Science

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A. Introduction:

Even the most established and universal laws of science are always regarded as provisional, subject to modification in the light of new observations, experiments and analyses. Science is a dynamic, expanding body of knowledge, covering ever-new domains of experience. In a progressive forward-looking society, science can play a truly liberating role, helping people escape from the vicious cycle of poverty, ignorance and superstition. The advances in science and technology have transformed traditional fields of work such as agriculture and industry, and led to the emergence of wholly new fields of work. People today are faced with an increasingly fast-changing world where the most important skills are flexibility, innovation and creativity. So the curriculum is designed to connect to Peace Vision and its Perspective of Education.

B. Curriculum Framework

Central to the curriculum framework is the inculcation of the spirit of scientific inquiry. The conduct of inquiry is founded on three integral domains of:

(a) Knowledge, Understanding and Application,

(b) Skills and Processes and

(c) Ethics and Attitudes.

These domains are essential to the practice of science. The curriculum design seeks to enable students to view the pursuit of science as meaningful and useful. Inquiry is thus grounded in knowledge, issues and questions that relate to the roles played by science in daily life, society and the environment.

The science curriculum seeks to nurture the student as an inquirer. The starting point is that children are curious about and want to explore the things around them. The science curriculum leverages on and seeks to fuel this spirit of curiosity. The end goal is students who enjoy science and value science as an important tool in helping them explore their natural and physical world.

The teacher is the leader of inquiry in the science classroom. Teachers of science impart the excitement and value of science to their students. They are facilitators and role models of the inquiry process in the classrooms. The teacher creates a learning environment that will encourage and challenge students to develop their sense of inquiry.

- The following table shows the description of each **domain** which frames the practice of science:

Knowledge, Understanding and Application	Skills and Processes	Ethics and Attitudes
○ **Scientific phenomena, facts, concepts and principles** ○ **Scientific vocabulary, terminology and conventions** ○ **Scientific instruments and apparatus including techniques and aspects of safety** ○ **Scientific and technological**	**Skills** ○ **Observing** ○ **Comparing** ○ **Classifying** ○ **Using apparatus and equipment** ○ **Communicating** ○ **Inferring** ○ **Formulating hypothesis** ○ **Predicting** ○ **Analyzing** ○ **Generating possibilities** ○ **Evaluating** **Processes** ○ **Creative problem solving** ○ **Decision-making** ○ **Investigation**	○ **Curiosity** ○ **Creativity** ○ **Integrity** ○ **Objectivity** ○ **Open-mindedness** ○ **Perseverance** ○ **Responsibility**

- The domains are contextually linked to the **roles** played by science to establish its relevance and relationship to modern-day living.

Science in daily life - Personal perspective focusing on the individual	Science in society - Social perspective focusing on human interactions	Science and the environment - Naturalistic perspective focusing on man-nature relationship
○ **Using scientific skills in everyday life, e.g. observing trends and patterns, analyzing data from media reports etc** ○ **Adaptable to scientific and technological advances** ○ **Able to make informed decisions that are related to science and technology e.g. consumption of GM food, health choices**	○ **Engaging in meaningful scientific discourse with others** ○ **Understanding role and impact of science and technology in society** ○ **Contributing to the progress of science knowledge**	○ **Understanding place of humanity in the universe** ○ **Awareness of safety and biological issues, e.g. SARS, AIDS, damage from pollution etc** ○ **Care and concern for the environment**

C. Learning Indicators in EVS for Primary Stage (Classes III, IV, V) (Ref: NCERT Learning Indicators)

Pedagogical Processes	***Learning Indicators Class III***	***Learning Indicators Class IV***	***Learning Indicators Class V***
Observation and Reporting			
Providing opportunities to expose children to the immediate surroundings (*animals, plants, seasons, shelters, food, water, local transport) and gradually to natural and social environment in Class V gradually to natural and social environment.* □ Providing opportunities *with due consideration for children with visual difficulties* for ***Exploring** the immediate surroundings and sharing experiences with others.* ***Collecting and recording** the information.* *Visiting different places.* □ Opportunities need to be given to share experiences based on their observations. - **Equal opportunities** to all children without any	Observes and explores environmental objects/plants/ animals / local transports in the immediate surroundings. *E.g., "Identifies names of objects, local plants, animals, means of transport, and shelters, etc., in their own language."* □ Shares and reports her/his observations on the collected information/objects/visited place through various ways. E.g., "shares *brief details of* *plants (part), animals, food* *items eaten in the family, local* *games, local transport, nearby* *park, garden/field, post office,* *market in their own language* *orally"* Draws simple designs/ drawings and patterns that have been seen on different objects at home/school with the support of elders E.g., "draw floral designs, pattern of leaves/circle/square/triangles and color them." □ Appreciates and	Observes and explores environmental objects, plants, animals, shelters, etc. *E.g., "Identifies various parts of plants (leaves, flowers),* *variations in animals (bird's beak, claws, feather, and nests) mode of transports, and variation in seasons.* □ Collects and reports her/his observations on the collected materials/ information through various ways : *E.g., "reports information about variety of leaves, flowers, various modes of transport to peers/elders through **orally as well as written forms,** drawings".* □ Shares and reports variations in seasons, day night variations oral as well as in written form. Draws simple designs, drawings patterns that have been seen by her/him or on her/his own E.g.**, "***thumb or creative printing from various materials, rangolis using various patterns of her/his choice, and label them*	□ Observes and explores the natural and social environment, gradually moving from immediate to the wider environment. - *E.g., "identifies objects, events, phenomenon in natural and social environment.* - *locates states on the map".* □ Collects and records the details of observed objects/phenomenon/ events of natural and social environment **in an organized manner.** *E.g., "while observing the sprouting of seeds (whole grain i.e. moong, chana), discussing ways how to collect and record the observation of each day(tabular form/ draw) / write".* Shares the details of the observed objects/events/ phenomenon orally/ in a

discrimination. - Feedback and **scaffolding for** further improvement - Engaging children in small group for **peer-learning.** Providing opportunities for integrating art activities with EVS learning such as using material for art work and discussing in the Class about the details of the design/drawings. - Materials for hands-on activities need to be provided. - Encouraging children about their creations. □ Providing opportunities to reflect on the work done by self, peer group through verbal and non verbal ways.	reflects on her/his observations, work done by self and others. E.g., "Reading and enjoying signboards, pictures, posters in the locality, school *(shops name, posters name, posters related to prevention of disease, notice board, etc)* and reflects on them verbally or through gestures".	□ Appreciates and reflects on the work done by others and self E.g., *" reflecting on work i.e. drawings/ creative work done by self/peer group, enjoying reading posters, sign boards in the locality and reporting through orally/ written forms/ gestures".*	written form/ drawings /any other ways of her/his choice *E.g., " in an activity on survey of sources of water in the neighborhood, to share the process of survey conducted by them, such as how many sources were observed, who provided information,. How information was recorded, (tabular form/ statements),etc.* □ Reflects on the observation report of peer group and takes feedback from others. E.g., "reflects on sprouts of various seeds, done by peer and accepts feedback on that."

Discussion

Creating a environment conducive for group work where children are well aware of each other's strengths and utilize opportunities to discuss and share personal experiences. Providing equal	Involves in group discussions related to the problems seen in immediate surroundings. *E.g., "wastage of water, littering and throwing garbage, use of plastic bags, food wastage in the family, need for bridges, kind of houses, etc".* Listens to others experiences/ideas in	Engages and participates in discussions on the themes related to her/his day to day life. E.g., *discusses on common topics such as "spoilage /wastage of food, causes of noise and water pollution need for bridges and level crossing, how to resolve disputes in games".* □ Listens to others on	Participates actively in group discussions in the class on the issues related to natural and social environment. *E.g., "on a topic defined role in the family and school" asking them (before giving*

opportunities to *All* children to share personal experiences by devising various ways; Opportunities to listen to other's point of view. □ Providing opportunities to all children for expressing views and ideas in the class, without any discrimination. *E.g. creating opportunities for learning from each other's experiences.* □ Making comments that relate to the topic being discussed with their daily life situation. □ Engaging children in **open ended activities** to make the discussion enriching Opportunities to discuss family experiences, newspaper clippings, other incidents.	group discussion on the problems / themes related to immediate surroundings *E.g., "from where does their family get water?, who fills water for the family?, does the family members discriminate in the family community/ public places?"***.** □ Shares experiences verbally and accepts feedback given by peers on her/his work. *E.g., 'Water in Our Life', and narrating one's own experiences of where she/he has seen people wasting water such as while cleaning the house, cars, utensils, clothes, vehicles, and reflects on her/his views".* □ Reflects on others work/views in a group *E.g., "suggests how can the use of plastic bags be reduced, how to dispose garbage in the locality".*	the themes related to day to day life *such as peer experiences related to food items eaten in the family, ways of cooking in the family, source of water in the locality.* □ Shares experiences or gives her/his own views in group or individually and accept feedback given by others on her/his work. *E.g. , "sharing experiences related to places (mela, festival, historical place) verbally or in written form; giving her own views/ opinions on the problems related to water in her/his day – to- day life, harmful effects of using plastics".* □ Reflects on others work/ views/ opinion in a group or asked by teacher individually in the class *E.g., "giving feedback to peer on written work/ drawing, giving opinion on ways to reducing wastage of water, reducing use of plastic".*	*their personal experiences, listen to other's views on gender discrimination in work/ at home(cooking food, fetching water, cleaning house and utensils). Later asking groups to give their opinion and reflect on this issue".* □ Listens carefully to other's experiences/ opinions in the group and waits for her/his turn *E.g., "on a topic related to animals/ birds in our lives, providing them opportunities to talk to some people who keep animals for their livelihood i.e. snakes, parrot and asking them to express their opinion".* □ Shares one's experiences / opinions on the issues related to social and natural environment. □ Reflects on others experiences/ ideas and accepts feedback from others on one's ideas/ thoughts with

			openness in group activities/ discussion. E.g., "harms in using plastic and suggest ways what can be done". □ Finds out from other available sources such as discussions with elders/ Teachers/peer groups to get more details *on any topic related to day-to-day life*.

