PHYSICAL SCIENCE
BIFURCATED SYLLABUS
FOR CLASSES IX-X

SUBJECT: PHYSICAL SCIENCE

Classes IX-X

Introduction:

1. In preparing the syllabus all the present syllabi of equivalent courses viz. ICSE, CBSE etc. have been considered in depth. It has been made uptodate keeping in mind the socio-economic needs of students in general of our state.
2. It will serve the purpose of terminal education at this stage and entry to Higher Secondary level.

Objectives:

1. To initiate students into the realm of play and interplay of the laws of science in life and matter around.
2. To rouse in young mind a spirit of enquiry about the nature of matter and forces in nature.
3. To develop scientific attitude and enable the students to know and understand some basic principles, concepts and laws involved in the natural phenomena around with special reference to Physical Science.
4. To make the students realise the impact of science and technology on the society and to enable the students to understand with insight the application of science and technology in the service of man and also to realise some evil effects of improper use of science and technology.
5. To develop respect for the philosopher-scientists whose contributions have benefited mankind.
6. To acquire problem solving and decision making skills through application of the knowledge and understanding of the subject towards tackling problems in the life situation.
7. To develop scientific values and to remain free from irrational beliefs and superstitions.
8. To understand the hazards of environmental pollution with particular reference to air, water, soil and noise and to suggest possible remedial measures particularly in local situation.
9. To enable the students to realise the necessity of judicious use of natural resources and to avoid unnecessary and wanton wastage and destruction of such resources and to inculcate among the students the idea of sustainable development.
10. To make the students appreciate the dignity of labour and the importance of learning by doing and to enable them to take up simple project work.

Syllabus for Class IX
Common to Physics and Chemistry

1. **System of measurements and measuring devices:**
   Physical quantities, Scalar and vector quantities. Units of physical quantities. All physical quantities do not have units. Fundamental and derived units (CGS and SI units).
   Idea of dimensions of physical quantities. Reason for using different smaller and larger units for measuring particular quantity. Measuring devices : ordinary scale, common balance, spring balance, measuring cylinder, clock and stopwatch. Measurement of density of an irregular solid by using common balance and measuring cylinder.
2. **Matter and energy:**
   Mass and weight, distinction between mass and weight, measurement of mass by common balance and measurement of weight by spring balance (Mention). Conservation of mass – burning of magnesium and burning of candle (experiment), examples from everyday life (two examples). Conservation of energy, different forms of energy like heat energy, light energy, sound energy, electrical energy etc., transformation of energy (non-quantitative treatment). Transformation of energy in everyday life to be explained. Sun is the most important source of energy on earth. Energy crisis: awareness, non-conventional sources of energy – solar, wind, tidal. Mention of Einstein's idea regarding conversion of mass and energy ($E = mc^2$). Conservation of mass and energy as a whole (mention only).
3. **Change of state:**
   Freezing, melting, boiling, evaporation and condensation. Melting point and boiling point: Factors (pressure & presence of other substance) affecting them – Constancy of temperature during melting and boiling. Regelation, Cutting of ice by metallic wire. Principle of pressure-cooker. Distinction between boiling and evaporation. Condensation. Formation of dew, fog and cloud.
   Idea of latent heat – Cooling by evaporation due to latent heat e.g. cooling by pouring ether or methylated spirit on the hand. Cooling of water in an earthen pitcher. Freezing mixture-one common example and its use.

Physics

1. **Rest and Motion:**
   Rest and Motion with respect to some fixed body. Rest or Motion of objects is a relative term.
2. **Displacement, Speed, Velocity and Acceleration:**
   Definition and illustration, distinction between speed and velocity. Idea of average speed. Idea of acceleration negative or positive. Units of speed, velocity and acceleration.
   Deduction of $v = u + ft$ Simple numerical examples.
3. **Newton's Laws of Motion:**
   (Rotational motion excluded) statement of laws, inertia of rest and inertia of motion. Definition of force and momentum. $P = mf$ (Deduction not required). Force of reaction with two common examples and its application in modern jet planes and space

Definitions with suitable examples, units. Relation between power and work. Potential and Kinetic energy – definitions with examples, Mathematical expression (Deduction not required).

Simple Machines:
Lever, Inclined plane, Wheel and axle (non-mathematical) – Definitions with illustration. Mechanical advantage – in case of lever and inclined plane.

6. **Light:**
Characteristics of image formed by a plane mirror, regular and irregular reflection. Lateral inversion. Images formed by parallel and perpendicular plane mirrors.
Refraction of light: phenomenon of refraction, Laws of refraction. Deviation of rays towards and away from the normal. Two natural phenomena depending on refraction.
Critical angle and Total internal reflection – Condition of total internal reflection, illustration. Formation of mirage in desert only.
Simple idea of velocity of light and its high value.

