

# Preface

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The Government of Punjab has a strong desire to improve the quality of teaching and learning in the classroom. Various initiatives have been undertaken for provision of quality education to students in the Province. Provision of quality education at elementary level is an important step towards building an education system meant to contribute meaningfully towards development of our society. To achieve the desired goal, activity oriented training for elementary school teachers based on modern teaching methodologies has been considered imperative and crucial.

Directorate of Staff Development (DSD) has been training in-service and pre-service public school teachers and developing educational material since its inception. Considering the quality work produced over the years, the task of development of the Teachers' Guides for Elementary school teachers in the subjects of English, General Science, and Mathematics was assigned to the Directorate of Staff Development by the Provincial Government.

DSD worked in collaboration with over three hundred professionals i.e. Teachers, Book Writers and Teacher Trainers from both public and private educational institutions in the subject of English, Science and Mathematics who worked in groups to develop these comprehensive Teachers' Guides. These Teachers' Guides with textbooks are aimed to achieve Students' Learning Outcomes (SLOs) through the teaching materials and methodologies which suit varying teaching and learning contexts of Punjab. These Teachers' Guides will help Elementary School Teachers to deliver and further plan their content lessons, seek basic information on given concepts and topics, and assess students' understanding of the taught concepts.

The DSD team acknowledges the cooperation extended by various public & private, national and international organizations in the preparation of Teachers' Guides. DSD is especially grateful to GIZ German International Cooperation Agency, for extending its full cooperation and support in conduction of workshops, development of material, quality management, layout and designing of these Guides. DSD is grateful to UNICEF for providing photographs for the guides. DSD recognizes the contribution made by all developers and reviewers belonging to following organizations including Institute of Education and Research (IER), Punjab University, Government Science College, International School of Choueifat, Crescent Model Higher Secondary School, Punjab Textbook Board, Lahore Grammar School, Himayat-e-Islam Degree College, SAHE, PEAS, NEEC, HELP Foundation, Ali Institute of Education, Beaconhouse School System, ALBBS, The Educators, Divisional Public School, The City School, AFAQ, M.A.O College, Portal, LACAS, BUNYAD, AIOU, University of Education, Children's Library Complex (CLC) and GICW Lahore, Govt. Higher Secondary Schools and Govt. Colleges for Elementary Teachers in Punjab.

( Nadeem Irshad Kayani)  
Programme Director  
**Directorate of Staff Development, Punjab**

UNIT

TOPIC

Lesson Plan

1

1

# Internal Structure of Leaf

## Photosynthesis & Respiration in Plants

Grade VI



### Students' Learning Outcome

Students will be able to:

- describe the internal structure of Leaf



### Information for Teacher

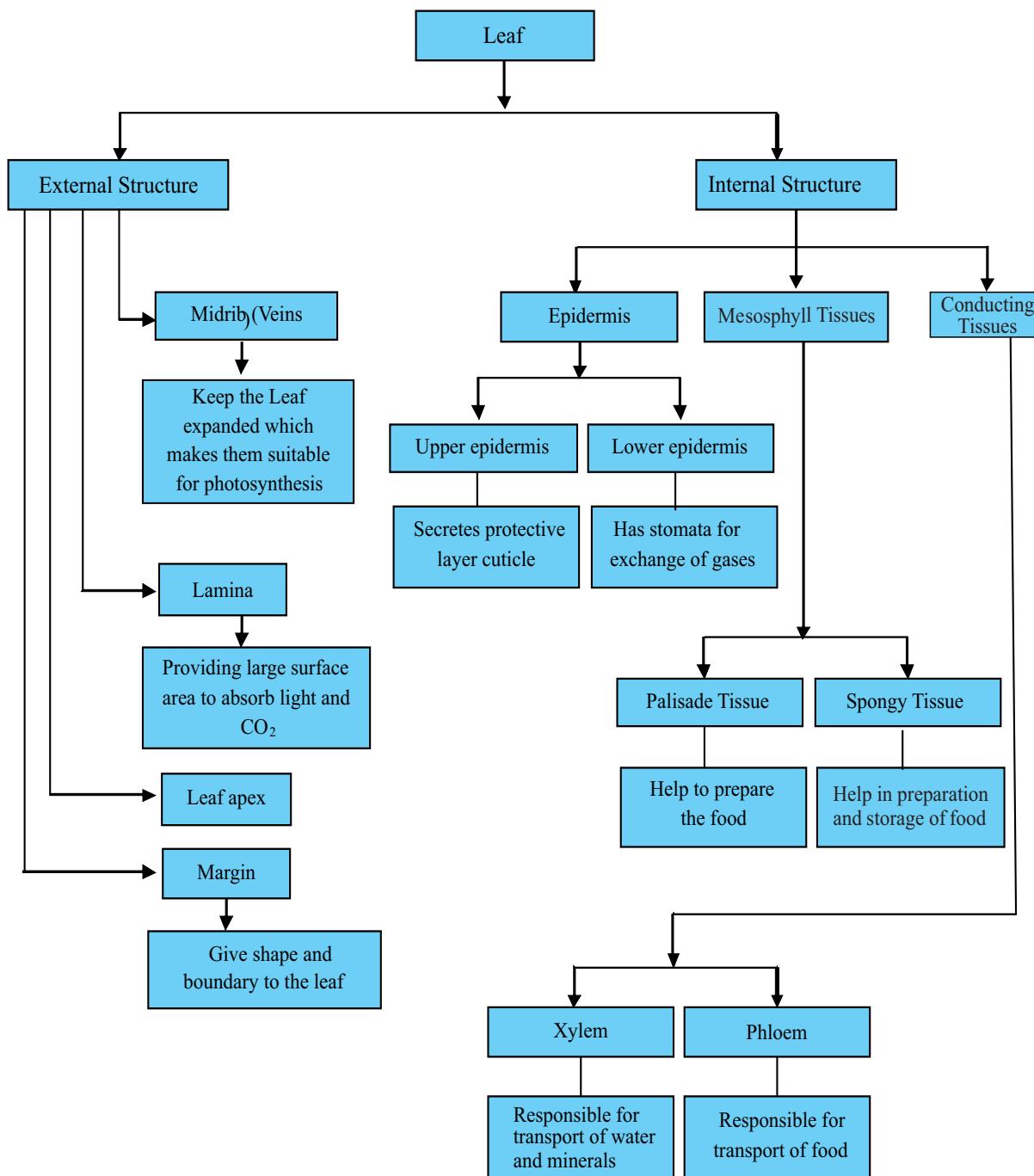
- In plants, leaves are the major site of photosynthesis.
- They are often referred as food factories of nature.

- A leaf is made up of many layers those are sandwiched between two layers i.e. the upper epidermis and lower epidermis.
- The upper epidermis is covered by waxy cuticle which reduce evaporation from the upper surface and lower epidermis has stomata pores for exchange of gases.
- Palisade mesophyll cells are tightly packed elongated cells where most food production takes place
- Spongy mesophyll cells are loosely packed

with large intercellular spaces, where the exchange of gases take place more efficiently.

Conducting tissues consist of xylem and phloem. Xylem transport water and minerals and phloem transport food to other parts of plant.

### Concept Map





## Duration/Number of Period

80 minutes/ 2 Periods



## Material/Resources Required

Different leaves, chart showing the internal structure of leaf, prepared slide showing Transverse section of leaf, microscope



## Introduction

- Bring some leaves to the class.
- Show them to the students and ask the following questions.
  - What is the role of a leaf in a plant? (Expected response: to prepare food)
  - Why is the colour of leaf green? (Expected response: due to chlorophyll)
  - Name the structures visible on the surface of the leaf? (Expected response: lamina and midrib)
  - Facilitate the students to get to the right response and then introduce the today's topic.



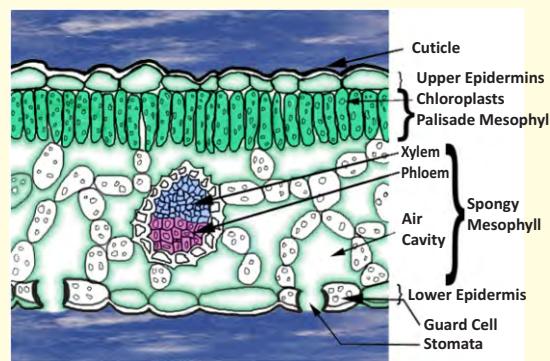
## Development

### ACTIVITY 1

- Show the students a prepared slide of the internal structure of a leaf under the microscope.
- Display a chart showing a diagram of the internal structure of a leaf.
- Ask the students to observe the chart showing the diagram of the internal structure of a leaf and

observe the prepared slide under the microscope one by one.

- Ask them to compare the internal parts of the T.S of leaf with the diagram displayed on the chart.
- Now explain the parts of the internal section of a leaf as shown on the chart and explain the function of each part.
- During the activity, ask the students to observe the chart of the internal structure of leaf and draw it on their notebooks.

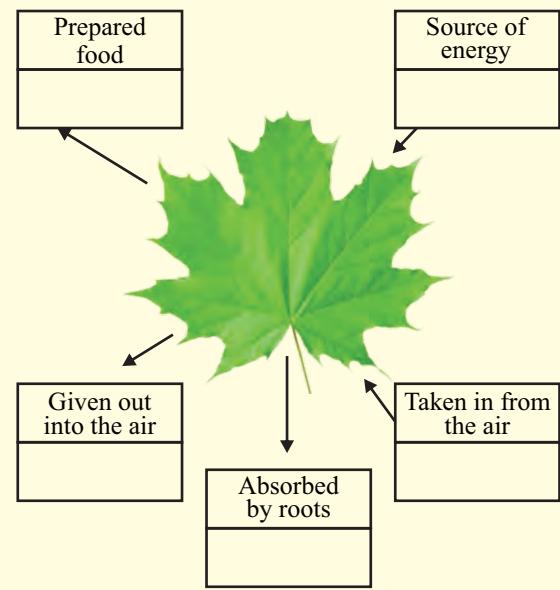


### ACTIVITY 2

- Draw the internal structure of leaf on board and explain the role of stomata, mesophyll tissues, xylem, phloem and cuticle.
- Explain how the internal and external structure of leaf facilitate photosynthesis.
- Draw the figure as given below, on board, and ask the students to complete these boxes by suitable answers.
  - Carbon dioxide
  - Sun light
  - Oxygen
  - Glucose

— Water

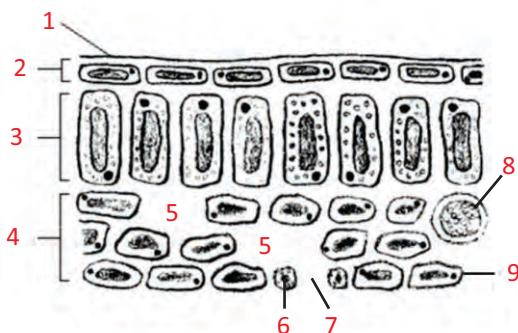
## Structure of Leaf



## Conclusion/Sum up

Repeat the important points of the lesson by involving the students as:

A leaf consists of many layers i.e. cuticle, upper and lower epidermis, mesophyll tissues (spongy and palisade), conducting tissues (Xylem and phloem) which perform different functions. In most plants photosynthesis takes place in the leaf. Leaves are often referred as food factories.



Sr. #	Structure of Leaf	Main Function
1		
2		
3		
4		
5		
6		
7		
8		
9		



## Follow-up

Write the following questions on the board and ask them to copy and solve as home work on their notebooks.

- How lamina can help in photosynthesis?
- Does the arrangement of leaves, play any role in photosynthesis?
- What is the role of stomata in photosynthesis?
- Why more chloroplasts are present in palisade tissues rather than the spongy mesophyll tissues?
- Guide the students to solve the exercise questions given at the end of the chapter of text book.



## Assessment

- Make a line drawing on the board to show the internal structure of the leaf and label it 1 - 9 as given in the diagram.
- Draw a table on the board as shown
- Fill it by the responses of the students and ask them to copy on their note books.

# Respiration in Plants

Grade VI



 **Students' Learning Outcome**

Students will be able to:

- Explain the importance and process of respiration in plants.

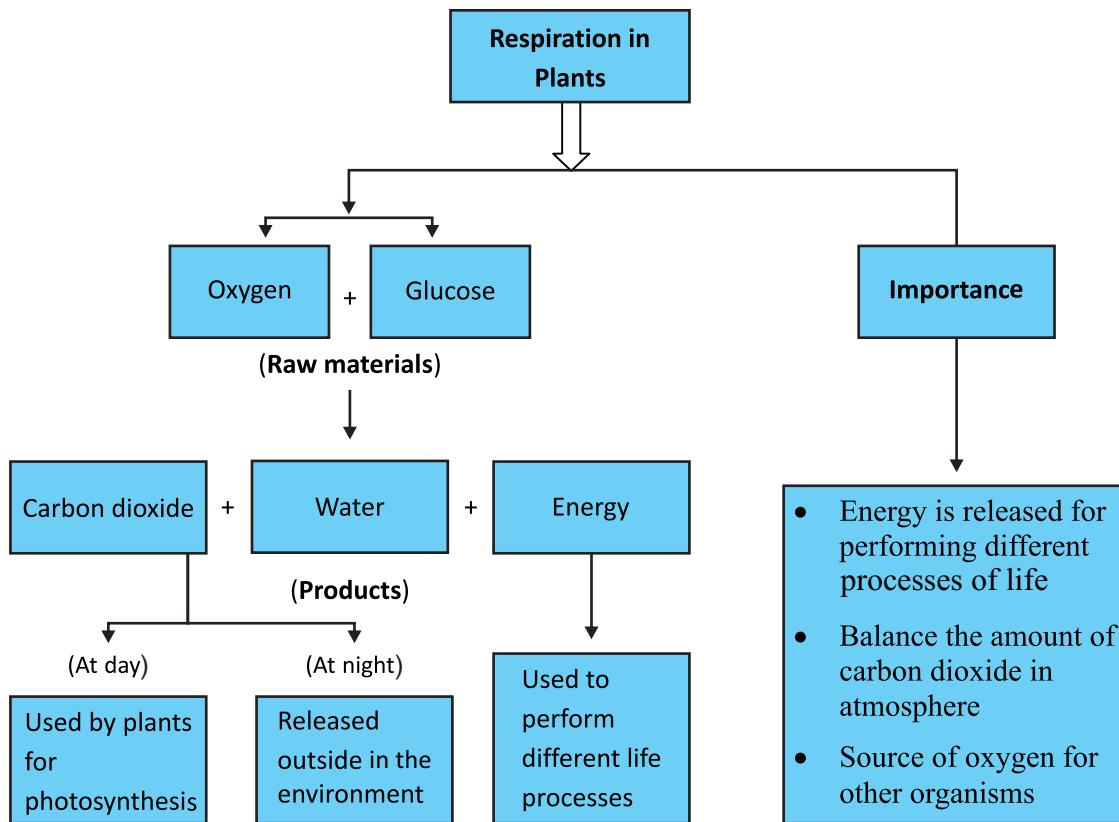
 **Information for Teacher**

- Like all other organisms, plants require oxygen for getting energy from food.

They also require to release extra carbon dioxide from their bodies.

- During day time plants utilize the carbon dioxide (produced during respiration) in photosynthesis and for respiration, they utilize the oxygen produce during photosynthesis.
- Plants do not have specialized breathing mechanism for gaseous exchange like animals.

## Concept Map



### Duration/Number of Periods

80 minutes/2 periods

involved in getting energy from food?  
(Expected response: respiration)

- Now introduce the today's topic to the class.



### Material/Resources Required

Germinating seeds, flask, thermometer, stand



### Development



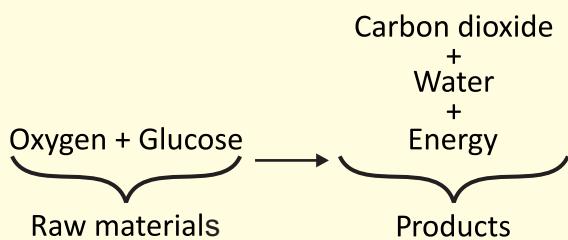
### Introduction

- Ask the following questions to the class.
- What do you need to grow? (Expected response: food and energy)
- From where do you get this energy? (Expected response: by the breakdown of food)
- Do you know the name of the process

### ACTIVITY 1

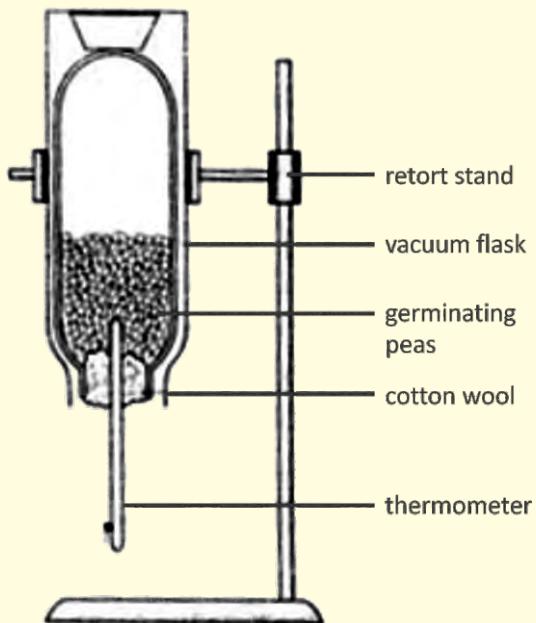
- Ask the questions
- How the chemical energy stored in food molecules is made available for life process? (Expected response: by chemical reactions)
- Inform the students that these chemical reactions are collectively called respiration.

- Link the above discussion by explaining the process of respiration in terms of a simple equation.
  - Draw this equation on the board.



## ACTIVITY 2

- Set the apparatus as shown in diagram and draw this diagram on the board to explain that this experiment is used to investigate the release of energy (heat) during respiration.
  - Now conclude this activity by asking the following questions.
    - Why germinating seeds are used in this experiment? (Expected response: In germinating seeds the



- process of respiration is going on.)
  - What will be the change in the reading of the thermometer after the experiment? (Expected response: an increase in the reading of the thermometer)



- How does the measurement of thermometer indicate that the seeds have released energy?  
(Expected response: In germinating seeds the process of respiration is going on. During the process of respiration the energy is released)
  - Ask about the importance of respiration and enlist the points on the board and ask the students to copy on their notebooks.



## Conclusion/sum up

Ask the students, what we have learnt? Expected response will be: in the process of respiration plants take in oxygen and release carbon dioxide ( $\text{CO}_2$ ), and this process continues day and night. During day time both processes of photosynthesis and respiration are going on thus  $\text{CO}_2$  during respiration is used in photosynthesis and oxygen released during photosynthesis is used for respiration.



## Assessment

- Draw the given table on the board.
- Ask the students to fill and copy on their notebooks.

Raw Materials	Products



## Follow-up

- Write the following questions on the board and ask them to copy and solve as home work on their notebook.
  - What is the purpose of respiration?
  - What is the energy released in respiration used for?
- In contrast to photosynthesis, why respiration in plants continues during day and night.
- Guide the students to solve the exercise problems given at the end of each unit / chapter of textbook.

# Photosynthesis and Respiration in Plants

Grade VI



## Students' Learning Outcome

Students will be able to:

- Compare and contrast the process of photosynthesis and respiration in plants.



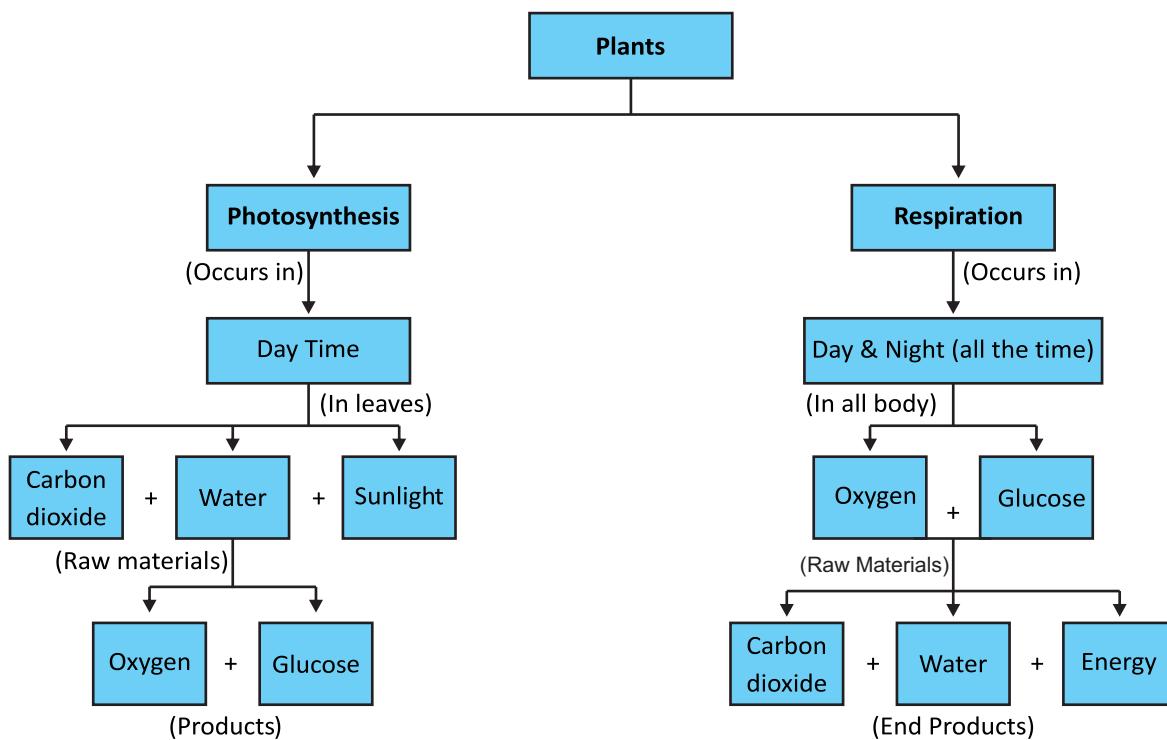
## Information for Teacher

- Respiration is quite the opposite of photosynthesis.
- Photosynthesis is a constructive process in which the organisms absorb energy

and gain weight.

- The raw materials for photosynthesis are glucose, water and oxygen while in respiration it is reverse.
- Photosynthesis is localized only to the green parts of the plants during day time while respiration occurs both, during night and day in all living cells of an organism.
- Photosynthesis is a non continuous process that depends mainly on solar energy while respiration is a continuous process that does not depend on solar energy.

## Concept Map



### Duration/Number of Period

40 minutes/1 period



### Material/Resources Required

Coloured chalks/markers, board



### Introduction

- Recall the previous knowledge of photosynthesis and respiration.
- Note down the points told by the students on one side of the board.
- Ask different questions and facilitate the students to get to the right response.
- Now introduce the today's topic.



### Development

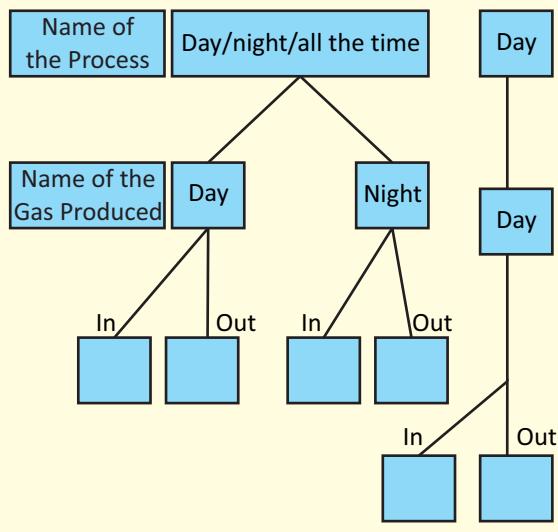
#### ACTIVITY 1

- Draw a table on the board as shown below.
- Fill it by the responses of the students and ask them to copy on their notebooks.

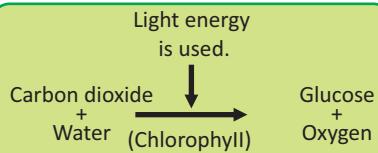
Photosynthesis	Respiration

**ACTIVITY 2**

- Draw this table on board or if possible draw on chart paper and display it on the board.
- Complete it by cross answering with students.

**Assessment**

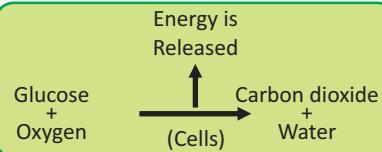
- To assess the understanding of the students ask the following questions:
  - What do plants take from the air and give to the air when they respire?
  - What do plants take from the air and give to the air during photosynthesis?
  - Why it is advised not to sleep under trees at night?
  - Why are the plants called "Lungs of the nature"

**Conclusion/Sum up****Photosynthesis**

It is important for the survival of Plants and Animals

Function only in the presence of light

Necessary factors: water, carbon dioxide, light, temperature and chlorophyll

**Respiration**

It is important for the survival of Plants and Animals

Function all the time.

Necessary factors: oxygen and food (glucose)

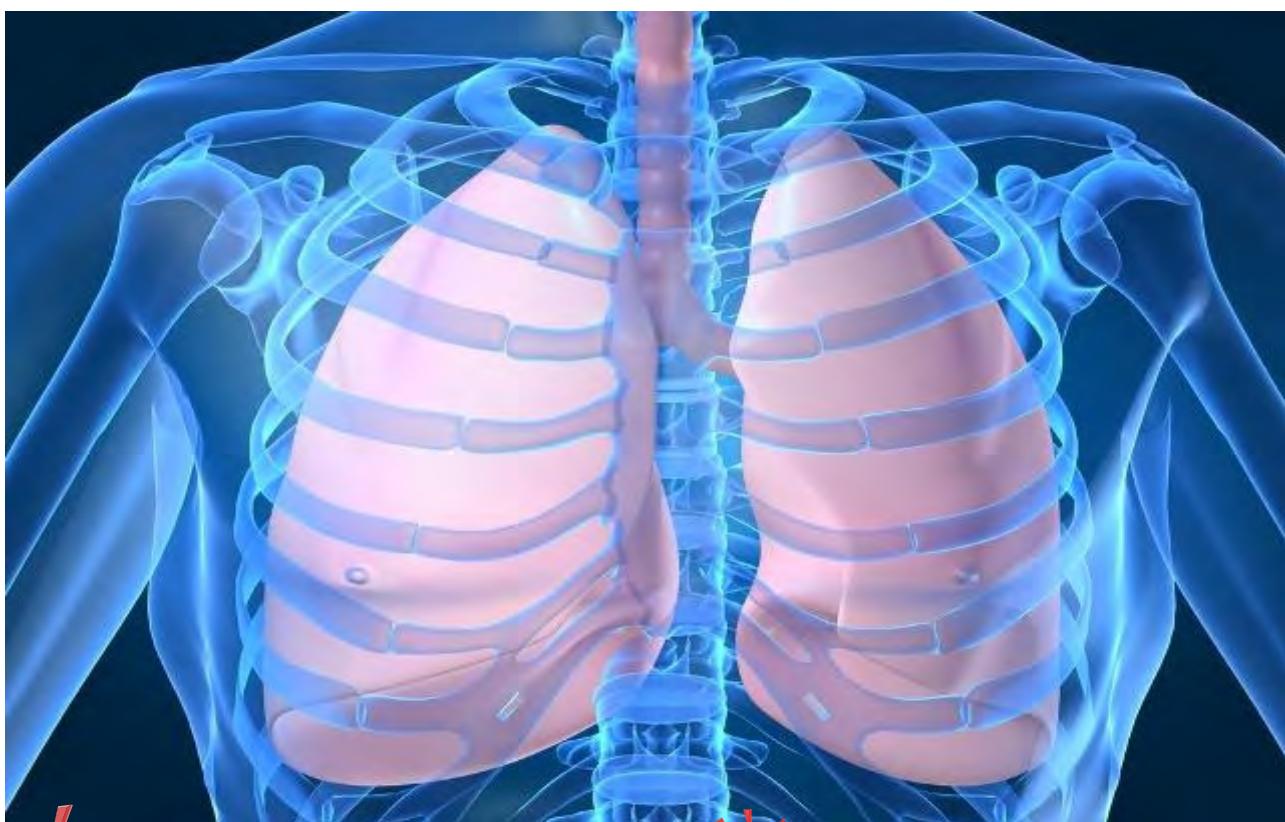
**Follow-up**

- Ask the students to prepare a chart showing the differences between respiration and photosynthesis.
- Ask them to bring it the next day and paste the prepared chart in the class.
- Encourage the working of the students in the class.
- Guide the students to solve the exercise problems given at the end of each unit / chapter of textbook

# Respiratory System

## Human Organ Systems

Grade VII



### Students' Learning Outcome

Students will be able to:

- describe the mechanism of respiration in humans.



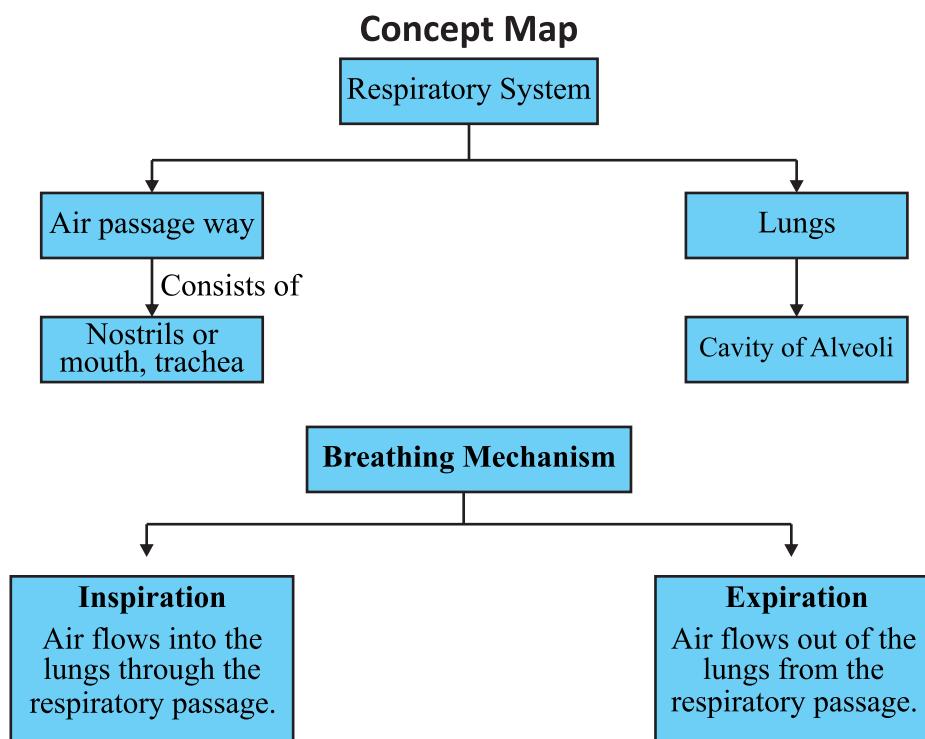
### Information for Teacher

- Many animals possess special breathing mechanisms which increase the rate of exchange of gases between the animals and the external environment.
- The movement of air into and out of the lungs, called "ventilation" renews the oxygen supply in the lungs and removes the surplus carbon dioxide.
- Breathing is a part of respiration in which air is inhaled and exhaled from the lungs.



### Material/Resources Required

charts showing breathing mechanism a large plastic bottle, vinyl tube of about 6 mm straw used for two balloons, plastic bag, thread, rubber band. Plasticines, a pair of scissors, plastic bottle.



### Duration/Number of Period

80 minutes/2 periods



### Introduction

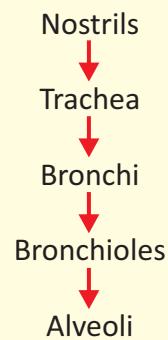
- Call one student in front of the class.
- Ask the student to take a deep breath and ask the other students to follow the same instruction.
- Now ask them what they did? (Expected response: they take in and give out the air)
- Ask the students to put their hand on their chest and feel the change in the thoracic cavity.
- After the students response introduce the today's topic that how the thoracic cavity helps in inhaling and exhaling.



### Development

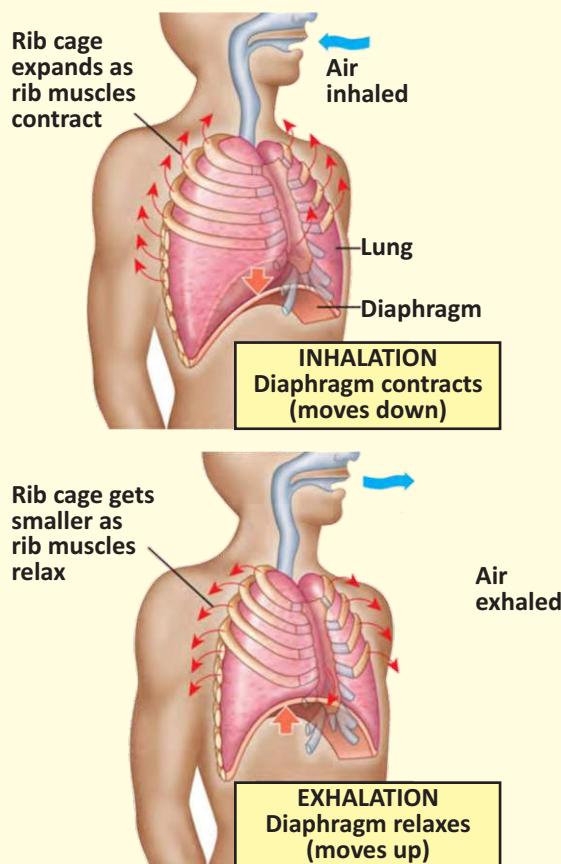
#### ACTIVITY 1

- Show the model / chart of human respiratory system.
- Ask the students to point out / identify parts of the respiratory system.
- Talk about the path or way of air in respiratory system.
- Draw the path way of air on the board by students instruction and ask them to note down on their notebooks.

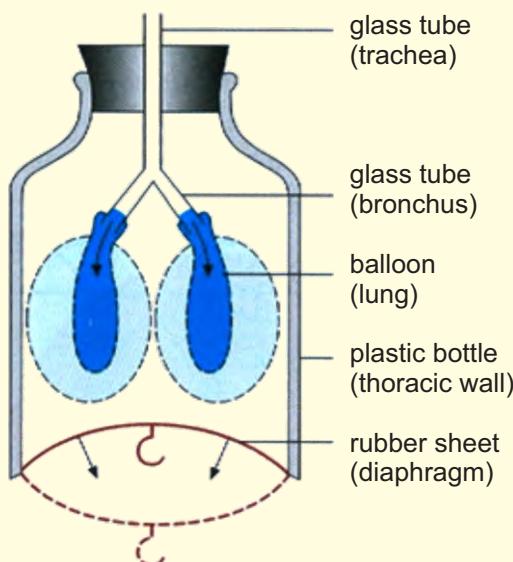


**ACTIVITY 2**

- Show a chart or draw on the board a diagram of the thoracic cavity.
- Ask the students to inhale air and ask:
  - When you inhale, do your ribs move outwards or inwards?
  - Will the diaphragm move upwards or downwards on inhaling air?
- Now ask the students to exhale air and ask:
  - When you exhale, do your ribs move outwards or inwards?
  - On exhalation, will the diaphragm move upwards or downwards?
- Inform the students that the capacity volume of the thoracic cavity will increase during inhalation and decrease during exhalation.

**ACTIVITY 3**

- Prepare a model as shown in figure.
- Ask the students to pull the rubber sheet/balloon attached at the base of the model representing the diaphragm.
- Instruct the students to watch the balloon representing the lungs carefully while diaphragm is being pulled downwards.



- Ask the following questions to involve the students:
  - What happens to the balloon representing the lungs?
  - On inhalation, will the diaphragm move upwards or downwards?
  - What happens when the diaphragm (rubber sheet) is pulled down?
  - What happens when the diaphragm (rubber sheet) is relaxed?
  - What is the relationship between movement of diaphragm (rubber sheet) and Lungs (balloons)?



## Conclusion/Sum up

Sum up the lesson by telling the students that breathing is a part of respiration in which air is inhaled and exhaled from the lungs. When air enters the lungs it is called inspiration and when air is removed from the lungs it is called expiration.



## Assessment

- Draw the given table on the board and ask the students to copy on their notebooks.
- Ask the students to fill the table that how do parts of thoracic cavity help in inhaling and exhaling?

Parts of thoracic cavity	Inhalation	Exhalation
Ribs		
Diaphragm		

- Ask the following questions to enhance their learning.
- Which contains more oxygen inhaled air or exhaled air?
- What is gaseous exchange?
- What happens in your lungs?
- Why does exhaled air have more carbon dioxide than inhaled air?

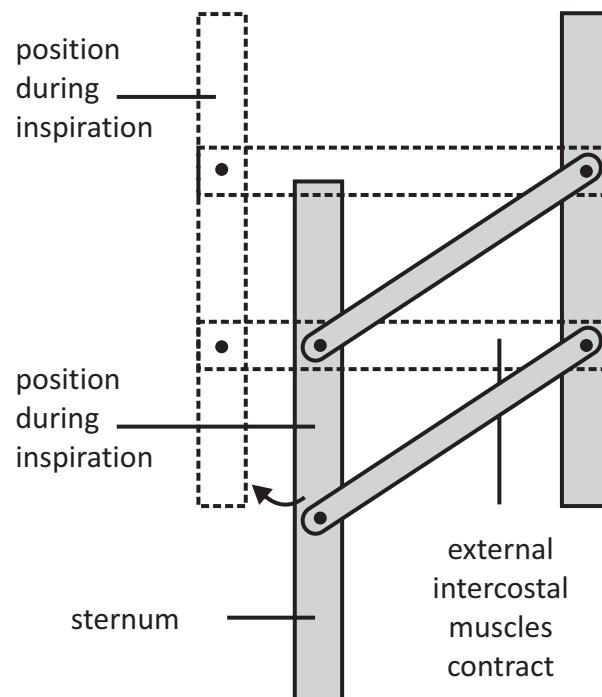


## Follow-up

- Ask the students to prepare a model at home by joining 4 card strips with thumb pins as shown in the figure.
- Ask the students to bring their model next day

and share the working and mechanism of breathing with their class fellows

- Guide the students to solve the exercise problems given at the end of each unit / chapter of textbook



## TOPIC

Lesson Plan  
5

# Common Diseases of Respiratory System

Grade VII



## Students' Learning Outcomes

Students will be able to:

- identify the common diseases of respiratory system and discuss their causes and preventive measures.

## Material/Resources Required



Petroleum Jelly, Paper, drawing board

## Information for Teacher

- Any disorder in the respiratory tract result in complications which ultimately lead to diseases of respiratory tract.

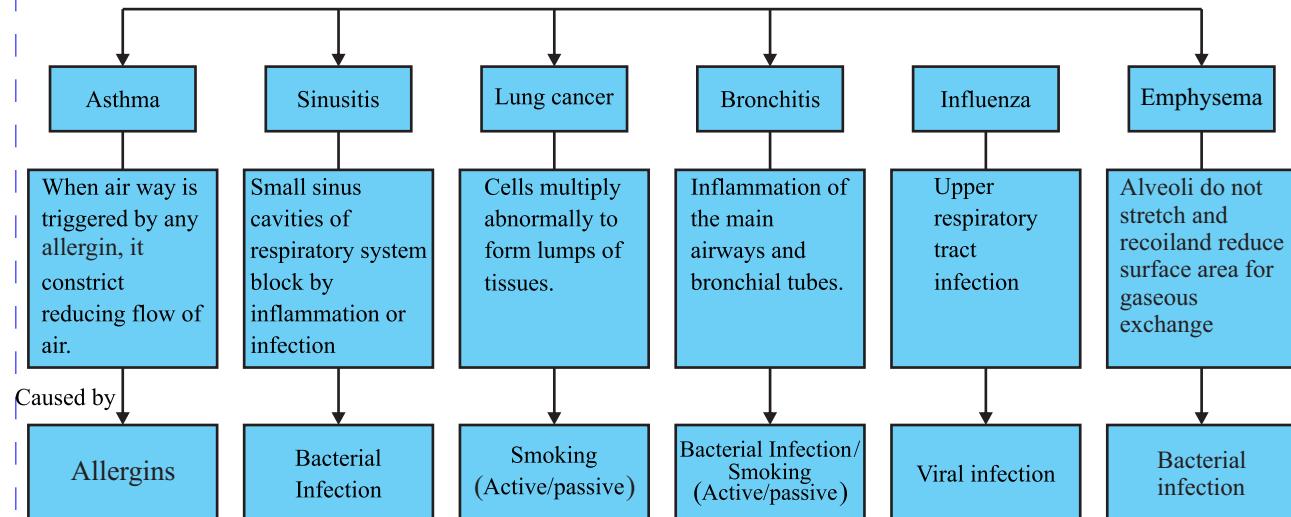


## Duration/Number of Period

40 minutes/1 period

## Concept Map

### Diseases of Respiratory System



## Introduction

- Ask the students have they ever experienced any respiratory disease for example, coughing flue or suffocation.
- Ask the students to make a list of diseases of respiratory system they know.
- After the students' response introduce the today's topic.

## Development

know about the diseases shown in the list.

- Ask the students to talk about symptoms, causes, and preventive measures of disease.
- After the given time, ask them to present the working material in front of the class and encourage.
- Encourage the healthy discussion.
- Add or correct the knowledge of the students.
- Draw a table on the board and fill it with the help of students.

### ACTIVITY 1

- Enlist the different diseases on the board mentioned by the students then add or delete the names of the diseases as the case may be.
- Make groups of the students and allot one disease to each group.
- Ask each group to discuss what they

No.	Disease	Symptoms	Causes	Preventive measures
1.				
2.				
3.				
4.				
5.				
6.				

**ACTIVITY 2**

- Divide the students into groups and instruct them for the following activity.
- Ask the student to take two clean white papers and apply the petroleum jelly on them.
- Ask them to fix one paper on the drawing board and put this paper outside of the classroom.
- Ask them to place the other paper inside the class for few days.
- After 2 or 3 days ask the students to compare both papers and note down the change.
- Ask the students which paper is looking more dirty.
- What this activity shows?
- How you can correlate this activity with the problems caused in respiratory tract.
- Inform the students that the respiratory tract has a similar sticky material like petroleum jelly that can trap the dust particals, smoke and different allergins. These particles can cause the inflammation and infection in the respiration tract.

**Assessment**

- Ask the following questions to assess the understanding of the students.
  - What healthy habits can keep us away from respiratory diseases?
  - Why do people with asthma use an inhaler?
  - What happens if your lungs get damaged?
  - What are the consequences of lung cancer?

**Follow-up**

- Discuss the trend of “Removal of Carpets” from living areas and ask them to discuss it with the class fellows. Ask the students to use the resources, library, magazines or internet at home.
- Ask the students to collect the different pictures showing the respiratory disorders from the newspaper or any journal and paste it on their notebooks.
- Guide the students to solve the exercise problems given at the end of each unit / chapter of textbook.

**Conclusion/Sum up**

Conclude the lesson with the help of students as: diseases in respiratory system occur due to unhealthy air having virus, bacteria, smoke and other pollutants. Some of these common diseases are asthma, sinusitis, lung cancer, bronchitis, influenza etc.

