Quality Improvement

&

Reference Manual

for

T.G.T. SCIENCE

September 2009

STATE COUNCIL OF EDUCATIONAL RESEARCH & TRAINING
NEW DELHI

Chief Advisor

Rakesh Mohan, *IAS*
Principal Secretary (Education)
GNCT of Delhi-cum-Chairperson, SCERT

Guidance

Chandra Bhushan Kumar, *IAS*
Director (Education) GNCT of Delhi

Rashmi Krishnan, *UTCS*
Director, SCERT

Daljeet Kaur
Additional Director, SCERT

Dr. Pratibha Sharma
Joint Director, SCERT-cum-State Pedagogy Coordinator

Dr. Pawan Sudhir
Secretary, SCERT

Coordinator & Editing

Dr. (Mrs.) S. V. Malik
Lecturer, SCERT

Contribution

Prof. Dr. Awtar Singh
DSME, NCERT

Prof. Dr. Hari Om Gupts
NCERT

Ansar Ahmad
Lecturer (Physics),
RPVV Thyagraj Nagar

Anil Kumar
Lecturer (Chemistry),
RPVV Thyagraj Nagar

Neelam Batra
Lecturer (Physics),
D.S. Arya Sr, Sec. School,
Lodhi Road

Ravinder Kumar
Principal, S.C.S.D. Sarvodaya
Vidyalaya, Sector-IX, Rohini

Dr. Pariksha Dabas
TGT (N.Sc.)
N.P. Coed. Sec. School
Laxmi Bai Nagar

Lalit Gupta
TGT (N.Sc.)
Govt. Boys Sec. School,
Hastsal

Sangeeta Ohri
TGT (N.Sc.)
S.C.S.D. Sarvodaya Vidyalaya
Sector IX, Rohini

Ashok Anand
Vice Principal
Govt. Boys Sec. School,

Dr. S. V. Malik
Lecturer, SCERT

Dr. Anamica Singh
Sr. Lecturer, SCERT

Shahbad Dairy

Mukesh Yadav, Publication Officer. State Council of Educational Research & Training, New Delhi

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19. NOTE FOR THE USER

The contemporary time is witnessing the radical changes in the milieu of pedagogy. The changes are sweet, satisfying, evolving and are heading toward our cherished goal of “quality improvement in education”. Student friendly syllabi, teacher orientation and training and Inset Programmes on regular basis combined with initiatives taken by Directorate of Education, has made the task possible to accomplish. Quality up gradation is evident from the results of board examination.

It is imperative on the part of the teacher to remain abreast and updated with recent trends and developments in the field of their study, and stay alert and competent. Keeping in mind the raised level of awareness among students in the present day time, it is the need of the hour that the teacher must gear up with latest trends and techniques. Periodic trainings are being imparted in this direction.

SCERT is prepared and competent enough to meet the emerging demands in the similar of education. Plethora of training is imparted in the field of planning, organization, administration, management at every level of primary, secondary, senior secondary schooling. Through these activities, our strides are heading toward quality improvement in education system. We wish that the science should not remain merely as a documented subject, rather should be related with our every walk of life. This is in consonance with the spirit of “National Curriculum Framework – 2005”.

SCERT is pleased to place the “Manual” in the hands containing identified hard spots, learning packages, easy scoring area and syllabus (including recent changes). Common errors committed by students and tips to excel in the examination are placed for the benefit of students/teachers.

EXCERPTS FROM NATIONAL CURRICULUM FRAMEWIRK-2005

NCF-2005 is designed by N.C.E.R.T with valuable inputs from educationist, teachers and parents. Under the chairmanship of Prof. YASHPAL, a core group committee of 35 learned persons prepared the NCF-2005 with valuable suggestions provided by 21 national focus groups.

DIRECTIVE PRINCIPLES (NCF-2005)

- Children's life at school must be linked to their life outside school.
- To ensure the learning free from rote process.
- Development of curriculum which provide opportunities of comprehensive development of child, instead of textbook centered.
- Evaluation process more flexible linking with class room activities
- Development of entity inherent with national concerns of democratic social order.

HIGH LIGHTS OF NCF-2005

- Strengthening the national management of education in society with diversities at different levels.
- Reduction in curriculum in the line of learning without burden.
- Constructive change through improvement in curriculum.
- Exercises in curriculum based on values inherent in our constitution – viz. Social justice, Equality and secularism
- To ensure quality education of call children
- Construction of civic society which is
  - having democratic practices
  - adherent to the values
  - caring for gender, SC/ST, CWSN
  - capability to take part in economic and political processes

NCF-2005

(Strategic changes in teaching-learning process)

THEN	NOW
• Teacher centered, static design	• Child
• Direction and decision of teacher	• Autonomy of the child
• Guidance of teacher	• Encourage to learn through co-operation
• Learning with passivity	• Active participation in learning
• Learning within four walls	• Learning in diverse social contexts
• Knowledge is fixed and "provided"	• Knowledge is created, evolves
• Discipline centered	• Multi-disciplinary learning vision
• Linear experience	• Multi-wayed and varied experiences
• Evaluation limited	• Continuous evaluation

4. SCIENCE

(Code No. 086 / 090)

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

Whereas the upper primary stage demands that plentiful 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.

COURSE STRUCTURE

CLASS IX (THEORY)

One Paper **Time : 2½ hours.** **Marks : 60**

	Unit	Marks
I.	Food	05
II.	Matter - Its nature and behaviour	15
III.	Organisation in living world	13
IV.	Motion, Force and Work	20
V.	Our Environment	07
	Total	60

Theme : Food (10 Periods)

Unit 1 : Food

Plant and animal breeding and selection for quality improvement and management ; use of fertilizers, manures; protection from pests and diseases; organic farming.

Theme : Materials (50 Periods)

Unit 2 : 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.

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 (45 Periods)

Unit 3 : 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, Thalophyta, Bryo phyta, Pteridophyta, gymnosperms and Angiosperms). Major groups of animals (salient features) (Non-chordates upto phyla and chordates upto classes).

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; chloroplast, mitochondria, vacuoles, ER, golgi apparatus; nucleus, chromosomes - basic structure, number.

Tissues, organs, organ systems, organism.

Structure and functions of animal and plant tissues (four types in animals; merismatic and permanent tissues in plants).

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 (60 Periods)

Unit 4 : 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, 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.

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 5 : 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, nitrogen

PRACTICALS

LIST OF EXPERIMENTS

Marks : 40 (20 + 20)

1. 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 of starch in water and egg albumin in water and distinguish between these on the basis of
      i) transparency
      ii) filtration criterion
      iii) stability

2. To prepare
   a) a mixture
   b) a compound

   using 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 solvant.
      iv) effect of heat.
3. To carry out the following chemical reactions and record observations. Also identify the type of reaction involved in each case.
   i) Iron with copper sulphate solution in water.
   ii) Burning of Magnesium in air.
   iii) Zinc with dilute sulphuric acid
   iv) Heating of Lead Nitrate
   v) Sodium sulphate with Barium chloride in the form of their solutions in water.
4. To verify laws of reflection of sound.
5. To determine the density of solid (denser than water) by using a spring balance and a measuring cylinder.
6. To establish the relation between the loss in weight of a solid when fully immersed in
   i) tap water
   ii) strongly salty water, with the weight of water displaced by it by taking at least two different solids.
7. To measure the temperature of hot water as it cools and plot a temperature-time graph.
8. To determine the velocity of a pulse propagated through a stretched string/slinky.
9. To prepare stained temporary mounts of (a) onion peel and (b) human cheek cells and to record observations and draw their labeled diagrams.
10. To identify parenchyma and sclerenchyma tissues in plants, striped muscle fibers and nerve cells in animals, from prepared slides and to draw their labeled diagrams.
11. To separate the components of a mixture of sand, common salt and ammonium chloride (or camphor) by sublimation.

12. To determine the melting point of ice and the boiling point of water.

13. To test (a) the presence of starch in the given food sample (b) the presence of the adulterant metanil yellow in dal.

14. To study the characteristic of spirogyra/Agaricus, Moss/Fern, Pinus (either with male or female conre) and an Angiospermic plant. Draw and give two identifying features of groups they belong to.

15. To observe and draw the given specimens—earthworm, cockroach, bony fish and bird. For each specimen record

    (a) one specific feature of its phylum

    (b) one adaptive feature with reference to its habitat.

SCHEME OF EVALUATION

Multiple choice type question written test (School based) : 20 Marks

Hands-on practicals examination (school based) : 20 Marks

CLASS X

(Theory)

One Paper **Time : 2½ hours** **Marks : 60**

Unit		Marks
I.	Chemical Substances	18
II.	World of living	16
III.	Effects of Current	10
IV.	Light	8
V.	Natural Resources	8
	Total	60

Theme : Materials **(55 Periods)**

Unit 1 : Chemical Substances - Nature and Behaviour

Acids, bases and salts : Their definitions in terms of furnishing of H+ and OH— ions, General properties, examples and uses, concept of pH scale (Definition relating to logarithm not required), importance of pH in everyday life; preparation and uses of sodium hydroxide, Bleaching powder, Baking soda, washing soda and Plaster of Paris.

Chemical reactions : Chemical Equation, Balanced chemical equation, Implications of a balanced Chemical equation, Types of chemical reactions : combination, decomposition, displacement, double displacement, precipitation, neutralization, oxidation and reduction.

Metals and non metals : Properties of Metals and Non-metals, reactivity series, Formation and properties of ionic compounds, Basic Metallurgical processes, corrosion and its prevention.
Carbon Compounds : Covalent bonding in carbon compounds. Versatile nature of carbon, Homologous series Nomenclature of carbon compounds containing, Functional groups (halogens, alcohol, ketones, aldehydes, alkanes and alkynes), difference between saturated hydrocarbons and unsaturated hydrocarbons, Chemical properties of carbon compounds (combustion, oxidation, addition and substitution reaction). Ethanol and Ethanoic acid (only properties and uses), soaps and detergents.
Periodic classification of elements : Modern Periodic table, Gradation in Properties.

Theme : The world of the living (50 Periods)
Unit 2 : World of Living
Life Processes : "living being"; Basic concept of nutrition, respiration, transport and excretion in plants and animals.
Control and Co-ordination in animals and plants : Tropic movements in plants; Introduction to plant hormones; control and co-ordination in animals : nervous system; voluntary, involuntary and reflex action, chemical co-ordination : animal hormones.
Reproduction : Reproduction in animal and plants (asexual and sexual). Reproductive health-need for and methods of family planning. Safe sex vs HIV/AIDS. Child bearing and women's health.
Heredity and evolution : Heredity; Model's contribution- Rules for inheritance of traits; Sex determination: brief introduction; Basic concepts of evolution.

Theme : How things work (35 Periods)
Unit 3 : Effects of Current
Potential difference and electric current. Ohm's law; Resistance, Resistivity, Factors on which the
resistance of a conductor depends. Series combination of resistors, parallel combination of resistors and its applications in daily life ; Heating effect of Electric current and its applications in daily life. Electric Power, Inter relation between P, V, I and R.
Magnetic effects of current : Magnetic field, field lines, field due to a current carrying conductor, field due to current carrying coil or solenoid; Force on current carrying conductor, Fleming's left hand rule. Electro magnetic induction. Induced potential difference, Induced current, Fleming's Right Hand Rule, Direct current. Alternating current; frequency of AC. Advantage of AC over DC. Domestic electric circuits.

Theme : Natural Phenomena (20 Periods)

Unit 4 : Reflection of light at curved surfaces, Images formed by spherical mirrors, centre of curvature, principal axis, principal focus, focal length. Mirror Formula (Derivation not required), Magnification.
Refraction; laws of refraction, refractive index.
Refraction of light by spherical lens, Image formed by spherical lenses, Lens formula (Derivation not required), Magnification. Power of a lens; Functioning of a lens in human eye, defects of vision and their corrections, applications of spherical mirrors and lenses.
Refraction of light through a prism, dispersion of light, scattering of light, applications in daily life.

Theme : Natural Resources (20 Periods)

Unit 5 : Management of natural resources : Management of natural resources. Conservation and judicious use of natural resources. Forest and wild life, coal and petroleum conservation. Examples of People's participation for conservation of natural resources.
The Regional environment : Big dams : advantages and limitations; alternatives if any. Water harvesting. Sustainability of natural resources.
Sources of energy : Different forms of energy, conventional and non-conventional sources of energy: fossil fuels, solar energy; biogas; wind, water and tidal energy; nuclear. Renewable versus non-renewable sources.
Our Environment : Eco-system, Environmental problems, their solutions. Biodegradable and non-biodegradable, substances.

PRACTICALS
LIST OF EXPERIMENTS

Marks : 40 (20 + 20*)

1. To find the pH of the following samples by using pH paper/universal indicator.
   i) Dilute Hydrochloric acid
   ii) Dilute NaOH solution
   iii) Dilute Ethanoic acid solution
   iv) Lemon juice
   v) Water
   vi) Dilute Sodium Bicarbonate Solution.
2. To study the properties of acids and bases HCl & NaOH by their reaction with
   i) Litmus solution (Blue/Red)
   ii) Zinc metal
   iii) Solid Sodium Carbonate
3. To determine the focal length of
   a) Concave mirror
   b) Convex lens
   by obtaining the image of a distant object.

4. To trace the path of a ray of light passing through a rectangular glass slab for different angles of incidence. Measure the angle of incidence, angle of refraction, angle of emergence and interpret the result.
5. To study the dependence of potential difference (V) across a resistor on their current (I) passing through it and determine its resistance. Also plot a graph between V and I.
6. To determine the equivalent resistance of two resistors when connected in series.
7. To determine the equivalent resistance of two resistors when connected in parallel.
8. To prepare a temporary mount of a leaf peel to show stomata.
9. To show experimentally that light is necessary for photosynthesis.
10. To show experimentally that carbon dioxide is given out during respiration.
11. To study (a) binary fission in Amoeba and (b) budding in yeast with the help of prepared slides.
12. To determine the percentage of water absorbed by raisins.
13. To perform and observe the following reactions and classify them into:
    i) Combination Reaction
    ii) Decomposition Reaction
    iii) Displacement Reaction
    iv) Double Displacement Reaction
    1. Action of water on quick lime.
    2. Action of heat on Ferrous Sulphate crystals
    3. Iron Nails kept in copper sulphate solution
    4. Reaction between Sodium sulphate and Barium chloride solutions.

14. a) To observe the action of Zn, Fe, Cu and Al metals on the following salt solutions.
    i) $ZnSO_4$ (aq.)
    ii) $FeSO_4$ (aq.)
    iii) $CuSO_4$ (aq.)
    iv) $Al_2(SO_4)_3$ (aq.)
    b) Arrange Zn, Fe, Cu and Al metals in the decreasing order of reactivity based on the above result.
15. To study the following properties of acetic acid (ethanoic acid) :
    i) odour
    ii) solubility in water
    iii) effect on litmus
    iv) reaction with sodium bicarbonate

Changed Syllabus

On referring the syllabus of CBSE 2009 & 2010, some changes in few units of Science Theory & in the list of practical IX & X have been done. The comparison of the two syllabus is given here in the Tabular form : (only changed / added / part shifted given)

A – Science Theory Class X

Unit No.	Syllabus	
	2009	2010
1.Chemicals subst-ances Nature & behaviour		
• Acids, bases & Salts	General Properties, example & uses.	General Properties, example & uses, concepts of pH scale, importance of pH in every day life, preparation and uses of Sodium Hydroxide, Bleaching Powder, Baking Soda, Washing Soda & Plaster of Paris.
• Metals & non-metals	Brief discussion of basic metallurgical processes, properties of common metals, elementary idea about bonding.	General properties of metals & non-metals, reactivity series, formation & properties of ionic compounds, basic metallurgical processes. Corrosion and its preventions.
• Carbon & compounds	Carbon compounds, elementary idea about bonding, saturated hydro carbons, alcohols, carboxylic acids, (No preparation only properties) some important chemical compounds – soap, cleansing action of soap	Covalent bonding in carbon compounds versatile nature of carbon, nomenclature of carbon compounds, functional groups, difference between saturated & unsaturated hydrocarbons, Ethanol and Ethanoic acid (only properties and uses), soap and detergents.
• Periodic classification of elements	Gradation in properties, Mendelevis periodic Table	Modern Periodic Table, Gradation in properties.
II – Our Environment	Our Environment – Environmental Problems, their solutions, Biodegradable & non-biodegradable ozone depletion.	Our environment shifted to unit V as such.
III – Effects of	Potential, Potential difference	Potential difference and electric

current	ohm's law, series-combination of resistors, parallel-combination of resistors, power, dissiflation due to current, inter relation between P, V, I & R	current, ohm's law, resistance, factors on which the resistance of a conductor depends, series combination of resistors, parallel combination of resistors, heating effect of electric current, electric power, inter relation between P, V, I and R
IV – Light	Convergence & divergence of light, image formed by concave mirrors, related concepts, centre of curvature, Principal axis, optic centre, focal length. Refraction – laws of refraction. Imaged formed by convex lens, functioning of lens in human eye, problems of vision & remedies, application of spherical mirrors & lenses. Application of concept of refraction, velocity of light, refractive index, twinkling of stars, dispersion of light, scattering of light	Reflection of light at curved surfaces, images formed by spherical mirrors, centre of curvature, principal axis, principal focus, focal length, mirror formula (derivation not required), magnification. Refraction – Laws of refraction, refractive index. Refraction of light by spherical lenses, image formed by spherical lenses, functioning of a lens in human eye, problem of vision & remedies, application of spherical mirrors, lenses, refraction of light through prism, dispersion of light, scattering of light, application in daily life
V – Conservation of natural resources : Sources of Energy Our Environemnt :	Management of natural resources conservation and judicious use of natural resources, forest and wild life, coal and petroleum conservation, people's participation, chipko movement, legal perspective in conservation and international scenario. Different forms of energy, leading to different sources for human use, fossil fuels, solar energy, biogas, wind water and tidal energy, nuclear energy, renewable versus non-renewable sources.	Management of natural resources, conservation and judicious use of natural resources, forest and wild life, coal and petroleum conservation, example of people's participation for conservation of natural resources. Different forms of energy, conventional and non-conventional sources of energy, fossil fuels, solar energy, bio gas, wind, water and tidal energy, nuclear energy, renewable versus and non-renewable sources. Eco-system, Environmental problems, their solutions,

	It is in unit II	Biodegradble & non-biodegradables substances, ozone depletion.

Changed in Practical List IX & X Science

Class IX

Experiment No.	2009	2010
3.	To study the extent of cooling caused by evaporation of the following liquids, using a thermometer, also to arrange these liquid in the increasing order of the extent of cooling produced i) Water ii) Alcohol iii) Ether	To carry out the following chemical reactions and record observations. Also identify the type of reactions involved in each case. i) Iron with copper sulphate solution in water ii) Burning of Magnesium ribbon in air. iii) Zinc with dil. Sulphuric acid. iv) Heating of lead nitrate. v) Sodium sulphate with Borium chloride in the form of their solution in water
13.	To observe the onion peel ceels. Placed in Hypertonic solution under the microscope and draw labeled diagram of the same.	To test (a) the presence of starch in the given food sample (b) the presence of the adulterant material yellow in dal.

Class X

Experiment No.	2009	2010
13.	To prepare SO_2 gas, observe its following properties and draw inferences in respect of i) Order ii) Solubility in water iii) Effect on litmus paper iv)actions on acidified $K_2Cr_2O_7$ solutions	To perform & observe the following reactions & classify them into: i) Combination reaction ii) Decomposition reaction. iii) Displacement reaction. iv) Double decomposition reaction. 1. Action of water on quick time. 2. Action of heat on $FeSO_4$ crystals. 3. Iron nails kept in $CuSO_4$ solution 4. Reaction between Na_2SO_4 and $BaSO_4$ solutions.

Restructuring of assessment in Practical work in Science at secondary level

The revised scheme of annual assessment in the subject in classes IX-X is as under:

Theory Examination : 60 Marks

Practical Examination : 20 + 20 = 40 Marks

The Practical Examination has two components :

a) Hands-on school based year-end practical components : 20 Marks
(Internal in Class X)

b) Practical skill based Multiple-choice question type year-end written examination : 20 Marks
(External in Class X)

Component (a) of the above examination will be conducted at school level for classes IX as well X whereas the component (b) above is to be conducted at school level for class IX and at Board's level for Class X.

The new scheme will be applicable from March 2007 Class X Examination. The contents of this document are also available on CBSE website www.cbse.nic.in. Following aspects of the new scheme deserve special attention :

a) The hands-on practical examination for 20 marks for class X also is to be conducted at school level.

b) Every student will perform all the fifteen experiments included in the practical syllabus during the academic year. The students are required to maintain proper record file of the practical work done. The Board may ask any school to produce this practical file work done by the students as well as the procedure and record of assessment in practical work.

c) The new scheme has been introduced with the objective of laying greater emphasis on acquisition of practical skills through experimentation.

d) The scheme of Board's examination for Class X March, 2007 Examination in the subject will be as under :-

Theory paper	:	60 Marks	:	2½ hrs.
Multiple-choice question type Written exam in practical skills	:	20 Marks	:	1½ hrs.

DESIGN OF QUESTION PAPER
X - SCIENCE (THEORY)

Time : 2½ Hours **Max. Marks : 60**

The weightage to marks over different dimensions of the question paper shall be as under:

A. Weightage to Content/Subject units

S.No	Content Unit	Marks
1.	Chemical Substances	18
2.	World of living	16
3.	Effects of current	10
4.	Light	8
5.	Natural Resources	8
	Total	**60**

B. Weightage to forms of Questions

S.No.	Form of Questions	Marks for each question	No. of questions	Total Marks
1.	Very short answer type (VSA)	01	09	09
2.	Short answer type (SA I)	02	09	18
3.	Short answer type (SA II)	03	06	18
4.	Long answer type (LA)	05	03	15
	Total		**27**	**60**

C. Number of Sections

The question paper will have two sections A & B

D. Scheme of Options

There will be no overall choice. However, there is an internal choice in every question of five marks category.

E. Weightage to difficulty level of questions

S.No.	Estimated difficulty level of questions	Percentage
1.	Easy	15
2.	Average	70
3.	Difficult	15

F. Typology of Questions

In order to assess different abilities related to the subject, the question paper includes open-ended questions, drawing/illustrations based questions, communication-skill based questions and activity-based questions.

About 20% weightage has been assigned to questions testing higher order thinking skills of learners.

CATEGORIES OF PRACTICAL SKILLS

A. Procedural and Manipulative Skills

To

- Select appropriate apparatus / instruments for performing the experiment.
- Know the limitations of the apparatus / instruments regarding their size, least count and accuracy.
- Arrange / assemble / set and adjust the apparatus systematically.
- Handle the apparatus, instruments, chemicals carefully to avoid any damage or injury.
- Perform the experiment with reasonable efficiency and accuracy.
- Separate and remove desired parts of a specimen for detailed study without damaging it.
- Use appropriate methods and materials for specimen mounting.
- Locate and rectify the errors in apparatus, instruments, etc.
- Add chemicals in appropriate quantity.
- Dismantle the experimental set-up carefully.
- Practice the precautions in handling sensitive apparatus or chemicals or flame.

B. Observational Skills

To

- Find the least count of the instrument.
- Read the instrument correctly.
- Notice colour change, evolution of gases, formation of precipitates, chemical reaction, etc., carefully.
- Notice the relevant details in the given specimens minutely.
- Locate the desired parts in a specimen accurately.
- Take observations carefully and in a systematic a manner.
- Read graph correctly.

C. Drawing Skills

To

- Make proper observation tables
- Draw circuit diagrams, ray diagrams, experimental set-ups, sketches etc correctly and proportionately.
- Label sketches and diagrams correctly.
- Draw graphs from observed data correctly.

D. Reporting and Interpretative Skills

To

- Make a proper plan for recording the observations.
- Record the observations/data/information correctly and systematically.
- Classify and categorize organisms.
- Make correct calculations/predictions.
- Use proper formulae and mode of summarizing and reporting the result.
- Report the result using correct symbols, units, terms and chemical equations.
- Interpret the observations and results correctly.

DESIGN OF THE QUESTION PAPER
Science and Technology (Class X)
Testing of Skills (Multiple Choice Type Test)

Time : 1½Hours **Max. Marks : 20**

A. UNIT-WISE WEIGHTAGEs

S.No	Content Unit	Chapters	Weightage
1.	Chemical Reactions and Some Important Chemical Compounds	1, 2	2.5
2.	Energy	3, 4, 5, 6, 7	6.5
3.	Life Processes	8, 9, 10, 11, 12	7.0
4.	Natural Resources	13, 14, 15	4.0

B. UNIT-WISE WEIGHTAGE

Most questions involve multiple skills and it may not be possible to precisely assign a particular skills to a specific question. The skill-wise weightage given in the table below, may, therefore, be considered as only indicative of what is required in the question paper.

Skills	Weightage
Procedural and Manipulative Skills	35%
Observational Skills	35%
Drawing Skills	15%
Reporting and Interpretative Skills	15%
Total	**100%**

C. QUESTION-WISE WEIGHTAGE

All the 30 questions are of the multiple choice variety having only one correct answer each. Part A of the question paper contains 20 questions, each carrying 0.5 mark. Part B contain 10 questions, each carrying 1 mark.

D. DIFFICULTY-WISE WEIGHTAGE

S.No	DIFFICULTY LEVEL	Weightage
1.	Easy	15
2.	Average	70
3.	Difficult	15

E. EXPECTED TIME

Approximate time for reading and answering one question	:	2.5 minutes
Revision time	:	15 minutes
Total	:	1 hour 30 minutes

METHODOLOGY FOR TEACHING SCIENCE SUBJECT

Dr. S. V. Malik, Lecturer, SCERT

The place of Teacher is in between the curriculum and the student primarily the person to impart the learning points, so must have the updated knowledge of the content areas of the subject. The value addition and upgradation of teacher can be done through –

- Self generated material.
- Question bank and sample papers,
- Inservice training, guest lecturers,
- Seminar and workshops,
- Web and library etc.
- Audio-visual aids

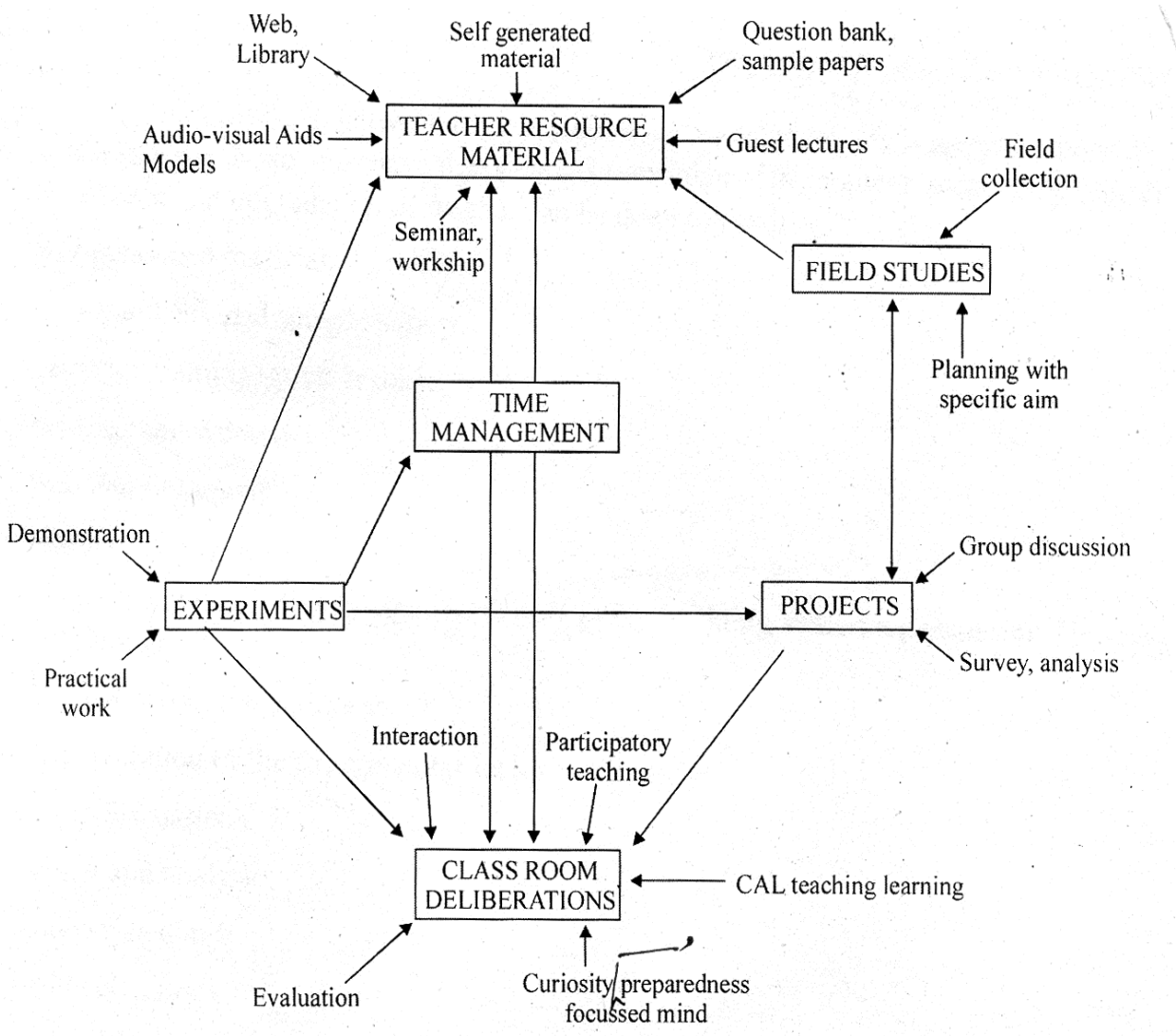
The experiment part is highly significant as learning becomes permanent by doing. This can be achieved through –

- Practical work in laboratories
- Demonstration of the experimental set up
- Group discussion
- Survey and analysis
- Audio-visual aids
- Field collections
- Project work etc.

The classroom is the place where learning outcomes are enacted. The optimum purpose can be achieved through –

- Chalk Board
- Discussion
- Interaction
- Computer aided learning
- Evaluation

Time management, specific planning with aim, preparedness and focused mind are the aspects which enable the maximum achievement and success.



ABSTRACT – METHODOLOGY FOR TEACHING SCIENCE

For further information contact

Dr. S. V Malik

Lecturer, SCERT

Defence Colony

New Delhi

CHAPTER-WISE LIST OF ACTIVITIES IN PHYSICS (CLASS X)

CHAPTER	ACTIVITIES	ITEMS REQUIRED
10. LIGHT REFLECTION AND REFRACTION	1. Compare the images formed on two surfaces of a spoon.	A large spoon
	2. Convergence by a concave mirror.	A concave mirror, sheet of paper
	3. Image formation by a concave mirror for different position of the objects.	Concave mirror, paper screen, candle, Match Box, Two stands holding mirror and candle.
	4. Ray diagrams for image formation by a concave mirror.	Pencil, Scale, compass, Sheet of paper. Convex mirror, Pencil.
	5. Image formation by a Convex mirror.	Plane, Concave on Convex mirror.
	6. Full length image formation by different mirrors.	Bucket filled with water, Coin.
	7. Phenomenon of refraction of light by putting a coin in bucket filled with water.	Shallow Bowl, Coin, Water.
	8. Appearance of coin slightly raised above its actual position.	Glass slab, paper, ink pen, scale.
	9. Viewing at the line from the top of glass slab.	Glass slab, Alpins, sheet of paper, drawing board.
	10. Refraction of light through a glass slab.	Convex lens, Scale
	11. Rough focal length of a Convex lens.	Convex lens, paper screen, candle, Match Box Two lens stand.
	12. Image formation by a Convex lens for different position of the object.	Concave lens, screen, candle, Match Box, lens stand.
	13. Image formation by a concave lens.	
11. HUMAN EYE AND THE COLOURFUL WORLD	1. Refraction of light through a triangular glass prism.	Glass prism, sheet of paper, Alpins, Drawing pins, Drawing Board, Pencil, Scale.
	2. Dispersion of white light through a glass prism.	Cardboard, Glass Prism, Screen.
	3. Scattering of light.	Sources of white light Convex lens, Glass tank, cardboard, screen conc. H_2SO_4, Sodium

		thiosulphate
12. ELECTRICITY	1. Relation between V and I and plot a graph between V and I	4 dry cells, ammeter voltmeter, plug key resistance wire, connecting wires.
	2. Resistance of a Conductor (current is diff. for diff. components)	Nichrome wire, torch bulb, Ten watt bulb, ammeter, plug key connecting wires.
	3. Factors on which the resistance of a conductor depends.	Cell, Ammeter, plug key, Nichrome wires of diff. length and thickness Copper wire of same length and thickness.
	4. Change in value of current when resistances connected in series.	3 resistors, Ammeter Battery, Key. Connecting wires.
	5. Relation between V, V_1, V_2 or V_3 when resistors are in series combination.	3 resistors, Ammeter Battery, Key. Connecting wires.
	6. Measuring of current and potential difference when resistances connected in parallel combination.	Ammeter, Voltmeter 3 Resistors, Connecting wires, battery, Key
13. MAGNETIC EFFECTS OF ELECTRIC CURRENT	1. Electric current through a conductor exhibits magnetic field.	Thick copper wire compass needle, 4 cells, plug key variable resistance.
	2. Magnetic field lines around a bar magnet using compass needle.	Bar magnet, Iron fillings, sheet of paper.
	3. Draw field lines around a bar magnet using compass needle	White sheet of paper, drawing board, bar magnet, Magnetic needle.
	4. Magnetic field due to a current carrying conductor.	Battery of 4 cells, plug key, compass needle, copper wire.
	5. Magnetic field due to a current through a straight conductor.	Cardboard, Battery, Ammeter, variable resistance, plug, key connecting wires.
	6. Magnetic field due to current carrying circular coil.	Card board, 4 cells, plug key, circular loop, connecting wires.
	7. Force on a current carrying conductor in a magnetic field.	Aluminum Rod, Horse-

	8. Producing induced potential difference across a coil. 9. Induced current from coil-1 to coil-2.	she Magnet, 4 cells, plug key, wooden stand, connecting wires. Coil, Magnet galvanometer Two different coils, battery, plug key galvanometer

CHAPTER-WISE LIST OF ACTIVITIES IN CHEMISTRY (CLASS X)