7. **Sound:**
Sources of sound, propagation of sound, material medium necessary. Characteristics of wave motion, frequency, wavelength, velocity ($V = n\lambda$), amplitude, natural and forced vibration (qualitative) only, reflection of sound and Echo, simple practical application, minimum distance of reflector for momentary sound. Simple problems.
Musical sound and noise – Difference, characteristics of musical sound.
Noise pollution, hazardous effect on public health. Possible remedial measures.

Chemistry

1.i) **Identification of matter:** Physical and Chemical properties.
How matters (solid, liquid and gas) differ in physical properties (touch, colour, smell, solubility, magnetic property) and chemical properties (action of heat, treatment with water, acids and alkalis). Characterisation of solid by melting point and liquid by boiling point. Differentiation of matter by touch (graphite and chalk; glycerine and water) smell (ammonia and oxygen), colour (blue vitriol and chalk powder), magnetic property (iron and aluminium), by heating (magnesium and platinum wires), by the action of water (quicklime and sugar), by the action of acid (zinc and copper), by the action of alkali (ammonium chloride and sodium chloride).

ii) **Physical and chemical change :**
Distinction between physical and chemical change – explanation with illustration – slaking of lime, rusting of iron, burning of coal, candle, straw, burning of magnesium wire, melting of ice, heating of platinum wire.
Physical and chemical changes take place simultaneously, burning of candle.
Mention of one natural physical change (melting of glacier) and one natural chemical change (forest fire).
Factors which induce and regulate chemical change: contact, temperature, pressure, catalyst. Chemical reaction by contact (conc. H_2SO_4 and sugar, quicklime and water, mention of white phosphorous and iodine).
Slow and fast reactions (elementary idea with example only): Catalysis and catalyst : Definition only – catalyst enhances the rate of a chemical reaction by participating in it, but remaining unchanged at the end – example of catalytic role of MnO_2 in the preparation of O_2 from $KClO_3$ (autocatalysis, inhibitors etc. not required).
Importance of catalyst (mention only)
Exothermic and endothermic changes both physical and chemical: Typical examples: slaking of lime (chemical change), dissolution of NH_4Cl or NH_4NO_3 in water (Physical change).

iii) **Separation of mixtures:**
1. By fractional distillation of two miscible liquids.
2. By separating funnel of two immiscible liquids.
3. By simple paper chromatography of the colouring matters of ink (theory not required).
4. By sublimation – NH_4Cl and sand.

iv) **Metals, non-metals and metalloids:**
Basic characteristics with typical examples.

2. **Solution:**
Solvent and solute, solution of solid in liquid, liquid in liquid and gases in liquid (simple examples like air dissolved in water, aerated water), unsaturated, saturated and super-saturated solutions – definition with example, Identification of unsaturated and saturated solutions of solid in liquid. Simple idea of colloid on the basis of practicle size. Mention of suspended particulate matter in air leading to air pollution.
Solubility (Definition and examples – problems not required). Effect of temperature, and pressure (in case of gas in liquid only) on solubility (effect of temperature on the solubility of $CaSO_4$, KNO_3, NaCl – experimental determination of solubility, and solubility curve not required). Crystals and Crystallisation. Water of crystallisation. Efflorescent and deliquescent substances definitions and examples. Drying agents (simple examples like anhydrous $CaCl_2$, anh. Na_2SO_4 and $MgSO_4$, conc. H_2SO_4).
Unit of concentration: in g/L, and in percentage (W/V only).

3. **Chemical reaction and chemical equation:**
Types of chemical reaction: Direct combination decomposition, double decomposition, acid-base, oxidation-reduction, addition, substitution, rearrangement (Definition with example only).
Chemical equation: Significance and Limitations of chemical equation, balancing of simple equations by trial & error method.

4. **Oxygen:**
i) Preparation of oxygen (statement and equation only) by heating $KClO_3$ and MnO_2, $KMnO_4$, $Pb(NO_3)_2$, (No experiment required).
ii) Reaction of oxygen with C, S, Ca, Mg (equations and statements only)
iii) Uses of oxygen. Identification, absorbent of oxygen.
iv) Gradual depletion of oxygen in atmospheric air and its possible remedy.

