Infographics based on Learning Outcomes in Science at Upper primary Stage

Class VII
(2020-21)

Department of Education in Science and Mathematics
National Council of Educational Research and Training
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PREFACE

Over the years, the focus of global educational efforts, particularly under the banner of *Education for All (EFA)*, has shifted significantly. No longer is it enough to simply get children into schools; the concern has moved toward what truly matters—*the quality of education*. This includes not just student enrolment and retention, but also what students actually learn and how they grow in the classroom.

Despite significant progress—highlighted in the *Global Monitoring Report (2015)*—countries like India still face serious challenges in ensuring meaningful learning for all. National assessments such as *ASER* and *NAS* reveal a sobering reality: while children are in school, many are struggling to master basic skills, and the gaps between different regions remain stark.

In the classroom, teachers often find themselves uncertain. What should students be learning? How should learning be assessed? With textbooks commonly used as the sole guide, and assessments limited to the back-of-the-chapter questions, deeper learning often gets overlooked. Local context, diverse teaching styles, and varying student needs are rarely considered, largely because there's no clear framework to do so.

This is where clearly defined *learning outcomes* become essential. They not only provide direction to teachers but also empower parents, school committees, communities, and policymakers to take shared responsibility for the child's learning. Everyone becomes more informed, more accountable, and more engaged.

In response, NCERT developed a detailed document outlining learning outcomes across all subjects for elementary education. These outcomes are carefully aligned with curricular goals and teaching strategies. To complement this, a series of thoughtfully designed infographics have been compiled into this booklet. These resources are meant to help teachers and parents had better understand students' thought processes and learning levels.

We owe this work to the dedication of the Development Committee and the many teachers who contributed their time and insights. NCERT deeply values their efforts. As an institution constantly striving for improvement, we invite readers to share their feedback so that future versions can be even more effective and relevant.

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Dr. Ruchi Verma

(Professor & Coordinator)

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2.	Differentiates materials and organisms such as, digestion in different organisms; unisexual and bisexual flowers; conductors and insulators of heat; acidic, basic and neutral substances; images formed by mirrors and lenses, etc., based on their properties, structure and function.	Sc0702	4
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A. Introduction

National Education Policy (NEP) -2020 lays particular emphasis on the development of the creative potential of each individual and believes that education must develop not only cognitive capacities, but also social, ethical, and emotional capacities and dispositions. Learning outcomes at elementary stage developed by NCERT is already in public domain. This is in consonance with most of the above mentioned characteristics. The document is expected to support and facilitate integrated and holistic learning approaches to achieve learning outcomes. Learners need to develop competencies in academic settings which they can use in real life contexts even after they leave the school. These competency based learning outcomes have been shared widely for their utilisation by the educationists, parents and students. Despite of wide sharing, it was observed that teachers, learners and parents were not really acquainted to take these learning outcomes in the teaching learning process.

Learning outcomes at upper primary stage includes competencies which the learners are expected to develop by the end of class VIII.With regard to NCERT's mandate also in consonance with the MHRD's communication, the learning outcomes related material including Infographics/posters/presentations, online teacher training courses for teachers of each grade, explaining their subject wise learning outcomes, in byte sized videos, extra resources based on LOs such as workbooks/worksheets/quizzes/etc. for each subject of each class and 10 items each to measure each learning outcome of each class in at-least two levels of proficiency are in the process of development at upper primary stage.

In this direction, the present report contains infographics, based on learning outcomes at upper primary stage which have been developed to meet the objective of the programme. In all 44 infographics have been designed one each for each Learning Outcome for classeses VI, VII and VIII.

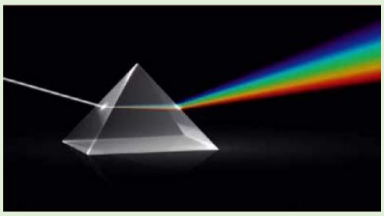
Specific Objectives:

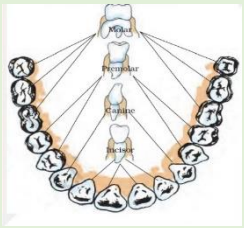
- To develop Infographics/posters explaining each Learning Outcomes for each class that communicates to all stakeholders (student, teacher, parent, community) in a simple manner (classes VI,VII and VIII).

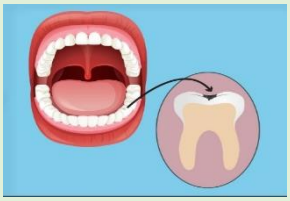
Methodology:

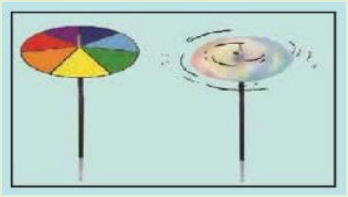
- Development of Infographics/posters explaining each Learning Outcomes in Science for classes VI, VII, VIII.
- Review of Infographics/posters/presentations explaining each Learning Outcomes in Science for classes VI, VII and VIII with the help of subject experts.
- Finalisation of Infographics/posters/presentations based on Learning Outcomes.