CHAPTER	ACTIVITIES	ITEMS REQUIRED
1. Chemical reaction and Equations	1. Burning of Magnesium ribbon in air.	Magnesium ribbon, sand paper, long burner/spirit lamp, watch glass.
	2. Reaction of lead nitration solution with potassium iodide solution.	Lead nitrate salt, potassium iodide, salt, water, beakers.
	3. Reaction of zinc granules with dil. Hydro-chloric acid.	Zinc granules, dil. Hydrochloric acid, conical flask, cork, glass tube.
	4. Reaction of quick lime (calcium oxide) with water.	Calcium oxide, water, beaker.
	5. Heating of Ferrous sulphate crystals in a boiling tube.	Ferrous sulphate crystals, hard boiling tube, burner.
	6. Heating of solid lead nitrate in a boiling tube.	Lead nitrate, boiling tube, burner
	7. Electrolysis of water.	Electrolysis apparatus, water.
	8. Silver chloride exposed to sunlight.	Silver chloride (Solid), watch glass.
	9. Reaction of copper sulphate with iron.	Test tubes, iron nail, copper sulphate solution, stand.
	10. Reaction of sodium sulphate with barium chloride solution.	Sodium sulphate & barium chloride salts, two test tubes, water.
	11. Heating of copper powder.	Copper powder, China dish, Tripod, Wire gauze, Burner.
2. Acids, bases and salts.	1. Testing the samples solution of acids & bases available in the laboratory by using red litmus, blue litmus, phenolphthalein and methyl orange solution. Tabulate	Hcl, H_2SO_4, HNo_3, CH_3COOH, NaOH,$Ca(OH)_2$, kOh, $Mg(OH)_2$, NH_4OH, Methyl orange, blue litmus, red litmus & phenolphthalein

	observation in table 2.1.	solution, test tubes & test tube stand.
	2. Testing the acidic & basic substances by using olfactory indicators.	Onion, Clove, cloth strip, acidic & basic substances, dil. NaOH, dil. Hcl, test tubes etc.
	3. Reaction of Zinc granules with dil. Sulphuric acid &testing of hydrogen gas produced.	Apparatus shown in fig 2.1, page 19, NCERT, candle, match box etc.
	4. Reaction of zinc granules with dil. Sodium hydroxide solution & testing the hydrogen gas produced.	Zinc granules, dil. H_2SO_4, dil. Sodium hydroxide solution.
	5. Reaction of Na_2CO_3 & $NaHCO_3$ with dil. Hcl & testing the CO_2 gas produced.	Appratus shown in fig. 2.2, page 20 of NCERT, Na_2CO_3, dil. Hcl, slaked lime, etc.
	6. To observe the effect of a base on an acid & vice-versa using phenolphthalein as an indicator.	Dil. Hcl, dil. NaOH, Phenolphthalein.
	7. Reaction of copper oxide with dil. Hydrochloric acid to form salt & water.	Copper oxide, dil. Hcl, beaker
	8. To investigate the glucose, alcohol, Hcl & H_2SO_4 compounds containing hydrogen are acidic.	Beaker, Glucose, alcohol (ethanol) Hcl, H_2SO_4, bulb, battery, water, wire etc.
	9. To observe that hydrogen ion in Hcl are produced in presence of water. (Preparation of Hcl gas by action Nacl & H_2SO_4)	Test tube, Nacl & H_2SO_4 solutions, delivery tube, litmus paper (blue).
	10. To study the effect when water is added to an acid and to a base (heat is evolved & dilution occurs)	Beaker, conc. H_2SO_4, NaOH pellets, Water.
	11. Test the pH values of the solution given intable 2.2	Soil, water, beaker, litmus paper (blue & red both)
	12. To check the pH of soil by mixing in water.	
	13. To find the family of salts by writing the molecular formula of various salts.	
	14. To find (a) solubility (b) nature of salt using litmus paper (c) pH value using Ph paper of the various salts samples. Record observations in table 2.4.	
	15. To show copper sulphate	$CuSO_4$ crystals, boiling tube, burner tongs,

	crystals contain water.	
3. Metals & non-metals	1. To observe the metallic lusture of various metal strips on rubbing.	Samples of iron, copper, aluminium and magnesium, sand paper.
	2. To study the hardness of various samples of metals by cutting with knife.	Above metal samples, knife, sodium metal, filter paper.
	3. To study the malleability of metal on hammering the pieces of Fe, Ca, Za, Pb.	Pieces of Fe, Cu, Zn, Pb and a hammer.
	4. To study the ductility of metals.	Small pieces of metallic wires.
	5. Observation of heat conductivity of metals by using a nail fixed on a wire.	Wax, iron nails, iron stand, burner.
	6. Observation of electrical conductivity of metals.	Battery, bulb, switch, wire, different metal wires.
	7. To carryout the activities from 1 to 6 with non-metals which are carbon (coal or graphite), sulphur & iodine.	Sulphur pieces, coal pieces, crystals of iodine, graphite rod.
	8. Testing the nature of Magnesium oxide & sulphus dioxide.	Sulphur powder, magnesium ribbon, red litmus, blue litmus, watch glass, water.
	9. Burning of metals samples over the flame & arrange them on decreasing order of reativity.	Metal sample, burner, a tong.
	10. Testing the reaction of metal sample with water (cold water, hot water) and steam, also no reaction with water. Arrange them in decreasing order of reactivity with water.	Metal samples, water (hot & cold) spirit lamp/burner, beaker, test tube, etc.
	11. To observe the reaction of metals (Except Na &k) with dil. Hcl. Arrange them in decreasing order of their reactivity.	Metal samples, dil. Hcl Iron nail, copper sulphate solution, test tubes, stand.
	12. To study the displacement reaction of iron with copper sulphate solution.	Nacl, KI, $Bacl_2$, beaker, wire, battery, bulb, water, graphite rod, etc.
	13. To study the properties of ionic compounds by taking the samples of Nacl, KI, $Bacl_2$ etc.	Three test tubes, iron nails, water oil, $Cacl_2$, Cork.
	14. To find out conditions under	

	which the iron rusts.	
4. Carbon and its compounds	1. Listing of ten things used/consumed since morning & categorized on the basis of their constituents in the table given. 2. To calculate the difference in the formulae and molecular masses for the alcohol series compounds, up to four carbon atoms. 3. To observe the nature of flame of carbon compounds (naphthalene, camphor, alcohol) on the flame. 4. To observe the flame in a burning bunsen burner by adjusting the hole. 5. To study the change in ethanol on adding the alkaline solution of $kMnO_4$. 6. Reactions of sodium with ethanol. 7. To compare the pH of dil. Acetic acid and dil. Hcl using litmus paper and indicator paper both. 8. To study the reaction of ethanol with acetic acid (esterification). 9. To study the reaction between acetic acid of Na_2CO_3 and $NaHCO_3$. 10. To demonstrate the effect of soap in cleaning. 11. To observe the foaming capacity of different sample of water with soap. 12. To observe the foaming capacity of different sample of water with detergent.	Naphthalene, camphor, ethanol, burner, metal plate. Bunsen burner, match box. Ethanol, $KMno_4$ crystals, NaOH, water, test tube. Sodium piece, ethanol, water, watchglass. Acetic acid, Hcl, litmus paper, pH paper, water. Acetic acid, ethanol, beaker, test tube, tripod, wire gauge, burner, water. Solid $NaHCO_3$ & Na_2CO_3, acetic acid, test tubes, passing tube, lime water etc. Test tubes, cooking oil, soap solution. Distilled water, hand pump water, soap, test tubes, stand. Above samples of water, liquid detergent.
5. Periodic classification of elements	1. Cooking the resemblance of hydrogen with alkali metals &the hydrogen family in the	Chart of Mendleev's periodic table (given in the book).

	mendleev's periodic table. 2. To study the placing of isotopes of chlorine (cl-35, cl-37) in Mendeleev's periodic table. 3. To observe the position of cobalt, nickel & hydrogen in Mendeleev's periodic table. 4. Writing electronic configuration of 1^{st} three element of 1^{st} group & group & study the valance electrons. 5. Writing electronic configuration of the elements of 2^{nd} period and study the same number of shell in them. 6. To study the change in valancy in a period from left to right in the periodic table. 7. To study the change in the atomic radius of the elements from left to right in a period. 8. To study the change in atomic size in a group from top to bottom. 9. Examining the elements of third period & classifying them into metals & non-metals. 10. To study the change of electrons in elements along a period & a group of periodic table. 11. To study the tendency of elements to gain electrons across a period and down in a group of modern periodic table.	Modern periodic table. Modern periodic table. Modern periodic table. Modern periodic table. Modern periodic table. Modern periodic table. Modern periodic table.

CHAPTER-WISE LIST OF ACTIVITIES IN BIOLOGY (CLASS X)

CHAPTER	ACTIVITIES	ITEMS REQUIRED
6. Life Process	1. To show that photosynthesis occurs in green leaves and to confirm that chlorophyll is essential for autotropic nutrition.	A potted plant with variegated leaves e.g. money plant or croton, 500ml beaker, 100ml beaker, alcohol, Iodine soln., burner.
	2. To show that Carbon dioxide is essential for photosynthesis.	Two healthy potted plants, glass plates, watch glass, KOH, 2 bell jars, Vaseline, 500ml beaker, 100ml beaker, alcohol, burner and Iodine soln.
	3. To show that saliva breaks down starch to give simple sugar and that digestion of starch begins in the mouth.	Two test tubes, 1% starch soln. test tube stand, dilute Iodine solution.
	4. To show that the air that we breathe out contains CO_2.	Freshly prepared Lime water, 2 test tubes, a syringe.
	5. To show that CO_2 is produced when anaerobic respiration takes place, as in fermentation.	Yeast powder, sugar soln. or fruit juice, 2 test tubes, one holed cork, bent glass tube, freshly prepared lime water.
	6. To show that aquatic organisms need to breathe faster than terrestrial organisms as the amount of dissolved Oxygen is fairly low as compared to O_2 in the air.	An aquarium with fishes.
	7. To find out the normal range of hemoglobin content in human beings and how it varies with age and sex.	This activity requires a visit to the local Health Centre.
	8. To show that transpiration takes place from the aerial parts of the plants to help in the absorption and upward movement of water and minerals dissolved in it from roots to the leaves.	Two small pots of approx. same size and having same amount of soil with a plant in one pot, plastic sheets and sticks.
	9. To demonstrate that sense of smell influences the sense of taste in most of the food items that we eat.	Some food items like sugar, fruits etc.
7. Control and Coordination	10. To demonstrate Phototropism and Geotropism in plants	A conical flask, wire mesh, freshly germinated bean

		seeds and a cardboard box.
8. How do organisms reproduce?	11. To demonstrate budding in yeast (an example of asexual reproduction)	100ml beaker, test tube, cotton, 10gm sugar, yeast granules, slide, cover slip and microscope.
	12. To demonstrate that spore formation is also a mode of asexual reproduction in some multicellular organisms.	Slice of bread, magnifying glass.
	13. To study binary fission in unicellular organisms.	Permanent slide of Amoeba and microscope.
	14. To study fragmentation as a mode of asexual reproduction in some multi-cellular organisms with simple body organization.	Water from a lake or pond that appears dark green and contains filamentous structures, slide, cover slip and microscope.
	15. To demonstrate that some plants reproduce by vegetative propagation of stems.	A potato, knife, a tray and cotton.
	16. To demonstrate vegetative propagation of leaves.	Leaves of Bryophyllum and Money plant and conical flasks.
	17. To demonstrate that seeds formed as a result of sexual reproduction in plants contain the embryo which develops into a seedling under appropriate conditions.	Few seeds of Bengal Gram soaked overnight, wet cloth.
9. Heredity and Evolution	18. To demonstrate the rules of inheritance by studying the inherited similarities and differences.	This activity requires careful observation skills only. (Human traits)
15. Our Environment	19. To study the waste materials generated in our homes and to categorise them into Bio-degradable and Non Bio-degradable waste.	Waste material from home (Kitchen waste empty cartons, milk packets, medicine bottles, strips, bubble packs, torn clothes, broken glass, footwear etc.), an old bucket, flower pot and soil.
	20. To study a man-made artificial Ecosystem.	An Aquarium, an Oxygen pump (aerator), fish food, some aquatic plants and small aquatic animals.

Word – Meaning

Understanding of New terms in biology becomes simpler if we dissect the word. The new term may have prefix, the word rot and often a suffix. Recognition of all these words always help in the studies. The scientific terms/words have greek/latin origin.

a, an- less, lack

ante- forward

anti- against

bi- two

bio- life

circum- circ-around

contra- against

crypt- hidden

cyt- cell

di-two

dis-apart, not

endo- inner

epi- on, upon

eu- good, well

ex- out of

hemi- half

hetero- other, different

homo- hom- same

hyper- excessive, above normal

hypo- under, below

im- not

inter- between, among

intra- within

iso- equal

mal – bad, abnormal

mega- large, great

meta- after, beyond

new- new
oo- egg
para- near, beside
pre- before
semi- half
trans – across, beyond

Suffix

-cide kill, destroy
-gen something produced or generated
-ic pertaining to
-ous, full of
-scope instrument for viewing or observing

Some common word roots

Blast a formative cell, germ layer
Bronch branch of the trachea
Chol bile
Derm skin
Enter intestine
Gastr stomach
Hist tissue
Hydr water
Leuk white
Mamm breast
Micro small
Nephr kidney
Odont, tooth
Sclera hard
Thromb clot
Ur urea, urine

Improvised Science Kit

Generally the students are taken to science laboratory for performing experiments but all the time it is not possible and worthwhile to go to lab for science activity. Some activities can be performed in the classroom by using daily house-hold and kitchen items. E.g.

(a) To Find pH value and know the nature of different substances one can take the substances from the kitchen like lemon, carrot, vinegar, tomato, milk curd, washing soda, soap etc.

(b) Broken mirror pieces can be utilized to make the students understand the concept of image formation.

For this, every science teacher must make his/her own science – Kit.

The following items can be kept in improvised Science – Kit.

Items which can be obtained from the Laboratory

1. pH paper
2. Litmus paper
3. Metal pieces (Aluminium, Copper, Iron Zinc, Magnesium)
4. Concave Mirror
5. Convex mirror
6. Concave lens
7. Convex lens
8. Prism
9. Glass slab
10. Cells or Battery
11. Connecting Wires
12. Ammeter
13. Voltmeter
14. Resistance wire
15. Magnets
16. Iron fillings
17. Compass Needle
18. Beakers

19. Test tubes
20. Slides
21. Petridish
22. China dish
23. Magnifying glass
24. Small Quantities of CuS_{O4}, FeS_{O4} or $Al_2 (SO_4)_3$.

General Items which canbe obtained from Outside Source

1. Iron nails
2. Common salt
3. Washing Soda
4. Soap Solution
5. Comphor
6. Aluminium Foil
7. Copper wire
8. Knife or Blade
9. Plastic bottle
10. Plane mirror pieces
11. Glass pieces
12. Empty medicine bottles
13. Cardboard
14. Tennis Balls
15. Alpins.

NCERT SECONDARY SCIENCE KIT

1. ABOUT THE KIT

The NCERT Secondary Science Kit with its manual provides various learner-centred activities on the chapters of Science Text books for class IX and X based on new syllabus developed by NCERT besides the facility to do the practical prescribed by CBSE for IX and X. These activities / practicals are meant to encourage the students to explore science concepts through their observations and to understand these concepts through various activities / experiments. In order to link the content, the names of the chapters of the text books have been mentioned.

The manual describes the activities most of which can be performed using items in the kit. However, some activities may require some items easily available from the surroundings. Each chapter has problem oriented topic (in an interrogative form). In case, you are interested in additional activities, you are at liberty to do so, given in extension activities.

In order to guide your activities, structured performing steps are suggested to facilitate the sequential development of the concepts. Motivational questions on the activity are also suggested. Wherever, required, the answer-clues for some questions are given. Materials required to perform the activity are also suggested.

NCERT Secondary Science Kit contains scientific and general items, some chemicals, glassware, tools, etc. Attempts have been made to make the items.

- Low cost
- Multipurpose
- Microscale

The best examples are W-tube, laboratory stand-cum-vise, compound and dissecting microscopes, belljar for electrolysis, electroscope, lung apparatus, etc.), kerosene burner, slides, coils, optics kit, spring balance, etc.

- The Science Kit has the following advantages:
- Availability of necessary piece of apparatus at one place.
- Multipurpose use of items.
- Economy of time in setting up of experiments.
- Portability from one place to another.
- Low cost.

The kit replaces the traditional science laboratory. There has been special provision of use of microscale chemistry lab technique which reduces the wastage of chemicals, hazards and provides pollution free atmosphere, besides other innovative materials.

II. SCIENCE LEARNING APPROACH

There has been a rapid expansion of scientific knowledge in recent years. Realization of the relevance of science education as reflected in human thought, style,

social values and culture have been made it imperative to upgrade the curriculum and learning approaches of science in order to improve the quality of life. To make a student (learner) a scientifically literate citizen as envisaged in the National Policy on Education (1986) and NCF 2005, there is an imperative need for the learner to :

- Understand and apply the basic concepts of science,
- Learn scientific inquiry skills of gathering information,
- Develop desirable attitudes and value appreciation for truth and objectivity,
- Nurture creative talents,
- Learn scientific method and apply it in solving problems and making decisions to improve everyday living and environmental conditions and to promote development and use of technology.

For achieving these objectives, it is necessary to shift emphases from rote memory based, content-oriented and teacher-centred method of teaching, to :

- Problem solving-based,
- Activity oriented,
- Performance-based, and
- Learner-centred approaches.

These approaches would require learner to :

- Investigate,
- Develop observation skills,
- Record observations,
- Structure, organize and communicate information,
- Hypothesise,
- Collect and analyse data,
- Draw relevant inferences,
- Design solutions and act accordingly.

Activity-based learning makes science more interesting, motivating, effective and meaningful. This provides plenty of opportunity for thinking, reasoning and looking at science in its totality as a highly rational, intellectual problem-solving human activity. This would help in developing qualities like self-confidence, curiosity, initiative, inventiveness, self-reliance, persistence and skills of innovation to solve problems in real life situations. However, to make the best use of the learning situations, it is very essential that the teacher is provided with effective instructional materials in addition to the textbooks. As a teacher you have to plan before hand, outline the general directions and prepare yourself adequately to conduct an investigation. You should read the subject matter from the textbook and this manual. Then, you can make note of scientific ideas, their applications, in daily life and the learning precesses that may be developed through an investigation. In this

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GRADING SYSTEM FOR SCHOOLS

INTRODUCTION

The Reforms in the examination is one of the important areas in which all Committees and Commissions on Education had made number of recommendations. The reforms were once again revisited in National Curriculum Framework (NCF) – 2005. The Position Paper on Examination Reforms has reiterated number of reforms such as introduction of the grading system, implementation of the school based continuous and comprehensive evaluation, use of multiple techniques of testing, online and on-demand examinations, abolishing pass/fail declaration etc. Since National Policy on Education (NPE) 1986, the issue of grading system has been discussed and debated upteen number of times in the National Conferences of the Chairpersons of the Boards of School Education. Some of the boards have attempted to introduce grading system both in scholastic and non-scholastic areas. The examples can be sited of Central Board of Secondary Education and Kerala Board of Public Examination, Goa Board of Secondary and Higher Secondary Education, Haryana Board of School Education. All these boards don't have a uniform system of grading as each one is doing in its own way. Inspite of that the unreliable raw marks still continue to dominate the examination results which promote unhealthy competition among the children (even among parents) at different stages of school education.

THE GRADING SYSTEM

The 'word grade' is derived from the Latin word ***gradus*** where it means 'step'. Grading in a process wherein subjects may be classified on the basis of pre-defined standards and minimised misclassification. In educational context, grading is essentially a method of communicating measurements of students' achievement. It involves the use of a set of symbols or numerals that ought to be clearly defined and uniformly understood by the students, teachers, parents and all others stakeholders. The absence of either of these will defeat the very purpose of awarding grades.

To measure achievement in terms of exact numbers like 50 or 51 it is difficult therefore, a better way of classifying and certifying students into different classes and categories is to put them into certain ranges or bands or **grades**. Therefore, students of similar ability will be put in a one group known as a **grade**. Thus the entire 101 point scale from 0 to 100 marks can be divided into **5 point** or **7 point** or **9 point** scale depending upon our requirement. For example all students having marks between 91-100 can be awarded **grade A** and those from 81 upto 91 can be awarded **grade B** and so on. In this way the mis-classification of students will be minimised over a large range of marks but it will remain at the cut off points of each grade. The score at the cut off points can be re-examined and if possible the benefit can be passed on to the students by awarding higher grade if the experts feel so. To enhance the usefulness of these grades for the purpose of awarding merit scholarships or admissions to other higher classes etc., each grade can be assigned in numerical value such as **9 for grade 'A', 8 for grade 'B'** and so on which can be used to determine the Grade Point Average (GPA).

While developing the grading system it is of utmost significance that the meaning of each grade is clearly spelt out. Having done so, it becomes obligatory on the part of each examiner to adhere to the specified system of grading. This would, however, in no way

encroach upon the autonomy of the examiner to determine which grade to award to a particular student. A properly introduced grading system may not only provide for the comparison of students' performance, but also indicate the quality of performance with respect to amount of efforts put in and the amount of knowledge acquired at the end of the course.

METHODS OF ASSIGNING GRADES

Grading may be carried out in a variety of ways. Its classification depends upon the reference point. When the reference point is the 'approach', grading may be classified as direct grading and indirect grading. When the reference point is the 'standard of judgement', the grading may be classified as absolute grading and relative grading.

DIRECT GRADING

In direct grading, the performance exhibited by the examinees is assessed in qualitative terms and the impression so obtained by the examiner is directly expressed in terms of letter grades for each question in the question paper. This method may profitably be exploited for the assessment of both cognitive and non-cognitive learning outcomes, however it is preferred for the assessment of non-cognitive learning outcomes. It is suggested that non-cognitive factors that are important should be enumerated stagewise and evaluated and reported separately in terms of letter grades. Employability of a three-point or a five-point scale for grading may be determined in consonance with the nature and the quality of the attribute. One of the advantages of direct grading is that it minimises the inter-examiner variability. Besides, it is easier to use in comparison of other methods. Direct grading, however, is devoid of transparency and diagnostic value.

INDIRECT GRADING

In this method the performance displayed by the examinees is first assessed in terms of marks and subsequently converted into grades by using different methods. The transformation of marks into grades may be carried out in terms of both absolute and relative standards using absolute and relative grading procedures. Each of these, have merits and demerits.

Absolute Grading

This type of grading is based on a pre-determined standard that becomes a reference point for assessment of students' performance. It involves direct conversion of marks into grades irrespective of the distribution of marks in a subject. It is just like classification of the students into five divisions namely, distinction, first division, second division, third division and unsatisfactory. The present system of classification as given under is an example of absolute grading.

75% and above	Distinction
60% - less than 75%	First Division
45% - less than 60%	Second Division
33% - less than 45%	Third Division
Below 33%	Unsatisfactory

It is possible to divide the absolute marks into any number of categories/grades. In absolute grading the range of marks for each grade is fixed and may be the same for different subjects, however the grades so awarded may not be comparable, for the marks themselves are not comparable. The grades range may or may not be of equal width. As the distribution of marks varies from subject to subject and from year to year for a given subject, the number of students placed in different grades will differ from subject to subject and from year to year making them incomparable.

Another example of absolute grading which shows better classification is given below:

S.No.	Letter of Grade	Range of Marks	Description
1.	A	91% and above	Outstanding
2.	B	81% to less than 91%	Excellent
3.	C	71% to less than 81%	Very Good
4.	D	61% to less than 71%	Good
5.	E	51% to less than 61%	Above Average
6.	F	41% to less than 51%	Average
7.	G	31% to less than 41%	Below Average
8.	H	21% to less than 31%	Marginal
9.	I	Below 21%	Unsatisfactory

This method of grading has got several advantages. The procedure is simple and straight-forward to use. Meaning of each grade is understandable and easy for the teacher to introduce it. Since the classification of grades is pre-announced, each student has the freedom to strive for the attainment of the highest possible grade. In this method, the criterion being the focal point, it enables the students to know their strengths and weaknesses serving the diagnostic purpose.

One of the limitations of this method is that the distribution of scores is taken on its face value regardless of the errors of measurement creeping in due to various types of subjectivity. Another limitation is that the cut-offs for different categories decided arbitrarily still remains a source of misclassification. Finally there may be subjects in which nobody gets grade 'A' or even lower one's i.e. G, H, I etc.

Relative Grading

This type of grading is popularly known as 'grading on the curve'. The curve refers to the normal distribution curve or some symmetric variant of it. The shape of this curve depends upon a number of factors and thus may assume any form varying from positively skewed curve to negatively skewed curve. In the event of the application of relative grading method the obtained curve is transformed into a normal curve. Conversion of obtained cure into a normal curve stems from the premise that there is always a difference between the true level of achievement and the perceived level of achievement that is captured through the

tests. The true level of achievement is expected to be normally distributed regardless of curricular areas for a larger population.

If the perceived curve is transformed into a normal curve, it allows us to categorise the students scores into any desired number of grades in a scientific manner. For a nine-point grading system, we may simply divide the entire measurement scale into nine equal parts. In this case the grade values will range from 1 to 9 with a mean of 5 and a standard deviation of approximately 2 units. It may be pertinent to mention here that while classifying students' performance into nine categories using stanine scale, two tail categories at the either end of the distribution are combined so as to make nine categories instead of eleven. In such a situation the grade wise distribution of students would be as:

S.No.	Letter Grade	Interval	% of Students	Grade Value
1	A	1.75 σ to ∞	4%	9
2.	B	1.25 σ to 1.75 σ	7%	8
3.	C	0.75 σ to 1.25 σ	12%	7
4.	D	0.25 σ to 0.75 σ	17%	6
5.	E	-0.25 σ to 0.25 σ	20%	5
6.	F	-0.75 σ to -0.25 σ	17%	4
7.	G	-1.25 σ to -0.75 σ	12%	3
8.	H	-1.75 σ to -1.25 σ	7%	2
9.	I	- σ ∞ to -1.75 σ	4%	1

Should one decide to use a seven-point grade system instead of the nine-point grade system, the measurement scale may be divided into seven equal parts. Further, if someone wishes to still reduce the number of ability ranges from 7 to 5, the measurement scale may be divided into five equal parts. In this case, the grade values will range from 1 to 5 with a mean of 3 and a standard deviation of approximately 1 unit. The grade-wise distribution in this case would be as given below:

S.No.	Letter Grade	Interval	No. of Cases	Grade Value
1	A	1.5 σ to ∞	7%	5
2.	B	0.5 σ to 1.5 σ	24%	4
3.	C	-0.5 σ to 0.5 σ	38%	3
4.	D	-1.5 σ to -0.5 σ	24%	2
5.	E	- σ ∞ to -1.5 σ	7%	1

The method of 'grading on the curve' will have the following positive features:

- The pass/fail terminology will be completely eliminated as the performance of individual students will be rated in terms of grades and no grade will signify the failure of students.
- Grades so awarded will indicate the relative position of the individual student vis-a-vis his/her group and thus serve better purpose of certification.
- Grades will provide for comparability across the curricular areas and years because the normal distribution ensures the uniformity in spread of scores regardless of the nature of curricular areas and other factors like test difficulty etc.
- Grades may fruitfully be used for recording the growth and development of individual students.
- Grades will provide for meaningful additivity without distorting the scale of measurement if we decide to arrive at the Grade Point Average (GPA).
- Undue significance attached to raw scores will be considerably reduced.

The limitation of this method is that some bottom students in spite of having scored of 50 or 60 marks, will still get lowest grade in some subjects particularly having practice and vocational courses.

NCF-2005 AND CBSE INITIATIVES

Different scales can be used at different stages of school education. The NCF-2005 has recommended the use of 3 point absolute scale at the primary stage and 5 point absolute scale at upper primary stage, 9 point absolute scale at the secondary stage. For the public examination 9 point relative grading has been recommended. As a follow-up of NCF-2005, CBSE is planning to introduce 9-point Absolute Grading System in place of marks. The proposed model is as follow –

Grade	Grade point	Marks range	Descriptors
A1	9	91-100	Exceptional
A2	8	81-90	Excellent
B1	7	71-80	Very Good
B2	6	61-70	Good
C1	5	51-60	Fair
C2	4	41-50	Average
D	3	33-40	Below Average
E1	2	21-32	Needs Improvement
E2	1	Less than 21	Unsatisfactory

The nomenclature of letter grades will be A1, A2, B1, B2 ..... E1 & E2. Each grade have descriptors such as Exceptional, Excellent ..... These grades can be applicable to all subjects and to all areas i.e. scholastic and non-scholastic.

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1. National Policy on Education -1986, Govt. of India, New Delhi.
2. National Seminar on Scaling and Grading in Public Examination – Guidelines, NCERT (1989), New Delhi.
3. Feasibility of Relative Grades in Public Examination, Avtar Singh, Journal of Indian Education – special Issue on Evaluation XXVI (2000) 112.
4. Grading in Schools, NCERT, New Delhi (2000).

For further information contact :

Prof. Avtar Singh

DSME, Head

NCERT, Sri Aurobindo Marg,

New Delhi-110016, India.

Chapter 10

Light Reflection and Refraction

Grey areas of the chapter

1. Rules for image formation by spherical mirrors/lenses
2. Drawing of ray diagrams
3. Use of sign conventions in solving numerical problems
4. Power of lens
5. Refraction through a transparent medium and refractive index
6. Magnification of lens/mirror

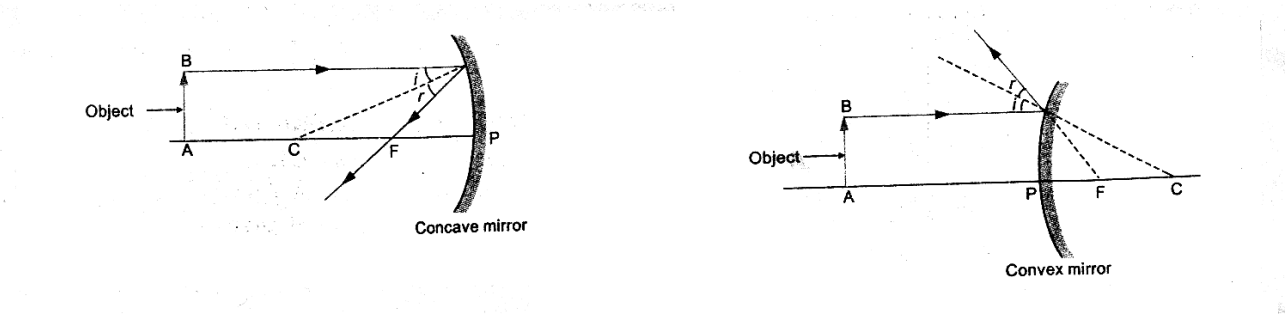
Topic – Image formation by spherical mirrors/lenses

Subtopic – Ray diagrams, sign convention nature of image

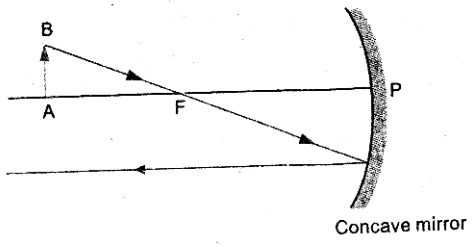
Objective – To develop skills among the students to draw ray diagrams and apply proper sign conventions for numerical problems.

Suggestions – Rules for obtaining images formed by spherical mirrors. The image is formed at that point where at least two reflected rays intersect (or appear to intersect).

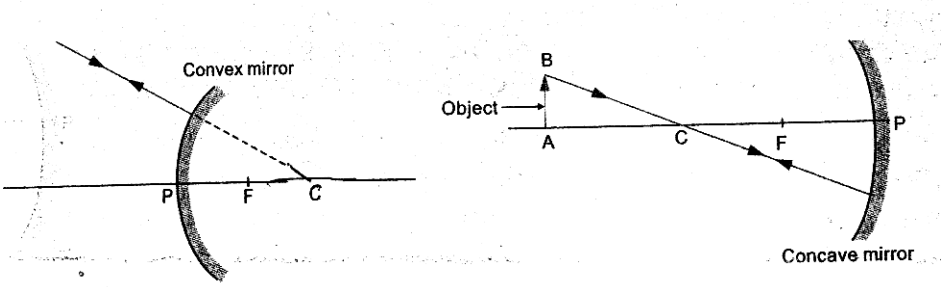
1. A Ray of light which is parallel to the principal axis of a spherical mirror, passes through its focus after reflection from the mirror.



2. Any incident ray of light passing through the focus of a spherical mirror travels parallel to the principal axis after reflection.



3. Any incident ray of light passing through the centre of curvature ‘C’ of spherical mirror retraces its path after reflection.



4. Incident ray of light traveling obliquely to the principal axis is reflected obliquely after striking a spherical mirror at its pole.

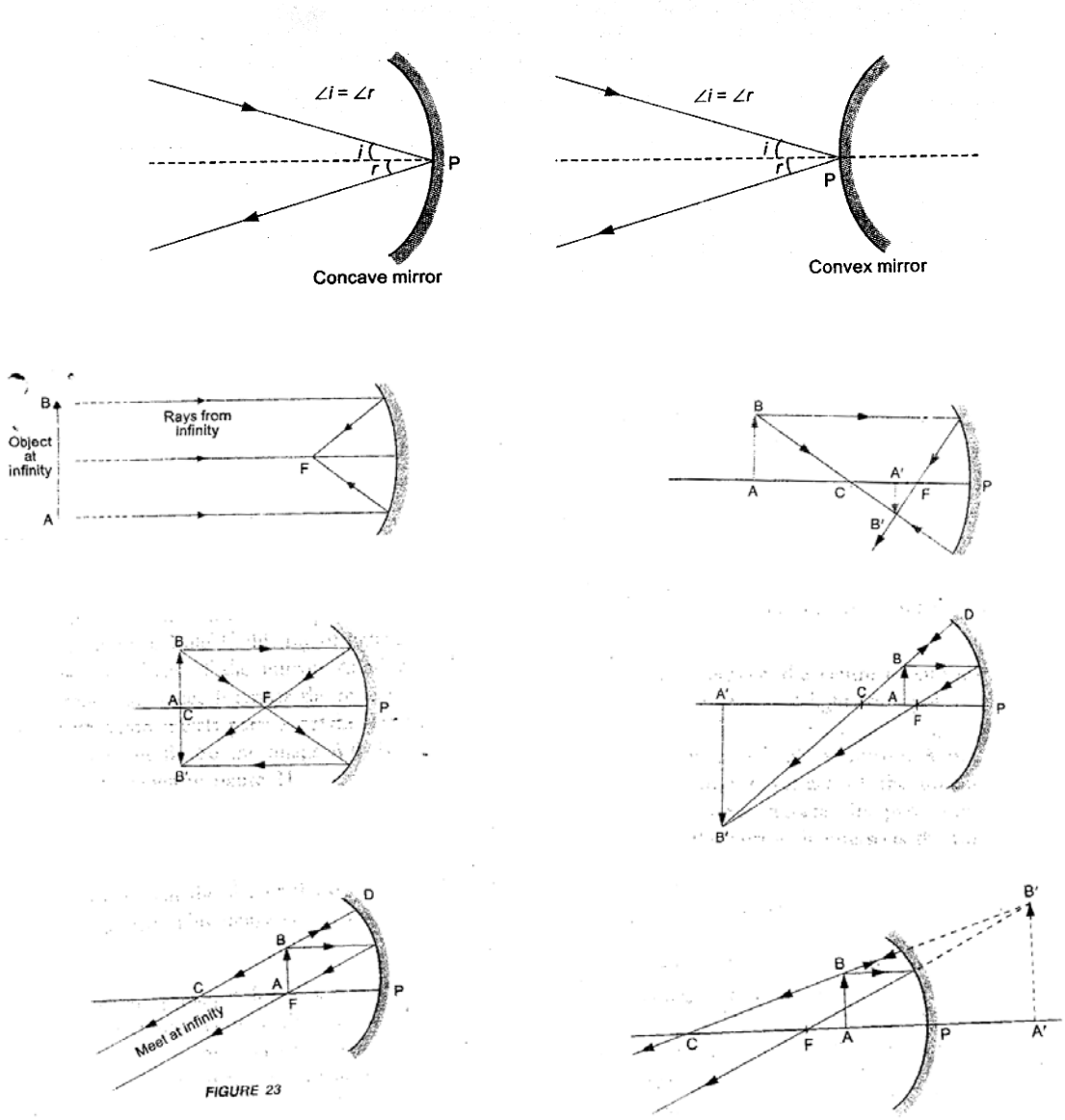


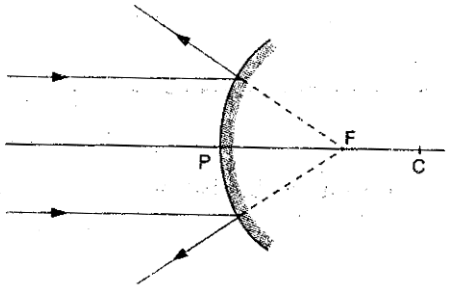
FIGURE 23

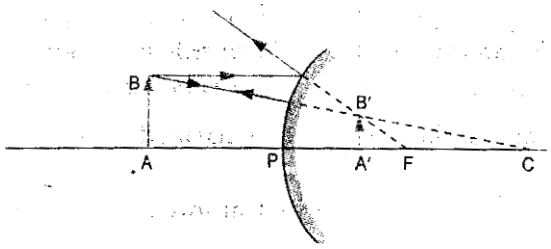
Table 1. For Concave Mirror

Objective Position	Image Position	Image size	Nature of Image
1. At infinity	At focus	Point sized	Real and inverted
2. Beyond C	Between f and C	Diminished	Real and inverted
3. At C	At C	Same as object size	Real and inverted
4. Between f and C	Beyond C	Enlarged	Real and inverted
5. At f	At infinity	Highly enlarged	Real and inverted
6. Between f and P	Behind the mirror	Enlarged	Virtual and Erect

Table 2. For Convex Mirror

Objective Position	Image Position	Image size	Nature of Image
1. At infinity	At focus	Point sized	Virtual and Erect
2. Between infinity and P	Behind the mirror between *f* and P	Diminished	Virtual and Erect

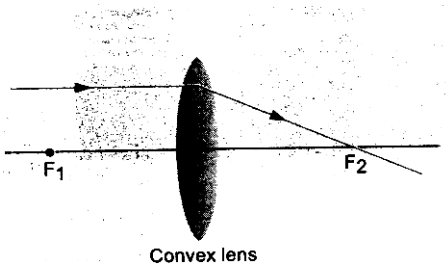




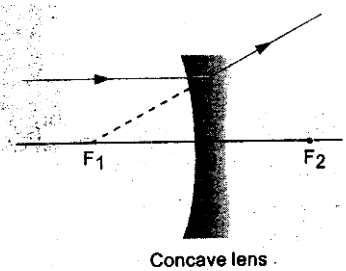
Rules for Obtaining Images Formed by Lenses

When an object is placed in front of a lens, an image is formed. The image is formed at that point where at least two refracted rays meet or appear to meet.

