Learning Outcomes in Science - Upper Primary Stage

Introduction

Science is a dynamic, expanding body of knowledge, covering new domains of experiences. It is a human endeavour to understand the world by building-up conceptual models on the basis of observations and thus arriving at theories, laws and principles. In a progressive society, science can play a truly liberating role, helping people escape from the vicious cycle of poverty, ignorance and superstition. People today are faced with an increasingly fast-changing world where the most important skills are flexibility, innovation and creativity. These different imperatives have to be kept in mind in shaping science education. Good science education is true to the child, true to life and true to the discipline.

As consistent with the stage of cognitive development, science is being taken as core subject in the curriculum at upper primary stage. At this stage, it is a gradual transition from environmental studies of the primary stage to the elements of science. It is important to expand the horizon of child gradually and start with things that are within the direct experiences of child. The child should be engaged in learning the principles of science through familiar experiences, working with hands to design simple technological units and models and continuing to learn more about the environment and health, including reproductive and sexual health. Scientific concepts are to be arrived at mainly from activities, experiments and surveys. Group activities, discussions with peers and teachers, surveys, organisation of data and their display through exhibitions, etc., in schools and the neighbourhood should be important components of pedagogy.

Curricular Expectations

Science curriculum at the upper primary stage intends to develop:

- scientific temper and scientific thinking
- understanding about the nature of scientific knowledge i.e., testable, unified, parsimonious, amoral, developmental and creative.
- process skills of science which includes observation(s), posing question(s), searching various resources of learning, planning investigations, hypothesis formulation and testing, using various tools for collecting, analysing and interpreting data, supporting explanations with evidences, critically thinking to consider and evaluate alternative explanations, reflecting on their own thinking.
- appreciation for historical aspects of evolution of science.
- sensitivity towards environmental concerns.
- respect for human dignity and rights, gender equity, values of honesty, integrity, cooperation and concern for life.

The curriculum has been organized around the following themes that are cross disciplinary in nature:

- Food
- Materials
- The World of the Living
- Moving Things, People and Ideas
- How Things Work
- Natural Phenomena
- Natural Resources

Class VI (Science)

Suggested Pedagogical Processes	Learning Outcomes
The learner is to be provided with opportunities in pairs/groups/ individually in an inclusive setup and encouraged to: ➢ explore surroundings, natural processes, phenomena using senses viz. seeing, touching, tasting, smelling, hearing. ➢ pose questions and find answers through reflection, discussion, designing and performing appropriate activities, role	**The learner:** • identifies materials and organisms, such as, plant fibres, flowers, on the basis of observable features i.e. appearance, texture, function, aroma, etc. • differentiates materials and organisms, such as, fibre and yarn; tap and fibrous roots; electrical conductors and insulators; on the basis of their properties, structure and functions • classifies materials, organisms and processes based on observable properties, e.g., materials as soluble, insoluble, transparent, translucent and opaque; changes as can be reversed and cannot be reversed; plants as herbs, shrubs, trees, creeper, climbers; components of habitat as biotic and abiotic; motion as rectilinear, circular , periodic • conducts simple investigations to seek answers to queries ,e.g., What are the food nutrients present in animal fodder? Can all physical changes be reversed? Does a freely suspended magnet align in a particular direction?

Suggested Pedagogical Processes	Learning Outcomes
plays, debates, use of ICT, etc. ➢ record the observations during the activity, experiments, surveys, field trips, etc. ➢ analyse recorded data, interpret results and draw inference/ make generalisations and share findings with peers and adults. ➢ exhibit creativity presenting novel ideas, new designs/patterns, improvisation, etc. ➢ internalise, acquire and appreciate values such as cooperation, collaboration, honest reporting, judicious use of resources, etc.	• relates processes and phenomenon with causes, e.g., deficiency diseases with diet; adaptations of animals and plants with their habitats; quality of air with pollutants, etc. • explains processes and phenomenon, e.g., processing of plant fibres; movements in plants and animals; formation of shadows; reflection of light from plane mirror; variations in composition of air; preparation of vermicompost, etc. • measures physical quantities and expresses in SI units, e.g., length • draws labelled diagrams / flow charts of organisms and processes, e.g., parts of flowers; joints; filtration; water cycle, etc. • constructs models using materials from surroundings and explains their working, e.g., pinhole camera, periscope, electric torch, etc. • applies learning of scientific concepts in day-to-day life,e.g., selecting food items for a balanced diet; separating materials; selecting season appropriate fabrics; using compass needle for finding directions; suggesting ways to cope with heavy rain/ drought, etc. • makes efforts to protect environment, e.g., minimising wastage of food, water, electricity and generation of waste; spreading awareness to adopt rain water harvesting; care for plants, etc. • exhibits creativity in designing, planning, making use of available resources, etc. • exhibits values of honesty, objectivity, cooperation, freedom from fear and prejudices.