Expression

Providing opportunities for sharing one's own feelings (through various ways), ideas and listening to others in classroom situations; □ Providing materials such as clay, paper, other objects or any locally available material for their expressions. □ Creating situations to express opinions on issues such as defined gender roles (discrimination seen at home in work done by mother/ father) in	Expresses one's feelings / ideas orally. E.g. *in a creative* *writing exercise on – E.g., "If I* *could fly like a bird", she/he* *can describe her/his own ideas creatively where would I like to go? She/he describes how does she/he interact with family as well as others who cannot see, speak or hear? How does she/he help them with their work?* □ Uses appropriate language and gestures to show care respect and accepts people as they are. □ Expresses views/opinion on problems related to day-to-day life and misuse of environmental resources. *E.g.,*	Expresses one's feelings/ ideas through various ways orally/written /gestures E.g. *she could orally express feelings of how she could help elders, differently able-d. She/he could creatively express in written form, what work she/he could do if she/he were the police?* □ Use appropriate language, gestures to show care, respect for others. *E.g., "shows concern for animals, respects elders, old people in the family/ locality".* □ Expresses her feelings/ideas on any event/ situation / objects through creative expressions by using locally available material. □ Creates designs by using variety of material	Expresses ideas, feelings of self to others through gestures, body movements, drawings, sculpting (nonverbal expressions). □ Uses appropriate language, gestures to show care, respect for others. *E.g. "Shows concerns for animals, respects elders, old people in the family and locality".* □ Expresses/shares one's own Ideas/feelings or of others through writing in a creative manner. □ Creates designs

family, school, playground; on issues of discrimination of the under privileged. □ Using mobility aids like wheelchair, crutches, white cane etc. □ Involving all children as active participants in all activities and creative play.	*"Reduce wastage of food, water in school/family".* Creates designs by using variety of material by using fallen dry leaves, flowers, clay and pebbles, etc.	like fallen dry leaves, flowers, clay and pebbles. Recognizes that there can be more than one possible explanation of an event/activity. *E.g., "describes beauty of Taj Mahal, monuments, process of water purification followed at home".*	by using variety of materials such as fallen dry leaves, flowers, clay and pebble. □ Recognizes that there can be more than one possible explanation of an event / activity. *E.g., "describes beauty of Taj Mahal, monuments, process of water purification followed at home".*

Explanation

Providing opportunities and getting children involved in making guesses/estimates by asking simple questions, creating situations, showing pictures, etc. □ Providing opportunities to understand one's relationship with others; *E.g. relationship with close and distant relatives;* □ Encouraging children to think of different ways (divergent thinking of any explanation) of solving of any problem *E.g. different ways to go to the*	Makes her/his own guesses and gives her/his own reasoning on any event/situation in day-today life. *E.g., "how many hand-spans will cover the table/desk?"* *Where do animals (other than pets) drink water?"* *"How many mugs of water are required to fill a bucket?"* □ Explains the relationships of self with other members of the family and depicts through drawings and written language. *E.g. makes a family tree(depicting only two generations (father/grandfather)*	Makes one's own guesses and formulates her own reasoning's on any event/phenomenon seen in day-to- day life. *E.g., "how much water is required to cook the rice for four people? How much food will be required for two days journey by train for her/his family"?* □ Seeing relationships of self with others. *E.g., "she/he explains the relationships of family members with self and also relationships among themselves. She/he can depict this by drawing family tree".*(more than two generations) □ Using evidences/ information to make simple predictions with the support of elders/ on her/his own. *E.g.," using information*	Describes any event/ phenomenon/ situation in one's own way (verbally/ written/ non-verbal). *E.g., " tries to reason out why people living in jhuggies/slums are displaced from their homes?; why do we need to keep pickles in the sun during its process of making, etc".* Identifies the reasons of any problem/event/ phenomenon in natural and social environment. *E.g., "making logical connections why does food spoil more in summer than in winter*

Principal's room. Which do they think is the longest/shortestroute and explain how/why? Children with no vision should be allowed to use their mobility stick to walk different paths beforehand. This will encourage them to participate with other children in the activities		*about modes of transport she/he could predict fuel consumption in different vehicles".*	*season; how do we know that one kind of food gets spoiled sooner than the others?"*
Classifications			
Creating and utilizing classroom for group work; activity site by depicting various objects in the classroom to develop discrimination/ identification skills. □ Providing materials and objects for **grouping** to get hands-on experiences; *Sorting objects by providing material of various size, colour, texture in small group and giving activities to sort out/group objects, based on one criteria at a time*	Identifies objects, plants, animals, food items based on their observable features in the surroundings. □ Engages actively in sorting the objects by one/two observable features at a time. *E.g., "**sorting objects** on the basis of one/two visible features at a time- (size, colour, shape, texture, etc., classify leaves on the basis of their smell, colour, shapes, texture)".* □ Groups objects/animals/plants according to **similarities** *in relation to their appearance/ habitat/ food/ movement. E.g., "looking for similarities and differences in different ways of cooking – like*	Identifies objects, plants, animals and food items based on their observable features. □ Differentiates/ discriminates environmental objects like animals, plants, food *items based on their observable features.* □ Engages actively and sorts/ group objects, plants, animals based on two common features at a time. *E.g., "groups animal's pictures having beak and claws in one group and animals that do not have these features in the other category".* Compares objects, plants, animals, modes of transport, food items, shelters of animals based on their similarities and differences as per their observable features. *E.g.," compares various*	Identifies similarities or differences in various environmental objects, plants, animals, food items *based on their observable features*. □ Sequences / sorts objects by *their size, shapes, colors, texture, etc.* □ Classifies/makes categories of the objects, leaves, pictures of plants, animals, food items, etc. *based on two or more than two features at a time.* *E.g., "groups flowers, stones, twigs, sambhar, tea and then sorting these into solids and*

Gradually (in Classes IV/ V) providing opportunities to classify objects based on two or more than two criteria at a time	*frying, roasting, steaming;* *Sorting things that are made from rice and wheat.* Classifies objects/ animals/ plants according to **differences** in relation to their appearance / habitat / food/movement. *E.g., "Making a list of foods that one often eats such as dals, vegetables, rice, soup, water, roti,, biscuits, sambhar, tea, and then sorting these into solids and liquids".*	*modes of transport having common features i.e. having 4 wheels, driven by petrol, and observes differences in them such as size of wheels (small, big), sounds of vehicles."*	*liquids".* Compares objects, plants, animals, food items based on their similarities and differences as per their observable features minutely. *E.g., "list the different materials seen in the buildings nearby- sand, cement, steel, bricks, and aluminum and classifying these in various ways."*

Questioning

Providing opportunities for new ideas/ questions to emerge Framing questions for own queries and sharing with peers/elders. Constructing knowledge by using various resources other than the textbook i.e peer group interaction, group work, puzzles, variety of concrete material. Creating supportive climate where children have a freedom to	Expresses curiosity on any phenomenon/ event/celebration at home/in the immediate surroundings *E.g., "rainbow and cloud formation; customs followed in family."* a. Asks questions that demonstrate a range of thinking skills (what, why, where) *E.g. "Why do we not eat all the vegetables throughout the year?" "Why does my four-month old sister drinks milk only?"* b. Generates/frames questions on her/his own on familiar objects/ animals/ plants and events in the immediate surroundings. *E.g. "from*	Expresses curiosity on observations on the new objects/ event/ phenomenon (not only of immediate surroundings but also through other sources i.e. T.V, films, newspapers). Asks questions/ frames questions of higher order (not only of what, and where level but want to know why and how level) to know the answer. *E.g. "why do we preserve winter (some) vegetables for summers, why do we need to keep preserved food items in the sun? Why do only some areas in the locality /colony get regular water supply"* Expresses her	Expresses curiosity while observing new objects /situations /phenomenon in the natural and social environment. a. Asks and frames questions to find out more details. b. Asks questions independently or with classmates, to explore a topic further. *E.g., "while working cooperatively in a group plan their flower garden by posing questions (what flowers*

raise questions.	*where do plants get water?"* *Where do lizards go in winter? "What happens if there are heavy rains?" "How* *is rain good and bad for the environment?' What will happen if birds could not fly but only walk on their feet?* *"Why dals/seeds are soaked* *before cooking?; Why round,* *smooth pebbles are found near the river side?; How do* *grass and small plants grow* *on their own, without being* *planted by anyone?".* □ Reflects critically on various issues of social and cultural discrimination (related to working children, girls/women, elder person and differently abled people).	creativity through various ways *E.g". Asking questions, framing questions in class activities, creates new work, etc."* □ *R*eflects critically on various issues related to social/cultural aspects to child's life. *E.g.* *gender discrimination in the* *family, school, neighbourhood,* *visit to Ojha's, Bhagats for* *treatment* □ Accepts feedback given by peers/ elders on one's own work/ views and gives feedback to others objectively.	*grow best in the available soil and light conditions?, what materials will be needed to maintain the garden?) and gathering data to address these questions."* □ Raises critical questions on the displayed material *such* *As posters/ advertisements/ news items in school/ neighborhood.*
Analyzing			
Creating situations and encouraging children to predict	Describes situation or events in simple language Predicts and identifies probable reasons of any event /situation /phenomenon seen /observed *E.g., " predict that a ten spoonful of water would fill a* *bowl or identifies why do a wet surface would dry more quickly when*	Describes situations/ events/ phenomenon in her/his own language in a sequential manner as seen by her *E.g.* *,"changes* *seen in sprouting of seeds, changes seen in various seasons".* □ Summarizes information and opinion about a selected problem or issues E.g., "*What*	Reads and analyses pictures, photographs, textual material on her/his own/ with support of elders. *E.g. "after observing pictures of a fort/visit to a fort to analyses the reasons why kings built huge walls, big gates, huge*