1. An incident ray parallel to the principal axis of a convex lens, passes through the focus of the lens after refraction.

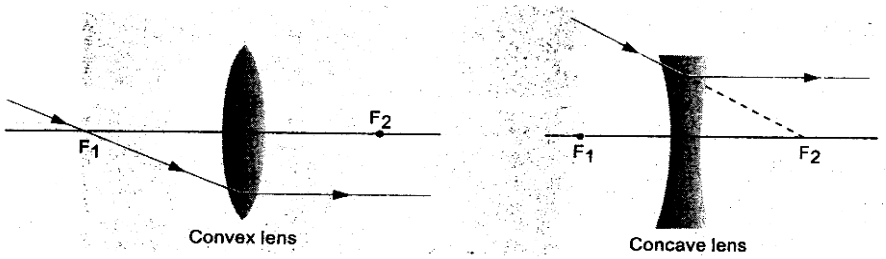


Convex lens

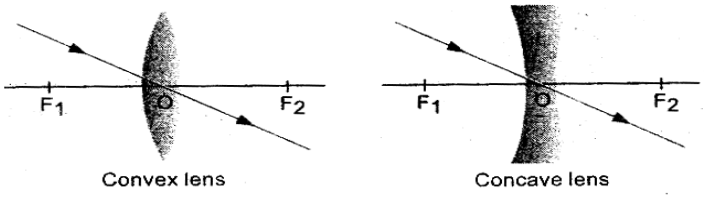


Concave lens

2. An incident ray passing through the focus of a convex lens, becomes parallel to the principal axis after refraction through the lens.



An incident ray passing through the optical centre of a convex lens goes straight after refraction through the lens. It does not get deviated



Summary of the Images Formed by Convex Lens/Concave Lens.

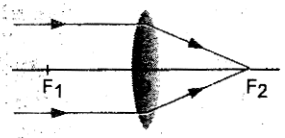
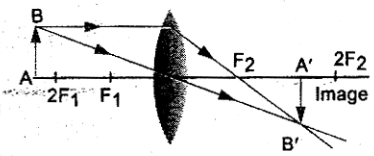
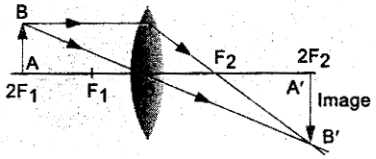
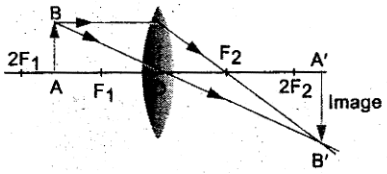
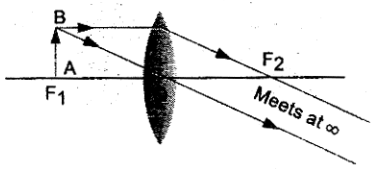
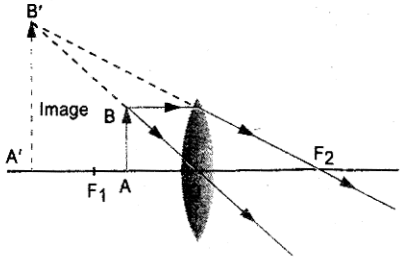
Table 3. For Convex Lens

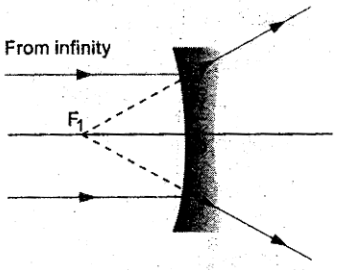
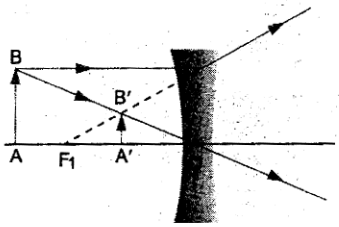
S. No.	Object Position	Image Position	Image Size	Nature of Image
1.	At infinity	At f	Highly diminished point sized	Real and inverted
2.	Beyond $2f$	Between f and $2f$	Diminished	Real and inverted
3.	At $2f$	At $2f$	Same as object size	Real and inverted
4.	Between f and $2f$	Beyond $2f$	Enlarged	Real and inverted
5.	At f	At infinity	Highly enlarged	Real and inverted
6.	Between f and O	On same side of object	Enlarged	Virtual and Erect

(f' and f refers to focus on left side and right side of convex has respectively)

Table 4. For Concave Lens

S. No.	Object Position	Image Position	Image Size	Nature of Image
1.	At infinity	At focus	Highly diminished point sized	Virtual and Erect
2.	Anywhere between Optical centre and infinity and focus	Between optical centre	Diminished	Virtual and Erect

S.No.	Position of object	Formation of image	Use of the lens
1.	At infinity		Used in astronomical telescope
2.	Beyond $2F_1$		Used in camera
3.	At $2F_1$		Used in terrestrial telescope
4.	Between F_1 and F_2		Used in a cinema projector
5.	At F_1		Used in search lights
6.	Between focus F_1 and the optical centre of the lens		Used in a simple microscope or used as a magnifying glass

S.No.	Position of object	Formation of image
1.	At infinity	
2.	Between infinity and optical centre of the lens	

Topic – Numerical Problems

Sign Conventions Used

Sign Convention for Lenses and Mirrors (In Tabular Form) :

Parameter	Lens		Lens	
	Concave	Concave	Concave	Convex
Distance of the Object, u	Negative	Negative	Negative	Negative
Distance of the real image, v	Positive	-	Negative	-
Distance of the virtual image, v	Negative	Negative	Positive	Positive
Focal length, f	Positive	Negative	Negative	Positive
Height of the object h	Positive	Positive	Positive	Positive
Height of the inverted real Image, h	Negative	-	Negative	-
Height of the virtual real Image, h	Negative	Positive	Positive	Positive

- **Mirror** $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$ **Formula** -

Note u – distance of the object from the pole

V – distance of the image from the pole

F – focal length of the mirror

Mirror formula valid in all situations for both concave and convex mirror for all position of the object.

$$m = \frac{h'}{h}$$

- **Magnification for mirror** -

Note h' – height of the image

H – height of the object

$m = \frac{-v}{u}$ for real image m is –ve (invtered)

for virtual image m is +ve (errect)

m = +1 indicates that mirror is plane and both image and object are erect.

- **Lens - formula** $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ **-**

Note u- distance of the object from the optical centre

V – distance of the image from the optical centre

F – focal length of lens

Lens formula valid for both concave and convex lens in all situations and for all positions of object.

- **Magnification of a** $m = \frac{h'}{h}$ **lens -**

Note h' – height of the image

h- height of the object

$m = \frac{-v}{u}$, m is –ve for inverted image

m, is +ve for erect image

- **Power of** $P = \frac{1}{f}$ **lens,** when f is in meter

$P = \frac{100}{f}$, when f is in centimeter

S.I. unit of power is Dioptre (D)

1D = $\frac{1}{1\,m}$

Numerical problem

1. An object is placed at a distance of 10cm from a convex mirror of focal length 15 cm. Find position and nature of the image?

Given f = 15cm, u = -10cm v?

$\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$, $\frac{1}{v}+\frac{1}{(-10)}=\frac{1}{15}$, $V = 6\,cm$

As v is + ve, nature of the image is virtual, erect and dimished

2. How far should an object be placed from the pole of a concave mirror of focal length 20 cm to form a real image whose size is 1/5th of the size of the object?

Given f = -20 cm, $m=-\frac{v}{u}$, $v=\frac{1}{5}u$, $\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$, $\frac{1}{u/5}+\frac{1}{u}=\frac{-1}{20}$, $\frac{5}{u}+\frac{1}{u}=-\frac{1}{20}$, u = -120 cm

3. A concave lens of focal length 15 cm forms a image 10 cm from the lens how far is the object placed from the lens.

Given f = -15cm, v = -10cm, u = ?

$\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$, $\frac{1}{(-10)}-\frac{1}{u}=\frac{1}{(-15)}$, u = -30 cm

4. A 2.0 cm tall object is placed perpendicular to the principal axis of a convex lens of focal length 10 cm. The distance of the object from the lens is 15 cm. Find the nature, position and size of the image. Also find its magnification.

Given h = +2.0 cm, f = +10cm, u = -15cm, v = ?

h' = ?

$\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$, $\frac{1}{v}=\frac{1}{u}+\frac{1}{f}=\frac{1}{(-15)}+\frac{1}{10}=\frac{1}{30}$

v = +30 cm, '+' sign of v shows that image is formed at a distance of 30 cm on other side of the optical centre. The image is real and inverted.

$m=\frac{h'}{h}=\frac{v}{u}$, $h'=\frac{h\times v}{u}=2.0\times\left(\frac{30}{-15}\right)=4.0\ cm$

$m=\frac{v}{u}=\frac{+30}{-15}=-2$, -ve sign of 'm' shows that image is inverted and real.

3. Topic – Refractive index

- The amount of change in the speed of light in a medium depends upon the property of the medium. This property is known as refractive index of the medium.
- $n=\frac{C}{V}=\frac{\text{Speed of light in air or Vacuum}}{\text{Speed of light in medium}}$

  n – absolute refractive index C = 3×10^8 m/s
- It is a pure number, it has no unit

- Relative refractive index of med 2 w.r.t. 1 is ratio of absolute refractive index of med2 to absolute refractive index

$$n_{21} = \frac{n_2}{n_1}$$

- It depends upon - . Nature of the material of density of the medium.
- Color or wavelength of the light.

H.O. Ts Information.

- When light travels from one medium to another medium, the speed of light and its wavelength change but frequency of light remains the same.
- $n = \frac{C}{V} = \frac{\lambda}{\lambda m}$, $\lambda m = \frac{\lambda}{n}$

refractive index of a medium is minimum for red light and maximum for violet light.

$n>1$, $\lambda m < \lambda$

wavelength of light decreases when it travels from air to another medium like water, glass etc.

- When a ray of light falls normally, then refraction of light does not take place.

If $\angle i = 0$ so $\angle r = 0$

- $n = \frac{C}{V}$ $V = \frac{C}{n}$ more is the refractive

index of a medium, less is the speed of light in that medium and vice versa

- Optical density and mass density of a medium are two different entities.
  - Optical density determines the ability of the medium to refract light.
  - Mass density is defined as mass per unit volume of the substance.

Chapter – 11 Human Eye and colourful world

Grey areas of the chapter

1. Functioning of human eye
2. Problems of vision and remedies
3. Examples of atmospheric refractions
4. Scattering of light

Topic – Functioning of human eye

Subtopic – Power of accommodation, Near point and far point

Objective – To develop the concept among the students how an eye lens accommodates near by objects and far objects.

Difficulties – Concept of contraction and expansion of cilliary muscles, variation in thickness of lens with distance of objects, near point and far point

Suggestions – Structure and function of the human eye –

- Pupil regulates and controls the amount of light entering the eye
- Iris controls the size of the pupil
- Image is formed on retina
- Ciliary muscles help in accommodation

Note : A normal eye can see objects clearly that are between 25cm and infinity

- Least distance of the distinct vision is the minimum distance at which objects can be observed without strain called near point of eye.

Power of accommodation is the ability to adjust the focal length of the lens to observe objects near by and far away.

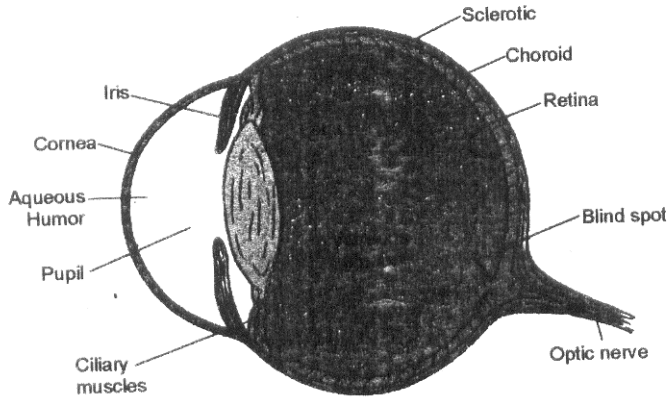
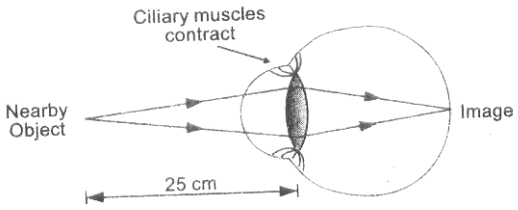
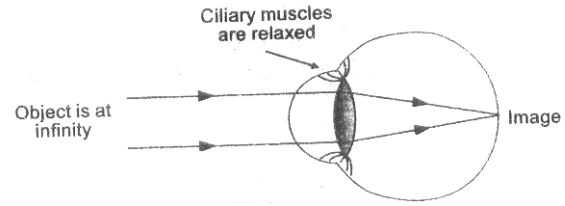


FIGURE 1. HUMAN EYE





Topic – Defects of vision and their correction

Subtopic – Myopia, Hypermetropia, presbyopia, Astigmatism and Cataract

Objective – To understand the image formation of myopic and hypermetropic eye and the correction of the defects.

- To know causes of Astigmatism and cataract.

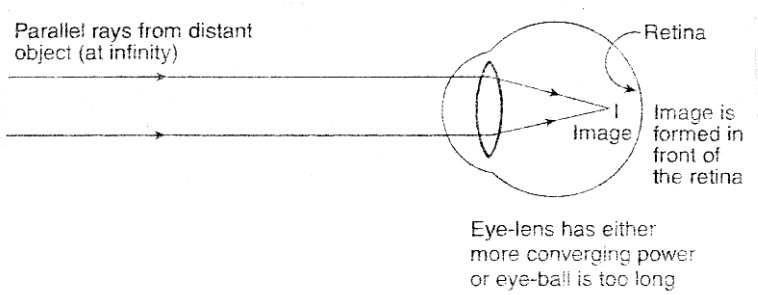
Difficulties – To draw dray diagrams of defected eye and corrected eye.

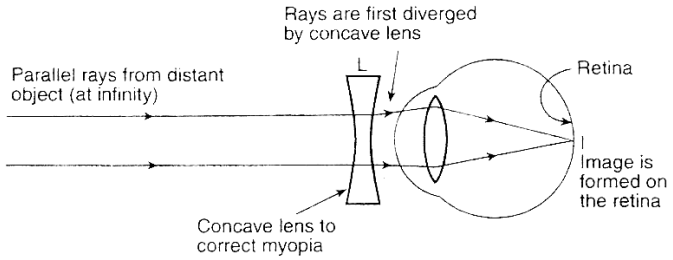
Suggestions –

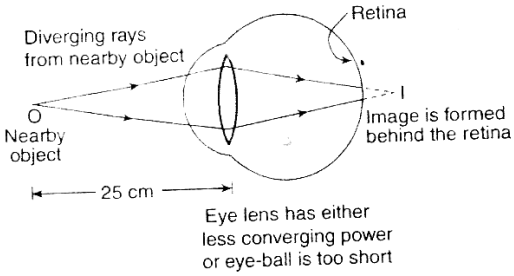
Myopia (Short – Sightedness)

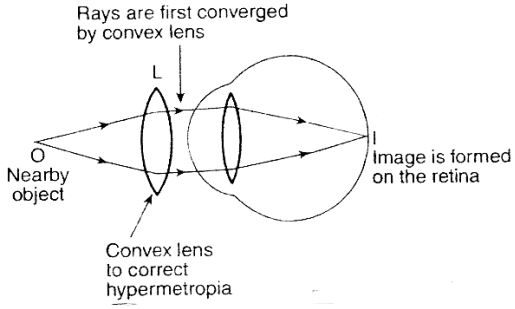
- Person can see nearby objects clearly but can not see distant objects distinctly.
- Image formed in front of retina.
- Caused due to – excessive curvature of cornea
  – elongation of the eyeball.

- Corrected by using concave lens of suitable power.









Hypermetropia (Long – sightedness)

- Person can see distant objects clearly but can not see nearby objects distinctly.
- Image falls behind the retina.
- Caused due to – greater focal length of the lens
  – eye-ball becoming smaller
- Corrected by using convex lens of suitable power

Presbyopia (Old age defect)

- Power of accommodation of the eye decreases with age, the near point recedes and the far point gets reduced.
- Caused due to – weakening of ciliary muscles
  – reducing ability of the lens to change the curvature
- Corrected by using bifocal lens.

Astigmatism

- Person is not able to focusing objects on both vertical and horizontal lines simultaneously.
- Caused due to – irregularities in the surface of cornea
- Correctd by using cylindrical lenses which compensate for irregularities I the surface of cornea.

Cataract (Old age defect)

- Vision of eye is decreased gradually

- Caused due to – formation of an opaque membrane over the eye lens.
- Corrected by surgically removing the affected lens and artificial lens is placed in its place.

Topic – Atmospheric refraction

Subtopic – Change in refractive index of air due to change in density.

Objective – To make the students understand optical phenomenon based on atmospheric refraction.

Difficulties – Change of refractive index with optical density of medium.

Suggestions –

- Refraction of light caused by earth's atmosphere having air layers of varying optical densities is called atmospheric refraction.
- Under standar conditions of temperature and humidity, the refractive index of air is slightly more than one. But as we move away from surface of earth, the refractive index of air decreases.
- The change in refractive index of air is due to change in density of air and change in temperature of air.
- The density of air is decreased with height, so the refractive index.
- The cooler air layers behave as a optically denser medium and warm air layers behave as optically rarer medium.

Examples – Twinkling of starts, starts seem higher than their actual height, sun can be seen two minutes before actual sun rise and two minutes after actual sun set.

Topic – Scattering of light.

Subtopic – Factors affecting scattering of light.

Objective – To make the students understand the reason for blue colour of sky, white colour of clouds and red colour of danger signals.

Difficulties – Relation of intensity of scattered light and wavelength of incident light

Suggestions – Scattering of light is affected by the size of scatterer and the wavelength of incident light

- If size of scatterer is very small as compare to the wavelength of the incident light, then scattering is called Raylight scattering, and the relation true.

Intensity of scattered light $\times$

Or $I \times \frac{1}{\lambda 4}$ $\qquad$ $\frac{1}{(\text{wavelength of incident light})4}$

Very fine particle scatter blue light and colour is least scattered

If the size of scatterer is much larger than the wavelength of incident light then all wavelengths are scattered equally.

Chapter 12
Electricity

Grey areas of the chapter

1. Resistance / Resistivity
2. Graphical representation of ohm's law.
3. Series / Parallel combination of resistances.
4. Use / Conversion of units
5. Connectivity of Voltmeter / Ammeter in electric ckt.

Topic – Resistance and resistivity

Subtopic – Factors affecting resistance and resistivity

Objective – To understand the variation of resistance with dimension, to study resistivity.

Difficulties – Difference between resistance and resistivity

Suggestions :

- Resistance of a conductor is the property of a conductor to oppose the flow of charge through $R \times \frac{V}{I}$ it, , S.I. unit is ohm or VA^{-1}

- Resistance of a conductor does not depend upon the potential difference applied across the ends of the conductor.
- Resistance of a conductor depends on the following four factors $R \times \frac{l}{A}$, $R = l\frac{l}{A}$
    - Length 'l' of the conductor
    - Area of cross – Section 'A'
    - Nature of the material of the conductor
    - Temperature of the conductor
    - Constant of proportionality, is known as resistivity specific resistance of a conductor

    - $l = \frac{RA}{l}$, l = R if A = $1m^2$ and l = 1m

    Specific resistance of a material is equal to the resistance of a cube of side 1m, made out of that material
- The unit of resistivity is ohm-meter
- Resistivity of a substance changes with temperature

- Resistivity is the property of a substance.
- Resistance is the property of an object.
- Resistances of objects of different shapes and sizes but made of same material are different
- Resistivity of objects of different shapes and sizes but made of same material is same.
- Resistivity of metals < resistivity of alloys < resistivity of insulator
- The metals and allyws have very low resistivity in the range of 10^{-8} Ωm to 10^{-6} Ωm.
- Insulator like rubber and glass have resistivity of the order of 10^{12} to 10^{17}Ωm
- Resistivity does not depend on length and thickness of the material.

Topic – Combinations of resistance and connectivity of voltmeter / Ammeter in electric ckt.

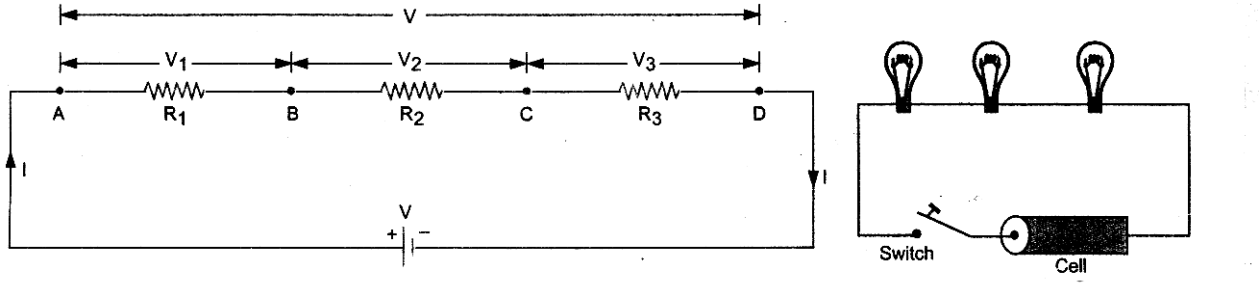
Subtopic – Series and parallel combinations, division of current and potential difference.

Objective – To develop the skills the connect the resistance, voltmeter and ammeter in an electric circuit.

Difficulties – Identification of combination of resistance, connectivity of voltmeter / Ammeter in electric ckt, resultant of resistance in parallel combination for solving numerical problems.

Suggestions –

1. **Resistors connected in series –** Two or more conductors are said to be connected in series if they are connected one after the other such that the same current flows through all conductors when some potential difference is applied across the combination



$V = V_1 + V_2 + V_3$, $V_1 = IR_1$, $V_2 = IR_2$, $V_3 = IR_3$

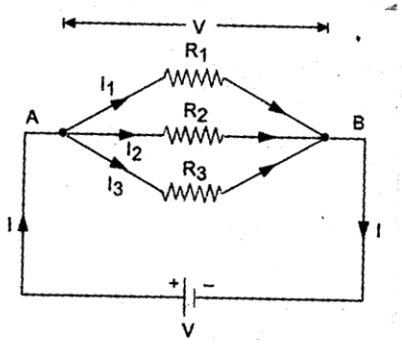
$V = I(R_1 + R_2 + R_3) = I(Rs)$, $Rs = R_1 + R_2 + R_3$

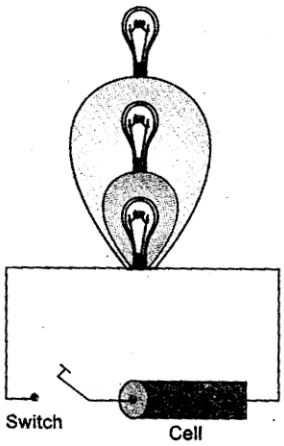
- To increase the total resistance in a circuit, resistors are connected in series
- Net resistance is equal to the sum of the resistance of the individual conductors.

- The current flowing through each conductor is the same.
- The voltage applied across the series combination of conductors is equal to the sum of potential differences across the individual conductors.
- Sereis arrangement is not used in domestic circuits, as if one of them fuses, then all the other appliances will also not work.
- Ammeter is always connected in series in an electric circuit, with its +ve terminal to +ve terminal of a cell or battery and its –ve terminal should be connected with –ve terminal of the cell or battery. It is used to measure current in the circuit. If it is connected in parallel, it will not measure total amount of current.

2. Resistors Connected in parallel

Two or more resistors are said to be connected In parallel if one end of each resistor is connected at one common point and the other end of each resistor is connected at other common point such that the potential difference across each resistor is equal to the applied potential difference across the combination of the resistors.





$I = I_1 + I_2 + I_3, \quad I_1 = \frac{V}{R_1}, \; I_2 = \frac{V}{R_2}, \; I_3 = \frac{V}{R_3},$

$I = V \left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \right) = \frac{V}{R_p}, \; \frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

$$R_p = \frac{R_1 R_2 R_3}{R_p R_3 + R_1 R_3 + R_1 R_2}$$

- To decrease the total resistance in a circuit, resistors are connected in parallel.
- Total effective resistance of a parallel combination of resistors is less than the least resistance of any resistor in the circuit.

- Different amount of current flows through different resistances. A large amount of current flows through a conductor of low resistance and a small amount of current flows through a conductor of high resistance. The total current flowing in such a circuit is the sum of the currents flowing through different resistances.
- The potential difference across each resistance is equal to the voltage applied across the parallel combination of the conductors.
- Parallel arrangement is used in domestic circuits, as if any one of the electric appliances or devices connected is parallel does not work, then the working of other devices will not be affected.
- When different electric devices are connected in parallel, the potential difference across each device is equal to the applied potential difference and they draw the current as per their requirement and hence they work properly.
- Voltmeter is connected in parallel across a conductor, with its +ve terminal connected to +ve terminal of a cell or battery and its –ve terminal to –ve terminal of a cell or battery.
- Electric current pass through a conductor only if the ends of a conductor are maintained at different electric potentials. Thus electric potential difference is the cause and the electric current is the effect.

Numerical problems :

1. How many 440Ω resistors connected in parallel are required to carry 5A in a 220V line?

   R = 440 Ω, I = 5A, V = 220 V

   Let n resistors each of 440Ω are connected in parallel.

   $\therefore \frac{1}{R} = \frac{1}{r} + \frac{1}{r} + \frac{1}{r} +$ ……. upto n = $\frac{n}{r}$.

   $R = \frac{r}{n} = \frac{440}{n}$, V = IR

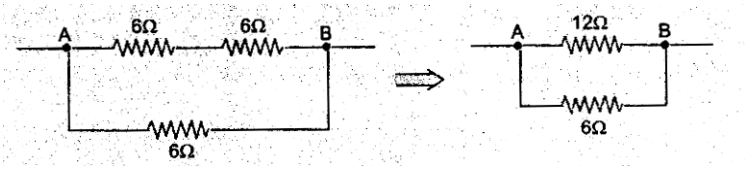
   $220 = 5 \times \frac{440}{n}$

   n = 10

   So, 10 resistors in parallel combination are required

2. Show diagrammatically, how you would connect three resistors, each of resistance 6Ω so that the combination has a resistance of (i) 4Ω, (ii) 9Ω.

   (i) When two resistors each of 6Ω are connected in series and the third resistor of 6Ω is connected parallel to the series combination, we get a resistance of 4Ω as shown in figure.

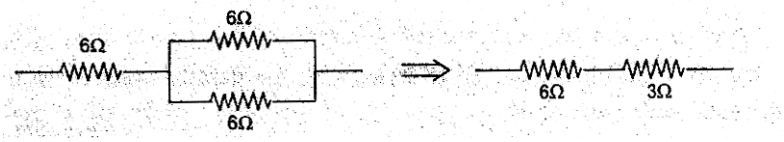


Equivalent resistance of 6Ω and 6Ω connected in series = 6Ω + 6Ω = 12Ω.

Now 12Ω and 6Ω are connected in paralle, so the net resistance of the combination is given by

$$\frac{1}{R} = \frac{1}{12} + \frac{1}{6} = \frac{3}{12} = \frac{1}{4} \quad \text{or } R = 4\Omega$$

(ii) When two resistors each of 6Ω are connected in parallel and this combination is connected in series with the third resistor of 6Ω, we get a resistance of 9Ω.



Equivalent resistance of parallel combination in the circuit is given by

$$\frac{1}{R} = \frac{1}{6} + \frac{1}{6} = \frac{2}{6} = \frac{1}{3} \quad \text{or} \quad R' = 3\Omega^{o}$$

Now 6Ω and 3Ω are connected in series, therefore, net resistance = 6Ω + 3Ω = 9Ω.

A copper wire having resistance R is cut into four equal parts. (i) Find the resistance of each part in terms of original resistance of the wire and (ii) Find the resistance of the combination if these four parts are connected in parallel.

Solution. Original resistance = R

(i) Since R $\propto$ length (l),

So the resistance of each part = $\frac{R}{4}$

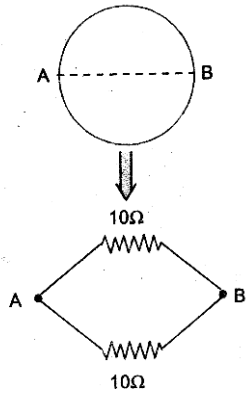
(ii) When four wires each of resistance $\frac{R}{4}$ are connected in parallel, then the resistance of the combination (R') is given by

$$\frac{1}{R'} = \frac{1}{R/4} + \frac{1}{R/4} + \frac{1}{R/4} + \frac{1}{R/4} = \frac{4}{R} + \frac{4}{R} + \frac{4}{R} + \frac{4}{R} = \frac{16}{R}$$

$$\therefore R' = \frac{R}{16}$$

4. A wire of resistance 20 ohm is bent in the form of a closed circle. What is the effective resistance between two points at the ends of any diameter of the circle?

Solution.



When a wire of resistance 20 ohm is bent in the form of a closed circle, then the resistance of each half of the circle above and below the diameter AB is 10 ohm. In this case, these two resistances are now connected in parallel as shown in figure.

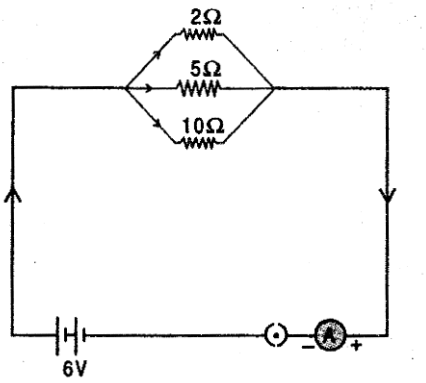
$\therefore$ The effective resistance between two points at the ends of the diameter (AB) of the circle is given by

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{10} + \frac{1}{10} + \frac{2}{10} = \frac{1}{5}$$

OR

R = 5 ohm.

5. In the circuit diagram given below



Calculate

(a) the total effective resistance of the circuit

(b) the total current in the circuit

(c) the current through each resistor.

Solution

(a) Since resistors are connected in paralle, so the total effective resistance of (R) of the circuit is given by

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} = \frac{1}{2} + \frac{1}{5} + \frac{1}{10} = \frac{8}{10}$$

OR

$$R = \frac{10}{8}\ \Omega$$

(b) Total current in the circuit,

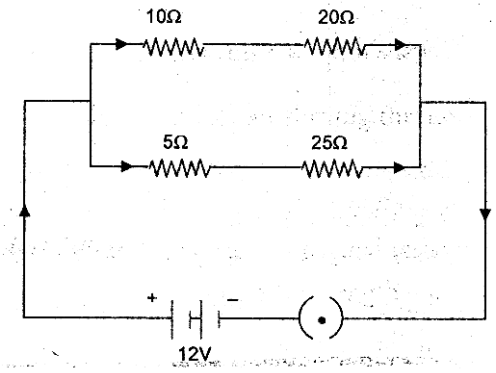
$$I = \frac{V}{R} = \frac{6V}{\frac{10}{8}\Omega} = 4.8 \text{ A}$$

(c) Let I_1, I_2, I_3 be the current through 2Ω, 5Ω and 10Ω respectively, Therefore,

$$I_1 = \frac{V}{R_1} = \frac{6}{2} = 3A$$

$$I_2 = \frac{V}{R_2} = \frac{6}{5} = 1.2A \text{ and } I_3 = \frac{V}{R_3} = \frac{6}{10} = 0.6 \text{ A}$$

6. If a 12 V battery is connected to the arrangement of resistance shown in figure, calculate (i) the total effective tance of the arrangement and (ii) the total current flowing in the ciruit.



Solution.

Step 1 : To find the total effective resistance of the arrangement.

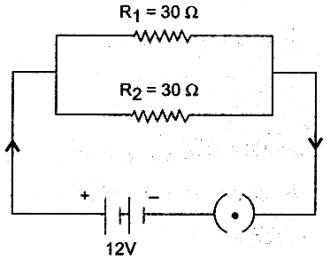
Here, 10Ω and 20Ω are in series, so their effective resistance is given by

$R_1 = 10\Omega + 20\Omega = 30\Omega$.

Similarly, 5Ω and 25Ω and are in series, so their effective resistance is given by

$R_2 = 5\Omega + 25\Omega = 30\Omega$.

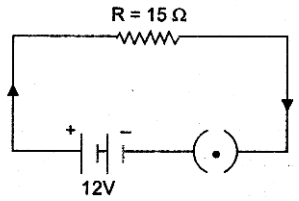
Now, the arrangement of resistance is represented as shown :



Step 2 : Since R_1 and R_2 and are connected in parallel, so the total effective resistance of the arrangement is given by

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{30} + \frac{1}{30} = \frac{2}{30} = \frac{1}{15}$$

Hence the circuit can be represented as shown :



Step 3 : Here, V = 12V, R = 15Ω.

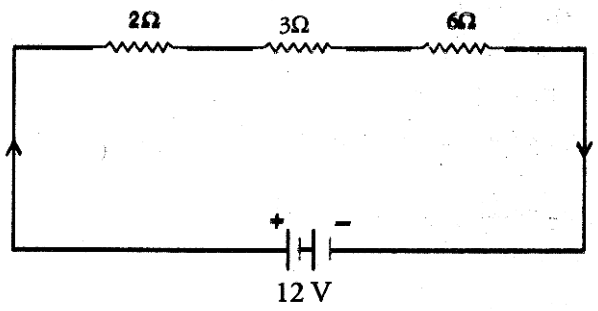
Therefore, using V = IR, we get;

$$I = \frac{V}{R} = \frac{12V}{15\Omega} = 0.8A$$

Hence (i) Total effective resistance of the arrangement = 15 ohm

(ii) Total current flowing in the circuit = 0.8A.

7. Three resistors of resistance 2Ω, 3Ω and 6Ω are connected in series with a battery of 12V as shown in figure.



Calculate

(i) the total current flowing through the circuit and

(ii) the potential difference across each resistor.

Ans. Here V = 12 V

Total resistance of the circuit, R = 2Ω + 3Ω + 6Ω = 11Ω.

Using V = IR, we get

$$I = \frac{V}{R} = \frac{12V}{11\Omega} = 1.09A$$

(ii) Potential difference across 2Ω $V_1 = IR_1$

= 1.09 × 2 = 2.18V

Potential difference across 3Ω $V_2 = IR_2 = 1.09 \times 3$

$= 3.27V$

Potential difference across 6Ω $V_3 = IR_3$

$= 1.09 \times 6 = 6.54V$

A wire of length 'l, cross-sectional radius 'r' is stretched to double its length. Find the new resistivity and resitance, if they are P and R originally.

