





Government of Kerala Department of General Education

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# THE NATIONAL ANTHEM

Jana-gana-mana adhinayaka, jaya he Bharatha-bhagya-vidhata Punjab-Sindh-Gujarat-Maratha Dravida-Utkala-Banga Vindhya-Himachala-Yamuna-Ganga Uchchala-Jaladhi-taranga Tava subha name jage, Tava subha asisa mage, Gahe tava jaya gatha Jana-gana-mangala-dayaka jaya he Bharatha-bhagya-vidhata Jaya he, jaya he, jaya he, Jaya jaya jaya, jaya he.

### PLEDGE

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 respect to my parents, teachers and all elders, and treat everyone with courtesy.

To my country and my people, I pledge my devotion. In their wellbeing and prosperity alone, lies my happiness.

#### State Council of Educational Research and Training (SCERT) Kerala

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#### Dear friends,

I'm sure this science textbook will prove to be your bosom companion. It will provide you with numerous opportunities for pure enjoyment by leading you to the heights of wisdom through a variety of activities such as observation, experimentation, construction, study tour, seminar, interview, quiz and project. This companion enables you to behold the diversity of nature by putting questions to you and empowering you to ask questions. This book has been envisioned to give you the chance to develop your own Science Kit and engage in investigative activities with your friends. How delightful such learning experiences can be ! These experiences will add wings to your imagination, raising you into the world of extra reading. You can also explore new avenues of knowledge with the help of ICT. You are also being given the opportunity to experience the country's development directly and also to participate in the local development activities. Activities enabling self assessment and leading to further inquiries are included at the end of each lesson. I believe that this book will provide learning experiences to elevate all the learners to higher levels of enlightenment. Your active participation is essential in all the learning activities specially designed for you. I'm sure you will enrich your Science Diary with the concepts you have imbibed through the different learning activities, scientific curiosities, scientific imagination and your vision for national development. I hope you will show interest in planning and implementing various activities of the Science Club in your school. May you be able to move ahead by engaging in scientific inquiries on your own and in the company of your friends, with the help of your teachers.

It will give me immense pleasure to get valuable comments and suggestions from you.

Warm regards,

Dr. Jayaprakash R.K.

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Additional information related to the concepts in the textbook is given under the heading 'For Further Reading'. It is not subjected to assessment. Please note the icon given to it.



# THE CONSTITUTION OF INDIA

# PREAMBLE

WE, THE PEOPLE OF INDIA, having solemnly resolved to constitute India into a <sup>1</sup>[SOVEREIGN SOCIALIST SECULAR DEMOCRATIC REPUBLIC] and to secure to all its citizens :

**JUSTICE**, social, economic and political;

**LIBERTY** of thought, expression, belief, faith and worship;

**EQUALITY** of status and of opportunity; and to promote among them all

**FRATERNITY** assuring the dignity of the individual and the <sup>2</sup>[unity and integrity of the Nation];

**IN OUR CONSTITUENT ASSEMBLY** this twenty-sixth day of November, 1949 do **HEREBY ADOPT, ENACT AND GIVE TO OURSELVES THIS CONSTITUTION.** 

<sup>1.</sup> Subs. by the Constitution (Forty-second Amendment) Act, 1976, Sec.2, for "Sovereign Democratic Republic" (w.e.f. 3.1.1977)

<sup>2.</sup> Subs. by the Constitution (Forty-second Amendment) Act, 1976, Sec.2, for "Unity of the Nation" (w.e.f. 3.1.1977)



You may have seen different types of mango trees in your home and surroundings. Ask the elders in your home how long it will take for the mango saplings to grow and produce mangoes.

What are your expectations while planting and nurturing a mango sapling?



Aren't our goals the same while cultivating fruits, vegetables or cereals too?

- Should yield quickly
- Must yield plenty
- Yield should have good quality

What things are to be taken care of to achieve this? Discuss with your friends and write in your Science Diary.

- Good seeds/planting materials should be used.
- •

**Basic Science** 

•

# Seeds and Planting Materials

Haven't you heard the proverb, 'vithu gunam pathu gunam'? What does it mean?

Observe the pictures and answer the questions given below.



Where are seeds formed? What about fruits?

What factors should be considered while selecting the best seeds?

Class - VII

Look at these plants.

Which of these plants would you choose to collect seeds from? Why?



You know that a single plant can produce many fruits. Fruits from which harvesting stage should be selected to get good seeds?

Are the fruits formed at the initial and final stages of the lifespan of plants ideal for seed collection?

Seeds should be collected from the ripened fruits produced during the middle of the plant's lifespan. Plants like ladies finger and pea contain numerous seeds in a single fruit. Can all these seeds be used for the production of seedlings? How can we select the best seeds from them?

Take a few pea seeds. Select the best seeds from them based on the following factors.

- Shape
- Size
- Weight
- Seed coat

Factors to be considered while selecting seeds are given below. Put a tick mark  $(\checkmark)$  in the appropriate box.

Plant selected for seed collection	Fruit selected for seed collection	Seeds selected
Low yielding	Fruits formed at the initial stage of plant's lifespan	Have definite shape
High yielding	Fruits formed at the end of the plant's lifespan.	Have normal weight 🗌
Healthy plant	Fruits formed at the middle of plant's lifespan.	Have damaged seed coat
Infected plant	Fully ripened	Light weight
Stunted growth	Not ripened	Normal size

Good quality seeds should be selected for better yield. For this, the respective plant and fruit should also have good quality.

Basic Science

Are new plants formed only from seeds? Observe the pictures given below. From which parts of these plants do saplings form?



- Bryophyllum .....
- Pepper plant .....

Haven't you understood that new plants are formed from parts like root, stem, leaf and underground stem? Saplings can be formed not only from seeds but also from these parts. Hence, these parts are also planting materials.

### Vegetative Propagation and Sexual Reproduction

The process of production of new saplings from the vegetative parts of plants like root, stem, leaf and underground stem is called vegetative propagation. This is a kind of asexual reproduction. Seeds are formed through sexual reproduction. Seedlings are germinated from seeds too.

Find out examples for plants which reproduce through vegetative propagation and sexual reproduction. Write them in the Science Diary.

	Sexual reproduction			
Root	Stem	Leaf	Underground stem	Seed
Bread fruit	Moringa	Bryophyllum	Dioscorea	Moringa

In Moringa, young plants are produced from seeds and by planting stem cuttings. Can you find more examples of plants which can reproduce both through sexual reproduction and vegetative propagation?

- Sheemakonna (Gliricidia)
- •
- •
- •

Selection of proper planting material is as important as selection of good quality seeds for cultivation. Care should be taken to choose planting materials from plants that have superior quality.

Listen to the conversation of these children.



What can be done to produce saplings that have all the qualities of this guava plant and can bear fruits in a short span?

You have already learnt that fruits and seeds are formed through pollination. Do the plants thus formed possess only the qualities of the mother plant? What if a new plant is formed from stem cutting? Won't it have the same qualities as the mother plant?

Stem cuttings of shoe flower, tapioca, sweet potato etc. sprout easily. But it is difficult for guava to sprout from a stem cutting. What if we can grow roots from stem? If it can be done, won't the guava plant grow and bear fruits much earlier? Let's do it.

# Layering

In plants such as guava, sapota, java apple (jampa), almond and fig rooting can be induced in the stem of mother plant. This stem with roots can be cut and planted. Let's get familiar with the stages of layering in a guava plant.

### Stage 1

Select a pencil-sized stem of the mother plant. It is better to select it from the main stem. Make a cut of 2-3 cm length in a circular shape on the bark in between two nodes of this stem.



Stage 2

Apply a slightly wet mixture of cocopeat, soil and cow dung powder to this area. Wrap this area with a polythene bag. Water the area if required.



### Stage 3

Roots will sprout in the area of layering within two months. Cut the stem just below the area of layering and this can be planted in a flower pot or grow bag. When it starts growing, it can be replanted in the soil.



### Layering

Layering is the practice of producing plantlets by cutting and planting the stem of a mother plant after generating roots from it.

# Serpentine Layering

In plants like pepper, layering can be done by bending the long branches into the soil and covering the branches with soil at intervals (nodes).

In this way, multiple saplings can be produced simultaneously from a single branch.

Plants with different layering methods			
Air layering	Serpentine layering		
Guava, Cashew tree, Sapota, Rose, Java apple, Fig, Almond	Bougainvillea, Jasmine, Betel, Pepper, Grapes, Chrysanthemum		

Class - VII

Consider some peculiarities of plants produced by layering.

- Possess the qualities of mother plant
- Small size and short lifespan
- Early flowering and fruiting
- Absence of taproot system
- Require more care

List out the advantages and disadvantages of plants produced through layering. Record it in the Science Diary.

# Grafting

Look at the picture. You need a sapling of this mango tree. Is it possible to make it through layering? It is difficult to induce roots in the stem of a mango tree. What about planting seeds? It takes years for the tree to yield mangoes. It need not have all the qualities of this mango tree. Then how is it possible to produce a sapling with all the qualities of this mango tree? Let's check.

The characteristics of two varieties of mango trees are given in the table. Analyse the table.



# Rooting by dipping!!

Dipping the tip of stem cuttings in solution containing plant hormones like auxin speeds up root formation. This practice is widely used now a days to enhance the success rate of vegetative propagation using stem cuttings.





Indigenous mango tree

- Relatively small mango
- Sour or sweet mango
- Grows well in our soil
- Doesn't need special care



Neelam mango tree

- Big sized mango
- Very sweet mango
- Doesn't grow well in our soil
- Needs special care

Which variety is better in terms of quality of fruits?

Does indigenous variety have any advantages over Neelam variety?

If a sapling is produced by joining the stem of Neelam mango with the young plant of indigenous variety, what specialities will it have?

- Grows well in our soil
- Yields mangoes of Neelam variety

Let's see how such a sapling is produced.

# Grafting

Choose a mango plant of Moovandan variety of six months to one-year. This plant with roots is called root stock.

Cut a stem that has the same size as the root stock from a high yielding tree of Neelam variety. This is called scion. A stem which has newly formed buds should be selected as scion.

Cut the root stock at 15cm from the bottom to join the scion. Make a 4cm deep cut along the centre of this root stock using a knife.

Make tapered cuts on both sides at the bottom of the scion



as shown in the figure.

Insert the scion into the gap made in the root stock and bind it with a polythene tape. Once the scion gets joined with the stock and begins to grow, the sapling can be replanted at a more convenient place.



Root stock







### Grafting

Grafting is a method of production of saplings by joining the stem of a superior quality plant with another plant that has roots and belongs to the same species. Plant that has roots selected for grafting is called root stock and the stem which is joined to it is called scion. What are the advantages of producing saplings through grafting? Discuss and write them in the Science Diary.

- Early flowering and fruiting
- •

What is the reason for early flowering and fruiting of mango saplings produced through grafting?

