will rotate, an iron box heats up etc.



Activities and Projects



1. In activity 4, we observed some situations where the torch bulb glows. Niharika challenged her friends that she could make the bulb not glow even with the cells kept in proper position. What would she have done?
2. Connect a circuit as shown in the given diagram.
 - a) Does the bulb glow? Why?
 - b) Draw the circuit so that the bulb glows.
 - c) Verify it by connecting cells and bulb as per the circuit drawn.
3. You have studied the story of Thomas Alva Edison. Write a note appreciating his efforts in inventing the bulb.
4. Connect circuits as shown in the following figure. Write your observation in each case.



CHAPTER - 11



Shadows - Images

Learning outcomes

Pupils will be able to..

- recognize the sources of light.
- define and describe a shadow.
- discuss the differences among opaque, transparent and translucent materials.
- predict whether certain objects cast shadows or not.
- infer the shadow size depends on distance between an object and the light source.
- create shadow puppets, shadow plays and hand characters.
- understand and explain the relative lengths and shapes of the shadows at different times of the day.
- understand the formation of lunar and solar eclipses.



A9T5W3

One day Raju started for his home from school, late in the evening. When he started, he was able to see trees, buildings, animals, buses etc. on the road and on either side of the road. As he kept walking, it started growing dark and soon he was not able to see objects either on the road or on the sides as clearly as earlier. When he reached home, it was already dark. He started doing his homework. Suddenly the power went off. He was not able to see any objects in the room.

Raju started wondering.

- Why am I not able to see the objects clearly when it gets dark?
- Why am I not able to see the objects when power goes off?
- How are we able to see the objects in the presence of light?
- Why are we not able to see the objects in the absence of light?

How can we see objects?

Activity: 1

Make your room dark by shutting the door and windows; and then put on the light. Look at any one of the objects in the room. After that, hold a plank or a writing pad in front of your face. Is the object visible to you? Why is it not visible though there is light? What happens when you hold a plank between the object and you?

The object is visible when there is no obstruction between your eyes and the object. If we keep obstructions like plank or a writing pad, they do not allow something that is coming from the object to reach us. What is that something coming from the object?

When we put on the bulb, light falls on the object, bounces from the object and reaches us. We can see an object only when light falls on it and bounces back to our eyes. See Fig. 1 and observe the direction of the arrowheads.

• Where does light come from? Which objects give us light? Think and write below : A substance which gives light is known as a light source. Sun, a glowing bulb, lighted candle etc.

-----, -----, -----, -----
are some sources of light. Any object which burns or glows acts as a source of light.

• Can you give some more examples for source of light?
You might have seen your shadow many times.

• When did you see it? Is it during day time or at night?
It is our common experience that we see shadows at day time. Are shadows formed at night? Try to see your shadow in the moonlight on a full moon day. It is also possible to get your shadow at night, in your house, when the electric bulb is on. Is it possible to form shadows when there is no sunlight, bulb or any other light?
• What do we need to form a shadow?
We need light to get the shadow of any object.

Do all objects form shadows?

Activity: 2

Try to form shadows of a book, a pen, a duster, a polythene cover, and a glass plate on the wall of your classroom with the help of a torch.

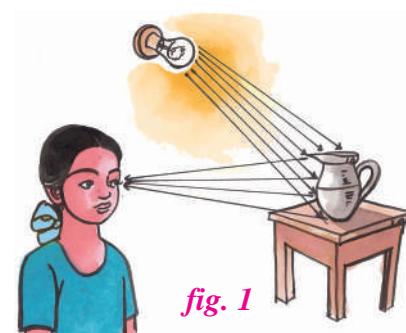


fig. 1

Do you find any differences in the shadow of the above objects? Do all objects form shadow?

- Which objects form shadows?

_____ , _____ , _____ , _____

- Which objects do not form shadows?

_____ , _____ , _____ , _____

- Think and write why some objects form shadows? And others do not?

The substances like paper, plank, wood, iron etc, don't allow light to pass through them. These objects form shadows. These are called **opaque substances**.

The substances like glass and air allow light to pass through them and hence we don't get their shadows. Such substances are called **transparent**.

The substances such as polythene cover and oily paper partially allows the light to pass through them. Their shadows are unclear. These are called **translucent** substances. You have also come across these terms in the chapter on materials.

Observe Fig. 2. Write whether the sheet held by the boy is transparent, translucent or opaque below each of the pictures.



fig. 2

Think, guess and write in table 1 which objects in your classroom and at home form shadows, which do not form shadows and which form an unclear shadow.

Table:1

Objects which form shadows.	
Objects which form unclear shadows.	
Objects which don't form shadows.	

Check the above objects in sunlight to verify your guess and make corrections in table 1 if needed. After checking, give your own examples for transparent, translucent and opaque substances.

Transparent Substances :

Translucent Substances :

Opaque Substances :

Thus we see that all objects do not form shadows. Only opaque objects form shadows. We need a source of light and an opaque object to get a shadow.

Are sources of light and an opaque object enough to get shadows?

Do we need something more?

Do this activity in a dark room with a torch and a leaf. Focus the light on the leaf with a torch as shown in fig. 3 (keep the distance about 30 cm between the leaf and the torch).

- Where do you find the shadow of the leaf in the room?

Now put the torch under the leaf at a distance of about 30 cm (fig. 4).

- Where do you find the shadow of the leaf this time?

Do the same activity, in open air (outside) at night. Where are the shadows formed in this situation? Do you see a shadow in an open air when the torch is under the leaf? If not, why not?

Place a drawing sheet or a plank at a distance of 1 m. above the leaf and try to find the shadow of the leaf.

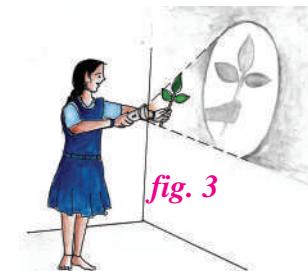
- Do you find the shadow of the leaf if you remove the sheet?
- What do you understand from the above activity?

We understand that only light and an opaque object are not enough to form the shadow of an object. In addition to these, we need a screen. In the above activity, we used a drawing sheet or plank to get the shadow. In our day-to-day life, we observe many shadows on the surface of the Earth. In all these cases, the earth is the screen.

