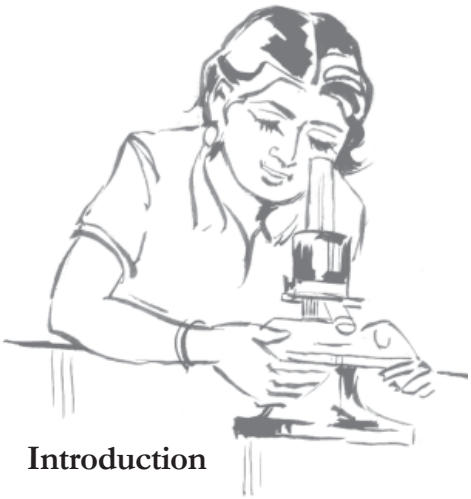

SCIENCE

Science
Classes VI to VIII

Introduction

The exercise of revising the syllabus for Science – or Science and Technology – has been carried out with "Learning without burden" as a guiding light and the position papers of the National Focus Groups as points of reference. The aim is to make the syllabus an enabling document for the creation of textbooks that are interesting and challenging without being loaded with factual information. Overall, science has to be presented as a live and growing body of knowledge rather than a finished product.

Very often, syllabi – especially those in Science – tend to be at once overspecified and underspecified. They are overspecified in that they attempt to enumerate items of content knowledge which could easily have been left open, e.g., in listing the families of flowering plants that are to be studied. They are underspecified because the listing of 'topics' by keywords such as 'Reflection' fails to define the intended breadth and depth of coverage. Thus there is a need to change the way in which a syllabus is presented.

The position paper on the Teaching of Science – supported by a large body of research on Science Education – recommends a pedagogy that is hands-on and inquiry-based. While this is widely accepted at the idea level, practice in India has tended to be dominated by chalk and talk methods. To make in any progress in the desired direction, some changes have to be made at the level of the syllabus. In a hands-on way of learning science, we start with things that are directly related to the child's experience, and are therefore specific. From this we progress to the general. This means that 'topics' have to be reordered to reflect this. An example is the notion of electric current. If we think in an abstract way, current consists of charges in motion, so we may feel it should treated at a late stage, only when the child is comfortable with 'charge'. But once we adopt a hands-on approach, we see that children can easily make simple electrical circuits, and study several aspects of 'current', while postponing making the connection with 'charge'.

Some indication of the activities that could go into the development of a 'topic' would make the syllabus a useful document. Importantly, there has to be adequate time for carrying out activities, followed by discussion. The learner also needs time to reflect on the classroom experience. This is possible only if the content load is reduced substantially, say by 20-25%.

Children are naturally curious. Given the freedom, they often interact and experiment with things around them for extended periods. These are valuable learning experiences, which are essential for imbibing the spirit of scientific inquiry, but may not always conform to adult expectations. It is important that any programme of study give children the needed space, and not tie them down with constraints of a long list of 'topics' waiting to be 'covered'. Denying them this opportunity may amount to killing

their spirit of inquiry. To repeat an oft-quoted saying: "It is better to uncover a little than to cover a lot." Our ultimate aim is to help children learn to become autonomous learners.

Themes and Format

There is general agreement that Science content up to Class X should not be framed along disciplinary lines, but rather organised around themes that are potentially cross-disciplinary in nature. In the present revision exercise, it was decided that the same set of themes would be used, right from Class VI to Class X. The themes finally chosen are: Food, Materials, The World of the Living, How Things Work, Moving Things, People and Ideas, Natural Phenomena and Natural Resources. While these run all through, in the higher classes there is a consolidation of content which leads to some themes being absent, e.g., Food from Class X.