5. **Oxides, acids, bases and salts:**
Types of oxides – acidic, basic, neutral and amphoteric oxides (Definition with common examples). Arrhenius concept of acids and bases. Important properties with regard to indicators (litmus, phenolphthalein and methyl orange). Salts: normal and acid

Uses of indicators for the determination of end point (litmus, phenolphthalein and methyl orange) of neutralisation reaction. Vanishing colour.

6. **Water:**
Hard and soft water. Temporary and permanent hardness caused by soluble calcium and magnesium salts. Removal of temporary hardness by boiling and both types of hardness by ion-exchange process.
Deionised water.
Water as versatile solvent.
Action of sodium and calcium on cold water.
Simple idea of activity series of metals.
Water pollution (presence of As, F^- in natural water, by the use of fertilizers, insecticides, and pesticides, by dumping of chemical effluent. Supply of Ars-free water).
Water crisis, avoiding wastage of water and its judicious use. Harvesting of water for agriculture.

7. **Nitrogen:**
i) Laboratory method of preparation: Chemicals required, condition, collection, drying, equation and apparatus required.
ii) Physical properties – State, smell, density, solubility.
iii) Chemical Reactions with hydrogen, oxygen, magnesium and calcium carbide (formation of nitrolim).
Significance of the presence of nitrogen in air.
iv) Uses.

8. **Ammonia:**
i) Laboratory preparation: Chemicals required, condition, collection, drying, chemical equation and apparatus required. Precautions to be taken during preparation of ammonia. Ammonia is obtained by heating any ammonium salt with base.
ii) Physical properties – Smell, density, solubility (fountain experiment) aqueous solution of ammonia alkaline, liquor ammonia.
iii) Chemical properties: Burning of NH_3 in Oxygen.
Reaction with acids (HCl, H_2SO_4, HNO_3), reaction with alkali metal (Na only) and non-metal (chlorine only).
Reducing property (reaction with CuO)
Reaction of aqueous ammonia with aluminium chloride and ferric chloride solutions (precipitation reaction).
iv) Precaution to be taken to combat the effect of NH_3 leaked from industries and ammonia tanks.
v) Identification.
vi) Uses of NH_3

9. **Sulphuretted hydrogen (H_2S):**
i) Laboratory preparation: Chemicals required, condition, collection, drying, chemical equation and apparatus required. Precautions to be taken during preparation and handling (Preparation in Kipp's apparatus not required). Choice of acid for the preparation of H_2S. (Why H_2SO_4 & not HCl or HNO_3)
ii) Physical properties – Smell, density, solubility (aqueous solution acidic).
iii) Chemical properties:
Combustible, not a supporter of combustion. Acidic properties: reaction with alkali (NaOH). Reducing properties: reaction with Cl_2, SO_2, HNO_3, H_2SO_4, $FeCl_3$. Simple precipitation reaction (reaction with $CuSO_4$ and $Pb(NO_3)_2$
iv) Identification.
v) Uses.

10. **Carbon:**
Allotropes of carbon (diamond, graphite & fullerene) physical properties & burning in oxygen.
Availability of carbon in different places in free state and in compound forms or as a by-product. Uses.
CO_2: A green house gas, global warming.
Probable measures to keep the balance of CO_2 in air.
Pollution of air by CO

11. **Fuel: (carbonaceous)**
i) Classification of fuel: solid, liquid, gaseous (examples only).
ii) Fossil: Coal, coke and coal gas (Industrial production of coke and coal gas not required). Uses of coke and coal gas.
Petroleum: Different fractions obtained by fractional distillation of petroleum (mention only and their uses). LPG and natural gas. CNG (simple discussion in a qualitative way), uses.
Air pollution due to combustion of fuels.

Syllabus for Class X
Common to Physics and Chemistry

1. **Structure of Atom:**
Concept of atom, Dalton's atomic theory (critical study not required). Nucleus, and extranuclear electrons. Structure of nucleus – constituents (protons and neutrons only). Simple mention of nuclear force.
Mass and charge of electron, proton, neutron.
Planetary model of atom – similarities and dissimilarities with solar systems.
Distribution of electrons in K,L,M,N shell: Electronic configuration upto Calcium.
Atomic number and mass number.
Atomic mass (based on $^{12}C = 12.00000$).
Nuclide (an atom with a particular atomic number and mass number).
Isotopes (Definition) – Isotopes of hydrogen, oxygen, carbon, chlorine. Isotopes have similar chemical properties. Ions – definition with example.

2. **Properties of gases – pressure and temperature:**
Boyle's Law: statement and explanation with mathematical expression.
Charles' Law: statement and explanation with mathematical expression. Concept of Kelvin (absolute) temperature. Kelvin Scale – relationship with Celsius scale.