Do You Know?

Shadow Puppetry

Shadow puppetry is one of our traditional recreational activities. In this, some puppets are used to form shadows on a screen and a story is narrated with the help of these shadows. Observe Fig. 6. Try to make puppets and do a shadow puppet show in your school.



Can we guess the object by observing its shadow?

Observe the shadows given in fig. 5(a). Guess and write the names of the objects which form the shadows.

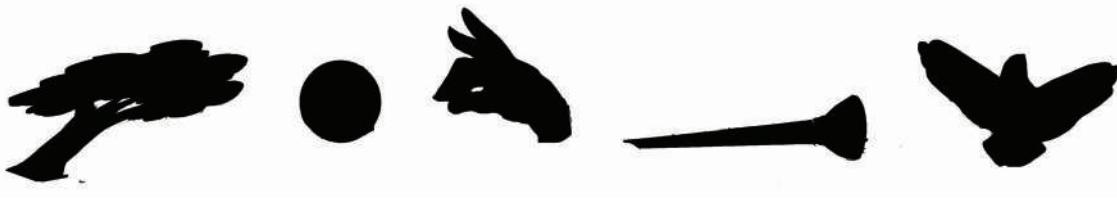


fig. 5(a)

See the objects in fig. 5(b) and compare them with the names guessed by you.

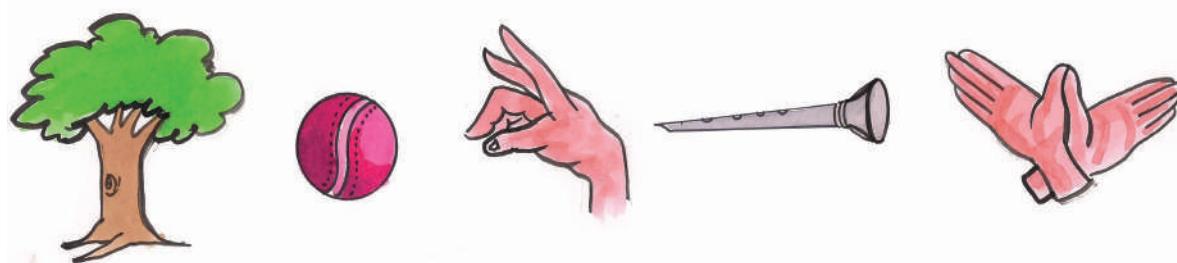


fig. 5(b)

- What do you find?
- Are you able to guess the object correctly in all cases?

You must have wondered when you compared your guesses and the actual objects of which shadows are formed. You may notice that the shadows that look like bird and animal are actually formed by hands. (Try to form similar shadows with your hands.)

- What can you conclude from the above activity?
- Can we guess the object by observing its shadow?



Colour of a shadow

Take four balls of equal size of different colours. Try to Form a shadow of each ball as shown in fig. 6. Ask your friend who is facing the screen and not able to see the balls to guess the colour of each ball.

- Is your friend able to guess the colour of the ball correctly?
- Is it possible to guess the colour of the object by observing its shadow? If not why?



fig. 6

A shadow is an area where light is absent. Hence, the shadow is colourless irrespective of the colour of the object.

We have seen that we can't guess the object by observing its shadow.

- Can we guess the shape of the shadow that would be formed by an object? Let us find out.

Activity: 4

Shape of shadow

Observe the shadows of a book, a pen, a duster, a ball and a round plate, one by one, in sunlight. While doing this, rotate the objects to change their positions and observe the changes in shadows. Try to answer the following questions on the basis of your observations:

- Is there any similarity between the shadows of the ball and the plate? If yes, what?
- What change do you observe in the shadows formed when you hold the pen horizontally and then vertically?
- What differences do you observe in the shadows when the duster is kept in different positions by rotating it?
- Why are the shapes of the shadows of the same object different when you change the position of the object?

Observe the objects, the formation of shadows and the path of light in fig. 7(a) and 7(b). Similarly, draw the shadows for the objects given in fig. 7(c, d). Extend the path of light and draw a shadow on the given screen.

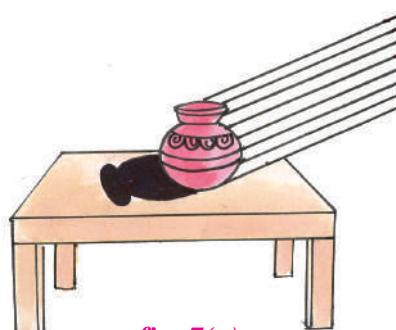


fig. 7(a)

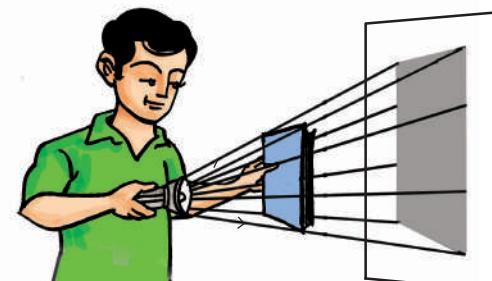


fig. 7(b)

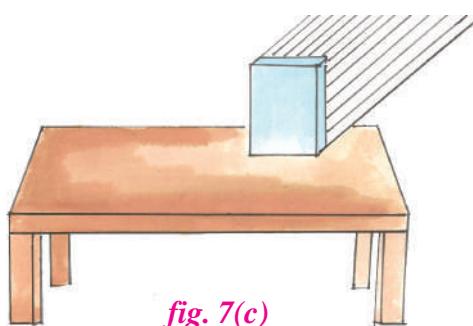


fig. 7(c)

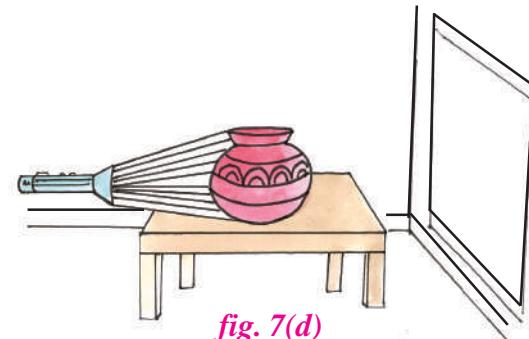


fig. 7(d)

We have drawn arrows in the above figures assuming that light travels like rays that are straight. We can predict the shapes of the shadows only when we consider that light travel as rays along a straight path. In ancient days, by observing the shapes of shadows people came to an understanding that light travels in a straight line.