The developed Infographics/posters may be produced in large scale for their dissemination in schools or online mode. Further, the materials will be disseminated through e-pathshala and NROER. Also such materials can be used in MOOCs, DIKSHA , besides during various training programmes of NCERT.









B. Infographics

Learning Outcome at the Elementary Stage: Science (Class VII)

Sc0701

Identifies Materials and Organisms

Explores | Shares Findings | Poses Questions | Find Answers | Analyses | Draws Inferences/ Makes Generalisations

Wash your hands with soap and use your index finger to feel your teeth. How many kinds of teeth do you find?

I can feel sharp teeth at the front of my mouth. Four teeth in the upper jaw and four in the lower jaw.

They are incisors and used for cutting food.

I can feel slightly pointed teeth next to incisors.

Yes, they are called canines.

Sir, I can feel more teeth present next to canines.

Yes, they are called pre-molars. Count them and tell me their number.

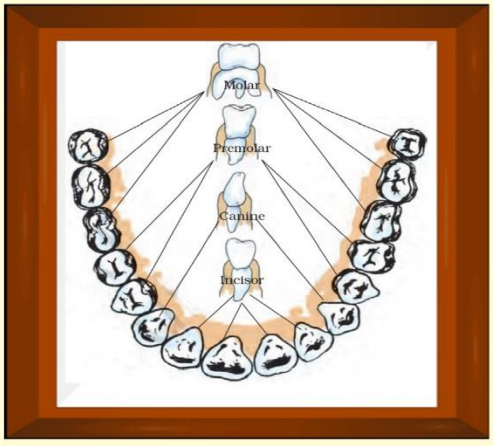
Four in upper jaw and four in lower.

Excellent! Now feel at the back of your mouth.

I can feel wide rectangular shaped teeth.

Yes, they are called molars. Now, record your observations in the table.

Types of teeth	Number of teeth		Total
	Lower jaw	Upper jaw	
Incisors Cutting and bitting food			
Canines Piercing and tearing food			
Premolars / Molars Chewing and grinding food			



At some age, the final four molars begin to erupt in the farthest your mouth. These are popularly called wisdom teeth.

Oh! I will ask my brother about it.

Other Learning Outcomes

The Learner

- **differentiates materials and organisms.**
- **applies learning of scientific concepts in day-to-day life.**

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Learning Outcomes at the Elementary stage: Science (Class VII)

Sc0702

Differentiates Materials/Processess/ Phenomena on the Basis of their Properties

Observes | Asks questions | Collects information | Explores | Finds similarities and differences

Students, I have brought old newspapers.

Group I, tear the paper, and make an aeroplane, cap or whatever you like.

Group II, Burn this paper. Remember to do it with caution under my supervision.

What changes do you observe?

Excellent! In first case, only shape is changing while in second case, a new substance is formed.

On the basis of your observations, we can differentitate between two types of changes.

Group I

The shape of paper changed.

Group II

Paper got converted into ash.

PHYSICAL CHANGE	CHEMICAL CHANGE
• Only physical properties of substance changes like shape, size etc	• Chemical properties of substance changes
• No new product is formed	• New products are formed
• Mostly reversible changes	• Mostly irreversible changes

Let us differentiate some more examples

Bending of Iron Rod, Burning of Wax, Melting of Wax, Cutting of Wood, Burning of Wood, Rusting of Iron

PHYSICAL CHANGE

- Bending of Iron Rod
- Cutting of Wood
- Melting of Wax

CHEMICAL CHANGE

- Burning of Wood
- Burning of Wax
- Rusting of Iron

Rusting of iron is a chemical change. How can we prevent it?

Other Learning Outcomes

The learner

- classifies materials and organisms based on properties/charecterstics.
- explains processes and phenomena.

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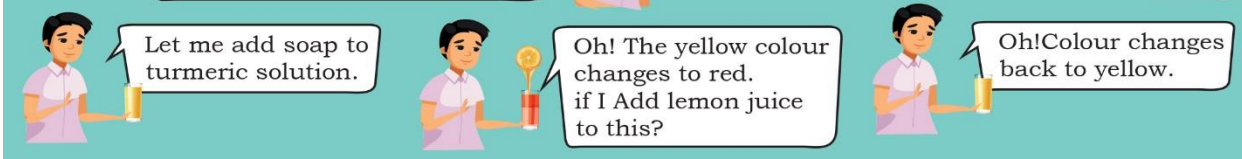
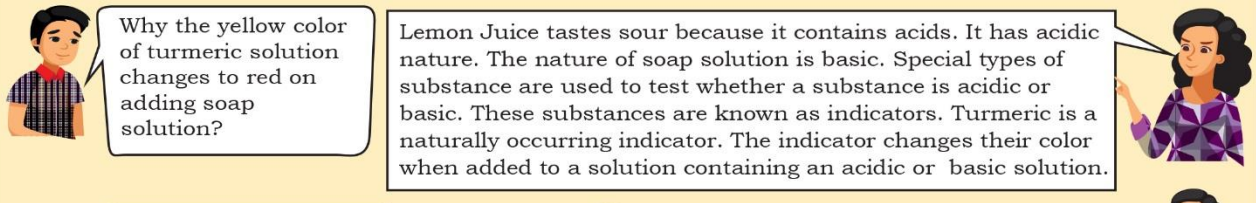
Learning Outcomes at the Elementary stage: Science (Class VII)

Classifies materials and organisms based on properties/characteristics

Sc0703

Observes | Asks Question | Collects Information | Finds Similarities And Differences | Groups Similar Materials





S. No.	Test Solution	Effect on Turmeric Solution	Acid	Base
1.	Lemon Juice			
2.	Orange Juice			
3.	Vinegar			
4.	Milk Of Magnesia			
5.	Baking Soda			
6.	Lime Water			
7.	Sugar			
8.	Common Salt			

Other Learning Outcomes

The learner
- differentiates materials and organisms.
- applies learning of scientific concepts in day-to-day life.