	exposed to wind". makes simple inferences (reasoning); E.g." between the shapes and sizes of vessels and the water stored in them. *E.g. Taking vessels of different shapes and sizes and predicting and testing which one contains more/less water, etc.?*	*difficulties would we face if there would be no bridge to cross over?".* Predicts/ identifies probable reasons of any situation/event/phenomenon seen by her/him *E.g., "predicting/ identifying why a six month old child cannot eat, why some old people cannot eat hard things, why a river gets polluted?" a) Making a guess of how far she/he can roll a ball along the ground and then measuring how far it actually goes."* b) *Thinking of three different ways to go from the classroom to the principal's room. Which does she/he think is the longest /shortest route?"* Makes simple inferences on any event/ situation / phenomenon seen by her /him *E.g., "all things cannot dissolve in water, sugar/salt dissolves fast in warm water than in cold water, River's water gets polluted due to cleaning of utensils and clothes; bathing animals, throwing garbage in water or near water*".	*boundary walls, etc".* Predicts the reasons (cause and effect) about different scientific phenomenon seen by her. E.g., "*why dal/whole grains are soaked before cooking? Why smooth pebbles are found near the riverside?; why does the curd get more sour in summers than in winters?"* Draws simple inference of any observed event or phenomenon in the natural environment. E.g. "*discussing possible reasons and derives conclusion".*

Hands on activities:

Providing opportunities for	Develops sensitivity towards	Reflects sensitivity towards the needs of	Reflects sensitivity towards plants,

activities and sharing experiences in an unbiased classroom environment to show respect and acceptance of people as they are, such as *reading stories/ narratives that promote respect, care, empathy, gender sensitivity and problem-solving.* □ Creating unbiased classroom environment and giving equal opportunities to all; *E.g. a child could make a ramp for physically handicapped people in her/his drawing, write a poem for her/his classmate who cannot see but has many other skills.* □ *Developing themes and activities that is inclusive of culture, language and diversity. Using appropriate words and statements with peers and children when speaking, sharing and taking turns*	plants, animals, environment needs of differently-able-d children, and learns to express feelings in different ways. □ Expresses concern for equality and for justice for disadvantaged group of society, and gives her/his own opinion □ Avoids wastage of material and suggests ways for reuse of material in day-to-day life □ Shows no biases in behavior *E.g. "while sitting, eating, working, sharing with all irrespective of traditional and cultural biases".*	differently- able-d children, and learns to express feelings in different ways towards these children. □ Expresses concern for equality and for justice for disadvantaged group of society, and gives her own opinion □ Describes in detail how to show respect for the environment and avoids wastage of materials and suggests ways to reduce wastage through reuse of material. *E.g., "recycle"; "clean up school premises*". □ Shows no biases in behavior *E.g. "sitting, eating, working, and sharing with all irrespective of traditional and cultural biases".*	animals, old, young ones, differently able-d, etc. *E.g. "protection of forest, species of various animals, such as poaching of tiger*." □ Voices opinions and attempts to take initiatives for equality. □ Describes and documents the steps involved in supporting actions that positively affect the school environment. *E.g. " involved in school cleanup campaign"; "group projects"; "putting used paper in the recycle bins";"conserving materials"," not to throw leftover food in the grounds".* □ Shows concern in any situation on gender differences/biases with children in family and school *such as defined gender roles in the family, caste discrimination and children belonging to marginalized sections of the society, etc.*

			□ Shows sensitivity towards plants, animals, old, young ones, differently- able-d, etc

Cooperation

Creating situations for group work and whole class activities in the class by - Providing opportunities to act as group leaders, as a team member - Giving responsibilities □ Creating and utilizing classroom environment for group learning □ Providing opportunities to identify their own strengths and areas which need improvement with the support of peer group and elders. □ Create situations to learn things in a collective manner.	Engages in group work and shares things with peers. □ Accepts responsibility for age appropriate tasks *E.g., "turning off the lights when not in use; not wasting paper; throwing litter in the bin";organizing belongings;"* □ Expresses empathy for others. *E.g., "Extends help/support to friends when required."* □ Follows rules made for games or other collective tasks undertaken in the school/home. □ Works with others to solve problems. *E.g., children are asked to turn to the child next to them and work cooperatively in answering a question; solve a problem by working with others, share ideas, and test the solutions.* □ Shows some responsibility for his/her own health, and the health and well-being of others. *E.g. , "practices good personal hygiene and cleanliness;*	Engages and cooperates in group work calmly." *E.g.," collage work, Mural, etc.* □ Accepts responsibility to lead the group for certain expected tasks, undertaken in the classroom. E.g., "*making a to –do list,";* *"Staying on a given task".* □ Shows respect for other children and adults. *E.g., "taking turns ; letting others to finish an activity or asks to join them* □ Follow rules and understands the reasoning behind that. *E.g. "listening to others without interrupting."* □ Works with others and appreciates contributions of others in class activities. *E.g. "works in groups to design a flower garden for their school".*	Engages and cooperates in group work calmly; listens and works with other children. □ Accepts and takes responsibility in a more refined manner. *E.g., "learning from mistakes"; "encouraging others to do the things in a right way".* □ Recognises and accepts individual differences. *E.g. "Describing the problem without blaming".* □ Follows rules made by group members for better functioning of the group E.g. "using dustbin, making queue for the Mid Day Meal, follow instruction for not using *polythene, avoiding the fire crackers on festivals.* a. Exercises appropriate control in independent and

	discusses healthy habits, and practices self-control by abstaining from actions that harm one's self as well as others". □ Creating and utilizing school environment for group learning E.g., "takes *a pollution walk, gathering litter and trash".*		group activities. *E.g., "focuses on group or independent task to completion."* b. Addresses challenges using appropriate social and coping skills. *E.g., "doing things for other people;" changes activity when told 'NO' or presented with an alternative by teacher or peer.* □ Working through challenges in a small group. *E.g., "learns to negotiate and appreciate the difference of opinion / view point of other members".*

D. Curricular Expectations and Learning Indicators in Science at the Upper Primary Stage:

I. Curricular Expectations

Science syllabus at the upper primary stage identifies age appropriate content that is being utilized as a vehicle to develop scientific temper and scientific thinking by:

o Developing process skills of science: The process skills include making observation, posing questions, looking for various resources of learning in search of the questions, planning investigations, making and testing hypothesis, using various tools for collecting, analyzing and interpreting data, communicating explanations with evidences, justifying explanations, critically thinking to consider and evaluate alternative explanations, reflecting on their thinking by comparing what they think with what scientific community thinks, and engaging in sustained discussion.

o Making generalization, proving or disproving hypothesis, developing explanation,

communicating and applying.

o Imbibing the development of historical perspectives, environmental concerns and sensitivity. Developing respect for human dignity and rights, gender equity, values of honesty, integrity, cooperation and concern for life.

II. Pedagogical Processes

To fulfill these curricular expectations, the suggested pedagogical processes are given below:

• Observe surroundings, natural processes, phenomena through visuals, touch, smell, feel, etc, individually and in groups.

For example, flower, wooden furniture, metallic lunch-box, spoon, pencil, stones, mirror, magnet, eraser, coal, plants, animals, sea breeze, land breeze, storms, cyclones, lightening, and night sky.

• Share observations with others (peers /adults), discusses, poses questions that can be answered through scientific investigations, seeks information and formulates hypothesis.

• Facilitate children to prove the hypothesis by designing and performing activities, experiments, surveys, etc. For example:

- Separating different parts of flower such as sepals, petals, stamens and carpel, etc.

- Cutting with knife, beating of materials with hammer, to check the hardness of different materials

- Heating materials to check their conductivity

- Using electric tester to check electrical conductivity of materials

• Observe the changes/findings during the activity, experiments, surveys, etc. For example:

- Distinguishes between different parts of flower on the basis of colour, shape, size, number, etc

- Some materials are easily cut with knife

- Some materials change into flat sheets on beating

- Some materials break down into a powdery mass

- Some materials heat up quickly while some hardly heat up

- The bulb of tester glows in case of some materials and does not glow for others

• Analyses data, interpret s results and draws inferences.

For example:

- Differentiates between different parts of flowers by comparing with figures/ pictures

- Identifies materials on the basis of hardness, softness, appearance, transfer of heat,

flow of electric current

•Communicate explanation and argument with evidence

For example,

- Materials which are lustrous, hard, malleable, ductile, conduct heat and electric current are generally known as metals.