Will it take a longer period for fruiting if the stem selected as scion is not mature enough?



Observe the picture given below.



Haven't you seen the bud growing beneath the grafted area? Will the quality of the plant be affected if this bud is not removed? Write in the Science Diary.

We have discussed the method of grafting the stem of Neelam mango tree with Moovandan mango tree. Is there any advantage in making a new mango variety by grafting the scion of a mature Moovandan mango tree with the root stock of another Moovandan mango tree?

Isn't the stem used as scion here of the same age as the mother plant? Will it help in early fruiting?

A sapling is to be produced in the same way using Malgoa and Gomav which is an indigenous variety of mango tree. Which should be the root stock? Which would be the scion? Write the reason for this in the Science Diary.

# Budding

How about choosing a bud instead of the stem?

Haven't you seen the rubber saplings for sale in nurseries?

Look at the advertisement of saplings produced through budding.

What are the advantages of these over the rubber saplings of native origin?

How are saplings produced through budding?

Quality saplings at reasonable price



Higher productivity Thicker latex



Here the bud of superior quality rubber plant is selected as scion instead of stem. This is joined with the stock.

### Budding

Budding is the method of producing superior quality planting material by joining the bud of a superior quality plant with another plant that has roots and belongs to the same species.

Let's produce a sapling of a jack fruit tree in this way.

Different steps of budding are given below.

Stage 1

Chisel off a bud along with the bark from the branch of a superior quality jack fruit tree. This is the scion.

### Stage 2

Peel off bark from the area where the bud is to be inserted in the native jack fruit tree sapling (root stock) which is grown in a pot/growbag.

### Stage 3

Attach the scion with a polythene tape to the area of the root stock from where the bark was removed, keeping the bud exposed.

### Stage 4

When the bud starts to grow well, remove the upper portion of the stock. The sapling can be replanted in soil when the bud is grown.

Have you understood the stages of budding? Grow a native rose plant in your Biodiversity Park in a similar way after budding it with different types of rose plants.

We are now familiar with different methods for producing superior quality saplings. How can we produce better seeds?

# Hybridization

Observe the pictures of chilli plants given below.



What are the characteristics of each plant?

Write them in the Science Diary.

If we can produce a chilli plant which has the qualities of both the varieties, what qualities will it have? Note them in the Science Diary.

How can we produce such a sapling? Are the methods that we have learnt so far suitable for this?

What if we can produce seeds that have qualities of both the plants?

Seeds are formed through pollination. You are familiar with different types of pollination. Observe the illustration of pollination in a pumpkin plant.



Is it in self pollination or cross pollination that the qualities of both the plants are combined? Why?

What kind of pollination should be carried out to produce a chilli plant that will have the qualities of both the chilli plants?

If pollination takes place through insects, can we be sure that it happened between the chilli plants we have selected?

If not, can cross pollination be done artificially?

# **Artificial Pollination**

Examine the stages of artificial pollination shown below.



When should these activities be performed? Put a tick ( $\checkmark$ ) mark. Discuss the reason.

Immediately after blooming After the flower has fully bloomed

When the flower begins to wither

### Hybridization

Hybridization is the method of production of seeds by artificially pollinating two plants which have different qualities and belong to the same species. From the seeds thus produced, those with superior quality are collected. These are the hybrid seeds.

Plant Hybrid seeds Chilli Ujjwala, Jwalamukhi Pea Jyothika, Bhagyalakshmi Paddy Pavithra, Annapoorna Coconut Chandralaksha, Chandrasankara Chandralaksha Bhagyalakshm Lady's Salkeerthi, Kiran finger

Let's get familiar with certain hybrid seeds.

It is in agricultural research centres that superior quality seeds are produced through hybridization.

The seeds thus produced are distributed to farmers.

# **Agricultural Research Centres**

#### Kerala Agricultural University (KAU), Mannuthi, Thrissur

Kerala Agricultural University is an important agricultural research centre in Kerala.

The main activities

are conducting researches on varieties of crops, animals, birds etc. and knowledge dissemination programmes. Regional research centres of Kerala Agricultural University are functioning in different parts of the state.

Central Tuber Crops Research Institute (CTCRI), Sreekaryam, Thiruvananthapuram

Cultivation and researches on tuber crops are conducted here.

#### Rubber Research Institute of India (RRII), Kottayam

Develops high yielding varieties of rubber plants suited for different geographical areas.

#### Central Plantation Crops Research Institute (CPCRI), Kasaragod

Conducts researches on coconut, arecanut and cocoa.





Is there any agricultural research centre in your locality? Organize a study tour to an agricultural research centre or a plant nursery.

Discuss the collected data in the classroom.

# Seed and Yield

Listen to the conversation of children



Both of them planted the same variety of lady's finger. Even then the yield from the plant of one child is low. What may be the reason?

Can good quality seeds alone give a better yield? What other things are to be considered for a better yield? Write them in the Science Diary.

- Fertile soil
- Pest control
- •
- •

#### Class - VII

# **Fertile soil**

Proper application of fertilizers is required for better yield. Which are the fertilizers commonly used by the farmers of your locality? List them after conducting an interview with farmers of your locality.

- Cow dung
- Urea

Classify the fertilizers into organic and chemical by examining your list and the pictures given below.



Compost





Urea

Bonemeal

# Father of Green Revolution

Dr. M.S. Swaminathan is an agricultural scientist, known as Father of Green Revolution in India. He had developed high yielding seeds and popularized them among farmers and thereby achieved a leap in the area of food production. The efforts made by him helped to overcome poverty in most of the South East Asian countries. He was awarded with Magsaysay, World Food Prize and Padmabhushan.



Dr. M.S. Swaminathan (1925-2023





Chicken manure

Organic	Chemical
Fertilizer	Fertilizer
Cow dung	Urea

Basic Science

The characteristics of organic fertilisers and chemical fertilizers are given in the table below. Analyze the table and record your observations in the Science Diary.

Organic fertilizers	Chemical fertilizers
Obtained from organic matter	Produced from chemicals industrially
Required in higher quantity	Required in lesser quantity
Not harmful to soil	Excess use destroys soil structure
Cannot be supplied as a single component	Components can be supplied as per requirement

Organic and chemical fertilizers have their own merits and demerits. Farmers of our state follow a mixed method of applying more of organic fertilizers and lesser quantity of chemical fertilizers. Farmers also use microbial fertilizers for better yield.

# **Pest Control**

Pest infestation in plants is a major issue faced by farmers. How can pest infestation be controlled?

Listen to the conversation given below.



### **Microbial Fertilizer**

In this method of application of fertilizer, microbes are used as fertilizers. *Pseudomonas* and *Azospirillum* are examples of microbial fertilizers.



Haven't you listen what each of them said? Write down the different methods of pest control in plants.

# **Pest Control Measures**

### **Biological Control**

Lady bug is an insect which eats the pests that grow on plants. *Trichogramma* is another friendly insect of this kind. Similarly Frog, Mabuya, Calotes, Bug etc. feed on pests which infest crops. This kind of pest control is called biological control. When pesticides are applied, these friendly agents also get destroyed along with the pests.



### **Mechanical Control**

Have you noticed the gold coloured fly which destroys the fruits of certain vegetable plants? Let's learn a trick to control these flies.

Crush a handful of basil leaves and put it in a steel plate. Observe the plate after a while. Can you see the gold coloured flies approaching the plate, attracted by the smell of basil leaves? Vegetable plants can be

protected by destroying these flies. This method of controlling pests by removing them manually or using traps is called mechanical control. Pheromone trap is an example for this. It is available in the market.

### Pesticides

Pesticides are of two types: chemical pesticides and organic pesticides.

Chemical pesticides

These are pesticides prepared using chemical substances.

### **Organic pesticides**

Organic pesticides are comparatively less harmful than chemical pesticides. Tobacco decoction, neem oil emulsion, garlic- kanthari (Chilli) mixture etc. are some organic pesticides. Many organic pesticides are available in the market nowadays. Let's prepare an organic pesticide.

### **Tobacco Decoction**

Chop 100 gram of tobacco and soak it in one and half litres of water for a day. Squeeze it and filter it. Dissolve 10 gram of washing soap in it. Tobacco decoction is ready now. Dilute it by adding twice the quantity of water and spray on plants. Shouldn't weeds also be controlled for getting a good yield?How can weeds be controlled? Write in the Science Diary.

- Application of weedicides.
- •
- •



### Artificial Intelligence and Agriculture

Technology based on Artificial Intelligence is being used nowadays to detect pests and to destroy them using lasers. The advantage is that it is not harmful to the environment.

Suitable climate also influences agriculture. Therefore, we need to cultivate crops that are suitable to the climate.

So far we have discussed various factors which help in getting better yield. Hope you will consider them while farming.



Which are the methods you have learnt so far to produce saplings? Hope you will try to develop the Biodiversity Park in your school by producing high quality saplings through these methods. Record the activities you have done for this in the Science Diary.

Class - VII

My Green Diary				
Name			ISS	
Conlings I have	Mathadaf	Stages of growth		
produced	Method of	July-	September-	November-
produced	production		October	December

# **Other Agricultural Sectors**

Does agriculture mean growing plants alone? Analyse the illustration given below. Find out various agricultural sectors and write them in the Science Diary. Collect maximum information related to this and conduct a quiz in your class.



Hope you have understood different agricultural practices, preparation of high quality seeds and planting material, aspects to be considered in farm management and other agricultural sectors. Let's love farming and farmers and move ahead with modern agricultural practices.

# Let's Assess

- 1. Identify the statement which does not suit organic fertilizers.
  - a. Can be prepared at home b. Required in large quantities
  - c. Destroy soil structure d. Can't apply the required component alone
- 2. Match the following
  - a. Apiculture Rearing of fish
  - b. Cuniculture Rearing of silkworm
  - c. Sericulture Rearing of honey bees
  - d. Pisciculture Rearing of rabbits
- 3. You have learned about layering.
  - a. Identify the type of layering shown in the figure.
  - b. While layering in this way, at which position should we cut the plant, A, B or C?
- 4. Look at the picture.
  - a. Identify stock and scion from A and B.
  - b. What is the advantage of attaching the stem of Malgoa to the local variety of mango tree?
  - c. Is there any merit in attaching the stem of a local variety of mango tree to the same variety?
- 5. List different methods of pest control. Give examples for each type.

# **Extended Activities**

- Prepare an agricultural edition on the topic 'Agriculture : Yesterday and Today ' by including proverbs and pictures related to agriculture and information collected from farmers.
- Observe the picture. In some places plastics is used for mulching in farms. Record its benefits in your Science Diary.