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Learning Outcomes at the Elementary stage: Science (Class VII)

Sc0704

Conducts Simple Investigation to Seek Answers to Queries

1. Asks Questions
2. Plans and Performs Activities/ Experiments/ Surveys/Field Trips/
3. Records Observations
4. Analyses the findings and formulates hypothesis
5. Tests the hypothesis by repeating observations

Compact Disk

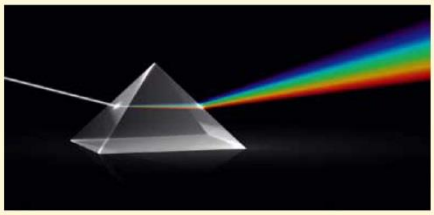
Rainbow

Blue Sky

Nature is so colourful! The sky is blue but at sunset, it apprears orange.

And what about a "Rainbow" where we can see seven colors ! Does that mean that the light is made up of many colours ?

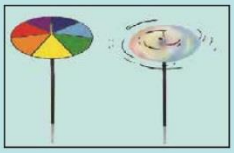
Let us Investigate



- Let me take a glass prism.
- Now I allow a narrow beam of sunlight through a small hole in the window of a dark room to fall on one face of the prism.
- I allow the light coming out of the other face of the prism fall on a white sheet of paper or on a white wall.

White light is composed of seven colours. Can we mix these seven colours to get white light?

- Take a circular cardboard disc with seven rainbow colors painted on it in seven segments.
- Fix the disc loosely on the tip of a refill of a ball pen.
- Rotate the disc in the day light.



- When the disk is rotated fast, it appears nearly white.
- Such a disc is popularly known as Newton's disc.

If the light of two different colors be mixed, will another colour be produced?

Well, another question for you!!

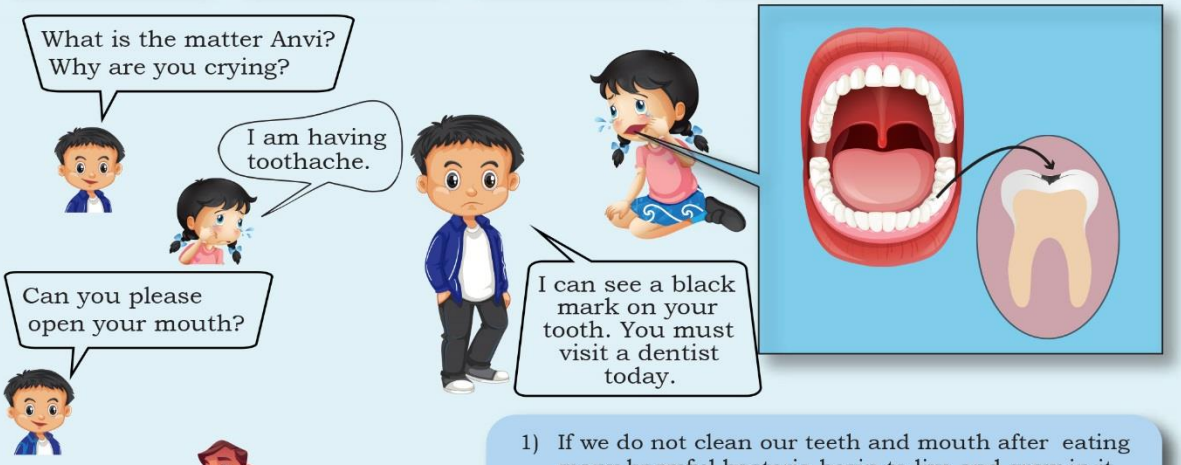
Other Learning Outcomes

The learner:

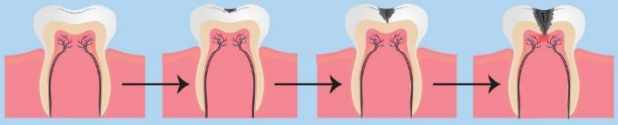
- constructs models using materials from surroundings and explains their working.
- applies learning of scientific concepts in day-to-day life.