Class VII(Science)

Suggested Pedagogical Processes	Learning Outcomes
The learner is to be provided with opportunities in pairs/groups/ individually in an inclusive setup and encouraged to: ➢ explore surroundings, natural processes, phenomena using senses viz. seeing, touching, tasting, smelling, hearing. ➢ pose questions and find answers through reflection, discussion, designing and performing appropriate activities, role plays, debates, use of ICT, etc. ➢ record the observations during the activity, experiments, surveys, field trips, etc. ➢ analyse recorded data, interpret results and draw inference/ make generalisations and share findings with peers and adults. ➢ exhibit creativity presenting novel ideas, new designs/patterns, improvisation, etc. ➢ internalise, acquire and appreciate values such as cooperation,	**The learner:** • identifies materials and organisms, such as, animal fibres; types of teeth; mirrors & lenses, on the basis of observable features, i.e., appearance, texture, functions, etc. • differentiates materials and organisms such as, digestion in different organisms; unisexual and bisexual flowers; conductors and insulators of heat; acidic , basic and neutral substances; images formed by mirrors and lenses, etc., on the basis of their properties, structure and function • classifies materials and organisms based on properties/characteristics, e.g., plant and animal fibres; physical and chemical changes • conducts simple investigations to seek answers to queries ,e.g., Can extract of coloured flowers be used as acid-base indicator? Do leaves other than green also carry out photosynthesis? Is white light composed of many colours? • relates processes and phenomena with causes, e.g., wind speed with air pressure; crops grown with types of soil ; depletion of water table with human activities, etc. • explains processes and phenomena , e.g., processing of animal fibres; modes of transfer of heat; organs and systems in human and plants ; heating and magnetic effects of electric current, etc. • writes word equation for chemical reactions, e.g., acid-base reactions**;** corrosion; photosynthesis; respiration, etc. • measures and calculates e.g., temperature; pulse rate; speed of moving objects; time period of a simple pendulum, etc. • draws labelled diagrams/ flow charts e.g., organ systems in human and plants; electric circuits; experimental set ups ; life cycle of silk moth, etc. • plots and interprets graphs e.g., distance-time graph

Suggested Pedagogical Processes	Learning Outcomes
collaboration, honest reporting, judicious use of resources, etc	• constructs models using materials from surroundings and explains their working ,e.g., stethoscope; anemometer; electromagnets; Newton's colour disc ,etc. • discusses and appreciates stories of scientific discoveries • applies learning of scientific concepts in day-to-day life, e.g. dealing with acidity; testing and treating soil; taking measures to prevent corrosion; cultivation by vegetative propagation; connecting two or more electric cells in proper order in devices; taking measures during and after disasters; suggesting methods for treatment of polluted water for reuse, etc. • makes efforts to protect environment, e.g., following good practices for sanitation at public places; minimising generation of pollutants; planting trees to avoid soil erosion; sensitising others with the consequences of excessive consumption of natural resources, etc. • exhibits creativity in designing, planning, making use of available resources, etc. • exhibits values of honesty, objectivity, cooperation, freedom from fear and prejudices

Class VIII(Science)

Suggested Pedagogical Processes	Learning Outcomes
The learner is to be provided with opportunities in pairs/groups/ individually in an inclusive setup and encouraged to: ➢ explore surroundings, natural processes, phenomena using senses viz. seeing, touching, tasting, smelling, hearing.	**The learner:** • differentiates materials and organisms, such as, natural and human made fibres; contact and non-contact forces; liquids as electrical conductors and insulators; plant and animal cells; viviparous and oviparous animals, on the basis of their properties, structure and functions. • classifies materials and organisms based on properties/ characteristics, e.g., metals and non metals; *kharif* and *rabi* crops; useful and harmful microorganisms; sexual and asexual reproduction; celestial objects; exhaustible and inexhaustible natural resources, etc.