Activity: 5

Getting different shapes of shadows of a single object:

Take a rectangular piece of cardboard. Try to form shadows of different shapes by using it. You can do this in the sunlight or with the light from a torch. Now, answer the following questions :

- Were you able to make a square shaped shadow?
- Were you able to make a triangular shadow?
- Were you able to make a circular shadow?
- What are the other possible shapes?
- Why are we getting different shapes of shadows when the object is the same?

Because of the straight line path followed by light rays, we can get different shaped shadows for a single object by changing its position. The nature of the straight line motion of light can also be understood by examining a pin-hole camera.

- Have you ever heard of a pin-hole camera?

With this camera we can observe a big object through a pin-hole. Isn't it interesting? Lets make a pin-hole camera.

Activity: 6

Making a pin-hole camera

You will need

A pvc pipe, about 8 cm in diameter and of length 30 cm.

A pvc pipe, about 7 cm in diameter and of length 20 cm.

One black drawing sheet, oil - 1 ml, two rubber bands, a pin, and A4

sheet. (If you cannot get pvc pipes, take a thick sheet of paper and roll it to form tubes. The diameter and length of the tubes should be the same as that given for the pipes.) Cut a piece of black paper and put it like a cap at one end of the big pvc pipe and fix it with a rubber band as shown in fig. 8(a). Put the white paper like a cap at one end of the thinner pvc pipe. Fix it with a rubber band as shown in fig. 8(a). Now make a hole in the middle of black paper cap with the help of a pin. Put 2 to 3 drops of oil on the white paper cap so that it becomes translucent. Insert the thin pipe into the big pipe. Your pin-hole camera is ready.

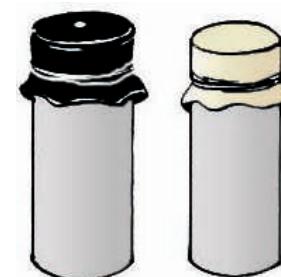


fig. 8(a)

Arrange a lighted candle in front of the pin-hole of the camera. Move the thinner pipe forward and backward to get a clear picture of the candle on the screen of the thin pipe. This picture is to be observed from the back of the thin pipe (see fig. 8b).



fig. 8(b)

What do you see? The flame of the candle appears inverted on the screen. Why is it like that? This is not the shadow of the candle. It is its image.

By observing fig. 9(a), try to understand how light enters into the pin-hole camera. This will explain the reason for inversion of the image.

The light from the candle travels straight in all directions from each point of the flame of the candle. But only the light coming in some particular directions can enter into the camera through its pin-hole.

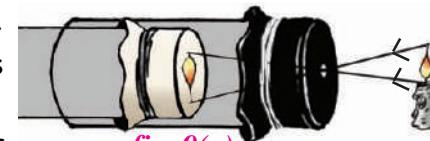


fig. 9(a)

Light which comes from the point at the top of the flame goes straight towards the bottom of the screen and light which comes from the point at the bottom of the flame goes straight towards the top of the screen, as shown in fig. 9(a). In this way, the light coming in a particular direction from each point of the flame, will be able to enter into the pin-hole, and light going in other directions is blocked by the black sheet.

This leads to the formation of an inverted image.

The formation of inverted image on the screen of the pinhole camera explains that light travels in a straight line.

Now look at a tree through the pinhole camera as shown in fig. 9(b). What do you see? We get the full image of the tree in the pin-hole camera. But when we put a candle in front of the pin-hole camera, we get the image of the flame only. Why is it so?

- Predict what would happen if we make two pin holes in the camera? Try it and write down your observations in your notebook.

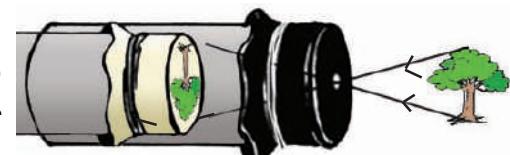


fig. 9(b)

- Did your predictions match with your observations?

Activity: 7

Fun with a magnifying lens

Take a magnifying lens and try to form an image of a tree on a white drawing sheet.

- What do you observe in the image formed on the sheet?

The image on the white drawing sheet is inverted. Isn't it? What difference do you notice

between the images formed through the pinhole camera and through the magnifying glass? You may notice that the image formed through the magnifying lens is clearer than that formed with a pinhole camera.

Difference between Image and Shadow

We see our face in the mirror everyday. Is the picture in the mirror a shadow or an image? How did you decide that?

We know that shadows are not coloured but an image has colours that are same as that of the object. Also, a shadow shows only the outline of the object but an image shows the complete object as it is, just like a photograph.

- Can you find any other differences or similarities between shadows and images? Write in your note book.

Can you show the difference of a shadow and an image through a drawing?

Draw the shadow and image of the object shown in fig. 10.



fig. 10

Activity: 8

Observe the Reflection

Make your class room dark by closing the doors and windows. Ask one of your friends to hold a mirror in his hand. Take a torch and cover its glass with a black paper leaving only slit in the middle. Now switch on the torch and adjust it so that light falls on the mirror in your friend's hand. Ask your friend to adjust the mirror so that the patch of light falls on another friend standing in front of him at some distance. (see fig. 11).



fig. 11

- What do you observe from the above activity?

When light falls on any object, it rebounds back. This is called **reflection**.

Ask your friend A to cover the mirror with a book. Now switch on the torch and focus it on the book. Can you see the patch of light on your friend? Why? Did the light that fell on the book not get reflected? We know that we can see the objects only after light is reflected from them, as mentioned in activity 1. If light falls on any object, it is reflected back. But we see reflected light, as if from a source, only when it falls on the objects like a mirror.

Precaution: You can reflect sunlight using mirrors and play with it. But make sure that the reflected light does not enter your eyes.

KEY WORDS

Light, sources of light, shadow, transparent substances, translucent substances, opaque substances, pinhole camera, image, reflection



What we have Learnt?