III. Learning Indicators

S. No	Learning Indicators	Examples		
		Class VI	**VII**	**VIII**
1	Explores surroundings and shares experiences with others	Explores Plants and animals as sources of food such as wheat, rice, egg, milk, fish, etc. Identifies food ingredients, such as *chapati* has two ingredients *Atta* and water; Cooked *Dal* has more than two ingredients, etc; and food components such as potato is rich source of carbohydrates while eggs and fish are rich in protein, and fat is a component of nuts. Various plant fibres such as cotton, jute, etc Materials on the basis of physical properties such as soft, hard, soluble, insoluble, appearance, transparency, etc Changes as reversible and irreversible such as melting of wax, making of *chapati*, burning of paper, etc. Types of	Explores Modes of nutrition in plants such as autotrophic in green plants, heterotrophic in non green plants and in animals Identifies various parts of digestive tract in human such as buccal cavity, oesophagus, stomach and intestine, etc. Process of digestion such as saliva breaks down starch into sugar in buccal cavity. Digestive juices break down the proteins into simpler substances Various animal fibres such as wool, silk, etc Changes as physical and chemical such as dissolving sugar in water, setting of curd from milk, etc. Nature of substances as acidic such as lemon, tamarind, and basic such as baking	Explores Various cropping patterns such as Rabi crops and Kharif crops Various practices of crop production, such as, soil preparation, irrigation, etc. and animal husbandry Roles of micro-organisms in our life Various synthetic fibres such as artificial silk, nylon, etc Physical and chemical properties of materials Result of application of force on an object such as change in its state of motion or shape Factors affecting friction such as nature of surfaces Pressure exerted by fluids such as water in a bottle, air in an inflated balloon

		movement such as motion of a vehicle on straight road, falling stone, hands of a clock, blades of an electric fan, swing □ Behaviour of magnets such as magnets attracting iron, attraction and repulsion between two magnets □ Shadow formation of objects of different shapes, sizes and colours □ Reflection from surfaces such as water of a pool, mirror □ Air and water as a natural resource with focus on components of air, water cycle, loss of water by plants and rain water harvesting □ Recycling of waste products, emphasis on recycling of paper and vermi-composting	soda, soap, etc □ Flow of heat such as a metal spoon becomes hot when kept in hot tea □ Heating effect of electric current such as electric heater or iron becoming hot after switching on electric current. □ Magnetic effects of electric current such as electromagnetic crane, electric bell □ Reflection of light from mirrors such as plane mirrors, convex mirrors, concave mirrors □ Issues related to Water Management such as treatment of polluted water, arrangement for sewage disposal, sanitation at public places □ Forest as a resource, deforestation, soil erosion, various products obtained from forest, forest as a life line for the forest dwelling communities	□ Sources of sound such as stretched strings, membranes, air columns Chemical effects of current such as electroplating □ Formation of multiple images by mirrors □ Ways by which air and water gets polluted, green house effect, ways of purification of water
2	**Asks questions leading to investigations**	Is chicken curry/honey an animal product? □ Are carbohydrates present in plants only? Why do living things	Why does pitcher plant feed on insects? □ How do animals utilise their food? Do some of our clothes	Why is weeding necessary in agricultural farm? □ Why is wheat not cultivated during

		need food? □ What are our clothes made of? □ Why are we advised to wear cotton clothes in summer? □ How do plants/animals get their food? □ How does a torch work? □ How is magnet used to find directions? □ What will happen if it does not rain or rains heavily? □ Can fruit and vegetable peels be reused?	come from animal sources? □ What kind of clothes helps us to keep warm? □ Why does turmeric stain become red on applying soap? □ What gets deposited on a *tawa /khurpi* if left in a moist state? □ How do we know how fast something is moving? □ How does a fuse work? □ Where and how do you get water for your domestic needs? □ What are the products we get from forests?	summer? How do vegetables and food items get spoiled? □ What helps make curd? □ Do we use cloth (fabric) for purposes other than making garments to wear? □ Why does a burning candle get shorter? □ What happens when we push or pull anything? □ Why needles are made pointed? □ How is sound produced? □ Why are ringing bells not made of wood? □ What are various activities which make air and water impure?
3	**Performs activities** Collects information from various learning resources in order to get answers to their questions □ Makes hypothesis and plans activities to test the hypothesis □ Suggests different ways of doing activities	Finds and lists out various food items, their ingredients and sources such as ingredients of idly are rice, *urad dal* and water □ Performs test for starch, protein and fats in various food items □ Identifies materials by doing various activities such as dissolving materials into water, by compressing or	Collects information about plant nutrition from various resources such as newspaper, internet, etc. □ Performs iodine test to confirm the presence of starch stored during the process of photosynthesis in leaves of different colors □ Collects information on structure of digestive tract via books, posters, news, paper and internet, etc.	Investigates/studies the effect of green manure and fertilizer on plant growth. □ Uses ice cream cups instead of earthen pots to germinate seeds □ Uses spatula while handling fertilizer □ Uses only a little dose of urea at a time □ Investigates physical and chemical properties of materials by performing various

	□ Selects appropriate materials/tools /instruments Collects and assembles materials appropriately for performing activities □ Improvises materials/tools/ instruments as per the need □ Follows relevant precautions such as handling objects/ chemicals/ equipments carefully □ Repeats activities to reproduce results	scratching materials, by immersing material into water, by looking through materials, by using the available resources □ Measures lengths using hand span, strings, metre scale, etc □ Lights up an electric bulb using electric cell and wires □ Using conduction tester, identifies materials as good and bad conductors of electric current □ Locates poles of a magnet using iron filings	□ Nature of materials in surrounding by testing with different indicators such as litmus paper, flower indicators. □ Studies transfer of heat by conduction, convection and radiation by heating metal strip, heating water and keeping a hand on top of candle flame □ Measures time period of a pendulum and speed of a ball □ Investigates heating effect of electric current by using some metal wires and battery □ Forms images of objects using plane, convex and concave mirrors	activities such as beating the material with hammer, burning of metals and non-metals in air reactions of metals and non-metals with water, acids, bases and salts. □ Investigates effect of force on speed and direction of moving object □ Performs various activities to study pressure exerted by water on the bottom and walls of the container □ Tries out different ways of reducing and increasing friction □ Performs activities to establish that a medium is needed for propagation of sound □ Makes a conduction tester and uses it to test electrical conductivity of liquids
4	**Records, reports and analyses the findings** □ Records findings in different ways, such as table, graph, figure, etc □ Organizes	Records observations of various food items for the presence or absence of carbohydrates, protein and fats □ Draws figures of the collected materials and records their properties in a tabular form.	Records observations of iodine test with different coloured leaves and variegated leaves for the presence or absence of starch in the tabular form. □ Prepares cards/ charts using natural indicators. □ Records the observations	Records names of various tools and their uses in agricultural practices in the tabular form such as plough for tilling and loosening the soil, leveller to level the soil, etc.

	scientific findings using appropriate tables, charts, graphs, diagrams and symbols □ Identifies relationships in the findings □ Applies appropriate mathematical skills to interpret quantitative data	□ Draws diagrams of various parts of flower. □ Relates the observations with the physical properties of materials and differentiates materials as soluble, insoluble, hard, transparent, translucent, conductor, insulator, etc. □ Counts floral parts □ Identifies different parts of flowers on the basis of position and structure	regarding nature of substances in a tabular form □ Makes distance-time graphs □ Draws diagram of a simple electric circuit using symbols Identifies the nature of materials as acidic, basic and neutral by observing different colours with indicators □ Calculates the time period of simple pendulum □ Calculates speed of an object	□ Records effect of green manure and urea on plant growth by recording length, number of leaves, etc everyday in seven days □ Records observations related to the physical and chemical properties of materials (metals and non-metals) in a tabular form □ Differentiates between metals and non-metals by observing their physical and chemical properties □ Records the action of force on the state of motion and shape of objects □ Measures the angle of incidence and angle of reflection of light □ Classifies the materials into metals and non-metals on the basis of physical and chemical properties □ Infers that liquids exert equal pressure at the same depth □ Draws conclusion that friction depends on the nature of surfaces in contact □ Infers that sound

				is produced by vibrating objects □ Concludes that most liquids that conduct electricity are solutions of acids, bases and salts.
5	**Discussion**			
	• Presents logical explanations and arguments • Communicates conclusions clearly • Provides justification in support of evidences	Concludes that most of the flowers have four parts □ Concludes that rice has carbohydrates in it but ground nut has fat in it □ Concludes that hard and lustrous materials are usually metals □ Concludes that light travels in a straight line	Concludes that starch is synthesised only in the green part of variegated leaves □ Communicates that starch is synthesised in different coloured leaves too □ Infers that material which turns blue litmus red are acidic in nature whereas a material which turns red litmus blue are basic in nature □ Concludes that warm air rises up □ Concludes that when electric current passes through a wire, it behaves like a magnet □ Concludes that white light consists of seven colours	Concludes that urea and green manure enhances growth of plants □ Concludes that force may change the state of motion of an object or its shape or both Concludes that metals are usually lustrous, sonorous, malleable, and ductile □ Generalises that metal oxides are basic in nature whereas nonmetals are acidic
	• Connects scientific concepts to everyday life	Explains that cooking utensils are made up of metals as they are good conductor of heat	□ Explains that copper vessels are not used to keep acidic materials □ Explains that convex mirror is used as a side view mirror in vehicles	□ Explains that metals are used for making aeroplanes, boilers, automobiles, etc. whereas nonmetals are used in fertilisers and in water purification, etc. □ Explains that soles of shoes are grooved for better grip

