

4. SCIENCE

(Code No. 086 / 090)

The subject of Science plays an important role in developing well-defined abilities in cognitive, affective and psychomotor domains in children. It augments the spirit of enquiry, creativity, objectivity and aesthetic sensibility.

Whereas the upper primary stage demands that a number of opportunities should be provided to the students to engage them with the processes of Science like observing, recording observations, drawing, tabulation, plotting graphs, etc., the secondary stage expects abstraction and quantitative reasoning to occupy a more central place in the teaching and learning of Science. Thus, the idea of atoms and molecules being the building blocks of matter makes its appearance, as does Newton's law of gravitation.

The present syllabus has been designed around six broad themes viz. Food, Materials, The World of The Living, How Things Work, Moving Things, People and Ideas, Natural Phenomenon and Natural Resources. Special care has been taken to avoid temptation of adding too many concepts than can be comfortably learnt in the given time frame. No attempt has been made to be comprehensive.

At this stage, while science is still a common subject, the disciplines of Physics, Chemistry and Biology begin to emerge. The students should be exposed to experiences as well as modes of reasoning that are typical of the subject.

General Instructions:

1. The units specified for each term shall be assessed through both Formative and Summative Assessments.
2. In each term, there will be two Formative Assessments each carrying 10% weightage.
3. The Summative Assessment in each term will carry 30% weightage.
4. Hands on Practical examination will be conducted through Formative Assessment in every term with 20% weightage of total term marks.
5. Assessment of Practical Skills through Practical Based Questions (PBQ) will carry 15 marks in every term end Summative Assessment.

COURSE STRUCTURE CLASS IX

First Term

Marks: 90

| Unit No. | Unit | Marks |
|----------|-----------------------------------|-----------|
| I | Matter - Its Nature and Behaviour | 29 |
| II | Organisation in the Living World | 18 |
| III | Motion, Force and Work | 30 |
| V | Food; Food Production | 13 |
| | Total | 90 |

Theme: Materials

(22 Periods)

Unit I: Matter-Nature and Behaviour

Definition of matter; solid, liquid and gas; characteristics - shape, volume, density; change of state-melting (absorption of heat), freezing, evaporation (cooling by evaporation), condensation, sublimation.

Nature of matter : Elements, compounds and mixtures. Heterogenous and homogenous mixtures, colloids and suspensions.

Theme: The World of the Living

(22 Periods)

Unit II: Organization in the Living World

Cell - Basic Unit of life : Cell as a basic unit of life; prokaryotic and eukaryotic cells, multicellular organisms; cell membrane and cell wall, cell organelles and cell inclusions; chloroplast, mitochondria, vacuoles, endoplasmic reticulum, Golgi apparatus; nucleus, chromosomes - basic structure, number.

Tissues, Organs, Organ System, Organism:

Structure and functions of animal and plant tissues (only four types of tissues in animals; Meristematic and Permanent tissues in plants).

Theme: Moving Things, People and Ideas

(36 Periods)

Unit III: Motion, Force and Work

Motion: Distance and displacement, velocity; uniform and non-uniform motion along a straight line; acceleration, distance-time and velocity-time graphs for uniform motion and uniformly accelerated motion, derivation of equations of motion by graphical method; elementary idea of uniform circular motion.

Force and Newton's laws : Force and Motion, Newton's Laws of Motion, Inertia of a body, Inertia and mass, Momentum, Force and Acceleration. Elementary idea of conservation of Momentum, Action and Reaction forces.

Gravitation: Gravitation; Universal Law of Gravitation, Force of Gravitation of the earth (gravity), Acceleration due to Gravity; Mass and Weight; Free fall.

Theme: Food

(10 Periods)

Unit V: Food Production

Plant and animal breeding and selection for quality improvement and management; Use of fertilizers and manures; Protection from pests and diseases; Organic farming.