- ◆ We need light to see objects.
- ◆ A substance which gives light is known as a source of light.
- ◆ Shadows are formed when opaque objects obstruct the path of light.
- ◆ In addition to light and object we also need a screen to obtain the shadow of an opaque object.
- ◆ The colour of objects cannot be determined by looking at their shadows.
- ◆ Light travels in a straight line.
- ◆ Light gets reflected when it falls on any object.
- ◆ People came to an understanding that light travels in a straight line by observing the shapes of shadows.
- ◆ An image is different from a shadow.



Improve Your Learning

Fill in the blanks

1. Light travels in a _____
2. A substance which gives light is known as _____
3. The bouncing back of light after hitting an object is called _____
4. The colour of the shadow formed by a green tree is _____

Choose the correct answer

1. Identify the transparent substance ()
A) Paper B) Wood C) Glass D) Oil Paper
2. Which of the following substance forms shadows ()
A) Transparent B) Translucent C) Opaque D) All the above
3. What do you need to get a shadow? ()
A) Light Source B) Opaque Object
C) Screen D) All the above

Answer the following

1. Classify the following objects into transparent, translucent, and opaque :
Cardboard, duster, polythene cover, oily paper, glass, spectacle lens, piece of chalk, ball, table, book, window glass, palm, school bag, mirror, air, water.
Which type of materials do you find more in your surroundings?
2. We can't identify the presence of completely transparent objects even in light. Is it correct or not? Support your answer.
3. Why can't we see objects which are behind us?
4. What are required to get a shadow of an opaque body?
5. Can we use a plain mirror as a rear view mirror? If not why not?
6. Why do we get shadows of different shapes of the same object?
7. What are the differences between a shadow and an image?
8. Malati noticed changes in the lengths of her shadows during the day time. She had some doubts about this. What could be those doubts?
9. How can you explain the straight line motion of light?
10. We would not be able to see any object around us if light does not get reflected. How do you appreciate this property of objects?
11. Where do you find reflection of light in your daily life?



Activities and Projects



1. Hold a glass slab at one end with your hand and stand in the sunlight. See the shadows of your hand and glass slab. Explain what you observed.
2. If we focus a coloured light on an opaque object, does the shadow of the object possess colour or not? Predict and do the experiment to verify your predictions. (Coloured light can be obtained by covering torch glass with a transparent coloured paper)
3. Between an electric bulb and a tube light, which forms sharp shadows of objects? Do an experiment to find out and give the reasons.
4. A mirror is kept on the wall of your room. Your friend is sitting on a chair in that room. You are not visible to him in the mirror. How do you adjust your place so that you are visible to your friend in the mirror? Explain.

CHAPTER - 12



Movement and Locomotion



Learning outcomes

Pupils will be able to..

- know the functions of muscles and bones.
- understand the different types of joints.
- know about cartilage, tendon and ligament.
- draw labelled diagram of Joints.
- explain the process of movements in animals.
- appreciate the locomotion in birds, snakes, fish and snails.

While doing physical exercise we move parts of our body in different ways. We lift and bend our legs, hands and other parts of our body. We can also rotate some parts of our body.

Now let us observe the picture.

- What games are the children playing in this picture?
- Are all the children playing in a similar way?

If we carefully observe the boy, he is doing exercise on the bar without changing the place. While the others are changing their places.

All these changes can be termed as: **1. Movements, 2. Locomotion.**

Movement: It is a temporary or permanent displacement of a body or its parts from its original position.

Locomotion: It is the displacement of the entire body from one place to another place.

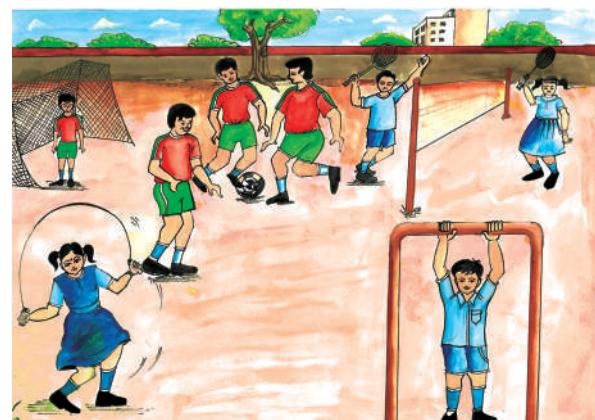


fig. 1

Let us look closely at some of our own movements.

Activity: 1

Human body and its movement

Do the following actions:

- Bowl an imaginary ball at an imaginary wicket.
- Lie down and try to rotate your leg at the hip.
- Bend your arm at the elbow and your leg at the knee.
- Stretch your arms sideways, chew some food, bend your arm to touch your shoulder with your finger and try to move other body parts as well.

Record your observations in table 1.

Table 1

S. No.	Body Part	Rotates Partially/Completely	Bends (Yes/No)	Lifts (Yes/No)	Moves (Yes/No)
1	Neck				
2	Wrist				
3	Fingers				
4	Knee				
5	Ankle				
6	Toes				
7	Back				
8	Head				
9	Elbow				
10	Arm				
11	Upper jaw				

All these movements are done with the help of certain parts of our body that lie beneath our skin. We cannot see these parts directly but we can get a sense of their movement under our skin. Can you guess the names of these body parts?

We can perform different types of movements with the help of muscles and bones. They are situated inside the body. We can't see and study them like we can see our hair, skin, eyes, nose, ears etc.

Let us study how muscles and bones help in our movement. For this, observe your body carefully so that you can sense these internal parts from outside.

Muscles

In this picture we can see the tender, fleshy structures attached to the bones. These are called muscles. Now we shall perform a few activities to find out how these muscles help the various parts of our body to move.

Activity: 2



fig. 2

Touch your shoulder

Make a fist with one hand, bend your arm at the elbow and touch your shoulder with the fist. Also touch your upper arm with the other hand, as shown in fig. 3.

- Can you feel a swollen region inside your upper arm?

This is muscle. The muscle bulges due to contraction. When the muscle is contracted it becomes shorter, stiffer and thicker.