On stretching volume has to be constant $Al = A_1 l_1$

$Al = \prod r^2 l = A_1 l_1 = \prod r_1^2 l_1$

l does not change as the material is same

R changes to R_1

$$\frac{R_1}{R} = \frac{l_1 A}{A_1 \times l} = \frac{l_1 r^2}{r_1^2 l}$$

$$R_1 = R\left(\frac{l_1}{l}\right)^2 \text{ or } R\left(\frac{A}{A_1}\right) \text{ or } R\left(\frac{r^2}{r_1^2}\right)$$

O.Ts Information

To Calculate current in circuit always use

$$I = \frac{\text{net emf}}{\text{net resistance}}$$

Slope of graph = $\frac{V}{I} = R$ if V is along y axis & I is along X = axis

Slope of graph = $\frac{I}{R} = \frac{I}{V}$ if V is along X – axis & I is along Y axis

Figure θ, greater , greater is slope

When components are in paralle, use $P = \frac{V^2}{R}$ as potential difference is same

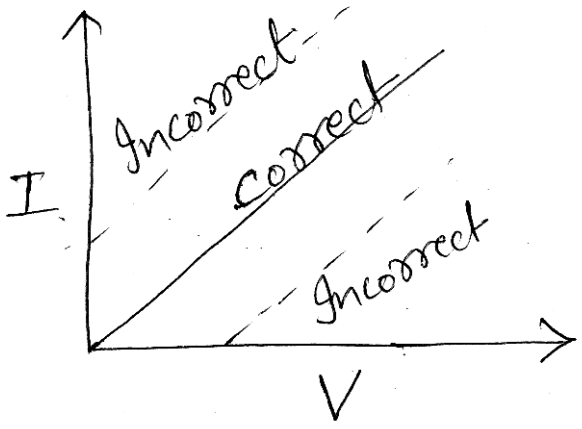
When components are in series, use

$P = I^2R$, as currentis same.

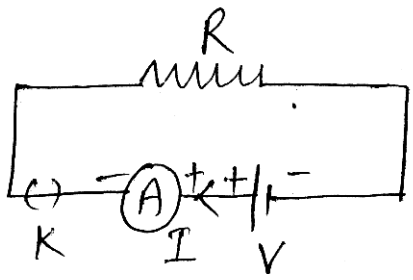
A 100 watt bulb gives less light as compared to 200 watt bulb when connected across the same potential difference. Because its resistance is high.

H.O.T's Information

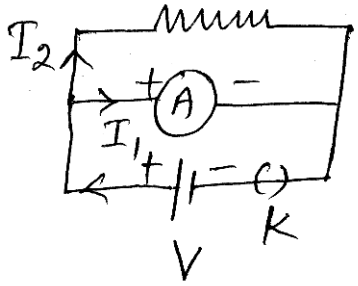
Graphical representation of ohm's law – line should pass through the origin as shown.



- Connectivity of ammeter

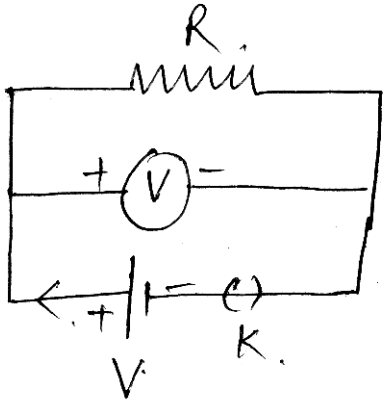


Correct



Incorrect

- Connectivity of Voltmeter



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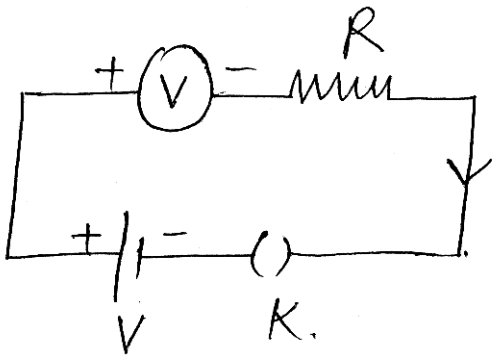


Incorrect

Chapter-13 Magnetic effect of current

Hard Spots of the Chapter

Grey areas of the Chapter

Application of Fleming right hand rule

Application of Fleming Left hand rule.

Application of right hand them rule.

Concept of electromagnetic induction.

Topic – Direction of induced current Force

Subtopic – Fleming L.H.R. and R.H.R, Induced current and nature of charge.

Objective – to differential – L.H.R. & R.H.R and dependence of direction of force on nature of charge.

Difficulties – Concept of induced current, force on current carrying conductor placed in magnetic field.

Suggestion –

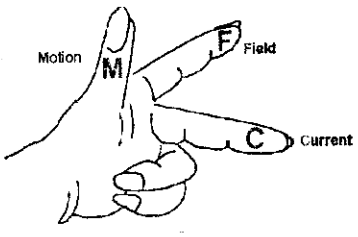
- Fleming's left-hand rule is used to determine the exact direction of the force experienced by a current carrying conductor placed in a magnetic field.

Fore-Finger – Field

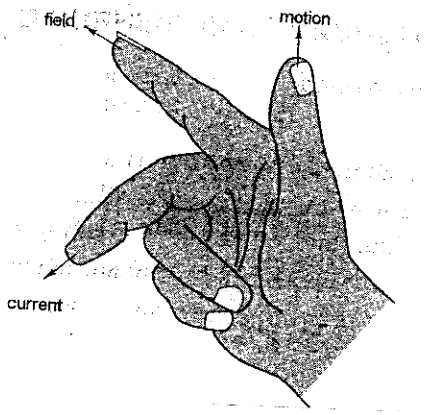
Middle Finger – Current

Thumb – Motion or direction of force

- It is also used to find the lorents force on a moving charge in a magnetic field. If positive charge is moving with velocity V, then I is along V., If negative charge like electron is moving with velocity V, then I is opposite to the direction of v. Take care of sign/nature of charge (+ve or –ve)

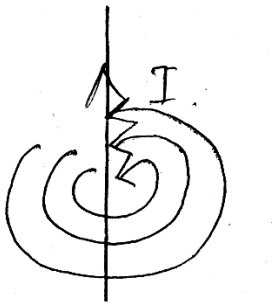


Fleming's L.H, rule



Fleming's R.H. rule

- Fleming's Right hand rule is used to determine the direction of induced current in conductor.
- Right hand thumb rule is used to determine the direction of magnetic field around a conductor carrying current.



- To identify the direction of current induced in a circular Coil. As N-Pole approaches the Coil, N-pole has to be created in the coil facing the magnet. So the induced current has to be anticlockwise as viewed from the magnet (approaching). It N-pole moves away, S-pole bas to be created making a clockwise current.

H.O.Ts information

- Relative motion between conductor and magnetic field produces electric current in the conductor.
- Current paned through a conductor placed in magnetic field produces relative motion between conductor and magnetic field.
- Better permanent magnets can be obtained. By using Al Ni Co and Nipermag.

Al Ni Co is an alloy of Ni, Co and aluminium Nipermag is alloy of iron, nickel, titanium and aluminium.

Right-hand thumb rule for circular loop.

Curl the fingers of the right-hand in the direction of current in the loop. Stretch the thumb normal to the fingers. The thumb now will represent the direction of magnetic lines of force and hence the direction of magnetic field, as shown in Fig. (a). This is right-hand thumb rule for current loop.

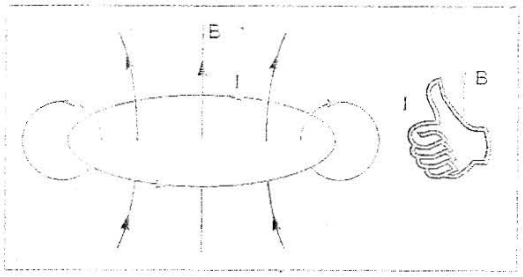
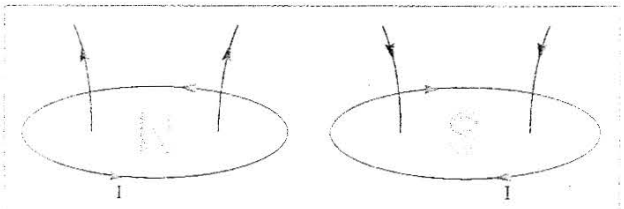


Fig. (*a*)



Anti-clockwise current produces N-face

Clockwise current produces S-face

Fig. (*b*)

A current loop has N-face and S-face. The face from which lines of force come out is N-face and the other is south face, as shown in Fig. (b).

CHAPTER - 1

CHEMICAL REACTIONS AND EQUATIONS

- How to make chemical reactions more informative
- Electrolysis of water
- Oxidation, reduction reactions
- Rancidity

HARD SPOT – DIFFICULT AREA IN CHEMISTRY

1. How to make chemicals equations more informative
2. Electrolysis of water
3. Oxidation reduction
4. Rancidity

Topic : Balanced Chemical Equation

Subtopic : How to make chemical equation more informative

Objective : The objective balanced chemical equation tells about reactants taking part in reaction and the product formed with their physical state and the associated conditions.

Difficulties : Students are not able to understand the physical state of reactant and products.

Suggestion : To make a chemical reaction more informative an example is illustrated here.

"Solution of Barium chloride and sodium sulphate in water react to give insoluble barium sulphate and the solution of barium chloride".

The above reaction in the form of chemical equation is written as :

$BaCl_2 + Na_2SO_4 \rightarrow BaSO_4 + NaCl$

Balanced chemical equation is

$BaCl_2 + Na_2SO_4 \rightarrow BaSO_4 + 2NaCl$

In the above reaction $BaCl_2$ and Na_2SO_4 Solutions are prepared in water therefore their physical state is aqueous whereas in product side $BaSO_4$ is in ppt form and NaCl in the tion form hence written as solid (s) and aquous (aq) respectively.

To test exothermic or endothermic nature of dissolution of any substance :

Take about 25 mL of water in a beaker. Note the temperature of water. Now, add two spatula of the given salt. Stirr and note the final temperature of the solution of in the beaker. If

the temperature of the solution rises, the dissolution is exothermic and if the temperature falls, the dissolution is endothermic. The results of the dissolution of a few salts are given below :

Salts whose dissolution is endothermic. Potassium chloride, potassium nitrate, potassium nitrate, potassium sulphate, ammonium nitrate, hydrated copper culphate ($CuSO_4$. $5\ H_2O$).

Salts whose dissolution is exothermic. Anhydrous copper sulphate ($CuSO_4$), sodium carbonate monohydrate ($Na_2\ CO_3$. H_2O). Calcium Oxide

Conditions under which the reaction takes places. The conditions of temperature, pressure and the presence of catalyst, if any, may be represented by writing these conditions above and/or below the arrow drawn between the reactants and the products. For example.

$$N_2(g) + 3\ H_2\ (g) \xrightarrow[Fe\ /\ Mo]{500^oC,\ 200\ atm} 2\ NH_3\ (g)$$

This shows that to get maximum yield of ammonia (NH_3), the most suitable conditions for the above reaction are a temperature of 500°C, pressure of 200 atmosphere and presence of iron as catalyst and Melybdenum as activator to catalyst Fe.

Similarly, if a reaction takes place on heating, the sign delta (Δ) is put o the arrow. For example,

$$2\ KClO_3\ (s) \xrightarrow[MnO_2]{\Delta} 2\ KCl\ (s) + 3\ O_2\ (g)$$

Potassium chlorate — Potassium chloride — Oxygen

This shows that the reaction takes place on heating in the presence of manganese dioxide as catalyst. If a reaction takes place in the presence of light, the word "light" is written on the arrow. For example,

$$H_2\ (g) + Cl_2\ (g) \xrightarrow{Light\ or\ hr} 2\ HCl\ (g)$$

Such reactions which take place in the presence of light are called photochemical reactions.

Note, during the balancing of chemical equations, only symbols and formulae of the reactants and products are written without writing their physical states. The physical states or other information, if any, may be included, if necessary, only in the final balanced equation.

HARD SPOT – DIFFICULT AREA - II

Topic : Electrolysis of water

Subtopic : Decomposition of H_2O into oxygen and hydrogen gas on different electrodes.

Objective : To identify the electrodes for Oxygen and Hydrogen gas and their volumes.

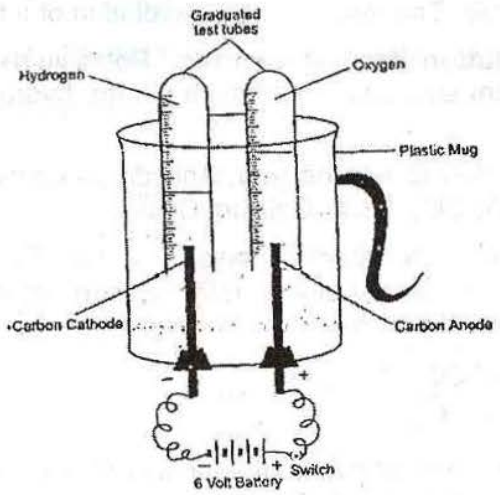


Figure : Voltmeter for electrolysis of water

Objective : Students are not able to identify the respective electrodes for hydrogen and oxygen gases evolved.

Suggestion :

1. It is suggested that during electrolysis of water the graphite rods used as anode and cathode.
2. Produce gases are collected on different electrodes i.e. O_2 and anode and H_2 on cathode.

The volume of O_2 gas collected in the tube is less than the volume of H_2 gas.

The whole arrangement is called a voltmeter.

The following results are observed.

(i) In the test tube covering the cathode, the amount of gas collected is double than that of the gas collected in the test tube covering the anode.

(ii) On resting the gases, the gas in the test tube covering the cathode is found to be hydrogen (a combustible gas-test by bringing a lighted candle).

The above experiment shows that on supplying electrical energy, water decomposes into hydrogen and oxygen according to the reaction :

$$2H_2O(l) \xrightarrow[\text{Current}]{\text{Electric}} 2\,H2\,(g) + O_2\,(g)$$

Water Hydrogen Oxygen

CHAPTER - 2

ACIDS, GASES & SALTS

- Formation of acidic, basic and neutral salts.
- Chlor-alkali process for sodium hydronide.
- Chemicals from common salts.
- How string are acid or base solutions.

HARD SPOT – DIFFICULT AREA - I

Topic : Acidic, Basic and Neutral Salts

Subtopic : Salts formed by acids and basis of different strengths

Objective : It is essential to know the salt formed is a resulting product for what kind of acids and bases.

Suggestion : There are three kind of salts formed from acdis and bases.

1. **Acidic Salts :** Strong acid + Weak bases $HCl + NH_4OH \rightarrow NH_4Cl + H_2O$
2. **Basic Salts :** Strong Base + Weak acid $NaOH + CH_3COOH \rightarrow CH3COONa + H_2O$
3. **Neutral Salt :** Strong acid + Strong base $NaOH + HCl \rightarrow NaCl + H_2O$
4. **Neutral Salt :** Weak acid + Weak base $CH_3COOH+NH_4OH \rightarrow CH_3COONH_4+H_2O$

Strong Acid	Weak Acid	Strong Base	Weak Base
HCl	CH_3COOH	NaOH	NH_4OH
$H2SO_4$	H_2CO_3	KOH	$Ca(OH)_2$
HNO_3	H_3PO_4		$NaHCO_3$ (Basic Salt)
			Na_2CO_3 (Basic Salt)

pH OF SALT SOLUTIONS

Some other examples of salts by different combinations of acids and bases.

1. Salts of strong acids and strong base

   NaCl, $NaNO_3$, Na_2SO_4, KCl, K_2SO_4, KNO_3

   ions eg. : Na^+ Cl^-

   Hence the acid and the base neutralize each other completely. As a result the solution is neutral with pH = 7

2. Salts of strong acid and weak base :
NH_4Cl, $CuSO_4$, $AlCl_3$, $ZnSO_4$, $BaCl_2$.
These salts on dissolving in water produce strong acid and weak base e.g.
$NH_4Cl + H_2O \rightarrow NH_4OH + HCl$
$CuSO_4 + 2H_2O \rightarrow Cu(OH)_2 + H_2SO_4$ $PH < 7$

3. Salts of weak acid and strong base
Na_2CO_3, $NaHCO_3$, CH_3COONa etc.
$Na_2CO_3 + 2H_2O \rightarrow 2NaOH + H_2CO_3$ $pH > 7$

4. Salts of weak acid and weak base
CH_3COONH_4 (Ammonium accetate)
P^H is nearly 7

Hard Spot /Difficult Area-II

Topic : Chemicals From common salts

Subtopic : Preparation and properties of NaOH, Bleaching Powder, Baking Soda, Washing Soda and Plaster of Paris.

Objective : To make the awareness among the students – the common name of different salts

Chemicals Names and their uses in everyday life.

Content : Salts and their formation

Table : Some Common Salts and their Formulate

Salt	Formula	Positive ion	Negative ion
Sodium chloride	NaCl	Na^+	Cl^-
Sodium sulphate	Na_2SO_4	$2Na^+$	SO_4^{2-}
Sodium nitrate	$NaNO_3$	Na^+	NO_3^{2-}
Potassium Nitrate	KNO_3	K^+	NO_3^{2-}
Copper Sulphate	$CuSO_4$	Cu^{2+}	SO_4^{2-}
Calcium Carbonate	$CaCO_3$	Ca^{2+}	CO_3^{2-}

A large number of reactions take place forming salt. A few most common reactions are as follows :-

1. By action of acids on metal carbonates and bicarbonates

$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$

Calcium carbonate Hydrochloric acid Calcium chloride Water Carbon dioxide

2. By action of metals on alkalies.

$2\,NaOH + Zn \xrightarrow{Heat} Na_2ZnO_2 + H_2$

Sodium hydroxide Zinc Sodium zincate Hydrogen

3. By neutralization of acids and bases

$NaOH + HCl \rightarrow NaCl + HO$

Sodium hydroxide Hydrochloric acid Sodium chloride Water

$MgO + H_2SO_4 \rightarrow MgsO_4 + H_2O$

$NH_4OH + HCl \rightarrow NH_4Cl\ H_2O$

4. By action of metals on acids

$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2O$

$Mg + 2HCl \rightarrow MgCl_2 + H_2$

1. Common Salt – Salt used in preparing food

NaCl – sodium chloride is a neutral salt

Present in nature in abundance – obtained from sea water by the process of evaporation.

Rock salt – obtained from underground deposits.

It is an important raw material used in obtaining many useful chemicals like : NaOH, Sodium, soap, baking soda, washing soda.

2. Sodium hydroxide – Common name : caustic soda (NaOH)

Preparation :

When electricity is passed through a concentrated solution of sodium chloride called Brine.

$2NaCl)aq)+2H_2O(l) \xrightarrow[\text{electrolysis}]{\text{electricity}} 2NaOH(aq) = Cl_2(g) = H_2(g)$

(Brine)

The above process is known as chloro alkali process as it produces chlorine and alkali. (NaOH)

- Chlorine gas is produced at anode
- Hydrogen gas is produced at cathode.
- *NaOH solution is formed on* mercury cathode
- All the 3 products are very useful in industry.
- NaOH is used for making
- Soaps and detergents.
- Artificial textile fibres. (rayon)
- Manufacture of paper
- Purifying bauxite ore in extraction of aluminium metal.
- De-greasing metals, oil refining
- Making dyes and bleaches

Chlorine is used :

- As bleaching agent for wool silk.
- To sterilize drinking water supply, swimming pools as it is a disinfectant
- In production of bleaching powder, HCl
- In production of PVC, pesticides, CFCs, CCl_4, paints, dyes

- Uses of hydrogen
- Hydrogenation of oils
- Production of hydrochloric acid, ammonia, fertiiizers, methanol, etc.
- Used as rocket propellant (liquid hydrogen)

3. Beaching Powder

Common name : Calcium oxy-chloride $Ca(OCl)_2$

Preparation : prepared by action of chlorine on dry slaked lime.

$2Ca(OH)_2(s) + 2Cl_2(g) \rightarrow Ca(Ocl)_2 + CaCl_2 + 2H_2O$

(Dry slaked lime) (bleaching powder)

It is used for

1. Bleaching cotton and linen in the textile industry
2. Bleaching wood pulp in paper factories and clothes in laundry
3. As an oxidizing agent in many chemical industries
4. Disinfecting drinking water

4. Baking Soda

Common Name : NaHCO3 (sodium hydrogen carbonate)

Preparation : Produced by reacting a cold and concentrated solution of NaCl (brine) with ammonia and carbon dioxide.

1. $NaCl + NH_3 + N_2O + CO_2 \rightarrow NaHCO_3 + NH_4Cl$

(Brine chloride) — Sodium hydrogen carbonate — Ammonium chloride

On heating, it decomposes

2. $NaHCO_3 \xrightarrow{\Delta} Na_2CO_3 + H_2O + CO_2$

Sodium carbonate

Uses

- For making baking powder. (Mixture of $NaHCO_3$)

  $NaHCO_3 + H^+ \rightarrow O_2 + H_2O$ + Sodium salt of tartaric acid.

  (From Tartaric acid) (CHOH - COOH)

  (CHOH COOH)

  CO_2 then produced causes bread or cake to rise and become spongy.
- Baking soda is used as an antacid.

- used in soda acid fire extinguishers.

5. Washing Soda

Common Name : Sodium carbonate (Na_2CO_3, 10 H_2O)

Anhydrous – Na_2CO_3 – soda ash

Preparation :

1. $NaCl + NH_3 + N_2O + CO_2 \rightarrow NaHCO_3 + NH_4Cl$
2. $2NaHCO_3 \rightarrow Na_2CO_3 + CO_2 + H_2O$
3. The anhydrous sodium carbonate (Soda ash) is dissolved in water and recrystallised to get washing soda crystals.

   $Na_2CO_3 + 10H_2O \rightarrow Na_2CO_3.\ 10H_2O$

Uses

1. Used as a cleansing agent for domestic purposes.
2. Used to remove permanent hardness of water.
3. Used in manufacture of glass, soap, paper, borax.
4. Used in detergents to keep them dry.

Water of crystallization – hydrated salts.

The water molecules which form the structure of a crystal are called water of crystilisation.

The salts containing water of crystallization are called hydrated salts.

Refer to activity (2.15) from NCERT textbook

Example :

Crystal hydrated	Amorphous anhydrous
$CuSO_4.\ 5H_2O$ (blue)	$CuSO_4$ (white)
$Na_2CO_3.\ 10H_2O$	Na_2CO_3 (soda ash)
$FeSO_4.\ 7H_2O$ – (green)	$FeSO_4$
$CaSO_4.\ 2H_2O$	$CaSO_4$

Water of crystallization is a part of crystal structure of a salt since; it is not free water and does not wet the salt.

Water of crystallization gives crystals of the salts their shape and in some cases their colour

Plaster of Paris

Preparation : It is prepared from heating gypsum to a temperature of 373 K in Kiln.

$$CaSO_4.\ 2H_2O \xrightarrow[373\ K]{Heat} CaSO_4.\ 1/2\ H_2O + 1\frac{1}{2}H_2O$$

Plaster of paris

Plaster of Paris has a very remarkable property of setting into hard mass on wetting with water.

The setting of Plaster of Paris is accompanied by slight expansion in volume due to which is used in kaing casts, statues, toys etc, used by doctors and dentists.

(group activity Pg – 35-36 NCERT)

Acids, Bases an Salts. (Questions For Practice)

1. What is the colour of the following in acidic medium : litmus, methyl orange and phenolphthalein?
2. What happens when dilute HCl is added to sodium carbonate, sodium hydrogen carbonate and zinc oxide salts?
3. Define : pH, Neutralization, Alkali
4. Name the acid present in Lemon juice, Rancid butter, Gastric Juice and sting of bees.
5. Two acids A and B have pH values 2 and 4 respectively, which is the stronger acid; A or B?
6. What will be the colour of the solution when phenolphthalein is added to a colourless solution of pH = 3?
7. If a solution changes colour of litmus from red to blue, what can you say about its pH?
8. What can you say about the pH of a solution that liberates CO_2 from sodium carbonate?
9. What is an alkali? Name two caustic alkalies
10. Explain the statement : 'all alkalies are bases but all bases are not alkalies'.
11. List any three properties of an acidic solution.
12. What is a hydronium ion?
13. You have been provided with 3 test tubes. They contain distilled water, an acidic solution and a basic solution respectively. If you are given only red litmus paper, how will you identify the contents of each test tube?
14. A is a soluble acidic oxide; B is a soluble base. Compared to the pH of pure water, what will be the pH of a solution of A and a solution of B?
15. Define pH.
16. Give the chemical name and formula of washing soda and baking soda.
17. What is the chemical composition of plaster of Paris?

CHAPTER – 3
METALS AND NON-METALS

- Reaction of metals with water
  - Cold water
  - Hot water
  - Steam.
- Difference between electrolytic reduction and electrolytic refining.
- Galvanization.
- Termite reaction.
- Amphitric oxides.

HARD SPOT/DIFFICULT AREA-I

Topic : Reaction of metals with water

Subtopic : Reaction of metals with
- Cold Water
- Hot water
- Steam
- Not at all

Objective : All metals do not read with water however few metals react with cold water, hot water and steam.

Content : A.) Reaction of metals with cold H_2O

K, Na and Ca react with cold water violently

$2K+2H_2O \rightarrow 2KOH + H_2$

$2Na +2H_2O \rightarrow 2 NaOH + H_2$

$Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$

B. Reaction of metals with Hot Water

Magnesium does not react with cold water it react with hot water only

$Mg + H_2O \rightarrow MgO + H_2$

C. Reaction of Metals with Steam : Aluminium

Iron and Zn neither react with Cold water nor Hot water or Hot Water they react with the stem to form Metal Oxide and H_2

$2Hl + H_2O \rightarrow Al_2O_3 + 3H_2$

$Zn + H_2O \rightarrow ZnO + H_2$

$3Fe + H_2O \rightarrow FeSo_4 + 4H_2$

D. metals such as A, Cu, Ag Pb do not react with cold and hot water and steam at all.

HOT SPOT/DIFFICULT AREA - II

Topic : Extraction of metals

Subtopic : Difference between Electrolytic Reduction and Electrolytic Refining.

Objective : 1. To aware the students that different types of reaction for the elements as per their reactivity in the activity in reactivity series.

2. Other steps involved in the extraction of metals i.e. electrolytic refining which is different from reduction.

Content : Electrolytic Reduction : The highly reactive metals such as (K, Na, Ca, Mg and Al) can not be obtained by reduction of their oxides by heating with Carbon or Aluminium

because of highly reactive affinitive for oxygen than for carbon or aluminium. Thus the oxides of the highly reactive metals are very stable. Hence at very high temperature these metals form their carbides. Hence these metals ae obtained by the electrolysis of their molten or fused oxides or chlorides. The methods is called electrolytic reduction because electrolysis metal ions being positive are librated at the cathole (negative electrode) where they gain of electron (coming from the source of electricity) and are converted into metal atoms. A few example are given below :

(i) Electrolysis of molten sodium chloride.

When sodium chloride melts, it splits into sodium ion (Na^+) and chloride ions (Cl^-).

$$NaCl\ (s) \xrightarrow[\text{melt}]{\text{Heatto}} Na^+\ (l) + Cl^-\ (l)$$

When electricity is passed through the melt, Na^+ ions go to the cathode whereas Cl^- ions are liberated at the anode. Na^+ ions gain electrons at the cathode and are thus reduced to sodium atoms. Cl^- ions lose electrons at the anode and are thus oxidized to chlorine atoms. These chlorine atoms then combine with each other to form chlorine (Cl_2) gas.

At Cathode :
$$\underset{\text{Sodium ions}}{Na\ (l)} + \underset{\text{Electron}}{e^-} \xrightarrow{\text{Reduction}} \underset{\text{Sodium metal}}{Na\ (s)}$$

At Anode:
$$\underset{\text{Chloride ion}}{Cl^-\ (l)} \xrightarrow{\text{Oxidation}} \underset{\text{Chlorine atom}}{Cl(g)} + e^-$$

$$\underset{\text{Chlorine atoms}}{Cl\ (g) + Cl\ (g)} \rightarrow \underset{\text{Chlorine gas}}{Cl_2\ (g)}$$

Thus, sodium metal is obtained at the cathode whereas chlorine gas is liberated at the anode.

It is important to note that if electrolysis of equeous solution of sodium chloride is carried out, the sodium metal obtained at the cathode reacts with water to form sodium hydroxide and hydrogen gas ($2Na + 2H_2O \rightarrow 2NaOH + H_2$). Thus, instead of sodium metal, hydrogen gas is liberated at the cathode.

Similarly, calcium and magnesium are also obtained by the electrolysis of their fused chlorides.

(ii) Electrolysis of molten alumina.

Alumina (Al_2O_3) is a stable compound. Hence it cannot be reduced to aluminium by heating with carbon. It is obtained by electrolytic reduction of the molten alumina. Molten alumina (Al_2O_3) contains aluminium ions (Al^{3+}) and oxide ions (O^{2-}). On passing electricity, the reactions taking place at the electrodes are as follows :

At Cathode :
$$\underset{\text{Aluminium ions}}{Al^{3+}\ (l)} + 3e^- \xrightarrow{\text{Reduction}} \underset{\text{Aluminium metal}}{Al\ (s)}$$

At Anode:
$$\underset{\text{Oxide ions}}{O^{2-}\ (l)} \xrightarrow{\text{Oxidation}} \underset{\text{Oxygen atom}}{O\ (g)}$$

$$\underset{\text{Oxygen atoms}}{O\ (g) + O\ (g)} \rightarrow \underset{\text{Oxygen gas}}{O_2\ (g)}$$

Thus, aluminium is deposited at the cathode (due to reduction of aluminium ions) whereas oxygen gas is liberated at the anode.

It may be noted that melting point of alumina is very high. Hence, it is dissolved in molten cryolite (Na_3AlF_6) before electrolysis. The mixture has a much lower melting point and a better conductor of electricity than molten alumina.

Step iii. Refining of Impure Metals.

The metal obtained by any of the reduction process explained above still contains a number of impurities. Thus, the metal obtained is not pure. It is called crude metal.

The process of purifying the impure (crude) metal is called refining of the metal.

The method used for refining depends upon the nature of the metal and the nature of the impurities present.

The most commonly employed method for the purification of metals is Electrolytic refining. A large number of metals such as copper, silver, gold, nickel, chromium, zinc, aluminium, zinc, aluminium, tin, lead, etc. are purified by this method. In this method, as the refining of the metal is done by electrolysis, it is called electrolytic refining. The general procedure is as follows :

The impure metal is taken in the form of a thick block and made the anode in the electrolytic bath (or tank), by connecting it to the positive terminal of the battery.

A thin plate of pure metal is made the cathode by connecting it to the negative terminal of the battery.

A suitable water-soluble salt of the metal is taken as electrolyte. Its solution in water is taken in the electrolytic bath (or tank).

When an electric current is passed through the solution, the pure metal from the anode passes into the solution in the form of metal ions and an equivalent amount of metal ions from the solution are deposited as pure metal on the cathode.

At Anode : $\underset{\text{Metal atom (from anode)}}{M\,(s)} \rightarrow \underset{\text{Metal ions}}{M^{n+}(aq)} + ne^-$

At Cathode: $\underset{\text{Metal ions (from solution)}}{M^{n+}(aq)} + ne^- \rightarrow \underset{\text{Metal atom}}{M\,(s)}$

The soluble impurities present in the impure metal pass into solution whereas insoluble impurities fall below the anode as anode mud or anode sludge. Thus, as the electrolysis proceeds, the size of the anode keeps on decreasing while that of the cathode keeps on growing.

To understand the process more clearly, let us take the example of **electrolytic refining of copper.**

The block of impure copper is made the anode. A thin plate of pure copper is made the cathode. A solution of copper sulphate acidified with dilute sulphuric acid is taken as the electrolyte in the electrolytic bath (or tank). On passing electric current, pure copper from the anode passes into the solution as Cu^{2+} ions. An equivalent amount of Cu^{2+} ions from the solution are deposited on the cathode as pure copper.

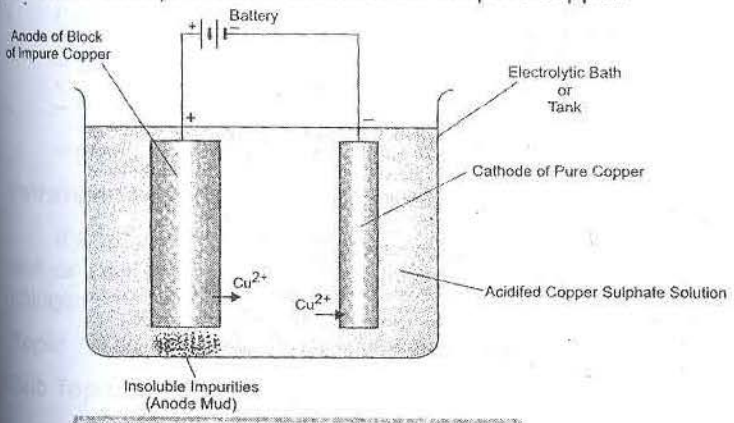


FIGURE Electrolytic refining of copper

Figure Electrolytic refining of copper

At Anode : $\underset{\text{Copper atom (from anode)}}{Cu\,(s)} \rightarrow \underset{\text{Copper ions}}{Cu^{2+}(aq)} + 2e^-$

At Cathode: $\underset{\text{Copper ions (from solution)}}{Cu^{2+}(aq)} + 2e^- \rightarrow \underset{\text{Copper atom}}{Cu}$

Thus, as the electrolysis proceeds, anode becomes thinner whereas cathode becomes thicker. Further, impure copper usually contains the impurities of iron, silver and gold. Iron, being more reactive than copper, is also oxidized to ferrous ions (Fe) which remain dissolved in the solution. The impurities of silver and gold which are less reactive than copper, do not undergo wxidation and fall below the anode as such in the form of 'anode mud'.

We observe that the electrolytic method of refining of copper not only purifies the metal but also gives precious metals like gold and silver in the native state (as anode mud).

To sum-up, the methods used and the steps applied for the extraction of different types of metals are given below :

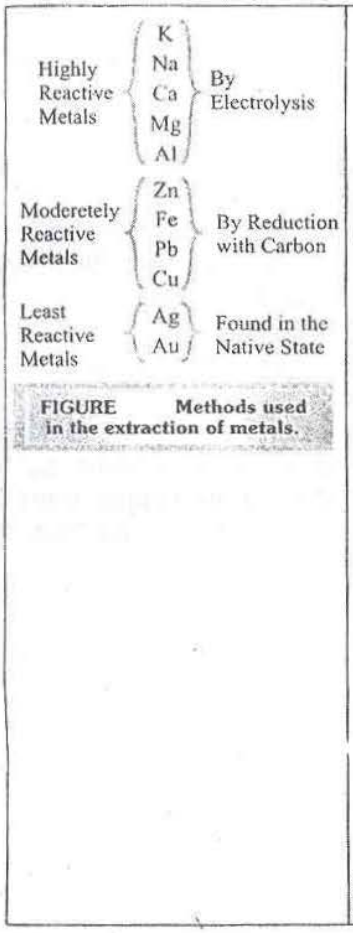


FIGURE Methods used in the extraction of metals.

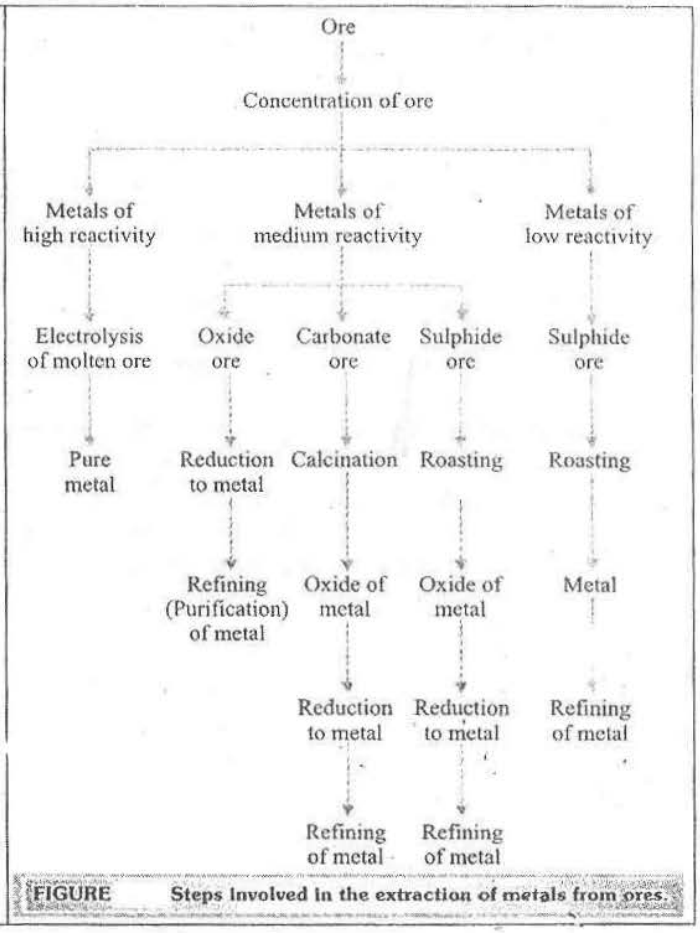


FIGURE Steps involved in the extraction of metals from ores.

