CHEMISTRY
For Class-IX

1. FUNDAMENTALS OF CHEMISTRY

Introduction

1.1 Branches of Chemistry

Physical Chemistry, Organic Chemistry, Inorganic Chemistry, Biochemistry, Industrial Chemistry, Nuclear Chemistry, Environmental Chemistry, Analytical Chemistry

1.2 Basic Definitions

- 1.2.1 Elements, Compounds and Mixtures
- 1.2.2 Atomic Number, Mass Number
- 1.2.3 Relative Atomic Mass and Atomic Mass Unit
- 1.2.4 Empirical Formula, Molecular Formula
- 1.2.5 Molecular Mass and Formula Mass

1.3 Chemical Species

- 1.3.1 Ions (Cations, Anions), Molecular Ions and Free Radicals.
- 1.3.2 Types of Molecules (Monatomic, Polyatomic, Homoatomic, Heteroatomic)

1.4 Avogadro's Number and Mole

- 1.4.1 Avogadro's Number
- 1.4.2 Mole
- 1.4.3 Gram Atomic Mass, Gram Molecular and Gram Formula Mass

1.5 Chemical Calculations

- 1.5.1 Mole-Mass Calculations
- 1.5.2 Mole-Particle Calculations

2. STRUCTURE OF ATOMS

Introduction

2.1 Theories and Experiments Related To Atomic Structure

- 2.1.1 Rutherford's Atomic Model (Experiment and Postulates)
- 2.1.2 Bohr's Atomic Theory (Postulates)

2.2 Electronic Configuration

- 2.2.1 Concepts of S and P Sub-Shells
- 2.2.2 Electronic Configurations of First 18 Elements

2.3 Isotopes

- 2.3.1 Definition
- 2.3.2 Examples (H, C, Cl, U)
- 2.3.3 Uses

3. PERIODIC TABLE AND PERIODICITY OF PROPERTIES

Introduction

3.1 Periodic Table

- 3.1.1 Periods
- 3.1.2 Groups

3.2 Periodicity of Properties

- 3.2.1 Atomic Size
- 3.2.2 Ionization Energy
- 3.2.3 Electron Affinity
- 3.2.4 Shielding Effect
- 3.2.5 Electronegativity

4. **STRUCTURE OF MOLECULES**

Introduction

4.1 Why do Atoms Form Chemical Bonds?

4.2 Chemical Bonds

4.3 Types of Bonds

- 4.3.1 Ionic Bonds
- 4.3.2 Covalent Bonds
- 4.3.3 Dative Covalent Bonds
- 4.3.4 Polar and Non-Polar Bonds
- 4.3.5 Metallic Bonds

4.4 Intermolecular Forces

- 4.4.1 Dipole-Dipole Interactions
- 4.4.2 Hydrogen Bonding

4.5 Nature of Bonding and Properties

- 4.5.1 Ionic Compounds
- 4.5.2 Covalent Compounds
- 4.5.3 Polar and Non-Polar Compounds
- 4.5.4 Metals

5. **PHYSICAL STATES OF MATTER**

Introduction

Gaseous State

5.1 Typical Properties

(Diffusion, Effusion, Pressure, Compressibility, Mobility, Density)

5.2 Laws Related To Gases

- 5.2.1 Boyle's Law
- 5.2.2 Charles's Law

Liquid State

5.3 Typical Properties

(Evaporation, Vapour Pressure, Boiling Point, Freezing Point, Diffusion, Mobility, Density and Factors affecting them.)

Solid State

5.4 Typical Properties

(Melting Point, Rigidity, Density)

5.5 Types of Solids

- 5.5.1 Amorphous
- 5.5.2 Crystalline State

5.6 Allotropy

6. **SOLUTIONS**

Introduction

6.1 Solution, Aqueous Solution, Solute and Solvent

6.2 Saturated, Unsaturated, Supersaturated Solutions and Dilution of Solution

6.3 Types of Solution

- 6.3.1 Solution of Gases (Gases in Gases, Gases in Liquids, Gases in Solids)
- 6.3.2 Solution of Liquids (Liquids in Gases, Liquids in Liquids, Liquids in Solids)
- 6.3.3 Solutions of Solids (Solids in Gases, Solids in Liquids, Solids in Solids)

6.4 Concentration Units

- 6.4.1 Percentage
- 6.4.2 Molarity
- 6.4.3 Problems Involving the Molarity of a Solution

- **6.5 Solubility**
  - 6.5.1 Solubility and Solute – Solvent Interaction
  - 6.5.2 Effect of Temperature on Solubility
- **6.6 Comparison of Solutions, Suspension and Colloids**
  - 6.6.1 Solutions
  - 6.6.2 Colloids
  - 6.6.3 Suspension (Turbidity)