#### 03.07.24 Wednesday

Our Science teacher usually comes to the class with some science experiments that kindle the curiosity of the children. Today the teacher had brought two transparent glass tumblers. One of them contained a pink liquid. The second tumbler was empty. The teacher placed both the tumblers on the table. She asked me to pour the pink liquid from the first tumbler into the empty glass tumbler. I did the same. And then, something amazing happened!! The pink liquid that was poured into the second tumbler turned yellow! We were thrilled by this magic. Haven't you read Jinu's diary entry? What could be the secret behind the experiment conducted by the teacher in Jinu's class?

We need some materials for finding it. Let's get them from the Science Kit.

### Science Kit

You can collect many materials that are required to conduct science experiments from your home and surroundings. Science Kit is a collection of such materials. Materials to be kept in the Science Kit to conduct the experiments in this unit are transparent glass tumblers, pink coloured water obtained by water boiled with pathimugam, vinegar, tamarind water, lemon juice, salt, ash, lime, baking soda and buttermilk. You can expand your kit by adding more materials required to conduct experiments in each unit.



Take out the glass tumblers from your Science Kit and arrange them on the desk. Add two or three drops of vinegar, tamarind water, lemon juice, salt solution, ash suspension and baking soda solution into separate tumblers. Pour half a glass of pathimugam water into each tumbler. Does the water in any of the tumblers turn yellow? What is your observation? Record it in your Science Diary.

Now you know what the pink liquid mentioned in Jinu's diary is.

In the experiment mentioned in Jinu's diary, the teacher must have added something to the second tumbler. Which among the following did the teacher add to turn the pink liquid into yellow? Put a tick ( $\checkmark$ ) mark on the appropriate boxes, based on the experiment you have done.

•	Ash suspension	
•	Lemon juice	
•	Salt solution	
•	Vinegar	
•	Tamarind water	
•	Baking soda solution	

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Do the substances that turned pathimugam water into yellow have anything common in their taste?

They all have a sour taste. The sour taste is due to the presence of some acids in them. Let's do some more experiments to know the properties of acids. Place everyone's glass tumblers on the desk. Fill half portion of each glass with a different liquid from the list given below.

- Soap water
- Lemon juice
- Clear baking soda solution
- Clear lime water
- Vinegar
- Buttermilk
- Tamarind water
- Clear ash suspension



Litmus is a dye made from the extract of lichens which grow on trees, rocks etc. It helps to identify the nature of substances by changing their colour. The extract of lichens is applied on paper to make litmus paper and dissolved in water to make a litmus solution. Litmus papers and litmus solutions of blue and red colours are available in school laboratories.



Take blue and red litmus papers from the school laboratory. Dip blue and red litmus papers in these liquids. Tabulate your observations in the Science Diary.

Timuid	Colour Changes Observed		
Liquid	Blue litmus	Red litmus	
Vinegar			
Lemon juice			
Clear Lime water			



Which liquids turned blue litmus into red?

- Lemon juice
- •
- •

Which liquids turned red litmus into blue?

C		
-	_	
	1	
		<b>7</b>
<		

•	Lime water

\_

#### Acids and Bases

Acids are substances that turn blue litmus into red. Substances that turn red litmus into blue are bases.

Classify the liquids you have experimented into acids and bases. Record it in the Science Diary.

# **Alternative for Litmus**

Rub a red Hibiscus flower thoroughly on both sides of a white paper. What is the colour of the paper now? This paper can be dried and cut into strips. It can be used instead of blue litmus paper. Dip this paper in acidic liquids. Didn't the colour of the paper change? This paper that turned red can be used instead of red litmus paper. This paper can be tested on the liquids in the Science Kit. Record your observations in the Science Diary.



### Indicators

Indicators are substances that help to identify acids and bases by changing their colour. Litmus paper is an indicator.

# **Laboratory Indicators**

In addition to the blue and red litmus papers that you are now familiar with, two other indicators that are commonly used in laboratories are Phenolphthalein and Methyl Orange.

Observe the change in colour when two or three drops of Phenolphthalein are added to various acids and bases. Similarly, add two or three drops of Methyl Orange in acids and bases and observe the change. Tabulate the colour change.

Liquid Tested	Phenolphthalein	Methyl Orange
Vinegar		
Clear Lime water		
Lemon juice		
Soap water		
Clear baking soda solution		

- Which substances can be used as indicators of acids?
- Which substances can be used as indicators of bases?

You have now realised that acids turn blue litmus into red and bases turn red litmus into blue. Do they have any other common properties?

How do vinegar, lemon juice, buttermilk and tamarind taste?





Basic Science





Universal indicator is used to identify both acid and base. It is a mixture of many indicators. When a few drops are added to acids or bases, it gives different colours according to their nature and concentration. It can be determined by comparing with the colour chart on the bottle. Have you ever happened to taste soap while taking bath? How does it taste? Soap and baking soda taste the same. They have an alkaline taste. Soap is basic in nature.

All acids have sour taste.

All bases have alkaline taste.

Dip your fingers in each liquids in the Science Kit and rub the fingers as shown in the picture. Which liquids feel slippery? List them.

- Soap water
- Baking soda solution
- •
- •

Which common property of bases did you identify here?

You have now



identified the common properties of acids and bases. Tabulate them.

Acids	Bases		
•	•		
• Turn blue litmus red	• Slippery		

# Substances that turn Blue Litmus Red

You have tested and found out some substances that turn blue litmus red.

Which among the following substances can turn blue litmus red? List them.

- Orange juice
- Rice soup
- Black tea
- Bilimbi (Irumban puli) juice
- Grape juice
- Tomato juice
- Coconut water



# **Behind the Name**

'Acidus' is the Latin word for sour taste. The term acid is derived from this.



Bilimbi

In my opinion, liquids that can turn blue litmus red	Reason

Experiment and check whether your assumptions are right.

# Acids in Food Items



All food items with sour taste have acids in them. Most fruits contain more than one acid.

Let's get familiar with some acids that are found in food items.

For Further Reading     Acid in Gooseberry!     Output     Output     Weight     Weight     State     Output     State     Output     State     Output     Output     State     Output     State     Output     State     Output     State     Output     Output <t< th=""><th>Food item</th><th>Main acid present</th></t<>	Food item	Main acid present						
	Buttermilk, Curd	Lactic acid						
	Vinegar	Acetic acid						
	Lemon	Citric acid						
	Tamarind	Tartaric acid						
	Apple	Malic acid						
	Gooseberry	Ascorbic acid						
	Tomato	Oxalic acid						

# When Milk Curdles

**Basic Science** 

Curd is a food product made from milk. What is the reason for the sour taste of curd?



Lactobacillus bacteria

You know that sour taste indicates the presence of acid.

How does milk turn acidic when it becomes curd? Don't we add a little curd to the milk which is boiled and cooled in order to turn it into curd? Curd contains a bacteria called Lactobacillus. The lactic acid that is produced when these bacteria nourish themselves with milk, gives curd its sour taste.

# Acids and Bases in Laboratories

Acids in food items are weak. But many acids and bases commonly used in laboratories are strong. Let's get familiar with some acids and bases used in laboratories.

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	Acids		Bases
•	Hydrochloric acid	•	Calcium hydroxide (Lime)
•	Nitric acid	•	Sodium hydroxide (Caustic soda)
•	Sulphuric acid	•	Potassium hydroxide ( Caustic potash)
•	Acetic acid		

### Acid Spill Causes Eye Injury

Anakkayam: A rubber tapping worker suffered severe eye injury due to acid spill. The accident occurred when he was trying to open a tin containing formic acid used for thickening latex.

Have you read the above news? Many chemical substances are dangerous. Yet we have to use them for various industrial and experimental purposes. What precautions should we take to avoid accidents while handling chemicals?

- Avoid spilling on body parts
- Don't touch with hands
- Don't smell
- Don't taste
- Use a dropper while taking out acid from a bottle
- Use a holder while using a test tube

# If Acid Spills

Strong acids can absorb water and liberate heat. They can cause burns if they get spilled on the body. Pouring cold water on the affected area for a long time is the first aid for this. If the burn is severe, the person should be taken to hospital.



So far, you have done experiments using acids and bases found in household items. Now let's do experiments by diluting some acids and bases in the laboratory.

- Which acids and bases can be taken?
- Which indicators are to be taken?

Take acids and bases in separate test tubes. Observe and tabulate the colour changes that occur when various indicators are added to them.

	Colour change on adding indicators				
Indicators	Hydrochloric acid	Sulphuric acid	Sodium hydroxide	Potassium hydroxide	
Methyl Orange					
Phenolphthalein					
Blue litmus paper					
Red litmus paper					



# Acid in the Body?

Hydrochloric acid is produced in the stomach to facilitate digestion of food. Some persons may have enhanced production of this acid in their body, resulting in a condition called acidity. Abdominal pain, heartburn, nausea and constipation are the symptoms of acidity. As a remedy for this condition, doctors prescribe medicines called antacids that can neutralize acids.

### **Acids and Metals**

So far you have identified two properties of acids. One more property can also be identified through experiments.

In the previous class, you have carried out the experiment of burning magnesium ribbon in air. Magnesium is also a metal like iron and copper.
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Fill a quarter of a test tube with vinegar (dilute acetic acid). Put three or four small strips of magnesium ribbon into it. Note down your observation. Close the mouth of the test tube with your thumb for a while. What do you feel?



Which is the gas that bubbles up and pushes at your thumb?

Let's do another experiment to identify this gas.

Tilt the test tube slightly. Remove your thumb after bringing a burning matchstick to the mouth of the test tube. What do you observe? Record it in your Science Diary.

Here a gas was produced when the acid reacted with metal. Identify it.

The gas which burned up with a pop sound in the presence of fire is hydrogen.

Will we get the same result if the experiment is repeated with other metals and acids? Let's find out. Repeat the experiment with dilute hydrochloric acid and zinc.

Haven't you got the same observations as in the previous experiments?

When acids react with metals, hydrogen is produced. Hydrogen is a flammable gas.

### General properties of Acids

How many general properties of acids have you identified from the experiments done so far?

Record in the Science Diary.



A British scientist named Henry Cavendish discovered hydrogen. Hydrogen is the lightest gas. Hence hydrogen



filled balloons can rise high. Hydrogen is used as fuel in rockets. Nowadays there are motor vehicles using hydrogen as fuel. In September 2023, a hydrogen bus was introduced experimentally in New Delhi. The meaning of the word Hydrogen is "Producing water". Hydrogen reacts with Oxygen to form water. Water can be dissociated into hydrogen and oxygen. Hence hydrogen is a promising energy source of the future. Г

- Has sour taste
- •
- •

You have understood that acids react with metals. Based on this, can you explain the reason for the following situations ?

- Metal containers are not used to store pickles.
- Earthen vessels are commonly used to cook dishes with curd and buttermilk.

## **Uses of Acids**

You know that vinegar is acidic in nature.

What are the uses of vinegar at home?

- In pickles

- •

You already know the use of formic acid. Some acids and their uses are listed in the table below. Complete the list.