Figure Steps involved in the extraction of metals from ores.

Chapter - 4

CARBON AND ITS COMPOUNDS

- Versatile nature of carbon
  - Catenation
  - Tetra Valency
- Nomenclature of Carbon Compounds
- Halo alkanes
- Isomaerism
- Soap and detergent
  - Cleansing action of soap
  - Structure

Hard Spot – I

CARBON AND ITS COMPOUNDS

Topic : Versatile Nature of Carbon

Subtopic : (1) Catenation and tetravalency

Objective : To know about million of Compounds

Are formed by carbon, through linkage and types of bonds

Content : Catenation – This property of self linking of carbon atoms through covalent bonds to form long straight chain or branched chains and rings of different sizes is called catenation.

Suggestion :

Tell the students about hydro carbons silanas and tetravalency, tendency to form multiple bonds. Isomerism.

- Catenation is probably due to –
  - Small size
  - Unique electronic configuration
  - great strength of carbon – carbon bond

Tetravalency of Carbon : Carbon has a valency of four.

It's capable of bonding four other atoms of carbon or some other elements. It links self as well as very strong bond with many elements such as hydrogen, oxygen, nitrogen, sulphur, halogens etc.

Topic : Nomenclature of organic Compound

Sub Topic : Rules for determing the organic compound per IUPAC system.

Objective : To know about how to give the name of organic compounds.

Content : A Carbon compound lie named as follows :

(1) Find and count the number of carbon atoms in the compound

(2) Find type of bond

(3) Find wheather it is a alkane, alkene or Alkyne

(4) Identify the functional group if any

Suggestions :

It is essential to know which type of general formula is followed by the compounds as

(1) C_nH_{2n+2}

(2) C_nH_{2n}

(3) C_nH_{2n-2}

- A compound containing one carbon atom named after methane
- A compound containing two carbon atoms named after ethane
- A compound containing three carbon atoms named after propane
- A compound containing four carbon atoms named after butane
- A compound containing five carbon atoms named after pentane
- A compound containing six carbon atoms named after hexane

First four C-compounds are given specific names.

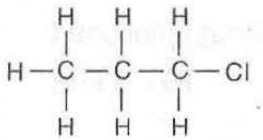
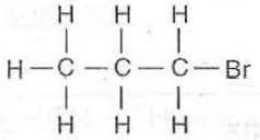
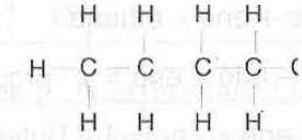
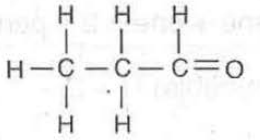
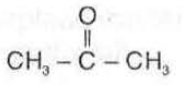
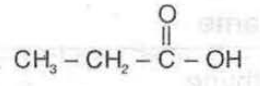
(2) The functional group present in inorganic compound are indicated either by a prefix or by a suffix.

(3) If suffix is to be added from the name of the carbon chain is deleted :

S.No.	Functional group	Suffix	Prefix
1.	Chlorine	Chloro	–
2.	Bromine	Bromo	–
3.	Alcohol	–	Ol
4.	Aldehyde	–	al
5.	Ketone	–	One
6.	Carboxylic Acid	–	Oic acid
7.	Double bond	–	ene
8.	Triple bond	–	yne

(4) The position of functional group on the carbon chain is given by the lowest possible numerical prefix as 1, 2, 3, 4, 5 ..... etc.

EXAMPLES

S.No	Org. Compound	Name of Carbon Chain	Prefix (P) or Suffix (S) in a group	Complete IUPAC Names
1.		Propane	Chloro (P)	Chloro + Propane = Chloro propane
2.		Propane	Bromo (P)	Bromo + Propane = Bromopropane
3.		Butane	Ol (S)	Butane – C + ol = Butanol
4.		Propane	al (S)	Propane e + al = Propanal
5.		Propane	One (s)	Propane –e + one e = Propanone
6.		Propane	Oic acid (s)	Propane –e + oic acid = Propanoic acid
7.	$CH_3 - CH = CH_2$	Propane	Ene	Propane – ane + ene = propene
8.	$CH_3 - C \equiv CH$	Propane	yne	Propane – ane + yne = propyne

GREY AREA – II

NOMENCLATURE OF DIFFERENT CLASSES OF ORGANIC COMPOUND

(1) Alkenes : General formula, C_nH_{2n}

where n = 2, 3, 4, ... etc.

Functional group C = C (double bond)

Suffix : ene

Name. Replace the terminal (ane) by 'en' suffix.

eg. $C^4H_3C^3H = C^2H\ C^1H_3$ – 2 - Butane – ane = Butene

n	Formula	Numerical Prefix
2	$CH_2 = CH_2$	Ethane – ane + ene = ethene
3	$CH_3 – CH = CH_2$	1 + propane – ane + ene = 1 - propene
4	$CH_3CH_2CH = CH_2$	1 + Butane - ane + ene = 1 – Butene
5	$CH_3CH_2CH = CHCH_3$	2 + pentane – ane + ene = 2 – pentene

(2) Alkynes : Gen. formula C_nH_{2n-2}

Functional group

– C ≡ C – (triple fond)

Suffix : yne

n	Formula	Numerical pre.	Name
2	CH ≡ CH	–	Ethyne
3	$CH_3 – CH ≡ CH$	–	propyne
4	$CH_3–CH_2–C ≡ CH$	1	1 + But – ane + yne = 1 – Butyne

Halo alkanes : Gen Formula = $C_nH_{2n} + 1\ X$

Functional group : F, Cl, Br, I

Prefix : Fluoro, Chloro, Bromo, Iodo

eg. – CH_3 –Cl Chloro + methane = Chloromethane

+ CH2 Homologons sequences

$CH_3 – CH_2 – CH_2 – I$ = 1 + Iodo + Propane = 1 – Iodopropane

$CH_3 - CH_2 - CH_2 - CHI - CH_3$ = 2 - Iodopropane

$CH_3 - CH_2 - CH_2 - \underset{\underset{Cl}{|}}{CH} - CH_3$ = 2 – Chloropentane

Alcohols : General formula : $C_n H_{2n+1}OH$

Functional group : OH (Hydroxyl)

Suffix – Ol

Name : Replace the terminal 'e' from the name of the corresponding olkane by suffix 'Ol'.

E.g.

$CH_3 - CH_2 - \underset{\underset{OH}{|}}{CH} - CH_3$ = 2 + Butane – e + ol = 2 - Butanol

Aldehydes : Gen. Formula : CnH_{2n+1} CHO

Functional Group :

$-\overset{\overset{O}{\|}}{C} - H$ (aldenyde)

Suffix : al

Name : Replace the terminal 'e' from the name of the corresponding alkane by suffix 'al'.

Eg. $CH3 - CH2 - CH2 - \overset{\overset{O}{\|}}{C} - H$ = Butane – e + al = Butanal

Ketones : Gen. formula : $C_nH_{2n+1}CO\ Cn'H_{2n'}+1$

Or

$R - \overset{\overset{O}{\|}}{C} - R'$

Where $R = C_nH_{2n+1}$

$R' = Cn'1H_{2n'_{1+1}}$

Functional Group : $-\overset{\overset{O}{\|}}{C} -$ (Ketone)

Suffix : one

$$\text{Eg.} - CH_3 - CH_2 - \overset{\overset{O}{\|}}{C} - CH_3$$

2 + butane – e + one = 2 – butanone.

Carboxylic acids :

Gen. formula : $C_nH_{2n+1}COOH$ or $R - \overset{\overset{O}{\|}}{C} - OH$

$R = C_nH_{2n+1}$

n = 0, 1, 2, 3 ..... etc.

Functional group : $\overset{\overset{O}{\|}}{C} - OH$ (Carboxyl)

Suffix : oic acid

Name : Replace terminal 'e' from the name of the corresponding alkane by suffix "oic acid".

$$\text{eg : } CH_3 - CH_2 - CH_2 - CH_2 - \overset{\overset{O}{\|}}{C} - OH$$

= Pentanoic acid

$$CH_3CH_2 - \overset{\overset{O}{\|}}{C} - OH$$ – propane – e + oic acid

= propanoic acid

Topic : Soaps and detergents

Subtopic : (i) Difference
(ii) Structure
(iii) Ecofriendly

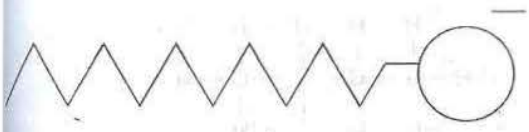
Objective : To make aware the students about the structure between soaps and detergents, which of them is ecofriendly, and letter cleansing agents.

Content :

Soap : Sodium and Potassium salts of higher fatty acids such as palmitic acid, stearic acid, oleic acid etc are called soaps. Soaps contain in two parts.

(1) Long Hydrocarbon tail (non polar - hydrophobic)

(2) Negatively charged head (polar - hydrophillic)



Hydrophillic

Soap or detergent molecule.

Hydrophobic tail

When a soap or detergent is added to water the polar heads of their molecules dissolve in water while non-polar tails dissolve in each other. As a result the soap or detergent forms spherical ionic micells.

DIFFICULT AREA – III

TOPIC : ISOMERISM

Subtopic : Structural Isomerism

Objective : It is very important to aware the students that isomerism is not possible in hydrocarbons with one, two and three carbon atoms, this is so because in these hydrocarbons different arrangements of carbon atoms, It means branching is not possible.

Contents :

Isomerism is the existence of more than one compound with the same molecular formula is called isomerism and the distinct compounds with the same molecular formula are called isomers.

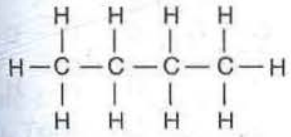
Characteristics of isomers :

1. Isomers have the same molecular formula
2. Isomers have the different structural formula.
3. Isomers have different physical & chemical properties.
4. Greater the numbers of carbon atoms the greater the number of ways of arranging those atoms and greater numbers of isomers are formed.

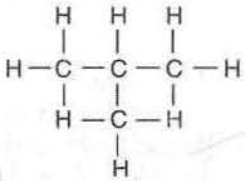
EXAMPLES OF STRUCTURAL ISOMERISM :

Butane, C_4H_{10} (It has only two isomers)

Possible isomers



(i)



(ii)

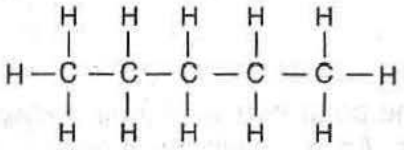
n – butane

iso-butane (2 – methyl propane) Pentane.

C_5H_{12} (It has only three isomers)

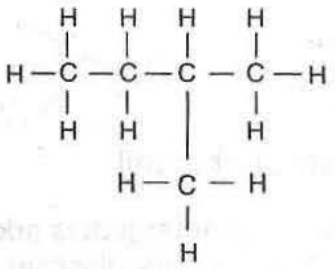
Possible isomers :

(i)



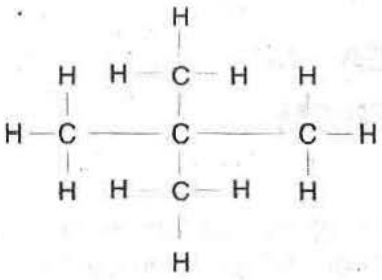
n – pentane

(ii)



Iso – pentane (2, methyl - butane)

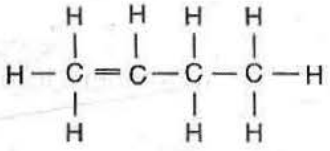
(iii)



(2, 2 Dimelthyl Propane)

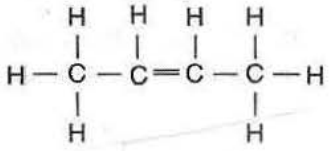
Butene C_4H_8 (Only two isomers are possible)

(i)



Butane – 1

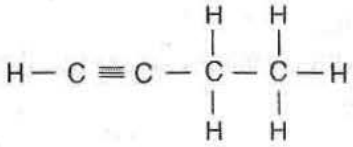
(ii)



Butene – 2

Butyne – C_4H_6 (Only two isomers possible)

(i)



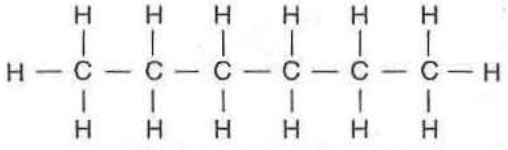
Butyne – 1

(ii)

Butyne 2

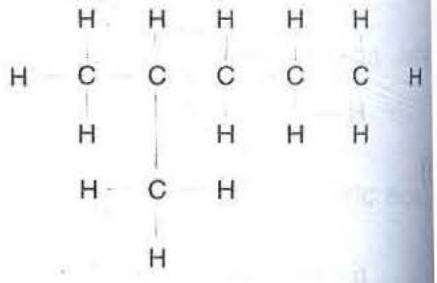
C_6H_{14} Hexane (Five isomers of hexane are possible)

(i)



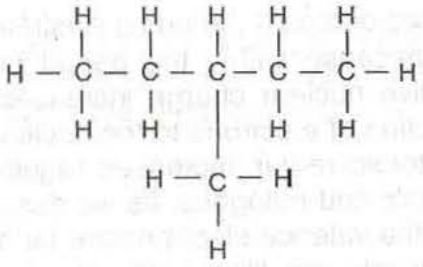
n-Hexane

(ii)



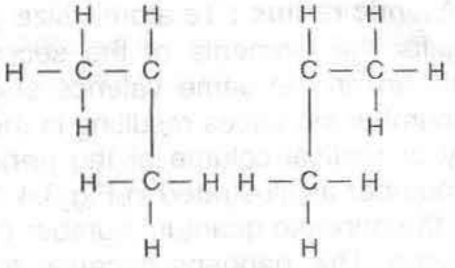
Iso-hexane

(iii)



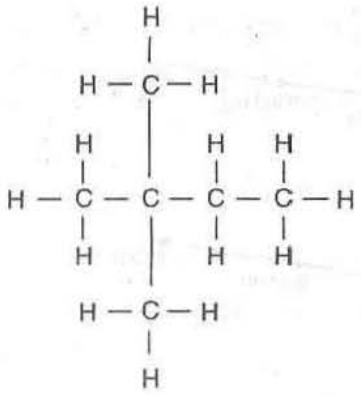
3, methyl pentane

(iv)



2, 3 - Dimethyl butane

(v)



2, 2 - Dimethyl butane.

Note : Only structural isomerism is to tech including Alkane, Alkene & Alkyne.

CHAPTER – 5.
PERIODIC CLASSIFICATION OF ELEMENTS

Hard Spot

- Mendeleev's Periodic Table
  - Achievement
  - Limitation
  - Formation of oxide & hydrides
- Modern Periodic table
  - gradation in properties
  - periodicity

HARD SPOT - I

Topic : Trends in physical and chemical properties of the elements

Sub. Topic : Gradation in properties in modern Periodic Table.

Objective : To aware the students that in groups and periods there is a change in properties as we move from left to right across the periods or top to bottom across the groups there is change in properties of different elements.

Content : Trends in Physical Properties :

(a) Atomic radius : Te atomic size generally decreases across a period as illustrate in Fig. 3.4 (a), for the elements of the second period. It is because within the period the outer electrons are in the same valence shell and the effective nuclear charge increases as the atomic number increases resulting in the increased attraction of electrons to the nucleus within a family or vertical column of the periodic table, the atomic radius increases regularly with atomic number as illustrated in Fig 3.4 (b). For alkali metals and halogens, as we descend the groups, the principle quantum number (n) increases and the valence electrons are farther from the nucleus. This happens because the inner energy levels are filled with electrons which serve to shield the outer electrons from the pull of the nucleus. Consequently the size of the atom increases as reflected in the atomic radii.

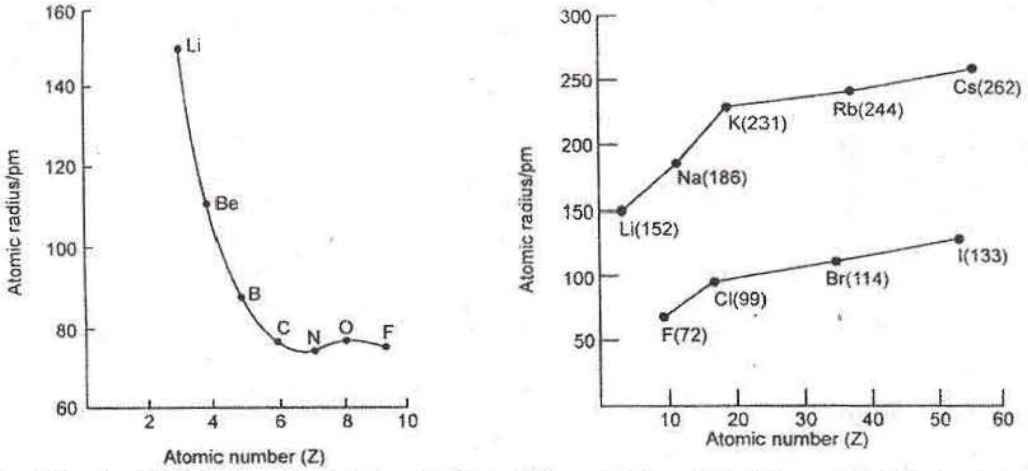


Fig 3.4 (a) Variation of atomic radius with atomic number across the second period. (b) Variation of atomic radius with atomic number for alkali metals and halogens.

Table Atomic Radii/pm across the Periods

Atom (Period II)	Li	Be	B	C	N	O	F
Atomic radius	152	111	88	77	70	74	72
Atom (Period III)	Na	Mg	Al	Si	P	S	Cl
Atomic radius	186	160	143	117	110	104	99

Table Atomic radii/pm down the group across a family

Atom Atomic radius Atom Atomic radius

Atom	Atomic radius	Atom	Atomic radius
Li	152	F	72
Na	186	Cl	99
K	231	Br	114
Rb	244	I	133
Cs	262	At	140

(b) Ionic radius : The removal of an electron from an atom results in the formation of a action whereas gain of electron leads to an anion. A action is smaller than its parent atom because it has fewer electrons while its nuclear charge remains the same. The

size of an anion will be larger than that of the parent atom because the addition of one or more electrons would result in increased repulsion among the electrons and a decrease in effective nuclear charge.

Atoms and ions which contain the same number of electrons, we call them is electronic species. The action with the greater positive charge will have a smaller radius because of the greater attraction of the electrons to the nucleus. Anion with greater negative charge will have the larger radius. In this case, the net repulsion of the electrons will outweigh the nuclear charge and the ion will expand in size.

(C) Ionization Enthalpy :

Ionization enthalpy : It represents the energy required to remove an electron from an isolated gaseous atom (X) in its ground state. In other words, the first ionization enthalpy for an element X is the enthalpy change ($\Delta_i H$) for the reaction depicted in equation.

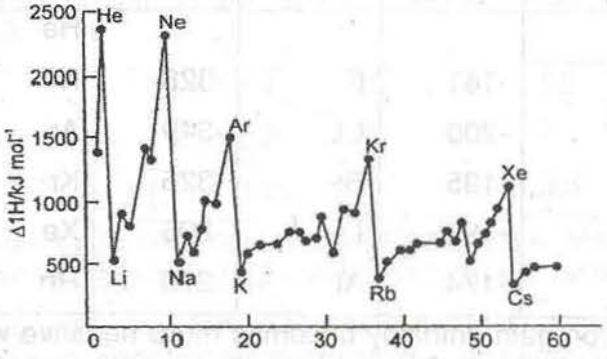
$$X(g) + \rightarrow X^{+}(g) + e^{-}$$

The ionization enthalpy is expressed in units of KJ mol^{-1}

Table IE_1, IE_2 and IE_3 of some elements (KJ mol^{-1})

Element	Atomic No.	IE_1	IE_2	IE_3
Li	3	52	7297	11810
Be	4	900	1757	14850
B	5	800	2427	3638
C	6	1086	2352	4619
N	7	1402	2858	4576
O	8	1314	3388	5296
F	9	1681	3375	6045

The first ionization enthalpies of elements having atomic numbers upto 60 are plotted in Fig. 3.5.



Variation of first ionization enthalpies ($\Delta_i H$) with atomic number for elements with Z – 1 to 60

The first ionization enthalpy generally increases as we go across a period and decreases as we descend in a group.

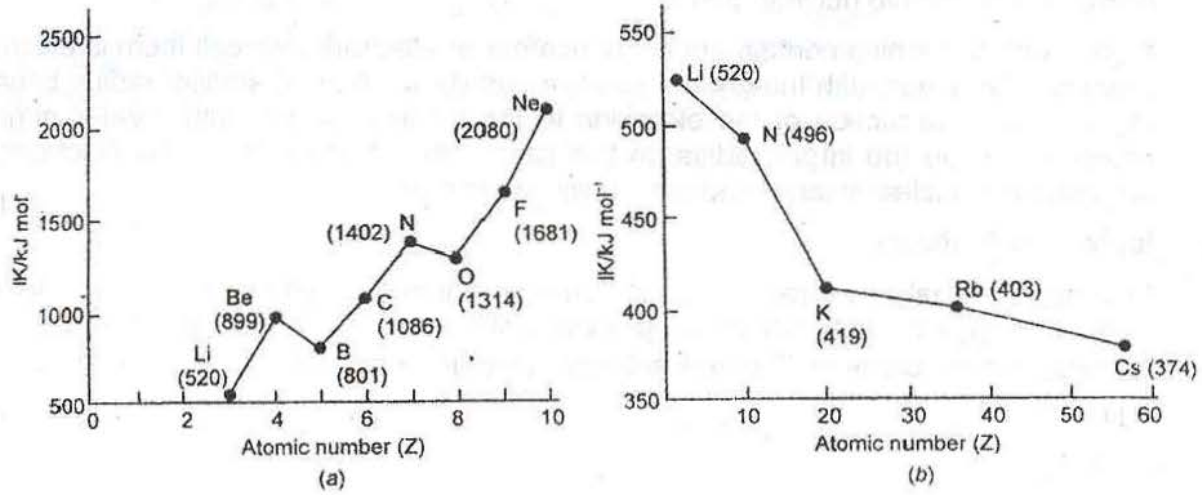


Fig. (a) First ionization enthalpies of elements of the second period as a function of atomic number.

(b) First ionization enthalpies of akkali metals as a function of atomic number.

(d) Electron Gain Enthalpy () : When an electron is added to a neutral gaseous atom (X) to convert it into a negative ion, the enthalpy change accompanying the process is defined as the Electron Gain Enthalpy (ΔH_{eg}). Electron gain enthalpy provides measure of the case with which an atom adds an electron to form anion as represented by equation.

$$X(g) + e^- \rightarrow X^-(g) \quad \Delta H = \Delta H_{eg}$$

Depending on the element, the process of adding an electron to the atom can be either endothermic or exothermic.

Table 3.9 Electron gain enthalpies/kJ mol^{-1} of some main group elements

Group I	$\Delta_{eg}H$	Group 16	$\Delta_{eg}H$	Group 17	$\Delta_{eg}H$	Group O	$\Delta_{eg}H$
H	-73					He	+48
Le	-60	O	-141	F	-328	Ne	+116
Na	-53	S	-200	Cl	-349	Ar	+96
K	-48	Se	-195	Br	-325	Kr	+96
Rb	-47	Te	-190	I	-295	Xe	+77
Cs	-46	Po	-174	At	-270	Rn	+68

As a general rule, electron gain enthalpy becomes more negative with increase in the atomic number across a period. The effective nuclear charge increases from left to right across a period and consequently it will be easier to add an electron to a smaller atom since the added electron on an average would be closer to the positively charged nucleus. We could also

expect electron gain enthalpy to become less negative as we go down group because the size of the atom increases and the dded electron would be farther from the nucleus. However, electron gain enthalpy at O or F is less than that of the succeeding element. This is because when an electron is added to O or F, the added electron goes to the smaller n = 2 quantum level and suffers significant repulsion from the other electrons present in this level. For the n = 3 quantum level (S or Cl), the added electron occupies a larger region of space and the electron-electron repulsion is much less.

Electro negativity : The relative tendency of an atom in a molecule to attract a shared pair of electrons towards itself is termed as its electro-negativity.

Electro-negativity of elements decreases down the group. This is because an increase in the atomic size decreases the tendency to attract the shared pair of electrons. The electro-negativities of alkali metals and halogens are given below.

Element	Li	Na	K	Rb	Cs
Electro-negativity	1.0	0.9	0.8	0.8	0.7
Element	F	Cl	Br	I	At
Electro-negativity	4.0	3.2	2.9	2.6	2.2

The electro-negativity increases from left to right in a period. In going from left to right in a period, the nuclear charge increases, while the electrons enter the same shell. The electrons in the same shell cannot shield each other effectively from the attractive force of the nucleus. Thus, the increased nuclear charge can attract the shared pair of electrons more strongly. This results in higher electro-negativity. The electro-negativities of elements of second period are given below

Element	Li	Be	B	C	N	O	F	Ne
Nuclear charge	+3	+4	+5	+6	+7	+8	+9	+10
Electronegativity	1.0	1.6	+2.0	2.5	3.0	3.4	+4.9	-

Periodic Trends in Chemical Properties

(a) Periodicity of valence or oxidation states : Combining capacity of an element is known as its valency. The valence of representative elements is usually equal to the number of electrons in the outermost orbital and/or equal to eight minus the number of outermost electrons as shown below.

Group	1	2	13	14	15	16	17	18
Number of valence electron	2	2	3	4	5	6	7	8
Valence	1	2	3	4	3.5	2.6	1.7	0.8

Thus in a group , the valency of an element remains constant while in a period it increases from left to right. However, noble gases on the extreme right are zero valiant.

The arbitrary charge assigned to an atom in a compound is known as its oxidation number or oxidation state. Transition and inner transition metals have variable oxidation numbers.

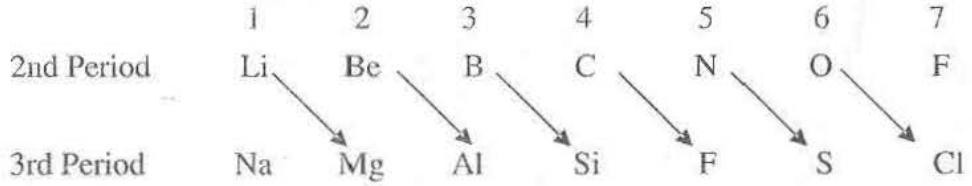
Some periodic trends observed in the valence of elements (hydrides and oxides) are shown in the table 3.11.

Table Periodic trends in valences of elements as shown by the formulae of their compounds

Group	1	2	13	14	15	16	17
Formulae of hydrides	LiH NaH KH			CH_4 SiH_4 GeH_4 SnH_4	NH_3 PH_3 AsH_3 SbH_3	H_2O H_2S H_2Se T_2e	HF HCl HBr HI
Formulae of oxides	Li_2O Na_2O K_2O	MgO CaO SrO BaO	B_2O_3 Al_2O_3 Ga_2O_3 In_2O_3	CO_2 SiO_2 GeO_2 SnO_2 PbO_2			

(b) Anomalous Properties of Second Period Elements :

Diagonal relationship : Elements of second period are known as bridge elements. Properties of the bridge elements resemble with the properties of the diagonal elements of the third period. For example, Li, resembles Mg, Be resemble Al, boron resembles Si, etc.



The anomalous behaviour is due to their small size, large charge/radius ratio and high electronegativity of the elements. In addition, the first member of group has only four valence orbitals (2s and 2p) available for bonding, whereas the second member of the groups have nine valence orbitals (3s, 3p, 3d). As a consequence of this, the maximum covalency of the first member of each group is 4 (e.g., boron can only from $[BF_4]$), whereas the other members of the groups can expand their valence shell to accommodate more than four pairs of electrons e.g., aluminum forms $[AlF_6]^{3-}$. Furthermore, the first member of p-block elements displays greater ability to form $p\pi - p\pi$ multiple bonds to itself (e.g., C = C, C≡C, N = N, N ≡ N) and to other second period elements (e.g., C = O, C = N, C ≡ N, N = O) compared to subsequent members of the same groups.

Periodic Trends and Chemical Reactivity

Reactivity of Metals : The reactivity of metals is measured in terms of their tendency to lose electrons from their outermost shell.

In a Period : The tendency of an element to lose electrons decreases in going from left to right in a period. So, the reactivity of metals decreases in a period from left to right. For example, the reactivity of third period elements follows the order.

Na	>	Mg	>	Al
More reactive				reactive

In a group : The tendency to lose electrons increases as we go down a group. So, the reactivity of metals increases down the group. Thus, in group 1, the reactivity follows the order.

Li	>	Na	<	K	<	Rb	<	Cs
Least								Most
Reactive								Reactive

Reactivity increases →

Reactivity of Non-Metals : The reactivity of a non-metal is measured in terms of its tendency to gain electrons to form an anion.

In a period : The reactivity of non-metals increases from left to right in a period. During reaction, non-metals tend to form anions. For example, in the second period, the reactivity of non-metals increases in the order.

C	<	N	<	O	<	F
Less						More
Reactive						Reactive

Reactivity increases →

In a group : the reactivity of non-metals in a group decreases as we go down the group. This is because the tendency to accept electrons decreases down the group. The reactivity of halogens follows the order

F	>	Cl	>	I
Most				Least
Reactive				Reactive

Reactivity decreases →

Chapter-5

Hard Spot-II

Topic : Mendeleev's periodic Table

Sub Topic : Achievements & Limitations of Mendeleev of Periodic Table

1. Systematic study of elements :

Since there is a systematic correlation between physical and chemical properties of groups of elements it permits the study of the group rather than individual elements.

2. Predication of new elements :

While arranging the elements in the order of increasing atomic mass Mendeleev had left gaps at certain places for the yet to be discovered elements. He foretold the properties of these yet to be discovered elements with great accuracy. Three of the elements which he had named as eka aluminum, eka boron, eka silican were discovered fifteen years later and are now named as scandium, gallium and germanium respectively.

3. Noble gases : Noble gases like helium, neon, argon were discovered very late since these are inert and present in very low concentration in the atmosphere. When these were discovered these could be placed in a separate new group without disturbing the existing order.

4. Provision of marked stimulaw : If stimulated the study of atomic structure and helped in the establishment of electronic configuration of element and their correlation with properties.

5. Correctness of atomic mass : It was useful to find out the correct atomic mass of some elements.

Limitations of Mendeleev's Periodic Table

1. Anomalous position of hydrogen. Hydrogen has one electron in its only shall i.e. K-shell. Alkali metals also have only one electron in their respective outermost shells. Therefore, many properties of hydrogen are similar to those of alkali metals.

   Compounds of hydrogen (H) Compounds of Sodium (Na)

   HCl, H_2O, H_2S NaCl, Na_2O, Na_2S

   Hydrogen can be placed alongwith alkali metals of group IA of the Mendeleev's periodic table.

   Halogens, on the other hand, have seven electrons in their respective outermost shells. In other words, like hydrogen, halogens also have one electron less than their respective nearest noble gases (which have eight electrons). Therefore, may properties of hydrogen are similar to those of halogens. For example, just like halogens (F_2, Cl_2, Br_2, I_2 etc.) hydrogen (H_2) also exists as a diatomic molecule. Similarly, like halogens, hydrogen also combines with alkali metals to form ionic compounds and with non-metals to form covalent compounds as shown below.

Element	Ionic compounds with metals	Covalent compounds with non-metals
Hydrogen	Na^+H^- $Ca^{2+}(H^-)_2$	CH_4, NH_3 H_2O
Chlorine	Na^+Cl^-	CCl_4
(Halogen)	$Ca^+(Cl^-)_2$	NCl_3

Hydrogen can be placed along with halogens of group VHA of the Mendeleev's periodic table.

2. **Position of Isotopes :** Isotopes are the atoms of the same element having similar chemical properties but different atomic masses.

   These isotopes cannot be placed at separate positions because there is no provision for them in the Mendeleev's periodic table.

3. **Wrong order of atomic masses of some elements could not be explained.**

   According to Mendeleev's periodic law, elements are arranged in order of their increasing atomic masses. It was found that the element with higher atomic mass comes first and the element with lower atomic mass comes later. For example, cobalt (Co) with higher atomic mass (58.93 u) has been placed before nickel (Ni) with lower atomic mass (58.71 u). Similarly, tellurium (Te) with higher atomic mass (127.6 u) has been paced before iodine (I) with lower atomic mass (126.9 u).

4. **Uncertainty in prediction of new elements** In Mendeleev's periodic table, the elements are arranged in increasing order of their atomic masses. But the atomic masses do not increase in a regular manner in going from one element to the next. Further, the difference in atomic masses between two successive elements is small among lighter elements but large among heavier elements.

Hard Spots /Difficult Areas in Biology Class X

Chapter-6 Life Processes

Hard Spot No. 1

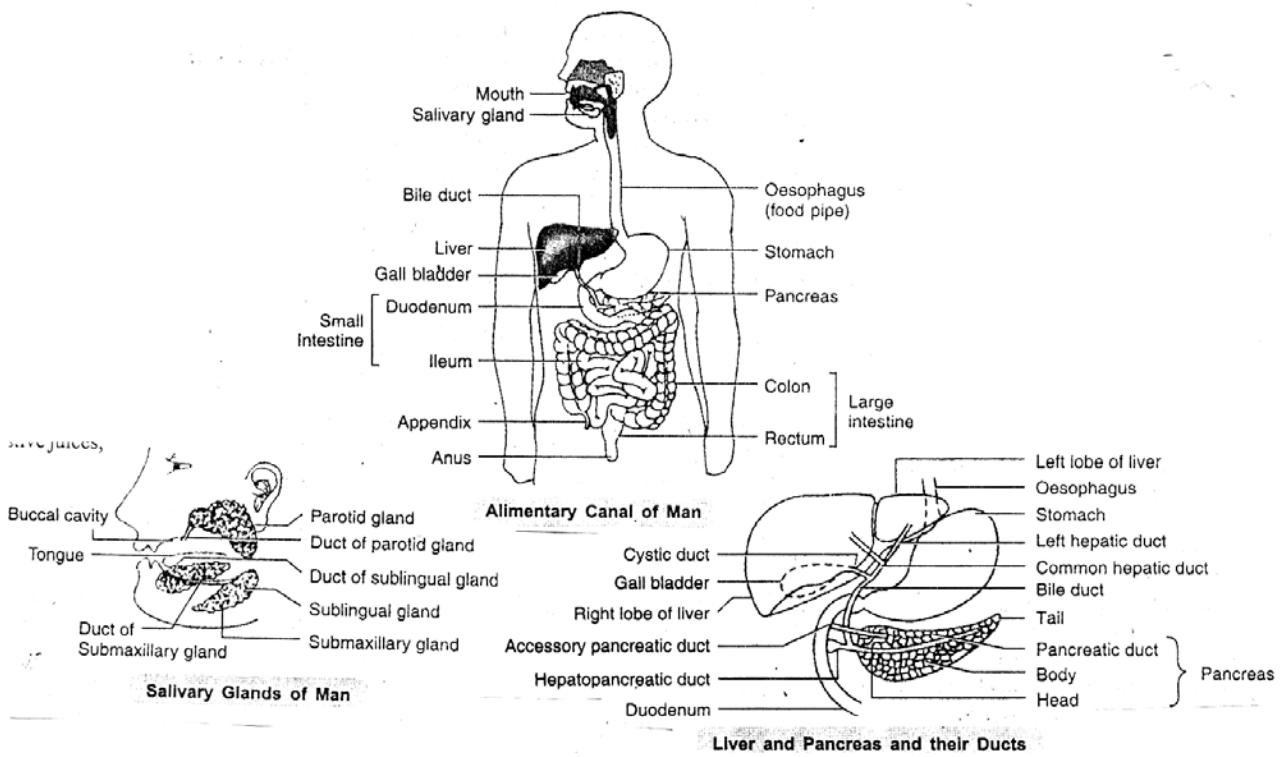
Topic - Nutrition

Difficulties Identified

Role of Enzymes in Nutrition Process

Suggestion- Different enzymes, their source and their substrate should be given in tabular from as under-

Organ	**Secretion**	**Enzymes**	**Type of Food on Which it Acts**	**Products of Digestion**
Salivary Glands in Mouth	Saliva	Salivary Amylase	Starch	Maltose
Stomach	Gastric Juice which contains DIL. HCL and Pepsin	Renin in Children, Pepsin	Milk and Protein	Curdles Milk Peptones
Liver	Bile	-------	Fat	Emulsifies Fat
Pancreas	Pancreatic Juice	Pancreatic Amylase, Trypsin and Lipase	Starch, Proteins	Maltose, Peptones, Amino Acids
Small Intestine	Succus Entericus	Peptidase, Maltase, Invertase, Sucrase, Lactase	Proteins and Peptones, Maltose, Sucrose, Lactose	Amino Acids, Glucose and Fructose Glucose and Galactose



Mouth consists of

a) Tongue has taste buds for taste. Mixes food with saliva. Helps in swallowing the food.

b) Teeth : four types of teeth. Incisors for biting food; canines for cutting and tearing: premolars and molars for grinding the food.

c) salivary glands; secrete saliva which contains salivary amylase enzyme.