# Nervous System

Grade VIII



## Students' Learning Outcome

Students will be able to:

- describe the structure and function of the nervous system.
- describe the working of the nervous system through a model.



## Information for Teacher

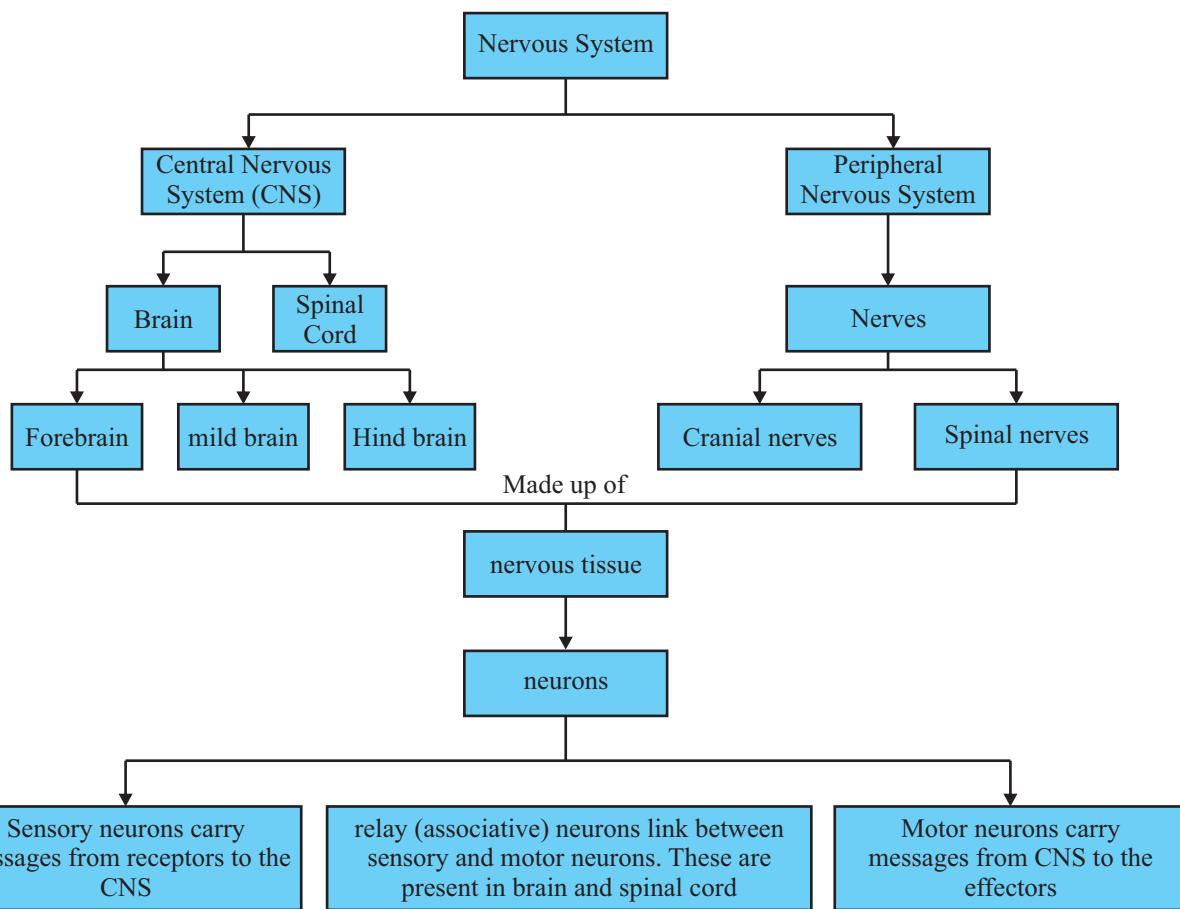
- The structural and functional unit of the nervous system is neuron.
- The nervous system is a mean by which quick coordination among the various parts of the body is carried out.
- Nervous system consolidate information of stimuli, comprehend it and formulate the type of response to be produce.



## Duration/Number of Period

80 minutes / 2 period

## Concept Map



### Working of Nervous System



### Material/Resources Required

Charts showing structure of brain, Model showing working of nervous system

- Why there is a need of nervous system in our body?
- After their response introduce the today's topic.



### Introduction

- Ask the questions like there
  - What is the role of brain in the body?
  - Where the spinal cord is present in your body?



### Development

#### ACTIVITY 1

- Show the chart or model of the nervous system to the students and explain the structure of nervous system along with the function of each part.

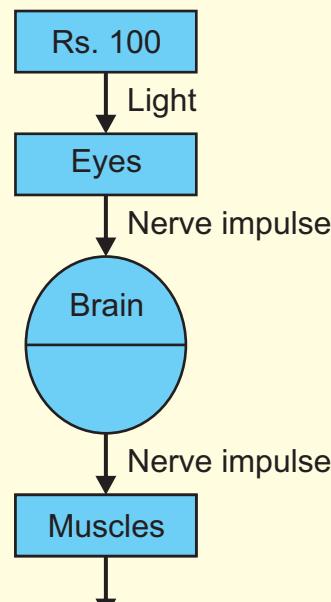
- Draw the following table on the board and fill it with the help of students.
- Ask the students to copy it on their note books.

Parts of Nervous System	Function
Forebrain	
Midbrain	
Hindbrain	
Spinal cord	
Nerves	

### ACTIVITY 2

- Let the students suppose that one of the student saw a Rs.100 note lying on the floor. He bend down and pick it up.
- Ask to them why this is so? (expected answer: this is because of our nervous system)
- Inform them that their sense organs send information to their brain all the time.
- Now ask the following questions:
  - How does your brain know about the money?
  - Which receptor inform you about the presence of Rs.100 note?
  - What is your response to seeing the Rs.100 note?
  - Which part of your body produced this response?
- Inform the students that the receptors in their eyes send information to their brain. This is called nerve impulse. The central nervous system (CNS) decides the action and muscles in their arm produce the necessary movement to pick up the Rs.100 note
- Further explain the topic by drawing the

table on board as following:



### ACTIVITY 3

- Ask the students to draw the sequence of stimulus, receptor, effectors, CNS and response according to their understanding from the above activity.
- Draw the following diagram after the students response.



### Conclusion/sum up

Sum up the lesson as: the nervous system is a means by which quick coordination of various parts of the body can be carried out. It consists of central and peripheral systems. Central nervous system consists of brain and spinal cord. Peripheral nervous system consists of two types

of nerves. Sensory nerves take message from sensory organs to central nervous system and motor nerves take message from central nervous system to effector.



### Assessment

#### Activity 1:

- Share this with the students that some athletes are ready to start a race. They must set off as fast as they can when they hear the sound of whistle.
- Ask them to describe, step by step, what happens inside an athlete's body when the whistle is blown.

#### Activity 2:

- Ask the students to enlist the names of receptors and effectors involved in the following daily life activities.



### Follow-up

#### Enrichment activity

- Ask students to prepare model of human nervous system with the help of thermopore sheet.
- Model preparation may be given as a project to the students.
- Guide the students to solve the exercise problems given at the end of each unit / chapter of textbook.



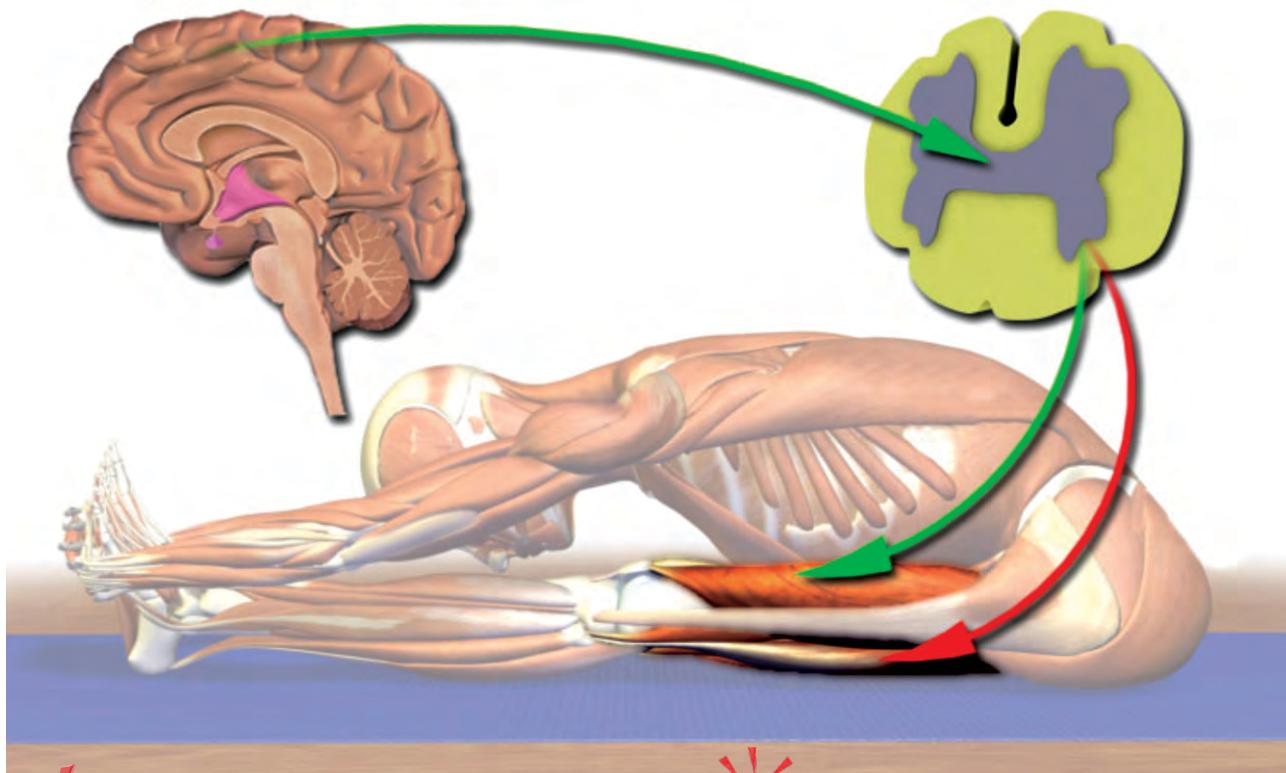
### Home work

Ask the students to create a resemblance to relate the nervous system to a telecommunication system in their note books with the help of other resources.

No.	Activity of the body	Receptor involved	Effector involved
1.	Reading a book		
2.	Writing letter to a friend		
3.	talking to a friend		
4.	Listening the radio		
5.	Looking for food		
6.	Smelling the flower/perfume		

# Reflex action

Grade VIII



## Students' Learning Outcomes

Students will be able to:

- Explain reflex action with an example.
- Differentiate between voluntary and involuntary actions they have experienced.



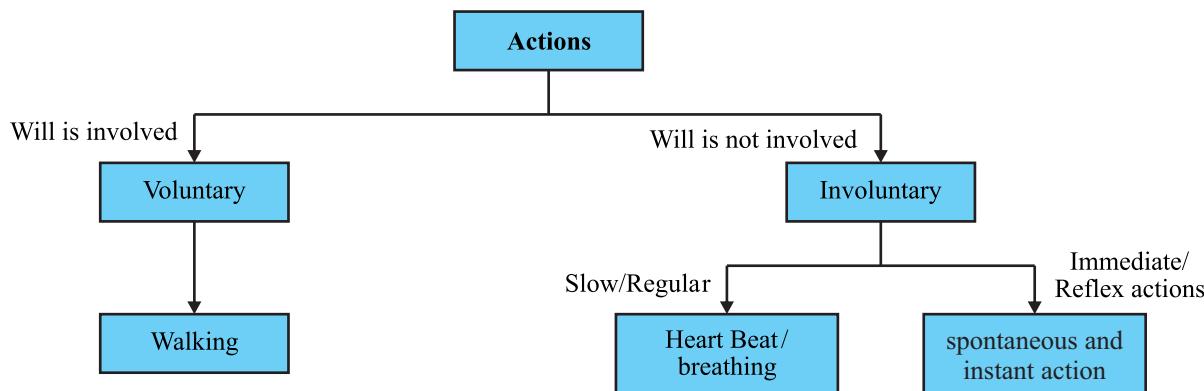
40 minutes/1 period



## Information for Teacher

- A reflex action is automatic response to a specific stimuli.
- The reflex is regarded as the functional unit of the system.
- An involuntary action is an action which takes place without any conscious recognition or control e.g. blinking of eye.
- An action which takes place willingly under the directions from brain is a voluntary action e.g. lifting of book.

### Concept Map:



### Material/Resources Required

Charts showing the reflex action



### Introduction

- Create some situation for example by throwing torch light in the eyes of one or two students to react suddenly. Teacher will ask questions like:
  - What I did?
  - What was the reaction of my act?
  - Why it happened?
  - If my action was not sudden, what could be the reaction?
- After their responses now introduce the today's topic.

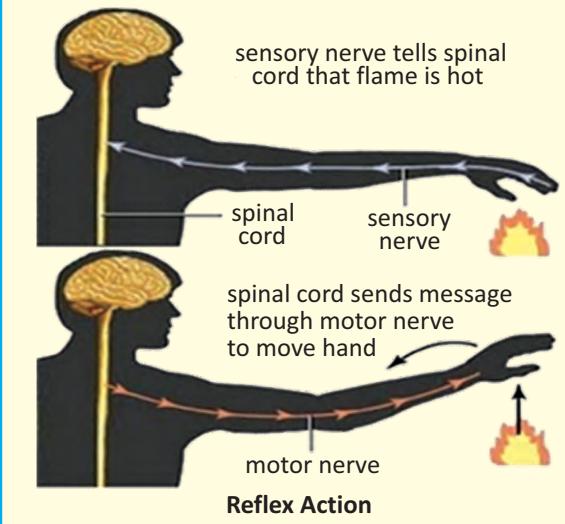


### Development

#### ACTIVITY 1

- Show the students chart of reflex action or draw it on the board and explain the reflex action.
- Ask the students to copy on their notebooks, what they understand.

- Now make groups of 3-4 students.
- Ask each group to think of 3 reflex actions other than the already mentioned.
- Ask them that for each action state the precise stimulus, name the receptor which first detects this stimulus, name the effector which responds to it, and describe the way in which this effector responds.



#### ACTIVITY 2

- Ask the students about voluntary and involuntary actions.
- After their responses explain these

actions.

- Draw a table on the board and ask the students to fill and copy on their notebooks.
- Ask the students to enlist the different voluntary and involuntary actions.

Voluntary Action	Involuntary Action



### Follow-up

- Ask the students to prepare chart or model showing reflex action.
- Ask them to bring it the next day and paste the prepared chart in the class.
- Encourage the working of the students in the class.
- Guide the students to solve the exercise problems given at the end of unit /chapter of textbook.



### Conclusion/Sum up

Repeat the important points of the lesson. A reflex action is automatic response to specific stimuli. It is of two types voluntary and involuntary. Voluntary action is that in which will is involved e.g. walking, catching etc. Involuntary action is that in which will is not involved e.g. heartbeat, knee jerk etc.



### Assessment

Ask the following questions to enhance their learning process:

1. A cricket player injured his lower back but not his legs. However, he could not move his legs. Why is that so?
2. Fatima and Ali are performing two actions. How these actions are similar or different?

- Fatima stretched out her arm to shake hands with Sara

- Ali suddenly withdrew his hand on touching a hot object.

UNIT

TOPIC

Lesson Plan

8

3

# Cell Division

## Heredity in Organisms

Grade VIII



### Students' Learning Outcomes

Students will be able to:

- understand process of cell division.
- differentiate between mitosis and meiosis.



### Information for Teacher

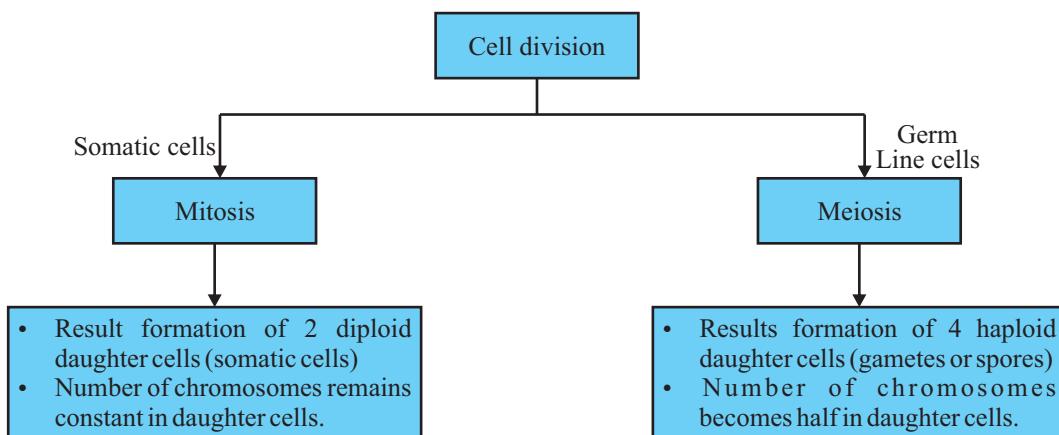
#### Process of Mitosis and Meiosis

- The ability to reproduce is a characteristic of living things.
- Cellular reproduction is commonly referred as cell division and it is a part of the whole life of a cell i.e cell cycle.



40 min/1 period

## Concept Map



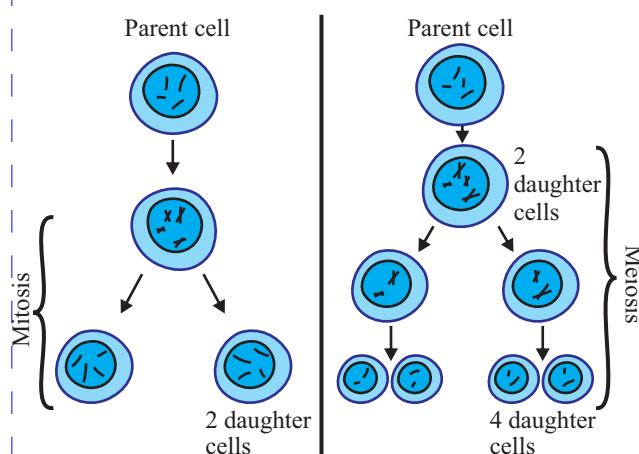
### Material/Resources Required

Charts of mitosis and meiosis



### Introduction

- Recall the knowledge about the cell and reproduction.
- Let them think that why there is a need of cell division?
- Introduce the term "cell division" by



simple line drawing on the board.

- Introduce the two types of cell division

i.e. mitosis and meiosis by drawing.

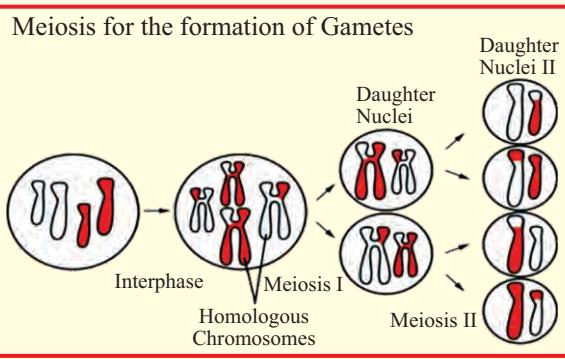
- Ask why our features resemble with our parents and siblings.



### Development

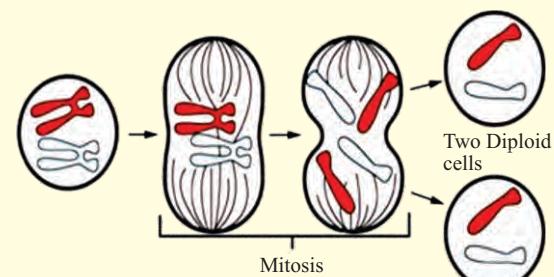
#### ACTIVITY 1

- Show the students charts of both divisions one by one or draw it on the board and explain the divisions on the basis of chromosomes, occurrence and importance.
- Inform the students about the haploid and diploid cells.
- Ask the students
  - From which type of cell a zygote is developed?



- Ask about the importance of these divisions.

Mitosis in Somatic Cells

**ACTIVITY 2**

Ask the student to draw a table on their notebooks and write the probable differences between mitosis and meiosis.

Mitosis	Meiosis

**Conclusion/Sum up**

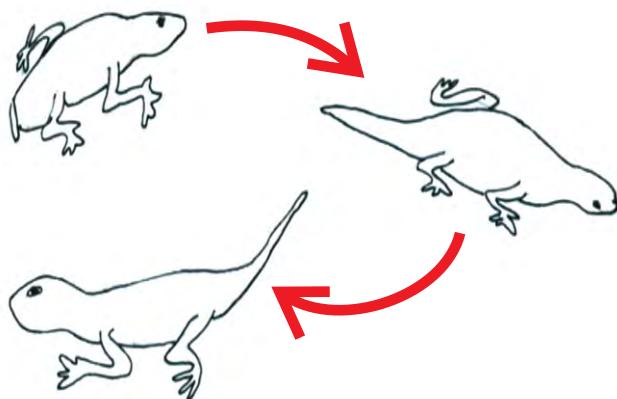
Conclude the lesson as: cell division is of two types; mitosis and meiosis. In mitosis two diploid daughter cells are formed and number of chromosomes remains as in parent cell. In meiosis four haploid daughter cells and number of chromosomes becomes half as compared to parent cell.

**Assessment**

- Draw a table on the board to differentiate between mitosis and meiosis and fill it with the help of students.
- Ask the students to copy on their notebooks.

No.		Mitosis	Meiosis
1.	Occurrence		
2.	Number of Chromosomes		
3.	Number of Daughter		

- Ask the following questions to enhance their learning:
  - If the parent cell having 24 chromosomes undergoes mitosis then how many chromosomes will be present in daughter cells?
  - If there is some cut in your body which division heals it?
  - The diagram below shows a lizard in various stages of regeneration of its tail.



What cellular process is directly responsible for this regeneration?

- a. Meiosis
- b. Mitosis



### Follow-up

Write the following questions on the board and ask them to copy and solve as homework on their notebooks.

- Draw a diagram to show a type of cell division which produces daughter cells just like the parent cell, also name the diagram.
- Draw a diagram to show a type of cell division which produces daughter cells with only half the number of chromosomes as the parent cell, also name the diagram.
- Guide the students to solve the exercise problems given at the end of each unit / chapter of textbook.

# Biotechnology and its Applications

Grade VIII



## Students' Learning Outcome

Students will be able to:

- define Biotechnology.
- list some biotechnological products used in daily life.
- list general application of biotechnology in various fields.



## Material/Resources Required

Water, flour, yeast, bowl, beaker



## Information for Teacher

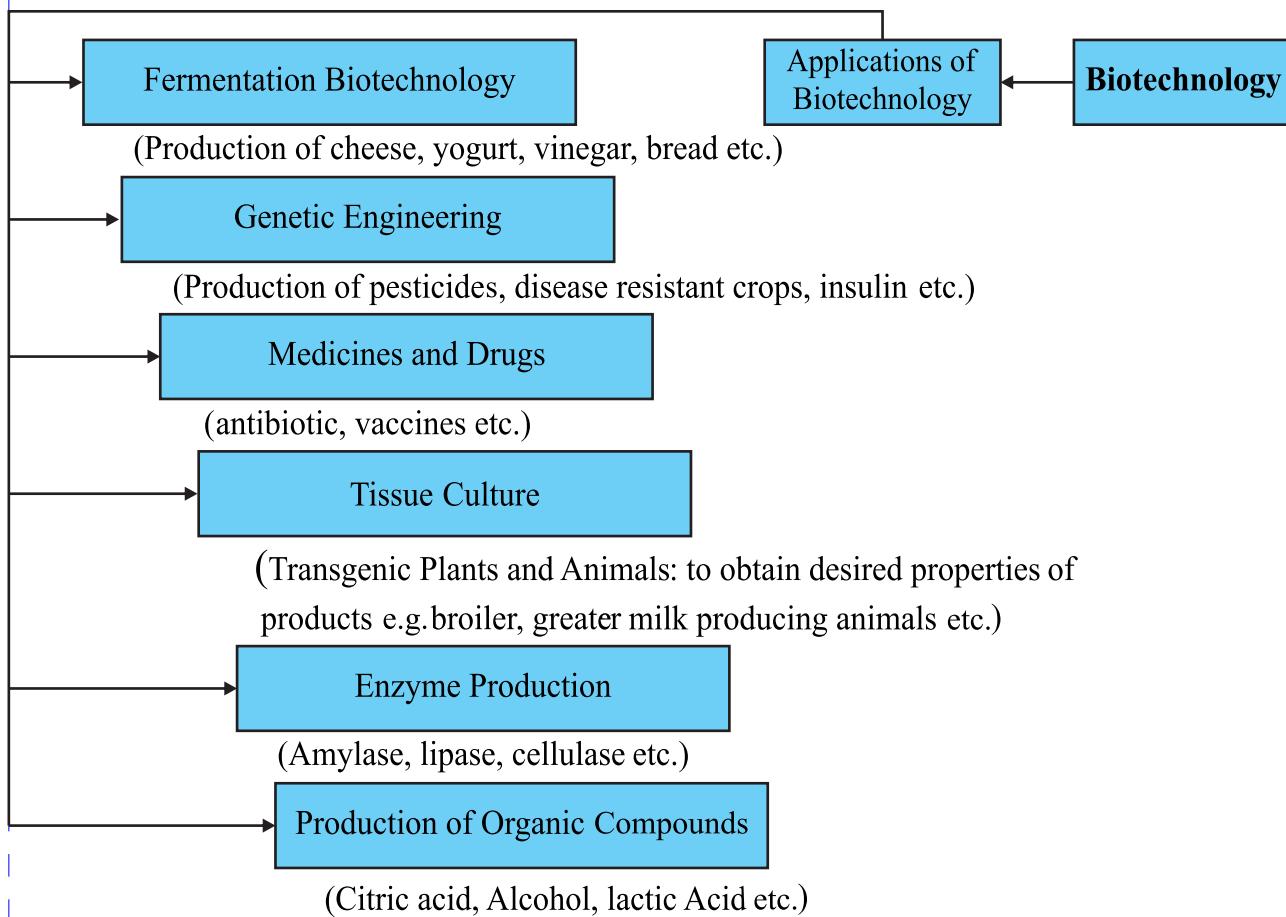
- Biotechnology is a large-scale industrial use of biological processes of microorganisms to make substances useful for mankind.



## Duration/Number of Period

80 minutes/2 period

### Concept Map



### Introduction

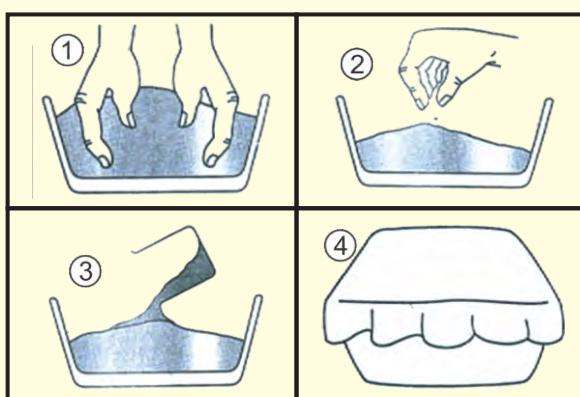
- Brainstorm the students about asking different questions:
  - What they know about microorganisms?
  - How they are useful for the mankind? (Expected response: They are used in making yogurt, cake, bread, milk, meat and medicines.)
- Now introduce them the today's topic “Biotechnology and its application” in which they will learn, how the scientists use the microorganisms in order to make products for human use.



### Development

#### ACTIVITY 1

- Arrange the warm water, flour and yeast.
- Ask the students to:
- Mix the yeast with the flour, and add warm water to make dough.
- Leave it for 20 minutes.
- Then ask the students to observe this dough carefully and tell:
  - What is the change?
  - What may be the cause of this change?



- Now explain that yeast acted upon flour dough and produced  $\text{CO}_2$  and alcohol, which made hollow cavities / pores inside the dough. This process is known as fermentation.

Water + Flour



Alcohol + Carbon dioxide

- Now introduce the term Biotechnology and define with the help of students.
- Ask the students about some biotechnological products used in daily life and make a list on the board.
- Ask the students about general applications of biotechnology in various fields and make a list on board.
- After that ask the students to copy from the board on their notebooks.

## ACTIVITY 2

- Ask the students that what do diabetic persons use for their treatment? (Expected response: Medicine Insulin)
- From where they get insulin? (Expected response: Medical store)
- Can you guess, how this insulin is prepared on commercial basis for the use of diabetic persons? (Expected response:

By microorganisms)

- Now explain the other applications of biotechnology like tissue culture, medicines, drugs, dairy and bakery items etc. (as given in the concept map)



## Conclusion/Sum up

Summarize the lesson. Biotechnology is a large scale industrial use of biological processes of microorganisms to make substances useful for mankind e.g. making of yogurt, cake, bread, and medicine etc.



## Assessment

- Ask the students to write the names of the products in front of process of biotechnology given in the table.

Applications	Products
Fermentation	
Genetic engineering	
Tissue culture	

- What will happen if we add yeast instead of baking soda in dough for making pizza/cake?



## Follow-up

- Make a list of biotechnology products.
- Guide the students to solve the exercise problems given at the end of unit / chapter of textbook.

## TOPIC

Lesson Plan  
10

# DNA, Genes and Chromosomes

Grade VIII



## Students' Learning Outcomes

Students will be able to:

- describe the relationship between DNA, Gene and Chromosome.
- explain how DNA is copied and made.



## Information for Teacher

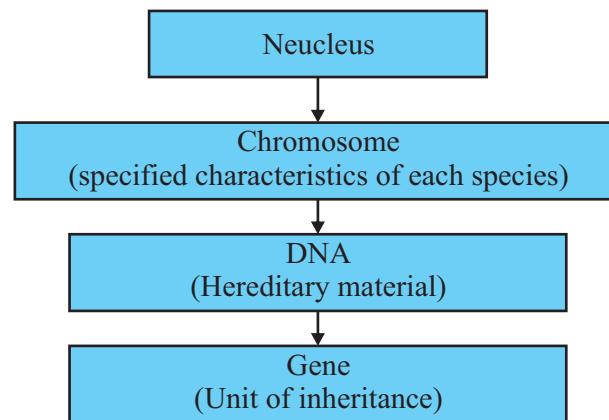
- Chromosomes are small thread like structure found in the nucleus of the cell which control the characteristics of living organisms.
- DNA is called the hereditary material because it is capable of self replication and is transferred from one generation to other.
- Genes are the unit of inheritance and these are the short lengths of DNA in chromosomes.



## Duration/Number of Period

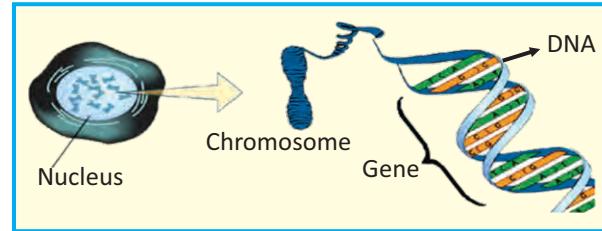
80 minutes/2 period

### Concept Map



### Material/Resources Required

- A chart or model showing DNA, Gene and chromosomes, A chart showing the process of replication of DNA



### Introduction

- Ask following questions to the students:
  - What is inheritance? (Correct response: passage of traits from one generation to the other)
  - What is called as the genetic material? (Expected response: DNA)
  - Genes are made of? (expected response: DNA)
  - Where the genes are located? (Expected response: on chromosomes)
- After the students response introduce the today's topic to the class.



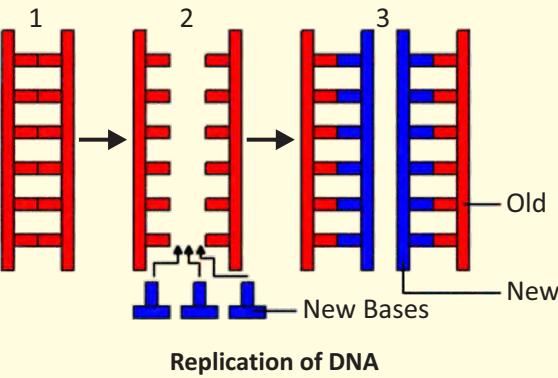
### Development

#### ACTIVITY 1

- Show chart or model to the students and explain them the relationship among DNA, Gene and chromosomes.

#### ACTIVITY 2

- Explain the process of replication of DNA to the students with the help of a chart.



### Conclusion/Sum up

Summarize the lesson as; chromosomes are thin thread like structures present in the nucleus of the cell. Chromosomes are made of DNA. Genes are the unit of inheritance which transfer characters to the next generation. DNA is capable of self replication.



## Assessment

- Ask the following questions to assess the understanding of the students:
  - How the genes and DNA are interlinked?
  - Where the chromosomes are located inside the cells?
  - Which information is stored in the genes?
  - What is meant by replication?
  - In DNA replication, what happens to the original DNA strands?



## Follow-up

- Ask the students to build DNA model by using cut outs of card board paper of different colors, and display the model in the class.
- Guide the students to solve the exercise problems given at the end of unit / chapter of textbook.

## TOPIC

Lesson Plan  
11

# Genetic Modifications

Grade VIII



## Students' Learning Outcomes

Students will be able to:

- define bacterium.
- explain how genes are introduced into a bacterium.



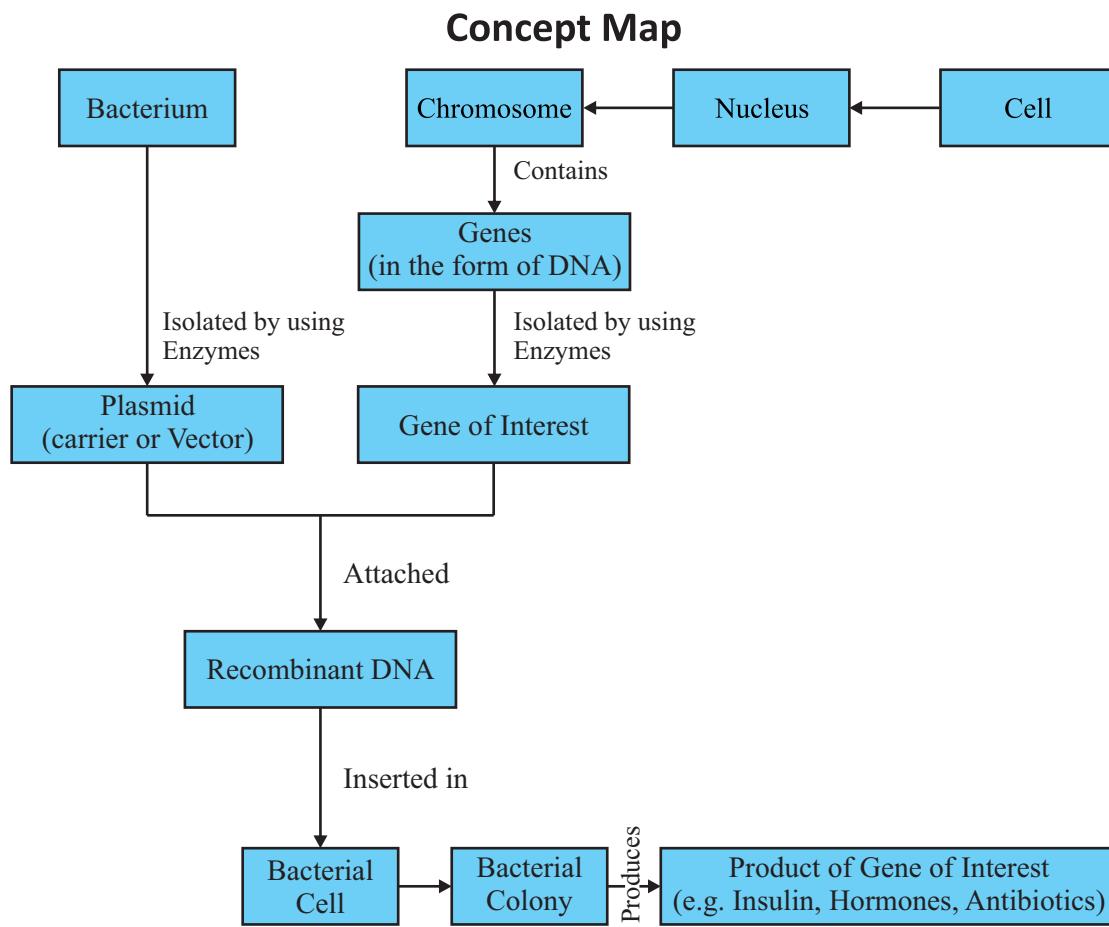
## Information for Teacher

- Bacterium is a unicellular microorganism which contains a circular extra chromosomal region, known as plasmid.
- Plasmid is used as vector, (can carry foreign gene) in genetic engineering
- Replication time of plasmid is very short. So, it replicates very fast.



## Duration/Number of Period

80 minutes/2 period



### Material/Resources Required

board, chalk/marker, Chart, coloured cards, scissors, white sheets, gum



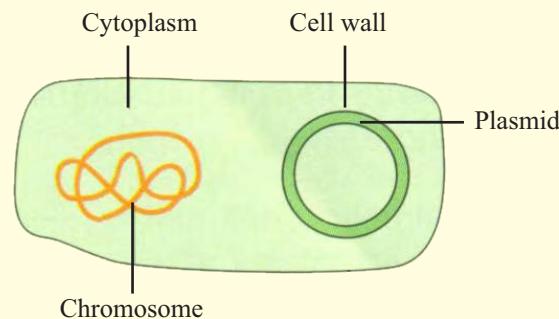
### Introduction

- Ask following questions to the students:
  - Are the bacteria unicellular or multi cellular?
  - Do the bacteria contain chromosome?
- Now introduce the students about today's topic "process of genetic engineering".

### Development

#### ACTIVITY 1

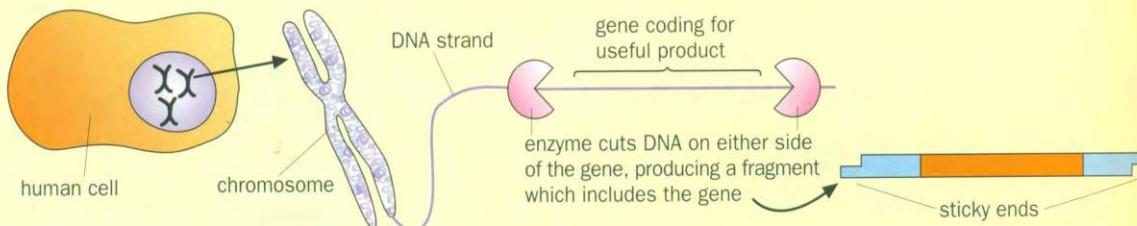
- Draw the diagram of a bacterium on the board.
- Explain the structure of a bacterium with the help of diagram.



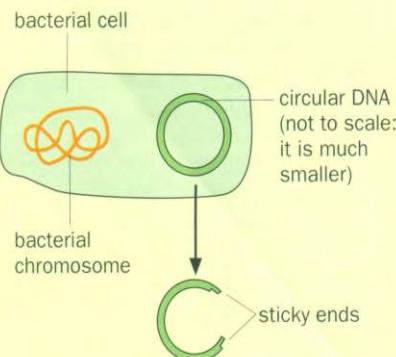
**ACTIVITY 2**

Explain the students that how genes are introduced into the bacterium with the help of following chart.

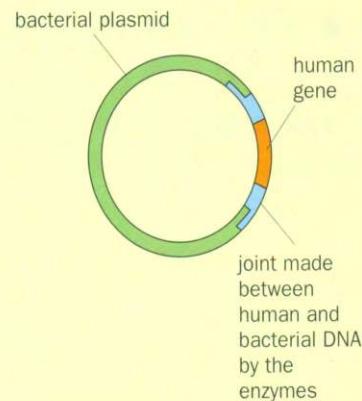
**Step 1:** Isolate the gene and cut it out using a suitable enzyme:



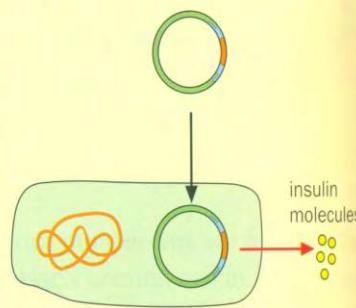
**Step 2:** Isolate a circular DNA (plasmid) from a bacterial cell and cut it with the same type of enzyme used in step 1.



**Step 3:** Insert the human DNA into the bacterial DNA using an enzyme to join the sticky ends.



**Step 4:** Treat the bacterium so that it takes up the DNA. Once this is successful, the bacterium will multiply, resulting in the simultaneous multiplication of the human gene. If the human gene codes for insulin production, then each transgenic cell will make insulin molecules.

**Conclusion/sum up**

Tell the students that we have learnt that bacterium is a unicellular microorganism and contains extra chromosomal region which can carry foreign gene. This extra chromosomal region is known as plasmid. It replicates very fast. Plasmid is used as vector.

**Assessment**

- Arrange the required material.
- Divide the class into groups.

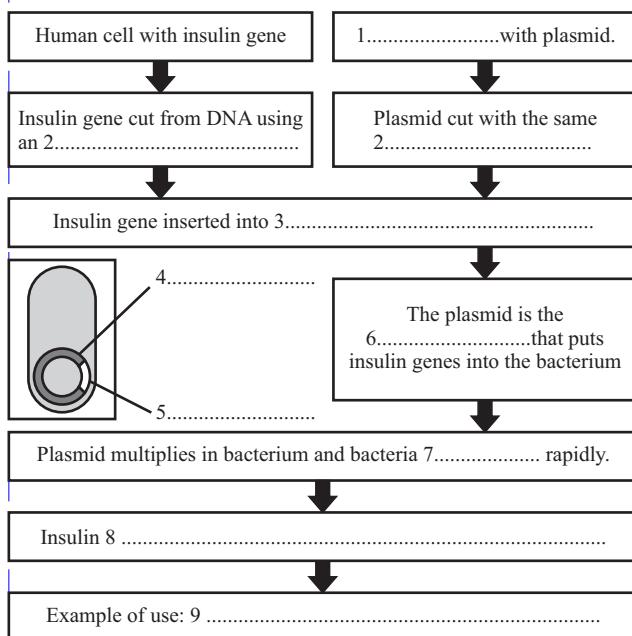
- Tell the students that each of the two different coloured cards represent bacterial plasmid and DNA (gene) respectively.
- Ask the students to prepare
  - A ring - like structure from a card which represents a plasmid.
  - Cut a half inch card from the ring making an opening.
  - Take a piece of the other card of same size of ring opening, and paste this piece on ring with the help of gum.
  - Paste the ring on piece of white paper.
- Now ask following question from the students.