Acid	Uses
Acetic acid	•
Formic acid	•
Citric acid	To make drinks
Sulphuric acid	In motor vehicle batteries and for manufacturing chemical fertilisers
Nitric acid	To make chemical fertilizers, paints and dyes
Tannic acid	To make leather and ink
Carbonic acid	•



## **Uses of Bases**

Base	Uses
Calcium hydroxide	Glass manufacturing, to reduce the acidity of soil
Sodium hydroxide	To make soap, paper and rayon
Potassium hydroxide	To make soft soap
Aluminium hydroxide, Magnesium hydroxide	In medicines

Analyse the table and find out the following.

- Which is the base used to make soap?
- Which are the bases used in medicines?

Soap making is one of the uses of bases. Shall we make soap?

# Let's Make Soap

Materials required (To make 20 soaps) :

Caustic soda 180 gram, coconut oil 1 Kilogram, water 350 millilitre, Sodium silicate 100 gram, stone powder 100 gram, colour and perfume.

# Method of preparation

Take water in a steel bowl and dissolve caustic soda in it. A large amount of heat is liberated when caustic soda dissolves in water. After the solution cools down, slowly pour it in a flat vessel containing coconut oil. Stir it well while

pouring. Then add sodium silicate and stone powder one by one to increase the hardness and quantity of the soap. Colour and perfume can be added to the soap to make it more attractive and fragrant. Stir the mixture continuously till it gets thickened. Pour the thick mixture into the mould. After solidification, remove the soap from the mould. It can be used after two weeks.

Prepare soap as part of Science Club activities in your school. Take care not to touch the caustic soda and soap mixture with your hands.



You can also make soap at home under the supervision of your parents. You may use pieces of PVC pipes instead of mould.

## **Turmeric: A Natural Indicator**

We have identified acids by using paper rubbed with hibiscus flowers which is a natural indicator. Similarly shall we find an indicator for identifying bases? Add either soap solution or baking powder solution to the following substances.

- Paper rubbed with turmeric
- Turmeric water

Observe the colour change.

Have you understood that turmeric is an indicator of bases? Is it possible to make use of coloured parts of plants to identify acids and bases? Let's do an experimental project.

Which are the coloured parts of plants that you know? List them.



- Red spinach
- Blue coloured clitoria (Sanghupushpam)
- Red cabbage
- Beetroot
- •
- •

Prepare either paper strips rubbed with each of the above vegetables, their juices or the coloured liquids obtained by boiling them in water. Test them with the acids available at home. Repeat the experiment with the bases also available at home. Write down the observations.

Part of plant	Natural colour	Colour in acid	Colour in base

Analyse the results of your observations based on these experiments. Record your inferences in the Science Diary.

Prepare a brief report of the project you have done and present it in your class.

## Let's Assess

- 1. Which among the following can be used as an indicator of acid?
  - a. Turmeric
  - b. Pathimugam
  - c. Red litmus paper
  - d. Phenolphthalein
- 2. Which acid is used in automobile batteries?
  - a. Hydrochloric acid
  - b. Nitric acid
  - c. Sulphuric acid
  - d. Formic acid
- 3. Among the liquids in the three beakers placed on the table, the first one is water, the second is an acid and the third is a base. Is it right to identify them by touching , tasting or smelling? Why? Suggest a method to identify each of them.
- 4. In the laboratory metalic caps are not used for glass bottles containing acids. Explain the reason for this.
- 5. Examine the statements given below. Classify them on the basis of properties of acids and bases.
  - a. Has sour taste
  - b. Turns to pink when phenolphthalein is added
  - c. Slippery
  - d. Turns to pink when methyl orange is added
  - e. Turns the colour of Pathimugam water into yellow
  - f. Red litmus turns blue
  - g. Reacts with metals to produce hydrogen
  - h. Has alkaline taste
- 6. You have learnt about various indicators to identify acids and bases. Complete the table below.



Indicators of acids		Indicators of bases	
Natural	Used in lab	Natural	Used in lab
<ul> <li>Paper rubbed with Hibiscus flower</li> <li></li></ul>	<ul> <li>Methyl Orange</li> </ul>	• Turmeric •	<ul> <li>Phenolphthalein</li> <li></li> </ul>

# **Extended Activities**

- 1. You have identified the colour changes produced in acids and bases when various natural indicators and indicators used in the laboratory are added to them. Use this information to design science magic and present them in your class as well as in the Science Club. After the presentation, explain the scientific principle behind the magic.
- 2. You have understood that hydrogen is released when acids react with metals. Using this principle, fill a balloon with hydrogen with the help of your teacher and let it fly.



There is an

emergency lamp in my

home.

Above is a scene from home. Haven't we experienced similar situations at our home as well?

What do we usually do to get light when there is a power failure?

- Candles are used
- •
- •

Haven't you realized that people take different measures when there is power failure? Using an emergency lamp is one among them.

Do you have an emergency lamp at your home? Shall we make one?



How to construct?

**Basic Science** 

What are the things needed to make an emergency lamp? Write them in the Science Diary based on the following indicators.

- How will we get the electricity to make the emergency lamp work?
- Don't we need a bulb to get light?
- How will we connect each part?
- How will we make a stand?

You may have such questions. Discuss your idea in the group and present it.

# Availability of Electricity

You know that electricity is a form of energy. It is a form of energy that can be easily converted into many other forms.

Let's check some facts related to electrical energy.

Where do we get electricity from? Pictures of some devices are given below. Observe them.

Where does each of these devices get its electricity from? Write it down in the Science Diary.







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Observe the pictures of some devices that supply electricity.



We use them on different occasions in our daily life. Let's learn more about them.

#### **Sources of Electricity**

You know that electric cells, generators, solar cells etc. are the devices that provide electricity. Devices that provide electricity are termed as sources of electricity.

You have learned that electric cells are devices that can convert chemical energy into electrical energy. Electrical energy is stored as chemical energy in them. This chemical energy is converted into electrical energy when we use them.

## **Cell and Battery**

Have you heard of cell and battery? What is the difference between cells and batteries?

Look at the pictures below.



What is the difference between them?

A battery is an arrangement made by connecting more than one cell into a single unit. Observe the pictures (A, B, C) in which the cells are connected in three different ways. Do all of them represent the right way for making a battery? Which among them is wrong? Which one will give more electricity?



Observe the pictures given below.



From which source do these two devices get electricity?

What is the difference between the sources of electricity used in these devices?

# Cells - Rechargeable and Non-rechargeable

What would you do if the cell in a clock is not working? What if your mobile phone runs out of charge? A cell in a clock cannot be used again when its charge is completely used up. But the battery in mobile phones can be recharged and used again.

You may be using rechargeable and non-rechargeable cells in different devices at home. Classify them and write in your Science Diary.

#### For Further Reading

# **A** Brief History of Electricity

Electricity, light, heat, sound etc., are different forms of energy. Electricity is a form of energy widely used for various purposes. The ancient Greeks understood that amber (a kind of thickened resin) could attract substances like hair when it was rubbed against wool. Subsequently numerous experiments conducted by a number of people over the years led to the production and use of electricity as seen today.







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## Lighting a bulb with a battery

Usually we depend on electric bulbs for getting light. Different types of bulbs are in use. Observe this picture. What kind of bulbs are used in emergency lamps?

What are the advantages of using LED?



L E D (Light Emitting Diode) helps to save energy considerably.

CFL requires less energy compared to filament lamps. CFL was widely used till recently. But nowadays CFL is not commonly used. LED bulbs require less energy than CFL. New generation LED bulbs have also been invented recently. Inquire about them.



LED module is an arrangement of more than one LED bulb in a strip.

Don't you have connecting wires, LED module, 9 V battery and a connector in your Science Kit? Try to light up the LED module using them. Do this experiment in groups and present in the class. Could all the groups light up the bulb? Draw the mode of connection in your Science Diary.



Haven't you lighted the LED bulb. Write down the electric source and electric device used for this other than the connecting wire.

### **Electric Circuit**

Electric circuit is an arrangement that passes electricity from an electric source to a device. A circuit requires at least an electric source, connecting wire and an electric device.

Basic Science

Observe the following pictures. Parts of certain circuits are represented in the pictures given below.



Will the bulbs in these circuits glow? Why? Analyse the pictures and record in the Science Diary.

#### **Closed Circuit and Open Circuit**

A circuit is a closed one, if it is complete. If the circuit is not complete, it is an open circuit. Electric devices can work only in a closed circuit.

Are the following circuits closed or open? Why? Analyse the figures and write down in the Science Diary.



We use bulbs and fans while we are in a room. Then are the circuits of the bulb and fan closed or open? Don't you switch off the bulb and fan when you leave the room? How can we make circuits open and closed as required? Observe the picture. What arrangement do you see in the picture to turn the bulb on and off whenever required?

#### Switch

Switch is a device used to make a circuit closed or open when required. A circuit becomes closed when switch is turned on. It becomes open when switch is turned off.



Can you include a switch also in the circuit you have made? Do it in groups and present it in the class.



## **Flow of Electricity**

In the circuit you have made, electricity from the battery reaches the bulb only when you switch it on. How does electricity reach the bulb from the battery? Do all substances allow electricity to pass through?

You might have noticed substances which conduct electricity and do not conduct electricity. Design an experiment to distinguish them and present it in the class.

Take the 9 V battery, connecting wire and the LED module from your Science Kit. Arrange them as shown in the figure.

Will the LED module glow in this circuit? Why? Connect the ends marked A and B using different materials.

Materials: Safety pin, a piece of wood, paper, steel scale, charcoal, pencil graphite, plastic bangle, metal bangle, wet paper, copper wire.



Tabulate your observations.

Material used	Observation	Inference
Paper	The LED module did not glow	does not conduct electricity

Which of the materials you used made the LED glow? What could be the reason? Isn't it due to the passage of electricity through those materials?

Which materials conduct electricity?

Which materials do not conduct electricity?

Write your observation in the Science Diary.

Place your fingers over the ends of A and B in the device made for the experiment. Does the LED glow? Repeat the experiment with wet fingers. What change did you notice? Give reason.

Do not operate a switch with a wet hand. Find out the reason behind it and write it down in the Science Diary.

#### **Conductors and Insulators**

Conductors are the substances that allow electricity to pass through them. Insulators are the substances that do not allow electricity to pass through. Iron, gold, copper, steel, graphite and water are electric conductors. Dry wooden block, paper, plastic, cloth etc., are insulators.

When we turn on a switch do we touch the parts through which electricity passes? The parts we touch in electrical appliances are made of insulators. What about the parts that conduct electricity? There are many situations where conductors and insulators are used. Tabulate such situations you are familiar with.

Situations in which	Situations in which	
conductors are used	insulators are used	
The copper wire through	Plastic coating over	
which electricity passes	copper wire	
through		
		Insulation Tape
		insulation rape

Let's repeat the experiment that you have done to distinguish conductors and insulators. Connect the ends A and B using each of the following substances.