	□ Makes efforts to acquire further knowledge	□ Visits a blacksmith, observes and reports how metals are moulded	□ Visits an electric shop to see various types of fuses and MCB and learns how these work	□ Visits a commercial electroplating unit to see the process of electroplating □ Finds out the locations of the deposits of iron, aluminum and zinc in India. Discusses in which form the deposits are found
	Displays a sense of interest in science by preparing charts, working models, etc. □ Participates enthusiastically in role plays, field trips, science exhibitions, etc.	□ Prepares models of pinhole camera, periscope, etc	□ Prepares models of sun- dial, sand clock, electromagnetic crane, etc	Prepares models of kaleidoscope, solar system, toy telephone, etc □ Prepares models of fire extinguisher
	□ Responds critically to media coverage of issues □ Shows innovation and creativity □ Shows some problem solving skills □ Engages in sustained discussion on scientific issues	□ Initiates and participates in discussion/ role play/ poster presentation on conservation of water □ Conducts surveys on waste management. □ Discusses issues such as, noise pollution, gender issues □ Suggests methods of rain water harvesting □ Suggests ways of recycling of paper	□ Helps the gardener to find out the nature of the soil and its treatment if required □ Discusses judicious use of water □ Debates on the effects of cutting down of trees □ Discusses the benefits of planting trees and preservation of forests. □ Discusses the eco-friendly toilets such as vermi-processing toilet	Discusses and debates on □ recycling of paper □ different methods of purification of water □ hazards of electroplating, noise pollution, disaster management □ methods of purification of water □ fuel efficiency □ harmful effects of agrochemicals in agriculture □ precautions to be taken while using LPG □ use of fire

				extinguishers □ steps to be taken for conservation of energy □ switching off the engine at traffic lights or at a place where one has to wait
6	**Demonstrates values imbibed** □ Uses resources/ □ materials without wasting □ Records and reports their findings in an honest way □ Takes responsibility and initiative while performing task □ Works cooperatively with Peers □ Listens patiently to arguments of others □ Advises the ways for conservation of environment so that changes in environmental conditions do not affect the survival of different species	□ Discusses with peers not to waste food □ Switches off electrical appliances when not in use, avoids wasting water, chemicals, etc □ Attempts to recycle used items □ Segregates biodegradable and non-biodegradable wastes □ Does not burn waste to avoid air pollution	□ Discusses with peers not to pluck flowers, leaves, etc □ Uses waste judiciously. □ Plants trees □ Protects trees □ Treats animals with kindness	□ Adopts correct practices to save electricity □ Avoids creating noise pollution □ Walks or uses bicycle for commuting short distances □ Washes fruits and vegetables properly before use

E. NCF direction about Science Education in various stages:

At the primary stage, the child should be engaged in joyfully exploring the world around and harmonizing with it. The objectives at this stage are to nurture the curiosity of the child about the world (natural environment, artifacts and people), to have the child engage in exploratory and hands-on activities for acquiring the basic cognitive and psychomotor skills through observation, classification, inference, etc.; to emphasize design and fabrication, estimation and measurement as a prelude to the development of technological and quantitative skills at later stages; and to develop basic language skills: speaking, reading and writing not only for science but also through science. Science and social science should be integrated as 'environmental studies' as at present, with health as an important component. Throughout the primary stage, there should be no formal periodic tests, no awarding of grades or marks, and no detention.

At the upper primary stage, the child should be engaged in learning the principles of science through familiar experiences, working with hands to design simple technological units and modules (e.g. designing and making a working model of a windmill to lift weights) and continuing to learn more about the environment and health, including reproductive and sexual health, through activities and surveys. Scientific concepts are to be arrived at mainly from activities and experiments. Science content at this stage is not to be regarded as a diluted version of secondary school science. Group activities, discussions with peers and teachers, surveys, organization of data and their display through exhibitions, etc. in schools and the neighborhood should be important components of pedagogy. There should be continuous as well as periodic assessment (unit tests, term-end tests). The system of 'direct' grades should be adopted. There should be no detention. Every child who attends eight years of school should be eligible to enter Class IX.

At the secondary stage, students should be engaged in learning science as a composite discipline, in working with hands and tools to design more advanced technological modules than at the upper primary stage, and in activities and analyses on issues concerning the environment and health, including reproductive and sexual health. Systematic experimentation as a tool to discover/verify theoretical principles, and working on locally significant projects involving science and technology, are to be important parts of the curriculum at this stage.

F. Curriculum Content

Grade I

Scientific enquiry

Ideas and evidence

→ Try to answer questions by collecting evidence through observation.

Plan investigative work

→ Ask questions and contribute to discussions about how to seek answers.

→ Make predictions

→ Decide what to do to try to answer a science question.

Obtain and present evidence

→ Explore and observe in order to collect evidence (measurements and observations) to answer questions.

→ Suggest ideas and follow instructions.

→ Record stages in work.

Consider evidence and approach

→ Make comparisons

→ Compare what happened with predictions.

→ Model and communicate ideas in order to share, explain and develop them.

Strand: Biology

Sub Strand: Plants

- Know that plants are living things.
- Know that there are living things and things that have never been alive.
- Explore ways that different animals and plants inhabit local environments
- Name the major parts of a plant, looking at real plants and models.
- Know that plants need light and water to grow.
- Explore how seeds grow into flowering plants.

Sub Strand: Humans and animals

- Recognize the similarities and differences between each other.

- Recognize and name the main external parts of the body.
- Know about the need for a healthy diet, including the right types of food and water.
- Explore how senses enable humans and animals to be aware of the world around them.
- Know that humans and animals produce offspring which grow into adults.

Strand: Chemistry

Sub Strand: Material properties

- Use senses to explore and talk about different materials.
- Identify the characteristics of different materials.
- Recognize and name common materials
- Sort objects into groups based on the properties of their materials.

Strand: Physics

Sub Strand: Forces

- Explore, talk about and describe the movement of familiar things.
- Recognize that both pushes and pulls are forces.
- Recognize that when things speed up, slow down or change direction there is a cause.

Sub Strand: Sound

- Identify many sources of sound.
- Know that we hear when sound enters our ear.
- Recognize that as sound travels from a source it becomes fainter

Grade II

Scientific enquiry

Ideas and evidence

Try to answer questions by collecting evidence through observation.

Plan investigative work

Ask questions and contribute to discussions about how to seek answers.

make predictions.

Decide what to do to try to answer a science question.

Obtain and present evidence

Explore and observe in order to collect evidence (measurements and observations) to answer questions.

Suggest ideas and follow instructions.

Record stages in work.

Consider evidence and approach

make comparisons.

Compare what happened with predictions.

Model and communicate ideas in order to share, explain and develop them.

Strand: Biology

Sub Strand: Plants

Know that plants are living things.

Know that there are living things and things that have never been alive.

Explore ways that different animals and plants inhabit local environments

Name the major parts of a plant, looking at real plants and models.

Know that plants need light and water to grow.

Explore how seeds grow into flowering plants.

Sub Strand Humans and animals

Recognize the similarities and differences between each other.

Recognize and name the main external parts of the body.

Know about the need for a healthy diet, including the right types of food and water.

Explore how senses enable humans and animals to be aware of the world around them.

Know that humans and animals produce offspring which grow into adults.

Strand: Chemistry

Sub Strand: Material properties

Use senses to explore and talk about different materials.

Identify the characteristics of different materials.

Recognize and name common materials

Sort objects into groups based on the properties of their materials.

Strand: Physics

Sub Strand: Forces

Explore, talk about and describe the movement of familiar things.

Recognize that both pushes and pulls are forces.

recognize that when things speed up, slow down or change direction there is a cause

Sub Strand: Sound

Identify many sources of sound.

Know that we hear when sound enters our ear.

Recognize that as sound travels from a source it becomes fainter

Grade III

Scientific enquiry

Ideas and evidence

Collect evidence in a variety of contexts to answer questions or test ideas

Plan investigative work

Suggest ideas make predictions and communicate these

With help, think about collecting evidence and planning fair tests.

Obtain and present evidence

Observe and compare objects, living things and events.

Measure using simple equipment and record observations in a variety of ways

Present results in drawings, bar charts and tables.

Consider evidence and approach

Draw conclusions from results and begin to use scientific knowledge to suggest explanations.

Make generalizations and begin to identify simple patterns in results.

Strand: Biology

Sub Strand: Plants

Know that plants have roots, leaves, stems and flowers.

Explain observations that plants need water and light to grow

Know that water is taken in through the roots and transported through the stem.

Know that plants need healthy roots, leaves and stems to grow well.

Know that plant growth is affected by temperature.

Sub Strand: Humans and animals

Know life processes common to humans and animals include nutrition (water and food), movement, growth and reproduction

Describe differences between living and non-living things using knowledge of life processes.

Explore and research exercise and the adequate, varied diet needed to keep healthy.

Know that some foods can be damaging to health, e.g. very sweet and fatty foods.

Explore human senses and the ways we use them to learn about our world.

Sort living things into groups, using simple features and describe rationale for groupings.

Strand: Chemistry

Material properties

Know that every material has specific properties, e.g. hard, soft, shiny.

Sort materials according to their properties

Explore how some materials are magnetic but many are not.

Discuss why materials are chosen for specific purposes on the basis of their properties.

Sub Strand: Physics

Forces and motion

Know that pushes and pulls are examples of forces and that they can be measured with force meters.

Explore how forces can make objects start or stop moving.

Explore how forces can change the shape of objects.

Explore how forces, including friction, can make objects move faster or slower or change direction.

Grade IV

Scientific enquiry

Ideas and evidence

Collect evidence in a variety of contexts

Test an idea or prediction based on scientific knowledge and understanding.

Plan investigative work

Suggest questions that can be tested and make predictions; communicate these.

Design a fair test and plan how to collect sufficient evidence.

Choose apparatus and decide what to measure.

Obtain and present evidence

Make relevant observations and comparisons in a variety of contexts.

Measure temperature, time, force and length

Begin to think about the need for repeated measurements of, for example, length.

Present results in drawings, bar charts and tables.

Consider evidence and approach

Identify simple trends and patterns in results and suggest explanations for some of these.

Explain what the evidence shows and whether it supports predictions. Communicate this clearly to others.

Link evidence to scientific knowledge and understanding in some contexts

Strand: Biology

Sub Strand: Humans and animals

Know that humans (and some animals) have bony skeletons inside their bodies.

Know how skeletons grow as humans grow, support and protect the body.

Know that animals with skeletons have muscles attached to the bones.

Know how a muscle has to contract (shorten) to make a bone move and muscles act in pairs.

Explain the role of drugs as medicines.

Living things in their environment

investigate how different animals are found in different habitats and are suited to the environment in which they are found.

Use simple identification keys.

Recognize ways that human activity affects the environment e.g. river pollution, recycling waste

Strand: Chemistry

Sub Strand: States of matter

Know that matter can be solid, liquid or gas.

Investigate how materials change when they are heated and cooled.

Know that melting is when a solid turns into a liquid and is the reverse of freezing.