What does it represent?	Correct/expected response
Ring	Plasmid
Small piece of card	D N A (Gene)
Scissors	Cutting enzyme
Glue / gum	Joining enzyme



### Follow-up

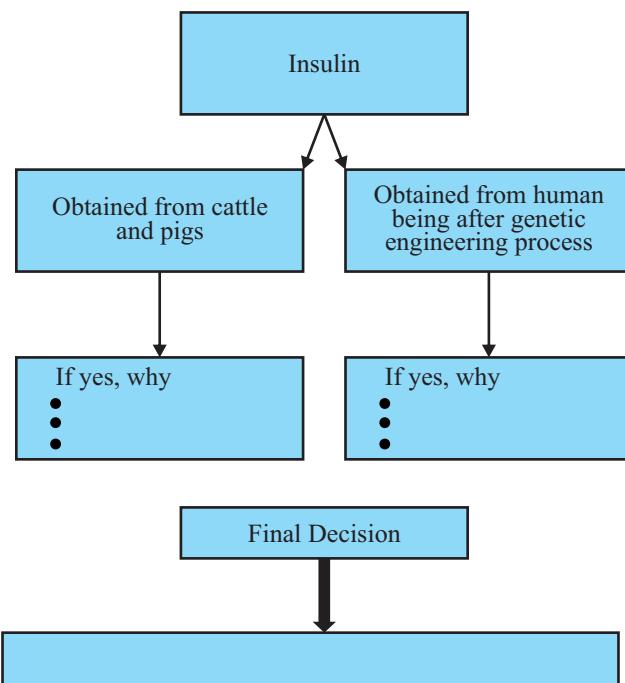
- Draw the following worksheet on the board
- Ask the students to copy on their notebooks and complete it.



Expected response is as follow:

1. Bacterium
2. Cutting enzyme
3. Plasmid
4. Plasmid
5. Inserted gene
6. Carrier
7. Divides

8. produced
  9. Genetic engineering
- A man was diagnosed diabetes. Doctors recommended him insulin daily. He has two options to get insulin, one from pig and other from bacteria through genetic engineering. Which source of insulin is best?



# Air Pollutants

## Pollutants and Their Effects on Environment

Grade VIII



### Students' Learning Outcome

Students will be able to:

- Explain the sources, properties and harmful effects of air pollutants.



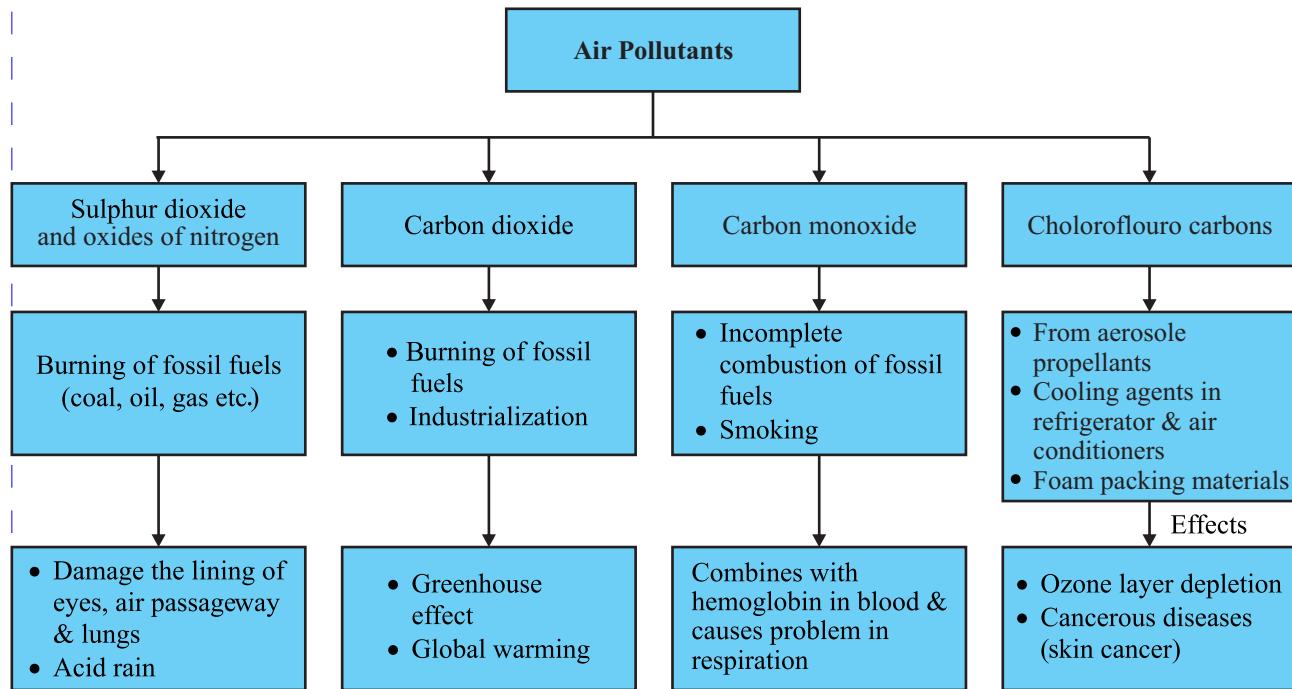
### Information for Teacher

- Pollution is a process through which harmful substances are added to the environment and these harmful substances are called pollutants. Presence of these substances in air

is called air pollution.

- Air pollution is mainly caused by dust, sulphur dioxide, carbon dioxide, nitrogen oxide, hydrocarbons and ozone.
- The air pollutants added into the air may be due to human activities (e.g. Burning of fossil fuels, exhaust fumes from motor vehicles and burning of garbage.) and natural occurrences (e.g. biological decay, forest fires or volcanic eruptions)
- Air pollution damages or defiles the environment, making it undesirable or unfit for life.

## Concept Map



40 minutes/1 period

### Material/Resources Required

board, chalk/marker, Chart, coloured cards, scissors, white sheets, gum



### Introduction

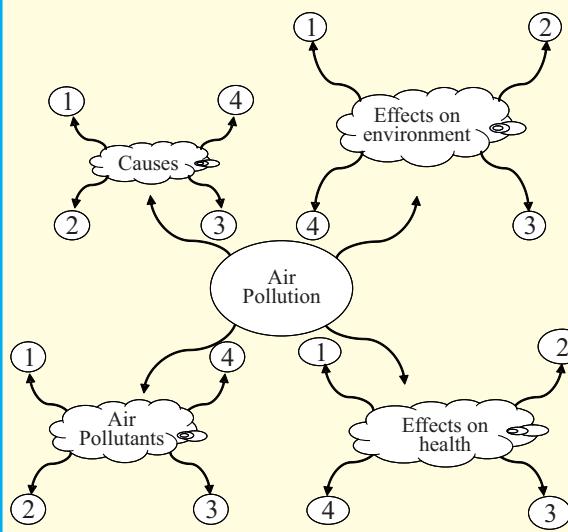
- Brainstorm the students by asking the following questions:
  - What do you mean by pollution?
  - Do you know about the different types of pollution?
  - What are the causes of pollution?
  - What are the effects of pollution on our health and environment?



### Development

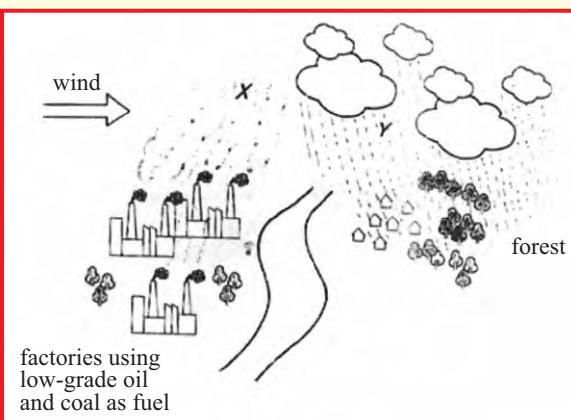
#### ACTIVITY 1

- Draw the diagram on the board as shown below and ask the students about the air pollutants, its causes, and its effects on the environment and health.



**ACTIVITY 2**

- Draw this figure or paste already drawn figure on a board showing an important source of air pollution and ask questions from the students.
- Write these questions on the board and complete it by the students.



- X' is a gaseous pollutant that gives rise to 'Y'. Identify 'X' and 'Y'

**X****Y**

- |   |              |
|---|--------------|
| <input type="checkbox"/> A. Carbon dioxide      | Hailstones   |
| <input type="checkbox"/> B. Carbon monoxide     | Acid rain    |
| <input type="checkbox"/> C. Chloroflouro carbon | Thunderstorm |
| <input type="checkbox"/> D. Sulphur dioxide     | Acid Rain    |

- How does 'Y' affect the forests in long term?
- A. It reduces its rate of transpiration.  
 B. It kills the trees  
 C. It reduces its photosynthesis

**Conclusion/Sum up**

Ask the students following questions

- Define pollution. (Expected response will be: Pollution is a process through which harmful

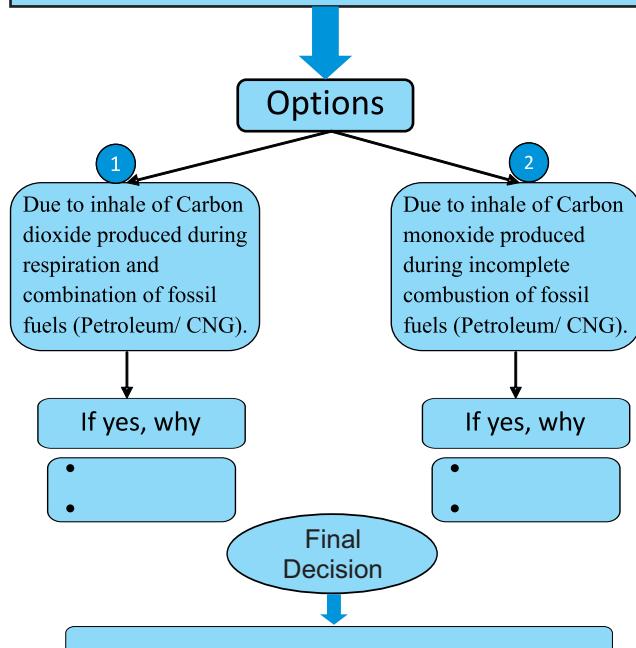
substances are added to the environment.)

- What are pollutants? (Expected response will be: Harmful substances are added to the environment by pollution.)
- What are the major causes and effects of air pollution? (Expected response will be: Air pollution is mainly caused by dust, sulphur dioxide, carbon dioxide, carbon monoxide, nitrogen oxide, hydrocarbons and ozone. It may also be due to human activities (e.g. burning of fossil fuels, exhaust fumes from motor vehicles, and burning of garbage.) and natural occurrences (e.g. biological decay, forest fires or volcanic eruptions). Air pollution damages or defies the environment, making it undesirable or unfit for life.

**Assessment**

Ask the students to solve the following problem:

A cat was left in a stationary car with its engine running, air conditioner and ir blower on, and window closed, the cat found deat after a few hours. What could have caused its death?





### Follow-up

Write the following questions on the board and ask them to copy and solve as homework on their notebooks:

- Since sulphur dioxide is the major pollutant because of human activities, what suggestions would you give to reduce its release into the atmosphere?
- What can you do to prevent the further thinning of the ozone layer?
- Guide the students to solve the exercise problems given at the end of unit / chapter of textbook.

## TOPIC

Lesson Plan  
13

# Deforestation and Our Environment

Grade VIII



 **Students' Learning Outcomes**

Students will be able to:

- define deforestation.
- state the effects of deforestation on the environment.

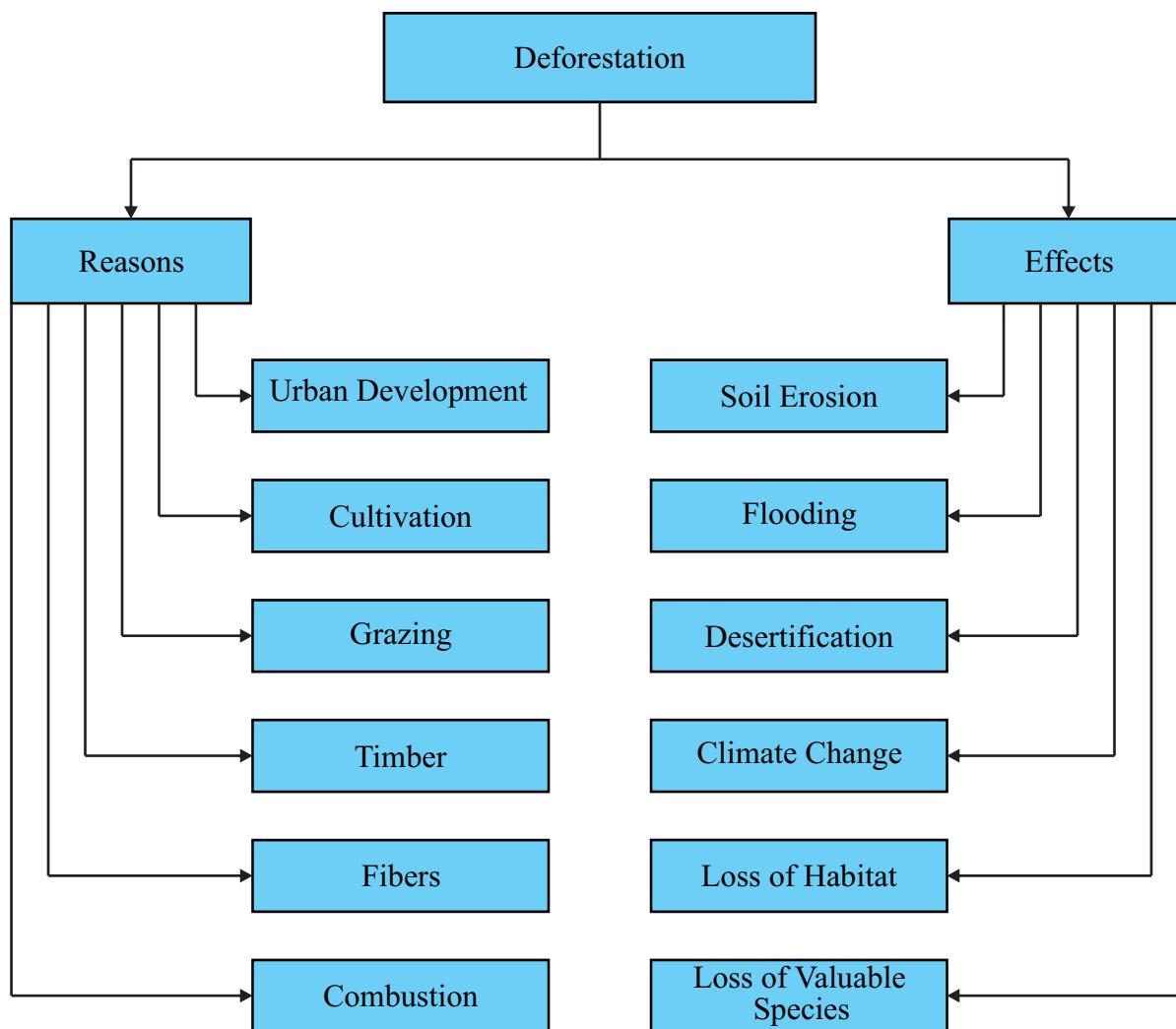
 **Information for Teacher**

- Deforestation means the cutting of trees. It is done for various purposes, like urban development, cultivation, grazing, and combustions and to get timber and fiber.
- Deforestation is one of the ways, through which human beings destroy the natural habitats for their own purposes.
- The total area of forests in Pakistan is 4.224 million hectares which is 4.8% of the total land area.

 **Duration/Number of Period**

40 minutes/1 period

## Concept Map



### Material/Resources Required

board, chalk/marker, coloured cards, scissors, white sheets, gum, Charts, flash cards



### Introduction

- Conduct a brainstorming session with the students. The following questions may be asked in this session:
- What are the benefits of trees?

- Each year the government and non-government organization conduct awareness and practical campaigns of tree plantation. What is the purpose of this activity?
- Whenever roads or huge buildings are constructed, the environmental protection department does not allow any cutting of trees that may be on the way of construction. Why is it done so?
- Now, summarize the benefits of trees and forests and introduce the today's topic.



## Development

### ACTIVITY 1

- Enlist the benefits of trees / forests (from students' response in the brainstorming session). Discuss the benefits which students have missed and add these to the list.
- Inform students about the rate of deforestation in the world and in Pakistan.

### ACTIVITY 2

- Divide the students into groups.
- Give the following cards to each group, and ask them to sequence the cards in a logical relationship i.e. how the processes are linked. The difficulty in the task is that an effect of one process is often the cause of another.
- Work out the **causal relationship** in the first effect "destruction of natural habitats".

Loss of home for wildlife	Cutting down of trees	Extinction of wildlife species in forest	Destruction of natural habitats
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- Work out the **causal relationship** in the second effect "increase in carbon dioxide concentration in the atmosphere".

Less carbon dioxide is absorbed	Cutting down of trees	Fewer plants carry out photosynthesis	Rise in the concentration of carbon dioxide in atmosphere
---------------------------------	-----------------------	---------------------------------------	---

- Work out the **causal relationship** in the third effect "soil erosion".

Cutting down of trees	Flooding	Soil erosion	Top soil is washed away to rivers by rain
Removal of protection	Soil is blow away by wind	Land may become a desert	Loss of agricultural land

- Discuss the other effects in the same way.



## Conclusion/Sum up

Tell the students that today we have learnt about deforestation and effects of deforestation on the environment.

Deforestation is the cutting of trees for various purposes and is one of the ways through which human beings destroy the natural habitats for their own purposes. Soil erosion, flooding, deforestation, climate change, loss of habitat and valuable species are the effects of deforestation.

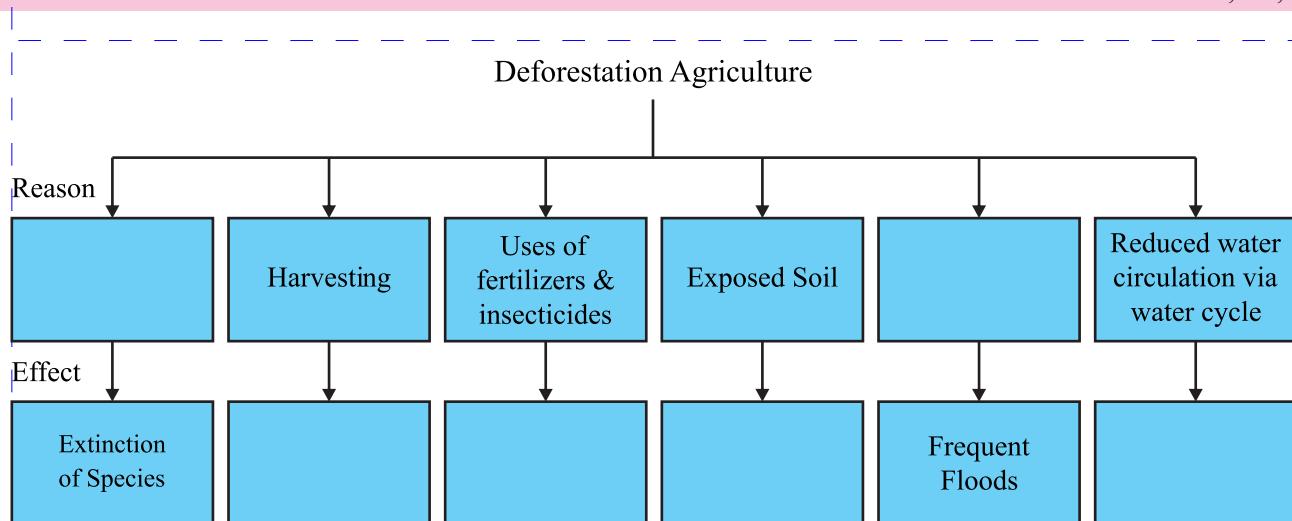


## Assessment

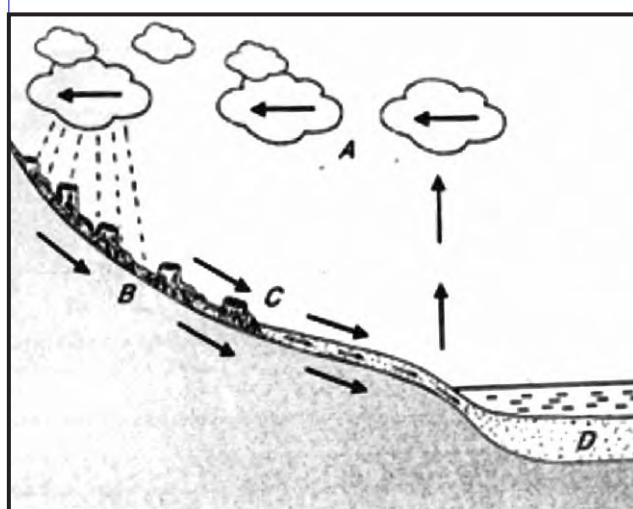
### Activity 1:

- The chart below shows the effects of deforestation for agriculture. Ask students to fill in each blank box in this chart with the most appropriate phrase given in 'A' to 'F'.

- A; Decrease in rainfall
- B; Pollution problems
- C; Silting of streams
- D; Depletion of soil nutrients
- E; Loss of natural habitat
- F; Soil erosion

**Activity 2:**

- Draw a simple line diagram on the board showing the effects of deforestation and label it as given in the diagram.
- Ask students to:
  - Name the harmful effect of deforestation shown in diagram. (B to D)
  - Describe the effects of this activity on plant and animal species.
  - Explain the effect on the local human population.

**Follow-up**

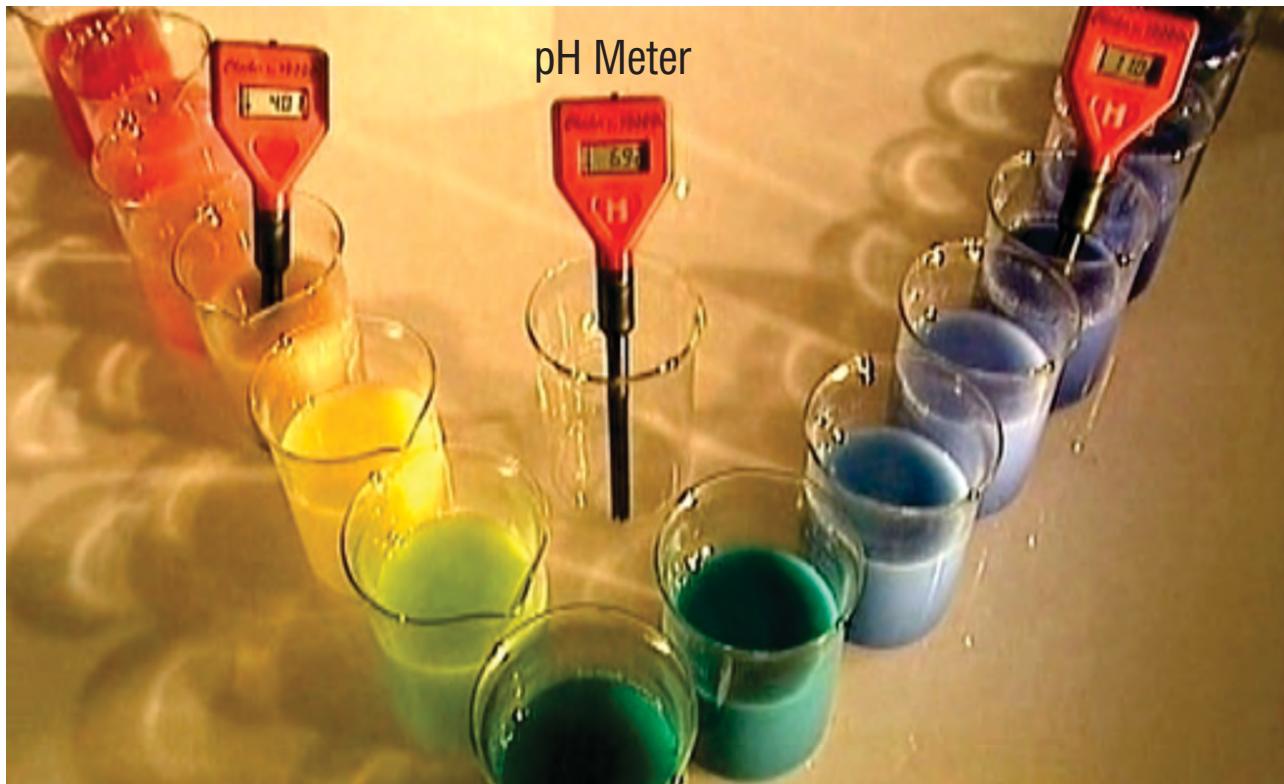
- 
- Have students pick a forest animal. Ask them to write a journal as if they were that animal living in the forest. How it spends its days and nights? Students can work independently or in groups.
  - Arrange a poster competition among students on the topic “Deforestation and its Effects on Our Environment”.
  - Guide the students to solve the exercise problems given at the end of each unit / chapter of textbook.

## 6

## Properties and uses of Acids

## Acids, Alkalies and Salts

Grade: VIII



## Students' Learning Outcomes

Students will be able to:

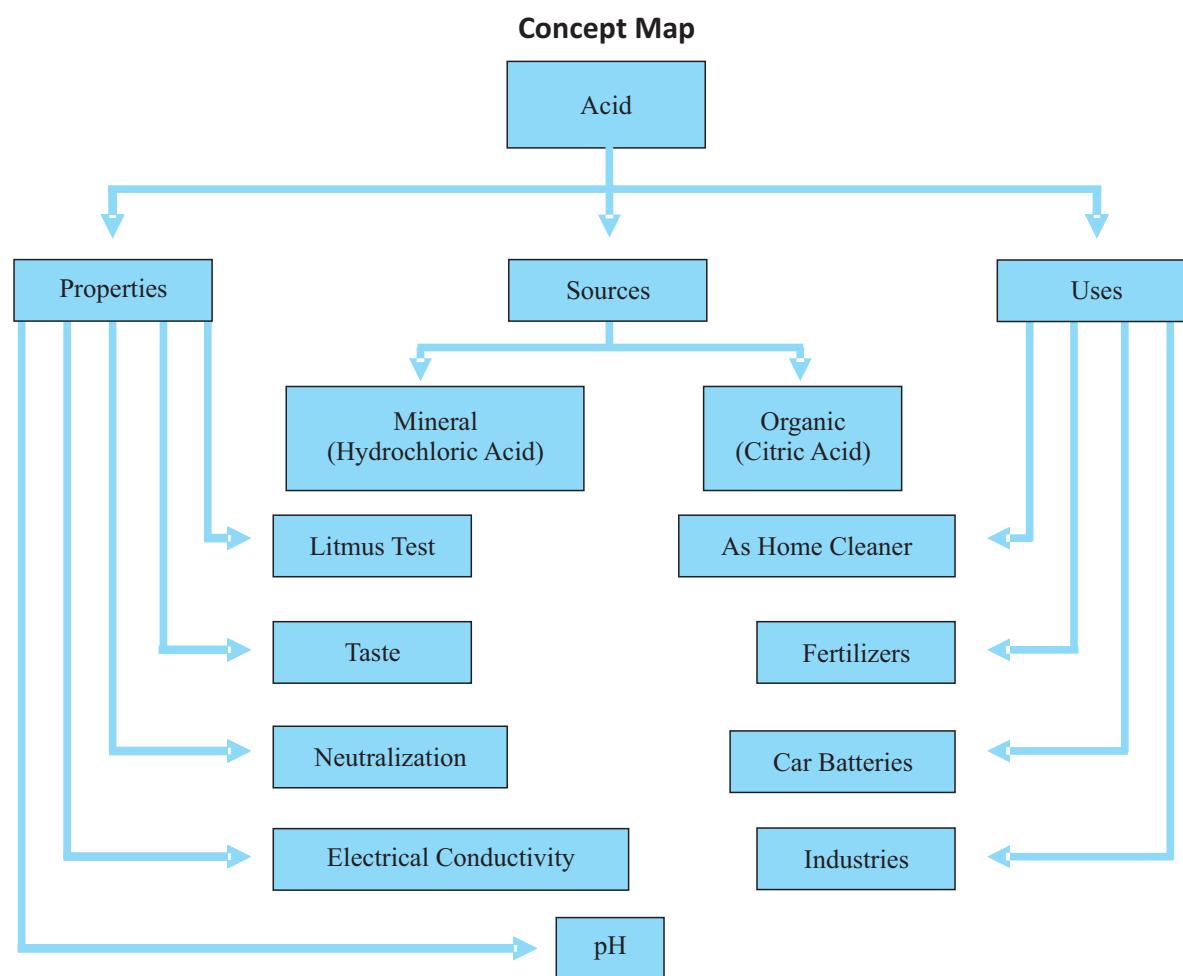
- define acid in their own words.
- describe the properties of acids.
- explain the uses of acids in daily life.

- Acids have sour taste.
- They change blue litmus paper to red.
- Acids react with bases to form salt and water (neutralization)
- Acidic solutions are good electrical conductors. Due to ionization in solution they form free mobile ions which conduct electricity.
- Nitric acid is used to make fertilizers like ammonium nitrate.
- Sulphuric acid is used as home cleaner and also in car batteries.



## Information for Teachers

- Acids are the chemical substances which give  $H^+$  ions in aqueous solution.



- Aqua regia can dissolve gold. it is made by adding one part concentrated nitric acid to three parts of concentrated hydrochloric acid.
- Sulphuric acid is used in almost all car batteries and is also known as “Oil of Vitriol”.
- The ‘fizz’ in soft drinks is produced by adding carbonic acid ( $H_2 CO_3$ )
- Acetic acid is extensively used in food industry as a preservative.
- Acids have a pH less than 7



**Duration/Number of Period**

80 mins/2 periods



**Material/Resources Required**

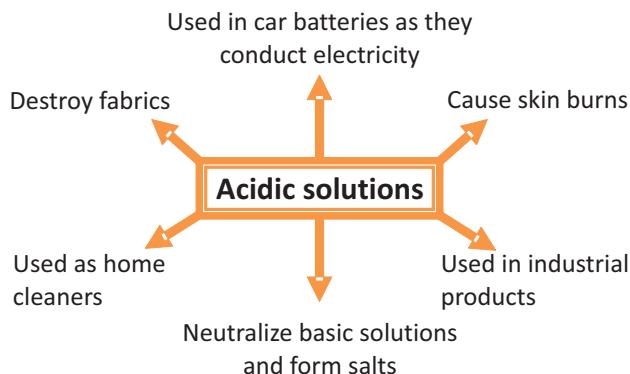
For each group you require: Blue litmus papers, vinegar, beakers, lemon juice, water , stirrer, pH papers .



## Introduction

### Brainstorming

Write the word, "Acidic solutions", on the board and ask students to give their ideas about it. Write all their ideas on the board.

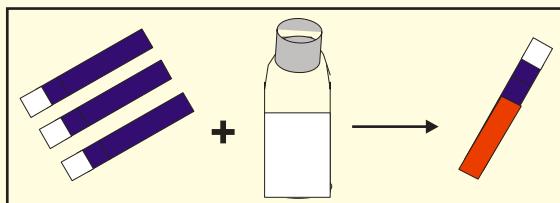


## Development

### ACTIVITY 1

Divide students in groups and instruct them to:

- Dip blue litmus paper in vinegar.
- Observe what happens to the blue litmus paper.



Now, ask these questions:

**Q<sub>1</sub>:** What is the change in colour of blue litmus paper?

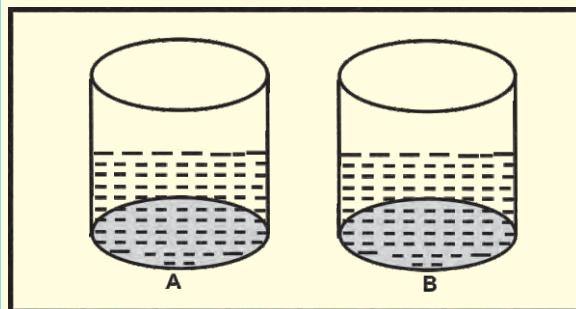
**Q<sub>2</sub>:** Vinegar is an edible acid, Can you predict its taste?(Don't allow Children to taste anything in laboratory)

After getting students response, conclude the activity by telling them that vinegar changes the blue litmus paper into red because it is acidic in nature & it is sour in

### ACTIVITY 2

Divide students in pairs and instruct them to:

- Take small amount of lemon juice in beaker A and water in beaker B.
- Dip blue litmus paper in both the solutions.
- Observe what happens to the blue litmus on dipping in the two solutions.



Now, ask the following questions:

**Q<sub>1</sub>:** Did you see any change in the colour of blue litmus paper?

**Q<sub>2</sub>:** What is the colour difference of two litmus papers dipped in different solutions in beaker A and B?

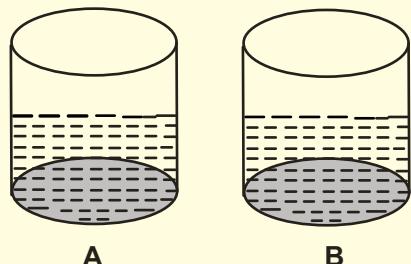
Conclude the activity by telling that beaker 'A', turned blue litmus paper into red as lemon juice is acidic in nature while beaker 'B', does not affect the blue litmus paper because it contains water that is neutral.

### ACTIVITY 3

• Divide students in small groups and instruct them to:

- Take two beakers, label them A and B.

- Half fill the two beakers with water.
- Add one teaspoon of vinegar in beaker A.
- Add 5 teaspoons of vinegar in beaker B.
- Stir these mixtures.
- Dip the strips of pH paper in the two solutions.
- Note the pH values of both the solutions.



**Now, ask the following questions:**

**Q<sub>1</sub>:** What are the pH values of two solutions?

**Q<sub>2</sub>:** Which of the two solutions (A and B) has smaller pH value and why?

Conclude the activity by telling the students that the solution in beaker 'A' is dilute and solution in beaker 'B' is concentrated. pH value of concentrated solution is less than pH value of dilute solution.



pH Paper roll



### Conclusion/sum up

Teacher can conclude the lesson by telling children that they learnt about:

- Acids give H<sup>+</sup> ions in aqueous solutions and turn blue litmus paper red
- Acids are of great use in fertilizers, car batteries and industries etc.
- Acidic solutions are good electrical conductors in solutions



### Assessment



**Q1:** Why does acid rain destroy buildings especially those made from limestone (a form of calcium carbonate)?

**A1:** Acid rain contains oxides of sulphur (SO<sub>2</sub>) which forms sulphuric acid on reacting with water. Acids have a corrosive effect and can cause limestone buildings to dissolve.

**Q2:** Name a fruit and a vegetable that is acidic in nature. How did you guess it?

**A2:** Fruit: Oranges Vegetable: Lemon.  
They have sour taste.

**Q3:** Ayesha has some transparent liquid which she claims to be an acid. How can you prove or disprove her claim?

**A2:** Dip a blue litmus paper in transparent liquid. It becomes red which proves that it is an acid.



### Follow-up

- Ask students to prepare a booklet on acids. The booklet should contain colourful pictures related to the sources, uses and properties of any two acids of your choice.

## TOPIC

# Properties and uses of Alkalies

Grade VIII



## Students' Learning Outcomes

Students will be able to:

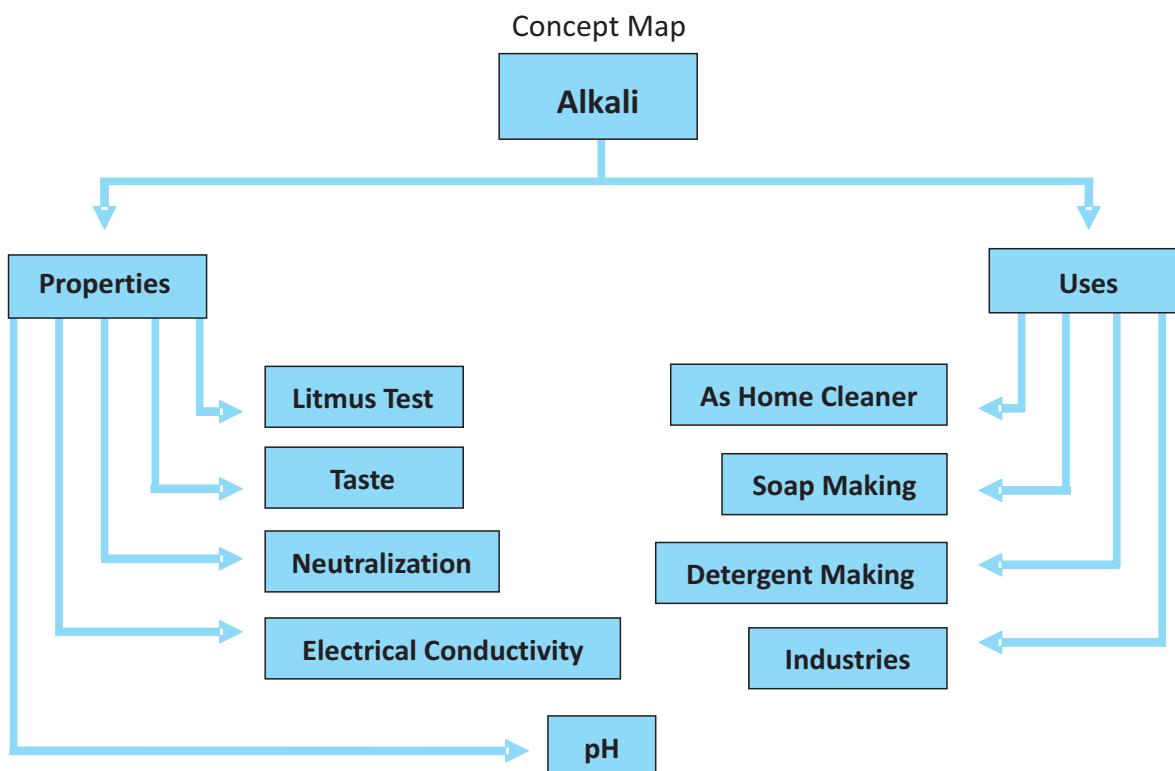
- define the term alkali in their own words.
- describe the properties of alkalis.
- explain the uses of alkalis in daily life.

- Alkalies have bitter taste & turn red litmus blue.
- Alkalies react with acids to form salt & water (neutralization).
- They are good electrical conductors in solutions. They have pH more than 7
- Household cleaner:  $\text{NH}_4\text{OH}$  to remove grease from window.
- Soap making:  $\text{NaOH} + \text{Oil}$  (Any Soap).
- Detergent making:  $\text{KOH}$ .
- Industries: medicines (milk of magnesia).



## Information for Teachers

- A chemical substance which gives hydroxyl ions ( $\text{OH}^-$ ) in water is called alkali



### Duration/Number of periods

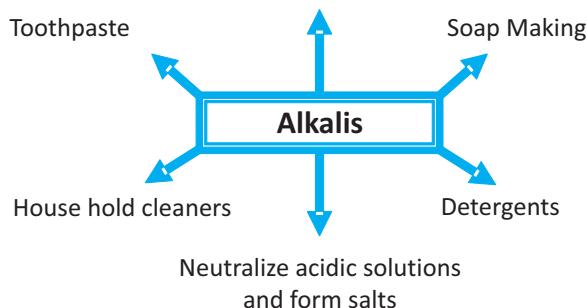
80 mins/2 periods



### Introduction

Write the ideas given by the students about alkalis on board.

Good electrical conductors



### Material/Resources required

You need this material for each group.

Soap bar, water, soap solution detergent solution and household cleaner solution, pH papers, Vegetables such as ginger, garlic, onion.



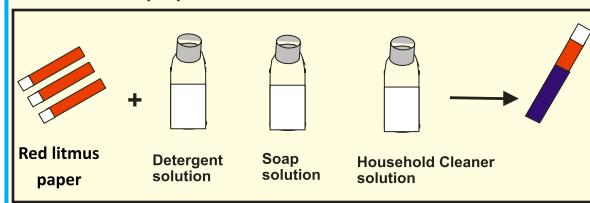
### Development

#### ACTIVITY 1

Divide students in pairs; give three type of solutions (detergent, soap and household cleaner) in separate bottles and red litmus papers.

Instruct the students to:

- Dip red litmus paper in soap, detergent and household cleaner solutions separately and observe what happens to the colour of red litmus paper.



Now, ask these questions:

**Q:** Did you see any change in the colour of red litmus paper?

**Q:** What does the change in the colour of red litmus paper indicate?

After getting students responses tell them that red litmus paper changes into blue in basic solutions thus indicating that detergent, soap & housecleaner solutions are basic in nature.

- Teacher can also provide students with vegetables such as ginger garlic onion and ask them to find their nature. Students will find out that these vegetables are alkaline in nature



## ACTIVITY 2

Teacher can provide students with small amounts of quick lime (choona) It can be obtained from pan shop / hardware shop.

Ask students to

- Dissolve it in water.
- Then dip the strips of pH paper in quick lime solution.
- Ask students:
  - Q.1 Did you notice any change in the color of pH paper?
  - Q.2 If yes, what does it indicate?
  - Q.3 Decide Quick lime solution is an alkali or a base?

After taking student's responses tell them that pH value more than 7 indicates that solution is basic in nature. The color ranges from dark green to dark blue which is an indication of basic solutions.

## ACTIVITY 3

### Group Discussion

Divide students in groups and ask them to discuss the following points.

- Discuss the properties, sources and uses of bases in daily life.
- Write main points on the board and ask students to give a presentation to compare properties of acid and alkalis.

Ask following questions to further elaborate the importance of alkalies in our daily lives.

**Q1:** A compound is found to react with fats to form soap and causes red litmus to turn blue. Would the compound be classed as an acid, or a base. Why?

**A1:** The Compound would be a base as it turns red litmus to blue.

**Q2:** Doctor has diagnosed stomach ulcer for Nabila. She was advised to reduce acidity level in the stomach. She was prescribed such medicines that lower the acidity in the stomach. Can you guess what would be the nature of chemicals found in the medicines? Why do you think so?

**A2:** The medicines used will be alkaline in nature. They neutralize the acidic affect and are called "antacids".



## Conclusion/Sum up

Conclude lesson by telling children that they have learnt

- All alkalis are bases but all bases are not alkalis.
- They have a pH value greater than 7.

- Alkalies are widely used for cleaning purpose in soap and detergent making



### Follow-up

Ask students to:

- Prepare a poster about the uses of common alkalies in our daily life.
- The poster should contain objects (empty bottles of cleaners, detergents and soap wrappers) and it must be eye catching.
- Guide the students to solve the exercise problems given at the end of unit / chapter of the textbook.



### Assessment

Ask following questions to recap the lesson and also to assess students understanding of the taught concepts.

- Q1: Why is it dangerous to identify alkalies by tasting or touching them?
- A1: Alkalies are corrosive and can cause skin burns.
- Q2: What should we do immediately if we accidentally touch an alkali?
- A2: We should treat the effected part with a mild acid to neutralize the effect of alkali.



## TOPIC

# Properties and uses of Salts

Grade VIII



## Students' Learning Outcomes

Students will be able to:

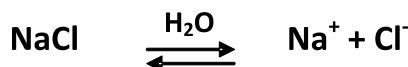
- define the term salt.
- describe the properties of salts.
- explain the uses of salts in daily life.