Materials: iron nail, copper wire, silver ornament, gold ornament, aluminium wire, a piece of zinc, lead wire, magnesium ribbon, a piece of tin sheet.

Do all substances conduct electricity?

Do these substances have any common characteristics?

You have understood that all metals are conductors of electricity.

For Further Reading

#### **Metals**

Metals are lustrous, hard and strong substances. Many metals like iron, copper, silver, gold, aluminium, zinc, lead, mercury, nickel, etc., have been discovered. Usually metals are in solid state under normal atmospheric temperature. But mercury exists in liquid state. All metals are conductors of electricity. The discovery and use of metals have brought remarkable changes in human life. You might have understood the changes that occurred in agriculture tools and social life from the Paleolithic to the Bronze Age.



In the circuit you have made, the electricity from the battery reaches the bulb through the metal wire coated with plastic.

We use different types of metallic wires in our home. Remove the insulation and examine the metallic wires inside.

Which metal do we normally use to transmit electricity through electric lines?

What is the reason for not using copper wire in electric lines? Inquire.





# Let's get to know more electric circuits

So far we have made electric circuits using LEDs. Can you make more circuits by including other devices? Observe the picture.



Haven't you prepared separate circuits for operating LED module and mini motor? What will happen if you include all of them in the same circuit? Do all the devices in your home start function when a single switch is turned on? If so, how many circuits will be needed in the house? Check how many circuits are there in your classroom. What tools did you use to make the circuits? Haven't you seen electricians use different tools for different purposes such as cutting wire, stripping off insulation and testing electric current. Observe the pictures.



Find out the uses of each of the above tools from an electrician.

# Symbols

How many circuits did each group make? Write down the materials used in each circuit. Certain signs are used to indicate the components in circuits. These are symbols. Some commonly used symbols are given below. Let's get familiar with them.

Material /Object	Figure	Symbol
Conducting wire		
Switch off mode	0	
Switch on mode		
Cell		
Battery	+	
An unlit bulb		$-\otimes$
A glowing bulb		
Buzzer		$\mathbf{Y}$
Mini motor	1.6	-M-
LED		

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Observe the given circuits. Identify the parts marked A, B, C and D.

What are the differences between the two circuits?

Draw the circuits you have already made using the symbols.

## **From Circuit to Device**

We can use 9 V battery and LED module for making an emergency lamp. How will you connect them to make a circuit? Try to draw it.



After arranging the circuit, check whether the LED glows.

Now we need a stand also. The easy way of making a stand is given in the figures (1, 2, 3 and 4). Examine them and find out the materials used.

# **Construction of Stand**

Take a half -litre bottle with a wide mouth as shown in Fig 1. Fill it with sand. Put two holes in the cap as shown in Fig 2. Make holes in the pipe also as shown in Fig 3. Fix the PVC pipe in the hole on the cap. Arrange the circuit as shown in Fig 4.



Pay attention to the following points while making the emergency lamp.

- The circuit should be made in such a way that the wire from LED to the switch and from the switch to the battery are not exposed.
- Battery should be fixed firmly in the sand.
- The emergency lamp should be lifted only by holding the bottle.

More than one LED module can be used for getting light in all directions. Insulation tapes of different colours can be used to make the emergency lamp more attractive. Exhibit the emergency lamp made by each group before the class. Select the best one based on the indicators given below.



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What are the things to be assessed?

- Efficiency
- Attractiveness
- Durability

# **Household Electricity**

We have used a 9 V battery to make an emergency lamp. Will we get an electric shock if we touch the wire connected to the battery?

If, somehow the electricity used at home passes through our body, it can cause electric shock.

What is the reason? The electricity we used at home is of 230 V. It is not safe to use high voltage electricity while conducting experiments.





#### **Electric Shock**

We get an electric shock when electric current passes through our body. Our body is an electric conductor since water is present in the living cells. Electric shock occurs when a broken power line or an external electric source, like an uninsulated circuit comes into contact with the body. Sometimes this causes severe burns. Cardiac arrest is the major reason for death due to electric shock.

Observe the given situations. Find out the situations in which there is a chance for electric shock and put a tick mark ( $\sqrt{}$ ) in the appropriate boxes.

Using devices of good quality		Removing the plug pin without switching off	
Changing bulb when the switch is on		Using wires without proper insulation	$\bigcirc$
Turning on a switch with wet hand	$\bigcirc$	Repairing devices while switches are turned on	$\bigcirc$
Removing the fan from the ceiling after turning the main switch off		Using footwear while ironing clothes	

Haven't you found out the situations in which you are likely to get an electric shock? Has anyone in your house experienced a severe shock? If so, in what context did it happen? Share your experience with the class.

What are the precautions to be taken while handling electrical appliances? Write them down in the Science Diary.

#### For Further Reading

# Lightning and Electricity

Haven't you noticed the lightning during rainy season? Clouds have a very high electrical charge. Lightning is caused by the transfer of charge in clouds to nearby clouds or to the earth. Lightning strikes cause accidents because it is a very powerful electric current.

## In Case of Electric Shocks

What happens if you try to touch or move someone who is experiencing an electric shock? Won't we also get the shock? Hence one should never touch a person who has an electric shock.

What are the things to be done immediately to save a person who has suffered an electric shock?



- The first thing to be done is to disconnect the electric contact. You can switch off or remove the fuse for this. If it is not possible, separate the person from the electric circuit using a dry wooden stick or some other good insulator.
- In the case of heart failure, perform chest compressions. Place one hand on top of the other and apply continuous pressure on the victim's chest. This should be done until the heart starts beating again.
- If breathing stops, give artificial respiration. Keep the body warm by massaging.
- Take the person immediately to a hospital if the shock is severe.

## Generator

Don't we use a generator at school when some fairs or PTA meetings are held? Why is it used?

Which fuel is used to operate a generator?

The generator produce electricity making use of energy from fuels like petrol, kerosene, diesel etc. You have learned in the previous class that in a generator chemical energy first gets converted into mechanical energy and then into electrical energy. Can generators be



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used regularly to get electricity at home and school? Discuss on the basis of cost of diesel, pollution etc. What is the solution?

# Hydroelectric Power Station

You might have seen metallic wires stretched over tall poles. From where do these lines bring electricity? How this electricity is generated?

The power we use at home is generated by huge generators in hydroelectric power stations.

How do generators in a hydroelectric power station work?

Generators in hydroelectric power stations work using the energy obtained when water stored in reservoirs of dams falls from a height. In dams, water which is stored in reservoirs is carried through pipes and made to fall forcefully on to the turbines connected to the generators. The force of falling water rotates the turbines. The generators connected to the turbines start to work and produce electricity. This electricity is transmitted to various places through electric lines.



Turbine

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A major part of electricity produced in Kerala is from the hydroelectric power station in Idukki. Discuss the merits of hydroelectric power stations as compared to diesel generators based on cost of fuel, pollution etc.

# **Other Possibilities for Electric Power Generation**

Observe these pictures.



You have already understood that electricity is produced in our country by using fuels like coal and diesel. We also use the power of wind and tidal waves as well as nuclear energy.

Observe the pictures given below.



Solar cell is a device that converts solar energy into electrical energy. Solar panel is a combination of two or more solar cells. Solar energy is a solution for the future energy crisis. Cost effective technologies for harnessing solar energy

are to be developed. Researches are going on for this purpose.

# **Don't Waste Electricity**

The production of electricity has to be increased when there is higher consumption. Doesn't the generation of more electricity require more fuels? Observe this poster.



What message does this poster convey? Which are the circumstances in which electricity is wasted? Discuss. Do the fans and bulbs left working even when there is nobody in your class room?

We have to adopt certain measures to prevent wastage of electricity and to ensure its judicious use. Prepare a poster highlighting these factors and display it in the class room.

## Let's Assess

- 1. What is the energy change in a battery when it is connected to an emergency lamp?
  - a. Electrical energy changes into light energy
  - b. Light energy changes into chemical energy
  - c. Chemical energy changes first into electrical energy and then into light energy
  - d. Chemical energy changes into electrical energy
- 2. Of the following, which is in an open circuit?
  - a) Rotation of fan
  - b) A damaged bell is switched on
  - c) Working of a mixie
  - d) Glowing of a bulb
- 3. From where do the artificial satellites get electricity for its working?a) Solar panelb) Dieselc) Petrold) Coal
- 4. Sometimes there is power shortage in Kerala during summer season. Why?
- 5. A person is standing in water. An electric line breaks and falls into the water. Is the person likely to get an electric shock? Give reason.
- Observe the diagram of an open circuit. Convert it to a closed circuit using appropriate symbols and draw it.



# **Extended** Activities

- 1. Construct electric circuits using different devices and battery.
- 2. Construct a model of a hydroelectric power station and explain its working.



This is the doubt expressed by a little girl.

You know that the light can enter the room through glass window even if it is closed.

Why did grandma ask the girl to close the curtain when light entered the room through the window?

What are the things that can be used instead of a curtain to prevent sunlight from entering a room through a glass window? List them.

Let's find out through an experiment.

Point a lighted torch at different objects such as scratched glass sheet, glass filled with pure water, wooden block, a piece of cloth, white paper, black chart paper, butter paper, window glass, a coin, a mirror, a piece of reading glass, marble, polythene cover and a colourless plastic bottle.

Objects that transmit light	Objects that do not transmit light
Window glass	Wooden block

What do you observe? Record your observations in the Science Diary.

There are substances that transmit light and substances that do not transmit light.

## **Objects that Transmit Light**

Didn't light pass through the butter paper? What about the glass used in spectacles? Do both of these substances transmit light in the same manner? Record it.

Repeat the experiment using butter paper, window glass, scratched glass piece, oiled paper, glass piece, polythene cover, pure water taken in a glass tumbler and colourless plastic bottle.

On the basis of the experiment, classify them as those which transmit light completely and those which transmit light partially.

You have found that there are three types of objects based on transmission of light.

#### Transparent Object, Translucent Object and Opaque Object

Objects that transmit light very well are called transparent objects. Objects which transmit light partially are called translucent objects. Objects which do not transmit light are opaque objects.

Repeat the experiment using more objects. Classify them as transparent, translucent and opaque objects and record them in the Science Diary.

# **Converting Transparent Object into Opaque Object**

Can you change a transparent glass sheet into a translucent or opaque one? How? Discuss. What methods can you suggest? Record them in the Science Diary.

Make a transparent glass sheet sooted as shown in the figure. What change do you observe?

What happens to the light transmitting property of transparent glass sheet when it becomes sootier? Do an experiment to find it out.



What other methods can be adopted to make the glass sheet translucent or opaque? Write down your suggestions in the Science Diary.

You have found that pure water is transparent. What about air?