The themes are largely self-explanatory and close to those adopted in the 2000 syllabus for Classes VI-VIII; nevertheless, some comments may be useful. In the primary classes, the 'science' content appears as part of EVS, and the themes are largely based on the children's immediate surroundings and needs: Food, Water, Shelter etc. In order to maintain some continuity between Classes V and VI, these should naturally continue into the seven themes listed above. For example, the Water theme evolves into Natural Resources (in which water continues to be a sub theme) as the child's horizon gradually expands. Similarly, Shelter evolves into Habitat, which is subsumed in The World of the Living. Such considerations also suggest how the content under specific themes could be structured. Thus clothing, a basic human need, forms the starting point for the study of Materials. It will be noted that this yields a structure which is different from that based on disciplinary considerations, in which materials are viewed purely from the perspective of chemistry, rather than from the viewpoint of the child. Our attempt to put ourselves in the place of the child leads to 'motion', 'transport' and 'communication' being treated together as parts of a single theme: Moving things, people and ideas. More generally, the choice of themes – and sub themes – reflects the thrust towards weakening disciplinary boundaries that is one of the central concerns of NCF 2005.

The format of the syllabus has been evolved to address the underspecification mentioned above. Instead of merely listing 'topics', the syllabus is presented in four columns: Questions, Key concepts, Resources and Activities/Processes.

Perhaps the most unusual feature of the syllabus is that it starts with questions rather than concepts. These are key questions, which are meant to provide points of entry for the child to start the process of thinking. A few are actually children's queries ("How do clouds form?"), but the majority are questions posed by the adult to support and facilitate learning (provide 'scaffolding', in the language of social constructivism). It should be clarified here that these questions are not meant to be used for evaluation or even directly used in textbooks.

Along with the questions, key concepts are listed. As the name suggests, these are those concepts which are of a key nature. Once we accept that concept development is a complex process, we must necessarily abandon the notion that acquisition of a specific concept will be the outcome of any single classroom transaction, whether it is a lecture or an activity. A number of concepts may get touched upon in the course of transaction. It is not necessary to list all of them.

The columns of Resources and Activities/Processes are meant to be of a suggestive nature, for both teachers and textbook writers. The Resources column lists not only concrete materials that may be needed in the classroom, but a variety of other resources, including out-of-class experiences of children as well as other people. Historical accounts and other narratives are also listed, in keeping with the current understanding that narratives can play an important role in teaching science. The Activities column lists experiments, as normally understood in the context of science, as well as other classroom processes in which children may be actively engaged, including discussion. Of course, when we teach science in a hands-on way, activities are not add-ons; they are integral to the development of the subject. Most experiments/activities would have to be carried by children in groups. Suggestions for field trips and surveys are also listed here. Although the items in this column are suggestive, they are meant to give an idea of the unfolding of the content. Read together with the questions and key concepts, they delineate the breadth and depth of coverage expected.

The Upper Primary or Middle Stage

When children enter this stage, they have just completed their primary schooling. It is important to start with things that are within the direct experience of the child. The need for continuity within thematic areas, and the effect this has on the structure, has already been mentioned above.

This is the stage where children can and should be provided plentiful opportunities to engage with the processes of science: observing things closely, recording observations, tabulation, drawing, plotting graphs – and, of course, drawing inferences from what they observe. Sufficient time and opportunities have to be provided for this.

During this stage we can expect the beginnings of quantitative understanding of the world. However, laws such as the universal law of gravitation, expressed in mathematical form, involve multiple levels of abstraction and have to be postponed to the next stage.

One of the major structural problems that plagues science education at this level is the lack of experimental facilities. Children of these classes usually have no access to any equipment, even if the school has functional laboratories for higher classes. While many experiments can be performed with 'zero-cost' equipment, it is unfair to deny children the opportunities of handling, e.g., magnets, lenses and low-cost microscopes. This syllabus is based on the assumption that a low-cost science kit for the middle classes can and will be designed. The Syllabus Revision Committee recommends that governments and other agencies make enough copies of such kits available to schools, assuming that children will perform the experiments themselves, in groups. Until a kit is designed and provided, specific items that are needed should be identified and procured. Glassware, common chemicals, lenses, slides etc. are items that will be in any such list. Such items are referred to as 'kit items' in the resources column of the syllabus.