Observe how water turns into steam when it is heated but on cooling the steam turns back into water.

Strand: Physics

Sub Strand: Sound

Explore how sounds are made when objects, materials or air vibrate and learn to measure the volume of sound in decibels with a sound level meter.

Investigate how sound travels through different materials to the ear.

Investigate how some materials are effective in preventing sound from travelling through them.

Investigate the way pitch describes how high or low a sound is and that high and low sounds can be loud or soft. Secondary sources can be used.

Explore how pitch can be changed in musical instruments in a range of ways

Electricity and magnetism

Construct complete circuits using switch, cell (battery), wire and lamps.

Explore how an electrical device will not work if there is a break in the circuit.

Know that electrical current flows and that models can describe this flow, e.g. particles travelling around a circuit.

explore the forces between magnets and know that magnets can attract or repel each other.

Know that magnets attract some metals but not others.

Grade V

Scientific enquiry

Ideas and evidence

Know that scientists have combined evidence with creative thinking to suggest new ideas and explanations for phenomena.

Use observation and measurement to test predictions and make links

Plan investigative work

Make predictions of what will happen based on scientific knowledge and understanding, and suggest and communicate how to test these.

Use knowledge and understanding to plan how to carry out a fair test

Collect sufficient evidence to test an idea.

Identify factors that need to be taken into account in different contexts.

Obtain and present evidence

Make relevant observations.

Measure volume, temperature, time, length and force

Discuss the need for repeated observations and measurements.

Present results in bar charts and line graphs.

Consider evidence and approach

Decide whether results support predictions.

Begin to evaluate repeated results.

Recognize and make predictions from patterns in data and suggest explanations using scientific knowledge and understanding.

Interpret data and think about whether it is sufficient to draw conclusions.

Strand: Biology

Sub Strand: Plants

Know that plants need energy from light for growth.

Know that plants reproduce.

Observe how seeds can be dispersed in a variety of ways.

investigate how seeds need water and warmth for germination, but not light.

Know that insects pollinate some flowers.

Observe that plants produce flowers which have male and female organs; seeds are formed when pollen from the male organ fertilizes the ovum (female).

Recognize that flowering plants have a life cycle including pollination, fertilization, seed production, seed dispersal and germination.

Strand: Chemistry

Sub Strand: States of matter

Know that evaporation occurs when a liquid turns into a gas.

Know that condensation occurs when a gas turns into a liquid and that it is the reverse of evaporation.

Know that air contains water vapor and when this meets a cold surface it may condense.

Know that the boiling point of water is 100°C and the melting point of ice is 0°C.

Know that when a liquid evaporates from a solution the solid is left behind.

Strand: Physics

Sub Strand: Light

Observe that shadows are formed when light travelling from a source is blocked.

Investigate how the size of a shadow is affected by the position of the object.

Observe that shadows change in length and position throughout the day.

Know that light intensity can be measured.

Explore how opaque materials do not let light through and transparent materials let a lot of light through.

Know that we see light sources because light from the source enters our eyes.

Know that beams/rays of light can be reflected by surfaces including mirrors, and when reflected light enters our eyes we see the object.

explore why a beam of light changes direction when it is reflected from a surface.

Sub Strand: The Earth and beyond

Explore, through modeling, that the sun does not move; its apparent movement is caused by the Earth spinning on its axis

Know that the Earth spins on its axis once in every 24 hours.

Know that the Earth takes a year to orbit the sun, spinning as it goes.

Research the lives and discoveries of scientists who explored the solar system and stars.

Grade VI

Scientific enquiry

Ideas and evidence

Consider how scientists have combined evidence from observation and measurement with creative thinking to suggest new ideas and explanations for phenomena.

Collect evidence and data to test ideas including predictions

Plan investigative work

Discuss how to turn ideas into a form that can be tested.

Make predictions using scientific knowledge and understanding

Choose what evidence to collect to investigate a question, ensuring that the evidence is sufficient.

Identify factors which are relevant to a particular situation

Choose which equipment to use.

Obtain and present evidence

Make a variety of relevant observations and measurements using simple apparatus correctly.

Decide when observations and measurements need to be checked by repeating to give more reliable data

Use tables, bar charts and line graphs to present results

Consider evidence and approach

make comparisons.

Evaluate repeated results.

Identify patterns in results and results that do not appear to fit the pattern.

Use results to draw conclusions and to make further predictions.

Suggest and evaluate explanations for predictions using scientific knowledge and understanding and communicate these clearly to others.

Say if and how evidence supports any prediction made.

Strand: Biology

Sub Strand: Humans and animals

Use scientific names for some major organs of body systems.

Identify the position of major organs in the body.

Describe the main functions of the major organs of the body.

Explain how the functions of the major organs are essential.

Sub Strand: Living things in their environment

Explore how humans have positive and negative effects on the environment, e.g. loss of species, protection of habitats.

Explore a number of ways of caring for the environment, e.g. recycling, reducing waste, reducing energy consumption, not littering, encouraging others to care for the environment.

Know how food chains can be used to represent feeding relationships in a habitat and present these in text and diagrams.

Know that food chains begin with a plant (the producer), which uses energy from the sun.

Understand the terms producer, consumer, predator and prey.

Explore and construct food chains in a particular habitat.

Strand: Chemistry

Sub Strand: Material changes

Distinguish between reversible and irreversible changes.

Explore how solids can be mixed and how it is often possible to separate them again.

Observe, describe record and begin to explain changes that occur when some solids are added to water.

Explore how, when solids do not dissolve or react with water, they can be separated by filtering, which is similar to sieving.

Explore how some solids dissolve in water to form solutions and, although the solid cannot be seen, the substance is still present.

Strand: Physics

Forces and motion

Distinguish between mass measured in kilograms(kg) and weight measured in Newton, noting that kilograms are used in everyday life.

Recognize and use units of force mass and weight and identify the direction in which forces act.

Understand the notion of energy in movement.

Recognize friction (including air resistance) as a force which can affect the speed at which objects move and which sometimes stops things moving.

Electricity and magnetism

Investigate how some materials are better conductors of electricity than others.

Investigate how some metals are good conductors of electricity while most other materials are not.

Know why metals are used for cables and wires and why plastics are used to cover wires and as covers for plugs and switches

Predict and test the effects of making changes to circuits, including length or thickness of wire and the number and type of components.

Represent series circuits with drawings and conventional symbols

Grade VII

Topics/Questions	Key Concepts	Resources	Activities/Processes
1. Food			
Food from where How do plants get their food?	Autotrophic and heterotrophic nutrition; parasites, saprophytes; photosynthesis.	Coleus or any other plant with variegated leaves, alcohol, iodine solution, kit materials.	Need for light, green leaf for photosynthesis, looking at any saprophyte/parasite and noting differences from a green plant.
Utilization of food How do plants and animals utilize their food?	Types of nutrition, nutrition in amoeba and human beings, Digestive system – human, ruminants; types of teeth; link with transport and respiration.	Model of human teeth, charts of alimentary canal, types of nutrition etc., chart and model of amoeba. The story of the stomach with a hole.	Effect of saliva on starch, permanent slide of *Amoeba*. Role play with children.
2. Materials			
Materials of daily use Do some of our clothes come from animal sources? Which are these animals? Who rears them? Which parts of the animals yield the yarn? How is the yarn extracted?	Wool, silk – animal fibers. Process of extraction of silk; associated health problems.	Samples of wool and silk; brief account of silkworm rearing and sheep breeding.	Collection of different samples of woolen and silk cloth. Activities to differentiate natural silk and wool from artificial fibers. Discussion.
What kinds of clothes help us to keep warm? What is heat? What is the meaning of 'cool'/'cold' and 'warm' 'hot'?	Heat flow; temperature.	Potassium permanganate, metal strip or rod, wax, common pins, spirit lamp, matches, tumblers, Thermometer etc.	Experiment to show that 'hot' and 'cold' are relative. Experiments to show conduction, convection and radiation.

How does heat flow from/to our body to/ from the surroundings?			Reading a thermometer.
Different kinds of materials Why does turmeric stain become red on applying soap?	Classification of substances into acidic, basic and neutral; indicators.	Common substances like sugar, salt, vinegar etc, test tubes, plastic vials, droppers, etc.	Testing solutions of common substances like sugar, salt, vinegar, lime juice etc. with turmeric, litmus, china rose. Activity to show neutralisation.
How things change/ react with one another What gets deposited on a *tawa/khurpi /kudal* if left in a moist state? Why does the exposed surface of a cut brinjal become black?	Chemical substances; in a chemical reaction a new substance is formed.	Test tubes, droppers, common pins, vinegar, baking powder, CuSO4, etc.	Experiments involving chemical reactions like rusting of iron, neutralisation (vinegar and baking soda), displacement of Cu from CuSO4 etc. *Introduce chemical formulae without explaining them.*
Why is seawater salty? Is it possible to separate salt from seawater?	Substances can be separated by crystallisation.	Urea, copper sulphate, alum etc, beaker, spirit lamp, watch glass, plate, petridish etc.	Making crystals of easily available substances like urea, alum, copper sulphate etc. using supersaturated solutions and evaporation.
3. The World of the Living			
Surroundings affect the living Why are nights cooler? How does having winters and summers affect soil? Are all soils similar? Can we make a pot with sand? Is soil similar when you dig into the	Climate, soil types, soil profile, absorption of water in soil, suitability for crops, adaptation of animals to different climates.	Data on earth, sun – size, distance etc, daily changes in temperature, humidity from the newspaper, sunrise, sunset etc.	Graph for daily changes in temperature, day length, humidity etc.; texture of various soils by wetting and rolling; absorption/ percolation of water in different soils, which soil can hold more water.