Can we convert pure water and air to translucent? Design an experiment for this.

Pay attention to the clues in the following pictures.

You can use ink and incense stick for doing this activity.





What other substances can you use for this? Design an experiment using the materials you have identified.

Record the details and findings of the experiment in your Science Diary.

Haven't you understood that some transparent substances can be converted to opaque substances?

# Transparency and Opacity of Objects in Daily Life

We have understood the difference in transmission of light by different objects.

How does the opacity and transparency of objects benefit us?

How do you know when the ink in a refill pen is completely used up?

Don't you use oil paper to trace pictures and maps?

Imagine the situation if the walls and doors of houses were transparent!

Haven't you realised that we utilise the transparency, opacity and translucency of objects in everyday life?

Find out more situations through group discussion and present them in the class.

Situations in which transparent	•
objects are used	•
Situations in which translucent	•
objects are used	•
Situations in which opaque objects	•
are used	•

Suppose if the human body is transparent

#### Sor Further Reading

## The Invisible Man

'The Invisible Man' is a famous science fiction by the English writer H.G. Wells. Griffin, a scientist, is a character in the novel. Griffin's



body becomes transparent as a result of his experiments. This novel portrays the experiences of Griffin who became invisible. **Basic Science** 

Can you write a science fiction with a transparent man or any other organism as a character?

# The Light that Returns

We have understood that some objects are transparent and some are opaque. What happens when light falls on opaque objects?

Dim the light in your class room by closing the doors and windows. Hold a mirror facing the wall and let the light from a torch fall on it. What happens to the light? Haven't you noticed that the light rays fall on the wall after hitting

on the mirror? Repeat the experiment by holding the following objects against the wall and allowing light from the torch to fall on each of them.

#### Materials required:

smooth tile, new steel plate, bronze, hardboard, paper, wooden block.

Record your observations in the table given below.



The object on which light fell	Difference in the returning of light after falling on the surface
Mirror	Light returns well
Paper	Very little light returns

#### Reflection of Light

Reflection of light refers to the returning of light when it strikes on an object.

Touch and feel the surfaces of the objects which reflect light very well. What do you feel?

What about the surfaces of objects that do not reflect light much?

Haven't you found that smooth surfaces reflect light very well and that it is less in the case of rough surfaces?

Why is it that rough surfaces cannot reflect light well?

The reflection of light from a mirror and a sand paper are depicted below.

Analyse the figures and write the inferences.



Mirror



Doesn't the light that fall on the mirror undergo a regular reflection? What about the light falling on the sandpaper?

Arrange a comb, a torch, a mirror and a sheet of A4 size paper as shown in the figure and light the torch. Observe the regular reflection of light.



#### **Regular Reflection and Diffused Reflection**

Light falling on smooth surfaces reflects with regularity. This is regular reflection. Mirrors give a regular reflection.

When light falls on rough surfaces, it gets scattered in different directions. This is irregular reflection or diffused reflection.

## When Light Reflects

Kick a ball to a particular point on a wall from different places. Doesn't the ball hit the wall and bounce back? Does it always bounce back in the same manner? Similarly, are there any peculiarities in the light rays falling on and bouncing off a mirror? Let's examine. Observe the figure.

The figure given below shows four children sitting at equal distances on two benches in front of a mirror. Listen to their conversation.



Why is it that the child who is sitting first can't see those sitting at the second and the third positions? Similarly, why can't the other children see all others through the mirror?

Write down your assumptions in the Science Diary.

Let's do an experiment using some materials in the Science Kit to verify the assumptions.

**Materials required:** A small piece of mirror, a protractor made as shown in the figure, a transparent plastic box, double-sided tape, laser torch, an incense stick and a match box.

Fix the small piece of mirror on one side of the transparent plastic box using the double sided tape. Fill up the box with smoke from the incense stick.

Point where light falls

Normal

Arrange the protractor you have made under the plastic box as shown in the figure. Draw a perpendicular line from this protractor to the mirror at an angle of 90°. This is the normal. Allow the light from the laser torch to fall through different angles of the protractor on the point where the normal touches the mirror. Observe the reflected light. Measure the angle between the ray of light from the laser torch and the normal. Similarly measure the angle between the reflected ray of light and the normal. Record them in the table.

Angle between the light ray from the torch and the normal	Angle between the reflected light ray and the normal
$40^{0}$	
550	
700	

Analyse the completed table. Is there any relation between the angle made by the light ray from the torch with the normal and the angle made by the reflecting light ray with the normal?

You have seen the light ray falling on the mirror and the reflected ray. Observe the diagram given below.



The ray of light falling on the mirror is the incident ray. The point at which the incident ray falls on the mirror is the point of incidence. The line drawn perpendicular to the mirror at the point of incidence is the normal. The light ray reflecting from the mirror is the reflected ray.

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#### Angle of Incidence and Angle of Reflection

The angle between the incident ray and the normal is the angle of incidence. The angle between the reflected ray and the normal is the angle of reflection.

What did you find out regarding the reflection of light from the experiment you have conducted?

You also have to know the concept of plane to understand more about the laws of reflection.

# Plane The two sheets of paper inserted into each other are on two planes. Each wall in your classroom is a plane. We will learn more about planes in higher classes.

#### Laws of Reflection

- The angle of incidence and the angle of reflection are equal.
- The incident ray, the reflected ray and the normal at the point of incidence are on the same plane.

# Light and Sight

In the previous class we have learnt that we see objects when their images are formed on the retina of our eye.

Observe the picture. The light from the bulb reaches the book and the eye. How does light reach the eye so that we see the book? Observe the picture showing the path of the light ray from the bulb falling on the book and reflecting to our eyes. Complete the flow chart.





Haven't you understood that we see a book when the light falling on it gets reflected and reaches our eyes? But we see a glowing bulb when the light from the bulb reaches our eyes directly.

#### How Do We See Things?

We see an object when light coming from any source of light falls on that object, gets reflected and reaches our eyes. But we see a source of light when the light from it reaches our eyes directly.



Don't we see many beautiful sights every day? How are these sights possible?

Haven't you understood that we see all sights on Earth due to the reflection of light?

## **Plane Mirror and Image**

Why can't we see our own face?

We see objects when the reflected light reaches our eyes. Will the light falling on our face get reflected to our eyes?

What is the device we use to see our face? What are the different surfaces from which light gets reflected and reaches our eyes while seeing our face in the mirror?



Observe the figure and identify the path of light. Complete the flow chart and record it in the Science Diary.



On which surfaces other than the mirror, can you see your face?

•

-

•

Look at the picture below. Haven't you seen mirrors of different shapes?



What are the peculiarities of the surfaces of these mirrors?

A mirror with a flat surface is a plane mirror. We can see our images in plane mirrors. Stand before a plane mirror and raise your left hand. Which hand of the image is raised? Write down your name in English using capital letters on a white paper and show it in front of the plane mirror. Can you read your name in the mirror?

If so, how should the word BASIC SCIENCE be written on a paper so as to read it on a plane mirror?

Try to write down the names of your friends in such a way that you can read it correctly from a plane mirror.

On which side of the image will a mole on one's left cheek be seen?

What property of the image formed in the plane mirror can be understood here?

#### **Lateral Inversion**

In a plane mirror, the left side of an object appears as the right side of the image and the right side of the object appears as the left side of the image. This phenomenon is lateral inversion.

Haven't you seen this vehicle? What would be the reason for writing like this on the vehicle? Discuss and record it in the Science Diary.

## Distance to the Image

Stand in front of a plane mirror. At what distance is your image seen?

Move a little forward and backward. Doesn't the position of the image also change?


If we take reflective glasses used in windows instead of plane mirror, we can measure the distance of an object from the mirror and the distance to the image from the mirror. Let's do an experiment.

Fix a reflective glass vertically on a table using a double sided tape.

Tear an A4 size paper lengthwise into two pieces. Draw lines at equal distances on both pieces of papers and mark the numbers 1 to 5 on each. Place the papers in front of and behind the reflective glass as shown in the figure.

Place a lighted candle at the area marked 3 as shown in the figure.



Place a coin at the area marked 3 on the other side. What will be the position of the image formed on the mirror? Repeat the experiment by placing the candle at different positions. Move the coin to the positions where the images are seen.

Is there any relation between the distance to the object from the mirror and the distance to the image from the mirror? Record your inference in the Science Diary.

### Size of the Image

Repeat the activity you have done using another candle of the same size. Place each candle at position 3 on both sides. If you look at it from one side, don't you see both the reflection and the candle on the other side at the same position? Observe the sizes of both. Compare the size of the object and the image by changing the position. Record it in the Science Diary.

Light up the candle on one side of the mirror. Measure the height of the candle upto the tip of the flame using a scale. Similarly, measure the height of the image on the other side with the help of your friends. Repeat the experiment by changing the size of the candle. Do the object and the image have the same size?



### **Characteristics of Images in a Plane Mirror**

- The image undergoes lateral inversion.
- In a plane mirror, the distance between the object and the mirror is equal to the distance between the image and the mirror.
- In a plane mirror, the size of the object will be equal to the size of the image.

# Number of Images

So far we have discussed the features of the image formed in a plane mirror.

When a burning candle is placed in front of a plane mirror, we get only one image. How many images will you see if a burning candle is placed in between two parallel plane mirrors? What is your assumption? Write it in the Science Diary.

Let's do this experiment using the following materials.

A wooden block sized 6 inch x 4 inch x 1 inch/small box, small candle, match box, two plane mirrors of different heights having the same breadth as that of the wooden block, double-sided tape.

Using the double side tape, fix the mirrors on either side of the wooden block in such a way that their reflecting surfaces come face to face. Place the lighted candle in between the mirrors on the wooden block.



Observe it from the side of the short mirror. How many images do you see on the mirror on the opposite side?

Why do we see such a large number of images?

# **Multiple Reflection**

A large number of images of the lighted candle placed in between the parallel mirrors are formed due to multiple reflection of light.

Repeat the above experiment using some other materials and pictures instead of candle. Observe the images. Won't you be able to create images of endless railway lines and rows of flowering trees?



The picture given depicts a situation involving multiple reflection in daily life. Find more examples.

- Barber shop
- •
- •

# Angle between the Mirrors and the Number of Images

Let's do an experiment. Glue two plane mirrors of equal size together with cellotape as shown in the above figure. Place a small ball in the middle and observe the number of images formed. Change the angles in between the mirrors. Observe whether there is a change in the number of images formed.



Basic Science

Make a protractor and place it below the mirrors as shown in the figure. Find out the angle between the mirrors and the number of images formed and complete the table.

Angle	Number of images
30°	
60 <sup>0</sup>	5
900	
$120^{0}$	

Is there any relation between the angle between the mirrors and the number of images formed?

What happens to the number of images when the angle between the mirrors increases?

What if the angle decreases? Note the inferences in the Science Diary.