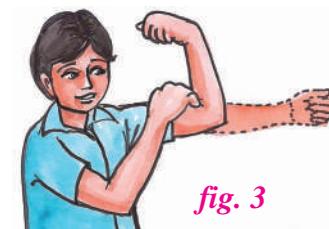


fig. 3

Activity: 3

Fold and un-fold

Hold one of your hands in front of you, in the manner shown in fig. 4(a), with the palm facing downwards. Fold and unfold the fingers of this hand one by one. Observe the back of your palm between the fingers and the wrist and study the movement of the muscles.

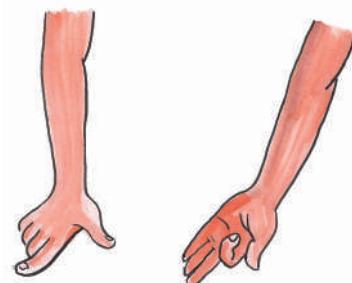


fig. 4(a)

fig. 4(b)

- Could you identify the different muscles that move as you open and close each finger?

Now hold your hand with the palm facing upwards, in the manner shown in fig. 4(b), and fold and unfold your fingers one by one. Study the moving muscles between the wrist and elbow.

- Could you identify the movements in different muscles?

Try to open and fold your fingers without moving these muscles. Is it possible to do so?

In a similar manner, try to feel movements of muscles in your legs and toes as well.

After doing all these activities try to find out the relation between moving parts of the body and muscles?

Now perform the following actions and say whether you are able to feel the movement of muscle here as well:

- Fluttering your eyelashes.
- Lifting a weight
- Chewing
- Moving your toes
- Breathing in and out

How do Muscles work?

Muscles work in pairs. When one of them contracts, the bone is pulled in that direction and the other muscle of the pair relaxes. To move the bone in the opposite direction, the relaxed muscle contracts and the first one relaxes. Thus two muscles have to work together to move a bone. Are the muscles attached to bones?

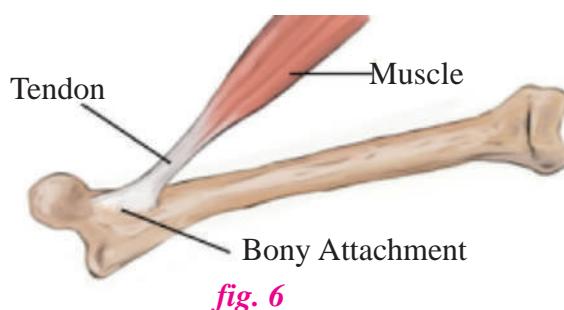


fig. 6

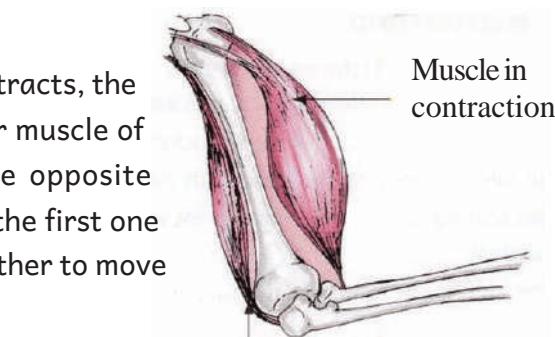


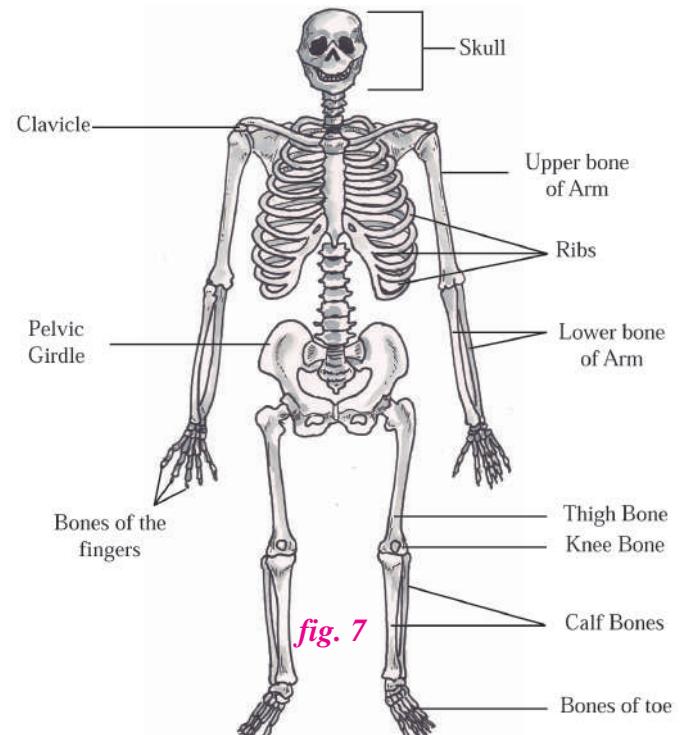
fig. 5

Some muscles are connected directly to bones. Some muscles have round, white, and rope-like fibers at their ends that connect them to the bone (fig.6). These fibrous structures are called **Tendons**.

You can feel the tendons in several parts of your body like; above the elbow, beneath the knee, near the ankle.

Do You Know?

There are more than 650 muscles in our body. The biggest muscle is Gluteus-Maximus and the smallest muscle is Stapedius. Interestingly the muscle of the heart works without rest. The human heart forces 4500 cc of blood per minute through blood vessels.



Bones

The different bones of different parts of the body combine together to form a single structure or system. This structure is called the skeleton. It is very interesting to study the skeletal system, and it is funny to think, how we are without skeleton.

You saw earlier that muscles are joined to the bones to help them move. In the same way, two bones are joined together in a special way by fibers. These fibers are called ligaments (fig.8).

Let us observe some important bones of our body.

Activity: 4

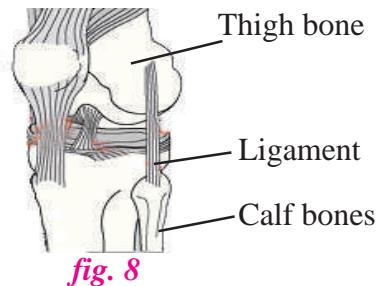


fig. 8

Jaw Bone

Ask your friend to open his mouth and move his lower jaw up and down as well as sideways. Observe his face carefully.

- Did you notice any joint in the bones near his ear?