ground? What happens to water when it falls on the cemented/ bare ground?			
The breath of life Why do we/animals breathe? Do plants also breathe? Do they also respire? How do plants/ animals live in water?	Respiration in plants and animals.	Lime water, germinating seeds, kit materials.	Experiment to show plants and animals respire; rate of breathing; what do we breathe out? What do plants 'breathe' out? Respiration in seeds; heat release due to respiration. Anaerobic respiration, root respiration.
Movement of substances How does water move in plants? How is food transported in plants? Why do animals drink water? Why do we sweat? Why and how is there blood in all parts of body? Why is blood red? Do all animals have blood? What is there in urine?	Herbs, shrubs, trees; Transport of food and water in plants; circulatory and excretion system in animals; sweating.	Twig, stain; improvised stethoscope; plastic bags, plants, egg, sugar, salt, starch, Benedicts solution, AgNO3 solution.	Translocation of water in stems, demonstration of transpiration, measurement of pulse rate, heartbeat; after exercise etc. Discussion on dialysis, importance; experiment on dialysis using egg membrane.
Multiplication in plants Why are some plant parts like potato, onion swollen– are they of any use tothe plants? What is the function of flowers? How are fruits and seeds formed? How are they dispersed?	Vegetative, asexual and sexual reproduction in plants, pollination - cross, self pollination; pollinators, fertilization, fruit, seed.	*Bryophyllum* leaves, potato, onion etc.; yeast powder, sugar.	Study of tuber, corm, bulb etc; budding in yeast; T.S./ L.S. ovaries, w.m.pollen grains; comparison of wind pollinated and insect pollinated flowers; observing fruit and seed development in some plants; collection and discussion of

			fruits/seeds dispersed by different means.
4. Moving Things, People and Ideas *Moving objects:* Why do people feel the need to measure time? How do we know how fast something is moving?	Appreciation of idea of time and need to measure it. Measurement of time using periodic events. Idea of speed of moving objects – slow and fast motion along a straight line.	Daily-life experience; meter scale, wrist watch/ stop watch, string etc.	Observing and analyzing motion (slow or fast) of common objects on land, in air, water and space. Measuring the distance covered by objects moving on a road in a given time and calculating their speeds. Plotting distance vs. time graphs for uniform motion. Measuring the time taken by moving objects to cover a given distance and calculating their speeds. Constancy of time period of a pendulum.
5. How Things Work *Electric current and circuits* How can we conveniently represent an electric circuit?	Electric circuit symbols for different elements of circuit.	Recollection of earlier activities. Pencil and paper.	Drawing circuit diagrams.
Why does a bulb get hot?	Heating effect of current.	Cells, wire, bulb.	Activities to show the heating effect of electric current.
How does a fuse work?	Principle of fuse.	Cells, wire, bulb or LED, aluminum foil.	Making a fuse.
How does the current in a wire affect the direction of a compass needle?	A current-carrying wire has an effect on a magnet.	Wire, compass, battery.	Activity to show that a current-carrying wire has an effect on a magnet.
What is an	A current-carrying	Coil, battery, iron nail	Making a simple

electromagnet?	coil behaves like a magnet.	and Electric bell.	electromagnet. Identifying situations in daily life where electromagnets are used.
How does an electric bell work?	Working of an electric bell.	Experience; newspaper reports.	Demonstration of working of an electric bell.
6. Natural Phenomena			
Rain, thunder and lightning What causes storms? What are the effects of storms? Why are roofs blown off?	High-speed winds and heavy rainfall have disastrous consequences for human and other life.	Narratives/stories.	Making wind speed and wind direction indicators. Activity to show "lift" due to moving air. Discussion on effects of storms and possible safety measures.
Light Can we see a source of light through a bent tube?	Rectilinear propagation of light	Rubber/plastic tube/ straw, any source of light	Observation of the source of light through a straight tube, a bent tube.
How can we throw sunlight on a wall?	Reflection, certain surfaces reflect light.	Glass/metal sheet/metal foil, white paper.	Observing reflection of light on wall or white paper screen.
What things give images that are magnified or diminished in size?	Real and virtual images.	Convex/concave lenses and mirrors.	Open ended activities allowing children to explore images made by different objects, and recording observations. Focused discussions on real and virtual images.
How can we make a colored disc appear white?	White light is composed of many colors.	Newton's disc.	Making the disc and rotating it.
7. Natural Resources			
Scarcity of water Where and how do you get water for your	Water exists in various forms in nature. Scarcity of	Experience; media reports; case material	Discussions. Case study of people living in conditions of

domestic needs? Is it enough? Is there enough water for agricultural needs? What happens to plants when there is not enough water for plants? Where does a plant go when it dies?	water and its effect on life.		extreme scarcity of water, how they use water in a judicious way. Projects exploring various kinds of water resources that exist in nature in different regions in India; variations of water availability in different regions.
Forest products What are the products we get from forests? Do other animals also benefit from forests? What will happen if forests disappear?	Interdependence of plants and animals in forests. Forests contribute to purification of air and water.	Case material on forests.	Case study of forests.
Waste Management Where does dirty water from your house go? Have you seen a drain? Does the water stand in it sometimes? Does this have any harmful effect?	Sewage; need for drainage/sewer systems that are closed.	Observation and experience; photographs	Survey of the neighborhood, identifying locations with open drains, stagnant water, and possible contamination of ground water by sewage. Tracing the route of sewage in your building, and trying to understand whether there are any problems in sewage disposal.

Grade VIII

Questions	Key Concepts	Resources	Activities/ Processes
1. Food *Crop production* Crop production: How are different food crops produced? What are the various foods we get from animal sources?	Crop production: Soil preparation, selection of seeds, sowing, applying fertilizers, irrigation, weeding, harvesting and storage; nitrogen fixation, nitrogen cycle.	Interaction and discussion with local men and women farmers about farming and farm practices; visit to cold storage, go- downs; visit to any farm/ nursery/ garden.	Preparing herbarium specimens of some crop plants; collection of some seeds etc; preparing a table/chart on different irrigation practices and sources of water in different parts of India; looking at roots of any legume crop for nodules, hand section of nodules.
Micro-organisms What living organisms do we see under a microscope in a drop of water? What helps make curd? How does food go bad? How do we preserve food?	Micro organisms – useful and harmful.	Microscope, kit materials; information about techniques of food preservation.	Making a lens with a bulb; Observation of drop of water, curd, other sources, bread mould, orange mould under the microscope; experiment showing fermentation of dough – increase in volume (using yeast) - collect gas in balloon, test in lime water.
2. Materials *Materials in daily life* Are some of our clothes synthetic? How are they made? Where do the raw materials	Synthetic clothing materials. Other synthetic materials, especially plastics; usefulness of plastics	Sharing of prior knowledge, source materials on petroleum products.	Survey on use of synthetic materials. Discussion.

come from? Do we use other materials that are synthetic?	and problems associated with their excessive use.		
Do we use cloth (fabric) for purposes other than making clothes to wear? What kind of fabric do we see around us? What are they used for?	There are a variety of fibrous materials in use. A material is chosen based on desired property.	Collection of material from neighborhood or should be part of the kit.	Testing various materials – for action of water, reaction on heating, effect of flame, electrical conductivity, thermal conductivity, tensile strength.
Different kinds of materials and their reactions. Can a wire be drawn out of wood? Do copper or aluminum also rust like iron? What is the black material inside a pencil? Why are electrical wires made of aluminum or copper?	Metals and non-metals.	Kit items.	Simple observations relating to physical properties of metals and non-metals, displacement reactions, experiments involving reactions with acids and bases. Introduction of word equations.
How things change/ react with one another What happens to the wax when a candle is burnt? Is it possible to get this wax back?	Combustion, flame	"The Chemical History of a Candle", by M. Faraday, 1860.	Experiments with candles.
What happens to kerosene/natural gas when it is burnt? Which fuel is the best? Why?	All fuels release heat on burning. Fuels differ in efficiency, cost etc. Natural resources are limited. Burning of fuels leads to harmful by products.	Collecting information from home and other sources.	Collecting information. Discussions involving whole class.
3. The World of the Living			
Why conserve What are reserve	Conservation of biodiversity/wild life/	Films on wild life, TV programs, visit to	Discussion on whether we find as

forests/sanctuaries etc? How do we keep track of our plants and animals? How do we know that some species are in danger of disappearing? What would happen if you continuously cut trees?	plants; zoos, sanctuaries, forest reserves etc. flora, fauna endangered species, red data book; endemic species, migration.	zoo/forest area/ sanctuaries etc.; case study with information on disappearing tigers; data on endemic and endangered species from MEF, Govt. of India, NGOs .	many diverse plants/ animals in a 'well kept area' like a park or cultivated land, as compared to any area left alone. Discussion on depletion of wild life, why it happens, on poaching, economics.
The cell What is the internal structure of a plant – what will we see if we look under the microscope? Which cells from our bodies can be easily seen? Are all cells similar?	Cell structure, plant and animal cells, use of stain to observe, cell organelles – nucleus, vacuole, chloroplast, cell membrane, cell wall.	Microscope, onion peels, epidermal peels of any leaves, petals etc, buccal cavity cells, *Spirogyra*; permanent slides of animal cells.	Use of a microscope, preparation of a slide, observation of onion peel and cheek cells, other cells from plants e.g. *Hydrilla* leaf, permanent slides showing different cells, tissues, blood smear; observation of T.S. stem to see tissues; observing diverse types of cells from plants and animals (some permanent slides).
How babies are formed How do babies develop inside the mother? Why does our body change when we reach our teens? How is the sex of the child determined? Who looks after the babies in your homes? Do all animals give birth to young ones?	Sexual reproduction and endocrine system in animals, secondary sexual characters, reproductive health; internal and external fertilisation.	Counsellors, films, lectures.	Discussion with counsellors on secondary sexual characters, on how sex of the child is determined, safe sex, reproductive health; observation on eggs, young ones, life cycles. Discussion on Gender issues and social taboo's.
4. Moving things, People and Ideas *Idea of force* What happens when we push or pull anything?	Idea of force-push or pull; change in speed, direction of moving objects and shape of	Daily-life experience, kit items.	Observing and analyzing the relation between force and motion in a variety of