Oesophagus : Also known as food pipe. It is the passage for food. The food moves by peristaltic movement.

Stomach : Muscular organ. Expands when the food enters it. Lined with gastric glands which secrete juices.

It contains dilute HCL, Two enzymes rennin and pepsin, a weak gastric lipase and mucus.

Functions of HCL :

i) Soften food.

ii) Kills bacteria present in the food. Stops the action of saliva.

iii) Creates an acidic medium for the action of enzymes.

Renin : The enzyme is present only in children. It enables coagulation or curdling milk.

Pepsin : breaks proteins to proteases and peptones.

Mucus : protects the inner lining of the stomach from the action of enzymes.

Sphincter muscles in stomach regulate the exit of food from stomach by releasing it in small amounts to small intestine.

Small intestine : longest and extensively coiled part. Site of complete digestion of carbohydrates, proteins and fats. Secretes intestinal juice for the digestion and absorption of food. The inner lining of small intestine has numerous finger like projections called willi. These increase the area of absorption.

Large intestine : Absorbs excess of water.

Rectum : Stores undigested waste food. This exits through anus which is controlled by anal sphincter muscles.

Hard Spot No. 2

Topic – Respiration

Difficulties Identified

1) Difference between breathing and Respiration

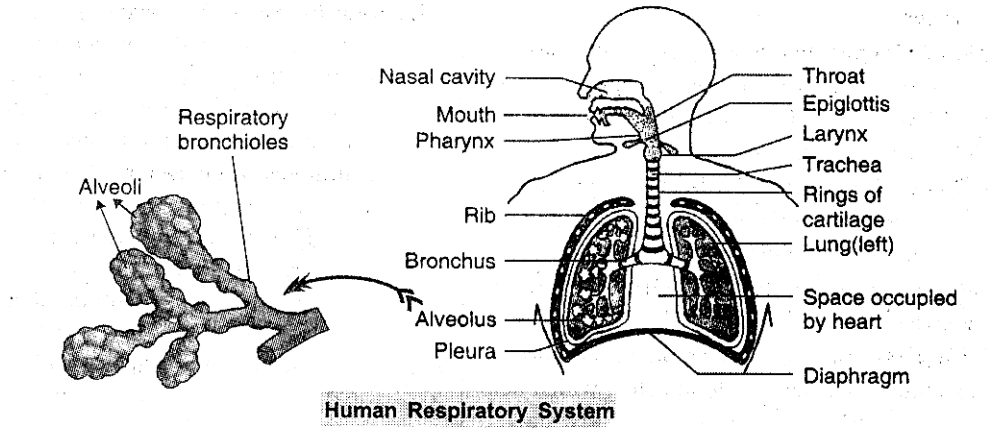
Suggestion –

Mechanism of breathing in Humans-

- Breathing is a physio- mechanical process of gaseous exchange taking place in lungs.
- It is a complex mechanical process involving muscular movements that alter the volume of thoracic cavity and thereby that of the lung.
- Breathing occurs involuntarily but its rate is controlled by the respiratory centre of the brain.
- Inspiration or Inhalation is concerned with the taking in of atmospheric air into the thoracic cavity
- Expiration or Exhalation is concerned with the expelling of carbon dioxide from the lungs

Respiration in human beings

- The food taken in during nutrition is used in cells to provide energy for various life processes.
- This is done in different ways by different organisms. This process is known as respiration.
- Respiration is a biochemical process taking place in every living cell.
- It is oxidation of nutrients in the presence of specific enzymes at optimum temperature in the mitochondria of cells to release energy for various metabolic activities.
- In the cells, continuous metabolism of glucose and other substances results in the production of CO_2 and utilization of O_2.



HUMAN RESPIRATORY SYSTEM

Hard Spot No. 3

Topic Respiration

Difficulties Identified

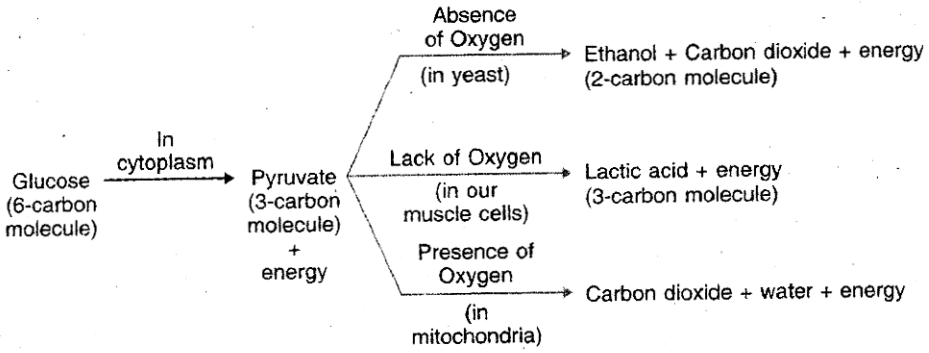
Breakdown of Glucose by Various Pathways

Suggestion- The idea of aerobic respiration and anaerobic respiration is included for the first time in the content, therefore should be dealt on dealt on quantum of energy yield basis.

Two types of respiration

Anaerobic Respiration – It takes place in the absence of Oxygen in yeast and other lower organisms. This type of respiration releases less amount of energy.

Aerobic Respiration- It takes place in the presence of Oxygen. It releases large amount of energy, takes place in the mitochondria of the cells.



BREAK-DOWN OF GLUCOSE BY VARIOUS PATHWAYS

Hard Spot No. 4

Topic – Transportation in Human Beings

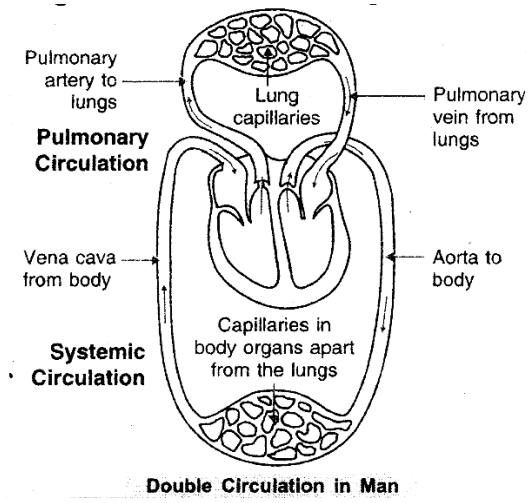
Difficulties Identified

Diagram showing schematic representation of transport and exchange of oxygen and Carbon Dioxide. The blood circulation to head region is not shown.

Suggestion-

a) The diagram is not self-explanatory. It can be inferred that the oxygen uptake is taking place at one site and the lung is not a paired structure.

b) Blood supply to the region above the level of lungs is not shown



Double Circulation in Man

Schematic representation of transport and exchange of oxygen and carbon dioxide

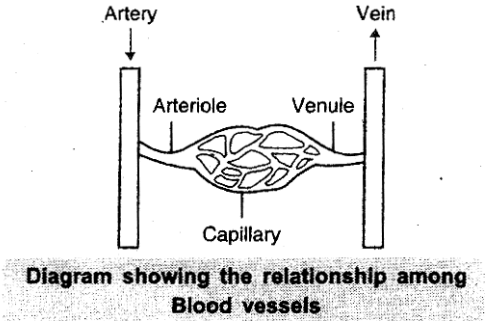


Diagram showing the relationship among Blood vessels

Diagram showing the relationship among blood vessels

The blood circulation of man is called double circulation as the blood passes through the heart twice in one complete cycle of the body. It involves two circulations :

1. **Pulmonary circulation :** This circulation is maintained by the right side of the heart
   - It begins in the right ventricle which expels the blood into the pulmonary trunk.

- The blood flowing into the vascular system of the lungs becomes oxygenated and returns to the heart through pulmonary veins.

2) **Systemic circulation :** This circulation is maintained by the left ventricle which sends the blood into the aorta.

   - The aorta divides into arteries, arterioles and finally to capillaries and thereby supplies oxygenated blood to various parts of the body.
   - From there deoxygenated blood is collected by venues which join to form veins and finally vena cava and pour blood back into the heart.

Hard Spot No. 5

Topic – Transportation

Difficulty Identified

Lymph

Suggestion

The formation of Lymph and the role of Lymph should be explained in details.

Lymphatic system

- It is a system of tiny tubes called lymph vessels or lymph nodes or lymph glands in the human body which transports the liquid lymph from the body tissues to the blood circulatory system.
- Lymph or tissue fluid is colorless containing lymphocyte cells which fight against infection.
- Lymph flows only in one direction i.e. from tissue to heart.
- Lymph is also called extra cellular fluid as it is outside the cells.
- Lymph drains into Lymphatic capillaries which are thin walled capillaries forming a network in every organ except nervous system.
- The lymphatic capillaries unite to form lymphatic vessels which are very small veins in structure.
- Lymphatic vessels from a secondary pathway for fluid returning from the tissues to the heart.

Functions of lymph

Lymph carries digested and absorbed fat from intestines and drains excess fluid from the extra cellular space back into the blood.

It protects the body by killing the germs drained out of the body tissues with the help of lymphocytes contained in the lymph nodes. It keeps the tissue moist.

Hard Spot No. 6

Topic- Excretion

Difficulties Identified

The definition of excretion is not putting stress on the excretory products

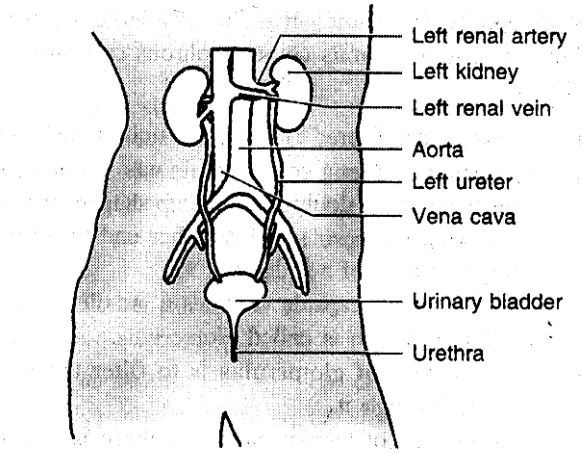
Suggestions

a) Main excretory product and accessory excretory product should be clearly told.

b) Removal of food waste does not come under the definition of excretion. This point need to be emphasized.

Excretion : It is the biological process of the elimination of harmful metabolic waste products from the body of an organism. The mode of excretion is different in different organisms. Many unicellular organisms remove these wastes by simple diffusion from the body surface into the surrounding water; while complex multicelluler organisms use specialized organs for excretion. The organs that are involved in this process constitute the excretory system.

Excretion in human beings : The excretory system of human beings collects and drains out the wastes form the body. It consists of a pair of kidneys' a pair of ureters, a urinary bladder and a urethra.



Excretory system in human beings

1) **Kidney –** It is the main excretory organ. The functional unit of kidney is Nephron. Kidneys remove waste from blood and regulate percentage of water and salts. This is also called Osmoregulation. (Structure and functions to be explained in details).

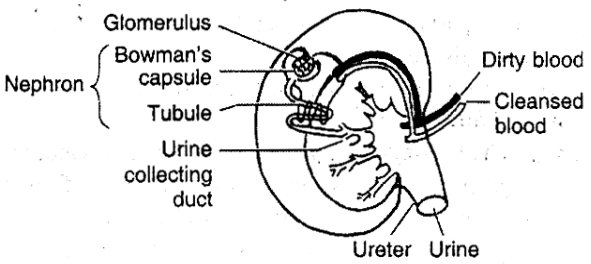
2) **Ureters or Excretory tubes –** They are the thin muscular tubes coming out from each kidney which opens into the urinary bladder. Ureters are ducts which drain out urine from the kidneys.

3) **Urinary Bladder –** It is a pear-shaped reservoir that stores urine before being discharged to the outside.

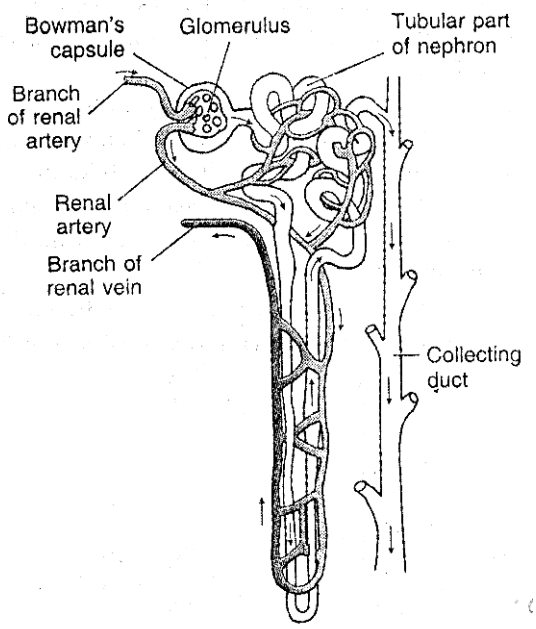
4) **Urethra –** It is a muscular tube that arises from the neck of the bladder and conducts the urine to the outside through an opening at its end, the urinary opening.

(*l*) **Kidneys.** It is the main excretory organ.

- Each kidney is bean-shaped, reddish brown in colour and are located in the abdomen, one on either side of the backbone.
- The left kidney is placed a little higher than the right kidney.
- The renal artery brings in the uncleaned blood containing waste substances into the kidneys.
- The renal vein carries away the cleansed blood from the kidneys.



Structure of a Kidney



Structure of a Nephron

The students should be clearly explained that elimination of undigested food formed in the lumen of large intestine (colon and rectum) through the anus is the fifth stage of nutrition which is also known as egestion. And that egestion is not a stage of excretion.

The process of nutrition involves five steps :

Ingestion, digestion, absorption, assimilation and egestion

Chapter-7 Control and Coordination

Hard Spot No. 7

Topic- Nervous system of Animals

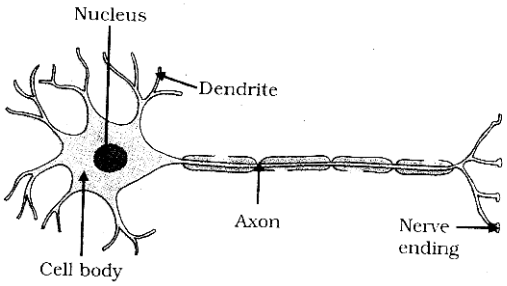
Difficulties identified

Mode of information transmitted in form of nerve impulse

Suggestions

a) A brief idea about transmission of nerve impulse to be given.

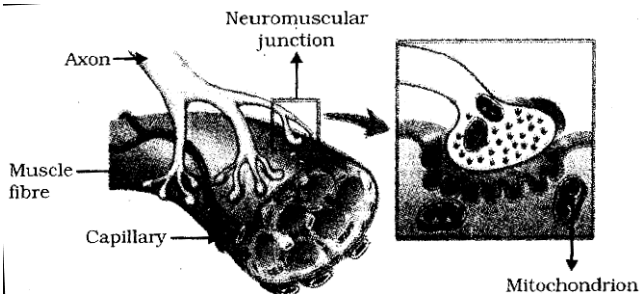
Nerve impulse – It is the information in the form of chemical and electrical signals passing through neurouns. These impulses are carried by dendrites towards the cell body, and towards syrapse.



Synapse – It is the junction between the two adjacent neurouns or nerve cells, i.e. between the axon ending of one and the dendrites of the next.

Neuromuscular junction- It is a point where a cuscle fibre comes in cantact with a motor neuron carrying nerve impulses form the central nervous system. The impulses travel from the neuron to the muscle fibre by by means of a neurotransmitter in the same way as the transmission of impulses across a synapse between two neurons.

b) The directional transmission towards Synapse to be emphasized.



Direction of Transmission – Dendrite – to – Cell body – to – Axon

Steps --- Detection of stimuli by tip of dendrites --- electrical impulse creation --- Travel to cell body --- to exon-tip of axon release chemical substance --- cross the gap between 2 neurons --- create electrical impulse in dendrites of next neuron--- finally impulse delivered to effectors.

Transmission of Nerve impulse – The information acquired at the end of the dendrite tip of a neuron sets off a chemical reaction which creates and electrical impulse. This impulse travels from the dendrite to the cyton along the axon to its end. At the end of the axon, the electrical impulse sets off the release of some chemicals, which cross the synapse and start a similar electrical impulse in a dendrite of the next neuron. In this way nervous impulses travel in the body. A similar synapse allows impulses from neurons to other cells such as muscle cells or glands. Thus nervous tissue is made up of an organized network of nerve cells or neurons which is specialized from conducting information via electrical impulses from one part of the body to another.

Hard Spot No. 8

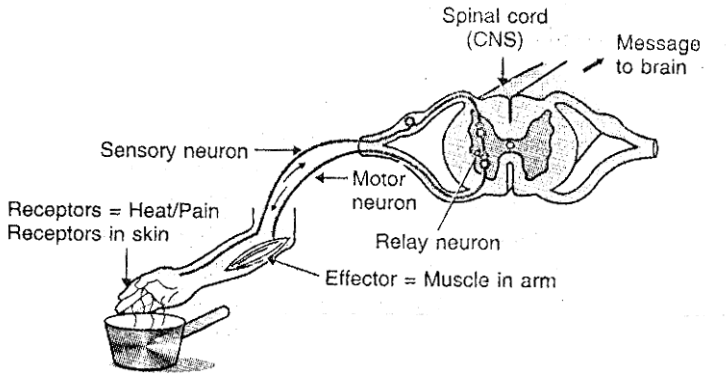
Topic – Nervous system of Animals

Difficulties Identified

Reflex action

Suggestions

Other Reflex Activities viz. Sneezing etc. Which do not involve hand (as shown in the fig. 7.2) should also be explained.



Hard Spot No. 9

Topic- Nervous system of animals

Difficulties Identified

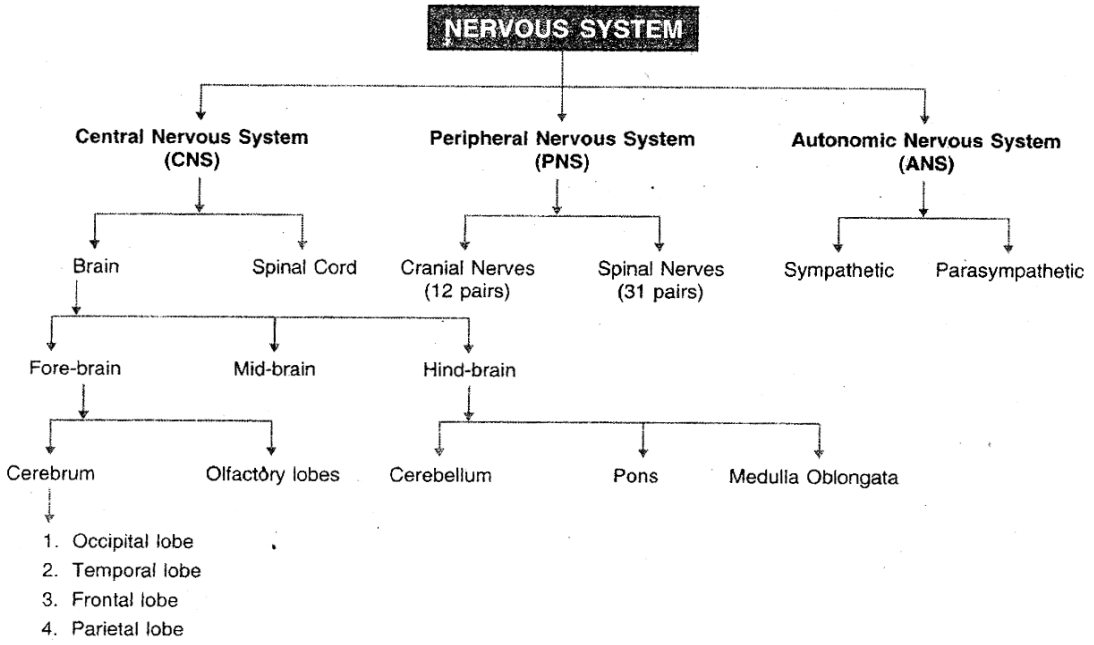
Human Brain

Various parts of the brain doing separate functions are not discernible from the Diagram

Suggestions

At least one more diagram of brain should be there showing its various parts related to a different activity.

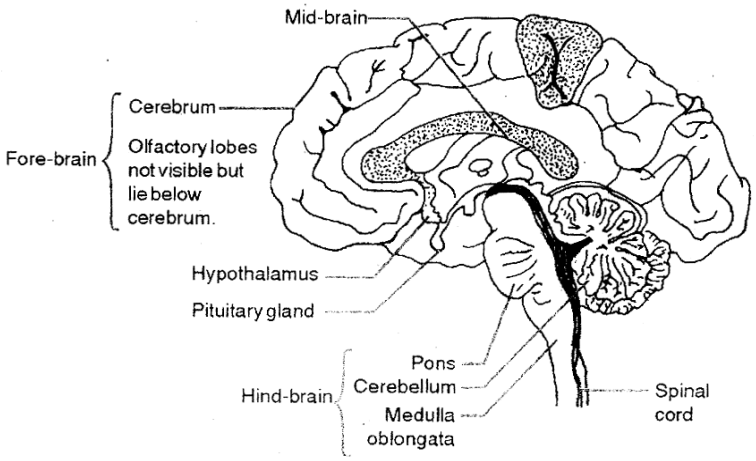
Part of brain related to its activity should be in table form.



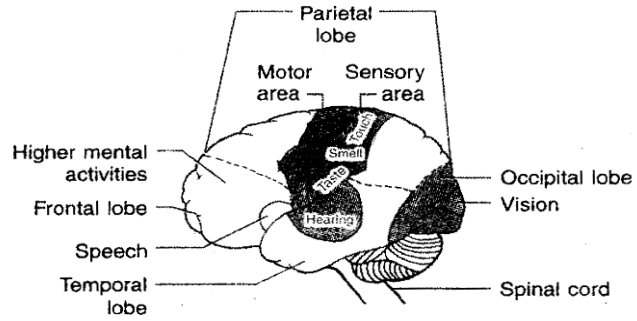
Central Nervous System. The CNS consists of the brain and the spinal cord.

The brain and the spinal cord are protected by the skeleton – brain by the cranium and spinal cord by the vertebral column.

Brain. It is the highest coordinating centre in the body.



Human Brain



Parts of the Human Cerebrum with its Various Functions

Hard Spot No. 10

Topic – Coordination in plants

Difficulties Identified

Plant Hormones and their roles

Suggestions

Location of particular plant hormone and its specific role need to be given.

Plant hormones or phytohormones: It can be defined as a chemical substance which is produced naturally in plants and are capable of translocation and regulating one or more physiological process when present in low concentration.

- Plant hormones help to coordinate growth, development and responses to environment.
- They are synthesized at places away from where they act and simply diffuse to the area of action.

Types of Phytohormones: The major types of plant hormones which are involved in the control and coordination in plants are as follows:

1) Auxins are the group of plant hormones synthesized at the shoot- tip of the plant body.

- It promotes cell elongation, root formation, cell division, respiration and other physiological processes like protein synthesis, water uptake and protoplasmic permeability.
    - Auxins also play an important role in the development of seedless fruits.

2) Gibberellins stimulate stem elongation, seed germination and flowering.
    - The maximum concentration of gibberellins is found in fruits and seeds.

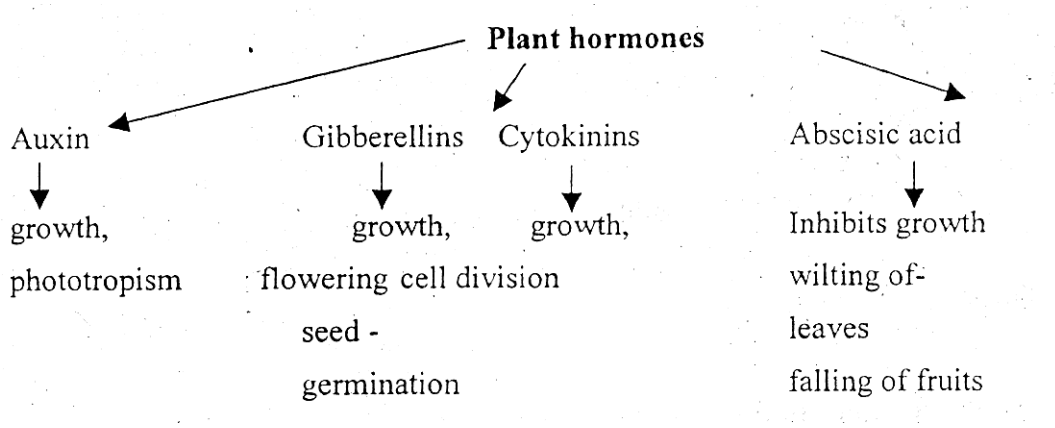
3) Cytokinins are produced in dividing cells throughout the plant.
    - In mature plants, cytokinins are produced in the root tips and are transported to the shoots.
    - Cytokinins promote cell division and also help in breaking the dormancy of seeds and buds and regulate the phloem transport.
    - Cytokinins delay the ageing in leaves and promote the opening of stomata.

4) Abscisic Acid (ABA) It is a growth inhibitor which reverses the growth promoting effects of auxins and gibberellins.
    - Its effect includes wilting of leaves.
    - It causes dormancy of seeds, tubers and bulbs.
    - It causes abrupt closure of stomata.

Functions of Plant hormones can be summarized as-

- Germination of seeds or breaking the dormancy of seeds,
- Growth of root, stem and leaves,
- Flowering of plants,
- Ripening of fruits,
- Movement of stomata in leaves, and
- Phototropism, geotropism, chemotropism and nastic movements

Plant Hormones :- Chemicals in plants used for control and co-ordination.



Hard Spot No.11

Topic – Coordination in plants

Difficulties Identified

Directional stimulus induced movement and growth movement suggestions

a) Clear distinction between growth movement and stimulus induced movement should be made.

b) Mechanism of water induced movements need be explained.

Plants' Responses to external stimuli

- Plants use electrochemical means to convey information from cell to cell.
- Sensitive plants move very quickly in response to touch that are independent of the direction of the stimuli.

- The folding up and drooping of leaves of the sensitive plant of 'touch-me-not (mimosa pudica) when lightly touched is an example.
- Plant cells change shape by changing the amount of water in them resulting in swelling or shrinking, thereby changing shapes.

Plant movements – The movements of the individual plant parts or orans of a plant like shoot, root, etc. are due to some external stimuli like light, force of gravity, chemical substances, water etc.

Directional or Tropic Movements- It is the directional growth or movement of a plant organ in response to an external stimulus.

- Growth towards the stimulus is Positive tropism and growth away from the stimulus is negative tropism.
- Tropic movement are classified as follows, depending on the type of stimulus causing it:

i) Phototropism is the movement of a part of the plant in response to light.

ii) Geotropism is the upward and downward growth of shoots and roots in response to the pull of earth or gravity.

iii) Hydrotropism is the movement of a part of the plant in response to water.

iv) Chemotropism is the movement of a part of the plant in response to a chemical stimulus.

Hard Spot No.12

Topic – Hormones in Animals

Difficulties Identified

Specific role of Hormones

Suggestions

Source gland, hormone and its target organ should be present the tabular form as under

	Endocrine gland	Hormone		Functions
1.	Pituitary	Growth hormone	→	Regulate growth
		Trophic hormone	→	Regulate secretion of other endocrine glands
		Prolactin	→	Milk secretion in mammary gland
		Vaso pressin		Water & electrolyte balance
2.	Hypothalamus	Releasing hormone	→	Controls pituitary
3.	Thyroid	Thyroxin	→	Metabolism of carbohydrate, fat, protein
4.	Parathyroid	Para thyroid hormone	→	Maintain & phosphate level in blood
5.	Thymus	Thymosin	→	promote immunity
6.	Pancreas	Insulin,	→	Decreases blood Sugar
		Glucagon	→	Increases blood Sugar
7.	Adrenal Glands	Adrenalins	→	Alarm reaction Increase B.P., Rate of heart beat & Respiration
8.	Testes	Testosterone	→	Develop Secondary sexual characters in male
9.	Ovary	Estrogen	→	Sec. Sexual character in females
		Progesteron	→	Maintain pregnancy.

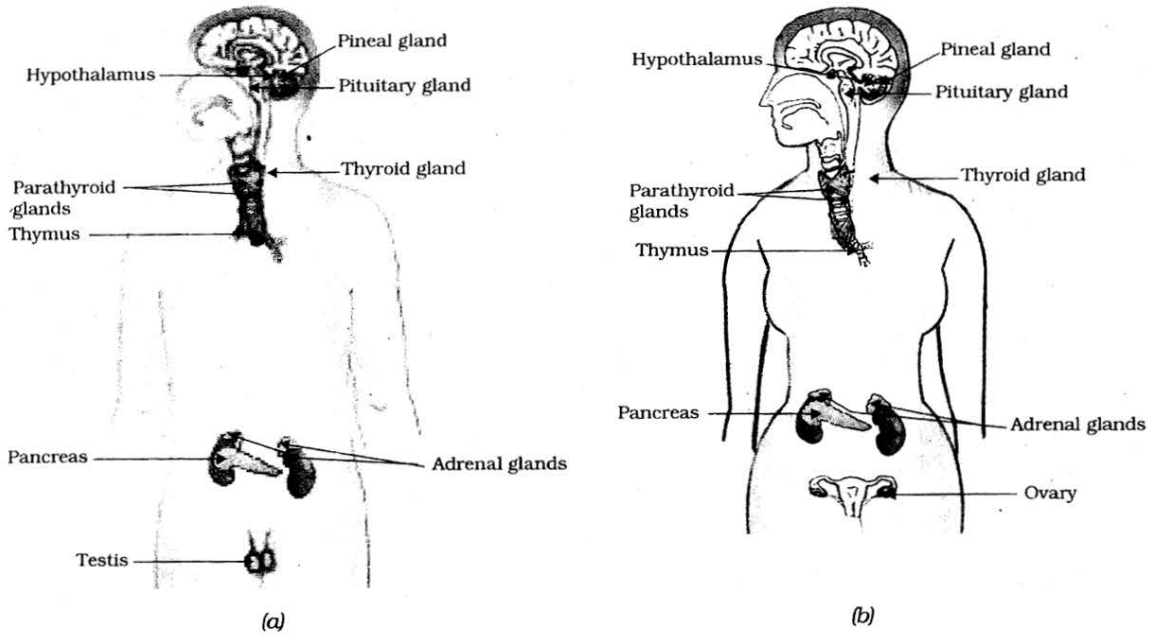


Figure 7.7 *Endocrine glands in human beings (a) male, (b) female*

Chapter-8 How do organisms reproduce?

Hard Spot No. 13

Topic- Do organisms create exact copy of Themselves?

Difficulties Identified

The organisms produce exact copies of themselves but still there are some variations and the offspring's are not absolutely alike.

Suggestions

i) The stage at which the variations are produced, need to be emphasized.

ii) The evolutionary role of variations need to be given

iii) Distinction between vegetative, asexual and sexual reproduction be made clear.

Reproduction – It is the process of producing new individuals of the same species i.e. parents.

Significance of Reproduction-

i) It allows perpetuation of species.

ii) It increases the population of a species

iii) It plays an important role in evolution by transmitting favorable variations from one generation to another generation.

Importance of Variation in organisms-

i) Organisms adap well in defined places or niches in the ecosystem .

ii) Organisms having similar body designs use the same niche or place.

iii) If a niche suitable for a population of organisms is drastically changed, the population may be wiped out completely.

iv) But if some variations are there in few individuals of these populations, there could be chances for survival.

v) For example, if there is a population of bacteria living in temperate water and if the water temperature increases due to global warming, most of the bacteria will die. But the variants resistant to heat will survive and grow further.

vi) Variation is thus important for survival.

Chapter-9 Heredity and Evolution

Hard Spot No. 13

Topic - Heredity
Difficulties Identified

1. Interrelation between DNA, Chromosomes, and Hereditary Units
2. How these terms are related to each other is not clear

Suggestions

Chromosomes are thread like structures present in the nucleus of a cell which contains hereditary information of the cell.

Gene is the unit of inheritance. It is therefore, a unit of specific biological function.

Deoxyribonucleic Acid (DNA) is a chemical in the chromosomes which carries the hereditary characters or traits in a coded form one generation to the next in all the organisms.

Mechanisms of Inheritance

- If both parents help to determine the trait in the progeny, both parents must be contributing a copy of the same gene.
- Thus each individual must have two sets of all genes, one inherited from each parent, so each germ cell must have only one gene set.
- Each gene set is present, not as a single long thread of DNA, but as separate independent pieces, each called a Chromosome and each cell will have two copies of each chromosome, one each from male and female parents.
- When two germ cells combine, they will restore the normal number of chromosomes in the progeny, ensuring the stability of DNA species.
- Therefore, such mechanism of inheritance explains the results of Mendel's experiments ands used by all sexually and asexually reproducing organisms.

Hard Spot No. 14

Topic – Heredity

Difficulties Identified

Rules for the inheritance of traits- mendel's contributions

Suggestions

The difficulties can be eliminated by explaining the cross between two plants having only one different trait, and cross between plants having two different traits with the help of flow charts as under.

Mendal's Experiments

Characters observed by Mendal in pea plants.

Seeds - Round / Wrinkled

Height - Tall / Short

Colour of cotyledon - Yellow /Green

Symbol Meanings :

P-Parental generations, F1 – First filial generation,

F2- Second filial generation.

Characters :

Height : Tall (T) - Dominant

Dwarf (t) - Recessive

Colour of cotyledon :

Yellow (Y) - Dominant

Green (y) - recessive

Nature of Seeds :

Round (R) - Dominant

Wrinkled (r) - Recessive

Character	Combinations of genes
Tall	TT, Tt, tT
Dwarf	Tt
Round	RR, Rr, rR
Wrinkled	Rr
Yellow	YY, Yy, yY
Green	Yy

Dominant trait : If single copy of gene is sufficient for expressing a trait, it is a dominant trait. Eg. Tall, Round seed, Yellow Cotyledon.

Recessive trait : If two copies of genes are required for expressing a character, it is a recessive trait. E.g. Dwarf, Wrinkled Seed, green Cotyledon.

Monohybrid trait : Cross between two plants which differ in only one trait.

Experiment – 1 : Mendal Selected a pure tall (TT) and a pure dwarf variety (tt) and cross-bred.