This is the place where the lower jaw bone is joined to the skull. Press your finger on both sides of your face and spot where you have these joints. This lower jaw is the only movable joint of the skull.



fig. 9

The clavicle

Fold one arm and rest it on your waist. Now slowly lift your arm and shoulder together (fig.10). Run a finger of your other hand from just below your neck towards your shoulder. Try and locate a raised bone there and the one behind it. The raised bone is called **clavicle** and the bone behind it is the shoulder blade. There are two bones protruding from the shoulder called shoulder bones. Look at fig.11 showing where the clavicle joins the shoulder blade. Now try to locate the joint between the clavicle and the shoulder blade.



fig. 10

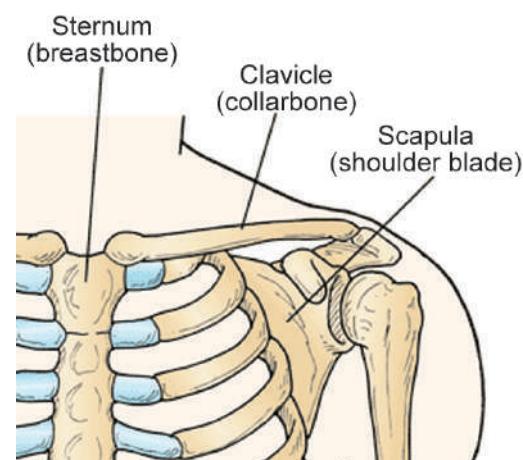


fig. 11



Activity: 6

The Ribs

Take a deep breath and hold it for a little while. Feel your chest bones by gently pressing the sides of the chest. Count as many bones as possible. These bones are called **ribs**.

Ribs are bent which join the chest bone and the back bone together to form a box. This is called the **rib cage**.

Some important parts of our body are located in the ribcage and are protected by it. What are they?

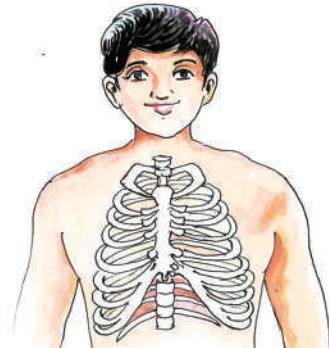


fig. 12



Activity: 7

Backbone

Ask your friend to stand up, bend forward at the waist and try to touch his toes with his palms. Run a finger along the centre of his back from below the neck. A long structure running down the middle of his back is called the **backbone** (vertebral column). The small bones that make up this backbone are called **vertebrae**. The spinal cord passes through the vertebrae of the backbone.

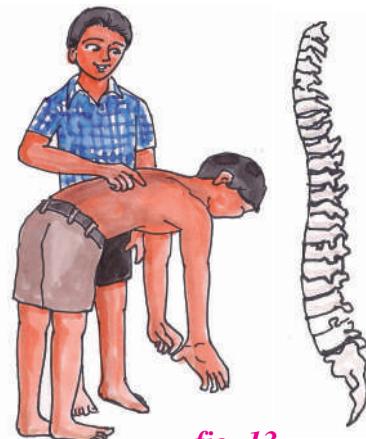


fig. 13



Activity: 8

Pelvic Girdle

Press the area just below your waist with the fingers of both hands as shown in fig.14. Can you feel the bones with the same shape on both sides of your body? This is called **pelvic girdle**. Here the leg bones are attached to the bottom of the spine by a group of bones. This is called pelvis. This is also the part you sit on.

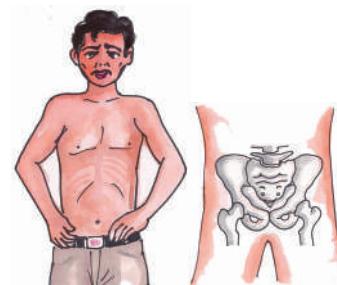


fig. 14

Skull

The skull is made up of many bones joined together. It encloses and protects the brain. The joints between the skull bones are fused. They are also called fixed joints.

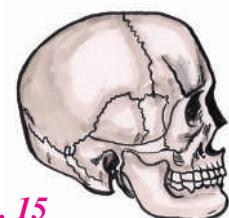


fig. 15

Do You Know?

There are 206 bones present in our body. These bones are so hard due to presence of calcium and phosphorus. The biggest bone is femur and the smallest bone is stapes.

Activity: 9

Flexible bones-cartilage

Hold your ear with your fingers, press it and bend it as shown in the fig.16. Also touch and feel the tip of your nose.

Some parts of the ear and nose are soft and others are hard. The hard parts are made up of a structure called cartilage. This is also a bone but it is flexible. Do you find these flexible bones in any other part of your body? The cartilage is present in other parts of the skeleton as well, like, between the tips of the rib, eyelids and sternum, between the vertebrae of the vertebral column etc.



fig. 16

Different types of joints:

We know that muscles help to move a bone.

- How does one bone help the other to move?
- Is there any arrangement between bones?
- Are ligaments of bones sufficient for body movement?
- Is the entire skeleton of our body made up of a single bone?

Let us understand different types of joints in our body.

Activity: 10

Put a meter scale under your arm so that your elbow is in the centre. Ask your friend to tie the scale and your arm together as shown in fig.17. Now try to bend your elbow. Is it possible?



fig. 17

Bones can't bend. You have seen that the human skeleton is made up of many bones.

- What will happen if bones can't move?
- Bones of our body move in their own way; How is it possible?

It is possible because of the joints of bones. **The point where two bones meet is called a Joint.** The joints help us to bend, twist and turn. There are different types of joints in our body to help us carry out different movements and activities. The joints are divided into two types.

1. Movable joints

2. Immovable joints or fixed joints

Movable joints are again divided into four types.

They are

1. Ball and socket joint
2. Hinge joint
3. Sliding joint
4. Pivot joint

Let us learn about each joint.



Ball and socket joint

Collect a fused bulb and half a shell of a coconut. Place the fused bulb inside the half shell of the coconut and rotate it in the way shown in fig. 18.



fig. 18



fig. 19



Hinge joint

Straighten your arm and hold your elbow in the palm of your other hand. Try to rotate your fore arm in all directions at the elbow joint.