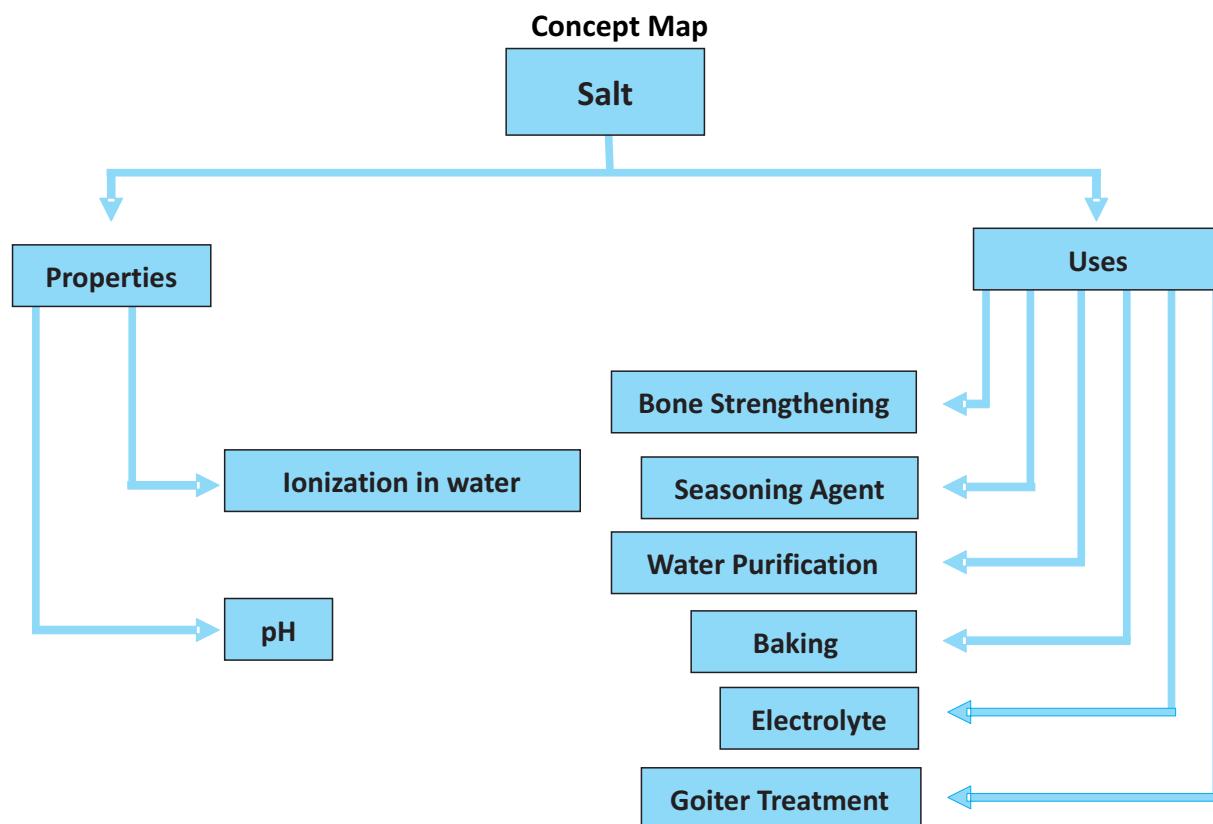
## Information for Teacher

- A salt is a compound formed by the neutralization reaction between an acid and a base.
- Salts of calcium, present in our bones are responsible for strengthening of bones.

- Potash alum is used for the purification of water.
- Salts of iodine are needed for the proper functioning of thyroid gland. They are also used for the treatment of goiter.
- Salts ionize in water e.g., NaCl dissociates into  $\text{Na}^+$  &  $\text{Cl}^-$



- Salt solutions are also used as electrolytes and as fertilizers.
- Salts are used for seasoning food.
- Salts such as baking soda is used to soften bread & cake.



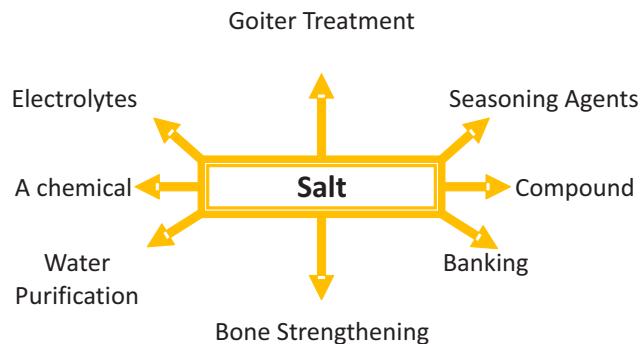
### Duration/Number of periods

80 mins/2 periods



### Introduction

Write the word "Salts" on the board & ask students to give their ideas about it. Write students ideas on the board.



### Material/Resources required

You require following material for each group.  
Vinegar, Sodium hydroxide , beakers, pH papers , burner/spirit lamp.



### Development

#### ACTIVITY 1

Divide students in small groups and instruct them to

- Take small amount of sodium hydroxide in beaker A
- Add few drops of phenolphthalein to it. Solution will turn pink.
- Take vinegar in beaker B and add it drop wise to beaker A until it

becomes colorless.

- Dip pH paper after each addition and then evaporate the solution mixture to dryness

Ask students to write answers of following questions in their journals

**Q.1.** What is the name of process when alkali is added in acid (Ans: Neutralization)

**Q.2.** What did you get after solution mixture is evaporated (Ans: Salt crystals)

**Q.3.** Can you name the solid product obtained after evaporation (Ans: Sodium acetate)

## ACTIVITY 2

Divide students in small groups & instruct them to:

- Dissolve washing soda (sodium carbonate) in water in beaker A.
- Dissolve baking soda (sodium bicarbonate) in water in beaker B.
- Dissolve common salt in water in beaker C.
- Dip pH paper in all the three solutions.

### Observations:

**Q1:** What change in colour of pH paper is observed in all the three solutions?

**Q2:** What is nature of the solutions in beakers A, B and C?

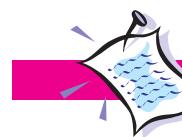
The beaker 'A' will give value of pH more than 7. (basic salt) The beaker 'B' will give value of pH less than 7. (acidic salt) The beaker 'C' will give value of pH equal to 7. (neutral)



## Conclusion/sum up

### Conclude the lesson by telling students

- Salts are formed as a result of neutralization reaction between an acid and base.
- Salts are of great use and are also found in human body.
- Salts are crystalline and soluble in water.



## Assessment

### Assess student's learning by asking these questions:

**Q1:** Explain the role of baking soda in the process of baking?

**A1:** Baking soda produces carbon dioxide which rises the baking material.

**Q2:** Which salts are used as fertilizers in different crops?

**A2:** Calcium phosphate, DAP or ammonium sulphate



## Follow-up

### Visit to the Khewra Mines

Read the situation below and give appropriate answers to the, "Khewra Mine Guide", questions based upon your recently developed knowledge about salts.

A group of students visited Khewra mines, where the Guide told them few interesting facts about mine:

#### Fact 1:

There are small ponds. If anyone jumps into the water, he/she will never be drowned. Can you tell the reason?

A:1 The person will not drown but can suffer from severe dehydration

**Fact 2:**

If you come in winter, you will never feel cold.

What you think, why is it so?

A2: Salts are bad conductors of heat.

**Solve the Mystery**

One morning a watchman's body was found lying on the floor of a warehouse. Nadeem was suspected murdering the watchman. Police found white powder in his socks. They said it was slaked lime from ware house where his body was found. But Nadeem insisted that he has been accused wrongly as he was on the salty beach last night. The powder in his socks was salt. What tests would you carry out to find out if Nadeem was telling the truth?



Ans: pH of salt and slaked lime could be checked. salts are neutral while slaked lime is highly basic.

- Guide the students to solve the exercise problems given at the end of unit / chapter of the textbook.

## TOPIC

# Indicators and their Uses

Grade: VIII



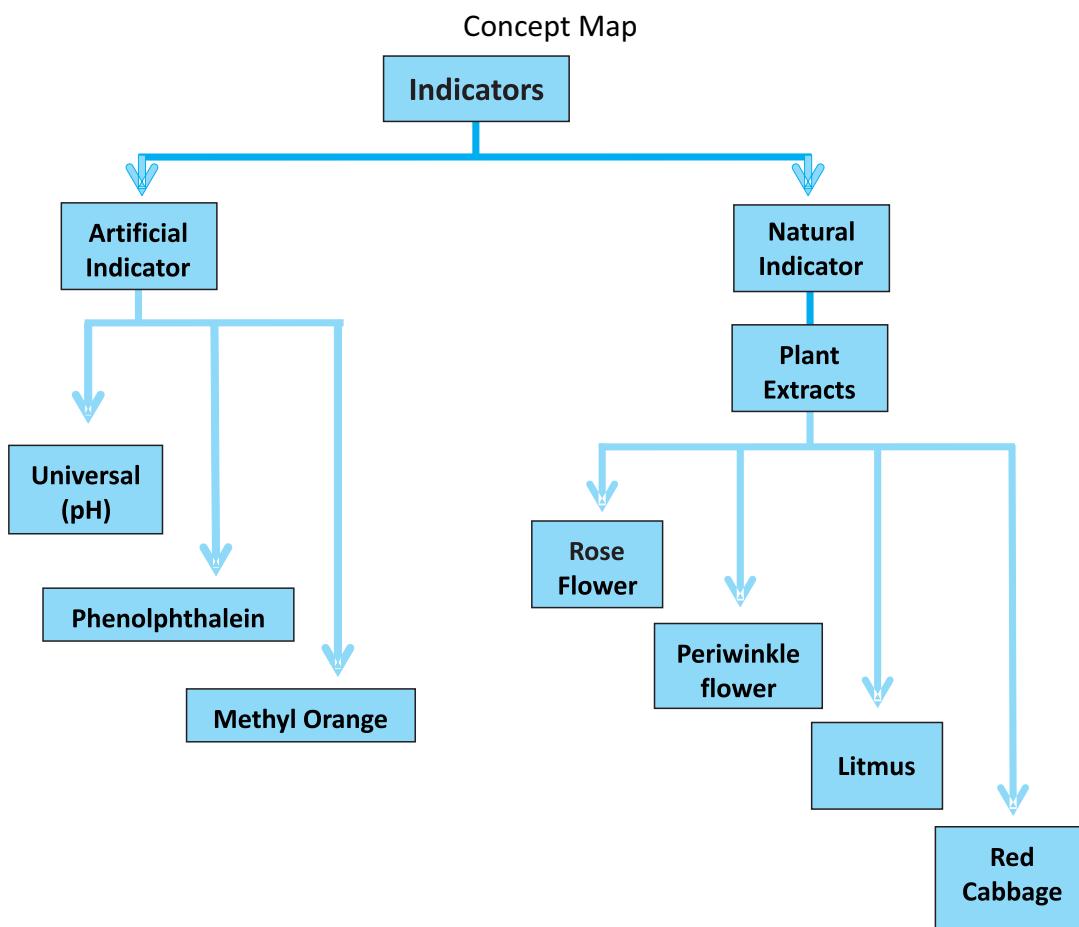
**Students' Learning Outcomes**

Students will be able to:

- define indicators.
- use indicators to identify acids, alkalis and neutral substances.
- investigate the colour changes in the extracts of various flowers and vegetables by adding acids and alkalis.

**Information for Teacher**

- An indicator is a chemical compound that can change its colour when an acid or an alkali is added into it.
- A chemical detector for protons in acid-base titrations.
- Artificial indicators are the man-made indicators such as universal indicator phenolphthalein & methyl orange.



- Litmus can only tell you about the acidic or alkaline nature but a universal indicator like pH paper can tell you the strength of acids and alkalis.
- Natural indicators are present naturally and we have to extract these from natural sources such as, rose, periwinkle, red spinach and red cabbage.
- Different indicators give different colors in different media

#### **“Making Methyl orange indicator “**

Add 0.1 gm methyl orange in 100 ml water-Filter if necessary



#### **Duration/Number of periods**

80 mins/2 periods

tubes , test tube stand , methyl orange , phenolphthalein , dropper , red cabbage , steel pot, transparent bottles .



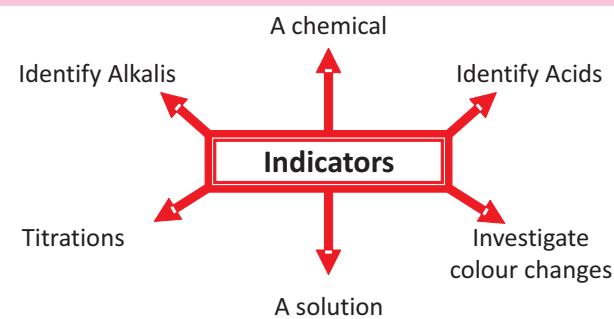
#### **Material/Resources required**

You require following material for each group:  
beakers , sodium hydroxide solution, vinegar , soap solution , water ,blue litmus papers , test



#### **Introduction**

Write the word “indicators” on board & ask students to give their ideas about it. write students' ideas on the board.



## Development

### ACTIVITY 1

- Place three transparent liquids in three beakers labeled as A, B and C on the table.



(A)  
Vinegar



(B)  
Sodium hydroxide  
solution



(C)  
Water

**Now, ask students:**

**Q1:** Can you guess which is an acid, which contains an alkali and which one is water? (Do not taste).

After getting their responses divide students in groups and instruct them to:

- Take a small amount of solutions, separately in three test tubes.
- Take a blue litmus paper.
- Dip the litmus paper in the above solutions separately and note the change in colour.

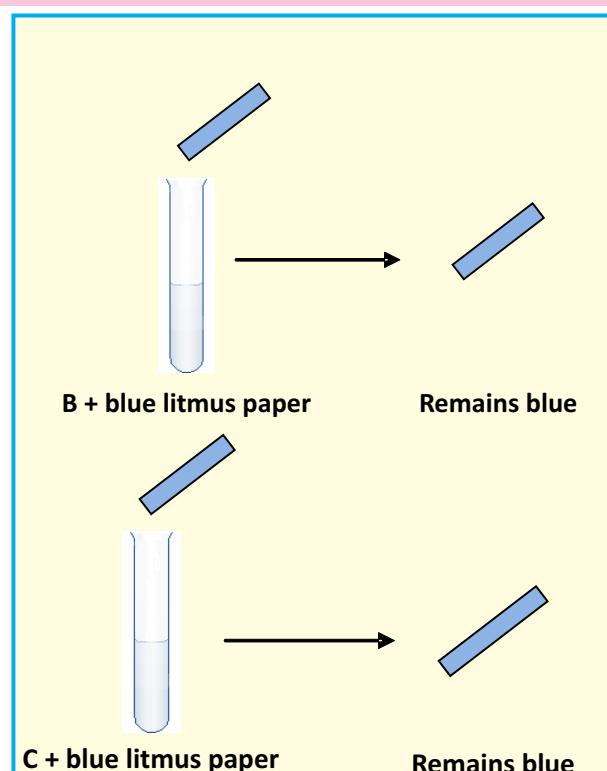


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A + blue litmus paper

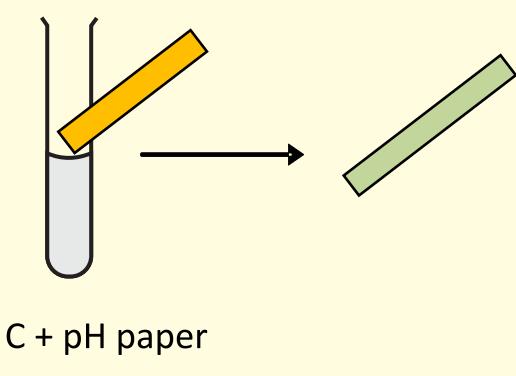
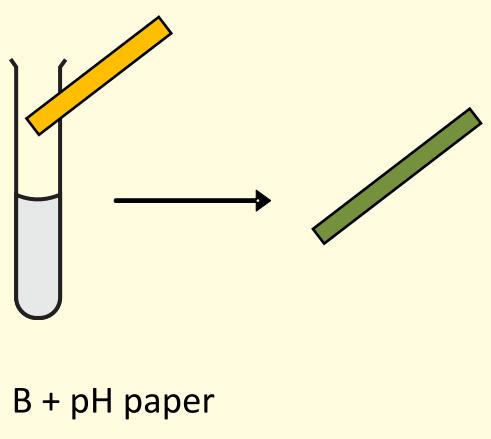
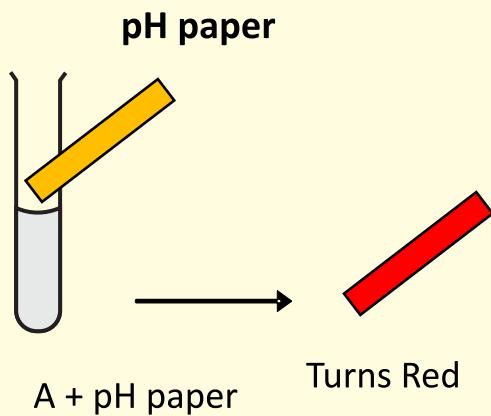
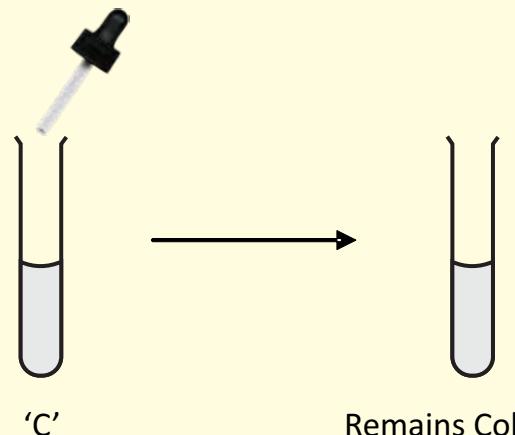
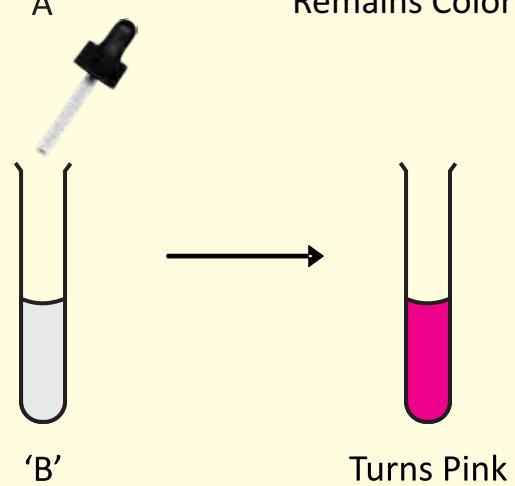
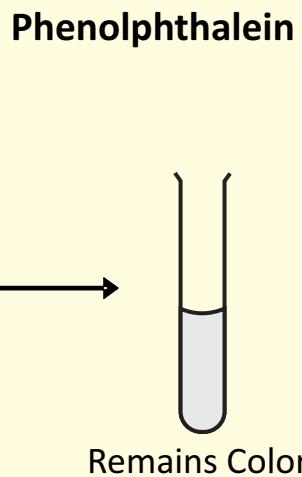
Turns Red



### Make your own litmus paper

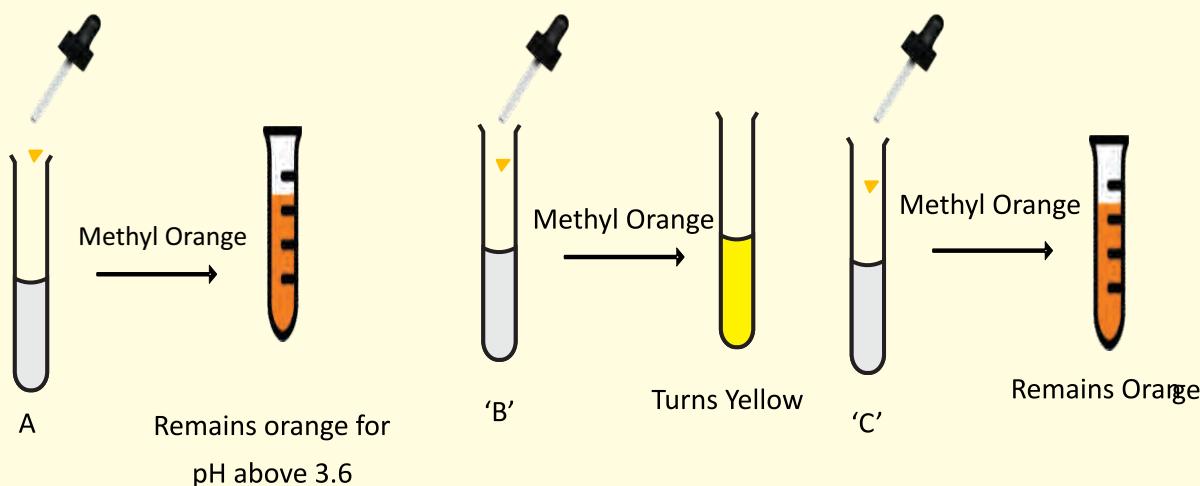
- Chop the red cabbage with a sharp knife
- Crush it with pestle and mortar
- Add a small amount of water
- Pour the blue liquid in a beaker and soak some blotting / filter paper into it.
- Let it dry and cut it into small pieces for use.

- Tell students that test tube 'A' contains an acidic solution, test tube 'B' contains an alkaline solution and 'C', contains a neutral solution.
- Repeat the experiment by using PH paper(1a) phenol phthalein (1b) and methyl orange(1c) indicators.
- Add indicators with a dropper

**ACTIVITY 1a****ACTIVITY 1b**

Explain children that pH paper turns red in acidic, dark green in basic and light green in neutral solution

Explain children that Phenolphthalein can not be used to distinguish between an acidic and neutral solution as it becomes colorless in both.

**ACTIVITY 1c**

Conclude all 1a, 1b and 1c activities by telling students that test tube 'A' contains acidic, test tube 'B' contains alkaline while test tube 'C' contains neutral solutions.

**ACTIVITY 2**

- Ask the students to copy it in their notebooks.
- Draw the following table on board and discuss it. (Whole class discussion)

Indicators	Colour change when placed in different solutions		
	Acidic	Alkaline	Neutral
Blue Litmus	Red	Blue	Blue
Red Litmus	Red	Blue	Red
Rose extract	Pink	Green	Pink
pH Paper	Red/orange	Blue/Dark Green	Light Green
Phenolphthalein	Colour less	Pink	Colour less
Red cabbage	Pink	Green	Purple
Methyl Orange	Red/Orange	Yellow	Orange
Periwinkle (Sada Bahar)	Pink	Yellow	Yellow
Red spinach extract	Pink	Yellow	Red



### Conclusion/sum up

**Conclude lesson by telling students that they learnt about**

- Indicators are the substances used to check the acidic and basic nature of solution.
- indicators can be natural (i.e extracted from plants)or artificial (extracted from chemical compounds)
- pH paper is a universal indicator which can measure strength of acids and bases



### Assessment

- A group of high school students are on their way to the forest Chang Manga on a research expedition. Their task is to study the quality of water & soil. Unfortunately, the bag containing the indicators was not brought. Instead of going back and wasting time, they decide to carry on their study by using natural indicators. As their research teacher, what plants would you suggest to the students and why? Briefly explain how students will prepare the plant extracts and then test various soil & water types.



### Follow-up

- Ask students to check pH of water from hand pumps or wells located near an industry/ tannery. Suggest its possible effects on environment.
- Students can be asked to find pH of soil of nearby field and suggest what kind of fertilizers should be used to neutralize soil's acidity / basicity
- Guide the students to solve the exercise questions given at the end of unit / chapter of the textbook

UNIT

7

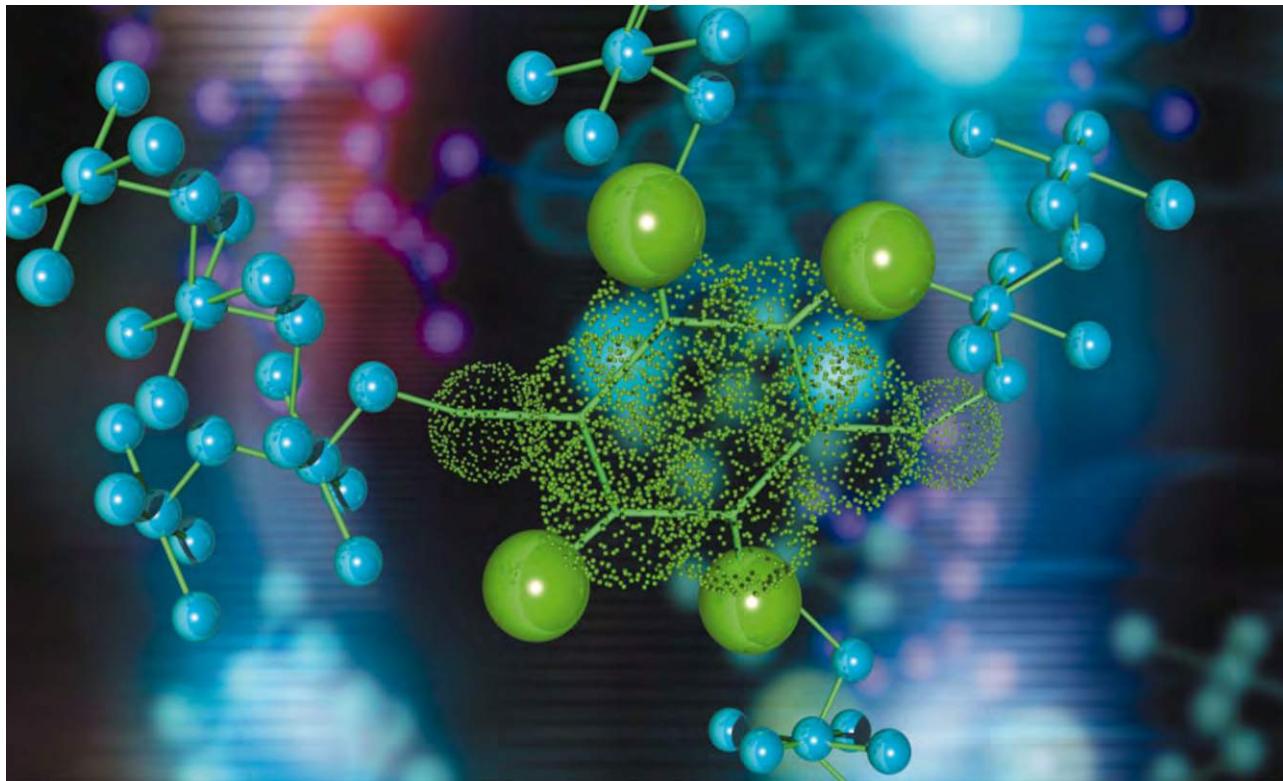
TOPIC

Lesson Plan  
18

# Introduction to Atoms and Molecules

## Atoms, Molecules, Mixtures and Compounds

Grade: VI



### Students' Learning Outcomes

Students will be able to:

- differentiate between an atom and a molecule.
- recognize the symbols of some common elements.
- differentiate between elements, compounds and mixtures.
- identify examples of some compounds and mixtures from their surroundings.



### Duration/Number of Period

80 mins/2 periods



### Material/Resources Required

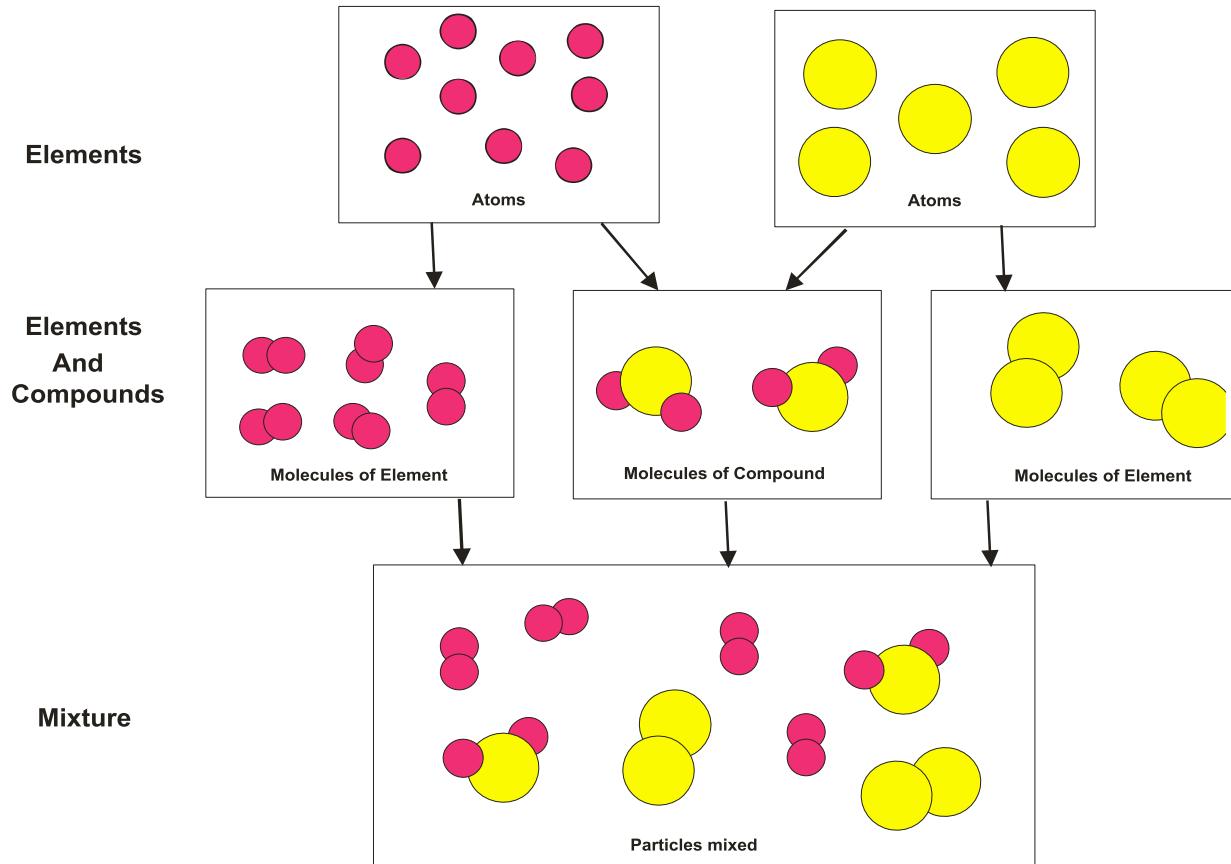
You require the following material for each group:

Paper clips (12 of each colour i.e., green, red and yellow), sulphur powder, iron fillings, China dish , burner/spirit lamp , bar magnet.



## Information for Teacher

Concept Map

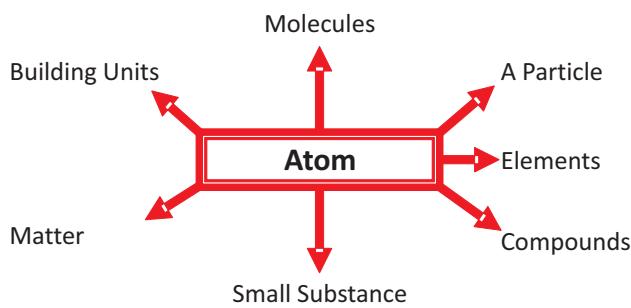


- An element is a pure chemical substance which contains same type of atoms.
- Chemists use symbols to represent elements. A symbol is a letter used to represent something. Chemists use one or two letters to represent elements. The symbol for aluminum is Al. The symbol for oxygen is O.
- A compound is a substance formed when two or more elements are chemically joined.
- Water, salt, and sugar are examples of compounds.
- When the elements are joined, the atoms lose their individual properties and have different properties from the elements they are composed of.
  - A chemical formula is used as a quick way to show the composition of compounds.
  - Molecules of element have same kind of atoms while molecules of compound have different kind of atoms
  - A mixture is made up of two or more different substances which are mixed together but are not chemically combined.



## Introduction

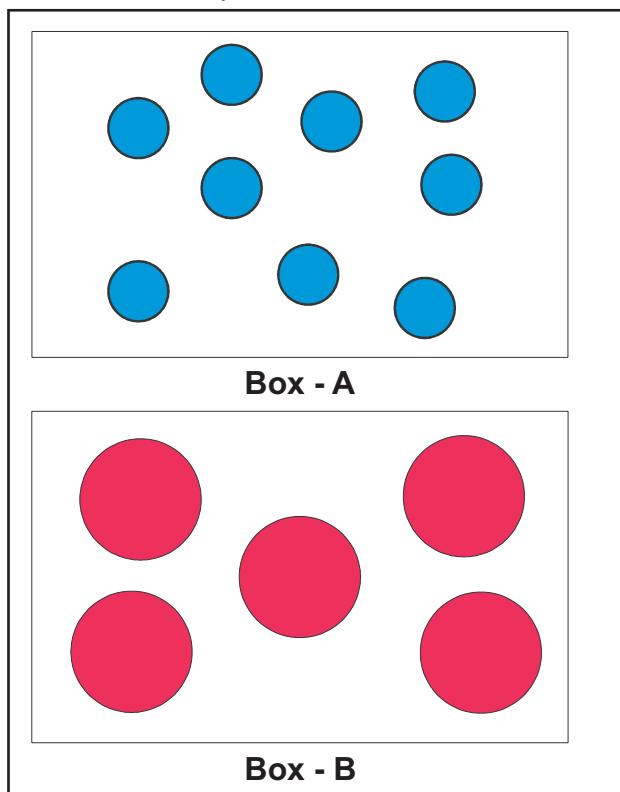
Write the word "Atom" on board and ask students to tell what they know about an "Atom".



Write their answers on board and give a brief touch to each answer.

### Introductory Activity

- Draw equal sized small circles as shown below in the box-A on board.
- Draw circles larger in size than those of box-A as shown in the box-B on board.
- Each circle represents an atom.



Ask students to observe/see the circles and answer the following questions.

**Q1:** Can we represent atoms by small circles?

**Q2:** Are these circles of the same size of both boxes?

Tell the students that atoms of the same size and shape form a pure substance known as an element.

**Q3:** Can circles of both the boxes A & B represent atoms of the same element?

**Q4:** Define an element in your own words.



## Development

### ACTIVITY 1

- Divide students in groups; provide different coloured paper clips to each group and say: "A green paper chip represents a hydrogen atom (symbol H). A red paper clip represents an oxygen atom (symbol O). A blue paper clip represents a carbon atom (symbol C)."
- Ask students to hold one red paper clip in each hand and again ask. Can you consider it an atom?

#### Instruct students to:

- Combine two red paper clips and show it to the teacher. (Ask: what is it? is this an atom or something else?)
- Introduce the term "molecule". Tell students that atoms combine to form a molecule. When two oxygen atoms combine they form an oxygen molecule.
- Ask: Can different atoms form a molecule? (Yes/No)
- Yes, write the formula of  $H_2O$  (water) on board and ask groups to name atoms present in  $H_2O$ .

- Students to attach two green paper clips with one red paper clip. This is the model of  $H_2O$ .
- Ask students to form the structure/model of  $CO_2$  (Carbon dioxide) by using paper clips of respective colours. (2 red paper clips with one yellow paper clip). Give feedback if required.

### ACTIVITY 1

Introduce "mixture" and write its definition on board. "When two or more than two substances are mixed in such a way that no new substance is formed."

#### Step I:

Divide students in groups and instruct them to:

- Take some sulphur crystals in a china dish.
- Mix them with some iron filings.
- Observe the mixture whether its constituents have lost their original properties or not.
- Move a bar magnet in the mixture.
- Observe what happens.
- Show the result to the teacher

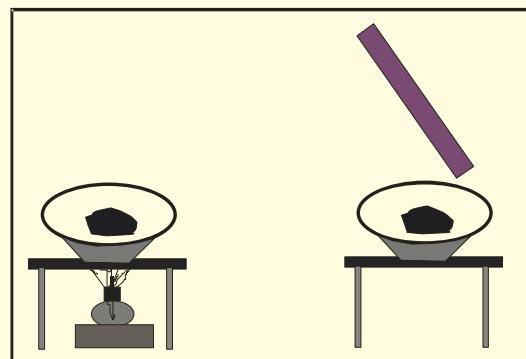
Ask how is it a mixture?( Explain it is a mixture because iron and sulphur can be separated by physical method)



#### Step II:

Divide students in groups. Give them material and instruct them to:

- Mix iron filings with sulphur crystals in a china dish.
- Heat the mixture strongly.
- Observe what happens with iron and sulphur.
- Let the matter cool to room temperature.
- Move a bar magnet in the substance present in china dish.



#### Conclude the activity by asking:

**Q1:** Why don't iron filings separate from the substance formed on heating the mixture?

**A1:** Due to heating ,the iron filings reacted with sulphur chemically and formed a new compound .

**Q2:** What type of substance is formed on heating the mixture of sulphur and iron?

**A2:** Iron sulphide.

**Q3:** Give examples of some common compounds and mixtures

**A3:** Compounds :water ,common salt

Mixture: Air, steel ,ice cream



#### Conclusion/sum up

Explain children that we learnt

- The smallest particle of an element is atom
- Atoms of different elements have different

sizes and combine to form compounds.

- Atoms cannot exist independently except that of noble gases
- Components of mixtures can be separated by physical methods
- Molecules of element have same kind of atoms while molecules of compound have different kind of atoms.



### Assessment

#### Ask:

- What is an atom?
- What is the difference between an atom and a molecule?
- What is H, C, O?
- Tell them that atoms/elements are recognized by "symbols" which is the shortest name of an element. Show students a periodic table and have a brief discussion on the symbols of the following like He, Na, N, Ca, Fe elements.



### Follow-up

- Make the following models with the help of the coloured paper clips.
  - $\text{CH}_4 \rightarrow$  Methane
  - $\text{CO} \rightarrow$  Carbon monoxide
- List down 4-4 examples of mixtures & compounds occurring/present in our surroundings.
- Guide the students to solve the exercise questions given at the end of unit / chapter of the textbook.

UNIT

8

TOPIC

Lesson Plan  
19

# Difference Between Solutions and Suspensions

## Solutions and Suspensions

Grade: VI



### Students' Learning Outcomes

Students will be able to:

- identify solute and solvent in a solution.
- differentiate between solute, solvent and solution.
- differentiate between solutions and suspensions.
- identify uses of solutions and suspensions in daily life.



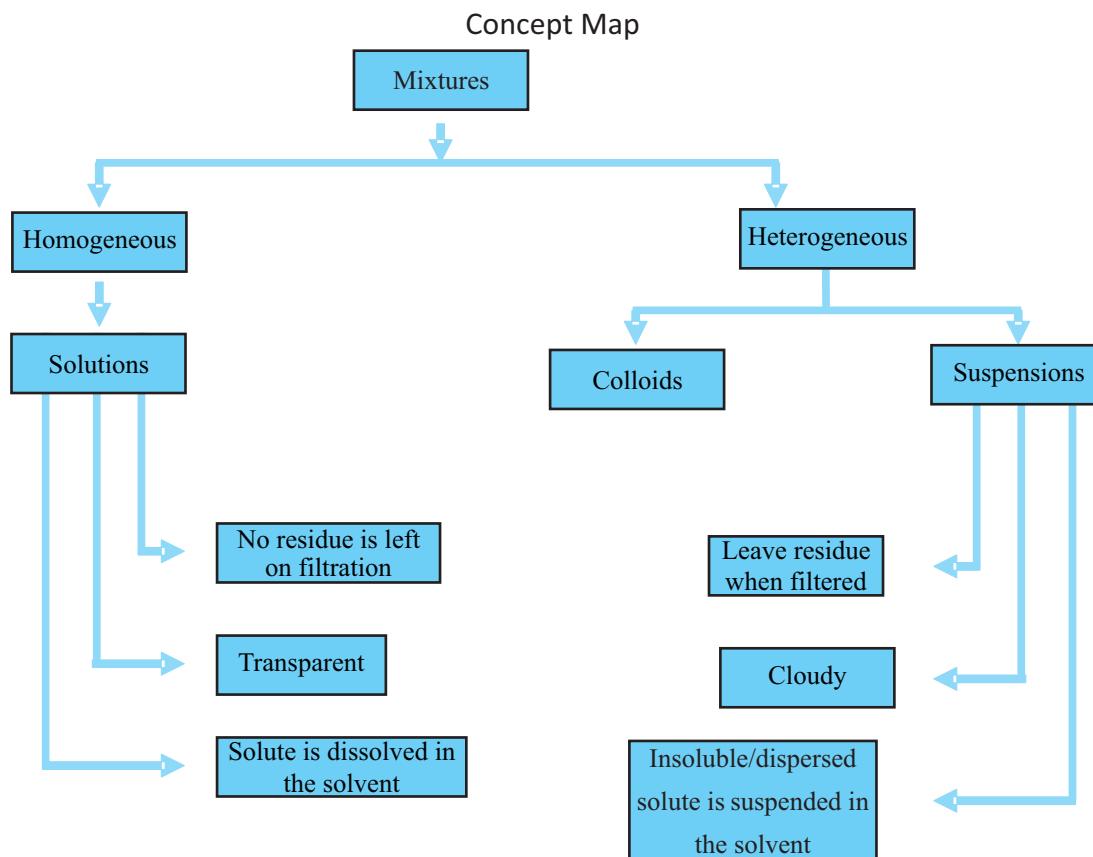
### Duration/Number of Period

80 mins/2 periods



### Material/Resources Required

You need following material for each group:  
beakers, sugar, salt, tea spoons, soil, glucose, and water.



### Information for Teacher

- When two or more than two substances are mixed in such a way that no new substance is formed, the resulting substance is called a **mixture**.
- Mixtures are either **homogeneous** or **heterogeneous**. The mixture having uniform composition is called the homogeneous mixture (mixture of sugar in water). The mixture having non-uniform composition is called the heterogeneous mixture (mixture of sand in iron, mixture of oil in water).
- A **solution** is a homogeneous mixture, which contains one, or more solutes dissolved in a solvent. **Solution** has particle size 1 nm or smaller in diameter. **Solute** is the substance that dissolves in the solvent & it is present in small amount in the solution e.g, salt, sugar,

etc. **Solvent** is the substance in which solute dissolves and it is present in large quantity in the solution. e.g., water, petrol, acetone etc.

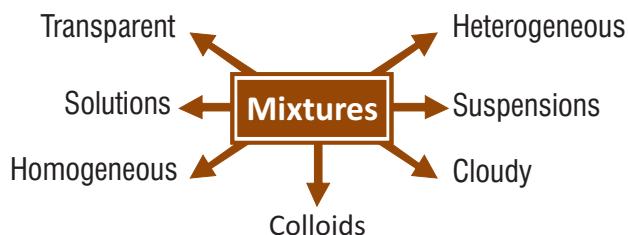
- A **suspension** is a heterogeneous mixture of two or more than two substances. (sand in water, chalk in water). Suspension particles are more than 100 nm in diameter.
- Colloid** is a mixture that is intermediate between homogeneous & heterogeneous mixtures. (foam, gel, smoke, milk,) They have particle size between 1 nm and 100nm.