How can we change the speed, direction of a moving object? How can we shape the shape of an object?	objects by applying force; contact and non-contact forces.		daily-life situations. Demonstrating change in speed of a moving object, its direction of motion and shape by applying force. Measuring the weight of an object, as a force (pull) by the earth using a spring balance.
Friction What makes a ball rolling on the ground slow down?	Friction – factors affecting friction, sliding and rolling friction, moving; advantages and disadvantages of friction for the movement of automobiles, airplanes and boats/ships; increasing and reducing friction.	Various rough and smooth surfaces, ball bearings.	Demonstrating friction between rough/smooth surfaces of moving objects in contact, and wear and tear of moving objects by rubbing (eraser on paper, card board, sand paper). Activities on static, sliding and rolling friction. Studying ball bearings. Discussion on other methods of reducing friction and ways of increasing friction.
Pressure Why needles are made pointed? Why does a balloon burst if too much air is blown into it? Why does an inverted glass/ bottle/pitcher resist being pushed down into water? How can air/liquids exert Pressure	Idea of pressure; pressure exerted by air/liquid; atmospheric pressure.	Daily-life experiences; Experimentation – improvised manometer and improvised pressure detector.	Observing the dependence of pressure exerted by a force on surface area of an object. Demonstrating that air exerts pressure in a variety of situations. Demonstrating that liquids exert pressure. Designing an improvised manometer and measuring pressure exerted by liquids. Designing improvised

			pressure detector and demonstrating increase in pressure exerted by a liquid at greater depths.
Sound How do we communicate through sound? How is sound produced? What characterizes different sounds?	Various types of sound; sources of sound; vibration as a cause of sound; frequency; medium for propagation of sound; idea of noise as unpleasant and unwanted sound and need to minimize noise.	Daily-life experiences; kit items; musical instruments.	Demonstrating and distinguishing different types (loud and feeble, pleasant/ musical and unpleasant / noise, audible and inaudible) of sound. Producing different types of sounds. using the samsource. Making a '*Jal Tarang'*. Demonstrating that vibration is the cause of sound. Designing a toy telephone. Identifying various sources of noise. (Unpleasant and unwanted sound) in the locality and thinking of measures to minimize noise and its hazards (noise-pollution).
5. How Things Work *Electric current and circuits* Why do we get a shock when we touch an electric appliance with wet hands?	Water conducts electricity depending on presence/ absence of salt in it. Other liquids may or may not conduct electricity.	Rubber cap, pins, water, bulb or LED, cells, various liquids.	Activity to study whether current flows through various liquid samples (tap water, salt solution, lemon juice, kerosene, distilled water if available).
What happens to a conducting solution when electric current flows through it?	Chemical effects of current.	Carbon rods, beaker, water, bulb, battery.	Emission of gases from salt solution.
How can we coat an	Basic idea of	Improvised	Deposition

object with a layer of metal?	electroplating.	electrolytic cell, CuSO4	of Cu from copper sulphate solution. Electric pen using KI and starch solution. Simple experiment to show electroplating.
6. Natural Phenomena			
Rain, thunder and lightning What is lightning? What safety measures should we take against lightning strikes?	Clouds carry electric charge. Positive and negative charges, attraction and repulsion. Principle of lightning conductor.	Articles on clouds and lightning; kit items.	Discussion on sparks. Experiments with comb and paper to show positive and negative charge. Discussion on lightning conductor.
Light What are the differences between the images formed on a new utensil and an old one? Why is there this difference?	Laws of reflection.	Mirror, source of light, ray source (mirror covered with black paper with a thin slit).	Exploring laws of reflection using ray source and another mirror.
When you see your image in the mirror it appears as if the left is on the right –why?	Characteristics of image formed with a plane mirror.	Plane glass, candle, scale.	Locating the reflected image using glass sheet and candles. Discussion with various examples.
Why don't we see images on all surfaces around us?	Regular and diffused reflection.		
What makes things visible?	Reflection of light from an object to the eye.	Experience.	Activity of observing an object through an object through a straight and bent tube; and discussion.
How do we see images of our back in a mirror?	Multiple reflection.	Mirrors and objects to be Seen .	Observing multiple images formed by mirrors placed at angles to each other. Making a kaleidoscope.
Why do we sometimes	Dispersion of light.	Plane mirror, water.	Observing spectrum

see colours on oil films on water?			obtained on a white sheet of paper/wall using a plane mirror inclined on a water surface at an angle of 45°.
What is inside our eye that enables us to see?	Structure of the eye.	Model or chart of the human eye.	Observing reaction of pupil to a shining torch.
Why are some people unable to see?	Lens becomes opaque, light not reaching the eye.	Experiences of children; case histories.	Demonstration of blind spot. Description of case histories of visually challenged people who have been doing well in their studies and careers.
	Visually challenged use other senses to make sense of the world around. Alternative technology available. Role of nutrition in relation to blindness	Samples of Braille sheets	Activities with Braille sheet
Night sky What do we see in the sky at night? How can we identify stars and planets?	Idea about heavenly bodies/celestial objects and their classification – moon, planets, stars, constellations. Motion of celestial objects in space; the solar system	Observation of motion of objects in the sky during the day and at night; models, charts, role-play and games, planetarium	Observing and identifying the objects moving in the sky during the day and at night. Observing and identifying some prominent stars and constellations. Observing and identifying some prominent planets, visible to the naked eye, (Venus, Mars, Jupiter) in the night sky and their movement. Design and preparing models and charts of

			the solar system, constellations, etc. Role play and games for understanding movement of planets, stars etc.
Earthquakes What happens during an earthquake? What can we do to minimize its effects?	Phenomena related to earthquakes.	Earthquake data; visit to seismographic centre.	Looking at structures/ large objects and guessing what will happen to them in the event of an earthquake; activities to explore stable and unstable structures.
7. Natural Resources *Man's intervention in phenomena of nature* What do we do with wood? What if we had no wood? What will happen it we go on cutting trees/grass without limit?	Consequences of deforestation: scarcity of products for humans and other living beings, change in physical properties of soil, reduced rainfall. Reforestation; recycling of paper.	Data and narratives on deforestation and on movements to protect forests.	Narration and discussions. Project- Recycling of paper.
What do we do with coal and petroleum? Can we create coal and petroleum artificially?	Formation of coal and petroleum in nature. (fossil fuels?). Consequences of over extraction of coal and petroleum.	Background materials, charts etc.	Discussion.
Pollution of air and water What are the various activities by human beings that make air impure? Does clear, transparent water indicate purity?	Water and air are increasingly getting polluted and therefore become scarce for use. Biological and chemical contamination of water; effect of impure water on soil and living beings; effect of soil containing excess of fertilizers and	Description of some specific examples of extremely polluted rivers.	Case study and discussion. Purification of water by physical and chemical methods including using sunlight. Discussion on other methods of water purification.

	insecticides on water resources. Potable water.		

G. Assessing Teaching And Learning

Assessment is an integral part of the teaching and learning process. It involves gathering information through various assessment techniques and making sound decisions. Assessment provides information to the teacher about students' achievement in relation to the learning objectives. With this information, the teacher makes informed decisions about what should be done to enhance the learning of the students and to improve teaching methods.

Why Assess?

• Assessment measures the extent to which desired knowledge, skills and attitudes are attained by students. While it complements the teaching and learning process, it also provides formative and summative feedback to students, teachers, schools and parents.

• Assessment provides feedback to ***students***, allows them to understand their strengths and weaknesses. Through assessment, students can monitor their own performance and progress. It also points them in the direction they should go to improve further.

• Assessment provides feedback to ***teachers***, enables them to understand the strengths and weaknesses of their students. It provides information about students' achievement of learning outcomes as well as the effectiveness of their teaching.

• Assessment provides feedback to ***schools***. The information gathered facilitates the placement of students in the appropriate stream or course, and the promotion of students from one level to the next. It also allows the schools to review the effectiveness of their instructional program.

• Assessment provides feedback to ***parents***, allows them to monitor their children's progress and achievement through the information obtained.

What to Assess?

The aims of the Science Syllabus are the acquisition of knowledge, understanding and application of the science concepts, the ability to use process skills, and the development of attitudes important to the practice of science. The assessment objectives of the syllabus are aligned to the three domains in the curriculum framework as shown below:

i. Assessment of Knowledge, Understanding and Application of Science Concepts

ii. Assessment of Skills and Process

iii. Assessment of Ethics and Attitudes

How to Assess?

Assessment measures the extent to which desired knowledge, skills and attitudes are attained by students. As it serves many purposes, it is important to match the type of assessment to the specific purpose for which it is intended. Before making an assessment about a certain aspect of students, performance, the teacher should ensure that the assessment mode used will generate information that reflects accurately the particular aspect of performance the teacher intends to assess.

In an inquiry-based classroom, the assessment can take many forms. In addition to the written tests, teachers can also conduct performance-based assessment using the following modes:

- Practical
- Projects
- Teacher observations
- Checklists
- Reflections / Journals
- Model-making
- Posters
- Games and quizzes
- Debates
- Drama / Show and Tell
- Learning Trails

Teachers can also assess students through the use of portfolio. It is a systematic collection of students' work and provides a comprehensive picture of their achievement. The work collected provides a continuous record of the students' development and progress in the acquisition of knowledge, understanding of scientific concepts, application of process skills, and development of attitudes. It also provides opportunity for the students to have self-evaluation and reflections by revisiting their own portfolio.