Step-I : **P (Parents)** **TT** × **tt**

(Tall) **(Dwaft)**

Gamete **(T)(T)** **(t)(t)**

F1 **Tt** **Tt** **Tt** **Tt**

(Tall) **(Tall)** **(Tall)** **(Tall)**

Step-II : **In F1 generation all are Tall. He self pollinated the F1 plants & produced F2 generation.**

F1 × **F1**

Tt × **Tt**

Gamete **(T)(t)** **(T)(t)**

F2 **TT** **Tt** **Tt** **tt**

(Tall) **(Tall)** **(Tall)** **(Dwarf]**

Tall : Dwarf = 3:1

TT : Tt : tt = 1:2:1

Conclusion: **The genes T & t remain together without mixing with each other in the organism. During gamete formation they separate & each gamete receive only one of them.T or t. Not both.**

Activity Page No. 144 Figure No. 9.4

Step-I : **P (Parents)** **RR** × **rr**

(Red) **(White)**

Gamete **(R)(R)** **(r)(r)**

F1 **Rr** **Rr** **Rr** **Rr**

(Red) **(Red)** **(Red)** **(Red)**

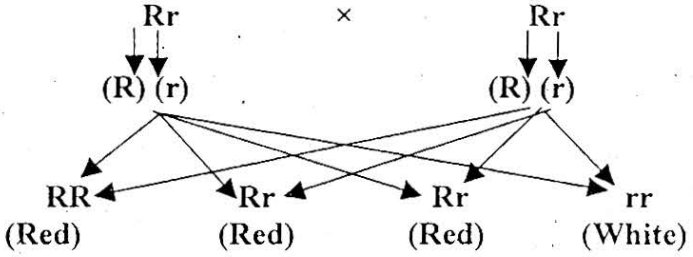
In F1 generation all Red.

Step-II : **In F1 plants are self pollinated.**

F1 × F1

Rr × Rr

Gamete



Red: White = 3:1
RR : Rr : rr = 1:2:1

Expt –2: **The cross between two plants, which differ only by 2 characters.**

Step-I : **P (Parents)** YY RR x yy rr
(Yellow) (Round) (Green) (Wrinkled)

Gamete (YR) (YR) (yr) (yr)

F1 Yy Rr Rr Rr Yy Rr Yy Rr
All yellow Round (Both the dominant character expressed).

Step-II : **In F1 plants are self pollinated.**

F1 x F1

Yy Rr x Yy Rr
(Yellow) (Round) (Yellow) (Round)

Gamete (YR) (Yr)(yR)(yr) (YR) (Yr)(yR)(yr)

	YR	Yr	yR	yr
YR	YYRR Yellow Round	YYRr Yellow Round	YyRR Yellow Round	YyRr Yellow Round

Round Yellow - 9

Yr	YYRr Yellow Round	Yyrr Yellow Wrinkled	YyRr Yellow Round	Yyrr Yellow Wrinkled
yR	YyRR Yellow Round	YyRr Yellow Round	yyRR Green Round	yyRr Green Round
yr	YyRr Yellow Round	Yyrr Yellow Wrinkled	YyRr Green Round	Yyrr Green Wrinkled

Round Green - 3
Wrinkled Yellow - 3
Wrinkled Green -1

9:3:3:1

Conclusion: **When parents differ in two or more pairs of characters, inheritance of one character is independent to the other characters.**

Activity 9.2 Page No. 144

Ans: **By Self pollination of F2**

25% of plants of F2 produced only dwarf-So they are rr.
50% of plants of F2 produced Tall & dwarfs in 3:1 ratio-So they are Tt.
25% of plants of F2 produces only tall. So they are TT

25:50:25 = 1:2:1

Hard Spot No. 15

Topic – Sex Determination

Difficulties Identified

Sex determination

Suggestions

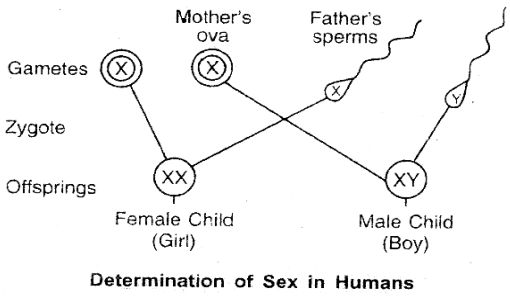
Factors that determine sex of the child :

Temperature of the environment

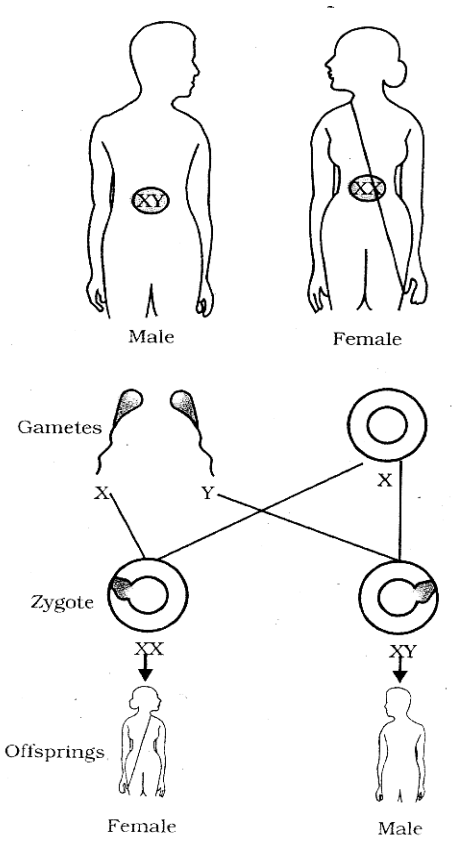
By sex chromosomes – X & Y

XX – Female

XY – Male



Determination of Sex in Humans



Hard Spot No. 16

Topic – Evolution

Difficulties Identified

Development of organisms through time and factors causing origin of new species

Suggestions

Evolution : Development of organisms through time, which include a gradual orderly change from one condition to another.

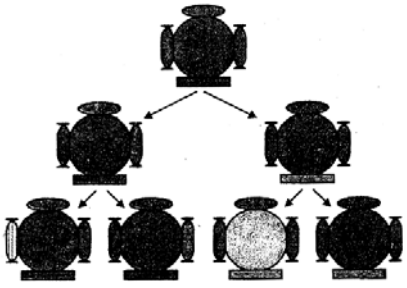


Fig. 9.1 – Creation of diversity over succeeding generations. The originals organism at the top will give rise to, say, two individuals, similar in body design, but with subtle

differences. Each of them, in turn, will give rise to two individuals in the next generation. Each of the four individuals in the bottom row will be different from each other. While some of these different from each other. While some of these differences will be unique, others will be inherited from their respective parents, who were different from each other.

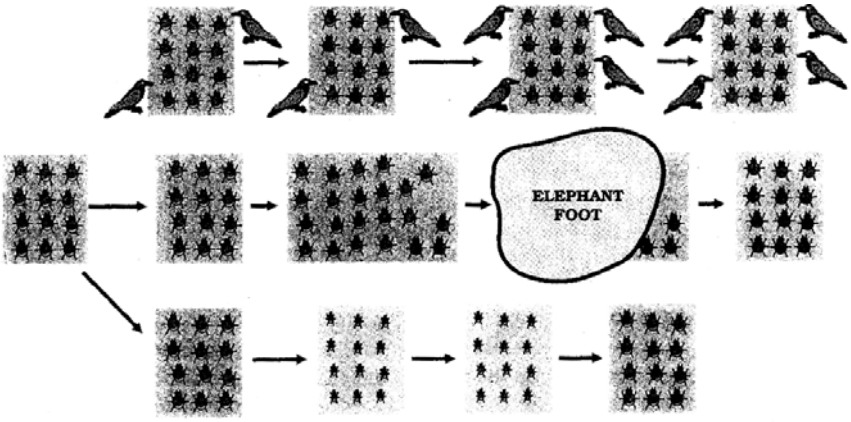
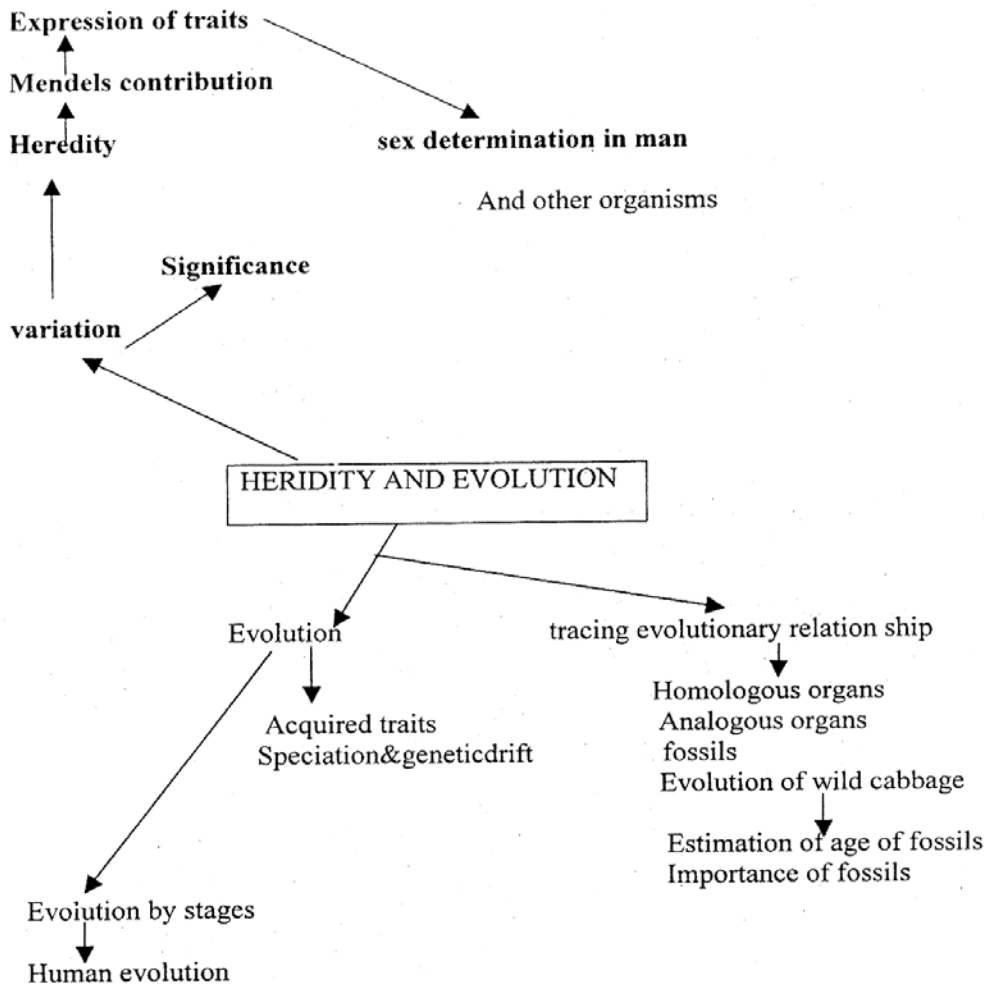


Figure 9.7 Variations in a population – inherited and otherwise

CONTENT MAPPING



1st situation: the crow's effect

- Crows eat beetles, leaving only fewer beetles available for reproduction.
- Due to color variation during reproduction, only one green beetle evolves and therefore, all its progeny beetles become green.
- Crows cannot see green colored beetles on green leaves and hence cannot eat them resulting more green beetles than red ones in the beetle population.
- This type of variation gives a survival advantage.

2nd situation : the elephant effect

- Due to color variation during reproduction, a blue colored beetle appears and all its progeny beetles become blue.
- Crows can see both red and blue beetles and therefore eat them.
- Initially there are less number of blue beetles and more of red beetles.
- Then an elephant stumps on the bushes and kills most of the beetles. By chance few beetles that survived were mostly blue.
- Thus the blue beetle population slowly expands.
- There is no survival advantage on this variation and provides diversity without adaptation.

3rd situation: the food effect

- As the beetle population expands, the bushes suffer from a disease and amount of leaf available for beetles have reduced.
- Thus, the beetles are poorly nourished and the average weight of an adult beetle has decreased.
- After a few years, the plant disease is eliminated and enough food is available for the beetles. Thus the beetles have come back to the normal size and weight.
- This change is not inherited over generation.

Acquired trait : It is a particular characteristic that is developed during the lifetime of an individual. Such characteristics are not genetically controlled and cannot be passed on to the next generation

Speciation: Development of one or more species from an existing species.

Micro evolution: Evolution on a smaller scale resulting in the emergence of a species or races etc.

Factors causing origin of new species :

1. Genetic variations and natural selections
2. Mutations
3. Genetic drift
4. Entry of migrant organisms in an isolated population.

Easy Scoring areas for 10th – science C.B.S.E. – 2009

Theory – 60 marks

Chemistry

Unit -1 Chemical substances –	Total marks 18

Chemical reactions & Equation – Identification of chemical reaction & balancing the given equation, corrosion, rancidity. **1 mark**

Acids bases & salts – Indicators, Activity No. 2.3, 2.5, 2.8, 2.9, 2.15 **2 marks**

Metals & Non Metals – Properties of Metals, Formation of Molecules Like NaCl,

MgCl2, Na_2O, MgO_2 etc by Transfer of electrons, Electrolytic Refining of Copper **3 Marks**

Carban & its Compound – Tetra Val ancy, Catenation, Electron Dot Structures of CH4, C2H6, Homolgous Series, Esterification, Soaponification, Micelles Formation. **3 Marks**

Periodic Classificatin of Elements – Mendeleev's Periodic law, Achievements & Limitations of Mendeleev's Periodic Table. **3 Mark**

Total 12 Mark

Physics

Unit –III	Effects of Currents -	Total Marks 10

Electricity – Ohm's Law, Series and Parallel combination of resistors, Heating effects of electric current, electric power. **3 Marks**

Magnet – Field lines around a bar magnet, Solenoid, Fleming's left hand rule,

Diag. Of Domestic Electric Circuit. Fuse, Overloading, Short-circuiting. **2 Marks**

Total:5 Marks

Unit – IV	Natural Phenomena -	Total Marks 08

Light – Ray diagram of Image formation by concave mirror, Fig 10.2 to 10.7, Table 10.1, Interpretation of Table 10.3 (Refractive Index) Image formation by convex lens,

fig 10.13 to 10.16 power of lens. **2 Marks**

Human Eye- Myopia, Hypermatropia, Presbyopia, Dispersion of Light, Scattering

of Light, Twinkling of Star. **3 Marks**

Total:5 Marks

Biology

Unit-II	World of Living -	Total Marks 16
Life Processes – Various Systems, Aerobic and An-aerobic Respiration, Enzymes, Transport in Plants.		3 Marks
Control & Co-ordination – Hormones & their secretions, Tropic Movements and Plant Harmones, Reflex Arc.		2 Marks
How Qxganisms Reproduce – Sexual Reproduction in Plants and Animals.		3 Marks
Heredity & Evolution – Mendel's Experiment, Fossils, Sex determination, Homologous and Analogous organs.		2 Marks
Our Environment – Biodegradable & Non- Biodegradable & Ozone Depletion		2 Marks
		Total:12 Marks

Unit-V	Natural Resources	Total Marks 08
Sources of Energy – Biogas, renewable & Non- Renewable Energy. Solar Energy		5 Marks
		Total:5 Marks

Total Easy Cores : **39 Marks.**

Practical Skills Based M.C.Q.

Class IX & X (Science)

Total Marks : 20

Topic	Skills
pH lindicator	Colour Change pH scale – Acidic, Basic & Neutral Procedure – Using Dropper or glass rod etc.
Stomata, Onion Peel, Cheek Cell Slides	Procedure – Labelling of Diagram Use of Safranine / Glyscerine / Methyline Blue Open & closed stomatal cell Possession of nucleus in plant & animal Cells. Shape of Plant & Animal Cell.
Experiment of Respiration in Plants	Diagram based labeling.

	Reason of water rise.
	Function of KOH.
	Type of Seeds (Just Germinating)
	Type of Gas Released
Raisins	Formula :
	$\% \text{ of water absorbed} = \frac{\text{Change in Weight}}{\text{Initial Weight}} \times 100$
Glass Slab	Position in Pins
	Relation between $\angle i, \angle e, \angle r$
	Proper Ray Diagram
Experiment of Photosynthesis	Reason for keeping the plant in Dark.
	Process involved in decolourisation of Leaf.
Measuring Focal Length of Concave Mirror & Concave Lens.	Correct Measurement.
Preparation & Differentiation	True Solution, Suspension, Colloids, Mixture & Compound.
Measurement	Reading in Spring Balance & Thermometer Volume in graduated cylinder least count.
Connections	Resistors, Ammeter & Voltmeter
Specimens	Identification, Feature of Phylum & labbelled Diagram
Permanent Slides	Identification & their features with Diagram

Hands on Practical Examination

Total Marks:20

Weightage of 20 marks for hands on-practical examination is to be further splits up as :

Testing of practical skills	:	15 marks.
Maintenance of practical work record	:	03 Marks.
Viva on practical	:	02 Marks.

Every student is required to perform 3 practical, one from each of the three components of the practical syllabus, during the hands-on practical examination. Sufficient time (not less than 3 hours) may be given to the students for conduct of this practical examination.

Note : Answer scripts and practical records are to be preserved for at least six months.

Common Errors/Mistakes Committed by the Students.

- Students should rach the examination hall well before time.
- They are not mentally relaxed when they reach in the examination hall.
- They do not read the question paper thoroughly.
- They do not write the question number in the Answer book.
- Question attempted in parts at different pages and not numbered properly.
- They forget to cross the wrong answer written if any, while right answer is written in subsequent pages.
- Diagrams not properly drawn/labeled.
- Un-necessarily shading and beautification of diagrams.
- They do not think about correct value points before answering the questions.
- They un-necessarily extend the answer. The answer should be brief and to the point Answer to be according to the value points.
- Handwriting is sometimes not legible and it should be given due care.

Common Errors Committed by Students in Biology.

- The students sometimes do not read the questions carefully and out of over enthusiasm end up writing insufficient answers.
- The Students sometimes do not give much importance to the proper shape of the diagram and also the labels asked in the question.
- The students at times do not give much importance to the word limit for each question and the valuable points.
- Pointed questions demand pointed answers but students at times ignore it and give vague broad answers.
- The students sometimes forget to keep track of time and hence leave some questions unattempted & loose marks.
- The students do not check their answers thoroughly at the end.
- The students also do not follow the general instructions given in the beginning of the question paper.
- Students are required to attempt the Question. Paper section-wise (A&B), but they sometimes pick-up the question from both the section randomly.

- Students do not give much time to the question with choices & decide in a hurry, and later either end-up attempting both the choices or do a lot of cutting & deleting, which is a wrong practice altogether.

Some useful Tips to Excel in the Examination.

- Always remain attentive in the class.
- Make habit of active participation and discussion & be inquisitive in the class room.
- Read regularly throughout the year.
- Prepare notes on class work and home work daily.
- Keep notes, text books and note books within reach.
- Sufficient practice of diagrams and labels.
- Take schedule of revision work and strictly follow it.
- Reach the examination hall in calm, relaxed and prepared mind.
- Don't get confused at the last moment.
- While answering , put the question number.
- Leave space between two answers attempted.
- Think of connected value points and then start answering.
- Start answering the question in which you are most confident.
- Have a simple & balanced diet.
- Keep your mind & body relaxed.
- It is suggested that the activities and prospects mentioned at the end of the chapters should also be taken up to have an edge.
- It is always beneficial to practice HOTS question to score maximum in the examination.

Some problems faced by teacher in laboratory.

Accidents

(1) Burning caused by steam or hot water and acids.

(2) Cuts and wounds by glass and sharp equipments.

(3) Eye injury due to splash of chemicals.

(4) A bit of phosphorus caused fire.

(5) Unconsciousness due to Inhalation of some gases.

(6) Eye sight may be affected due to direct contact with light through convex lens.

Remedies

First-Aid : *Precautions of Accidents*

(1) For burning caused by steam or hot water wash the affected part with cold running water Do not use ice and apply an antiseptic ointment.

(2) For acid burn, wash the wounded part with water and apply dilute solution of sodium Hydrogen Carbonate.

For an alkali burn wash with water and wash with dilute acetic acid then apply antiseptic ointment.

(3) In case of injury to eyes wash the eyes with cold water and consult with the doctor.

(4) Victim of Inhalation of gases, Take the students at once to the open air then inhale ammonia vapour in case of inhalation of SO_2, Cl_2, Br_2.

(5) If ammonia is inhaled then drink juice.

(6) Inhale dilute ammonium hydroxide if acid vapours are inhaled.

Fire –

If clothes catch fire, immediately lie clown on the floor and roll.

If container of liquids catches fire, turn off the gas burner immediately.

Fire extinguishers should be used if the fire goes out of control.

In case of fire due to short circuit, switch off the main switch. Do not use water in such case.

Precautions by Students and teachers

1. Each student is expected to prepare in advance for the performance of the experiment.
2. All equipments should be handled properly after understanding their functions.
3. Labels on the reagent bottles should be read carefully before using them.
4. Glass rods, filter papers, droppers should never be dipped directly into the reagent bottle to avoid the contamination of the reagents.
5. Month of the test tube should not be pointed towards yourself or your neighbors.
6. Always pour acid to water for dilution, never add water to acid.
7. Be extra careful while using devices like ammeter and Voltmeter etc. regarding their connectivity.
8. Use spatula to take out salts from bottles.
9. Safety equipments should be properly installed.
10. Use dc/ battery eliminator not ac.
11. Use insulated wire while performing the experiment.

Assignments and project work

A project work is a planned and definitely formulated piece of study involving a task taken up by the Learner. It follows the approach of 'Learning by Doing'. Project work is more or less open-ended activity and depends on the nature of the task. Selection of the task or problem should be simple, useful, feasible and practicable and within the capability aspect of the students. The project work aims pupil's knowledge and understanding daily life problems and promotes habit of critical thinking.

Various approaches may be adopted while taking up a project work. Such approaches may be based upon modes like projects that involves experimentation, survey based projects, projects based on use of available data, projects based on field work and exploration. The report of project mayinclude.

1) Title of the project
2) Objectives
3) Theory/Hypothesis
4) Materials Required.
5) Procedure
6) Observations
7) Results
8) Discussions (if desired)
9) References.

Some Suggestive projects

1. Find current – Voltage relationship for a conducting wire at different temperatures.
2. Survey of people with vision defect – clarification and categorization 7 defects.
3. Collect rain water at different times in raining reason. Compare their acidity.
4. Prepare natural pH indicators.
5. List down exothermic and endothermic reactions taking place around you.
6. To study acids and bases used in your kitchen.
7. Comparison of stomata of monocots and dicots.
8. To study the effect of different colours of lights on germination of seeds.
9. Managements of waste (Bio-degradable and Non-Bio-degradable).
10. Genetic Variations within a family, Study siblings of a family on the basis of their appearance. Infer the existence and origin of variations.
11. To study the refraction of light ray from a semiconductor laser source by a plane mirror and a concave mirror in a smoke box.

12. To study the refraction of light ray from a semiconductor laser source by a convex/concave lens in a smoke box.
13. To Study rusting of iron and identify the condition for rusting.
14. Economic and efficient use of water.
15. Plastic- uses and abuses.
16. Judicial use and conservation of natural resources.
17. Defects of eye- defect and correction, effect of good diet.
18. The killer diseases AIDS – causes, symptoms prevention and awareness.
19. Pollution – Air, water on soil pollution causes, Effects and solutions.
20. Skillful Domestic consumption of electricity.

Assignment will include the project concerned queries commonly asked.

Critical Analysis of CBSE Question paper

Class X Science Theory & Practical

Skill – 2009

A group of Science teachers and Subject experts took an initiative to critically analyse the CBSE Question paper 2009 of Science Theory and Practical skills, and identified the short-falls.

It is suggested that such short falls should be taken care of influence. This can be a regular activity done by every teacher soon after the paper is over and can be sent to CBSE for improving the quality of science question paper.

Analysis of the Science Question Paper 2009 above with practical skills for each set is given here in tabular form.

Q. No.	Unit	Form of Question	Difficulty level E/Av/D/Hots	Quality of Questions (Ambiguity/Precision/Language)	Translation	Remark
1	1	VSA	Average	Precise and understandable	Appropriate	----
2	1	VSA	Average	Precise and proper language	Appropriate	---
3	1	VSA	Average	Satisfactory	Appropriate	---
4	4	VSA	Difficult	Needed correction in Hindi version	Inappropriate	To change the word
5	4	VSA	Average	Precise and understandable	Adequate	---
6	4	VSA	Difficult	Precise and proper language	Appropriate	---
7	1	SA-I	Average	Precise and simple English language	Hindi translation	Needs correction
8	1	SA-I	Difficult	Language needs improvement	Appropriate	In NCERT book strong heating of $FeSO_4$ not mentioned
9	4	SA-I	Average	Satisfactory	Needs Improvement	---
10	3	SA-I	HOTS	Precise and proper language	Appropriate	---
11	1	SA-II	Average	Precise and adequate language	Appropriate	---
12	1	SA-II	Average	Quality of question is poor	Needs improvement	SA-II question should be framed such that the different parts are linked i.c. not to be based on different concepts
13	4	SA-II	Average	Adequate	Appropriate	---

14	3	SA-II	Average	Adequate	Appropriate	---
15	5	LA	Difficult	'C' part of the alternate choice pertains to Modern Periodic Table and hence out of syllabus	Appropriate	---
16	3	LA	HOTS	Adequate	Needs improvement	---
17	5	VSA	Easy	Satisfactory	Appropriate	
18	5	VSA	Average	English language proper but Hindi language needs correction	It should be--- In place of ----	
19	2	VSA	Difficult	Adequate and proper language	Appropriate	---
20	5	SA-I	Average	Precise and proper but Hindi translation to be modified	Translation needs Improvement	
21	5	SA-I	Easy	Proper language	Appropriate	---
22	2	SA-I	Average	The word 'Nastic and curvature' movements are not mentioned in NCERT book	Appropriate	Out of syllabus
23	5	SA-I	Easy	Precise and proper language	Appropriate	---
24	5	SA-I	Easy	Precise and satisfactory	Appropriate	---
25	2	SA-Ii	Average	Satisfactory but Hindi version needs modification	In place of → It should be→	
26	2	SA-II	Average	(Transplantation)		(a) Implantation is neither defined nor explained in the text book. The word implant was mentioned only (b) Hindi version was difficult.
27	2	LA	Average	More appropriate and relevant labeling according to excretory system should have been asked, instead of Aorta/Vena cava	Appropriate	---

Question-wise Analysis of C.B.S.E. Question Paper-2009

Class – X **Subject- Science (Theory)** **Code No. 31/1/2**

Q. No.	Unit	Form of Question	Difficulty level E/Av/D/HOTS	Questions (Ambiguity/Precision/Language)	Translation	Remark
3	1	VSA	Average	Adequate	Appropriate	---
6	4	VSA	Average	Satisfactory	Appropriate	---
7	1	SA-I	Difficult	May not be understood by the students	Appropriate	The exothermic nature of oxidation reactions is NOT discussed in NCERT text book
9	3	SA-I	HOTS	Concept of resistivity is not given in the CBSE syllabus	Adequate	Question is out of syllabus
12	1	SA-II	Average	Adequate	Appropriate	---
13	3	SA-II	Average	Adequate	Satisfactory	---
17	2	VSA	Easy	Precise and simple	Appropriate	---
22	5	SA-I	Easy	At the end of the sentence 'taking place' is not required	Appropriate	---
25	2	LA	Average	Names of only three STDs are mentioned in the NCERT text book	Appropriate	---

Question-wise Analysis of C.B.S.E. Question Paper-2009

Class – X **Subject- Science (Theory)** **Code No. 31/1/3**

Q. No.	Unit	Form of Question	Difficulty level E/Av/D/HOTS	Questions (Ambiguity/Precision/Language)	Translation	Remark
1	1	VSA	Easy	Adequate	Satisfactory	---
7	1	SA-I	Average	Adequate	Appropriate	---
10	3	Sa-I	Difficult	Resistivity is not given in the Syllabus, so this question should have been avoided	Appropriate	The exothermic nature of oxidation reactions is NOT discussed in NCERT text book
11	3	SA-II	HOTS	Process of concentration of ores is not given in the syllabus	Needs correction	First part is out of syllabus
14	1	SA-II	Difficult	Satisfactroy		It is suggested that the term Potential difference should have been used as e.m.f. is not mentioned in NCERT book
18	2	VSA	Easy	Precise and adequate	Appropriate	---
21	5	SA-I	Easy Satisfactory	Appropriate	---	24
24	5	SA-II	Average	Precise and understandable	Appropriate	---

Question-wise Analysis of C.B.S.E. Question Paper-2009

Class – X **Subject- Science (Theory)** **Code No. 31/1/3**

(General Observations & Remarks about the Question Paper)

1. Under the General Instructions, point (v), (vi) and (vii) instead of labeling all questions of as **Short answer type,** these should include the nomenclature as mentioned in the design of "Sample Question Paper" published b the C.B.S.E. (Page 270) as follows :

   for (v) ..... Very short Answer type (VSA) question

   for (vi) ..... Short Answer type (SA0I) question

   for (vii) ..... Short Answer type (SA0II) question

   Similarly for (viii) Long Answer type, it may be mentioned as Long Answer type (LA question.

2. The printing of same diagrams for English version and Hindi version separately could be avoided. Instead, only one diagram appropriately labeled (if needed) and appropriately placed can serve the purpose. That will (i) cut the cost of printing and also (ii) Psychologically help the student that the question paper in not too long.

3. Strictly speaking, the question paper did not follow in totality the Sample Question Paper/Design published by CBSE.

4. The Following questions may be said to be out of the syllabus. This could be one of the reasons for which students were deprived of scoring very good marks.

Set-1	Question No. 8	(1 Mark)
	Question No. 12	(2 marks)
	Question No. 22	(2 Marks)
Set-2	Question No. 9	(1 Mark)
Set-3	Question No. 11	(1 Mark)

5. Language of some questions and their Hindi translations were not perfect/clear eg. Set-1-Question No. 4, 7, 9, 12, 16, 18, 20, 25 and 26. Some of these translations need improvement, some used wrong words while some created confusion (the detail remarks may be referred).

   The other specific remarks are given in the specific columns in the enclosed sheets.

Question-wise Analysis of C.B.S.E. Question Paper -2009

Class-X **Subject- Practical Skills in Science** **Code No. HRL/1 (A-C)**

Q. No.	Set	S. No. of Question	Difficulty level E/Av/D /HOTS	Skill Outcome	Correct choice	Quality of /Question (Ambiguity / Precision/ Language)	Translation	Remark
1	A B C	01, 18, 09	Easy	Observational	1	Up to the mark	Appropriate	Options 3rd & 4th are not good distracters
2	A B C	02, 19, 10	Difficult	Observational	1	No up to the mark Imperfect distracters	Appropriate	Options confusing 15 minutes time is not sufficient for observation
3	A B C	03, 20, 18	Easy	Observational	3	Good	Appropriate	Not related to experiment
4	A B C	4 15 18	Easy	Observational	4	Good	Appropriate	---
5	A B C	5, 16, 19	Easy	Theoretical not skill based	1	Not satisfactory language in both versions	Inadequate	Length and diameter of the tube be mentioned Not related to listed experiment.
6	A B C	6, 17, 20	Easy	Observational	4	Satisfactory	Appropriate	
7	A B C	7, 12, 5	Difficult	Observational	4	Not up to the mark	Appropriate	Not related to the objectivity of the experiment Calorimeter is not familiar to the students.
8	A B C	08, 13, 06	Difficult	Observational	1	Not up to the mark	Appropriate	Not according to listed experiment. Slinky/string should be used. Pulse should be used in place of wave.
9	A B C	09, 14, 07	Easy	Observational	1	Just up to the mark	Hindi version not appropriate	Better diagram expected
10	A B C	10, 09 08	Can not be ascertained	---	Can not be said	Ambiguous labeling IV and V are same in the figure. Cell wall is not clearly indicated	Defective	

11	A B C	11, 10, 15	Easy	Observational	4	Up to the mark	Incorrect	
12	A B C	12, 11, 16	Easy	Observational	1	Satisfactory	Incorrect	Figures in Hindi & English version are different.
13	A B C	13,05, 17	Easy	Observational	2	Satisfactory	Defective	---
14	A B C	14, 06, 01	Easy	Manipulative/Procedural	1	Well designed	Defective	Proper Hindi word for 'Setup' be used.
15	A B C	15, 07, 02	Easy	Observational	4	Up to the mark	Appropriate	----
16	A B C	16, 08, 03	Easy	Manipulative/Procedural	2	Well designed	Appropriate	Ray diagram should be same but the position of projector should be different
17	A B C	17, 01, 04	Could not be ascertained	---	Can not be said	Wrongly framed : language defective	Appropriate	Improvement needed
18	A B C	18, 02, 12	---	Procedural	3	Wrongly designed and misleading language	---	Diagram should have been given
19	A B C	19, 03, 13	Easy	Reporting and Interpretive	2	Up to the marks	Appropriate	---
20	A B C	20, 04, 14	Easy	Procedural	4	Up to the mark	Hindi Punctuation is wrong	---
21	A B C	21, 30, 25	Easy	Observational	3	Up to the mark	Inappropriate	Translation to be improved
22	A B C	22, 27, 22	Easy	Procedural	3	Tricky and up to the mark but language faulty.	---	Language to be corrected.
23	A B C	23, 24, 30	Easy	Procedural	3	Not up to the mark	---	A few step in the option are missing for correctly answering the question.

Question-wise Analysis of C.B.S.E. Question Paper-2009

Class-X Subject – Practical Skills in Science Code No. HRL/1 (A-C)

(General Observations & Remarks about the Question Paper)

1. It is felt that some of the questions as stated below are theoretical in nature and so could be avoided:
   1. A (05), B (16), C (19)
   2. A (27), B (23), C (29)
   3. A (28), B (22), C (26)
2. It is felt that the following questions are not properly framed as MCQ and so not up to the mark;
   1. A (02), B (19), C (10)
   2. A (05), B (16), C (19)
   3. A (07), B (12), C (05)
   4. A (08), B (13), C (06)
   5. A (17), B (01), C (04)
   6. A (18), B (02), C (12)
   7. A (23), B (24), C (30)
   8. A (24), B (21), C (27)
   9. A (28), B (22), C (26)
3. Although some of the questions were given well thought and framed with perfection but for high achievers, the over all framing and translation parts lack perfection.
4. Printing the same diagram twice for English and Hindi versions could conveniently be avoided. Instead, only one diagram with appropriate placement and labeling could serve the purpose. That would psychologically help the student, that the paper is not too lengthy and so also cut the cost of printing/handling.
5. It is felt that the over all performance of the science subject for secondary examination has been affected by the major discrepancies in the setting of skill based MCQ papers, and in future, it will become more and more difficult to set such papers.

   The other specific remarks are given in the specific columns in the enclosed sheets.

Sample Paper (for practice)
Practical Skill in subject Science
Section-A

1. A blue litmas paper was first dipped in dil HCL and then in dil NaOH solution. It was observed that the colour of the litmas paper :

   (1) Changed to red.

   (2) Changed first to red then to blue.

   (3) Changed blue to colourless.

   (4) Remained blue in both the solutions.

   एक नीले लिटमस पत्र को पहले तुन HCL
   में तथा बाद में तनु NaOH में डुबोया गया। यह प्रेक्षित किया गया कि लिटमस पत्र का रंग :

   (1) लाल हो गया।

   (2) पहले लाल हुआ बाद में नीला।

   (3) नीले से रंगहीन हो गया।

   (4) दोनों विलयनों में नीला ही रहा।

2. The correct method of finding the pH of a solution is to

   (1) Heat the solution in the test tube and expose the pH paper to the vapours formed.

   (2) Pour few drops of the solution from the test tube on the pH paper.

   (3) Drop the pH paper in the solution.

   (4) Put a drop of solution on the pH paper using a dropper.

   किसी विलयन का pH मान ज्ञात करने का सही ढंग यह है कि :

   (1) विलयन को परखनली में गर्म करें तथा बनने वाली वाष्प में pH-पत्र रखें।

   (2) विलयन की कुछ बूँदों को परखनली से Ph -पत्र पर गलें।

   (3) Ph-पत्र को विलयन में डालें।

   (4) ड्रापर द्वारा Ph-पत्र पर विलयन की एक बूँद डालें।

3. Two beakers 'A' & 'B' contains an aqueous solution of FeSo4, In beaker 'A' a small rubbed pice of copper metal and in 'B' zinc metal piece is placed. It was found that grey coating was observed on Zinc metal but not on copper metal. On the above observation arrange Cu, Fe and Zn metals in the decreasing order of reactivity.