Relates Processes and Phenomena with Causes

Identifies the problem | Poses Questions | Tries to find Answers | Relates with possible causes | Tries to find solutions

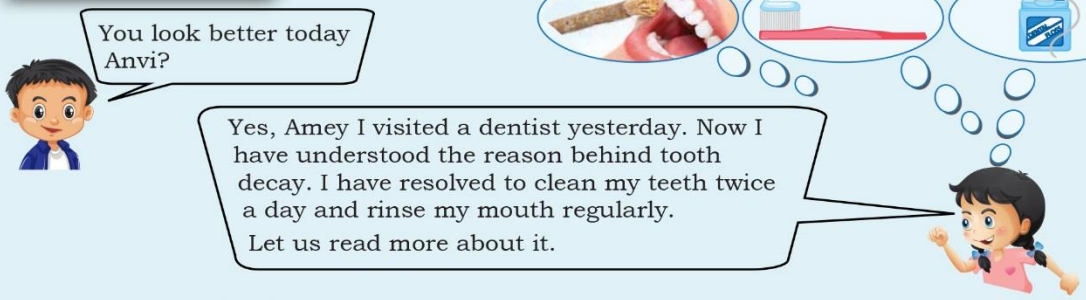


1) If we do not clean our teeth and mouth after eating many harmful bacteria begin to live and grow in it.
2) They break down the sugars present from the left over food and release acids.
3) This acid gradually damages the teeth. This is called tooth decay. If this is not treated in time, it causes severe toothache. Therefore, you should clean your teeth thoroughly.



Gradual Decay of Tooth

Next Day



Other Learning Outcomes

The learner

- explains processes and phenomena.
- applies learning of scientific concepts in day-to-day life.

Explains processes and phenomena

Observes → Investigates → Makes Hypothesis → Tests Hypothesis → Establishes the Explanation

I read an interesting phenomenon about people living in coastal seas.

What is it ?

The windows of the houses in coastal areas are made facing the sea to receive the cooler sea breeze.

Amazing, let us read more about it.

During the day,heat transfers from the sun to the earth through radiation. The land gets heated faster than the water. The air over the land becomes hotter and rises up (heat transfer in liquid and air through convection).
The cooler air from the sea rushes in towards the land to take its place.The warm air from the land moves towards the sea to complete the cycle the air from the sea is called sea breeze.

At night the water cools down more slowly than the land. The cool air from the land moves towards the sea.This is called the land breeze.

Other Learning outcomes

The learner:

- relates processes and phenomena with causes.

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Learning Outcomes at the Elementary stage: Science (Class VII)

Sc0707

Writes Word Equation for Chemical Reactions

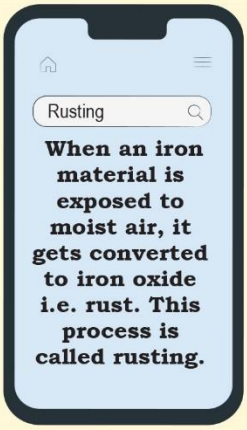
Gathers material required for the reaction → **Performs reactions** → **Gathers information about the reaction** → **Writes the word equation of the reaction**

Hey! Can you notice that the colour of my cycle has changed?

Oh yes! This is because the part of your cycle are rusted.

What do you mean by rusting?

Ok. Let's search it online.



This description of a chemical reaction in a sentence form is quite long. Can it be written in a shorter form?

Yo, the simplest way to do this is to write it in the form of a word - equation.

Oh yes! Teacher explained us, how to write word equations.

Tell me how to do it.

- A word-equation shows change of reactants to products through an arrow placed between them.
- The reactants are written on the left-hand side (LHS) with a plus sign (+) between them. Similarly, products are written on the right-hand side (RHS) with a plus sign(+) between them.
- The arrowhead points towards the products, and shows the direction of the reaction.

Rusting of Iron
Iron + Oxygen (from the air) + Water — Iron oxide (Rust)

This is intresting! Let us try more examples.

Formation of Salt
Acid + Base → Salt + Water
Hydrochloric acid + Sodium Hydroxide → Sodium chloride + Water

Displacement Reaction
Copper sulphate solution (blue) + Iron → Iron sulphate solution (green) + Copper (brown deposit)

Other Learning Outcomes

The learner:

- classifies materials based on properties/characteristics.
- explains processes and phenomenon.

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Learning Outcomes at the Elementary stage: Science (Class VII)

Sc0708

MEASURES AND CALCULATES

Observes → Questions → Relates → Measures → Calculates

Papa, My teacher told me that temperature is the measure of degree of hotness or coldness of an object. A thermometer is used to measure the temperature. I also know there are 3 commom types of thermometers:

» Laboratory thermometer.
» Digital thermometer.
» Clinical thermometer.

Can you help me read a clinical thermometer?

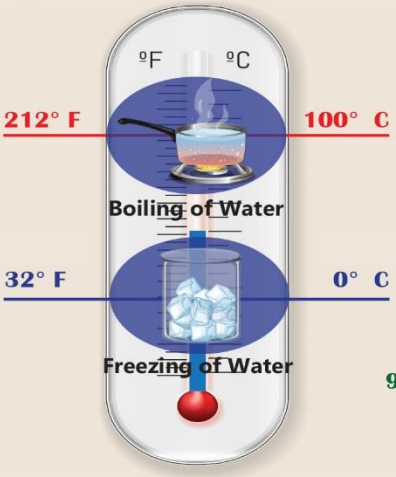
Laboratory Thermometer | Clinical Thermometer | Digital Thermometer

In the clinical thermometer there is a kink, so that mercury level doesn't drop automatically. I can also see 2 scales.