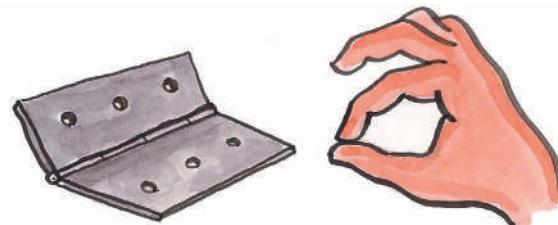
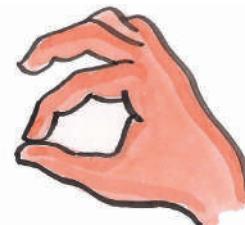


fig. 20(a)



20(b)



20(c)



20(d)

• Is it possible at the elbow as well?
No. Why not?

Try one more thing; bend your arm towards your shoulder in the opposite direction. fig. 20(a) shows a hinge.

- Where do you find such hinges in your house?

Observe how objects attached by these hinges move. Compare these things with that of your elbow and knee. Like the hinge of a door the joint which helps the bones to move in one direction is called a **hinge joint**. Identify and list the hinge joints in your body by taking help of fig. 20(b, c, d).

Activity: 13

Sliding joint

Stand straight up and touch the floor with your palm by bending your body forward without bending at your knees. Again stand back straight up and try to bend your body to the left and right at the waist. Which part of your body you think is responsible for this movement?

It is because of your backbone. There is tender and flexible cartilage between the vertebrae of the backbone. Due to the cartilage, the vertebrae slide over each other, so that the backbone could move in all directions. The joint where the bones slide over each other is called the **sliding joint**. It is present in the vertebral column, wrist and ankle.



fig. 21

Activity: 14

Pivot joint

Move your head up and down, side to side.

- Do you think there is any joint present below the head?
- Imagine what happens if there is no joint in between the head and neck.

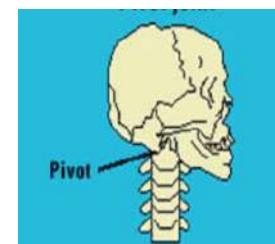


fig. 22

The joint that joins the skull to the back bone is called the **pivot or neck joint**.

Immovable or Fixed joints

Some joints between bones in our body can't move; such joints are called fixed joints. These joints are fused and seem to be a single bone. These are present in the skull. When you open your mouth, you can move your lower jaw.

- Can you move the upper jaw as well?
- There is a joint between the upper jaw and the rest of the head. It is a fixed joint. So, you cannot move the upper jaw.

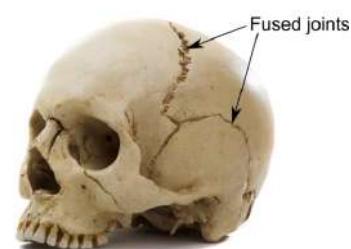


fig. 23

Movements in other animals

We can move parts of our body with the help of muscles, bones and joints. With the help of legs and hands we are moving from one place to another place also. Do all animals have these parts like us? Let us study how animals move.

Activity: 15

Locomotion

Let us see how animals move from one place to another. Fill in your observations in the table.

Table 2

Animal	Body part used for moving	How does the animal move
Cow	Legs	
Human		walks, jumps, ...
Snake		
Bird		hops, flies, ...
Insect		
Fish		

By analyzing table 2 you will see that different animals use different parts of the body for moving from one place to another (locomotion).

Locomotion in fish

Fish swim in water.

- Do they swim the same way as humans?
- What is the difference?
- What features help the fish in swimming and how?

Activity: 16

Make a paper boat. Put it in water and push it forward at the narrow end (fig.24.a). Now hold the boat sideways and push it into water from the broad end (fig.24.b). What did you observe? In which process was it easy for the boat to move?

The body of the fish is streamlined. The shape is such that it allows the fish to move in water easily. The skeleton of the fish is covered with strong muscles. While swimming, muscles make the front part of the body swing towards one side while the tail swings its body towards the opposite side (fig.25).

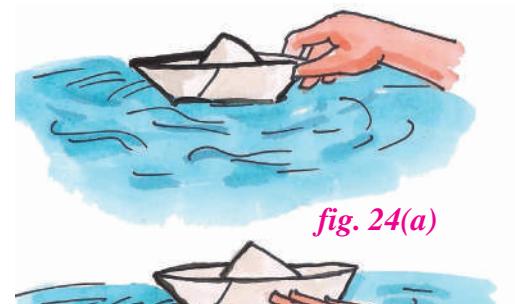


fig. 24(a)



fig. 24(b)

This creates a jerk and pushes the body forward. A series of such jerks help the fish swim forward. The tail fins also aid in this movement.

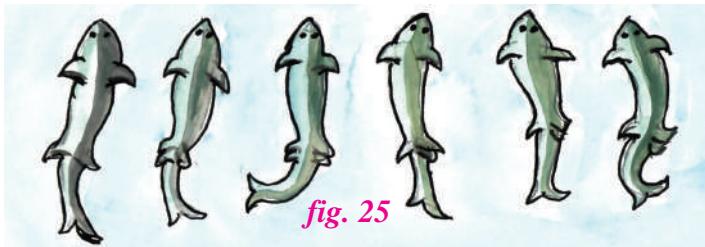


fig. 25

Locomotion in birds



fig. 26

Birds fly in the air and walk on the ground. Birds can fly because their bodies are well suited for flying. Their bones are hollow and light. The bones of the hind limbs are typical for walking and perching. The fore limbs are modified as wings which help the bird in flight. Feathers also play an important role in flight mechanism.

Observe the hen and the sparrow. How do they move? Write your findings about similarities and dissimilarities in your notebook.

Locomotion in snake

Snakes do not have limbs (legs). Snakes have a long back bone and several muscles. Usually the snake's body curves into many loops. Each loop of the snake gives it a forward push by pressing against the ground. This helps the snake move forward very fast. There are other ways in which snakes move.

Try to find out about them. Collect those pictures, information and display them on wall magazine.



fig. 27

Locomotion in snail

Collect a snail from a garden. Have you seen the rounded structure it carries on its back? Place the snail on a glass plate and watch it when it starts moving fig. 28(b). A thick structure may come out of an opening in the shell. The thick structure is its foot, made of strong muscle. The wavy motion of its foot is the reason why a snail moves slowly.