दो बीकर 'A' व 'B' जिनमें $FeSo_4$ का जलीय विलयन है, बीकर में कॉपर धातु का एक छोटा स्वच्छ टुकड़ा तथा बीकर B में जिंक धातु का टुकड़ा रखा गया है। यह पाया गया कि जिंक धातु के ऊपर भूरे रंग की पर्त जम गयी जबकि कॉपर धातु पर नहीं।

उपरोक्त प्रेक्षण के आधार पर Cu, Fe तथा Zn की उनकी सक्रियता के घटते क्रम में व्यवस्थित करें:

(1) Zn > Fe > Cu (2) Fe > Zn > Cu

(3) Cu > Fe > Zn (4) Zn > Cu > Fe.

4. A student has three test tubes A, B and C containing salt solutions. The colour of the solution B and C are blue and green respectively. If the solution in test-tube A is colourless, then the solution in these test-tubes are as

किसी विद्यार्थी पास तीन परखनलियाँ A, B तथा C हैं जिनमें लवणों के विलयन भरे हैं B तथा C में भरे विलयनों के रंग क्रमशः नीला तथा हरा है। यदि परखनली A में रंगहीन विलयन भरा है, तो इन तीनों परखनलियों में भरे विलयन इस प्रकार है:

(1) A - $CuSO_4$, B – $FeSO_4$, C- $ZnSo_4$

(2) A – $Al2(SO_4)_3$, B – $CuSO_4$, C-$ZnSO_4$

(3) A – $ZnSO_4$, B – $CuSO_4$, C – $FeSO_4$

(4) A – $ZnSO_4$, B – $Al_2(SO_4)_3$, C – $FeSO_4$

5. In an experiment to determine the focal length of a convex Lens, the image of a distant tree is obtained on the screen. To determine the focal length of the Lens, you are required to measure the distance between the

(1) Lens and the tree only (2) Lens and the screen only

(3) screen and the tree only (4) Screen and the tree and also between the screen and the lens

उत्तल लैंस की फोकस दूरी ज्ञात करने के लिए किए गए प्रयोग में लाये गये पेड़ का प्रतिबिम्ब किसी पर्दे पर पास किया गया लैंस की फोकस दूरी ज्ञात करने के लिए निम्न में से कौन सी दूरी मापनी होगी :

(1) केवल लैंस तथा पेड़ के बीच की दूरी (2) केवल लैंस तथा पर्दे के बीच की दूरी

(3) केवल पर्दे तथा पेड़ के बीच की दूरी (4) पर्दे तथा पेड़ तथा पर्दे तथा लैंस, दोनों के बीच की दूरी।

6. Your school laboratory has large window. To find the focal length of a concave mirror using one of the walls as the screen, the experiment maybe performed

(1) Near the wall opposite to the window.

(2) On the same wall as the window.

(3) On the wall adjacent to the window.

(4) Only on the table as per the laboratory arrangement.

आपके विद्यालय की प्रयोगशाला में एक बहुत बड़ी खिड़की है। अवतल दर्पण की फोकस दूरी ज्ञात करने के लिए किसी एक दीवार परदे की तरह उपयोग करना है। प्रयोग किया जा सकता है :

(1) खिड़की के विपरीत दीवार के समीप।

(2) उसी दीवार जहाँ खिड़की है।

(3) खिड़की से संलग्न दीवार पर।

(4) केवल प्रयोगशाल में व्यवस्थित मेज पर।

7. A student performed an experiment of glass slab and with different angles of incidence, measured the angles of refraction and emergence in each case, he then recorded his observations in the table as given

S. No. क्र.सं.	**Angle of incidence** आपवर्तन कोण	**Angle of refraction** अपवर्तन कोण	**Angle of convergence** निर्गत कोण
A	30^0	25^0	30^0
B	40^0	42^0	40^0
C	50^0	50^0	50^0
D	60^0	60^0	62^0

The correct observation table is :

(1) A (2) B

(3) C (4) D

एक विद्यार्थी ने काँच के गुटके का प्रयोग किया तथा आपतन कोणों के लिए अपवर्तन कोण तथा निर्गत कोण को मापा इसके पश्चात उसने अपने प्रेक्षणांकों को उपरोक्त सारिणी में दर्शाये अनुसार लिखा।

उसके द्वारा लिए गए सही प्रेक्षणांक की सारिणी है:

(1) A (2) B

(3) C (4) D

8. In an experiment on finding the equivalent resistance of two resistors, connected in series, a Mukesh connects the terminals of the voltmeter to :

(1) One terminal of each of the two resistors and these terminals are not interconnected.

(2) One terminal of each of the two resistors and these terminals are also interconnected.

(3) Both the terminals of each resistors

(4) Both the terminals of one resistor & one terminal of the other resistor.

एक प्रयोग में दो प्रतिरोधकों के श्रेणीक्रम संयोजन का तुल्य प्रतिरोध ज्ञात करने के लिए, मुकेश वोल्ट मीटर के टर्मिनलों को किस प्रकार जोड़ता है?

(1) प्रत्येक प्रतिरोधक के एक टर्मिनल से और ये टर्मिनल आपस में नहीं जोड़े जाते।

(2) प्रत्येक प्रतिरोधक के एक टर्मिनल से और ये टर्मिनल आपस में जोड़े जाते हैं।

(3) दोनों प्रतिरोधकों के दोनों टर्मिनलों से।

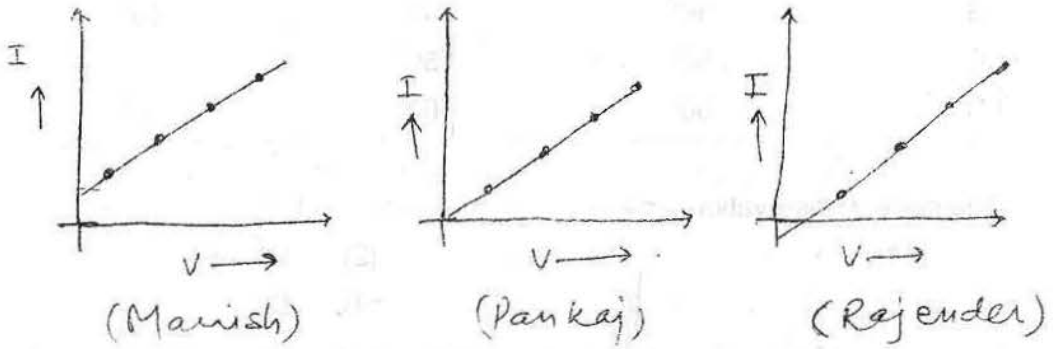
(4) एक प्रतिरोधक के दोनों टर्मिनलों से और एक-दूसरे प्रतिरोधक के एक टर्मिनल से।

9. In the experiment on studying the dependence of current (I) on the potential difference (V), three students, Manish, Pankaj and Rajender Plotted the following graphs between (V) and (I) as per their respective observations.

The observations likely to be correct are those of student :

(1) manish (2) Pankaj

(3) Rajender (4) all the three student



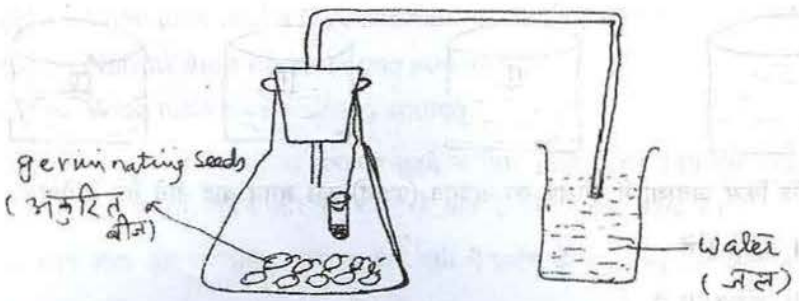
किसी प्रतिरोधक के विभवान्तर (v) तथा धारा (i) की निर्भरता का अध्ययन करने के प्रयोग में तीन विद्यार्थियों, मनीष, पंकज तथा राजेन्द्र ने अपने प्रेक्षणों के आधार पर (v) तथा (I) के मध्य उपरोक्त ग्राफ बनाये। सही प्रेक्षण वाल विद्यार्थी होगा :

(1) मनीष (2) पंकज

(3) राजेन्द्र (4) तीनो विद्यार्थी

10. In an experimental set up shown in figure, in experiment to show that germinating seeds do respire, the chemical filled in test tube is;

चित्र में दर्शायी गई प्रायोगिक व्यवस्था में प्रयोग द्वारा दर्शाने के लिए कि अंकुरित बीज श्वसन करते हैं, परखनली में भरा रसायन है :



(1) KOH (2) NaOH

(3) NH_4OH (4) HCl

11. The part of leaf commonly used for preparing the slide of stomata is :

(1) leaf margin (2) leaf apex

(3) leaf epidermis (4) leaf petiole

स्टोमेटा की स्लाइड बनाने के लिए सामान्यतः पत्ती का भाग उपयोग किया जाता है :

(1) पत्ती का किनारा (2) पत्ती का अग्रभाग

(3) पत्ती की वाह्य त्वचा (4) पत्ती का डंठल (पर्ण वृत्त)

12. The best result for the experiment, "that light is necessary for photosynthesis", would be yielded by using leaves from a plant kept for over twenty four hours :

(1) In a pitch dark room.

(2) In a dark room with the table lamp switched on.

(3) Out side the garden.

(4) Out side the garden covered by a glass case.

"प्रकाश संश्लेषण के लिए प्रकाश आवश्यक है" प्रयोग के अच्छे परिणाम प्राप्त करने के लिए उस पौधे की पत्ती का उपयोग करते हैं जिसे चौबीस घंटे से अधिक समय तक रखते हैं :

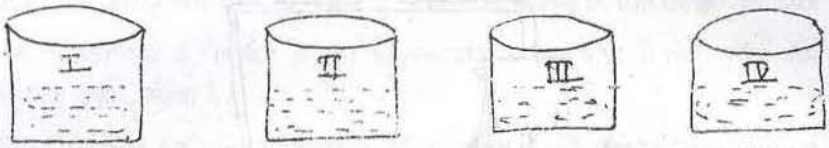
(1) एक नितांत अंधेरे कमरे में,

(2) एक अंधेरे कमरे में जिसके टेबिल लैम्प का स्विच खुला हो

(3) बाग के बाहर

(4) बाग के बाहर एक काँच के कवर से ढक कर।

13. In which of the following sets of the mixture, one component (sub stance) will settle down when left undisturbed for some time:



उपरोक्त मिश्रण कि किस व्यवस्था में, मिश्रण का अवयव (पदार्थ) कुछ समय बाद नीचे बैठ जायेगा :

(1) Only in I, केवल I में

(2) Only in II, केवल II में

(3) Both in III & IV, III तथा IV दोनों में

(4) Both in I & IV तथा IV दोनों में

14. Suppose a student by mistake has mixed iron filings and sulphur powder. Now he wants to separate the two and comes to you for advise. Which of the following you would suggest him for dissolving the mixture?

(1) Cold water (2) hot water

(3) Kerosene (4) Carbon disulphide

मान लीजिए किसी विद्यार्थी ने गलती से लोह रेतन और सल्फर-पाउडर को मिला लिया है। अब वह मिश्रण से इन दोनों को पृथक करना चाहता है और परामर्श के लिए आपके पास आता है। आप उसे इस मिश्रण को निम्नलिखित में से किस में घोलने का सुझाव देंगे?

(1) ठंडा जल (2) गरम जल

(3) किरोसीन (4) कार्बन डाई सल्फाइड

15. When magnesium combines with oxygen it produces magnesium oxide that appears to be like

(1) Wood ash (2) Chalk Powder

(3) Table salt (4) Powdered sugar

जब मैग्नेशियम आक्सीजन से संयोग करता है तो मैग्नेसियम आक्साइड बनता है जो दिखायी देता है जैसे कि :

(1) लकड़ी की राख (2) चाक पाउडर

(3) साधारण नमक (4) शर्करा पाउडर

16. While performing an experiment on verifying the laws of reflection of sound, a student is to choose between : (i) a narrow or a wide tube, (ii) a strong or a faint source of sound.

The observed experimental difference, between the two values of angle of incidence and angle of reflection, is likely to be minimum when he chooses a :

(1) Narrow tube and a faint source.

(2) Wide tube and a faint source.

(3) Narrow tube and a strong source

(4) Wide tube and a strong source.

ध्वनि के परावर्तन के नियमों का सत्यापन करने के लिए, प्रयोग करते समय एक विद्यार्थी को (i) संकीण व चौड़ी नली के बीच व (ii) सबल और मंद ध्वनि के स्रोत के बीच चुनाव करना है।

आपतित कोण और परावर्तित कोण के बीच मान में प्रयोग के समय न्यूनतम अंतर होगा यदि वह चुनता है :

(1) संकीण नली और एक मन्द स्रोत ।

(2) चौड़ी नली और एक मंद स्रोत।

(3) संकीर्ण नली और एक सबल स्रोत।

(4) चौड़ी नली और एक सबल स्रोत।

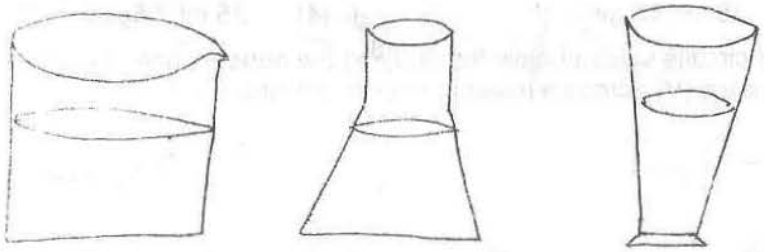
17. A given solid is weighed in air using a spring balance. It is then weighed by immersing it fully, in each of three vessels containing water, as shown, its weight when immersed, will be –

(1) Least in vessel 'A'

(2) Least in Vessel 'B'

(3) Least in vessel 'C'

(4) Equal in all the three vessels.



एक दिये गये ठोस को कमानीदार तुला की सहायता से तोला गया। इसके बाद उपरोक्त दर्शाये गये अनुसार, ठोस को पानी से भरे तीन बर्तनों में पूरी तरह डुबाया गया। पानी में डुबोने पर इसका भार होगा-

(1) बर्तन 'A' में सबसे कम

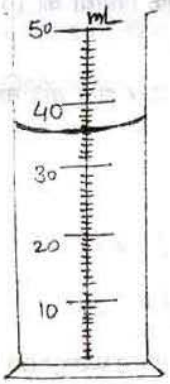
(2) वर्तन 'B' में सबसे कम

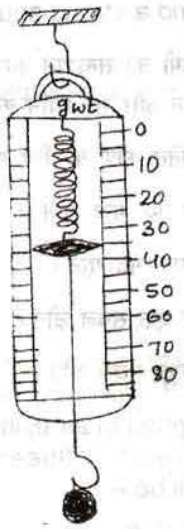
(3) बर्तन 'C' में सबसे कम

(4) तीनों बर्तनों में बराबर

18. As shown in the diagram the volume of liquid filled in the graduated cylinder and the weight of the bob suspended from the spring balance are respectively :

(1) 37 ml, 45 gwt.
(2) 37 ml, 35 gwt.
(2) 35 ml, 45 gwt.
(4) 35 ml, 35gwt.

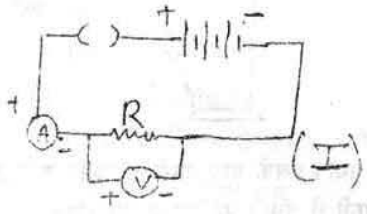


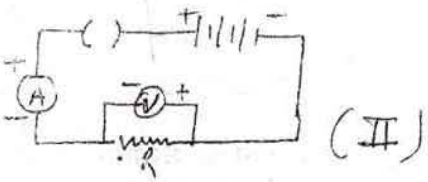


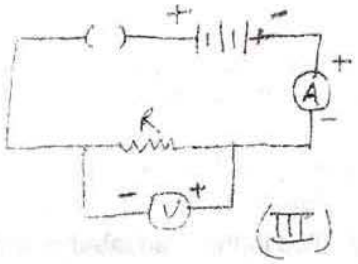
उपरोक्त चित्र में दर्शाए अनुसार अंशांकित सिलिण्डर में भरे द्रव का आयतन तथा कमानीदार तुला से लटके गोलक का भार क्रमशः है :

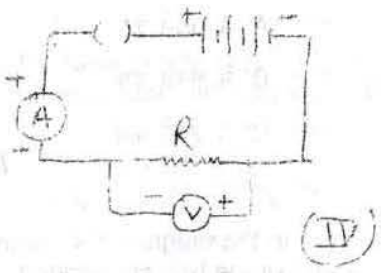
(1) 37 ml, 45 gwt.
(2) 37 ml, 35 gwt.
(2) 35 ml, 45 gwt.
(4) 35 ml, 35gwt

19. Out of the four circuits shown below for studying the dependence of current (I) on the potential difference (V) across a resistor, the correct circuit is :









(1) I (2) II

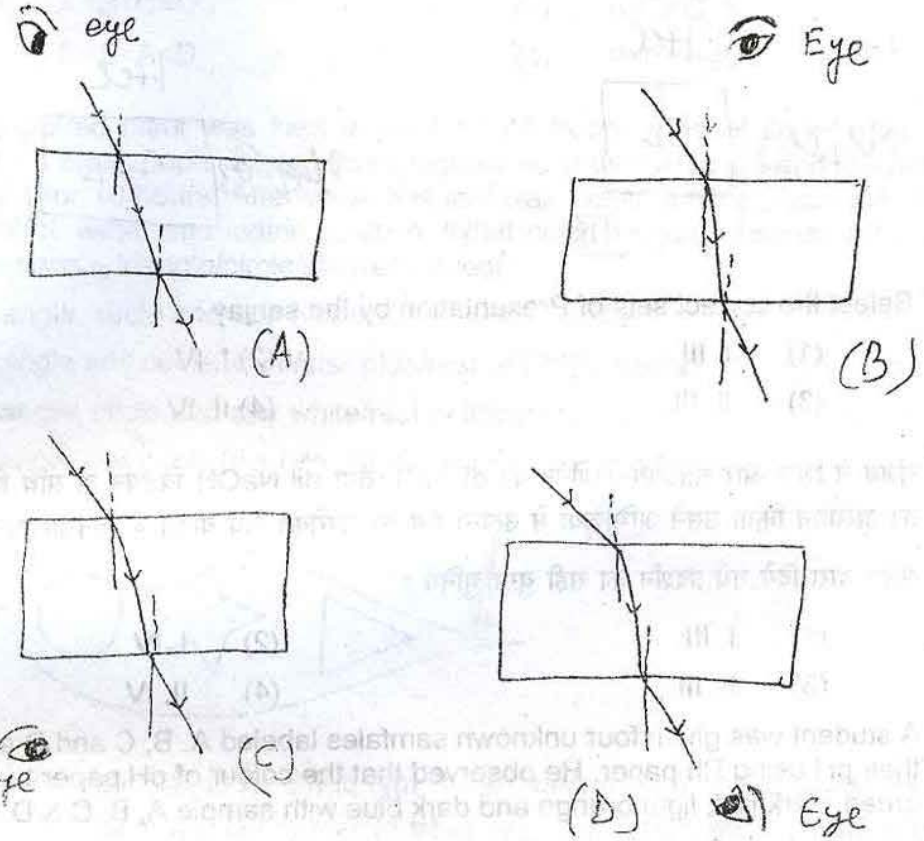
(3) III (4) IV

उपरोक्त दिये गये चार विद्युत-परिपथों में प्रतिरोधक के सिद्धान्त लगोय गये विभवान्तर (V) तथा प्रवाहित होने वाली विद्युत धारा (I) की सही गणना के लिये सही परिपथ है :

(1) I (2) II

(3) III (4) IV

20. Out of the following positions correct position of eye for Observing the emergent ray in the experiment of glass slab is :



आयताकार काँच के गुटके के प्रयोग में निर्गत किरण को ठीक प्रकार से देखने के लिये आँख की सही स्थिति है :

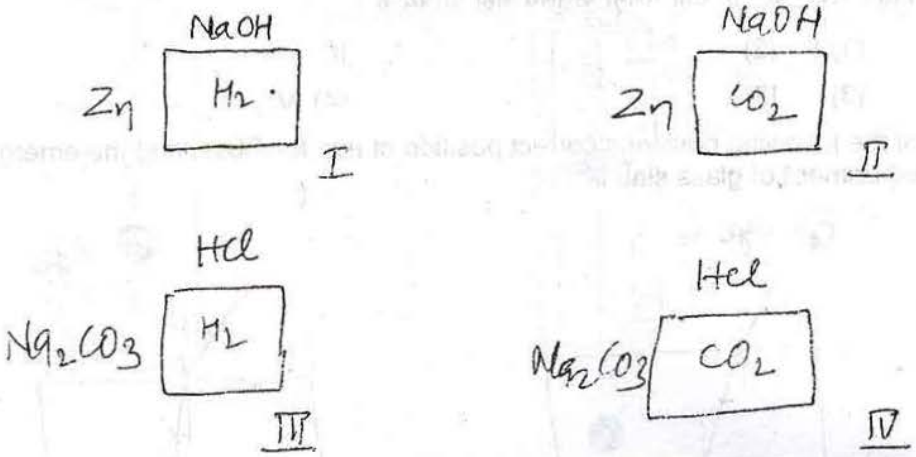
(1) A (2) B

(3) C (4) D

SECTION - B

खण्ड - ब

21. Sanjay studied in the reaction of Zinc and sodium carbonate with dil HCl and dil NaOH solutions. He recorded the gas evolved in the box given as below;



Select the correct sets of Presentation by the sanjay :

(1) I, III (2) I, IV

(3) II, III (4) II, IV

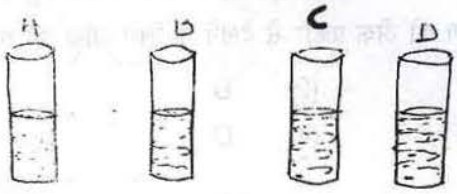
संजय ने जिंक और सोडियम-कार्बोनेट की dil HCL तथा dil NaOH विलयन के साथ होने वाली अभिक्रिया का अध्ययन किया उसने अभिक्रिया में उत्पन्न गैस को उपरोक्त दिये बाक्स के अनुसार भरा :

संजय द्वारा दिये गये प्रदर्शन का सही युग्म चुनिये :

(1) I, III (2) I, IV

(3) II, III (4) II, IV

22. A student was given four unknown samfales labeled A, B, C and D asked to test their pH using Ph paper. He observed that the colour of pH paper turned to light green, dark red, light orange and dark blue with sample A, B, C & D respectively.



Light Green Dark Red Light Orange Dark Blue

हल्का हरा गहरा लाल हल्का गुलाबी गहरा नीला

The Correct sequence of order of the pH value for sample is :

(1) A<B<C<D (2) A<D<C<B

(3) C<B<A<D (4) B<C<A<D

एक छात्र को चार रंगहीन अज्ञात नमूनों, जिन पर A, B, C तथा D अंकित है, दिये गये और उनका pH पात्र द्वारा **pH** जाँचने को कहा गया। उसने देखा कि नमूनों A,B,C तथा के साथ pH पात्र का रंग क्रमशः ह ल्का हरा, गहरा लाल, हल्का गुलाबी तथा गहरा नीला हो गया।

नमूना बढ़ते pH मान का सही क्रम है :

(1) A<B<C<D (2) A<D<C<B

(3) C<B<A<D (4) B<C<A<D

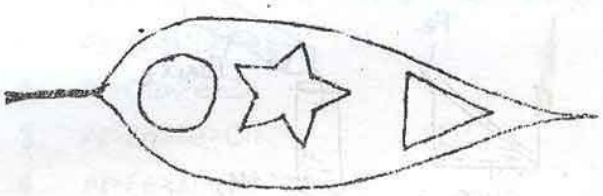
23. A healthy potted plant was kept in dark for 48 hours. One of its leaf was totally covered by a black paper except three regions as shown in figure and the plant was kept in light for 10 hours. Afterwards this leaf was tested for the presence of starch using alcohol, water and iodine solution. What color will you observe in the leaf at various regions – triangle/circle/star/rest of leaf :

(1) Triangle, circle and star blue/rest of the leaf white.

(2) Triangle and circle white/star blue/rest of the leaf green.

(3) Triangle, circle and star white/rest of the leaf blue.

(4) Triangle and circle blue/star white/rest of the leaf green.



गमले में लगा एक स्वस्थ्य पौधा 48 घंटे के लिए अंधेरे में रखा। इसकी एक पत्ती को चित्र अनुसार तीन भागों को छोड़ पूरा काले कागज से ढंका और पौधे को 10 घंटे के लिए प्रकाश में रखा। बाद में इस पत्ती में एल्कोहल, पानी और आयोडीन घोल की मदद से स्टार्च (मंड) की उपस्थिति की जाँच करी। पत्ती के विभिनन भागों (त्रिभुज, वृत्त, सितारा और पत्ती का बाकी भाग) में आपको कौन से रंग दिखते हैं :

(1) त्रिभुज, वृत्त और सितारा नीला/पत्ती का बाकी भाग सफेद।

(2) त्रिभुज और वृत्त सफेद/सितारा नीला/पत्ती का बाकी भाग हरा।

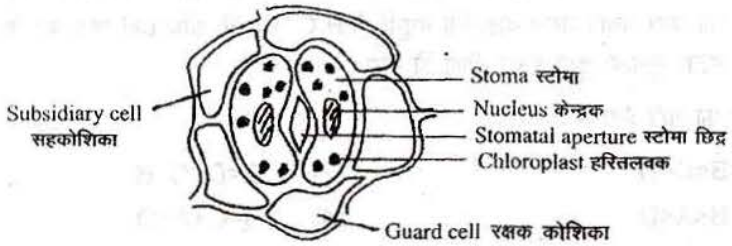
(3) त्रिभुज, वृत्त और सितारा सफेद/पत्ती का बाकी भाग नीला।

(4) त्रिभुज और वृत्त नीला/सितारा सफेद/पत्ती का बाकी भाग हरा।

24. After observing epidermal peel of a leaf under microscope, a student prepared its figure with six labels as given below. The teacher marked two labels wrong. The two wrong labels in the figure are :

(1) subsidiary cell and stoma. (2) guard cell and nucleus.

(3) guard cell and stoma. (4) chloroplast and stoma.



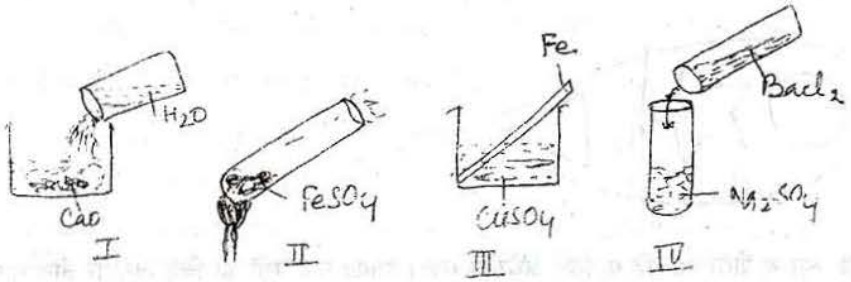
एक विद्यार्थी ने पत्ती की बाह्यत्वचा की झिल्ली को सूक्ष्मदर्शी में देखकर इसका चित्र बनाया और निम्न चित्रानुसार छः नामांकन लिखे। अध्यापक ने उसके दो नामांकन गलत कर दिए। चित्र में यह दो गलत नामांकन हैं :

(1) सहकोशिका और स्टोमा। (2) रक्षक कोशिका और केन्द्रक।

(3) रक्षक कोशिका और स्टोमा। (4) हरित लवक और स्टोमा।

25. Four students A, B, C & D performed the reactions as shown in I, II, III & IV, They observed the reaction and classified them into their types and recorded in the following table :-

The correct result show table student :



Student विद्यार्थी	अभिक्रिया के प्रकार Types of reactions			
	Combination संयोजन	Decomposition वियोजन	Displeasent विस्थापन	Double displeasent द्वि-विस्थापन
A	I	III	II	IV
B	I	II	III	IV
C	II	III	IV	I
D	IV	I	II	III

चार विद्यार्थियों A, B, C तथा **D** ने उपरोक्त चित्र I, II, III तथा IV में दर्शाएनुसार अभिक्रियाओं को किया। उन्होंने अपने प्रेक्षणानुसार अभिक्रियाओं के प्रकार सारिणी में दर्शाए। सही परिणाम देने वाला विद्यार्थी है :

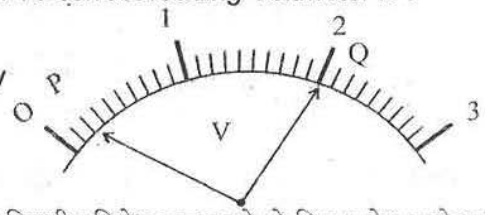
(1) A (2) B

(3) C (4) D

26. A student while performing the experiment to find the equivalent resistance of two resistance when connected in parallel observes Voltmeter pointer at P; When key is off and the pointer at Q when key is on. Te correct reading Voltmeter is :

(1) 0.2 V (2) 2 V

(3) 2.2 V (4) 1.8 V



दो प्रतिरोधकों को समान्तर क्रम में जोड़कर उनका परिणामी प्रतिरोध ज्ञात करने के लिए प्रयोग करते समय एक विद्यार्थी वोल्टमीटर संकेतक को P स्थान पर देखता है जब कुँजी में प्लग नही डला गया है। वह इसे Q स्थान पर देखता है जब कुँजी में डाला गया है। वोल्टमीटर का उचित मापांक है :

(1) 0.2 V (2) 2 V

(3) 2.2 V (4) 1.8 V

27. The rubbed strips of Al, Zn, Fe & Cu were placed in the aqueous solutions or $Al_2(SO_4)_3$, $ZnSO_4$,$FeSO_4$ & $CuSO_4$. The results are given in following observation table :-

Find the correct order of metals in decreasing their reactivity:-

1. Al>Zn>Cu>Fe
2. Al>Cu>Fe>Zn
3. Al>Zn>Fe>Cu
4. Al>Fe>Zn>Cu

Metal Added	Solution taken			
	$Al_2(SO_4)_3$	$ZnSO_4$	$FeSO_4$	$CuSO_4$
Al	--	Zn is displaced	Fe is displaced	Cu is displaced
Zn	No reaction	--	Fe is displaced	Cu is displaced
Fe	No reaction	No reaction	--	Cu is displaced
Cu	No reaction	No reaction	No reaction	

Al, Zn, Fe व Cu की साफ व रगड़ी हुई पट्टियों को $Al_2(SO_4)_3$, $ZnSO_4$, $FeSO_4$, व $CuSO_4$ के विलयनों में डाला गया। उनके परिणाम प्रेक्षण तालिका में दिए गए हैं।

डाली गई	लिया गया विलयन			
	$Al_2(SO_4)_3$	$ZnSO_4$	$FeSO_4$	$CuSO_4$
Al	--	Zn का विस्थापन	Fe का विस्थापन	Cu का विस्थापन
Zn	कोई अभिक्रिया नहीं	अभिक्रिया	Fe का विस्थापन	Cu का विस्थापन
Fe	कोई अभिक्रिया नहीं	कोई अभिक्रिया नहीं	--	Cu का विस्थापन
Cu	कोई अभिक्रिया नहीं	कोई अभिक्रिया नहीं	कोई अभिक्रिया नहीं	--

धातुओं को उनकी घटती सक्रियता क्रम के सही विकल्प चुनिये :-

1. Al>Zn>Cu>Fe
2. Al>Cu>Fe>Zn
3. Al>Zn>Fe>Cu
4. Al>Fe>Zn>Cu

28. Jubere was asked to add alum with equal amount in three test tubes containing A – pond water, B- Sandy water, and C- distilled water, After shaking well correct observation is :

(1) Pond water forms homogeneous solution in alum.

(2) Sandy water from homogeneous solution in alum.

(3) Distilled water from homogeneous solution in alum.

(4) All are correct

जुबेरा को फिटकरी की बराबर मात्रा तीन जलीय विलयन क-तालाब का जल, ख - रेतीला जल तथा ग -आसवित जल में मिलाने को कहा गया। हिलाने के बाद सही प्रेक्षण है :

(1) तालाब का जल, फिटकरी के साथ सामांगी विलयन बनाता है।

(2) रेतीला जल, फिटकरी के साथ सामांगी विलयन बनाता है।

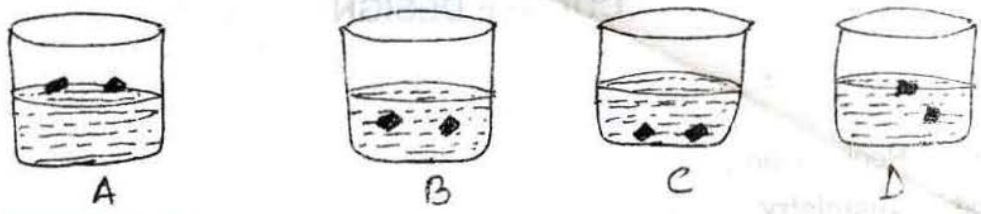
(3) आसवित जल के साथ सामांगी विलयन बनाता है।

(4) सभी विकल्प सही है।

29. Identify the diagram showing correct position of ice cubes when put in water

(1) A (2) B

(3) C (4) D



निम्नलिखित में से कौन-सी आकृति जल में बर्फ के टुकड़ों की सही स्थिति को निरूपित करती है :

(1) A (2) B

(3) C (4) D

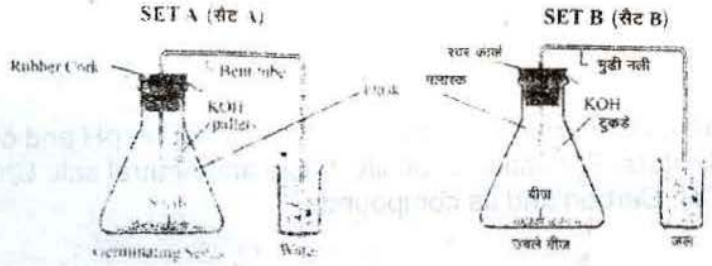
30. In the experiment 'Respiration by germinating seeds', two sets are arranged, set – B has boileded seeds and set-A has living germinating seeds. After 4 hours the water level in the bent tube was checked. It was noticed that :

(1) Water level increased in bent tube of A set but not in bent tube of B set.

(2) Water level increased in bent tube of B set but not in bent tube of A set.

(3) Water level increased in bent tube of both sets A and B.

(4) Water level remained same in bent tubes of both sets A and B.



'अंककुरण करते बीजों में श्वसन' प्रयोग में दो सेटों में से सेट B में उबले बीज और सेट A में सजीव अंकुरित बीज हैं। 4 घंटे बाद मुड़ी हुई नली में पानी के तल का निरीक्षण करा। यह पाया गया कि :

(1) सेट A की मुड़ी नली में जलस्तर बढ़ा पर सेट B की मुड़ी नली में नहीं।

(2) सेट B की मुड़ी नली में जलस्तर बढ़ा पर सेट A की मुड़ी नली में नहीं।

(3) दोनों सेट A और B की मुड़ी नलियों में जलस्तर बढ़ा।

(3) दोनों सेट A और B की मुड़ी नलियों में जलस्तर पहले जैसा रहा।

COURSE DESIGN

Day I

1st period	Registration
2nd Period	**Chemistry**
	Discussion on difficult areas/grey areas in Chemistry out of - Electrolysis of water, rancidity, Oxidation and
Break ---	
3rd period	**Physics**
	Discussion on difficult areas/grey areas in physics out of - Image formation and use of sign convention, numerical problems. Functioning and defects of human eye, Numerical problems.
4th period	**Biology**
	Discussion on difficult areas/grey areas out of – Difference between breathing and respiration, breakdown of glucose by different pathways, transportation in human beings, excretion in human beings.

Day II

1st period	**Chemistry**
	Discussion on difficult areas/grey areas in Chemistry out of- pH and colour change with indicators. Formation of acidic, basic and neutral salt. Chlor-alkali process for NaOH. Carbon and its compounds.
2nd period	**Physics**
	Discussion on difficult areas/grey areas in Physics out of- Combination of resistance and connectivity of voltmeter/ammeter in electric circuit, numerical problems. Induced current, application of Fleming's Right hand rule and left hand rule.
Break ---	
3rd period	**Biology**
	Discussion on difficult areas/grey areas in Biology out of- Nutrition in human beings with the role of enzymes. Transmission of nerve impulse, synapse, Hormones. Factors causing origin of new species. Artificial selection.
4th period	Valediction
Note :-	The RPs may choose the grey areas/difficult areas as per their choice/demand of teachers.