Because these scales were proposed by two different scientists !
CELSIUS AND FAHRENHEIT.
Let me tell you more about the thermometric scales.

Daniel Gabriel Fahrenheit
24 May 1686

Anders Celsius
27 November 1701



The temperature of freezing and boiling of water becomes the fied point of these scales.

Now, I am prepared to read the thermometer?

Normal Human Body Temperature
98.6° F
37° C

Yes !

UPPER SCALE Fahrenheit Scale	10 DIVISIONS = 2° F So, 1 DIVISION = 2/10 =0.2°	TEMPERATURE IS 102° F
LOWER SCALE Celcius Scale	10 DIVISIONS =1° C So, 1 DIVISION = 1/10 =0.1°	TEMPERATURE IS 38.9° C

- ✓ Never touch the bulb of a thermometer while reading it.
- ✓ Always keep the clinical thermometer straight and directly in front of your eyes while reading it.
- ✓ Sanitize it with rubbing alcohol or mild soap solution before and after use.

Why is mercury no longer preferred as a thermometric liquid?

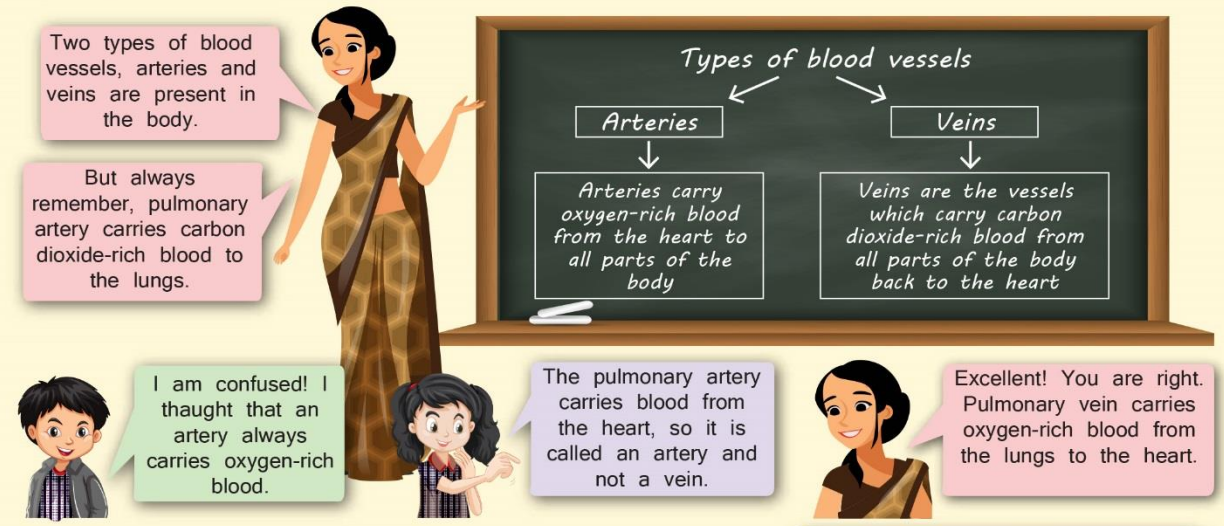
Because mercury is a toxic substance.