At this stage, many children enter puberty. They are curious about their own bodies and sexuality, while being subject to social restrictions and taboos. Thus it is important that the topic of human reproduction not be treated merely as a biological process. Thus the syllabus provides space for addressing social taboos, and for making counselling on these matters part of the classroom process.

CLASS VI
SCIENCE

Questions	Key Concepts	Resources	Activities/ Processes
1. Food			**(Periods - 20)**
Sources of food			
What are the various sources of our food? What do other animals eat?	Plant parts and animal products as sources of food; herbivores, carnivores, omnivores.	Examples of food from different parts of plants and of food from animals sources.	Germination of seeds such as mung, chick pea etc.; preparing a chart on food habits of animals and food culture of different regions of India.
Components of food			
What is our food made up of? Why do we eat a variety of food?	Carbohydrates, fats, proteins, vitamins, minerals, fibres, their sources and significance for human health; balanced diet; diseases and disabilities due to food deficiencies.	Mid Day Meal; Charts, pictures/films of children suffering from food deficiencies and disabilities.	Studying the variety of food in different regions in India; preparing a menu of balanced diet in the context of the diversity of foods eaten in different parts of the country. Classifying foods according to food components; test for starch, sugars, proteins and fats.
Cleaning food			
How do we separate the grains after harvesting the wheat /rice crop?	Threshing, winnowing, hand picking, sedimentation, filtration.	Talking to some elders about practices after harvesting the crop; kit materials.	Discussion on threshing, winnowing, handpicking; experiments on sedimentation, filtration. Separating mixture of salt and sand.
2. Materials			**(Periods - 26)**
Materials of daily use			
What are our clothes	Different types of cloth	Sharing of prior	Whole class discussion.

Questions	Key Concepts	Resources	Activities/ Processes
made of? How did people manage when there were no clothes?	materials – cotton, wool, silk and synthetics. Development of clothing materials.	knowledge with parents and community. Archaeological and historical accounts.	Simple activities to distinguish among different types of cloth.
Are some of our clothes made of materials obtained from plants? In what kinds of places do these plants grow? Which parts of the plants are used for making clothes?	Plant fibre, especially cotton and jute; production of cotton, jute and other locally available plant fibres; types of soil required for the growth of different fibrous plants.	Sharing of prior knowledge with parents and community.	Whole class discussion. Field survey/ collecting information on locally available plant fibres (coconut, silk cotton, etc.)
Different kinds of materials			
What kinds of things do we see around us?	Grouping things on the basis of common properties.	Materials, kit items.	Collecting and grouping things on the basis of gross properties e.g. roughness, lustre, transparency, solubility, sinking/floating using prior knowledge, through experiments.
How things change/ react with one another			
In what ways do things change on being heated? Do they change back on being cooled? Why does a burning candle get shorter?	Some changes can be reversed and others cannot be reversed.	Prior knowledge, kit items.	Experiments involving heating of air, wax, paper, metal, water to highlight effects like burning, expansion/compression, change of state. Discussion on other changes which cannot be reversed – growing up, opening of a bud,

Questions	Key Concepts	Resources	Activities/ Processes
			ripening of fruit, curdling of milk.
How much salt can be dissolved in a cup of water?	Solubility, saturated solutions. Amount of substance dissolving varies with temperature. At the same temperature amounts of different substances that dissolve varies.	Salt, sugar and other common substances, kit items.	Experiments for testing the solubility of commonly available substances. Experiments on the effect of heating and cooling on solubility. Comparison of solubilities of different substances using non-standard units (eg. spoon, paper cone).
3. The World of the Living ***Things around us*** Are all things around us living? What is the difference between living and non-living? Are all living things similar? Do all living things move? Where do plants and animals live? Can we grow plants in the dark?	Living/non-living characteristics; habitat; biotic, abiotic (light, temperature, water, air, soil, fire)	Recollection of diversity of living organisms and the habitat where they live.	**(Periods - 36)** Listing of things around us, listing of characteristics after making observations say on size, colour, shape etc., categorisation; observations on habitat; observing germination of seeds, also observing under dark conditions; growth and development of domestic animals, hatching of birds' eggs etc., developing drawing skills.
The habitat of the living How does habitat affect plants and animals? How	Habitat varies – aquatic, deserts, mountains etc. –	Potted plants or seeds, pots, etc; thermometer,	Listing the diverse set of living organisms around