7. ELECTROCHEMISTRY

Introduction

- **7.1 Oxidation and Reduction**
- **7.2 Oxidation States and Rules for Assigning Oxidation States**
- **7.3 Oxidizing and Reducing Agents**
- **7.4 Oxidation - Reduction Reactions**
- **7.5 Electrochemical Cells**
  - 7.5.1 Concept of Electrolytes
  - 7.5.2 Electrolytic Cells
  - 7.5.3 Galvanic Cells (Daniel Cell)
- **7.6 Electrochemical Industries**
  - 7.6.1 Manufacture of Sodium Metal from Fused NaCl
  - 7.6.2 Manufacture of NaOH from Brine and its properties
- **7.7 Corrosion and Its Prevention**
  - 7.7.1 Rusting of Iron
  - 7.7.2 Electroplating of Tin, Zinc, Silver and Chromium on Steel

8. CHEMICAL REACTIVITY

Introduction

- **8.1 Metals**
  - 8.1.1 Electropositive Character
  - 8.1.2 Comparison of Reactivity of Alkali and Alkaline Earth Metals
  - 8.1.3 Inertness of Noble Metals
- **8.2 Non- Metals**
  - 8.2.1 Electronegative Character
  - 8.2.2 Comparison of Reactivity of the Halogens

Recommended/Reference Book:

An-interactive approach
Chemistry
for Class IX

Developed & Published by:
National Book Foundation, Islamabad

LIST OF PRACTICALS

1. Fundamentals of Chemistry

	PRACTICALS	EQUIPMENT	CHEMICALS
1.	Separate the given mixture by physical method.	glass plate, spatula, magnet, test tube, beaker, gas burner, matches, safety goggles	iron filings, sand or any other soluble mix
Chapters – 2, 3 and 4		None	None
5.	**Physical States of Matter**		
1.	Determine the Melting Point of Naphthalene.	beaker, thermometer, Bunsen burner, tripod stand, wire gauze, glass stirrer, capillary tube and iron stand	water and naphthalene
2.	Determine the Melting Point of Biphenyl	beaker, thermometer, Bunsen burner, tripod stand, wire gauze, glass stirrer, capillary tube and iron stand	water and biphenyl
3.	Determine the Boiling Point of Acetone.	beaker, thermometer, Bunsen burner, tripod stand, wire gauze, glass stirrer, fusion tube, iron stand and capillary tube	water and acetone
4.	Determine the Boiling Point of Benzene.		water and benzene
5.	Determine the Boiling Point of Ethyl Alcohol.	beaker, thermometer, Bunsen burner, tripod stand, wire guaze, glass stirrer, fusion tube, iron stand and capillary tube	water and ethyl alcohol
6.	Separate naphthalene from the given mixture of sand and naphthalene by sublimation.	beaker, thermometer, Bunsen burner, tripod stand, wire guaze, glass stirrer, fusion tube, iron stand and capillary tube	Mixture of sand naphthalene
7.	Separate the given mixture of alcohol and water by distillation.	china dish or watch glass, tripod stand, funnel, burner, sand bath and cotton	Mixture of water and alcohol
8.	Demonstrate that a chemical reaction release energy in the form of heat.	round bottom distillation flask, thermometer, corks, water condenser, receiving flask, burner, iron stand, tripod stand, wire guaze, filter paper and funnel	Anhydrous copper sulphate, distilled water
9.	Demonstrate sublimation using solid Ammonium Chloride	test tubes, test tube racks, thermometer, safety goggles test tubes, test tube holder, gas burner, matches, safety goggles	Ammonium chloride
6.	**Solutions**		
1.	Prepare 100 cm^3 of 0.1M NaOH solution.	beaker, stirrer, volumetric flask and physical balance	Distilled water and solid sodium hydroxide
2.	Prepare 100 cm^3 of 0.1M Na_2CO_3 solution.	beaker, stirrer, volumetric flask and physical balance	Distilled water and solid sodium carbnonate
3.	Prepare 250 cm^3 of 0.1M HCl solution.	beaker, stirrer, volumetric flask and physical balance	Distilled water and concentrated hydrochloric acid
4.	Prepare 250 cm3 of 0.1M of oxalic acid solution.	beaker, stirrer, volumetric flask and physical balance	distilled water and oxalic acid