### Introduction

Write the word, "mixture", inside a box drawn on board and ask students to give their ideas about it. You may get a similar kind of response from

the students as shown below. Write their ideas on board around the mixture box. (Brainstorming)

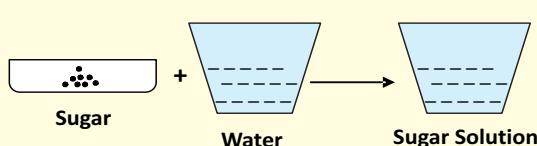
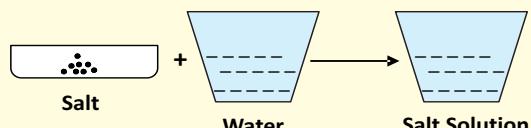


### Development

#### ACTIVITY 1

Divide students in groups and instruct them to:

- Half fill a beaker with water, add half teaspoon of salt in it and stir.
- Half fill another beaker with water, add half teaspoon of sugar in it and stir.
- Observe the mixtures in both the beakers.



Now ask the following questions:

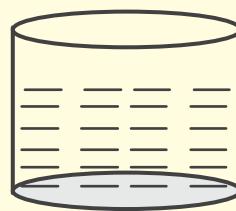
- Q<sub>1</sub>:** Can you see the salt in water?  
**Q<sub>2</sub>:** Can you see the sugar in water?  
**Q<sub>3</sub>:** Where did they go?  
**Q<sub>4</sub>:** Can you separate them? (If yes, then how?)

After taking students responses tell them that salt & sugar are solutes that dissolve in water to give solution. Tell them the definitions of solute, solvent and solution.

#### ACTIVITY 2

Divide students in small groups and instruct them to:

- Dissolve a small amount of glucose in water and stir.



Now ask the following questions:

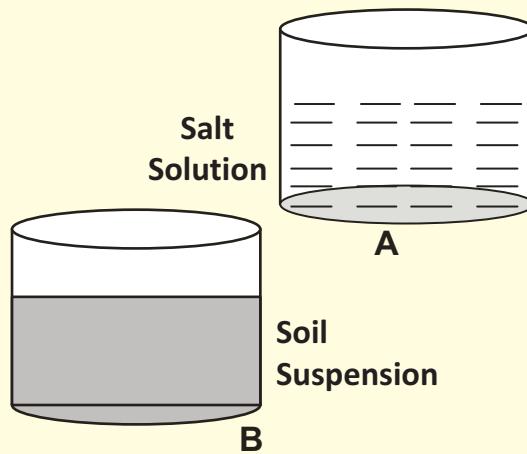
- Q<sub>1</sub>:** What is the result of the experiment?  
**Q<sub>2</sub>:** What is solute in the solution?  
**Q<sub>3</sub>:** What is solvent in the solution?

After getting their responses tell them that glucose is solute & water is solvent.

#### ACTIVITY 2

Divide the students in groups and instruct them to:

- Take two beakers, label them A and B.
- Half fill the two beakers with water.
- Add one teaspoon of salt in beaker A.
- Add one teaspoon of soil in beaker B.
- Stir the two mixtures for a while.
- Observe the two mixtures.



Now, ask the following questions:

**Q<sub>1</sub>:** How are two mixtures different from one another?

**A<sub>1</sub>:** Mixture A is solution and B is a suspension.

**Q<sub>2</sub>:** Give one example of solution and suspension?

**A<sub>2</sub>:** Solution; Glucose in water.

Suspension: Chalk in water.

**Q<sub>3</sub>:** Which of the following techniques could be used to separate the mixture A?

- a) Decantation
- b) Filtration
- c) Evaporation
- d) Distillation

**A<sub>3</sub>:** Evaporation

**Q<sub>4</sub>:** Which of the following techniques could be used to separate the mixture B?

- a) Decantation
- b) Filtration
- c) Evaporation
- d) Distillation

**A<sub>4</sub>:** Filtration

After getting students responses explain them the difference between solutions & suspensions. Also explain the meanings of these four mixture separating techniques i.e., decantation, filtration, evaporation and distillation.

- Solution can be in any physical state e.g. alloy is a solid-solid solution of metals.
- Upon filtration solution do not leave a residue but suspensions leave residue.



### Assessment

**Assess student learning by this activity:**

- Take a paper and make 6 paper strips out of it (prepare 6 strips for each group.)
- Write properties of solutions and suspensions on these paper strips, (one property or example per paper strip).
- Distribute the strips among the groups.
- Ask students to separate the solution and suspension strips from one another.



### Follow-up

Ask students to think and discuss about the phrase "Shake well before use". Tell them that this sentence is usually written on certain medications. Why do you think it is important to shake well before using any such medication?



### Conclusion/sum up

Conclude lesson by telling children that we learnt

- Homogeneous mixtures are called solution.

UNIT

TOPIC

Lesson Plan  
20

9

# Energy changes in Chemical Reactions

Chemical Reactions

Grade: VIII



## Students' Learning Outcomes

Students will be able to:

- explain the energy changes in chemical reactions.
- differentiate between exothermic and endothermic reactions.
- describe the importance of exothermic reactions in daily life.



## Duration/Number of Period

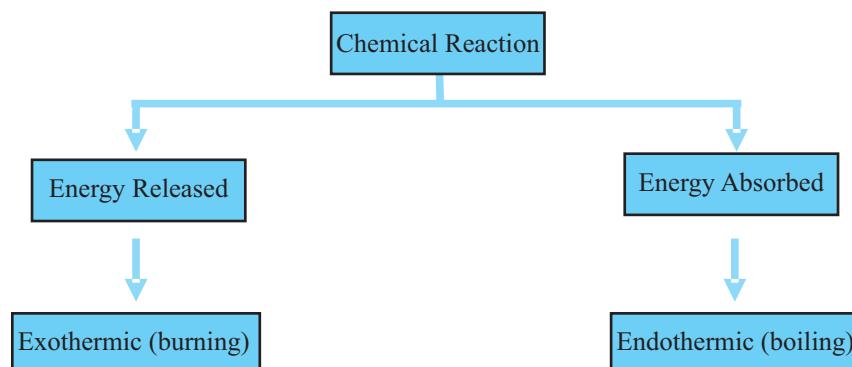
40 mins/1 period



## Material/Resources Required

You require following material for each group:  
Candle , match box , water, beakers glasses (3-4), jug , sodium hydroxide (few pellets), stirrer ,unslaked lime, urea.

### Concept Map



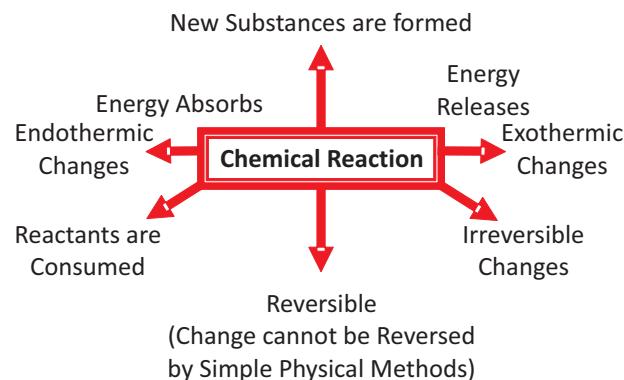
### Information for Teacher

- A chemical reaction occurs when energy is released or absorbed. e.g the reaction between an acid and base to form salt and water is a chemical reaction.
- A chemical reaction is also irreversible, because we can't get the original substance back. e.g: If we bake a cake with milk, flour and sugar we can't get each substance back therefore it is irreversible and a chemical reaction.
- A chemical reaction or change that releases heat or energy is called exothermic reaction e.g combustion reactions of fuels, neutralization and burning.
- Endothermic reaction takes place when heat is absorbed by the reactants to form products e.g melting ice cubes and solid salts, evaporating liquid water.



### Introduction

Write the word “chemical reaction” on board and ask children to give their ideas about it



### Brainstorming:

- After making the above spider map, direct students' discussion towards the relation between energy and temperature of a chemical reaction by asking following questions and have a class discussion on these:
  - i. When you heat water, are you giving heat to water or getting heat from water? If Yes, Why?
  - ii. Burning of a paper gives us heat or not? Give reasons 1-2.
- After discussion: introduce exothermic and endothermic changes, by telling them their definitions, and elaborating through examples.

- Then ask students:
- Are these a type of chemical change?
  - Listen to their responses and explain that yes, these are the chemical changes in which new products are formed by losing or gaining heat. Write the following on board:

Exo = out (loose)

thermic = energy (heat)

- Explain that an exothermic change means the loss of heat in a chemical reaction. And again write the following on board:

Endo = in (gain)

thermic = energy (heat)

Ask a volunteer to define an endothermic change with the help of the words. "Endothermic change or reaction is that in which heat is absorbed by a chemical reaction.

Endo = in (gain)

thermic = energy (heat)

- Ask a volunteer to define an endothermic change with the help of the words. "Endothermic change or reaction is that in which heat is absorbed by a chemical reaction.



## Development

### ACTIVITY 1

Divide students in three groups.

#### Group 1:

Give material to the 1<sup>st</sup> group (a candle for each group, a match box) instruct them to:

- Light a candle.
- Observe what happens with the candle.
- Feel the heat which is given out by the burning candle.



Conclude the activity by asking:

**Q<sub>1</sub>:** Can we return the products of burnt out wax into the original candle?

**Q<sub>2</sub>:** What type of reaction is this? (Exothermic or Endothermic)

After getting students responses than tell them that "yes" it is an exothermic reaction."

### ACTIVITY 2

To the second group, give material (NaOH, water, beaker/glass, stirrer) and instruct them to:

- Half fill a beaker/glass with water.
- Add 1 table spoon of sodium hydroxide pellets in the water and mix it with a stirrer.
- Touch the sides of the beaker.
- What do you feel and why?

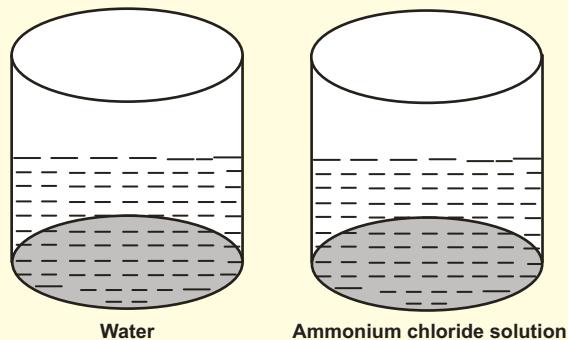
### ACTIVITY 3

To the third group, give material (NH<sub>4</sub>Cl, H<sub>2</sub>O, stirrer, beaker) and instruct them to:

- Half fill a beaker/glass with water.
- Add half table spoon ammonium chloride in the water and mix it with a stirrer.
- Touch the sides of the beaker and

conclude by asking:

- What is your observations?
- Is it an exothermic reaction or endothermic?



### Conclusion/sum up

Conclude the lesson by telling students that they learnt :

- Changes which cannot be reversed by physical methods are called chemical changes or chemical reactions.
- Chemical reactions involve/use production of energy, as we have observed the production of heat energy in burning of candle and consumption of heat energy on dissolving ammonium chloride in water.
- Burning of fuel, rusting of iron, digestion of food etc. are the examples of chemical reactions.



### Assessment

Assess student learning by asking these questions.

**Q<sub>1</sub>:** Take a few drops of spirit on your palm and blow it. What do you feel and why?

**A<sub>1</sub>:** We feel cooling effect as spirit evaporates- Evaporation is an endothermic process.

**Q<sub>2</sub>:** Is respiration an exothermic or endothermic

change?

**A<sub>2</sub>:** Respiration is exothermic as energy is released during the process.

### Follow-up

Ask students to write answer of the following question:

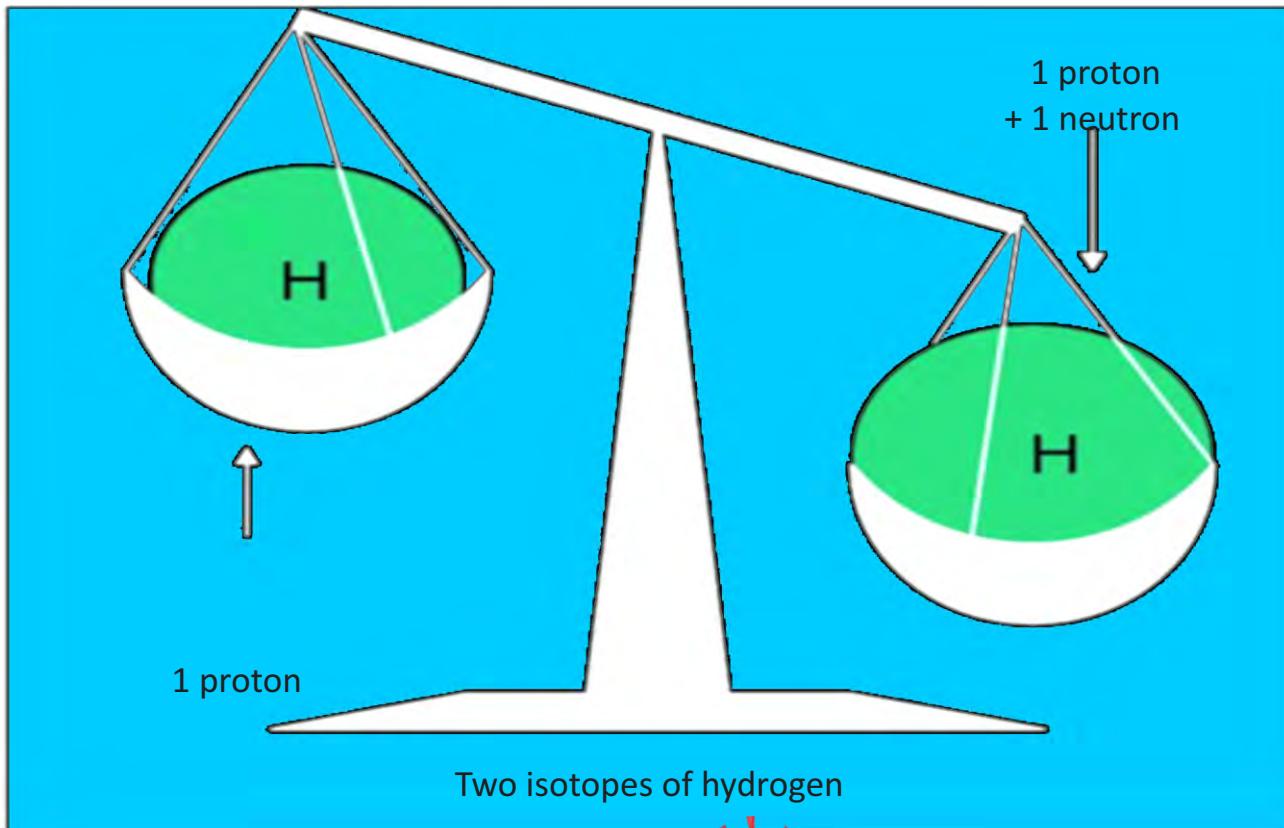
- Sometimes burning results into damage, e.g. a house on fire. How can you control such situations?
- Dissolve 5g – 15g urea in a glass/beaker half filled with water. Observe the sides of the glass. Why is it so?
- Guide the students to solve the exercise questions given at the end of unit / chapter of the textbook

10

# Atomic Structure and Isotopes

Structure of an atom

Grade: VII



## Students' Learning Outcomes

- Students will be able to:
  - Describe structure of an atom
  - Define the term isotopes.
  - Explain uses of isotopes in medicines and agriculture



## Duration/Number of periods

80 minutes/2 periods

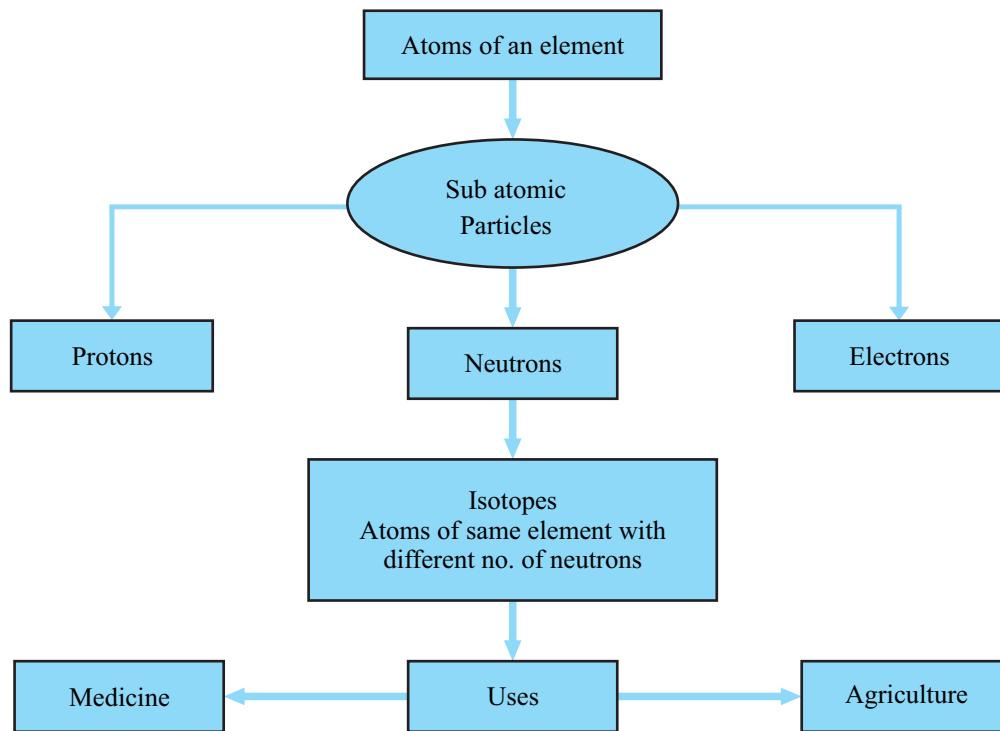


## Information for Teacher

- Atoms are basic building blocks of matter. The word atom is derived from the Greek word atom which means indivisible.
- Atoms are composed of three types of particles: protons, neutrons, and electrons.
- Protons have a positive (+) charge, neutrons are neutral while electrons have a negative charge (-).
- Atoms of a given element which have the

- same number of protons but different numbers of neutrons are called isotopes. Thus, isotopes of an element have same chemical properties but different physical properties.
- Isotopes are often used in medical research and therapy for a variety of diseases and genetic disorders.

### Concept Map



### Material/Resources required

A ball made of plasticine, different colored marbles or stones (Chocolate bunties can also be used), glue. Small rosary beads (Tasbeeh danay)

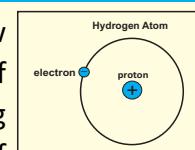


### Introduction

- Teacher can start the lesson by asking what is everything made of? Every building, every person, every object?(Students will answer matter and atoms).After getting their ideas about atom, they can be taught about atomic structure by using following activity:

### ACTIVITY

- Teacher can now explain structure of atom by showing children the model of hydrogen atom made from ball and marbles.
- In the model the ball may be depicted as the nucleus of the atoms.
- The marbles of orange color will represent protons. Put these in the nucleus. There are no neutrons in a hydrogen atom.
- Use a bendable wire to make the orbital and add rosary beads. Ask



children to keep on rotating the beads to show movement of electrons. Leave 2 inches distance between nucleus and electrons.

- Teacher should explain about the different types of charges on electrons and protons.
- Teacher should explain children that electrons are always moving. They spin very quickly and in any direction around the nucleus.
- Draw following pictures on board to give the spin and orbital concept.



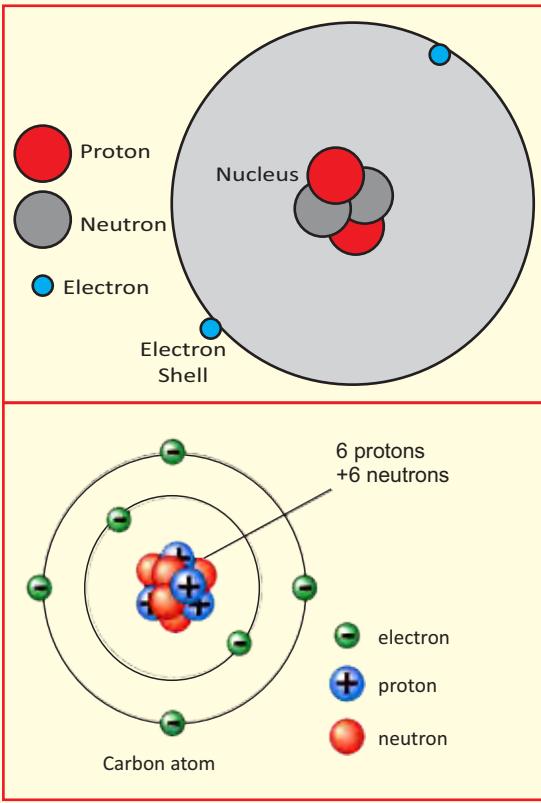
### Development

#### ACTIVITY 1

- Teacher can divide the class in three groups and ask children to make models of carbon and helium atom.
- Teacher will write the following data on board
- Carbon: 6 protons, 6 neutrons and 6 electrons.
- Helium: 2 protons, 2 neutrons and 2 electrons.
- Instructions should be given to children that electrons are present around the nucleus in shells. Shells or orbitals serve as home of electrons.
- First shell can have two electrons, 2<sup>nd</sup> shell can have 8 electrons and third can have upto 18 electrons.
- Move around the class and assist children in making models. Also ask them questions like where will be the

protons, what will be their charge.

- Ask both groups to come for a presentation and explain their atomic models.
- The models should look have the arrangement given below.



#### ACTIVITY 2

- Teacher can draw the following diagram on board.
- Ask the children to identify the four parts of the atom that are pointed out by arrows in the diagram above.
- Describe the electrical charges of the structures that are labeled 1, 2, and 3 in the diagram.

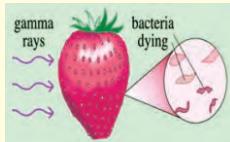
Ans: Number 1 is the electron, 2 is the proton, 3 is the neutron, and 4 is the

nucleus.

**Charges:** The electron is negative, proton is positive and neutron is neutral.

### ACTIVITY 3

- Teacher can explain students what are Isotopes and where are they used(given in information).To strengthen their concepts more, she can tell that
- Colbat-60 is used in food preservation. It is also used to sterilize medical equipment (e.g., gloves, syringes, cotton balls, etc.) as it produces gamma radiations.
- Medical isotopes are also used in treatment and diagnosis of diseases.
- Show students the following picture and ask them to explain the process.
- After listening to their explanations tell them that using radiations produced by isotopes is a method of treating food in order to make it safer to eat.
- Tell them that this method is also used to export fruits and vegetables to other countries as food life is increased.
- Students can be asked to prepare a list of other processes where isotopes can be used.



protons, neutrons, electrons.

- Protons have positive charge, electrons have negative while neutrons have no charge.
- Isotopes are of great medical and industrial use.hj



### Assessment

Teacher may ask some questions at the end of the lesson to ensure that they now know:

- What is the position of electrons, protons and neutron in the structure of any atom?
- What are types of charge on electrons and protons and neutrons?
- Define the term isotopes.  
What are uses of isotopes in food and medicine industry?



### Follow-up

Show students the following picture of destruction in Japan caused by an isotope of hydrogen. Tell them the interesting fact that all new clocks and watches made in Japan have the same time 10:10 as bomb was dropped at this time. It is in the memory of those who died in Hiroshima Nagasaki nuclear attack. Ask them to find out which isotope of hydrogen was used for it?



### Conclusion/Sum up

- Teacher may conclude the lesson by telling children that they have learnt:
- An atom has subatomic particles called

- Guide the students to solve the exercise questions given at the end of unit / chapter of the textbook.

UNIT

TOPIC

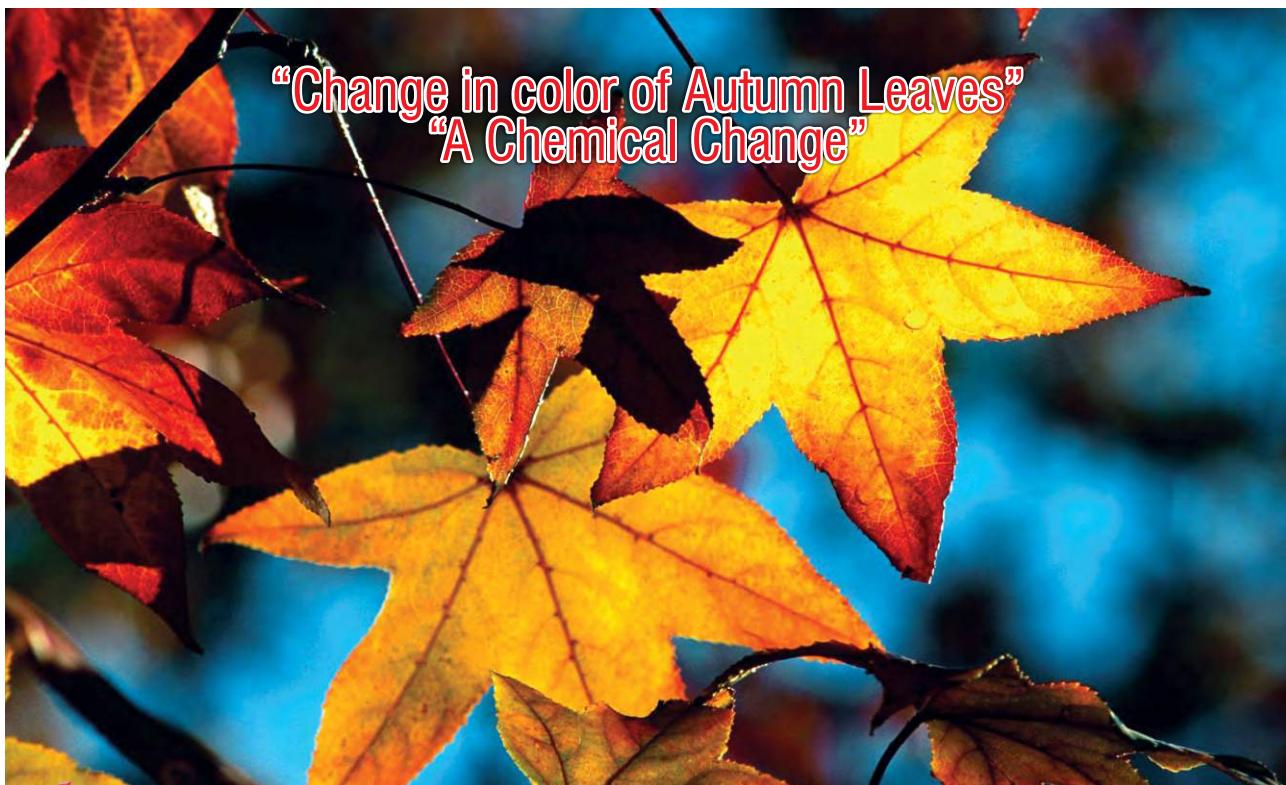
Lesson Plan  
22

11

# Physical and Chemical Changes

## Physical and Chemical Changes and Processes

Grade: VII



### Students' Learning Outcomes

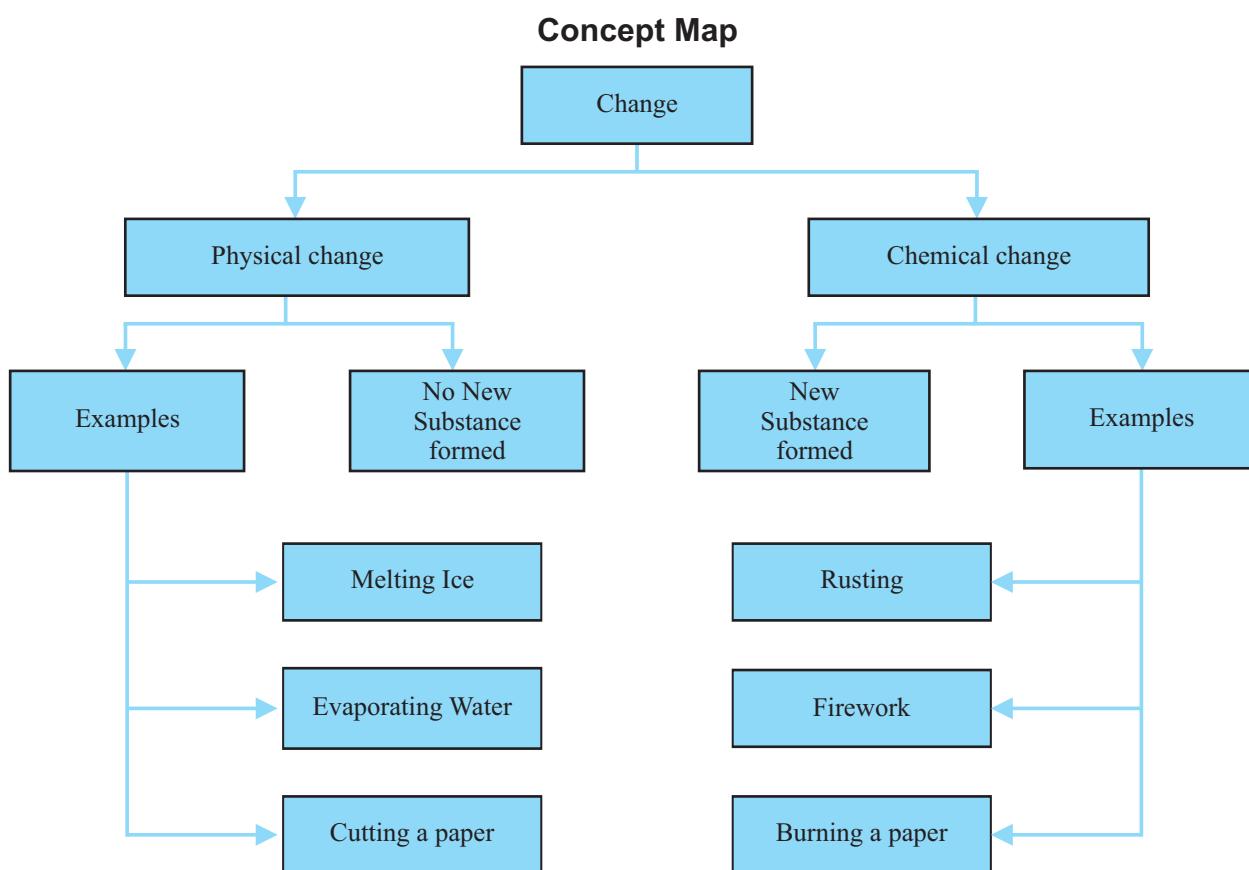
- Students will be able to:
  - Differentiate between physical and chemical changes.
  - Identify the physical and

- A physical change is a change in the size, shape, state, or appearance of matter. No new substance(s) are produced. Example: ice melting to water or water boiling.
- In a chemical change one or more NEW substances are created. The new substance has different properties from the original one.
- A physical change is reversible, a chemical change is not. For example, the freezing of water would be a physical change because it can be reversed, whereas the burning of wood is a chemical change - you can't 'unburn' it.



### Information for Teacher

- There are two types of change: Physical change Chemical change.



### Duration/Number of periods

80 minutes/2 periods



### Material/Resources required

Candle, Milk, yogurt, salt, baking soda, vinegar, papers



### Introduction

Teacher can introduce the lesson by using the following activity:

- Show children milk and yoghurt and ask them to explain the difference between them.
- Teacher will explain that due to a chemical



change milk has changed into a new product with different taste and properties. As it cannot be changed into milk again so it is a chemical change.

- Light up a candle in class. Candle will start to melt.
- Students will be explained that as candle wax has melted due to heating, it's a physical change but a chemical change is also taking place i.e burning of candle wick in air forming carbon dioxide and water.
- Brainstorm children by asking about different types of chemical and physical changes around them.





## Development

### ACTIVITY 1

- Teacher can divide the class in tow 4 groups and assign them activity 1 and 2. After performing the experiment presenter from each group will share their observations and conclusions with other groups.
- Ask children to put one spoonful of salt into the cup A
- Put some water into the cup and stir.
- Ask them to wait 15 seconds and observe what happens.
- Ask children following questions:
  - What happened when the water was added to the salt? (Children will answer that salt dissolved completely in water)
  - Did a physical or chemical change happen? Explain. (A physical change has occurred as salt and water can be separated by evaporation)



### ACTIVITY 2

Assign the following activity to 2<sup>nd</sup> group.



- Put one spoonful of baking soda into the beaker/cup B.
- Put three spoonfuls of vinegar into the cup.
- Ask them to observe what happens and then answer following questions:
  - What happened when the vinegar was

added to the baking soda? (Students will answer that bubbles started rising in the cup. Tell them that this is carbon dioxide and rising of bubbles is called effervescence)

- Did a physical or chemical change happen? (Explain It is a chemical reaction as new products are formed)
- Homogeneous mixtures are called solution.
- Solution can be in any physical state e.g. alloy is a solid-solid solution of metals, Air is a gas-gas solution etc.
- Upon filtration solution do not leave a residue but suspension leave residue.

### ACTIVITY 3

- Show students a piece of paper. Ask them to take 2 minutes to come up with examples of how this paper could physically change and how it could chemically change.
- Ask students to share their examples.
- Crumple or fold the paper to demonstrate physical change.
- Burn the tip of a piece of paper to demonstrate chemical change.
- Homogeneous mixtures are called solution.
- Solution can be in any physical state e.g. alloy is a solid-solid solution of metals, Air is a gas-gas solution etc.
- Upon filtration solution do not leave a residue but suspension leave residue.





### Conclusion/sum up

Conclude lesson by telling children that they have learnt.

- In physical change the chemical properties are retained.
- In chemical change the chemical properties of reactants are lost.



### Assessment

#### ACTIVITY 1

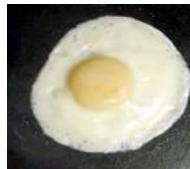
Teacher can assess student learning by asking them to write answers of following statements in their note books:

1. Cutting paper is a \_\_\_\_\_ change.
2. A melting ice cube is an example of a \_\_\_\_\_ change.
3. Burning Fire is an example of a \_\_\_\_\_ change.
4. Boiling Water is an example of a \_\_\_\_\_ change.
5. Rusting of iron is a \_\_\_\_\_ change.



### Follow-up

- Show children following picture and ask them to find out what kind of change occurs
  1. when you fry an egg
  2. light up fireworks.
  3. Change of color of autumn leaves.
- Support your answers with logical reasons.



#### ACTIVITY 2

Find three examples of Chemical and Physical Changes in everyday life. Explain why each of these changes are either chemical or physical.

UNIT

12

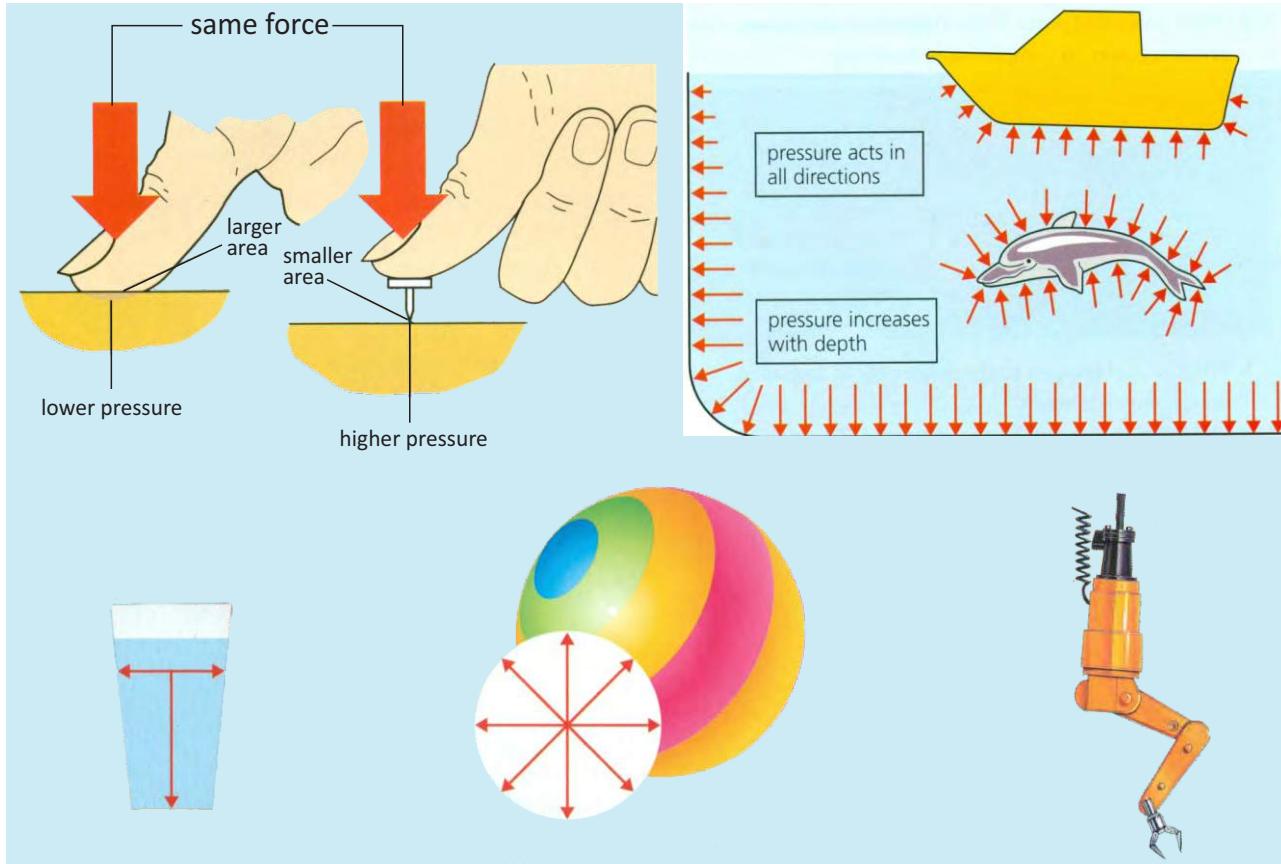
TOPIC

Lesson Plan  
23

# Units of Pressure & its Application

## Force & Pressure

Grade VIII



**Students' Learning Outcomes**

Students will be able to:

- define the term pressure.
- identify the units of pressure.
- explain hydraulics and hydraulic system by giving examples.

**Duration/Number of Period**

80 minutes/ 2 periods

**Material/Resources Required**

Balloon, water, common pin, tread, 2 syringes, water, rubber tube 2x10cm, 2 cylinders, 1 big and 1 small, 2 cork pistons according to the sizes of cylinder, toy car or any other thing.



### Information for Teacher

- When a force acts on an object it exerts **pressure**. The pressure acts at a right-angle to the object itself, and its strength depends on the amount of force and the area over which it is applied.
- When we apply a force on a body then according to conditions it has two effects like:-
- When force applied on small area, it gives high pressure e.g., force applied on the sharp edge of a knife produces a high pressure due to which cut things easily.



- When force on a large area is applied it gives low pressure, e.g. camels have wide feet to spread their weight on the sand which lowers the pressure and allows them to walk on sand without sinking in sand.
  - Pressure is the force exerted on a unit area.
- Mathematically, it is represented as

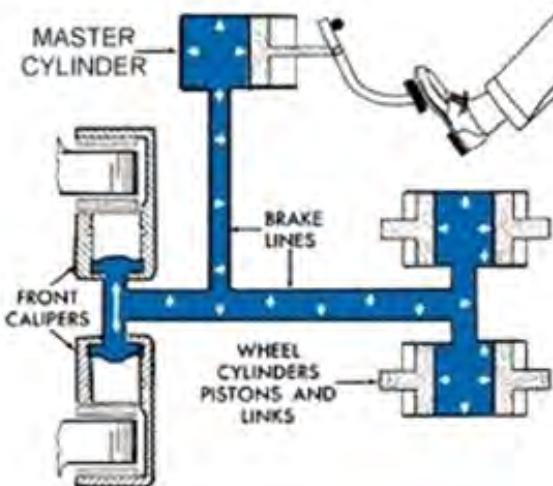


Camels have big feet

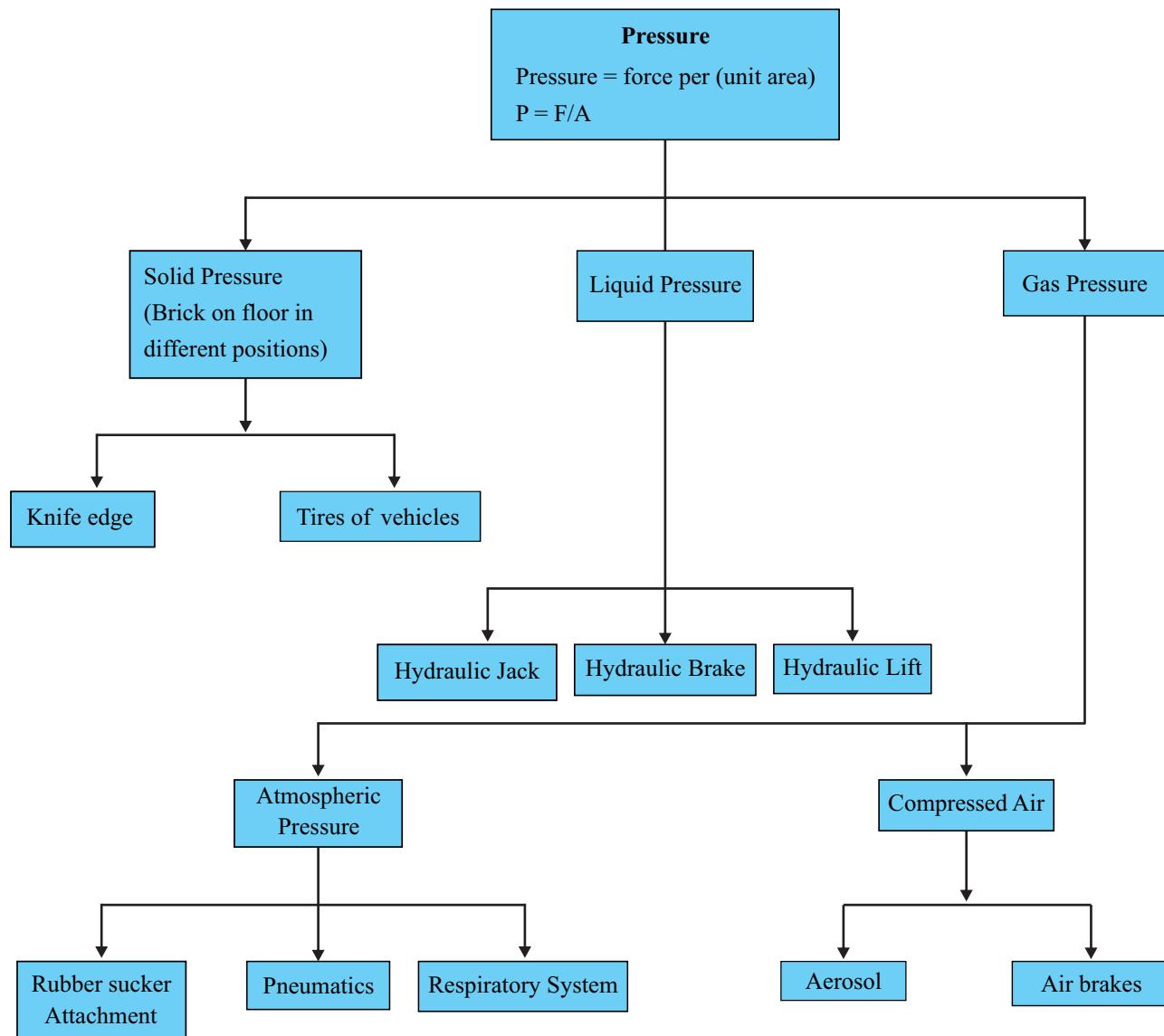
$$P = F/A$$

Where  $F$  = force,  $A$  = area and  $P$  = pressure.