PRACTICALS - FIRST TERM

Practicals should be conducted alongside the concepts taught in theory classes.
(LIST OF EXPERIMENTS)

1. To test (a) the presence of starch in the given food sample, (b) the presence of the

- adulterant metanil yellow in dal.
2. To prepare:
 - a) a true solution of common salt, sugar and alum
 - b) a suspension of soil, chalk powder and fine sand in water
 - c) a colloidal solution of starch in water and egg albumin/milk in water and distinguish between these on the basis of
 - transparency
 - filtration criterion
 - stability
 3. To prepare
 - a) a mixture
 - b) a compoundusing iron filings and sulphur powder and distinguish between these on the basis of:
 - (i) appearance, i.e., homogeneity and heterogeneity
 - (ii) behaviour towards a magnet
 - (iii) behaviour towards carbon disulphide as a solvent
 - (iv) effect of heat
 4. To carry out the following reactions and classify them as physical or chemical changes :
 - a) Iron with copper sulphate solution in water
 - b) Burning of magnesium ribbon in air
 - c) Zinc with dilute sulphuric acid
 - d) Heating of copper sulphate crystals
 - e) Sodium sulphate with barium chloride in the form of their solutions in water
 5. To prepare stained temporary mounts of (a) onion peel, (b) human cheek cells & to record observations and draw their labeled diagrams.
 6. To identify Parenchyma and Sclerenchyma tissues in plants, striped muscle fibers and nerve cells in animals, from prepared slides. Draw their labeled diagrams.
 7. To separate the components of a mixture of sand, common salt and ammonium chloride (or camphor) by sublimation.
 8. To determine the melting point of ice and the boiling point of water.
 9. To establish relationship between weight of a rectangular wooden block lying on a horizontal table and the minimum force required to just move it using a spring balance.

10. To determine the mass percentage of water imbibed by raisins.

COURSE STRUCTURE
CLASS IX

Second Term

Marks: 90

| Unit No. | Unit | Marks |
|----------|-----------------------------------|-----------|
| I | Matter - Its Nature and Behaviour | 18 |
| II | Organisation in the Living World | 26 |
| III | Motion, Force and Work | 36 |
| IV | Our Environment | 10 |
| | Total | 90 |

Note: The material for Open Text Based Assessment (OTBA) for SA-II will be from Unit - IV: Our Environment. This unit will be tested through OTBA only.

Theme: Materials

(28 Periods)

Unit I: Matter-Its Nature and Behaviour

Particle nature, basic units : Atoms and molecules. Law of constant proportions. Atomic and molecular masses.

Mole Concept : Relationship of mole to mass of the particles and numbers. Valency. Chemical formula of common compounds.

Structure of atom: Electrons, protons and neutrons; Isotopes and isobars.

Theme: The World of the Living

(23 Periods)

Unit II: Organization in the Living World

Biological Diversity: Diversity of plants and animals - basic issues in scientific naming, basis of classification. Hierarchy of categories / groups, Major groups of plants (salient features) (Bacteria, Thallophyta, Bryophyta, Pteridophyta, Gymnosperms and Angiosperms). Major groups of animals (salient features) (Non-chordates upto phyla and chordates upto classes).

Health and Diseases: Health and its failure. Infectious and Non-infectious diseases, their causes and manifestation. Diseases caused by microbes (Virus, Bacteria and Protozoans) and their prevention; Principles of treatment and prevention. Pulse Polio programmes.

Theme: Moving Things, People and Ideas

(24 Periods)

Unit III: Motion, Force and Work

Floatation: Thrust and Pressure. Archimedes' Principle; Buoyancy; Elementary idea of Relative Density.

Work, energy and power: Work done by a Force, Energy, power; Kinetic and Potential energy; Law of conservation of energy.

Sound: Nature of sound and its propagation in various media, speed of sound, range of hearing in humans; ultrasound; reflection of sound; echo and SONAR.

Structure of the Human Ear (Auditory aspect only).