### **Illusions in the Mirror**

Shall we make some interesting devices with mirrors that make use of the principle of multiple reflection?

#### 1. Kaleidoscope

**Materials required:** Three plane mirror pieces of 6 inch x 2 inch, insulation tape, transparent plastic sheet.

**Method of construction:** Using the insulation tape, fix the three plane mirrors in a triangular pattern as shown in the figure. Cover one of the open ends with the transparent plastic sheet using the insulation tape. Put some coloured bangle pieces or beads inside this device and observe. What do you see?







Tilt the device and enjoy the different patterns.

We can also make a kaleidoscope using three plastic scales of the same size.

### 2. Periscope

**Materials required:** A cardboard piece of size 25 cm x 30 cm, two plane mirror pieces of size 3 inch x 2.5 inch (Sunpack sheet can also be used instead of cardboard piece).



#### Method of construction

- Stage 1: Cut a cardboard/sunpack sheet of size 25 cm x 30 cm.
- Stage 2: Draw lines on it with the same measure as shown in Figure 1.
- Stage 3 : Cut off the unshaded parts of the figure along the lines. Didn't you get a shape as shown in Figure 2 now?
- Stage 4 : Fold this shape as shown in Figure 3 and glue it up.
- Stage 5 : Cut two pieces of plane mirrors of size 3 inch x 2.5 inch. While fixing them on the slanting ends of the device you have made, make sure that the reflecting surface faces the inner side of the device.

Isn't it the upper view that we get when we look through the lower end of periscope? Why is it so?

By observing the path of light shown in the figure, will you be able to explain how this view is possible?



Discuss how a periscope is useful for the submarines in the Navy and for soldiers observing enemies from trenches in the battle field.



What if the periscope you have made is similar to the one as shown in the figure? The view from which part can be seen? Try to draw the path of light. Construct the device and examine its working.

We have learnt a lot about light. We cannot imagine a world without light. Can you believe that excess of light creates problems for human beings and many other living organisms?



Didn't you notice how worried the owl is? When do owls go out for preying? How does the intense light at night affect them? Are the owls alone affected by the artificial light at night?

# **Light Pollution**

Today, we use many sources of light that dispel darkness. You've probably seen in cities and parks neon bulbs and the likes that are kept lit up throughout the night. This light is harmful to many organisms that hunt for prey in the dark. They are also the heirs of this earth. Intense illumination at night also causes people to miss many of the sky views that can only be seen on clear nights.

Didn't you realize some problems caused by light pollution? Too much light at night causes many difficulties for human beings as well as animals. Discuss them in the class and record in the Science Diary.

# Let's Assess

1. Examine the following table and find the odd one out.

Transparent Objects	Translucent Objects	<b>Opaque Objects</b>
Clear water	• Soil	• Stone
• Air	• Tiles	• Mirror
• Box filled with	• Turbid water	Clear water
smoke		• Hardboard
• Screen guard of a mobile phone		• Fog

2. Observe the pictures. Which type of reflections do you see here?



Explain both views based on the reflection of light.

3. Observe the following situations. Find out which type of reflection takes place in each.

Situation	Reflection
Ornaments shine	
• We get light inside the home during day time	
• A polished furniture shines	
• See reflection of trees on stagnant water	

# **Extended Activities**

Arrange three benches in a room as shown in the figure given below. Arrange one of them perpendicular to the wall and keep the others at a particular distance from the wall. Fix a nail on the bench at the end which touches the wall. Place a mirror vertically behind the nail fixed on the bench. Mark A, B at equal intervals at one of the benches placed away from the wall. Similarly mark C, D on the other bench. At the end of the bench perpendicular to the wall, mark X as shown in the figure. Make four children sit on the bench at position A, B, C and D. Wrap a thread around the nail and give the two ends of it to the children in positions A and D. Similarly, wrap another thread around the nail and give the ends to the children in positions B and C.



- Light a torch on to the mirror through the thread held by child A. Where does the reflected light fall?
- Similarly, let child D also light the torch on the mirror. Where does the reflected light fall?
- Let the children B and C repeat the activity. Write down your observations.
- Where will the reflected light fall, if the torch is lighted on to the mirror from X?

# Human Body: A Wonder Digestion and Respiration

All living organisms need food. The food and the method of obtaining food vary from

> organism to organism. Rabbits eating tender grass, parrots pecking at and flying away with the grains, snakes swallowing rats, bears climbing trees to gobble up the honey laden combs....

How diverse these sights are!





Haven't you

observed the diverse food of organisms around you and the methods they adopt to collect it? Compile a list of the organisms you have observed, and their respective food. Present it in the class room.

Name of the organism	Food
Cow	• Grass
Goat	• Leaves
Cat	• Mice
Bear	• Honey
Rabbit	•
Human	• Cooked rice

Add more organisms and expand the list. With the help of the list, classify the living organisms into herbivore, carnivore and omnivore. Write it in the Science Diary.

Haven't you understood that each animal's food is different? All living organisms obtain food and utilize it.

#### Nutrition

Nutrition is the process by which organisms obtain and utilize food.

Every organism obtains the energy necessary for its vital activities from their food. The food we consume undergoes various changes within our body.

How is the ingested food utilized by the organisms?

Let's examine what happens to the food we consume and how it is utilized.

#### Ingestion

There are 5 stages in nutrition. The first stage is ingestion. The food first reaches the mouth. What are the changes that occur to food in the mouth?

• It mixes with saliva.

What is the role of lips, tongue and teeth in ingestion?

Observe the experiences on your own while consuming food.

# Teeth

Teeth are used to masticate food. The structure and arrangement of teeth is suitable for biting, chewing and grinding food.

Observe the picture.



Enamel is the outer most layer of the tooth. It is also the hardest substance in the human body.

# Milk Teeth and Permanent Teeth

Do you still have your first set of teeth?

Will an infant's first set of teeth last throughout its life?

### Milk Teeth

In infants, teeth development starts around the age of six months. These teeth are known as milk teeth. Ten milk teeth each develop at the upper and lower jaws (in total-20).



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### **Permanent Teeth**

Permanent teeth are those that replace milk teeth when they fall off. If permanent teeth break or fall off, new teeth will not grow in its place.

#### **Basic Science**

The food we eat - are they the same? Some are large and hard while some others are soft. Various types of teeth assist us in biting and tearing, chewing and grinding different food items.



Observe the picture and

try to understand the different types of teeth and their position.

Observe the table depicting different types of teeth, their position, numbers and uses. Analyse the table and record in the Science Diary the position and use of different types of teeth.

Differen	t types of teeth	Position and number	Uses
	Incisor	Eight incisors in front; four in the upper jaw and four in the lower jaw.	To bite and tear food items.
	Canine	Four canines adjacent to incisors on both sides; two in the upper and two in the lower jaws.	To tear and cut food.
	Premolar	Eight premolars adja- cent to canines; two on both sides, in the upper and lower jaws.	To chew and grind food.
	Molar	Twelve molar teeth near the premolars on both sides at the back. Six in the upper jaw and six in the lower jaw.	To chew and grind food.

The generic name for molars and premolars is molars.

How many teeth does an adult have? Examine the table and write the use and number of each type of tooth in the Science Diary.

Observe the picture below. Find out the distinctive features of teeth in carnivorous and herbivorous animals and understand how closely the shape of the teeth is related to their food habits.



The canines of carnivores are much developed and it helps in biting and tearing meat.



Incisors in herbivores help to bite and tear the food and premolars and molars, to masticate the food.

# **Tooth Decay**

Teeth play a major role in masticating food. Hence they should be protected with care. But in many people tooth undergoes decay.

Examine the picture.

Let's do an experiment to find out how tooth decays.

Marble is a hard material made of calcium compound. Take a small piece of marble and observe using a hand lens. Put it in dilute hydrochloric acid. After some time take it out and again observe using the hand lens.

What change do you observe in the marble piece?

It is seen that the marble has started to corrode. The reason is that acid has reacted with the calcium compound in marble.

Similarly tooth enamel is also a calcium compound. It reacts with acid and gets damaged gradually.



**Basic Science** 

Let's listen to a conversation between a child and her dentist.

Doctor, my sister has dental caries. What is the reason for this? If you don't clean the mouth properly after having food, bacteria will feed on the food particle struck between the teeth. This will result in lactic acid production. This is what damages the teeth. Lactic acid is a very weak acid. How does it cause tooth decay? You know marble piece started to corrode when it reacted with hydrochloric acid; likewise enamel, which is a calcium compound, reacts with lactic acid and causes tooth decay in the long run. I clean my teeth thoroughly at night. But sometimes after eating sweets I skip it. Is there anything wrong in it, doctor? No matter what food you eat, you should clean your mouth well, especially after consuming sweet. Otherwise it will accelerate the bacterial action. Brush your teeth in the morning before breakfast and at night, after dinner. Always clean your mouth whenever you eat something.

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Wouldn't you like to know more about dental care?

Discuss in group and prepare questions to conduct an interview with a dentist.

Prepare a note based on the information obtained from the interview and record it in your Science Diary.

So far we have discussed the importance of teeth in digestion. Now let's discuss the role of tongue.

# Tongue

You have already learned in your previous classes that the taste buds on the tongue help us to sense taste.

What are the other functions of the tongue?

- Helps in swallowing.
- Tongue helps to move food inside the mouth so that teeth can chew it.
- •

There is saliva in the mouth. Saliva also plays an important role in the digestive process. Observe the picture and identify from where it is produced.







# Food through the Oesophagus

Look at the picture and identify to which part of the digestive system does the chewed food reach next?

Let's go on a journey with food.

To which part of the digestive system does food first reach from the mouth?

Look at the picture. Locate the position of the oesophagus through which the chewed food reaches the stomach.

What is oesophagus?

The oesophagus is a long tube that connects the mouth to the stomach. It is made of muscles. The wave-like movement of the oesophageal wall helps food to reach the stomach. This movement is called peristalsis.

### Food in the Stomach



You know that digestion of food begins in the mouth and it reaches the stomach through the oesophagus.

Digestion is the second stage of nutrition. It takes place partially in the stomach where food remains for 4 to 5 hours. Due to the peristaltic movement of the stomach wall, the food is turned into a paste form. Gastric juice, produced by glands in the stomach wall facilitates digestion. Stomach wall also produces small amount of hydrochloric acid. This helps in protein digestion and pathogen destruction.

The partially digested food in the stomach then moves on to the small intestine.

# Food in the Small Intestine

Human small intestine is five to six meters long. It is here that the second stage

of nutrition (digestion) is completed. Absorption of nutrients also takes place in the small intestine.

Bile produced by the liver and the pancreatic juice produced by the pancreas are mixed with partially digested food in the first part of the small intestine. This completes the digestion of food.



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How do the nutrients in the digested food get absorbed into the blood?