- Pressure is measured in **Pascals (Pa)**. This is the SI unit of pressure. It is a pressure of one newton per meter square ( $N/m^2$ ).
- Kilopascal (kPa) is 1000 pa.
- Pressure is everywhere. It operates many machines and affects our weather. Solids liquids and gases all apply pressure to the surfaces they touch.
- Pneumatic machines are driven by the pressure of gases, usually air. Unlike liquid, air can be compressed into a smaller space, and this increases its pressure.
- "Hydraulics" is the study in which we deal with mechanical properties of liquids.
- Hydraulic system is used in car braking systems. A small piston connected with one end of a tube is pressed with a small force by pressing on the brake pedal, consequently the large piston connected to the other end of the tube is pushed out with a much larger force which pushes the brake brushes. This results in stopping the car ultimately.



## Concept Map



### Introduction

Perform a following activity involving the students for giving them the concept of gas pressure.

#### ACTIVITY 1

- Fill the balloon with water
- Tie the upper end of balloon.
- Water exerts pressure downward so

the balloons look like a drop.

- Make several holes on the balloon's surface. The water will start dropping down.
- When the balloon is squeezed gently, the water starts to drop down from every hole equally and more speedily.
- After the demonstration tell the students that when we apply a small amount of force to squeeze the balloon, it increases the pressure on

water and ultimately water comes down from the holes with more speed. Now announce that we will learn about **pressure**, its **units** & its functions in the form of **hydraulics**.



## Development

Tell the definition of pressure to the students first as Force acting per unit area is called pressure. tell the factors upon which Pressure depends.

Write the following formula & units as:-

$$P = F/A \text{ (N/m}^2\text{)}$$

### ACTIVITY 1

Aks the students a day before to bring Clay and a coin. Divided the students into 5 or 6 groups. Ask the students to press the coin flat and then edgewise. Now ask the following questions from the students.

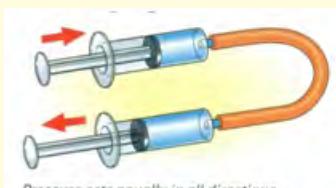
- What you observed when the coin was pressed edgewise and then flat?

(Expected answer: More force was applied when the coin was pressed flat and less force was applied when the coin was pressed edgewise.

### ACTIVITY 2

Clear the student's concept by performing the following activity under his/her assistance.

Divide the students in pairs.



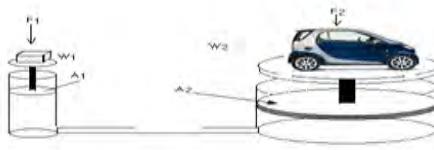
- Instruct to fill the syringes about half

with water.

- Put the hollow rubber tube from both sides at nozzles of the syringes as shown in the figure.
- Ask the student to push the plunger of one syringe inward, the pressure exerted through it will push the plunger of other syringe outward direction.

Now asks a student to push both the plungers inward with the same force. There will be no movement in the plungers because the amount of pressure on both sides is equal.

### ACTIVITY 3



- Perform the following activity to give the concept of hydraulics.

Instruct the students to attach the cylinder according to the figure shown above.

- Instruct the students to place a toy car on the piston of larger cylinder.
- Add some weight of 50 gm or more on the piston of smaller cylinder. The student will observe the changes. Now add more weight on the piston.
- As well as the weight increases on the small piston, the amount of pressure exerted by it will increase on the larger piston, so the car will raise up.
- Now tell the students that hydraulics lift at service stations work in the same manner.
- Ask the students to identify more hydraulic systems which can be used in daily life.



### Conclusion/Sum up

- The hydraulic system works out on the principle of 2<sup>nd</sup> activity.
- The pressure transmits equally in all directions.
- Amount of pressure increases with the depth of the liquid.
- Larger weights can be lifted by applying smaller force using hydraulic systems.



### Assessment

Ask the following questions.

Q1. At service station why hydraulic lifts are used?

(Expected answer: To lift the car so that it can be washed properly)

Q2. Why people with high heel shoes are not allowed on jogging tracks?

(Expected answer: Because high heels exert more pressure than flat shoes which make the ground uneven)

Q3. When will the pressure be more, while standing on the mattress or when lying on the mattress?

(Expected answer: Pressure will be more when one stands on the mattress)



### Follow-up

- Make a diagram of hydraulic system from the books on their notebooks.
- How pressure cooker works? Describe its principle.
- Guide the students to solve the exercise problems given at the end of unit / chapter of textbook.

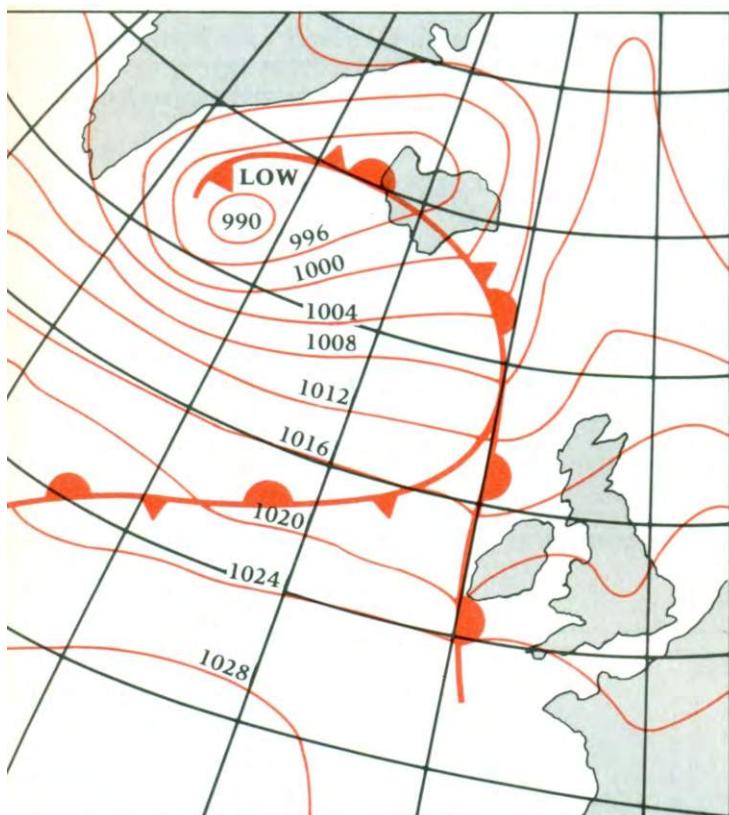
## TOPIC

Lesson Plan  
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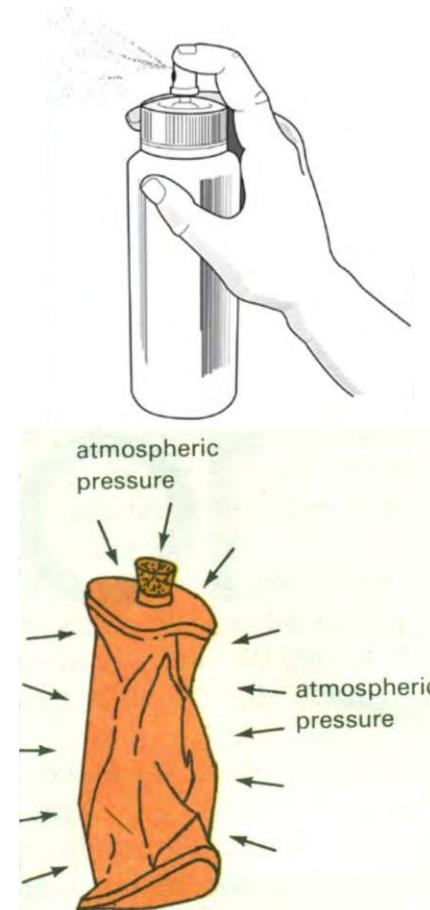
# Pneumatics

## (Behaviour of Gases Under Pressure)

Grade VIII



Atmospheric Pressure varies with height above sea level

**Students' Learning Outcomes**

Students will be able to:

- explain how gases behave under pressure.
- describe the causes of gas pressure in a container.
- identify the application of gas pressure.

- describe the term atmospheric pressure.
- explain the working of aerosols.

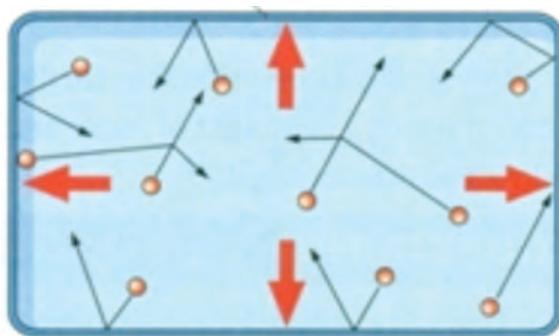
**Duration/Number of Period**

80 minutes/ 2 periods



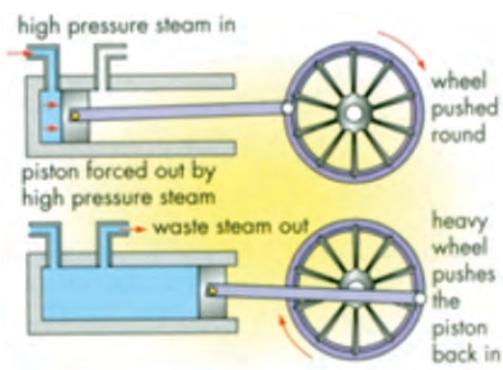
### Information for Teacher

- There are three states of matter e.g., solid, liquid, and gas. Every state made up of atoms, molecules, which are always in random motion. These molecules exert a force on the walls of the vessel.



Gas pressure

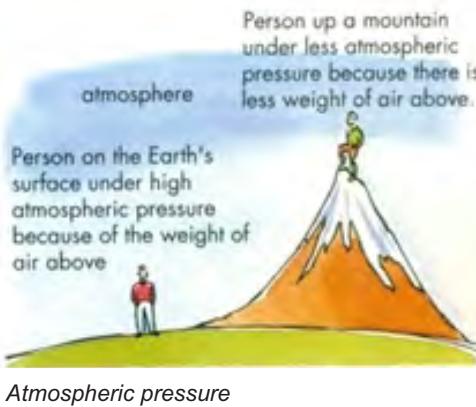
- The collision of gas particles with the walls of a container and with themselves is called gas pressure in a container.
- “Pneumatics” is the term which is used for gas molecules in pressure.
- Pneumatics machines are driven by the pressure of gases, usually air. Unlike liquid, air can be compressed into a smaller space, and this increases its pressure.
- Gas pressure is one of the most



How a steam engine works

important way of making machines to move, e.g., the working of a steam engine, fire extinguisher and aerosol sprays.

- Atmosphere is a wide ocean of air. It is a blanket of gases that surrounds the Earth.
- Air exerts pressure on our body.
- The pressure on the Earth caused by the weight of the gases in the atmosphere is called atmospheric pressure.
- The closer you get to the ground, the greater the atmospheric pressure.
- The pressure of air molecules at ground level or at plain surfaces is greater than the surfaces of hilly areas.
- Air inside a ball / tire pushes out in all directions keeping it blown up.
- Barometers and manometers are the instruments to measure pressure of a gas with respect to its surroundings.
- Atmospheric pressure is measured in millibars (mb)



Atmospheric pressure

### Material/Resources Required

Charts showing different aerosol sprays, juices, straws, syringes, corks, rubber tube, balloons, aerosol sprays



## Introduction

Ask some questions to assess the previous knowledge of the students

Q1. What is surrounding the earth?

(Expected answer: Atmosphere)



Q2. What is atmosphere?

(Expected answer: Atmosphere is a cover or blanket of different gases)

### ACTIVITY

Do the following activity to give the concept of atmospheric pressure as.

- Call one of the student and give him a pack of juice with straw.
- Tell him/her to drink the juice with the straw.
- The juice in pack will start to move upward as he/she sucks the juice.
- Tell the students that when we drink juice or bottle, we suck the air from the juice pack or bottle and thus a vacuum is created in it. The outside pressure of air become greater from the inside pressure and this greater pressure crushes the juice pack by pushing the liquid up into the mouth.
- Tell students about the working of the can crushing activity which work due to the difference of atmospheric pressure.



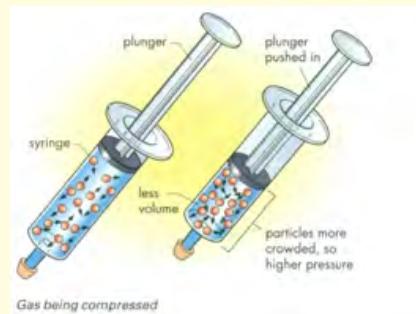
When the atmospheric pressure outside the can is much greater than the pressure inside the can it crushes the can and makes its volume very small.



## Development

### ACTIVITY 1

- Instruct the students to take two syringes and take out their needles and put a cork

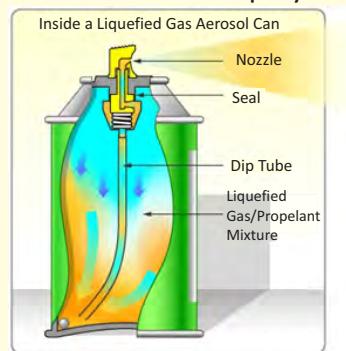


at the opening ends.

- Move the plunger inward, then a stage will come when plungers will no more move inward, because the air molecules are now more crowded and can not be pressed further. In this way a high pressure is produced in the syringe which stops the downward movement of the plunger.

### ACTIVITY 2

- Show a chart of aerosol spray:



- Tell the students to spray out from the aerosols.
- The students will see that an air is coming out from the spray. But when they shake the bottle they will feel that there is some liquid in it. Tell students about the working of aerosol.
- The aerosol has some empty space above the liquid where the gas is enclosed. When the bottle is shacked gas mixes with liquid and produces a high pressure.
- When the valve is opened by pressing the button, the high pressure gas liquid mixture inside the bottle comes outside where the pressure is low.
- In this way the expanding gas forces the liquid out of the nozzle.



### Assessment

**Q.1** What happen in the pressure cooker on heating?

(Expected answer: Pressure inside the pressure cooker increase than the outside atmospheric pressure.)

**Q.2** What units for atmospheric pressure are used in weather forecasting?

Expected answer: millibars

$1 \text{ bar} = 100 \text{ kPa}$  = normal atmospheric pressure

$1 \text{ bar} = 1000 \text{ millibars}$

**Q.3** Why food takes more time to be cooked on hilly areas?

(Expected answer: Due to low pressure in hilly areas).

**Q.4** Why do you think air is used rather than water in tires?

(Expected answer: because air is more compressable than water)

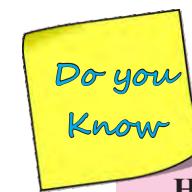
**Q.5** In which direction gas particles will move when they are heated.

(Expected answer: They will move in upward direction)



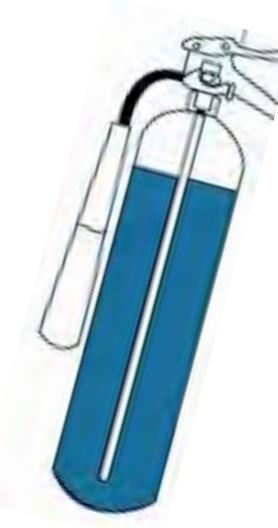
### Follow-up

- Visit a tire shop to observe how air is filled in the tires, also observe the following
  - What instruments he uses to measure air pressure in the tires?
  - What units of pressure are being used by him?
  - Is there any harmful effect of aerosol sprays on the atmosphere?
- Guide the students to solve the exercise problems given at the end of unit / chapter of the textbook.



### How a fire extinguisher works

A foam and water fire extinguisher is a pneumatic machine which uses compressed carbon dioxide gas.



UNIT

TOPIC

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13

# Physical Quantities and System International Units

## Measurements of Physical Quantities

Grade VIII



### Students' Learning Outcomes

Students will be able to:

- define a physical quantity with examples.
- apply the prefixes (milli, kilo, centi) and interpret the units.
- interconvert smaller units and bigger units.
- Interpret SI units in the daily life.
- Investigate why it is desirable for a scientists to use the SI units in their work.



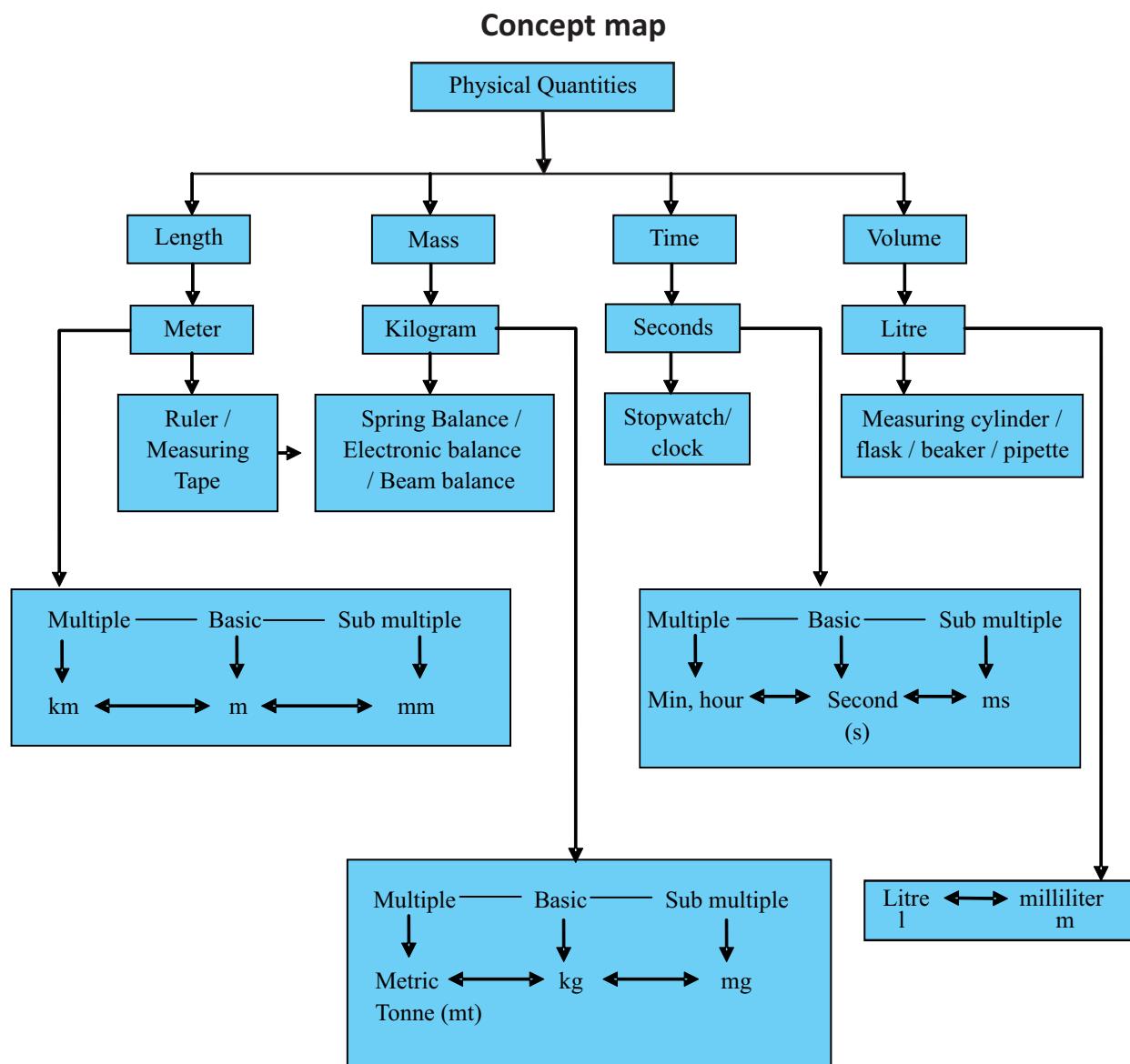
### Duration/Number of Period

40 mins/1 period



### Material/Resources Required

Chart of S.I units and pictures of measuring instruments from different science books, newspaper etc, two buckets, stopwatches and graduated cylinders.



### Information for Teacher

- Measurement is a different phenomenon from counting, even though both associate with numbers.
- A **Physical quantity** is a quantity that can be measured or it is a physical property that can be qualified. Length, mass, time & volume etc. are the examples of physical quantities.
- They are measured in suitable units such as meter, kilogram, second, litre and meter<sup>3</sup>etc.
- Value of a physical quantity is expressed as the product of a numerical value and a unit of measurement.
- At the international conference on weights and measures in 1960, a coherent system of metric units known as international system of units was adopted. It is officially abbreviated as SI in all languages.
- One meter is the distance travelled by light in

vacuum during a time of 1/299,792,458 second.

- A standard kilogram is the mass of platinum and iridium alloy cylinder kept at the "international Bureau of Weight and Measures" Near Paris.
- A second is the duration in which the cesium - 133 atom completes 9,192,631,770 vibrations.
- Volume = Length x Breadth x Height
- In calculations we must be careful that all the unit are S.I units with same multiples or submultiples of the basic units. The terms used internationally for the multiples and submultiples for various units are called prefixes.
- Standard measurement helps us in different fields of life. These values always give us accurate results which are accepted by everyone. Most countries today use the metric system. Buying and selling between countries is much easier if every one uses the same system



## Introduction

### ACTIVITY

Show a chart on which a table of physical quantities, their respective SI units are shown like as:-

Physical Quantities	SI Unit	Symbol
Length	meter	m
Mass	kilogram	kg
Time	second	s
Electric current	Ampere	A
Temperature	kelvin	k
Volume	Liter	l

Ask some questions to assess the students' previous knowledge and write the expected responses on the board

- Q1. In which units do you measure your height?

(Expected answer: In feet or meters)

- Q2. In which units do we show time?

(Expected answer: In minutes hours or seconds)

- Q3. How much do you weight

(Expected answer: 35-40 kg)

- Q4. How far away is your school?

(Expected answer: meters or kilometers)



## Development

### ACTIVITY 1

Make the following table on the board and then ask the students to fill it with the appropriate values:

Mass	3 kg	----- g	3000000 mg
Length	---- m	50 cm	500 mm
Time	120 min	2 hours	---- s

The expected answers will be as:-

Mass	3 kg	3000 g	3000000 mg
Length	0.5 m	50 cm	500 mm
Time	120 min	2 hours	7200 s

### ACTIVITY 2

Show the chart of prefixes and then perform the following activity involving the students.

#### Prefixes for use with SI units

Sub - Multiple	Multiple	Prefix	Symbol
$10^{-2}$		centi	c
$10^{-3}$		milli	m
	$10^3$	kilo	k

- Ask the students to read chart to observe the prefixes, their symbols and multiplication factors.
- Ask different students about the multiplication factors of different prefixes.
- Now remove the chart and ask them to write the multiplication factors of the kilo, centi, milli on their

### ACTIVITY 3

In this activity the students will be able to measure the time in seconds and minutes with the help of a stopwatch. Divide the class into 5-6 groups.

Place one bucket under the tap, open tap and at the same time start the stop-watch. When the bucket is filled, stop the stopwatch. Note the time and repeat the process with the 2nd similar bucket. Ask the following questions:

- What is the time taken to fill each of the buckets? What is the difference between both the times intervals?  
(Expected answer: Both the buckets are filled in equal time)
- How can you find the volume of water in the bucket? What instrument will you require?  
(Expected answer: with the help of a graduated cylinder)



### Conclusion/Sum up

Complete the lesson by showing S.I chart to the students. Ask them the following questions:

- What is the basic unit of length?  
(Expected answer: metre)
- What is the basic unit of time?  
(Expected answer: second)
- write one multiple and one submultiple units of length  
(Expected answer: km, cm)



### Assessment

Assess the students by asking the following questions:

- How many seconds are there in an hour?  
(Expected answer: 3600 seconds)
- What is the approximate mass of your school bag?  
(Expected answer: 4-5 kg)



### Follow-up

- What happens to an astronaut's weight and mass, when he leaves Earth and travels to the Moon?
- Make a chart for the multiples or prefixes of time.
- Guide the students to solve the exercise problems given at the end of unit / chapter of textbook.

14

# Types of Electric Circuits

## (Parallel and Series Circuits)

Circuits and Electric Current

Grade VII



### Students' Learning Outcomes

Students will be able to:

- define current.
- make parallel and series circuit.
- investigate about types of circuits, used for different purposes.
- identify the disadvantage of series circuit.



### Information for Teacher

- Flow of electrons passing through a conductor per second is called electric

current. It is measured in Amperes (A) or milli ampere (mA).

- The path followed by the current is called circuit.
- Electric circuit is of two types; open circuit and closed circuit.
- Basic components for an electric circuit are battery, key / switch, bulb and connecting wires.
- The electric components may be connected in two ways; series combination and parallel combination.



## Duration/Number of Period

40min/ 1 Period



## Material/Resources Required

Dry cell(1.5 V), cell holder, electric bulb, bulb holder, connecting wires and switch.

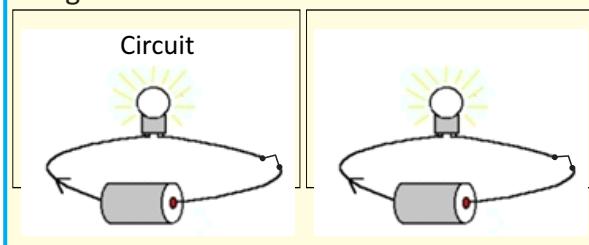


## Introduction

### ACTIVITY 1

To set up a simple electric circuit Students will use cell, an electric bulb, a switch and connecting wires. Connect the bulb, cell and key to form a circuit so that the bulb lights up.

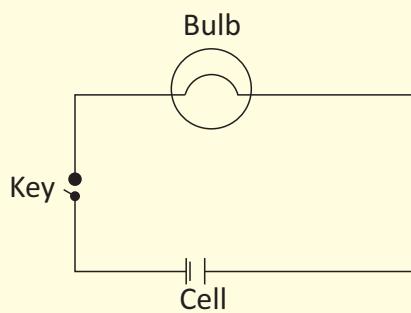
Ask the students to draw the circuit diagram on their notebook.



### ACTIVITY 2

Demonstrate open and closed circuits arrange the apparatus as shown.

Draw the table on the board and ask the students one by one to fill the spaces.



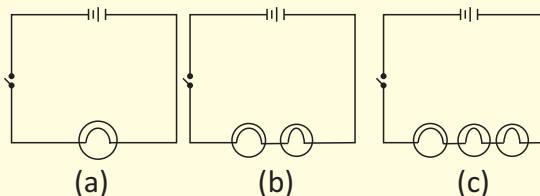
Tell about	Key is open	Key is closed	Key is closed but the wire is broken	Bulb does not glow although the circuit is complete
Bulb				
Circuit Type				

## Expected Answers

Tell about	Key is open	Key is closed	Key is closet but the wire is broken	Bulb does not glow although the circuit is complete
Bulb	Do not glow	Glow	Do not glow	Fuse bulb
Circuit Type	Open	Closed	Open	Open

### ACTIVITY 2

Set up a circuit as show in fig (a), (b), (c), (d), (e)



Ask the student about the type of combination

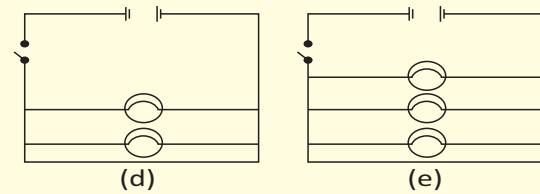
Expected answer: (Series circuit)

Ask to observe the brightness in each circuit.

Expected Answer: (As the number of bulbs increases, their brightness decreases)

What happens when one of the bulbs is removed in fig.c

Expected answer: All the bulbs goes OFF



Ask the students about the type of combinations in fig.d and e  
 Expected answer: (Parallel Combination)  
 Ask to observe the brightness in (d)  
 The bulbs in (d) glow with equal brightness  
 Q. what happens if one of the bulbs in (e) gets fused?  
 Expected answers: The other bulbs will keep on glowing



### Assessment

1. What is the function of a switch?  
 (Expected Answer: To open or close the circuit)
2. Name the source of electrical energy in the circuit.  
 (Expected Answer: Cell or battery)
3. Metal wires are used as connecting wires.  
 Why?  
 (Expected Answer: Metals are good conductor of electricity)
4. Name the electrical equipments in the house  
 (Expected Answer: Bulb, Tube light, Fan, T.V. Computer, Air Conditioner etc.)



### Conclusion/Sum up

- Q.1 What is series circuit?
- Ans. When two or more bulbs are connected one after the other in such a way that same current flows through all the bulbs is called series circuit.
- Q2. What is parallel circuit?
- Ans. When two or more bulbs are connected to

each other in such a way that the current flows through different paths is called parallel circuit.

When the circuit is open (either by opening the Key, broken wire, fused bulb or exhausted cell) the bulb does not glow.

The current flows only when the circuit is closed.



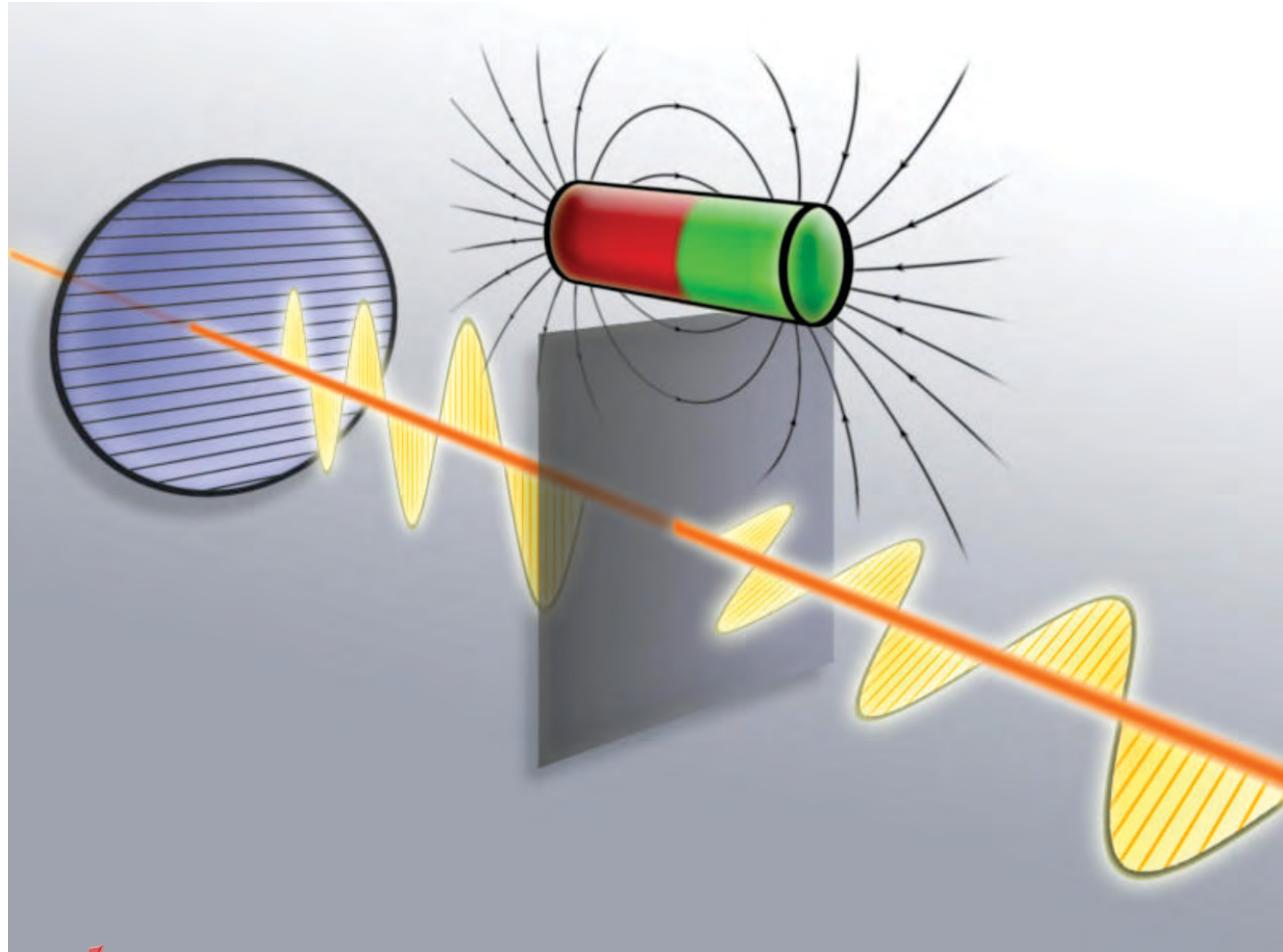
### Follow-up

- Draw circuit diagrams to connect three bulbs in various ways and observe the characteristics.
- Guide the students to solve the exercise problems given at the end of unit / chapter of the textbook.

# Effects of Electric Current

## (Heating, Chemical and Magnetic Effects)

Grade VII



### Students' Learning Outcomes

Students will be able to:

- explain the effects of electric current in daily use appliances.



### Information for Teacher

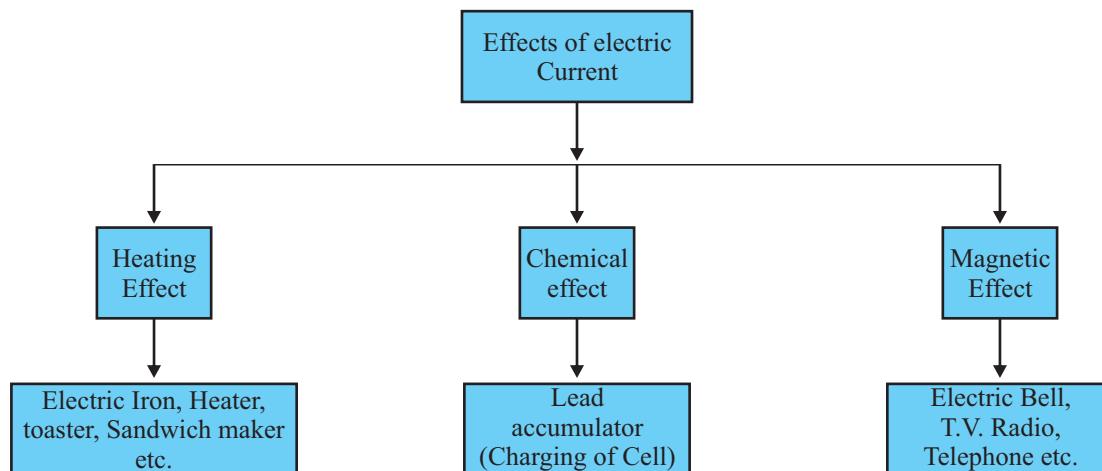
- The friction offered by a conductor, is called resistance.
- Different materials offer different amount of resistance.
- More is the resistance, more will be the heat

- produced in a conductor.
- Some materials give off heat and light when current flows through them (bulb, heater etc.)
  - A magnetic effect is produced due to passage of current
  - Such magnets are called electromagnets.

Electromagnets are used extensively in telephone, radio, television, telegraph, electric bell etc.

- When current is allowed to pass in electric cells, lead accumulator etc. electric energy is converted into chemical energy (e.g. charging of cells), but when the cells are used as a source of electric current then the chemical energy changes into electric energy.

### Concept map



40min / 1 Period



### Material/Resources required

Electric heater (1), Magnet, cell/battery, conducting wire wrapped over iron nail, compass needle and steel paper clips.



### Introduction

- Q. What makes electric iron hot?  
(Electric current)
- Q. What makes electromagnet acts as a

magnet? (Electric current)

- Today we will learn about the effects of electric current.



### Development

#### ACTIVITY 1

Divide the students into groups and ask to make a list of at least five home appliances in which electricity is used.

Q. Why do we use electric heater?  
(To produce heat)

Q. How does electric heater work?  
(electrical energy into heat energy)

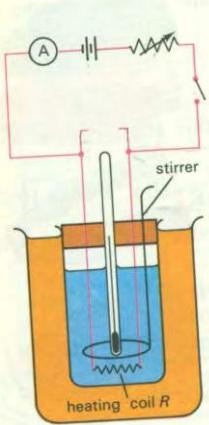
Q. Why electric current produces heat in an electric heater?

(The heater's element offers a hindrance /friction in the passage of current, which is converted into heat.)

Arrange an electric heater for activity in the class.

### ACTIVITY 2

Divide the students in groups. Ask the students to get the necessary apparatus i.e. beaker, oil/water, battery, key & connecting wires. Ask them to take 50ml of mustard oil in a beaker. Make a coil of Nichrome wire. Connect the coil with a battery using connecting wires and a switch as shown in figure. Dip the coil in the oil. Also suspend a thermometer in the oil & note the temperature. Close the circuit. Observe the temperature after 10 minute and complete the table.



Temperature before the Current is Passed	Temperature after the Current is Passed	Observation	Inferences

### Expected Answer

Temperature before the Current is Passed	Temperature after the Current is Passed	Observation	Inferences
May be $10^{\circ}\text{C}$	May be $13^{\circ}\text{C}$	Current has increased the temperature	Electric current has converted into heat

### ACTIVITY 3

Provide a bar magnet, compass, battery/cell, wire wrapped around an iron nail and steel paper clips.

Q. If we bring a bar magnet near the paper pins what will happen?

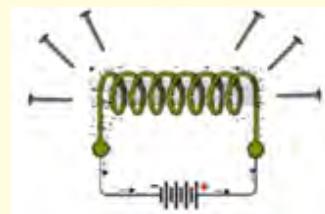
Ans. (attracted by the magnet)



Wrap the insulated wire around a nail. Connect the two ends of the wire with a battery. What happens by bringing the nail near the steel paper clips?

### Answer

Bring the nail near the steel paper clips. Steel paper clips cling to the iron nail. The nail changes into a magnet when current flows through the wires wrapped around the nail. Remove



the wire from the battery. The paper clips fall down.

Q. Why the coil becomes an electromagnet?

Ans. (Due to electric current).

Q. What happens or removing the cell from the coil?

Ans. (will not attract the paper clips).

Q. why it does not attract the paper clips on removing the cell?

Ans. (It no longer remains a magnet).

**ACTIVITY 4**

Provide required material to the students:

A cardboard, insulated copper wire, key, dry cell and connecting wires. Pass the copper wire through the middle of the cardboard and connect its ends with the battery. Place a compass needle on the cardboard. Discuss the students as:

**Q. What do you observe on completing the circuit?**

**Expected Answer:** there is some deflection in the compass needle.

**Q. Why compass needle is deflected?**

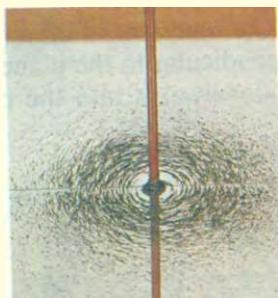
**Expected Answer:**

Magnetic field has been produced.

**Q. What is your conclusion after passing the current through copper wire, which produces the deflection in compass needle?**

**Expected Answer:** magnetic

effect has produced due to the passage of current through a conductor.



**Q. What makes the iron nail a magnet?**

**Ans.** (Electric current, when current is passing through a coil it acts like a magnet)

**Q. What makes the electric heater heat up?**

**Ans.** (Electric current, when current is passing through an electric heater it heats up due to high resistance)

**Q. How a battery is charged?**

**Ans.** (Electric energy is converted into chemical energy)

**Follow-up**

List at least three appliances in which you can observe the magnetic effects of current

- Guide the students to solve the exercise problems given at the end of unit /chapter of the textbook.

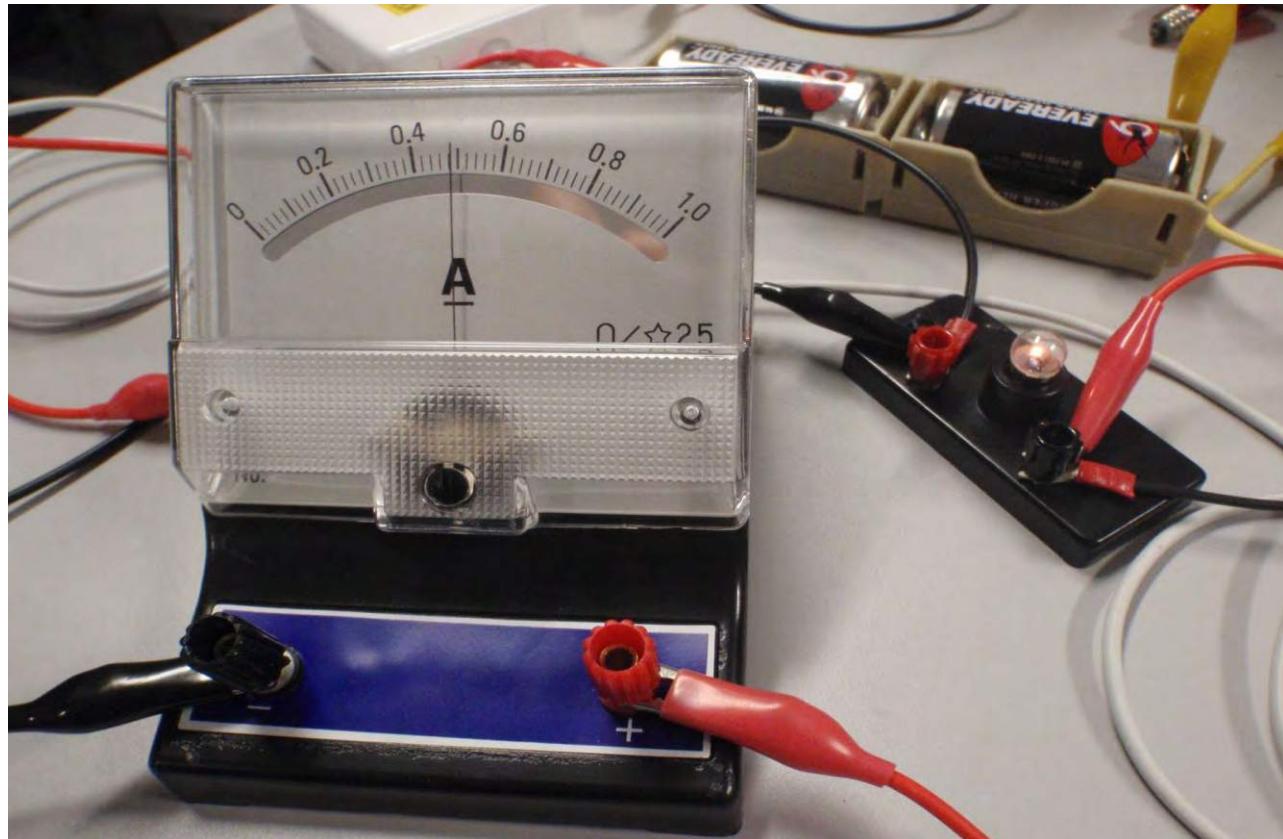
**Conclusion/sum up**

Conclude the lesson by asking the following questions.