Theme: Natural Resources

(15 Periods)

Unit IV: Our Environment

Physical resources : Air, Water, Soil.

Air for respiration, for combustion, for moderating temperatures; movements of air and its role in bringing rains across India.

Air, water and soil pollution (brief introduction). Holes in ozone layer and the probable damages.

Bio-geo chemical cycles in nature: Water, Oxygen, Carbon and Nitrogen.

PRACTICALS - SECOND TERM

Practicals should be conducted alongside the concepts taught in theory classes.

LIST OF EXPERIMENTS

1. To verify the Laws of reflection of sound.
2. To determine the density of solid (denser than water) by using a spring balance and a measuring cylinder.
3. To establish the relation between the loss in weight of a solid when fully immersed in
 - a) tap water
 - b) strongly salty water, with the weight of water displaced by it by taking at least two different solids.
4. To observe and compare the pressure exerted by a solid iron cuboid on fine sand/ wheat flour while resting on its three different faces and to calculate the pressure exerted in the three different cases.
5. To determine the velocity of a pulse propagated through a stretched string/slinky.
6. To study the characteristic of *Spirogyra/Agaricus*, Moss/Fern, Pinus (either with male or female cone) and an Angiospermic plant. Draw and give two identifying features of the groups they belong to.
7. To observe the given pictures/charts/models of earthworm, cockroach, bony fish and bird. For each organism, draw their picture and record:
 - a) one specific feature of its phylum.
 - b) one adaptive feature with reference to its habitat.

8. To verify the law of conservation of mass in a chemical reaction.
9. To study the external features of root, stem, leaf and flower of monocot and dicot plants.
10. To study the life cycle of mosquito.

QUESTION PAPER DESIGN FOR SCIENCE (CODE NO. 086/090)
Class-IX (2016-17)

Time: 3 Hours

Max. Marks: 90

| S. No. | Typology of Questions | Very Short Answer (VSA) 1 Mark | Short Answer -I (SAI) 2 Marks | Short Answer -II (SAII) 3 Marks | Long Answer (LA) 5 Marks | Total Marks | % Weightage |
|--------|---|--------------------------------|-------------------------------|---------------------------------|--------------------------|---------------|-------------|
| 1 | Remembering (Knowledge based simple recall questions, to know specific facts, terms, concepts, principles, or theories, Identify, define or recite, information) | 3 | - | 1 | 1 | 11 | 15% |
| 2 | Understanding (Comprehension - to be familiar with meaning and to understand conceptually, interpret, compare, contrast, explain, paraphrase, or interpret information) | - | 1 | 4 | 1 | 19 | 25% |
| 3 | Application (Use abstract information in concrete situation, to apply knowledge to new situations, use given content to interpret a situation, provide an example, or solve a problem) | - | - | 4 | 1 | 17 | 23% |
| 4 | High Order Thinking Skills (Analysis & Synthesis - Classify, compare, contrast, or differentiate between different pieces of information, Organize and/or integrate unique pieces of information from a variety of sources) | - | 2 | - | 1 | 9 | 12% |
| 5 | Inferential and Evaluative (Appraise, judge, and/or justify the value or worth of a decision or outcome, or to predict outcomes based on values) | - | - | 2+1* | 2 | 19 | 25% |
| | Total (Theory Based Questions) | 3x1=3 | 3x2=6 | 12x3= 36 | 6x5=30 | 75(24) | 100% |
| | Practical Based Questions (PBQs) | 9x1=9 | 3x2=6 | - | - | 15(12) | |
| | Total | 12x1=12 | 6x2=12 | 12x3=36 | 6x5=30 | 90(36) | |

Note: The question paper of SA-II will include a section on Open Text Based Assessment (OTBA) of 10 marks. The case studies will be supplied in advance. This material is designed to test the analytical and higher order thinking skills of students.

* One question of 3 marks will be included to assess the values inherent in the texts.