Questions	Key Concepts	Resources	Activities/ Processes
do fish live in water?	plants and animals show adaptation; other plant part modifications like tendrils, thorns etc. Animals in deserts and water.	any water plants, any xerophytic plants, Information on desert and aquatic plants and animals.	us; prepare herbarium specimens of different leaves, plants; studying modifications in plants and animals; observing how different environmental factors (water availability, temperature) affect living organisms;
Plants – form and function What is the structure and function of various parts of the plants - stem, leaf and roots? How do different flowers differ from one another? How does one study flowers?	Morphological structure and function of root, stem and leaves. Structure of the flower, differences.	Plants, flowers, blade, hand lens.	Studying plant parts – types of stems, roots, leaves, seeds; experiment to show conduction by stem, activity to show anchorage by roots, absorption by roots. Study of any flower, counting number of parts, names of parts, cutting sections of ovary to observe ovules.
Animals – form and function What is inside our bodies? How do animals move? Do all animals have bones in their bodies? How do fishes move? And birds fly? What about snakes, snails, earthworms?	Structure and functions of the animal body; Human skeletal system, some other animals e.g. fish, bird, cockroach, snail.	Observation of nature; model of skeleton, X-rays of arms or legs, chest, hips, jaws, vertebral column (could be given in the textbook).	Activities to study X-rays, find out the direction in which joints bend, feel the ribs, backbone etc. Observation/ discussion on movement and skeletal system in other animals.

Questions	Key Concepts	Resources	Activities/ Processes
4. Moving Things, People and Ideas			**(Periods - 12)**
Moving			
How did people travel from one place to another in earlier times? How did they know how far they had travelled?	Need to measure distance (length). Measurement of length. Motion as change in position with time.	Everyday experience; equipment (scale etc.) to measure length.	Measuring lengths and distances.
How do we know that something is moving?		Stories for developing contexts for measuring distances.	Observation of different types of moving objects on land, in air, water and space.
How do we know how far it has moved?			Identification and discrimination of various types of motion.
			Demonstrating objects having more than one type of movement (screw motion, bicycle wheel, fan, top etc.)
			Observing the periodic motion in hands of a clock / watch, sun, moon, earth.
5. How things work			**(Periods - 28)**
Electric current and circuits			
How does a torch work?	Electric current: Electric circuit (current flows only when a cell and other components are connected in an unbroken loop)	Torch: cell, bulb or led, wires, key.	Activity using a bulb, cell and key and connecting wire to show flow of current and identify closed and open circuits. Making a switch. Opening up a dry cell.
Do all materials allow current to flow through them?	Conductor, Insulator.	Mica, paper, rubber, plastic, wood, glass metal clip, water, pencil (graphite), etc.	Experiment to show that some objects (conductors) allow current to flow and others (insulators) do not.

Questions	Key Concepts	Resources	Activities/ Processes
Magnets			
What is a magnet?	Magnet.	Magnet, iron pieces.	Demonstrating how things are attracted by a magnet. Classification of objects into magnetic/ non-magnetic classes.
Where on a magnet do things stick?	Poles of a magnet.	Magnet, iron pieces, iron filings, paper.	Activity to locate poles of a magnet; activity with iron filings and paper.
How is a magnet used to find direction?	A freely suspended magnet always aligns in a particular direction. North and South poles.	Bar magnet, stand, thread, compass.	Activities with suspended bar magnet and with compass needle.
How do two magnets behave when brought close to each other?	Like poles repel and unlike poles attract each other.	Two bar magnets, thread, stand.	Activities to show that like poles repel and unlike poles attract.
6. Natural Phenomena			
Rain, thunder and lightning			
Where does rain come from? How do clouds form?	Evaporation and condensation, water in different states. Water cycle.	Everyday experience; kit items.	Condensation on outside of a glass containing cold water; activity of boiling water and condensation of steam on a spoon. Simple model of water cycle. Discussion on three states of water.
Light			**(Periods - 26)**
Which are the things we can see through?	Classification of various materials in terms of transparent, translucent and opaque.	Previous experience, candle/torch/lamp, white paper, cardboard box, black paper.	Discussion, observation; looking across different materials at a source of light.