5.	Prepare 100 cm3 of 0.1M NaOH solution from the given 1M solution.	beaker, stirrer, volumetric flask and measuring cylinder	distilled water and 1M NaOH solution
6.	Prepare 100 cm3 of 0.01M Na2CO3 solution from the given 0.1M solution.	beaker, stirrer, volumetric flask and graduated cylinder	distilled water and 0.1M Na2CO3 solution
7.	Prepare 100 cm3 of 0.01M HCl solution from the given 0.1M solution.	beaker, stirrer, volumetric flask and measuring cylinder	distilled water and 1M HCl solution
8.	Prepare 100 cm3 of 0.01M oxalic acid solution from the given 0.1M solution.	beaker, stirrer, volumetric flask and measuring cylinder	distilled water and 0.1M oxalic acid solution
9.	Prepare pure copper sulphate crystals from the given impure sample.	beakers, funnel, filter paper, stirrer, china dish, burner	impure copper sulphate and distilled water
10.	Demonstrate that miscible liquids dissolve in each other and immiscible liquids do not.	8 small beakers, organic waste bottle, safety goggles	water, oil, ethanol,
11.	Demonstrate that temperature affects solubility.	test tubes, burner, matches, test tube holder, test tube rack, stirring rod, safety goggles	sucrose, water
7.	**Electrochemistry**		
1.	Demonstrate the conductivity of different given solutions.	Dry battery cell with holder with two electrodes, beakers, stirrer test tube holder	distilled water, sugar, NaCl, vinegar, HCl, NaOH
2.	Demonstrate a metal displacement reaction in aqueous medium.	copper wire, bulb with bulb holder test tube,	copper sulphate and iron strip or nail
8.	**Chemical Reactivity**		
1.	Demonstrate that two elements combine to form a binary compound.	test tube, test tube holder, burner	Iron and sulfur
2.	Demonstrate that compounds can be products of a decomposition reaction.	test tubes, one holed stopper with glass tube and rubber tubing attached, mortar and pestle, gas burner, matches, test tube holders, safety goggles	calcium carbonate, lime water (solution of calcium hydroxide)
3.	Demonstrate that an element and a compound can react to form a different element and a different compound.	beakers, safety goggles	copper chloride, small piece of aluminium foil or copper sulphate and iron strip
4.	Demonstrate that some chemical reactions absorb energy.	test tube, stirring rod	water, ammonium chloride, cold packs (ammonium nitrate and water)

LIST OF CHEMICALS
(Based on 20 students)

CHEMICALS	QUANTITY
Acetic acid	02 litre
Aluminium Foil	250 g
Ammonium Chloride	01 kg
Ammonium Nitrate	01 kg
Barium Chloride or any salt of Barium	01 kg
Bromothymol Blue	20 g
Calcium Carbonate	01 kg
Calcium Chloride or any salt of Ca	500 g
Calcium Hydroxides	500 g
Cinnamic Acid	100 g
Concentrated Hydrochloric Acid	01 litre
Copper Chloride or any salt of Cu	100 g
2,4-Dinitrophenyl Hydrazine	05 g
Distilled Water	50 litre
Ethanol	01 litre
Fehling's Solution	500 cm3
Ferric Chloride	250 g
Fructose	250 g
Glucose	250 g
Iodine	100 g
Lime water	02 litre
Litmus solution	01 litre
Magnesium Hydroxides	500 g
Methanol	01 litre
Methyl Orange	10 g
Nitric acid	01 litre
Oil	01 kg
Oxalic Acid	250 g
Phenol Solution	01 litre
Phenolphthalein	10 g
Potassium Chloride or any salt of K	50 g
Potassium Hydroxides	500 g
Potassium Permanganate	500 g
Powdered Zinc	250 g
Silver Nitrate	25 g
Soap	05 bars
Sodium Bicarbonate	250 g
Sodium Carbonate	500 g
Sodium Chloride	2 kg
Sodium Hydroxide	500 g
Sodium Metal	100 g
Sodium Sulphate	500 g
Sulphuric Acid	1 litre
Strontium Chloride or any salt of Strontium	100 g
Sugar	500 g
Tollen's Reagent	500 cm3
Vinegar	1 litre

LIST OF Equipment/Apparatus
(Based on 20 students)

Battery cells with two Electrodes	20
Beakers 50 cm3	50
Beakers 100 cm3	100
Beakers 250 cm3	100
Beakers 500 cm3	100
Blue Litmus Paper	01 packet
Bunsen Burners	20
Burettes	50
Capillary Tubes Pack of	100
China Dishes	50
Conical Flasks (250 cm3)	50
Corks	24 each of four different sizes
Cotton	01 roll
Delivery Tubes	30
Droppers	30
Filter Papers	01 packet
Forceps	20
Funnels	20
Fusion tubes	100
Glass Plates	20
Glass Stirrers	20
Graduated Cylinders 50 cm3	20
Graduated Cylinders 100 cm3	20
Graduated Flasks 100 cm3	20
Graduated flasks 250 cm3	20
Graduated flasks 1000 cm3	10
Iron Stands (complete with heavy base)	20
Knives	10
Magnets	20
Match Boxes	20
Organic Waste Cans	20
Physical Balances	20
pH paper (1to 14)	10 packets
Pipettes (10 cm3)	20
Platinum Wires	20
Red Litmus Paper	01 packet
Round Bottom Distillation Flasks	20
Rubber Tubing	25 m
Sand Baths	20
Spatulas (stainless steel)	20
Test Tube Holders	20
Test Tube Racks	20
Test Tubes	200
Thermometers (110°C)	20
Tripod Stands	20
Watch Glasses	20
Water Condensers	20
Wire Gauzes	20