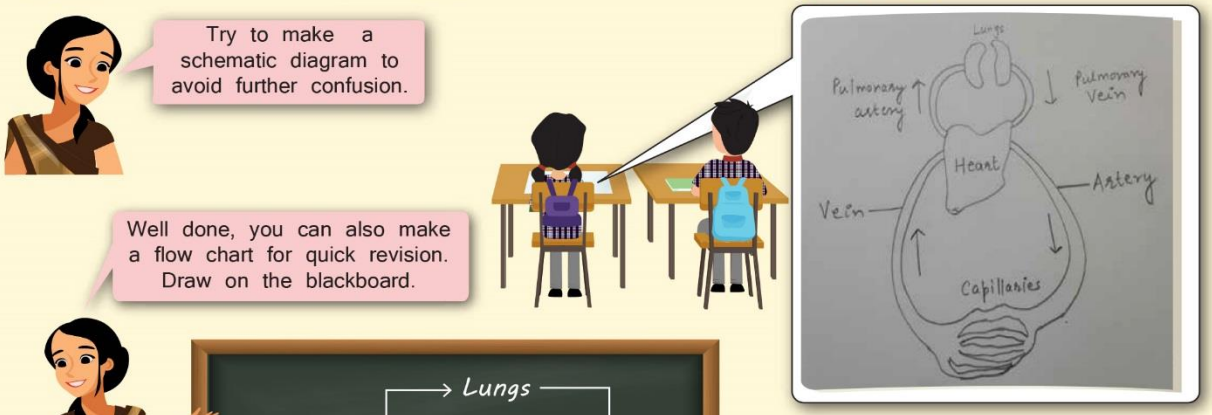
Other Learning Outcomes

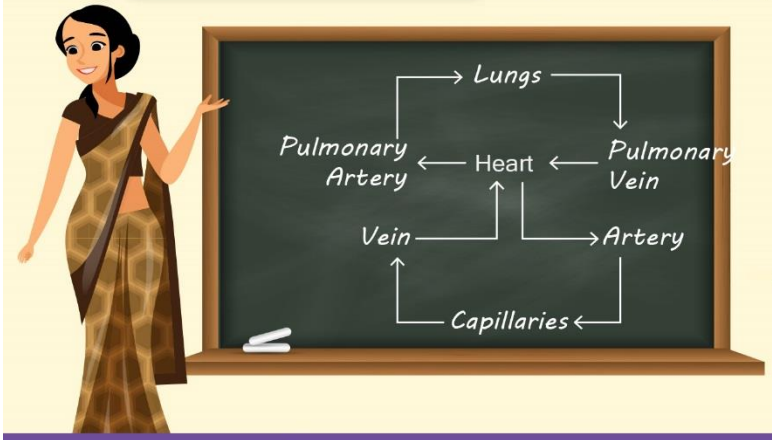
The learner:
- conducts simple investigations to seek answers to queries.
- applies learning of scientific concepts in day-to-day life.

Draws Labelled Diagrams/ Flow charts

Observes/ studies | Understands /visualizes | Decides proportions/ sequence | Arranges in sequence | Labels appropriately | Writes caption







Record your own pulse beats per minute and those of your classmates.

Other Learning Outcomes

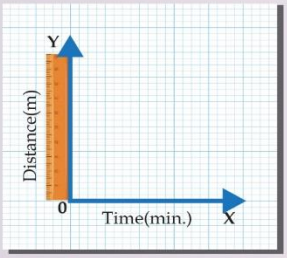
The learner
- explains processes and phenomenon.
- applies learning of scientific concepts in day-to-day life.

Plots and Interprets Graphs

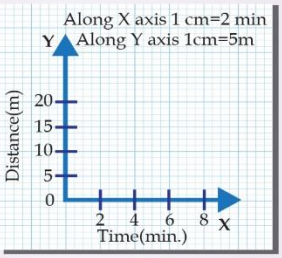
Identifies the variables | **Determines the scale of the graph** | **Labels each axis** | **Plots the graph**

Children please get a graph paper, a ruler, pencil and an eraser. I am giving you the data of your journey to school by bicycle bus for the distance (covered in meters) in given time (in minutes). Let's plot a Distance-Time graph!

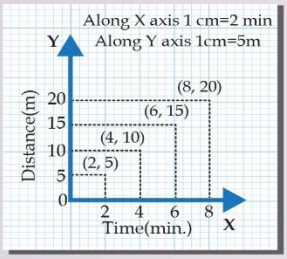
Distance(m)	5	10	15	20	Y axis
Time(min.)	2	4	6	8	X axis



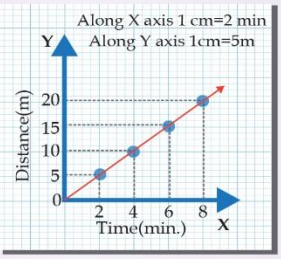
Make the axes with a pencil and scale.
Choose the X axis for time and Y axis for distance.
Mark 0 at the origin.



Choose an appropriate scale
You may take
Along X axis 1 cm=2 minutes
Along Y axis 1 cm=5 meters

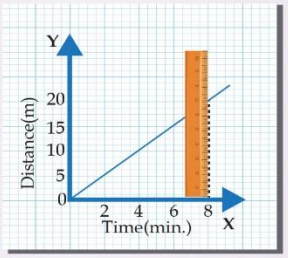


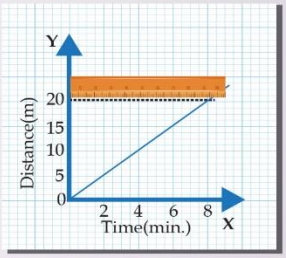
From the data table choose the first set of values. Let us suppose (2,5)
Now find 2 on the X axis, using a scale draw a vertical line.
Locate 5 on the Y axis, using a scale make a horizontal line parallel to X axis.
These 2 lines intersect and you get a point.
Now repeat this process for all sets of values.



Let's highlight the points
Draw a line with a scale joining the origin and the points and your graph is ready.

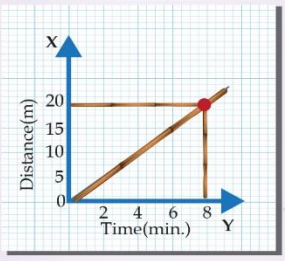
Rani, now you know how to plot a graph!
Observe Graph 4 and tell me without looking at the data table, the distance your school bus travelled in 8 minutes.





Yes ma'am, I will take a scale and keep it vertically at 8 minutes. I will then locate the point where my scale intersects the graph.
Thereafter, I will keep my scale horizontally. I can see the distance covered by the school bus is 20 metres.

Well done Rani ! 20 m is the right answer. Yes, Rohan can make a graph in the maths notebook and Aparna, your graph is looking nice too. It's quiz time now !
Why was time depicted on X axis and not on the Y axis?



Ma'am, Rohan is making this graph in his maths notebook and Aparna has used sticks and bindis to depict her graph.