Don't forget to put back the snail from where you collected it. If you let it go away it will die. Show concern towards biodiversity.

Movement or locomotion is an important function in every living organism. It is very interesting to watch ants running hurriedly in a line or squirrels and monkeys jumping on trees. Try to enjoy watching various types of locomotion in the animal kingdom.

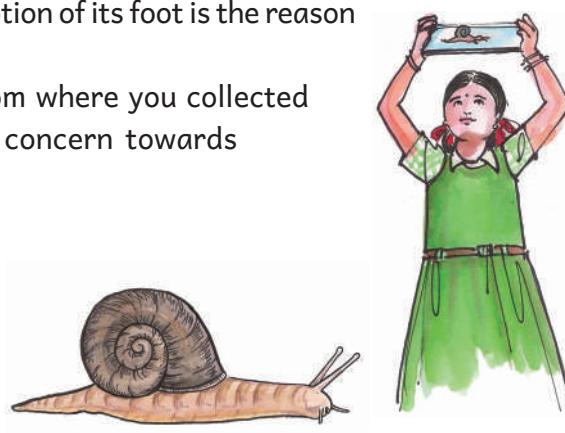


fig. 28(a)



fig. 28(b)

KEY WORDS

Bones, muscles, ligament, tendon, cartilage, clavicle, pelvic girdle, ball and socket joint, hinge joint, sliding joint, pivot joint, locomotion.



What we have Learnt?

- ◆ The displacement of a body or its parts from its original position is called movement.
- ◆ The displacement of an entire body from one place to another is called locomotion.
- ◆ Different muscles of our body perform different functions.
- ◆ Muscles are connected to bones either directly or with the help of tendons.
- ◆ Muscles work in pairs.
- ◆ Different bones of our body combine together to form the skeleton.
- ◆ The point where two bones meet is called a joint.
- ◆ Joints are of two types. They are movable and immovable (fixed)
- ◆ Movable joints are four types namely 1. Ball and socket 2. Hinge 3. Sliding 4. Pivot joints.
- ◆ Tendons join muscles to bones.
- ◆ Ligaments join one bone to the other bone.
- ◆ Our back bone works like a spring.
- ◆ The joint between the upper jaw and the skull is the fixed joint.
- ◆ The streamlined body, fins in fish; wings, legs in birds; ribs in snake; muscular foot in snail are useful in locomotion.



Improve Your Learning

Fill in the blanks

- 1) Joints of the bone help in the _____
- 2) The contraction of the _____ pulls the bones during movement.
- 3) The bones at the elbow are joined by a _____ joint.

Multiple choice

- 1) The immovable joints are present in ()
a) Knee b) shoulder c) neck d) skull

- 2) The hollow bones are present in ()
 a) cow b) sparrow c) buffalo d) snake
- 3) The fibers which join the muscles to the bones ()
 a) Tendon b) Ligament c) Cartilage d) none
- 4) The joint responsible to move our head up and down and side to side is ()
 a) Sliding joint b) Hinge joint
 c) ball and socket joint d) Pivot joint

Answer the Following

1. Write a short notes on different types of joints in our body.
2. What are the uses of muscles and bones?
3. Differentiate the ball and socket joint from hinge joint.
4. How is the body of a fish suitable for swimming?
5. Guess who I am?
 - i) I am a joint that works like joint of doors and window.
 - ii) I help to join two bones.
 - iii) I am a joint between upper jaw and skull.
 - iv) I am a chain of small-small bones
 - v) I join the bone and muscle
6. What would happen if there are no bones and joints in our body?
7. What would happen if there is a single bone in your fingers?
8. Draw a neat and labeled diagram of Ball and socket joint and write its location and uses.
9. How do you appreciate locomotion in birds?



Activities and Projects

1. Collect information regarding joint pains from an orthopedic.
2. List out the activities that you performed at your home and which joints were involved in each activity.
3. Observe the whole body of a hen from internet and make a list of different joints, bones, muscles, tendons and ligaments present in it.
4. Try to identify the joints in the body of a goat through internet and make a list of those joints
5. Collect x-ray films and identify which body part they represent and write a note on them.

Glossary

01. Menu	= వంటకాల జాబితా
02. Recipe	= వంట చేయడానికి సూచనలు
03. Fermentation	= పులియబెట్టడం
04. Cotyledon	= ప్రథమ మూలము
05. Transpiration	= ఆకుల్లోని నీరు ఆవిరపటం
06. Sprout	= మొలక
07. Natural Scavenger	= సహజ పారిశుద్ధ్య కారకం
08. Rumination	= నెమరువేయుట
09. Conservation	= నంరక్షణ
10. Precipitation	= అవక్షేపము
11. Deforestation	= అటవీ నిర్యాలన
12. Hazard	= విపత్తు
13. Insoluble	= కరగనిది
14. Decantation	= వేరుపరచడం
15. Crystallization	= స్ఫూర్తికరణం
16. Sublimation	= ఉత్పత్తనం
17. Magnetic induction	= ఆయస్కాంత ప్రేరణ
18. String	= తాడు / దారం
19. Standard Unit	= ప్రామాణిక కౌలత
20. Cubit	= మూర
21. Stride	= అంగ
22. Ginning	= దూదినుండి గింజలను వేరుచేయడం
23. Spinning	= నూలువడకడం
24. Weaving	= నేయడం
25. Calico	= పుస్కాల బైండింగ్‌లో వాడే నూలు వస్తుం
26. Wrinkle	= ముదతలుపడిన
27. Artisans	= హస్కళాకారులు
28. Soil erosion	= నేల క్రమక్షయము
29. Stimulus	= ప్రేరణ
30. Habitat	= ఆవాసము
31. Orchard	= పండ్లతోట
32. Deciduous forests	= ఆకులురాలే అడవులు
33. Electric circuit	= విద్యుత్ ప్రవాహం
34. Terminals	= ధృవాలు, చివరలు
35. Filament	= సున్నితమైన దారం లాంటి తీగ
36. Conductor	= వాహకం
37. Insulator	= విద్యుత్ నిరోధకం
38. Reflection	= పరావర్తనం
39. Opaque	= కాంతి నిరోధకం
40. Ligament	= సంధిబంధనం