# Measuring Current, Voltage and Resistance

## (Ammeter, Voltmeter and Resistance)

Grade VII



### Students' Learning Outcomes

The students will be able to:

- explain the use of ammeter in an electric circuits.
- measure current using different devices.
- list electrical hazards and precautionary measure to ensure the safe use of electricity at home.
- describe why electricity is hazards to humans.



### Information for Teacher

- The current is measured by ammeter or ampere-meter and galvanometer. Ammeters are of different ranges. Smaller current is measured with milli ammeter. A minute current is measured with galvanometer.
- A low value resistance is connected in parallel to the galvanometer. This provides an easy path to the current and it is converted into an ammeter.

- To measure the current in the components. The ammeter is always connected in series otherwise it will be damaged.

Considerable increase of current in a circuit may occur due to overloading, short circuit and random voltage fluctuation. Often fire is caused due to short circuit. A fuse or Circuit breaker is used to protect the electric appliances. Some time live wire of faulty appliance comes in contact with the metallic body. A person touching the body will get electric shock. Earthing the metallic body saves the person from the shock. It is dangerous to touch the device with wet hands. Electricity is a good servant but a bad master. One must observe proper safety precautions while using the electricity or electrical devices. Some precautions are as

- Proper insulation of wires and joints.
- Proper electrical connections
- Use of circuit breaker, fuse and earth wire.



### Duration/Number of Period

35min / 1 Period



### Material/Resources Required

Bulbs(3.0V), connecting wires, bulb holder, ammeter, dry cells cell and holder

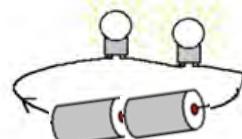


### Introduction

Draw two simple circuits on the board, circuit 1 consists of one bulb and two dry cells, and circuit 2 consists of two bulbs and two dry cells connected in series. Ask the students:



Circuit 1



Circuit 2

- In which circuit bulb will be brighter?

Ans.(The bulb in circuit 1)

- Why it lights brighter?

Ans. ( Because the current passing through the bulb in circuit 1 is larger than that in circuit 2)

- How can we measure the current?

(By connecting a device like ammeter or Galvano meter)



### Development

#### ACTIVITY 1

##### using an ammeter

Divide the students in groups and provide an ammeter to each group.



Ask the students to look at this apparatus and observe it carefully.

Connect a bulb, key and cell in series as show in fig 1

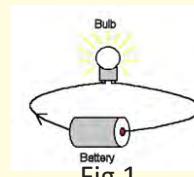


Fig 1

##### Step 1:

Cut the connecting wire at P (we can take point P anywhere in the circuit) and name two ends of connecting wire as P+ and P- as shown in Fig 2.

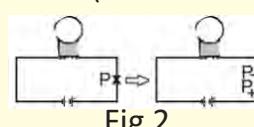


Fig 2

##### Step 2:

Connect the end P+ to the positive terminal of the ammeter and P- to the negative terminal as shown in Fig3.

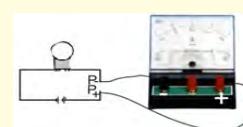


Fig 3

**Step 3:**

As a result, the ammeter is connected in series with the bulb.

After the explanation, the teacher will ask:

Q. Why the colors of the terminals is red and black?

(Red is positive terminal and black is negative terminal)

Q. If we want to measure the current passing through the bulb, how should we connect the ammeter?

(In series)

Q. Why we connect the ammeter in series? (So that the current may flow through the ammeter without damaging it)

Q. What is the unit of the current? (ampere)

Draw the circuit as shown in Fig.8 on the writing board and ask:

Q. If we connect the ammeter at this position as shown in Fig. 5 what will happen?

(Never connect the ammeter in parallel. It will be damaged).

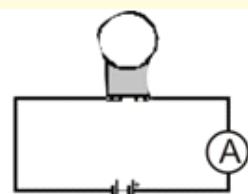


Fig 4

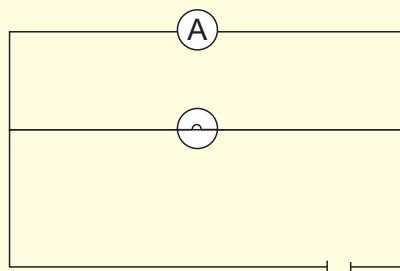


Fig 8

**ACTIVITY 2**

Divide the class in four groups.

The teacher will provide all the necessary materials to each group and instruct each

group to make simple circuits.

Circuit -1 one bulb and two dry cells connected in series.

Circuit-2 Two bulbs and two cells connected in series.

Ask each group to measure the currents.  $I_1$  and  $I_2$  which passes through each circuit and fill the following table on the writing board after collecting the information from the groups.

Group	Current $I_1$ (Circuit 1)	Current $I_2$ (Circuit 2)
G1		
G2		
G3		
G4		

Q. What do you find from the table? ( $I_2$  is larger than  $I_1$ )

Q. Why the bulb in circuit 1 lights brighter than the bulb in the circuit 2?

(More current is passing in circuit 1)

**Conclusion/sum up**

Ammeter and Galvanometer are used to measure the current. Ammeter is always connected in series. Never connect these meters in parallel to the load.

**Assessment**

Q. Why the ammeter should not be connected in parallel?

(Ammeter will be damaged)

Q. How the ammeter is connected in a circuit?

(The ammeter is connected in series with the load (bulb) in the circuit)

Q. What is the function of ammeter?

(To measure the flow of current)

Q. Name the devices used to measure the current?

(Ammeter & galvanometer)



### Follow-up

- Write down the dangers associated with electricity.
- How precautionary measures saves the human being.
- Why an electrician wears insulated gloves while repairing the electrical appliances.
- Guide the students to solve the exercise problems given at the end of each unit / chapter of textbook.

# Generating Electricity

## Electricity in Action

Grade VIII



### Students' Learning Outcomes

Students will be able to:

- design an experiment to generate electricity.
- explain the working of the model generator.



### Information for Teacher

- Electricity generation is the process of generating electrical energy from other

forms of energy.

- We need electricity in our daily life.
- We do not find electricity just laying around ready for us to use. We have to generate it.
- Dynamo converts the mechanical energy into electrical energy.
- Electricity is generated by using the energy from different sources i.e. fuels, coal, wind, hydro-electricity.
- Hydro-electric power stations generate electricity using water trapped behind the dams.



## Duration/Number of Period

40 mins / 1 period



## Material/Resources Required

Dynamo, connecting wire, bulb, switch, hand pulley, wooden board, string, bicycle fitted with dynamo



## Introduction

- Show the picture of a dam to the students and ask them:  
What is happening in the picture?  
What is the function of turbine?
- Show the picture of a power station and ask the following questions:  
Where does the electrical energy come to our houses.  
(Expected answer: From Power Stations)
- We use generators at our homes. What is its function?  
(Expected Answer: Produce Electricity)
- What is dynamo?  
(Expected Answer:Dynamo converts mechanical energy into electrical energy).

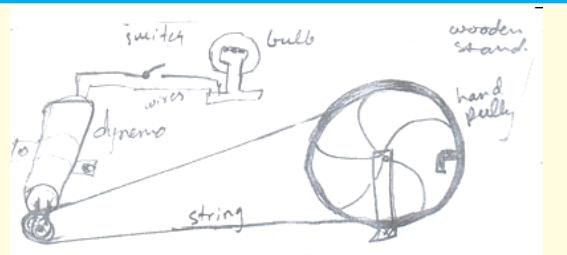


## Development

### ACTIVITY 1

Set the following apparatus according to the following diagram.

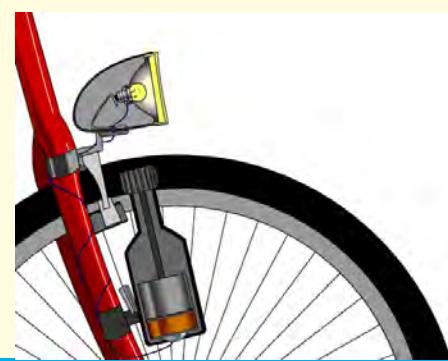
Dynamo, connecting wire, bulb, switch, hand pulley, wooden board, string



- Demonstrate the working of this model electricity generator.
- Ask different students to rotate the pulley and observe its effect on the bulb.
- When pulley will be rotated, string attached to it will rotate the dynamo.
- This in turn will make the bulb glowing.
- Faster the pulley is rotated; more light will be produced by the bulb.
- This experiment shows that potential energy provided by the hand is used to rotate pulley and dynamo converts this energy into electrical energy.

## ACTIVITY 2

- Bring a bicycle fitted with dynamo in the class.
- Ask a student to move the paddle of bicycle in order to move the wheel. As the dynamo is connected with the tire so it will also rotate.

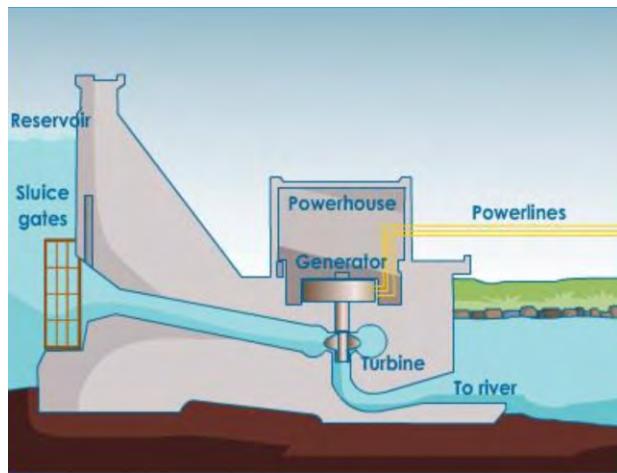


- The bulb connected with the dynamo will provide light.
- Faster the wheel of the bicycle is moved; brighter will be the light of the bulb.
- This indicates that the potential energy stored in human body is used to move the wheel, which turns the dynamo and electricity is produced.



### Conclusion/Sum up

Show the picture of a dam or hydro electrical power station to the students and conclude the lesson by telling the students that model generator generate electricity by using other forms of energy.



A schematic view of a hydro power plant



### Assessment

As the following questions to assess the students.

- Q1. How can we produce electricity on a large scale?

(Expected Answer: by using the energy from other sources).

- Q2. Name the different energy sources we need to generate electricity

(Expected Answer: Fuels, hydro-electricity, wind etc).

- Q3. In a generator, what is the function of dynamo?

(Expected Answer: to convert mechanical energy into electrical energy)



### Follow-up

To produce electrical energy, generators are being used at houses, offices, hospitals, etc as alternate to national supply of electricity. Renewable sources as solar energy and wind energy are also being used to produce electrical energy at cheaper rates. General awareness to conserve the electrical energy should be created in students in order to overcome the electrical energy crises in our country. Lights and electrical appliances should be switched when not in use.

- Guide the students to solve the exercise problems given at the end of each unit / chapter of textbook.

UNIT

TOPIC

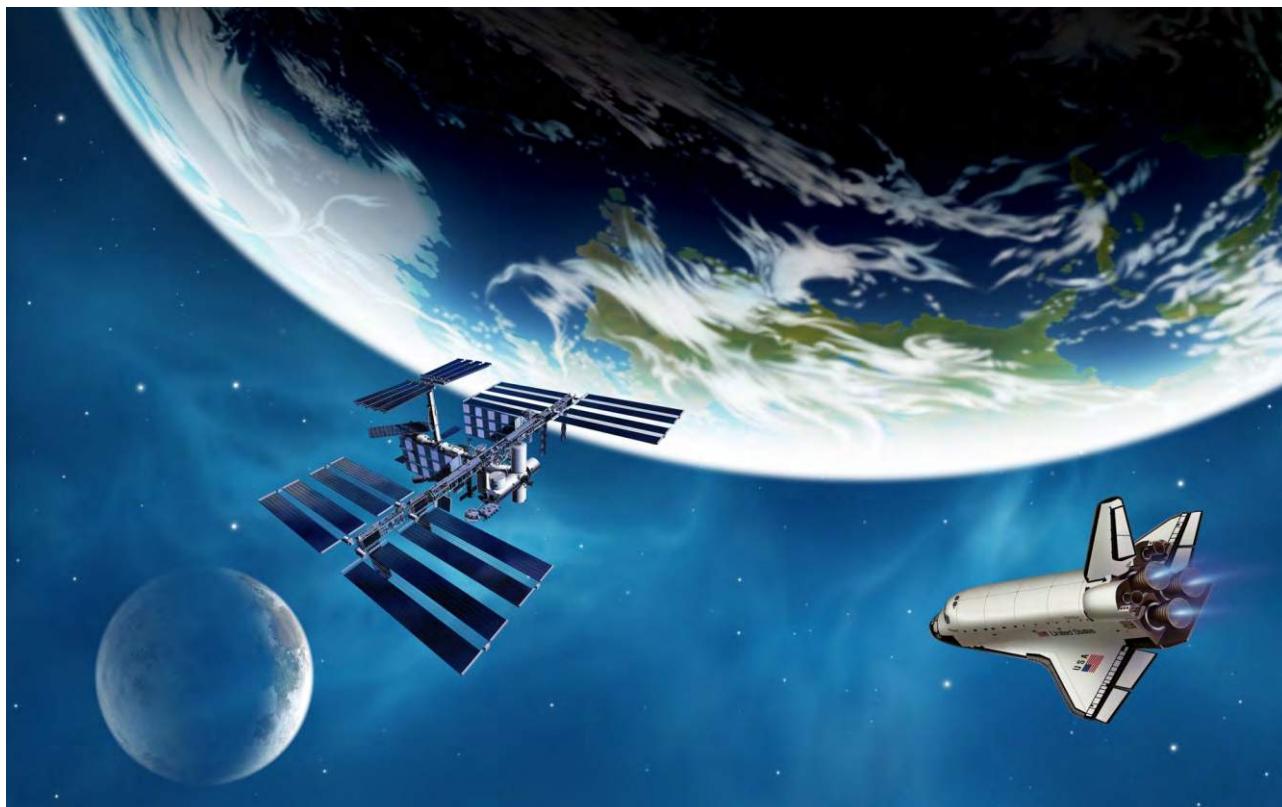
Lesson Plan  
30

16

# Satellites

## Space and Satellites

Grade VI



### Students' Learning Outcomes

Students will be able to:

- define the term satellite.
- describe the uses of various satellites in space.
- explain that how do satellites tell us where we are.



### Information for Teacher

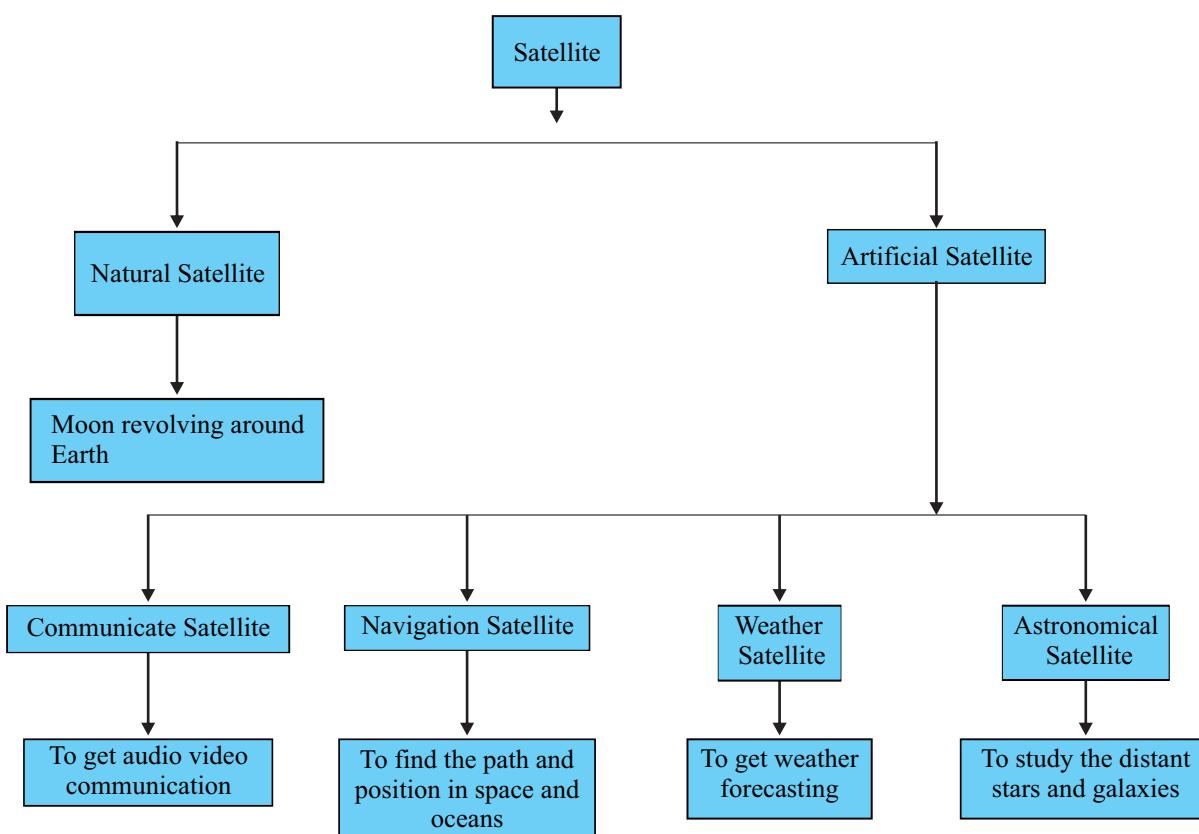
- Satellite is an object which revolve around some massive body e.g, Earth around the Sun.



- Moon is a natural satellite of the Earth.
- Artificial satellite is a man-made space craft manufactured on this Earth and sent into an orbit around the Earth.
- Artificial satellites are used for different purposes and they can be categorised as: Communication satellites, Navigation satellites, Weather satellites, Military satellites and Astronomical satellites.



### Concept Map



40 mins / 1 period

### Duration/Number of Period



### Material/Resources Required

Pictures of satellites from different books, magazines and other resources



### Introduction

Ask some questions to assess the students' previous knowledge

- Have you ever seen the booster on the roofs of high buildings?  
(Expected answer: yes)
- Ask the students, have they seen live cricket

or hockey match on T.V.?

(Expected answer: yes)

- How are we able to watch live cricket match?  
(Expected answer: With the help of a satellite)
- There are some man made satellites sent into the space orbiting the Earth for navigation, communication, military purpose. Do you know some other satellites?  
(Expected answer: for weather forecast etc.)



## Development

do the following activity

### ACTIVITY 1

Divide the class in five groups and provide them pictures of artificial satellites. Students will be asked to discuss in groups about the uses of different artificial satellites. Involve them in discussion to tell the uses of these satellites.

Make the following chart on the board and have the students copy and complete the table on their notebooks working in groups.

Artificial Satellite	Uses

Observe their response and appreciate them. Recap the uses of artificial satellites.

### ACTIVITY 2

Ask the students which satellite tells us:

- Where we are?
- Where am I?
- I want to go to the moon how can I get there?

Involve them in discussion to answer these questions. After recording their response, tell them that Navigation Satellite is the satellite which helps us to answer the questions about our position.

Navigation Satellites were developed in the late 1950's as a direct result of ships routes, so that one can know exactly where they were at any given time, in the middle of the ocean or out of sight of land.



## Assessment

Assess the students by asking following questions:

- Q.1 How many types of satellites are there?  
(Expected answer: two; natural and artificial)
- Q.2 What type of satellite is used for audio and video communications?  
(Expected answer: communication satellite)



## Follow-up

### Project:

- Collect some picture of satellite and paste them on a colour chart paper.
- Guide the students to solve the exercise problems given at the end of unit / chapter of textbook.

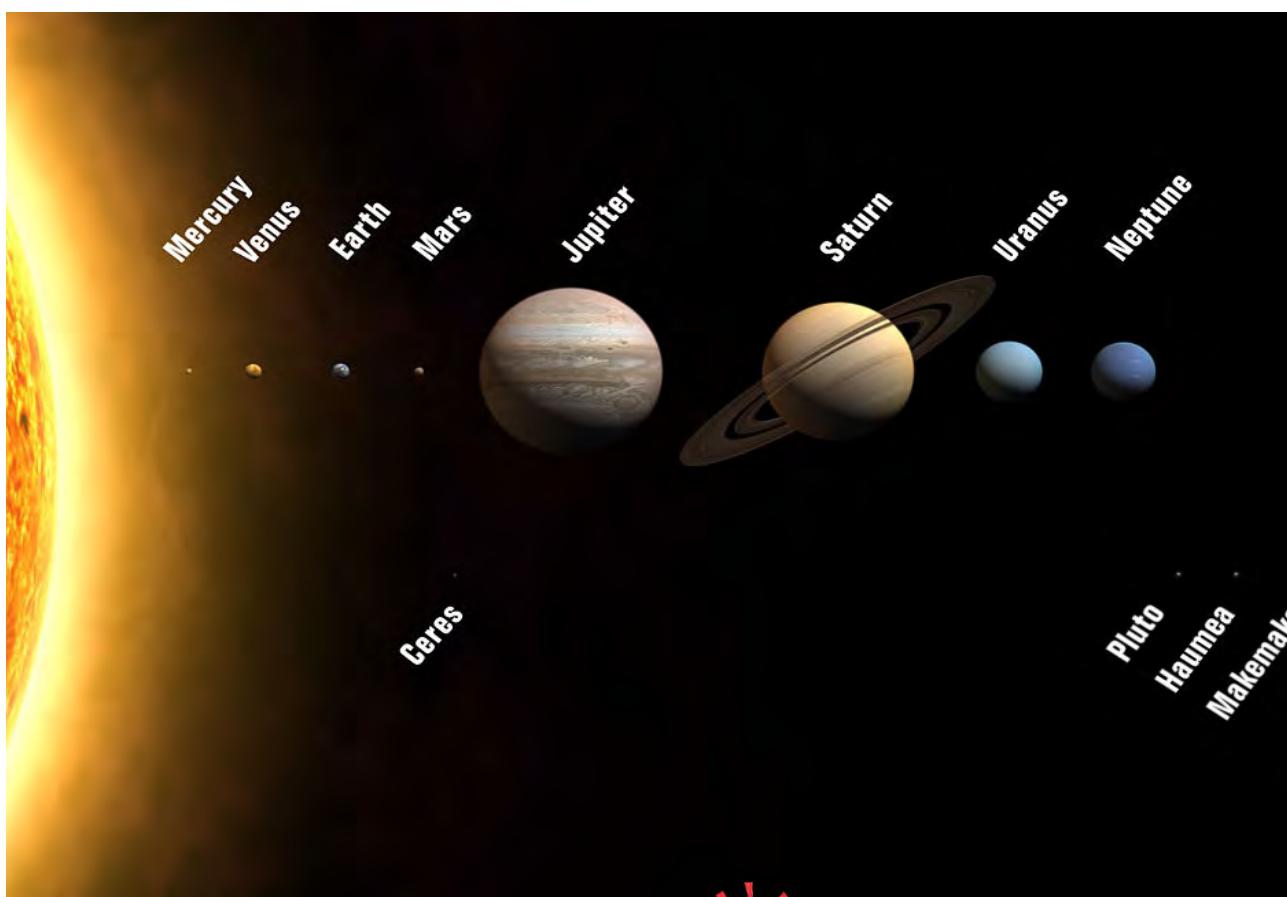
## TOPIC

Lesson Plan  
31

# Natural Satellites

## (Asteroids, Comets, Meteors)

Grade VI



**Students' Learning Outcomes**

Students will be able to:

- compare the Physical Characteristics of Comets, Asteroids & Meteors.
- describe different kinds of meteors.
- inquire into the sight of Halley's Comet; describe what would they feel if they saw it.

**Information for Teacher**

**Comets**

- Comets are the icy bodies exist in huge clouds.

- They are composed of rock, dust and frozen gases.
- In space they look like a bright ball with a long tail.
- Occasionally, they can crash into planets and moons and make craters.

### Asteroids

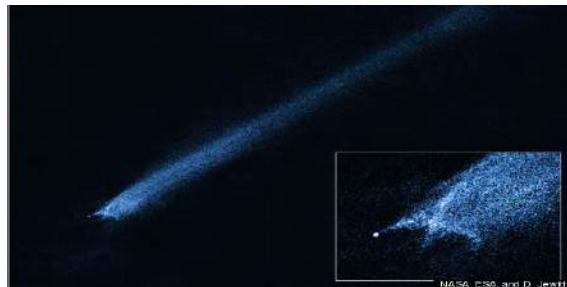
- Asteroids are the rocky objects.
- There are thousands of asteroids between Mars & Jupiter.
- They are very small in size.
- The word of Asteroid means "like stars".



### Meteorites

- These are probably fragments of asteroids.
- These are the portion of a meteoroid or

asteroid that survives its passage through the atmosphere.

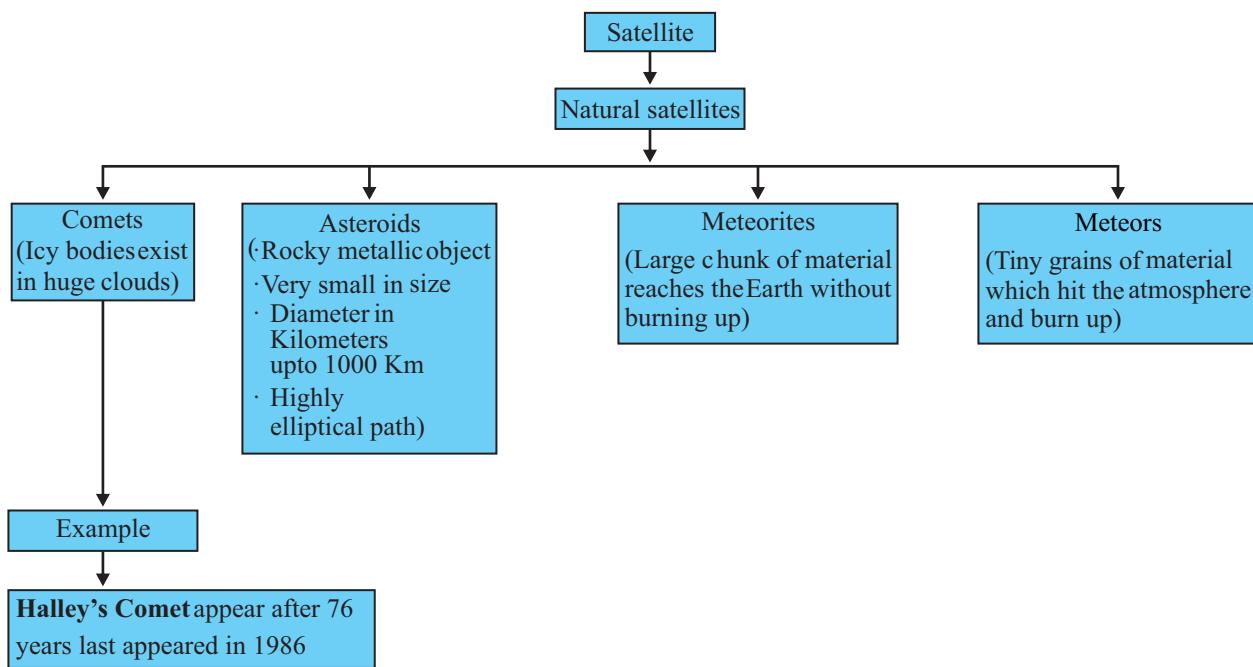


### Meteors:

- A meteor is a meteoroid that enters the Earth's atmosphere making a visible track.
- Meteors typically occur in the mesosphere and their range are from 75 km to 100 km.
- Millions of meteors enter in the Earth's atmosphere every day.



### Concept Map





## Duration/Number of Period

80 minutes/ 2 periods



## Material/Resources Required

Charts, use pebbles as model to give idea of meteoroids, pictures of comets specially Halley's Comet, cotton 3-D model for the concept of space.



## Introduction

Show the chart of Asteroids, Comets, and Meteors and ask some questions related to the pictures given in the chart.

- Are there some other objects present in the solar system?  
(Expected answer: yes)
- Have you ever seen asteroids or comets at night?  
(Expected answer: yes, these are like the fire balls)
- Do you know the exact path of asteroids in our solar system?  
(Expected answer: no)

After asking these questions tell the students that today we will learn about natural satellites like Asteroids, comets, and Meteors except moon. The moon is also a "Natural Satellite".



## Development

### ACTIVITY 1

Collect the reading materials for comets, meteors and asteroids a day earlier. Divide the class in three groups and provide them

the collected material. Draw the following table on the board and ask them to copy and complete the table.

	Asteroids	Comets	Meteors	Comparison
Size				
Shape				
Composition				
Location				

- Each group will present his observations.
- conclude the activity by summarizing the data.

Expected filling of the chart will as:-

	Asteroids	Comets	Meteors
Size	Upto1000 kmin diameter	Up to 20 km in diameter	From few cm to few meters in diameter
Shape	Irrerular	Irrerular	Irrerular
Composition	Carbon, iron & other metals	Iron, rock ammonia & other gases	Iron, rock etc
Location	Between Mars & Jupiter	They move in elliptical orbit around the sun	These are the wandering bodies in the solar system



### Conclusion/sum up

Conclude the lesson by recapping the definitions of the natural satellites and give the following activity to check the student's learning.

#### Extended Activity

Fill in the blanks by using given key words:-

**Vapours, deflected, atmosphere, source,**



### Assessment

Conclude the lesson by asking the following questions:-

- What is the exact location of Asteroids?
- (Expected answer: lies between Mars & Jupiter.)
- Describe the composition of Asteroids?
- (Expected answer: carbon, iron and other metals.)
- Compare the sizes of asteroids and meteors?
- Why the comets have tails?
- (Expected answer: Comets' frozen gases melt and form a tail.)

### comets, water

Millions of small \_\_\_\_\_ strikes the earth yearly and break up into water \_\_\_\_\_. Some scientists believe that they are \_\_\_\_\_ of \_\_\_\_\_ in earth's ocean and \_\_\_\_\_. Asteroids crossing the earth's path will either be \_\_\_\_\_ or detonated.

#### Answer of the extended activity

Millions of small **comets** strikes the earth yearly and break up into water **vapours**. Some scientists believe that they are **source** of **water** in earth's ocean and **atmosphere**. Asteroids crossing the earth's path will either be **deflected** or detonated.



### Follow-up

- Draw the diagram of Asteroids on the notebooks.
- Write the difference between meteors and meteorites.
- Paste the pictures of natural satellites on the scrap book.
- Guide the students to solve the exercise problems given at the end of unit / chapter of textbook.



## TOPIC

Lesson Plan  
32

# Artificial Satellites and Geostationary

Grade VI



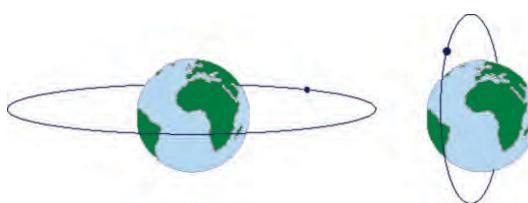
**Students' Learning Outcomes**

Students will be able to:

- describe artificial satellites and geostationary satellites.
- investigate how artificial satellites have improved our knowledge about space and are used for space research.
- explain the key milestones in space technology.

**Information for Teacher**

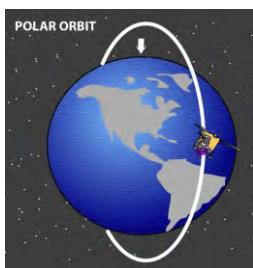
- The objects revolving around a massive body due to its attraction or gravity is called "Satellite" of that body. e.g,



1. Planets are satellites of the Sun.
  2. The moon is satellite of the Earth
- Artificial satellites are human-built objects orbiting the Earth.
  - Satellites are the objects which are launched in space by rockets.
  - Like the Moon, they are held in orbit by the gravitational pull of the Earth.
  - The higher the satellite, the slower is the speed and longer is the time required to complete its one orbit.
  - Satellites can be launched into two orbits like **Polar** and **Equatorial** orbits.

### Polar Orbit

- A polar orbit is a satellite orbit that passes over or very close to both poles of the Earth.
- Satellite in polar orbit can observe all points on the Earth.
- These orbits are used for observation all satellites.



### Equatorial Orbit

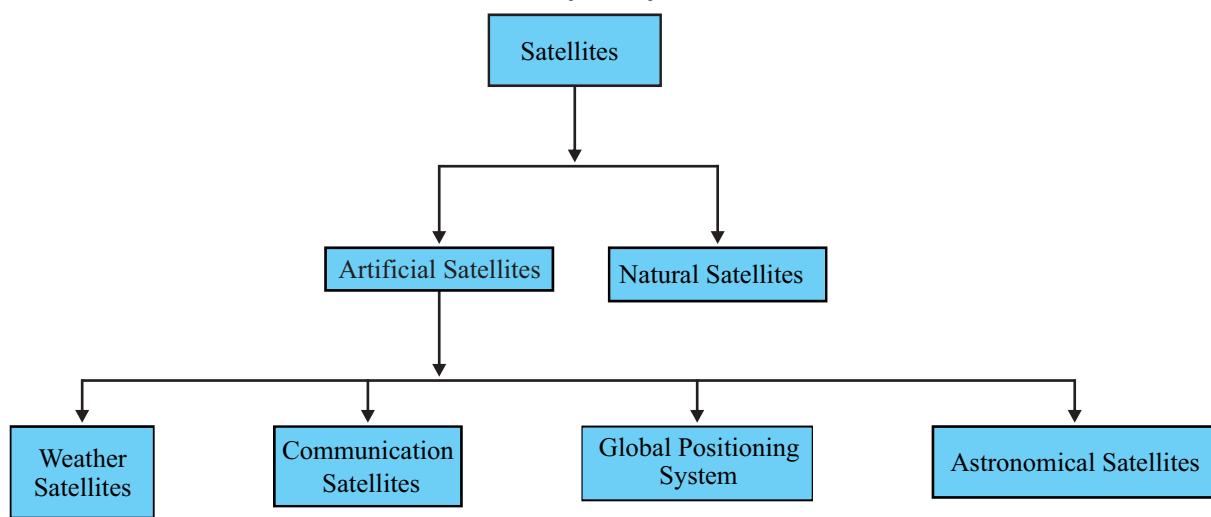
- A satellite in equatorial orbit flies along the line of the Earth's equator.
- To get into equatorial orbit, a satellite must be launched from a place on earth close to equator.
- Equatorial orbit are useful for satellites observing weather patterns.



### Geostationary Satellites

- The period of a geostationary satellite is the same as that of the Earth, so the satellite appears to be stationary at one place all the time.
- The orbit of a geostationary satellite is also called "geostationary orbit".
- The GPS (global positioning system) uses 24 satellites.
- They orbit the earth in 6 sets of orbits.
- At any time, a receiver on the ground can receive the signal from these satellites.
- GPS helps the vehicles and ships to take best routes.

### Concept Map





## Duration/Number of Period

40 mins/ 2 Periods



## Material/Resources Required

Colour charts, glue, markers, strings/thread, stone, etc.



## Introduction

Ask the students about artificial satellites, where do they exist? and the purpose of sending up these satellites in space to assess the students' previous knowledge.

### I. What are artificial satellites?

(Expected answer: Man made objects sent into space orbiting the Earth)

### II. Why we launch artificial satellites?

(Expected answer: To get up-to-date information from our surroundings)

### III. How in ancient time people get guidance to travel from one place to another?

(Expected answer: With the help of a magnetic compass)

Ask the students that whether they might have seen ever a movie or clip regarding spaceships/satellites, how are they being launched into space?



## Development

### ACTIVITY 1

Tell the students that in the modern era new technologies are introduced. Artificial Satellites are one of them. To understand the idea about the movement of satellites

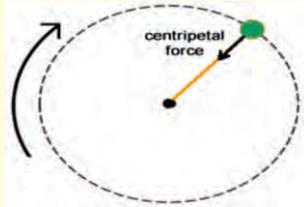
around the Earth, we will do an activity.

Attach an object with a string and ensure that it has been tied properly. Whirl the object in a circular path.

Ask them why the object is moving in the circular path?

After taking their response, tell them that we require a force which tends to move the objects in circular path. In this case with the help of our hand we are applying such force to move the object in the circular path.

With the help of this example clear the concept about the motion of satellites around the Earth. Give knowledge to the students that an object under the action of gravity, revolves around the earth in a fixed path.



## ACTIVITY 2

Divide the class in groups and ask them to read the material about artificial satellites from their textbooks or library books.

Make the following table on the board and ask the students to copy it on their notebooks.

Artificial Satellites	Advantages

Each group will give the table from the information given in the textbook. At the end teacher will summarize the activity.

**ACTIVITY 3**

Make a chart on key milestones in space technology from the Science textbooks or books from library.

Name of Satellite	Launching date	Purpose
US Tinos 1	April 1, 1960	To study weather conditions

Display the chart in the class and ask the students to read and note their observations.

Involve the students in discussion about the key milestones in space technology.

**Conclusion/sum up**

Conclude the lesson by recapping the artificial satellites and their kinds. Summarize the key advantages of some artificial satellites.

- Communication satellite.

These satellites help to transmit the communication signals from one place to another e.g. communication through mobile phones and telephones.

- Weather satellites.

These types of satellites help us to receive up-to-date information about weather conditions.

- Navigation satellites.

These type of satellites are used by ships to navigate their directions through GPS (Global Positioning System).

- Astronomical satellites.

These type of satellites take sharp photographs of the objects outside the earth's atmosphere.

**Assessment**

Assess the students' understanding by asking the following questions:

- Q.1 Name different artificial satellites.

(Expected answer: Weather satellites, communication satellites and astronomical satellites etc)

- Q.1 What are weather satellites?

(Expected answer: There are the satellites which help us about the forthcoming changes in weather.)

**Follow-up**

Ask the students to make a poster on artificial satellites to highlight their advantages.

- Guide the students to solve the exercise problems given at the end of unit /chapter of the textbook.

UNIT

TOPIC

Lesson Plan  
33

17

# Stars, Galaxies

## Milky Way & Black Holes

Investigating The Space

Grade VII



### Students' Learning Outcomes

Students will be able to:

- describe the terms star, galaxy, milky way.
- explain the types of galaxies.
- describe a star using properties such as brightness and colours.

produces heat and light from nuclear reactions.

- Stars are formed in huge clouds of dust called nebulae.
- Stars appear brighter if they radiate more energy.
- Colour of stars vary from blue to red. It depends on its temperature.

### Galaxies

- Stars are grouped together in vast collections called galaxies.
- Each galaxy contains billions of stars.



### Information for Teacher

#### Star

- A star is a ball of tremendously hot gas, which

- Our solar system forms a tiny part of a galaxy called the milky way.

- The types of galaxies can be described into four shapes as:

- Spiral
- Barred spiral
- Elliptical
- Irregular

All the stars that can be seen on the night sky are part of milky way. Make the chart related to galaxy information. The chart contains the following information,

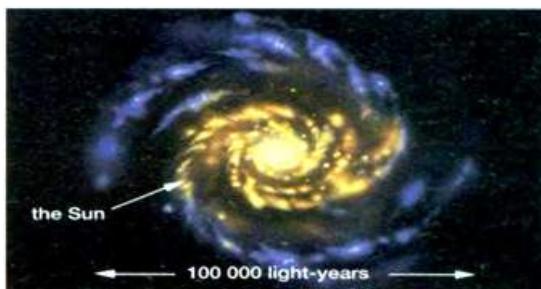
### Our galaxy: the Milky way

It is a collection of about 100 000 million stars.

Our Sun is just one of them, placed somewhere near the edge, in a **spiral arm**.

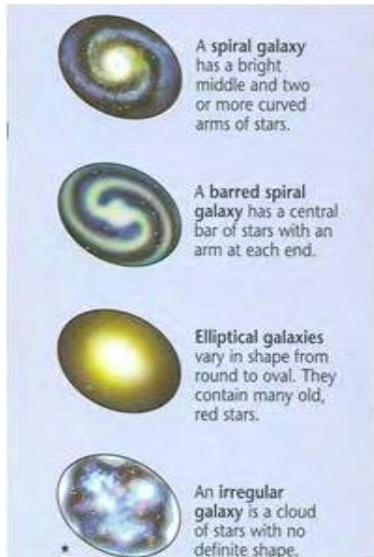
The Galaxy is huge. It takes 8 minutes for light to travel from the Sun to Earth: 4 years for light to travel from the nearest star: but 100 000 years for light to travel across our Galaxy!

The Milky way contains 100 to 200 billion stars.



### Duration/Number of Period

40 mins / 1 period



### Material/Resources Required

Chart of milky way and galaxy, computer work sheets for writing observation.



### Introduction

Ask the students one day earlier to start this lesson, to observe the stars in the night sky and try to note the location of some bright stars in the sky.

Ask some questions before the start of lesson.

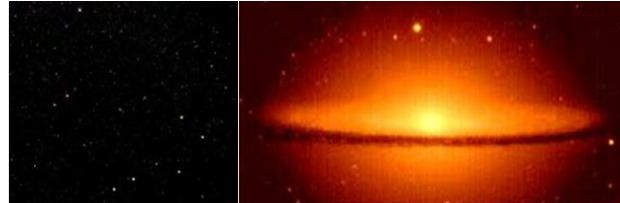
- How many stars you observe at night sky?  
(Expected answer: A large number of stars)
- Can you tell the name of closet star to us?  
(Expected answer: Thy Sun)
- What name is given to a group of stars?  
(Expected answer: galaxy)
- In which galaxy we live?  
(Expected answer: Milky Way)



### Development

#### ACTIVITY 1

Divide the students in three groups Provide some material to them related with the SLOs and ask to collect the information about stars, galaxies and milky way. After 15 minutes ask each group to demonstrate their working in the class.





## Conclusion / Sum up

Stars are grouped together called galaxy. Each galaxy contains billions of stars. Our solar system forms a tiny part of a galaxy called milky way. Most astronomers believe that the milky way is spiral galaxy. The specific patterns of bright stars in the sky are called constellations. These are visible. Stars are classified by their colour and brightness



## Assessment

**Ask the following questions to assess the students.**

Q1. Differentiate between star and galaxy?

(Expected answer: Galaxy in a group of stars)

Q2. What's the name of our galaxy?