Simple numerical problems. Brief mention of the motion of gas molecules and dependence of pressure and temperature on such motion (very elementary non-mathematical discussion).

3. **Avogadro's Law:**
Concept of molecules.
Statement and explanation of Avogadro's Law.
Molecular mass based on $^{12}C = 12.00000$.
Gram atomic mass and gram molecular mass.
Molar Volume.
Statement of deductions from Avogadro's Law (deduction not required): Molecules of common elementary gases like hydrogen, oxygen, nitrogen are diatomic, Gram-molecular volume of all gases at STP is 22.4 litres.
Avogadro number (definition with explanation).
Mole – Unit of amount of substance.

4. **Simple weight – weight calculations using chemical equation.**

Physics

1. **Heat:**
Heat and temperature – (Definition and difference), Unit of heat. Celsius, Fahrenheit scale of temperature and numerical examples on conversion.
Factors determining the quantities of heat – idea of specific heat. Unit – cal/gm/°C, principle of calorimetry. Definition of thermal capacity and water equivalent. Simple numerical examples.

2. **Light: Lens & Dispersion:**
Lens – Convex and Concave, optical centre – Focussing action and focal length, linear magnification, distinction between real and virtual images; Formation of magnified real and virtual images by a convex lens; magnifying glass.
Dispersion of light – Definition, dispersion of white light by a prism. Spectrum – Pure and impure (distinction only).

3. **Current Electricity & Electromagnetism:**
Current – charges in motion
Concept of emf, potential difference – Ohm's Law and resistance; units of current, emf and resistance, dependence of resistance on length and cross-section, resistances in series and parallel, simple problems.
Demonstration with dry batteries, resistances, torch-light lamps and switch.
Heating effect of current – Joule's law with practical application to heater and electric iron; Electrical power and energy, household consumption.
Household circuits – switches, fuses, three-pin plugs, earthing, colour coding of wires.
Magnetic effect of current, Ampere's swimming rule. Action of magnet on current, Fleming's left hand rule, Burlow's wheel and application in case of a motor, electromagnet – its strength and use; use of voltameter and ammeter.

4. **Modern Physics:**
Thermionic emission (Basic idea – no analytical details) and hot cathode ray tube: diode valve (Principle only).
Principle of production of x-rays – properties and uses.
Natural Radioactivity – the nature of α, β and γ rays, (charge and mass), penetrating power; radioactivity – a nuclear phenomenon, hazards and safety precautions.
Simple idea of fission, fusion (only qualitative idea)

Chemistry

1. **Periodic Table:**

A. Periodicity of properties of elements.
Mendeleef's periodic law.
Modified Mendeleef's periodic law.
Periodic table based on modified periodic law (atomic number)
Periods, groups & sub-groups (mention only).
Periodic properties and their variations in periods (2nd & 3rd periods) and groups (Li, Na, K) and (F, Cl, Br, I), -- atomic size, metallic character, non-metallic character, electronegativity (Pauling's definition only).
Position of hydrogen, alkali metals, halogens and inert gases in the periodic table.

B. Modern long form of periodic table (IUPAC numbering of groups): Full table to be shown but to be studied upto period 3 (upto Ar).
(Whole topic to be discussed in elementary way.
Idea of transition elements not to be given).

2. **Chemical Bonding:**
What is a Chemical bond?
Simple idea of electrovalent and covalent bonds formed by transfer and sharing of electrons respectively. Characteristic properties of electrovalent and covalent compounds and difference between them. Electron – dot structures of: NaCl, CaO, H_2, O_2, N_2, HCl, H_2O, CH_4.

3. **Electronic theory of oxidation and reduction:**
(Simple idea only)
Oxidation: Loss of electron
Reduction: Gain of electron.
Oxidant & Reductant.
Simple examples.
Oxidation and reduction take place simultaneously – electronic explanation.

4. **Electrolysis: electrolytes and non-electrolytes:**

Application of electrolysis: (1) Electroplating (with copper), nickel and (2) Extraction of metals (example with the extraction of aluminium only. Only materials with their physical states and electrodes required. No technical description or equation required). (3) Prification of copper.