Other Learning Outcomes

The learner:
- measures and calculates.
- applies learning of scientific concepts in day-to-day life.

Constructs models using materials from surroundings and explains their working

Identifies the issue/raises questions	Plans the model to answer questions	Collects the material required	Constructs model	Uses model to verify queries	Shares the findings

The walls of the chambers of the heart are made up of muscles. These muscles contract and relax rhythmically. This rhythmic contraction followed by its relaxation constitute a heartbeat.

I have seen doctors using stethoscope to feel our heartbeats.

Absolutely right!

Can we construct a stethoscope?

Let us construct a model of a stethoscope.

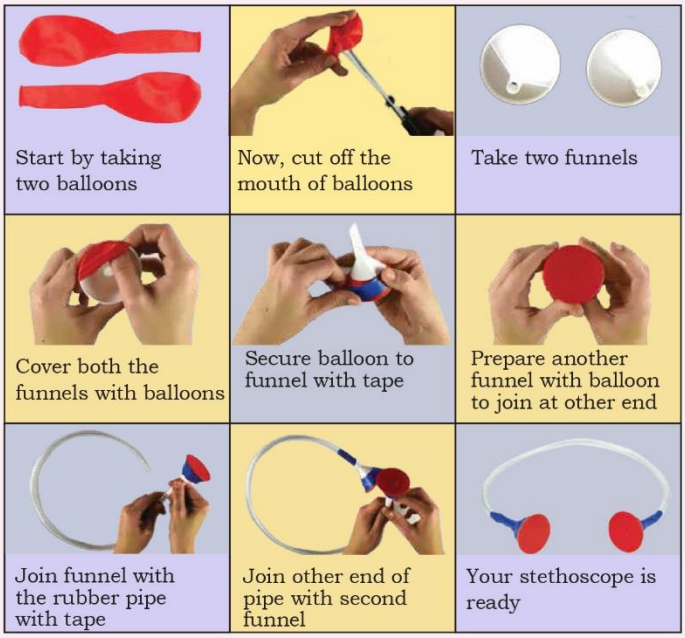
What will we need?

Stethoscope

Stethoscope is a device used to amplify the sound of the heart. It consists of a chest piece that carries a sensitive diaphragm, two ear pieces and a tube joining the parts.

Doctors can get clues about the condition of your heart by listening through a stethoscope.

Materials Required: Funnels, Pair of scissor, Balloons, Insulation tape and Flexible hollow tube. Let us try it.



Now, record your own pulse rate and heart beat and that of your friends while resting and after running and record in the table. Do you find any relationship between your heart beat and pulse rate?

Name of Student	While resting		After running (4-5 minutes)	
	Heartbeat /minute	Pulse rate /minute	Heartbeat /minute	Puls rate /minute

That will be fun. Let us do it.

Other Learning Outcomes

The learner
- applies learning of scientific concepts in day to day life.
- exhibits creativity in designing, planning, making use of available resources.

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Learning Outcomes at the Elementary stage: Science (Class VII)

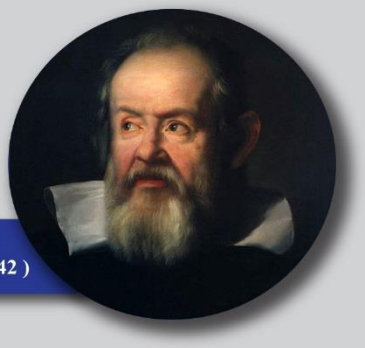
Discusses and Appreciates Stories of Scientific Discoveries

Sc0712

Observes and experiences → **Appreciates the persistence of scientists** → **Values the importance of the discoveries** → **Draws inspiration**

I learned that the time period of a given pendulum is constant. I wonder how it was discovered!

Oh! There is an interesting story behind this discovery.



Galileo Galilei
(A.D. 1564-1642)

In 17th century, Galileo Galilei was sitting in the Pisa Cathedral.

He noticed that a chandelier suspended from the ceiling with a chain was moving slowly from one side to the other.

He was surprised to find that his pulse beat the same number of times during the interval in which the lamp completed one oscillation.

He investigated and found that a pendulum of a given length takes always the same time to complete one oscillation.

This absorption led to development of pendulum clocks.

Winding clocks and wristwatches were refinements of the pendulum clock.

Let us do a role play. Would you like to play the role of Galileo?

Other Learning Outcomes

The Learner

- relates processes and phenomena with causes.
- applies learning of scientific concepts in day-to-day life.

Learning Outcomes at the Elementary Stage: Science (class VII)

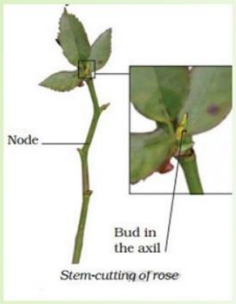
Applies learning of scientific concepts in day-to-day life

Sc0713

Explores surroundings | Investigates | Finds solutions | Applies learning

Wow! Such beautiful roses.I wish I had such roses in my garden.

I learnt that you can grow rose plant by stem cutting. This is called vegetative propagation. It will save a lot of your time.