Questions	Key Concepts	Resources	Activities/ Processes
When are shadows formed? Do you get a shadow at night – when there is no light in the room, no moonlight or other source of light? What colour is a shadow?	A shadow is formed only when there is a source of light and an opaque material obstructs a source it. A shadow is black irrespective of the colour of the object.	Child's own experience, candle/torch/lamp, white paper, black paper, coloured objects.	Discussion; observing shadow formation of various objects of different shapes, and of same shape and different colours; playing and forming shadows with the hands in sunlight, in candle light, and in a well lit region during daytime; making a pinhole camera and observing static and moving objects.
On what kinds of surfaces can we see images?	Reflecting surfaces; images are different from shadows.	Experience, objects with polished surfaces, mirror etc.	Observing differences between the image and the shadow of the same object.
7. Natural Resources ***Importance of water*** What will happen to soil, people, domestic animals, rivers, ponds and plants and animals if it does not rain this year? What will happen to soil, people, domestic animals, plants and animals living in rivers and ponds, if it rains heavily?	Importance of water, dependence of the living on water. Droughts and floods.	Experience, newspaper reports.	Estimation of water used by a family in one day, one month, one year. Difference between need and availability. Discussion. Activity: plant growth in normal, deficient and excess water conditions.
Importance of air Why do earthworms come out of the soil when it rains?	Some animals and plants live in water; some live on land and some live in	Experience.	Discussion.

Questions	Key Concepts	Resources	Activities/ Processes
	upper layers of soil; but all need air to breath/to respire.		

Waste Do you throw away fruit and vegetable peels and cuttings? Can these be re-used? If we dump them anywhere, will it harm the surroundings? What if we throw them in plastic bags?	Waste; recycling of waste products; things that rot and things that don't. Rotting is supported by animals/animal and plant products.	Observation and experience.	Survey of solid waste generation by households; estimation of waste accumulated (by a house/ village/colony etc.) in a day, in a year; discussion on 'what is waste'; Activity to show that materials rot in soil, this is affected by wrapping in plastics.

VII
Class VII
Science

Questions	Key Concepts	Resources	Activities/ Processes
1. Food			**(Periods - 22)**
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.
Utilisation of food			
How do plants and animals utilise 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			**(Periods - 38)**
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 fibres. 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 woollen and silk cloth. Activities to differentiate natural silk and wool from artificial fibres. 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.

Questions	Key Concepts	Resources	Activities/ Processes
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, $CuSO_4$, etc.	Experiments involving chemical reactions like rusting of iron, neutralisation (vinegar and baking soda), displacement of Cu from $CuSO_4$ 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.

Questions	Key Concepts	Resources	Activities/ Processes
3. The World of the Living			**(Periods - 42)**
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 ground? What happens to water when it falls on the cemented/ bare ground?	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.
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 the	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, $AgNO_3$ solution.	Translocation of water in stems, demonstration of transpiration, measurement of pulse rate, heartbeat;after exercise etc. Discussion on dialysis, importance; experiment

Questions	Key Concepts	Resources	Activities/ Processes
body? Why is blood red? Do all animals have blood? What is there in urine?			on dialysis using egg membrane.
Multiplication in plants Why are some plant parts like potato, onion swollen – are they of any use to the 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, fertilisation, 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. **(Periods - 16)**
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; metre scale, wrist watch/ stop watch, string etc.	Observing and analysing 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.

Questions	Key Concepts	Resources	Activities/ Processes
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, aluminium 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 electromagnet?	A current-carrying coil behaves like a magnet.	Coil, battery, iron nail.	Making a simple electro-magnet. Identifying situations in daily life where electromagnets are used.
How does an electric bell work?	Working of an electric bell.	Electric bell.	Demonstration of working of an electric bell.
6. Natural Phenomena			**(Periods - 24)**
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.	Experience; newspaper reports. 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.