(Expected answer: Milky way)



## Follow-up

**Homework :**Distribute this worksheet to the students as homework. Fill the blank space using following words.

Meteorites Galaxy Supernova Big Bang  
constellation moon Comet Solar System

- i) A rocky object orbiting a planet-----
- ii) The Sun, its planets and other objects in orbit-----
- 
- ii) A small rocky object which collides with a planet and may be a fragment from an asteroid-----
- vi) A clump of ice, gas and dust and usually in a highly elliptical orbit around the Sun -----
- v) A huge group of millions of Stars-----

v) A gigantic explosion that occurs-----

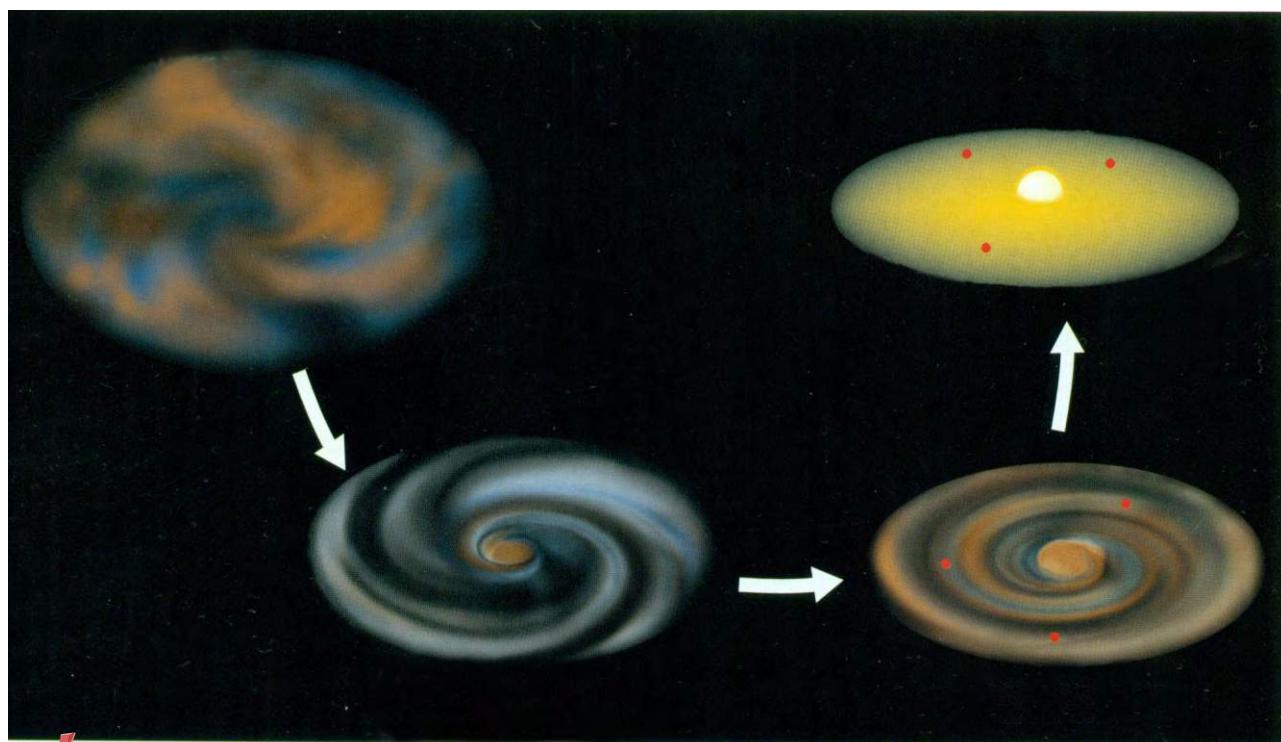
### Answer the following questions

- What causes stars to look bright or dim?
- What is the shape of the Milky way galaxy?
- What affects the apparent lightness of a star?
- Guide the students to solve the exercise problems given at the end of unit / chapter of the textbook.

# The Life of Stars

## (The birth & death of our sun)

Grade VII



### Students' Learning Outcomes

Students will be able to:

- explain the birth and death of our sun.
- explain the term black hole.
- describe the formation of black holes.



### Information for Teacher

- Stars are formed in huge clouds of dust and swirling gases in space.
- A star is created when gases are pulled together by gravity.
- When ever the burning gases in the stars run

out they die.

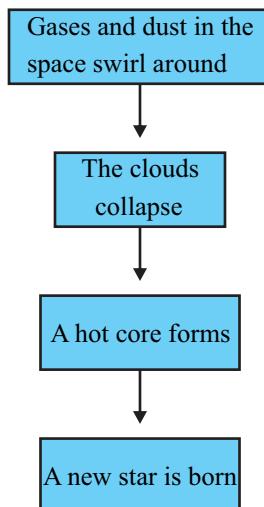
- When big stars die, they form red super giants, then explode into a supernova. However, when they collapse, they virtually vanish from the universe. they may become what are called black holes, bottomless pits from which nothing escapes.
- A black hole is so heavy and dense that its gravity sucks everything inside it, even light.
- Black holes cannot be seen.
- Black holes some scientists think in the middle of our galaxy lies an enormous black hole, surrounded by a squeezed mass of ancient red dust.

- Ask star dies its size swells up and turns red. At this stage it is called a red giant.
- Slowly it puffs its out layers of gas into space, leaving behind a small, almost dead star called a white dwarf.

### Formation of black hole



#### Concept map:



#### Duration/Number of Period

80 mins/2 periods



#### Introduction

Ask the following question.

Q1. Where are the stars?

Expected answer: The stars are in the sky.

Q2. Why can't you see stars during the day?

Expected answer: They have dimmer light as compared to the day light.

Q3. Do stars move? Yes/No

Expected answer: Stars do not move.

After these questions make the above flow chart on the board to understand the complete life cycle of a star.



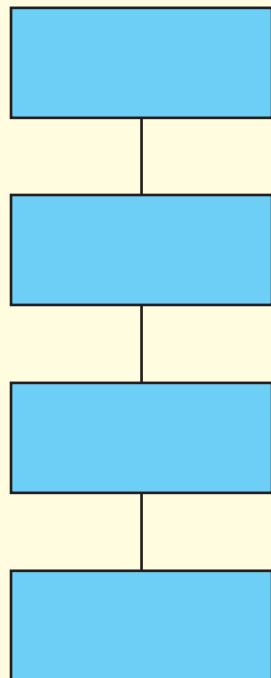
## Development

### ACTIVITY 1

Collect reading material for the birth and death of the sun from internet or school library a day earlier. Divide the class into 6 groups and give them the reading material having story regarding the birth and death of the Sun.

Facilitate the students by telling simple story first and then ask the students to arrange the stages in the boxes given below in order to understand the birth of a new star

- A hot core forms
- The clouds collapse
- Swirling gases and dust in space
- A new star born



Students take help from the reading material and then fill the boxes in proper order as.

Swirling gases and dust in space



The clouds collapse



A hot core forms.

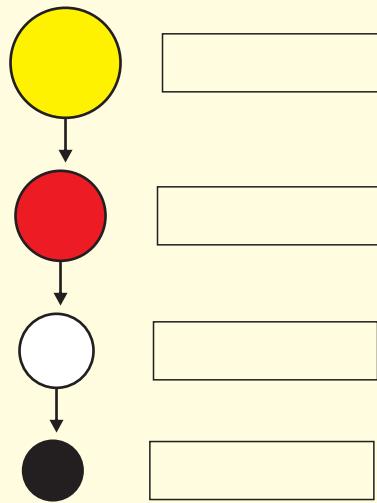


A new star born



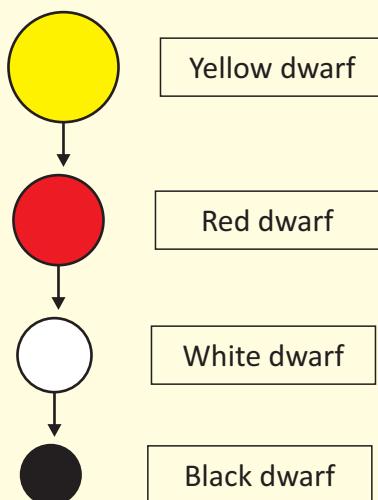
### ACTIVITY 2

Briefly tell the student's about the gradual death of a star and formation of black hole. Draw the following chart on the board



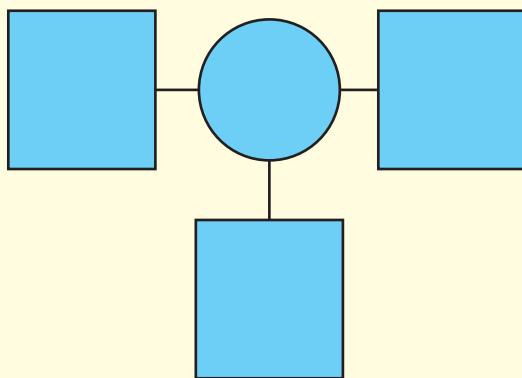
Ask the students write all the stages in order for the death of star or birth of a black hole. Students will copy and complete the flow chart

Expected response by the students

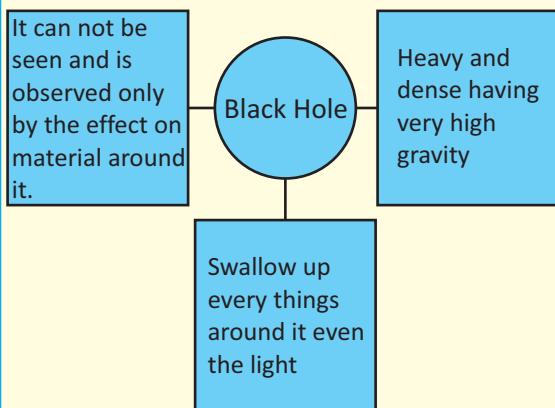


### ACTIVITY 3

Draw the following flow chart on board and ask the students to complete by writing the characteristics of a black hole.



The expected response of the students.



### Conclusion/sum up

Explain the whole life & death of sun by sketching a flow chart.



### Assessment

Q1. Describe the stage how black hole is formed?

(Expected answer: Drawing of flow chart)

Q2. What type of star is the sun?

(Expected answer: hot & luminous)

Q3. Describe different stages of life of stars?

Expected answer: Gases and dust in the space swirl around → The clouds collapse →

### Follow-up

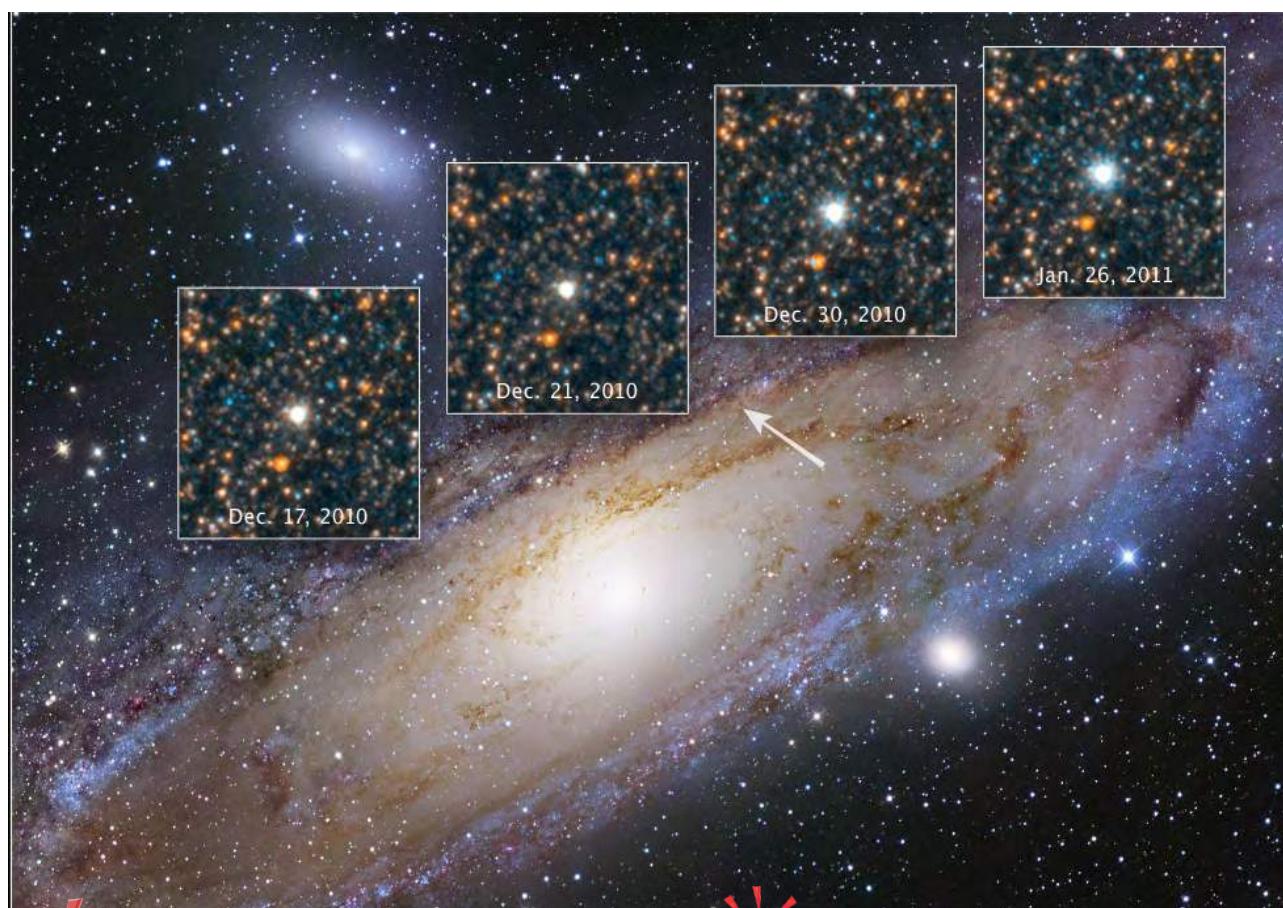
Project: Find the history of another larger star like "Blue giant".

- To find out more about stars collect amazing images of stars and nebula and paste them in your note book.
- Guide the students to solve the exercise problems given at the end of unit / chapter of the textbook.

## TOPIC

# Looking at Stars

Grade VII



## Students' Learning Outcomes

Students will be able to:

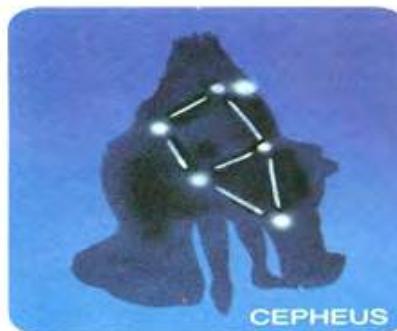
- identify major constellations visible at night in the sky.
- identify bodies in space that emit and reflect light.
- suggest safety methods to use when observing the sun.



## Information for Teacher

- Constellations are the patterns of stars that aid in mapping the sky.
- Earth rotation causes the stars to appear to move.
- Earth revolution causes the constellations to appear during certain parts of the year.
- Some constellations have many stars while some have only a few.

- A circumpolar constellation appears to move in a circle around the pole.
- Circumpolar constellations in the northern hemisphere include the big & little dippers like Cassiopeia, cepheus and draco.
- Some bodies in space have their own light while some reflect light of the other stars. For example the Sun has its own light and moon only reflect its light.
- Some safety methods to view the Sun are to use the:
  - i) Blackened X-Ray film
  - ii) Welder's glass
  - iii) Pinhole camera



### Duration/Number of Period

40min/1 period



### Material/Resources Required

A chart of big bear like ursa major six pieces of chalks of black & blue colour, 10 gummed stars White crayon, blue or black computer sheet, pencil & pages



### Introduction

#### ACTIVITY 1

Paste the gummed star on the black paper



- Ask the student to think about some imaginary objects which they could make with the help of stars like hen, duck, bear etc.
  - Draw lines between the stars to make different patterns with white chalk.
- After doing this activity students will be able to know more about different star patterns. Now tell the students that these patterns of stars are called the constellations.



## Development

### ACTIVITY 1

Make the following table on the board.

Sr. No.	Bodies in Space	Emitting light.	Reflecting light.
1	Sun		
2	Moon		
3	Earth		
4	Comet		
5	Asteroid		
6	Meteor		

Ask the students to copy and fill the table.

Sr. No.	Bodies in Space	Emitting light.	Reflecting light.
1	Sun	✓	
2	Moon		✓
3	Earth		✓
4	Comet	✓	
5	Asteroid		✓
6	Meteor	✓	

### ACTIVITY 2

Ask the students whether they have seen an X Ray surely more of the students will answer in yes.

Ask one of the students to bring an old X Ray sheet and a cello tape tomorrow.

On the next day help the students in making a safety viewer to view the sun as.

- Cut two circles of about 3cm diameter from the sheet.
- Round a cardboard to make a cylinder of the same diameter with the help of cello tape.
- Paste both the X Ray circular sheet placed one above the other at one end of the cardboard cylinder and fix it with the cello tape.



- Now view the Sun through this safety viewer. You can observe the Sun easily. Call some students one by one to view the Sun through it. All the students will engage the activity. At the end tell the students that it is very dangerous to view the Sun directly with naked eyes. Now tell them some other safety methods to view the Sun safely.



### Conclusion/sum up

There is large number of constellations in the sky.



### Assessment

- I. Name some two constellations?

Expected answer: Hercules, Leo, Lyza, Gemini, orion, cancer and Pegasus.

- ii. How many constellations are there over all?

Expected answer: There is a large number of constellations in the sky.

- iii. At which part of the day we able to see the stars/constellations?

Expected answer: At night.



### Follow-up

- Collect some constellations pattern from internet or from library and paste their images in your notebook.
- Guide the students to solve the exercise problems given at the end of unit / chapter of the textbook.

UNIT

18

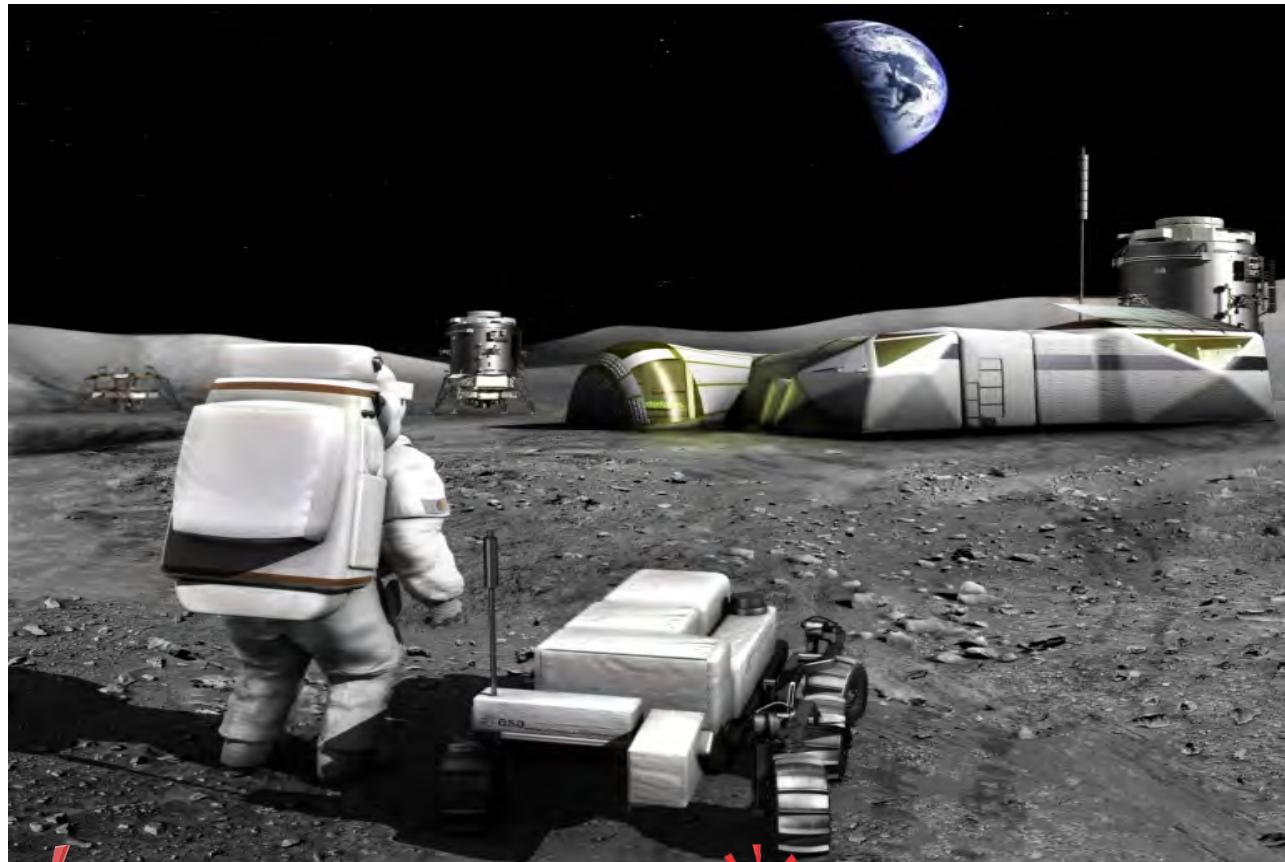
TOPIC

Lesson Plan  
36

# Space Exploration

## Exploring Space

Grade VIII



### Students' Learning Outcomes

Students will be able to:

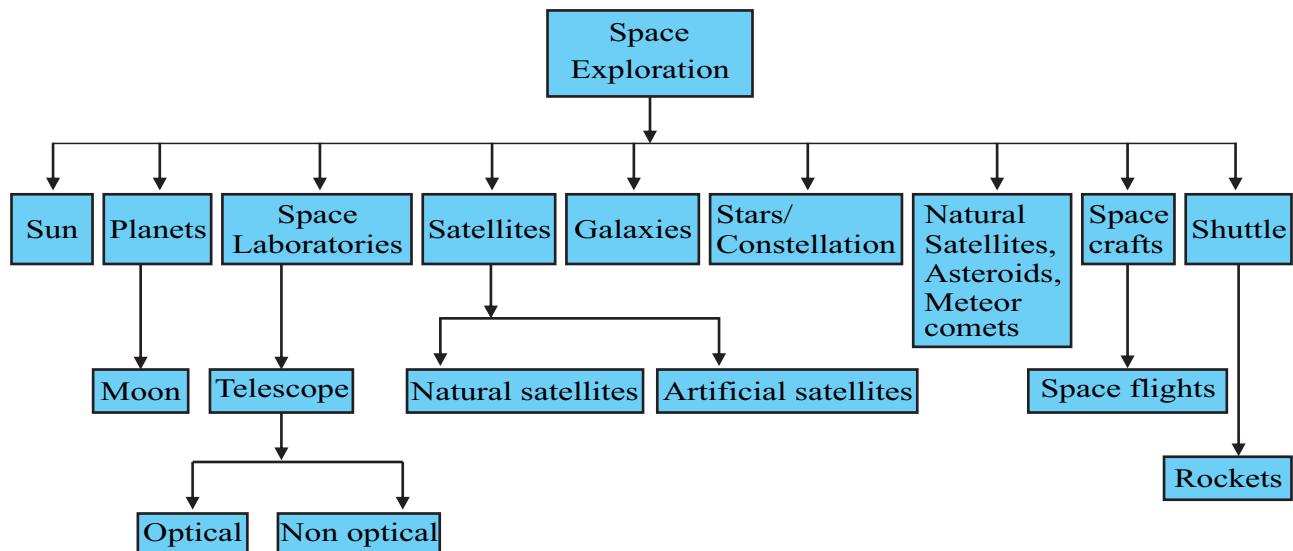
- identify the technological tools used in space exploration.
- describe development of tools and technologies used in space exploration.
- analyze the benefits generated by the technology of the space exploration.
- suggest the ways to solve the problems that have resulted from space exploration.



### Information for Teacher

- Modern astronomy has shown that there are billions of galaxies and constellations.
- We live in milky way galaxy.
- There are Eight planets in our solar system. They are revolving around a hot star sun.
- Space stations carry out those experiments and work in space that cannot be done on earth.

- The invention of telescope is important
- Shuttles are launched into space by huge boosters called rockets.
- The shuttles mission usually last about a week.
- Satellites are sent into space through these spacecrafts.
- Benefits generated by the space exploration technology are aviation safety system for pilots, weather forecasting and development in vehicles we drive.
- Invention of the telescope and the description of gravity are two milestones in the development of modern astronomy.

**Concept Map****Duration/Number of Period**

80minutes/2 period

**Material/Resources Required**

Thermopore sheet, different colour chart papers, pebbles, wires, cotton, poster colours, gum, scissor.



## Introduction

Show a model of whole space which is made on thermopore sheet. All the components, planets, stars, galaxies satellites, Moon, comets, constellations etc, will be represented on it.

Now ask the following questions to assess the previous knowledge of the students related to space.

1. Why we can't walk in space properly?  
(Expected answer: because in space we have no weight)
2. What do astronauts bring into space to breathe?  
(Expected answer: Oxygen tank)
3. Why can't you pour water in glass for yourself in space?  
(Expected answer: Due to weightlessness and lack of gravity)



## Development

### ACTIVITY 1

This activity will be conducted in pairs or in group of 4 students.

Instruct the students as:

1. Imagine yourself as an Astronaut going in space for the first time.
2. You have to require a special space suit which can protect you in hazardous conditions while taking a space walk for your space mission.
3. Investigate the following factors in space and suggest the solutions to these factors.

Factors	Details of your findings	Suggested Solutions
Oxygen		
Atmospheric Pressure		
Temperature		
Gravity		

Expected answer

Factors	Details of your findings	Suggested Solutions
Oxygen	No oxygen in space	Astronauts carry oxygen cylinders for breathing with them
Atmospheric Pressure	No atmospheric pressure in space	Space suit provides the required atmospheric pressure
Temperature	Cold	Space suit keeps at optimum temperature
Gravity	No gravity	Gravity is obtained by spinning the space ship

**ACTIVITY 2**

Draw the following table on the board:

Sr#	Space Exploring Tool	Benefits
1	Hubble Telescope	
2	Space Suit	
3	Navigation satellites	
4	Communication satellites	
5	Space Shuttle	

Now ask the students to copy and fill the table.

**Expected answer:**

Sr#	Space Exploring Tool	Benefits
1	Hubble Telescope	Provides pictures of distant planets, stars and galaxies etc.
2	Space Suit	Protects from dangerous space effects such as no atmospheric pressure and low temperature etc.
3	Navigation satellites	Provide aviation safety system to pilots.
4	Communication satellites	Provide audio video signals in every part of the Earth.
5	Space Shuttle	Carries astronauts and scientific devices needed in space exploration from Earth to the space

**Assessment**

Ask the following questions:

- Q1. Which galaxy contains the hot star "Sun"  
(Expected answer: Our Galaxy named "Milky way")
- Q2. How can you explain the space?  
(Expected answer: space is a place where stars, planets and galaxies exist)

Now tell the students some suggestions to solve the problem related to space exploration and ask some suggestions from the students to check their point of view towards it.

- As space exploration is very costly. Is it possible for every country to explore the space?
- There is always some unforeseen risks in exploring space.

**Follow-up**

- Make a chart on which paste "different technological tools such as telescope, space shuttle, space suit and different kinds of satellites
- Guide the students to solve the exercise problems given at the end of each unit / chapter of textbook.

**Conclusion/Sum up**

Explain the space concepts in key points in the end.

# Telescopes, Space Crafts, Spectroscopes

Grade VIII



## Students' Learning Outcomes

Students will be able to:

- Identify new technologies used on earth that have developed as a result of the development of space technology
- Explain that how do astronauts survive and research in space



## Information for Teacher

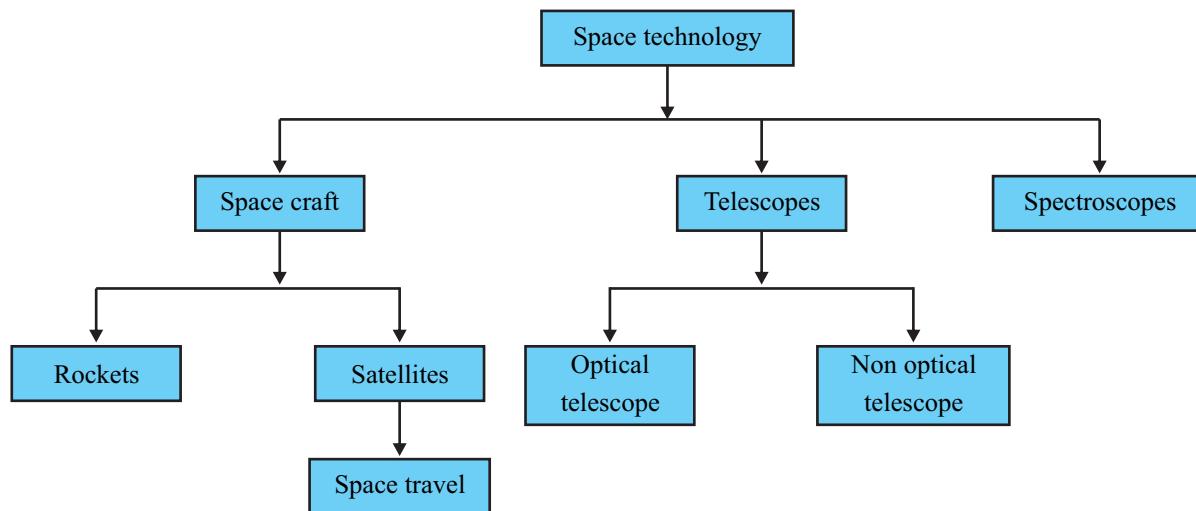
- Astronomers use telescopes to study objects in space
- Telescopes are the instruments that collects light from the sky and concentrate it for better observations

- Telescopes have two main kinds e.g.,
  - i. Optical
  - ii. Non-optical
- Hubble space telescope has photographed newborn stars emerging from dense gases and dust.
- Hubble space telescope is an optical telescope launched by NASA in 1990 orbiting the Earth.
- First space craft called space probes have been sent to space in 1960 to explore solar system.
- Satellites are launched through rockets.
- The radius of the orbit of geo-stationary satellite is 42300 km.
- Spectroscopes are the optical devices which produce or observe the spectrum of light

and radiations from any source. It consists of a slit, collimating lens and a prism.

- An astronaut in orbit feels weightlessness, because the astronaut and his clothes and spaceship are all freely falling bodies,
- Insulations that keep homes energy efficient in the very cold parts of the Earth are based of the technology used to insulate the space shuttle.
- Treatments of some diseases such as calcification and some heart disorders has also become possible due to the development of the space technology.
- Many advances are found in our food, advanced materials, medicines and vehicles we drive.

### Concept Map



40minutes/1 period

### Duration/Number of Period



### Material/Resources Required

Picture of astronaut, plastic wraps, news paper, magnifying glass, blank paper, hand mirror, modeling clay, table lamp



## Introduction

### ACTIVITY 1

The teacher will show a picture of an astronaut. The picture shows different features of an astronaut as:-



After showing the picture teacher will ask some questions like.

Q1. Who is the person in a picture?

(Expected answer: an astronaut)

Q2. Why is he wearing this dress?

(Expected answer: to work or survive in the outer space)

Q3. What is on the head of the astronaut?

(Expected answer: helmet with an Arial)

After asking the above questions teacher will tell the students that they are going to study about spacecrafts and developments of space technology on Earth



## Development

The students understand the working of the telescope, for this purpose teacher will perform the following activity from the students.

### ACTIVITY 2

#### Making water drop lens:

- Divide students in groups/pairs
- The teacher will give two 6X6cm, pieces of plastic wrap to each pair
- Students will place the plastic wrap over a news paper put a drop of water on each piece of plastic
- Student will note the shape of the drop
- Teacher will ask the students that what they observe the changes in the size of the news print. (it will magnifies the newsprint image)

### ACTIVITY 2

#### Observe an image through lens

- Students will use modeling clay to hold a lens (convex mirror) in this activity according to teacher's instructions.
- All the lights will be turned off only the light of lamp will be ON.
- A blank paper at the end will be placed as a screen, at which the image will be taken
- Adjust the position of the lens for a shape image



## Conclusion/Sum up

By doing the above activity teacher will give the concept that how telescope work and convex

lens are used in them to locate the far away things. Then teacher will wind up the lesson and in the end she will tell about some uses of spectroscope as:-

- It is used to observe the light spectra
- Light spectra consists of 7 primary colours
- Astronomers use spectrosopes to determine that what elements stars are made up of as well what elements and molecules are present in the dust of space
- Scientists also used it for the study of spectra of stars and galaxies.

After that teacher will ask the following questions

**Q1. Why space rockets are used?**

(Expected answer: To launch the satellites)

**Q2. Describe the types of a telescope?**

(Expected answer: It has two types)

- i. Optical
- ii. Non optical

**Q3. What is a light spectrum?**

(Expected answer: It is made up of seven colours)



### Follow-up

Enrichment activities:-

To study the function of reflecting telescope.

### Handmade Reflecting Telescope

Instruct the students about making this telescope as:

Use a makeup mirror, and a hand mirror, place the makeup mirror near the window so that the moon and stars can be reflected in it. Hold a

mirror so that he or she can see a reflection of the makeup mirror in the hand mirror than some other person use a magnifying lens to view the reflection in the hand mirror of the makeup mirror. Then observe this reflection of stars and Moon through a magnifying glass. The observation of this magnifying glass will be same as the working of some ordinary telescope

- Guide the students to solve the exercise problems given at the end of unit / chapter of the textbook.

# Glossary

Words	meanings
Acid	a compound containing hydrogen which dissolves in water to produce hydrogen ions ( $H^+$ ) in the solution
Acid Rain	rain water which is more acidic than usual. Rain water normally has a pH between 5 & 6 but acid rains have pH below 5
Acidic Salts	salt obtained as a result of reaction between strong acid & weak base. ( $Na_2CO_3$ )
Aerosol	a pressurized container used to spray liquids, like paint, in a fine mist
Alkali	a base which dissolves in water is an alkali
Alveolus	an air sac found in the lung which is adapted for gaseous exchange.
Ammeter	an instrument for measuring electric current
Antibiotics	chemicals used to treat many infectious diseases caused by microorganisms such as bacteria
Apparent brightness	how bright a star looks to observers on earth
Asexual reproduction	reproduction that does not involve the fusion of two gametes
Asteroids	large lumps of rock and metal that orbit the sun in a region called the asteroid belt between mars and Jupiter
Astronomer	a scientist who studies the stars, planets, and other objects in space
Astronomy	The scientific study of the objects in space such as stars, asteroids and planets
Astrophysics	the science of the physical and chemical aspects of heavenly bodies
Atmosphere	The blanket of gases that surrounds the earth
Atmospheric pressure	the pressure caused by the weight of the air pressing down on the earth's surface
Atom	this is a basic unit of matter which can't be further divided.
Basic Salts	salt obtained as a result of reaction between strong base and weak acid ( $NaHCO_3$ )
Big Bang	a tremendous explosion on the beginning of the universe
Big Bang theory	the idea that all the matter in the universe came into being with a massive explosion known as the big bang
Biotechnology	the use of biological processes from microorganisms to make substances (e.g. penicillin) or to provide services for human being
Black Hole	What is left when a very massive star collapses at the end of its life. A black hole's gravity is so strong that nothing can escape, not even light
Breathing	the process that brings about an exchange of gases between the organism and the environment
Bronchiole	one of the many tiny tubes which carries air to and from the alveoli in the lungs

Bronchitis	a lung disease in which the cells lining the bronchi and bronchioles are inflamed
Cancer	a disease in which body's cells start to divide and multiply in an uncontrolled and disorderly fashion
Chemical Reaction	a change in which one or more chemical elements or compounds (reactants) form new compounds (the products)
Chemistry	the scientific study of all substances and how they react and combine together
Chlorophyll	a green pigment found in most plants. It absorbs light energy during photosynthesis.
Chromosome	a thread-like structure present in the nucleus of a cell. It contains hereditary materials called genes
Colloid	a mixture of extremely small particles of a substance dispersed in another in which it does not dissolve. The particles are smaller than in a suspension
Comet	an icy lump of material that moves around the sun in a highly elliptical orbit. Its 'tail' is a thin stream of gas and dust that reflects sunlight.
Compound	it consists of two or more elements chemically combined together
Constellation	stars that appear to form a group with a definite pattern or arrangement, when viewed from the earth.
Current electricity	the type of electricity that can flow through wires
Decanting	process of separating a liquid from a solid that has settled by pouring the liquid carefully out of the container
Deforestation	destruction of forests due to human activities
Detergents	substances which when added to water, enable it to remove dirt
diaphragm	a muscular sheet that separates the chest
Distillation	the process of separating a mixture of liquids, or a liquid from an impurity, by heating. the vapour of the liquid with the lowest boiling point comes off first and is condensed back to a liquid in the condenser
DNA	hereditary material of the cell
Dwarf star	a very small star that may be no larger than earth
Dynamo	a type of generator that produces direct current
Eclipse	the total or partial disappearance of a heavenly body when another one moves between it and the viewer.
Effector	a muscle that responds to a message and reacts accordingly
Electric charge	Something that has an electric charge carries electricity. There are two types of electric charge, called positive and negative
Electric circuit	the path along which an electric current flows
Electric Current	the flow of positive or negative electric charges
Electric field	the area in which an electric force has an effect
Electric Motor	a device that changes electrical energy into movement
Electric shock	the effects on the human body caused by electric current from batteries or

Electricity	the effect caused by the presence or movement of electrically charged particles
Electrolysis	chemical reactions produced by passing electric current
Electrolytes	electrolytes are chemical compounds, that help electric current to pass through them on ionization (e.g., NaCl, H <sub>2</sub> SO <sub>4</sub> )
Element	it is a pure substance which contains same type of elements
Endothermic Reaction	a chemical reaction that takes heat from its surroundings
Evaporation	a change of state from liquid to gaseous (vapour), due to the escape of molecules from the surface. A liquid which readily evaporates is described as volatile
Evening Star	another name for the planet venus, as it appears just after sunset
Exothermic Reaction	a chemical reaction that releases heat into its surroundings
Filtering	the process of separating a liquid and a solid by pouring the mixture through a fine mesh (filter paper). the filter paper only lets liquid through pto
Galaxy	a large group of stars, gas, and dust
Galvanometer	an instrument for detecting or measuring very small electric currents
Gamete	a reproductive cell containing the haploid number of chromosomes
Genes	units controlling inheritance and expression of characters
Genetic engineering	a technique used to transfer genes from one organism to another
Genotype	the genetic combination in an individual
Generator	a machine that turns the energy of movement, or kinetic energy, into electrical energy
Guard cells	a pair of special cells present around opening (stomata) in the epidermis of a leaf that regulate the opening and closing of stomata
Hereditary characters	characteristics which are inherited
Heredity	transfer of characters from parents to their offspring
Indicators	a chemical compound that changes its colour when an acid or an alkali is added into it.
Insulation	a material that reduces heat transfer
Irregular galaxy	a galaxy with no definite shape or arrangement
Irregular galaxy	a galaxy that does not have any special shape or form
Kilogram (kg)	unit of mass
Lens	a piece of transparent substance with curved surfaces, that makes light bend in a certain way
Light-year	the distance light travels in one year, or 9.5 trillion kilometers

Luminous	the term that describes any object that gives off light
Mass	the amount of matter that is in an object
Mass	the amount of matter contained in an object
Mesophyll	cells found between upper and lower epidermis in a leaf. these cells contain chloroplasts
Meteor (or shooting star)	a meteoroid that starts to burn up as it enters the atmosphere
Meteorite	fragments of rocks striking the surface of the earth
Meteorite	the remains of a meteor that has survived the atmosphere and landed on earth
Meteoroid	a small piece of space debris
Meteoroids	rocks or fragments of rocks and iron travelling in space
Metre (m)	unit of length. 1000 metres equals 1 kilometre (km)
Milky Way	a spiral galaxy to which our sun and the planets belong
Milky way	the galaxy in which our solar system lies
Milky Way Galaxy	such a galaxy containing solar system
Mineral Acid	an acid which is produced chemically from a mineral e.g. hydrochloric acid is produced from sodium chloride and sulphuric acid is produced from sulphur
Mixture	it is formed by the combination of two substances in such a way that no new substance is formed
Model	a representation of something that cannot be seen easily or directly
Molecule	it is formed by the combination of same or different atoms.
Motor neurones	a nerve cell that transmits impulses to an effector
Nebula	gigantic clouds of dust and gases in space
Nerve	a collection of nerve fibers
Nerve fiber	a long cytoplasmic extension of a cell body of a neurone. It serves to transmit impulses
Neurone	a nerve cell
Neutron Star	a star whose core contains neutrons only
Non-luminous	describes an object that does not give out light of its own
Optical microscope	an instrument that uses lenses to make small objects look bigger
Optical telescope	an instrument that uses lenses and mirrors to make distant objects look closer
Orbit	the path in which one heavenly body moves around another.
Organic Acid	an organic compound that is acidic in nature . the most common ones are carboxylic acids (e.g., oxalic acid, formic acid, acetic acid)
Palisade tissues	cylindrical cells arranged closely and vertically in the upper layer of mesophyll. these cells contain numerous chloroplasts which facilitate the absorption of sunlight

pH	stands for power of hydrogen, a measure of hydrogen ion concentration in a solution
Pneumatic	powered by the pressure of a gas, usually air
Pressure	a measure of the amount of force applied to a given area
Receptor	sense organ, cell or nerve endings that detect stimulus
Recycling	rendering used articles into useful ones
Reflex action	an immediate response to a specific stimulus without conscious control.
Respiration	the process by which energy is released from food substances in living cells
Revolution	the movement of one object around another
Rotation	the spinning motion of an object
Salt	a compound formed by the neutralization reaction between acid & base
Satellite	bodies that rotate in orbits around other bodies of greater mass under the influence of a gravitational field. for example, the moon is a natural satellite of the earth. Satellites which are used for relaying radio, television and telephone signals around the earth are artificial earth satellites. They are called communication satellites.
Second (s)	unit of time. A second is a duration in which the cesium-133 atom completes 9,192,631,770 vibrations under specified conditions
Selective breeding	technology using breeding of selected organisms
Sexual reproduction	reproduction that involves the fusion of two reproductive cells called gametes
SI units	an internationally agreed system of standard units used for scientific measurements
Soap	it is the sodium or potassium salt of a long-chain carboxylic acid. It is made by reacting animal fats or vegetable oils with NaOH or KOH. The process of making soap is called saponification
Solar System	the sun together with all of the planets and other objects orbiting it
Solar wind	a constant stream of invisible particles blown out into space from the sun
Space probe	unmanned spacecraft sent to explore the solar system and beyond
Space shuttle	a reusable manned spacecraft that is launched like a rocket, but lands on reentry like a plane
Space station	a large satellite orbiting the earth where astronauts can live and perform scientific research over fairly long periods
Stars	shining objects of gases in nebula
Sun	this is a star
Supergiant	an extremely large star
Suspension	fine particles of a solid suspended in a liquid in which the solid does not dissolve.
True brightness	the actual amount of energy in the form of light that is released by a star
Universe (or cosmos)	the collection of all matter, energy and space that exists

Universe theory	the idea that the universe expands and shrinks, in a repeating cycle of big bangs and big crunches
Vacuum	an empty space where there are no particles of air or other matter
Variable resistor (or rheostat)	an electronic component that can be adjusted to give different amounts of resistance
Variable star	a star that changes gradually in brilliance
Variation	the differences that can be observed within a species
Voluntary action	an action that is controlled by the will
Volume	the amount of space something takes up. It is measured in cubic metres ( $m^3$ ). A smaller unit of volume is the cubic centimeter ( $cm^3$ ), or milliliter (ml). $1\ cm^3 = 1\ ml = 1/1\ 000\ 000\ m^3$
Weather forecast	a prediction of what the weather will be for some time in the future
Weight	the measure of the force of gravity acting on an object
X-Rays	short-wavelength, high -frequency electromagnetic waves that can pass through most soft substances but not hard, dense ones
zygote	a cell formed as a result of the fusion of the sperm and the ovum. it divides repeatedly and becomes the embryo