Suggested Pedagogical Processes	Learning Outcomes
➢ pose questions and find answers through reflection, discussion, designing and performing appropriate activities, role plays, debates, use of ICT, etc. ➢ record the observations during the activity, experiments, surveys, field trips, etc. ➢ analyse recorded data, interpret results and draw inference/ make generalisations and share findings with peers and adults. ➢ exhibit creativity presenting novel ideas, new designs/patterns, improvisation, etc. ➢ internalise, acquire and appreciate values such as cooperation, collaboration, honest reporting, judicious use of resources, etc	• conducts simple investigations to seek answers to queries ,e.g, What are the conditions required for combustion? Why do we add salt and sugar in pickles and *murabbas*? Do liquids exert equal pressure at the same depth? • relates processes and phenomenon with causes ,e.g., smog formation with the presence of pollutants in air; deterioration of monuments with acid rain, etc. • explains processes and phenomenon ,e.g., reproduction in human and animals; production and propagation of sound; chemical effects of electric current; formation of multiple images; structure of flame, etc. • writes word equation for chemical reactions, e.g., reactions of metals and non-metals with air, water and acids ,etc. • measures angles of incidence and reflection, etc. • prepares slides of microorganisms; onion peel , human cheek cells ,etc., and describes their microscopic features.. • draws labelled diagram/ flow charts, e.g., structure of cell, eye, human reproductive organs; experimental set ups, etc. • constructs models using materials from surroundings and explains their working , e.g. , *ektara*, electroscope, fire extinguisher, etc. • applies learning of scientific concepts in day-to-day life, e.g., purifying water; segregating biodegradable and non-biodegradable wastes; increasing crop production;using appropriate metals and non-metals for various purposes; increasing/ reducing friction; challenging myths and taboos regarding adolescence, etc. • discusses and appreciates stories of scientific discoveries • makes efforts to protect environment, e.g., using resources judiciously; making controlled use of fertilisers and pesticides; suggesting ways to cope with environmental hazards, etc. • exhibits creativity in designing, planning, making use of available resources, etc.

Suggested Pedagogical Processes	Learning Outcomes
	• exhibits values of honesty, objectivity, cooperation, freedom from fear and prejudices

For Children with Special Needs (EVS and Science)

In learning EVS and science, some students may require support with mobility or manipulation skills to participate in experiments or other hands on activities being performed both indoors and outdoors. Students can benefit from adapted or alternative activities, adapted equipment, the use of ICT, adult or peer support, additional time, and support in lessons that may not be accessible to them because of their impairment. Additional care may be taken for some specific needs as mentioned below.

For Visually Impaired children

- Abstract and difficult concepts
- Experiments, especially that involve physical safety
- Requirement of more time
- Understanding visual inputs like chalkboard, demonstrations, presentations graphics and diagrams, etc.

For Hearing Impaired children

- Understanding abstract words and the connections between abstract concepts, knowledge, ideas; (science concepts like photosynthesis, habitat, microorganisms, etc. are difficult for these children to understand without visual representations.)
- Conducting experiments
- Solving problems that involve more than one dimension; For example,comparing objects on the basis of multiple dimensions like number, size ,shape, colour may be difficult as compared to single dimension like size only

For Children with Cognitive Impairments, Intellectual Disability

- Understanding the technical language of Science

- Drawing meaningful linkages/relationships between concepts (for example, between pressure and force)
- Planning, organizing, sequencing and generalising
- Understanding abstract concepts
- Conducting or handling science experiments