Villi are the small finger-like projections present in the wall of small intestine. Nutrients in the digested food are absorbed into the blood through the villi.

This is the third stage in nutrition and the process is called absorption.

The nutrients that reached the blood become part of the body. This is the fourth stage of nutrition and this process is called assimilation.

The digested food will also have substances not needed by the body.

Let's see how they are eliminated.





After the absorption of nutrients, the residues in the digested food move to the large intestine. Water and some salts are absorbed into the large intestine from the digestive waste as needed by body. Later the digestive waste stored in the rectum is egested through the anus. This is the fifth stage of nutrition and this process of digestive waste removal from our body is called egestion.

Let's complete the flow chart showing the various stages of nutrition.



Observe the diagrammatic representation of human digestive system. Write in your Science Diary the names and functions of the labelled parts.



# Nutrition in other Organisms

The picture illustrates the process of nutrition in the single-celled amoeba. Analyze the picture and record in the Science Diary the various stages of nutrition in amoeba.



Let's observe the pictures of the digestive system of some animals.



Do the digestive system of these animals have any similarity with our digestive system? Discuss.

Humans can survive without food for some days. But can we sustain life without breathing?

Observe the picture.

A man and some fishes are swimming in the water. How long can this man remain in water without the support of an

oxygen cylinder? Why are we unable to take oxygen from water, like fish?

You can easily guess the reason. It is due to the difference in the respiratory system of man and fish.

## **Human Respiration**

How long can you hold your breath? Let's do a simple activity.

Please stand up. Take a deep breath. Now try to hold your breath as long as you can. Who has been able to hold breath for long? Couldn't hold your breath even for a minute, could you?

Let's learn more about breathing.

Press your hand on your chest and take a deep breath in and a deep breath out. What are the changes that your body is experiencing? Don't you feel the air coming in and going out? What else do you feel?



### Materials required

Y tube, one big balloon, 2 small balloons, a plastic bottle with its bottom part cut off, string, rubber band, paper ball.



#### Method of construction

Let's make a model as shown in the picture.

Fix the two small balloons in the Y tube and insert it through the lid of the bottle as shown in the figure. Place a small paper ball tied to a rubber band, in the middle of the big balloon and tie it with a long string. Attach the other end of the rubber band to the Y tube. Invert the big balloon and attach at the bottom of the bottle with the free end of the string outside.

Prepare the model with the help of your teacher.

#### Procedure

Gently pull down the string tied to the big balloon.

Don't the smaller balloons expand when the larger balloon is pulled down?

What happens when the string is released?

(While pulling the string it will be better to hold the Y tube so as to keep it steady.)

- When the string attached to the large balloon is pulling down, the two small balloons inside the bottle begin to expand. Why?
- Why do the small balloons shrink when the string attached to the large balloon is released?

Isn't there a similarity between the model you have made and the functioning of human lungs.



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Human lungs are placed in a space inside the chest called the thoracic cavity. Below it is the abdomen. Diaphragm is the muscular wall that separates the thoracic and abdominal cavities. It is slightly bent upwards and is domeshaped. In the above model, the big balloon stretched over the bottom of the bottle can be imagined as the diaphragm and the two smaller balloons, as the two lungs.

The contractile activities of human lungs and of the model you made are almost similar.

The diaphragm and the muscles attached to the ribs play a role in the contraction and expansion of human lungs.

Observe the picture and find answers to the questions given below. Write them in the Science Diary.



- What happens to the diaphragm during inhalation and exhalation?
- When does the thoracic cavity increase in volumeduring inhalation or exhalation?

During inhalation, the diaphragm contracts and flattens. This increases the volume of the thoracic cavity. The atmospheric air enters the lungs and the lungs expand.

During exhalation, the diaphragm relaxes and both the diaphragm and the lungs return to their previous positions. The air from the lungs moves out.

# **Respiratory Tract**

Air entering through the nostrils reaches alveoli of the lungs. Respiratory tract is this air passage from nostrils to lungs.

Complete the flowchart of the respiratory tract using the indicators.

#### Indicators

Alveolus, Trachea, Bronchioles, Nostrils, Bronchi.



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How is the passage of air through the respiratory tract made possible? Examine the illustration below.



Write in the Science Diary the different stages of inhalation and exhalation.

Observe the table showing the levels of various components in the inhaled and exhaled air.

Inhaled air	Level (in percentage)	Exhaled air	Level (in percentage)
Oxygen	21	Oxygen	15
Carbon dioxide	0.04	Carbon dioxide	4
Nitrogen	78	Nitrogen	78
Moisture	0.96	Moisture	3

Is the level of all components in inhaled and exhaled air the same? Which all components show difference in percentage?

Which of the components are in higher level and lower level in exhaled air than in inhaled air?

Analyze your findings and find out which gas is utilized by us in respiration.

### **Incidents of Food Getting Stuck in the Trachea**

Have you come across news items in the newspaper about breast milk getting stuck in the trachea, causing harm to small children. What first aid should be given in such cases of choking on food or breast milk?





- If the food is stuck in the trachea, that person should be asked to cough forcefully. With the force of cough the food will be ejected.
- As shown in the picture, keep the person who has difficulty in breathing in a slightly bent position. With both hands, press firmly on the affected person's stomach from behind. If necessary, repeat this process for a few more times.
- If the affected person is a baby, place the baby face down on your forearm as shown in the picture. Your arm should be resting on your thigh. With the palm of your other hand, give the child forceful blows between the shoulder blades. Provide medical attention if necessary.

#### For Further Reading

### **Smoking and Health Issues**

Smoking impairs the functioning of lungs. Carbon, tar, and other toxic substances present in the cigarette smoke can remain in the lungs. This can cause persistent cough. Tobacco contains chemicals that cause cancer.

# **Diversity in Breathing**

Paramecium is an aquatic unicellular organism that cannot be seen with the naked eye. Analyze the picture and find out how gas exchange takes place in a protozoan like paramecium.



Paramecium takes in oxygen dissolved in the surrounding water through the cell membrane and gives out carbon dioxide.

Diversity in Respiration		
Organism	Part that helps in respiration	
Earthworm	Moist skin	
Fish	Gills	
Frog	Lungs (while on land) Moist skin (under water)	
Spider	Book lungs	

Analyze the table and understand the diverse types of respiration in organisms.

### Respiration

The process through which organisms receive oxygen from their environment and eliminate carbon dioxide is called respiration.

You have learned that plants also respire like other organisms.

Read the note given below and find the answer to the questions

### **Respiration in plants**

Plants also absorb oxygen from the atmosphere and release carbon dioxide. Stomata are fine pores, found in leaves and tender stem that help in gas exchange in plants.

- Which gas do plants take in during respiration?
- Name the gas released by plants during respiration?
- Where does the gas exchange take place in plants?

From this unit we have understood two important activities that take place in our body such as digestion and respiration. You are also convinced about the importance of maintaining healthy habits that will help in proper functioning of digestive and respiratory systems. Follow them in your daily life.

# Let's Assess

- 1. Which of the following combination is correct?
  - a. Goat, Horse, Crow, Pigeon (Herbivores)
  - b. Leopard, Vulture, Elephant, Lizard (Carnivores)
  - c. Man, Hen, Monkey, Peacock (Omnivores)
- 2. In which of the following organ digestion is completed?
  - a. Mouth b. Small intestine c. Large intestine d. Stomach
- 3. What are the precautionary steps to be taken to prevent tooth decay?
- 4. Compare the dentition of a six year old child and that of an adult.
- 5. A person is lying down and eating food. Do you think the food will reach the stomach? Why?

# **Extended Activities**

- 1. Like man, other organisms also breathe. Observe the body movements of cat, cow etc during inhalation and exhalation.
- 2. Breathe into a mirror. What do you see? What is the reason?
- 3. List out the ideas to be covered in the seminar to be organized in the school on the topic, "Respiratory System and Health" and display them on the bulletin board.
- 4. Have you ever noticed air pump in the aquarium? Find out its significance.
- 5. With the help of your teacher organize a medical camp at school to get more information about dental care.

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# NOTES


### CHILDREN'S RIGHTS

Dear Children,

Wouldn't you like to know about your rights? Awareness about your rights will inspire and motivate you to ensure your protection and participation, thereby making social justice a reality. You may know that a commission for child rights is functioning in our state called the **Kerala State Commission for Protection of Child Rights**.

Let's see what your rights are:

- Right to freedom of speech and expression.
- Right to life and liberty.
- Right to maximum survival and development.
- Right to be respected and accepted regardless of caste, creed and colour.
  - Right to protection and care against physical, mental and sexual abuse.
  - · Right to participation.
  - Protection from child labour and hazardous work.
- Protection against child marriage,
- Right to know one's culture and live accordingly.

- Protection against neglect.
- Right to free and compulsory education.
- Right to learn, rest and leisure.
- Right to parental and societal care, and protection.

#### Major Responsibilities

- Protect school and public facilities.
- Observe punctuality in learning and activities of the school.
- Accept and respect school authorities, teachers, parents and fellow students.
- Readiness to accept and respect others regardless of caste, creed or colour.

Contact Address:

Kerala State Commission for Protection of Child Rights 'Sree Ganesh', T. C. 14/2036, Vanross Junction Kerala University P. O., Thiruvananthapuram - 34, Phone : 0471 - 2326603 Email: childrights.cpcr@kerala.gov.in, rte.cpcr@kerala.gov.in Website : www.kescpcr.kerala.gov.in

Child Helpline - 1098, Crime Stopper - 1090, Nirbhaya - 1800 425 1400 Kerala Police Helpline - 0471 - 3243000/44000/45000

Online R. T. E Monitoring : www.nireekshana.org.in

# CONSTITUTION OF INDIA Part IV A

### FUNDAMENTAL DUTIES OF CITIZENS

### ARTICLE 51 A

Fundamental Duties- It shall be the duty of every citizen of India:

- (a) to abide by the Constitution and respect its ideals and institutions, the National Flag and the National Anthem;
- (b) to cherish and follow the noble ideals which inspired our national struggle for freedom;
- (c) to uphold and protect the sovereignty, unity and integrity of India;
- (d) to defend the country and render national service when called upon to do so;
- (e) to promote harmony and the spirit of common brotherhood amongst all the people of India transcending religious, linguistic and regional or sectional diversities; to renounce practices derogatory to the dignity of women;
- (f) to value and preserve the rich heritage of our composite culture;
- (g) to protect and improve the natural environment including forests, lakes, rivers, wild life and to have compassion for living creatures;
- (h) to develop the scientific temper, humanism and the spirit of inquiry and reform;
- (i) to safeguard public property and to abjure violence;
- (j) to strive towards excellence in all spheres of individual and collective activity so that the nation constantly rises to higher levels of endeavour and achievements;
- (k) who is a parent or guardian to provide opportunities for education to his child or, as the case may be, ward between age of six and fourteen years.