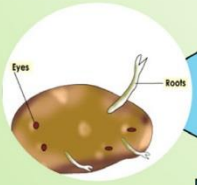
Stem-cutting of rose

Cut a branch of rose plant with a node.

Plant the cutting in the soil and water everyday.

Gradually, it will grow as a rose plant.

Oh great! let me read about this idea and find out which other vegetables and plants I can grow in my garden using vegetative propagation.



I can grow potatoes by using its few pieces, each with an eye and burying them in the soil.

Awesome! I can grow sweet potatoes also by using this concept.

Other Learning outcomes

The learner:

- relates processes and phenomena with causes.
- exhibits creativity in designing, planning and making use of available resources.

Learning Outcome at the Elementary Stage: Science (Class VII)

SC0714

Makes Efforts to Protect Enviornment

Gathers information about environmental problems

Collects information about possible solutions

Takes action to solve environment problems

Water Water Everywhere Nor Any Drop to Drink

Oh! These are the lines of the poem "Rime of the Ancient Mariner" written by S.T. Coleridge.

What do these lines mean?

The poet has described the plight of sailors lost in the ocean. Only a small fraction of water available on the earth is fit for use. Most of the water is in the oceans and it can not be used directly.

I saw a picture in which people were standing in long queues to collect water.

Yes, many parts of the world's are suffering from water scarcity. We must conserve water.

Water Scarcity | Lack of fresh water resources to meet the water requirement

What causes water scarcity?

What can we do?

Prepare a poster showing do's and don'ts and share the pictures with your friends.

Other Learning Outcomes

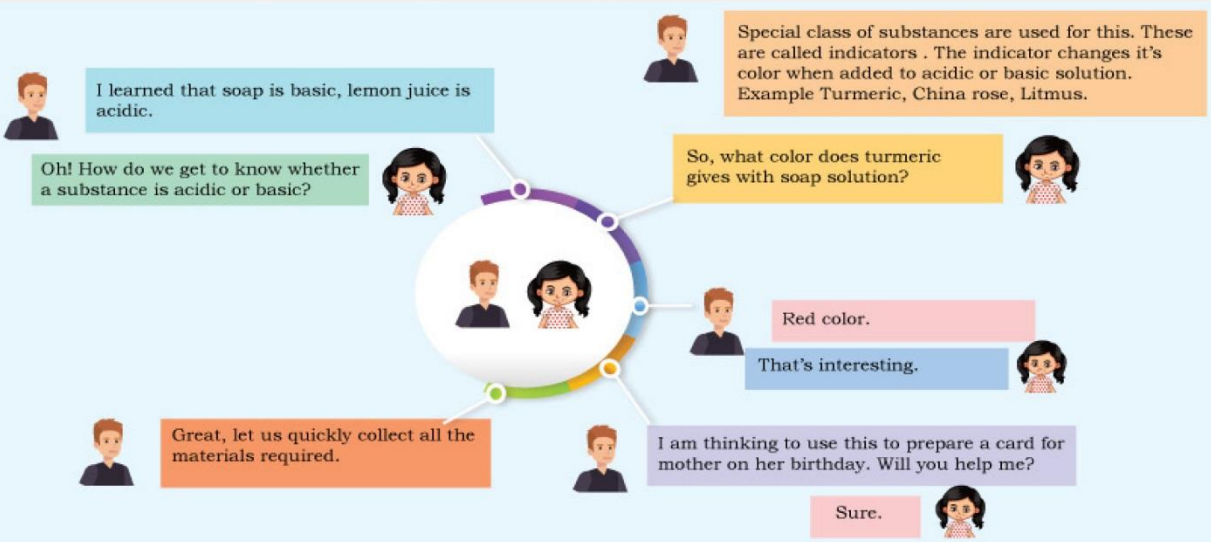
The Learner

- relates processes and phenomena with causes.
- applies learning of scientific concept in day-to-day life.

Learning Outcomes at the Elementary Stage: Science (Class VII)

Sc0715

Exhibits creativity in designing, planning, making use of available resources



Materials Required

Soap solution, Turmeric paste, Blotting paper ,Cotton bud

Other Learning Outcomes

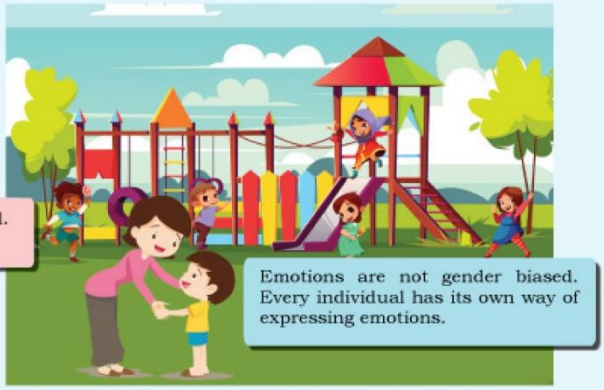
The learner

- identifies materials and organisms.
- applies learning of scientific concepts in day to day life.

Learning Outcomes at the Elementary Stage: Science (Class VII)

Exhibit values of honesty, objectivity, cooperation, freedom from fear and prejudices

Sc0716



Other Learning Outcomes

The learner

- applies learning of scientific concepts in day to day life.

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