5. **Hydrogen Chloride (and Hydrochloric acid), Nitric acid and Sulphuric acid:**
Laboratory method of preparation of hydrogen chloride and hydrochloride acid from sodium chloride.
Preparation of nitric acid from chili salt petre. Fuming nitric acid. Catalytic oxidation of ammonia for the production of nitric acid. (only principle – conditions and equations. No technical discussion required).
Contact process for the manufacture of sulphuric acid (only principle – conditions and equations. No technical discussion, diagram, etc. required).
$S \rightarrow SO_2$, $SO_2 \rightarrow SO_3$ (condition only)

$SO_3 \xrightarrow{98\%\ H_2SO_4} H_2SO_4$

Fuming sulphuric acid.
Pollution of air by SO_2 – from automobiles, metallurgical process of S–containing ores (mention only), from oil refineries.
Danger to historical monuments like Tajmahal. (Stone cancer), possible remedial measures.
Physical properties of HCl, HNO_3, H_2SO_4: Colour, odour, solubility, density and boiling point.
Chemical properties of HCl, HNO_3, and H_2SO_4
Reactions: with alikali, with metals (Mg, Fe and Cu), with $AgNO_3$ and $BaCl_2$.
In case of HNO_3 reaction in hot and concentrated condition only with the above metals.
Oxidising action of conc. HNO_3 and conc. H_2SO_4 (on Cu-turnings and charcoal)
Dehydration action of conc. H_2SO_4
Ring test for HNO_3 (Demonstration)
Identification and distinction of the three acids – by $AgNO_3$, $BaCl_2$ and Cu-turnings.
Aqua regia (equation not required) – its use.
Pollution (of air, water) from goldsmith's workshop – its possible remedy, Acid rain (due to presence of SO_2 & NO_2 in air).
Uses of hydrochloric acid, sulphuric acid & nitric acid.

6. **Some important substances – nature and uses:**
Washing soda, common salt, bleaching powder, slaked lime, copper sulphate, ammonium sulphate, urea, soap, detergent, methylated spirit, vinegar, rectified spirit, naphthalene.
Regarding nature the following points are to be studied:
(i) solid, liquid or gas (ii) colour (iii) odour (iv) volatility (v) solubility in water (vi) acid, base or salt (vii) organic or inorganic (viii) hazard, if any.
Hazard of using ammonium sulphate repeatedly as a fertilizer, Health hazard of using copper sulphate for colouring vegetables and as pesticides.

7. **Some metals: aluminium, magnesium, zinc, iron, copper:**
Important ores (definition of ore to be given) and uses.
Reaction with (i) air, (ii) water, (iii) alkalis.
Alloy – an elementary idea.
Advantage of using alloys over pure metals (Qualitative idea)
Some important alloys: Brass, stainless steel, bronze, duralumin – their composition and uses only.

8. **Organic Chemistry:**

A. **What is organic chemistry?**
The role of organic compounds in life process, Biomolecules – definition, some biomolecules such as carbohydrates, amino acids, proteins, RNA, DNA – mention only in elementary way. Structures not required.
Bonding in organic compounds (covalent) – different from inorganic compounds (ionic and covalent)
Functional group and elementary classification: Hydrocarbons (saturated and unsaturated – alkane, alkene, alkyne), alcohols (only primary alcohols), aldehydes, ketones and carboxylic acids, examples (upto three carbon atoms).
Constitutional isomerism (Definition and example).

B. **Alkane** – definition and general formula : Methane (only) – Source (preparation not required), will-ó-the-wisp, and uses; burning in oxygen (its value as fuel) Mention that CH_4 is a green-house gas.
Substitution reaction (1^{st} Step of the reaction with chlorine only)

C. **Alkene** – definition and general formula : ethylene (only) : Source (mention only, laboratory preparation or production by any method not required) and uses ; addition reaction with hydrogen and bromine only.

D. **Alkyne** – definition and general formula :acetylene (only) : Source (Preparation not required) and uses; addition reaction with hydrogen and bromine only.

E. **Monomer and polymer** – only definition with example (addition, condensation polymer or polymerisation reaction not required)
Some common polymers : Polyethylene, Teflon, PVC – their monomer and uses (structures not required)
Hazards of using these substances – their non-biodegradability. Danger of using polyethylene materials indiscriminately and possible alternative.

UNITISATION

Class IX

UNIT	TOPIC
1st	• System of measurement and measuring devices • Matter and energy • Change of state • Rest and motion
2nd	• Displacement, Speed, Velocity, Acceleration • Newton's Laws of Motion • Identification of Matter Physical and chemical change Separation of mixtures Metals, non-metals and metalloids
3rd	• Work, Power, Energy • Simple Machines • Solution • Chemical reactions & chemical equations • Oxygen • Oxides, Acids, Bases, Salts • Water
4th	• Light upto Total Internal Reflection • Sound upto Echo, practical application & simple problems • Nitrogen • Ammonia • Hydrogen Sulphide
5th (Oral)	• Sound: Musical sound, Noise onwards • Carbon and fuel