Questions	Key Concepts	Resources	Activities/ Processes
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. Focussed discussions on real and virtual images.
How can we make a coloured disc appear white?	White light is composed of many colours.	Newton's disc.	Making the disc and rotating it.
7. Natural Resources *Scarcity of water* Where and how do you get water for your 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 exists in various forms in nature. Scarcity of water and its effect on life.	Experience; media reports; case material.	Discussions. Case study of people living in conditions of 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.

Questions	Key Concepts	Resources	Activities/ Processes
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 neighbourhood, 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.

CLASS VIII
SCIENCE

Questions	Key Concepts	Resources	Activities/ Processes
1. Food			**(Periods - 22)**
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			**(Periods - 26)**
Materials in daily life			
Are some of our clothes synthetic? How are they made? Where do the raw materials come from?	Synthetic clothing materials. Other synthetic materials, especially plastics;	Sharing of prior knowledge, source materials on petroleum products.	Survey on use of synthetic materials. Discussion.

Questions	Key Concepts	Resources	Activities/ Processes
Do we use other materials that are synthetic?	usefulness of plastics 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 neighbourhood 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 aluminium also rust like iron? What is the black material inside a pencil? Why are electrical wires made of aluminium 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.

Questions	Key Concepts	Resources	Activities/ Processes
3. The World of the Living			**(Periods - 44)**
Why conserve			
What are reserve 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?	Conservation of biodiversity/wild life/ plants; zoos, sanctuaries, forest reserves etc. flora, fauna endangered species, red data book; endemic species, migration.	Films on wild life, TV programmes, visit to zoo/ forest area/sanctuaries etc.; case study with information on dis-appearing tigers; data on endemic and endangered species from MEF, Govt. of India, NGOs .	Discussion on whether we find as 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	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.

Questions	Key Concepts	Resources	Activities/ Processes
animals give birth to young ones?			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? How can we change the speed, direction of a moving object? How can we shape the shape of an object?	Idea of force-push or pull; change in speed, direction of moving objects and shape of objects by applying force; contact and non-contact forces.	Daily-life experience, kit items.	Observing and analysing the relation between force and motion in a variety of 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.

Questions	Key Concepts	Resources	Activities/ Processes
Pressure Why are needles 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 characterises 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 minimise 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 same source. 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

Questions	Key Concepts	Resources	Activities/ Processes
			locality and thinking of measures to minimise noise and its hazards (noise-pollution).
5. How Things Work ***Electric current and circuits***			**(Periods - 14)**
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. Deposition of Cu from copper sulphate solution. Electric pen using KI and starch solution.
How can we coat an object with a layer of metal?	Basic idea of electroplating.	Improvised electrolytical cell, $CuSO_4$	Simple experiment to show electroplating.
6. Natural Phenomena ***Rain, thunder and lightning***			**(Periods - 26)**
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	Laws of reflection.	Mirror, source of light,	Exploring laws of

Questions	Key Concepts	Resources	Activities/ Processes
between the images formed on a new utensil and an old one? Why is there this difference?		ray source (mirror covered with black paper with a thin slit).	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.
Why don't we see images on all surfaces around us?	Regular and diffused reflection.		Discussion with various examples.
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 see colours on oil films on water?	Dispersion of light.	Plane mirror, water.	Observing spectrum 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. Demonstration of blind spot.
Why are some people unable to see?	Lens becomes opaque, light not reaching the eye. Visually challenged use other senses to make sense of the world around.	Experiences of children; case histories. Samples of Braille sheets.	Description of case histories of visually challenged people who have been doing well in their studies and careers. Activities with Braille sheet.

Questions	Key Concepts	Resources	Activities/ Processes
	Alternative technology available. Role of nutrition in relation to blindness		
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 minimise 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.

Questions	Key Concepts	Resources	Activities/ Processes
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 fertilisers and insecticides on water resources. Potable water.	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.