AIET 2015
ALL INDIA ENTRANCE TEST - 2015
SYLLABUS

PHYSICS

Mechanics and Properties of Matter Circular motion

Angular displacement, Angular velocity, Angular acceleration, Relation between linear and angular velocity. Uniform circular motion, Radial acceleration, centripetal and centrifugal forces, Banking of roads.

Gravitation

Newton's law of gravitation, periodic time, binding energy and escape velocity of a satellite, weightlessness condition in a satellite.

Rotational motion.

Centre of mass of a two particle system, its generalization to 'n' particles, rigid body and its centre of mass, definition of moment of inertia it's physical significance, radius of gyration , K.E. of a rotating body, torque, M.I. principle of perpendicular and parallel axes its application to M.I. of uniform rod and disc with proof. Angular momentum and its conservation.

Oscillations

Explanation of periodic motion, Simple Harmonic Motion (S.H.M.), uniform circular motion and S.H.M ., phase of S.H.M., K.E. and P.E. in cases of S.H.M., composition of the two S.H.M. having same period and parallel to each other (Analytical treatment), simple pendulum, angular S.H.M., magnet vibrating in the uniform magnetic induction.

Elasticity

General explanation of elastic property (a few examples) plasticity, deformation, Definition of stress and strain , Hooke's law, Elastic constants Y,K, N, and O. Determination of Young's modulus by Searle's method, observations on a wire under applied increasing load, calculation of work done in stretching a thin uniform wire.

Properties of fluids

Behavior of liquid surfaces, its explanation on the basis of molecular theory, surface energy, surface tension, Angle of contact, capillary action.

SOUND

Wave motion

Explanation of formation of wave, simple harmonic progressive waves, longitudinal and transverse types of waves, deflection of

sound waves, change of phase, superposition of sound waves, explanation of formation of beats, Doppler effect.

Stationary waves.

Study of vibrations on strings, explanation of formation of stationary waves on strings, study of Vibrations of air columns, forced vibrations, resonance. Experiments like sonometer, resonance tube, Mold's experiment to study stationary waves.

Heat And Thermodynamics
Kinetic theory of gases

Assumptions of kinetic theory, mean free path, derivation for pressure of a gas in the container on the basis of Kinetic theory of gases,

Derivation of Boyle's law, specific heat at constant volume and pressure (Cp and Cv). Method of determination of Cp, Mayor's relation, Internal and external latent heat.

Radiation

Absorption, emission, reflection of heat radiations, Corresponding Coefficients and relation between them, Perfectly black body, emissive power, emissivity, Kirchhoff's law of radiation, it's theoretical proof, Ritche's experiment, Prevost's theory of exchange of heat, Stefan's law, Newton's law of cooling and radiation correction.

Thermodynamics

Thermodynamic state, equation of state, Isothermals, pressure temperature phase diagram, Vander's waal's equation of state.

LIGHT
Wave theory of Light

Newton's corpuscular theory, wave theory of light, wave front and wave normal, Huygen's principle construction of plane and spherical wave front Reflection and refraction at plane surfaces, Ray optics as a limiting case of wave optics, scattering of light.

Interference of light

Interference of light, conditions for producing steady, interference pattern, Young's experiment Analytical treatment of interference bands, Measurement of wave length by' biprism experiment.

ELCTRICITY AND MAGNETISM
Electrostatics

Gauss's Flux theorem, its proof and applications, mechanical force on unit area of charged conductor energy per unit volume. Capacity of a parallel plate condenser with a dielectric, Energy of a charged condenser, Condensers in series and parallel.

Current Electricity

Flow of current in a conductor, sources of e.m.f., simple cell, electric current, Ohm's law, Kirchhoff's laws, Wheatstone's bridge, Potentiometer.

Magnetic effect of current

Moving coil galvanometer, ammeter, voltmeter, sensitivity and accuracy of moving coil galvanometer Theory and construction of Tangent Galvanometer, sensitivity and accuracy of TG.

Magnetism

Magnetic induction at any point due to a magnetic dipole; Magnetic potential at any point due to a magnetic dipole; Diamagnetism, Paramagnetism, Ferromagnetism on the basis of domain theory, Curie temperature.

Electromagnetic Induction

Electromagnetic induction, Faraday's experiment, laws of the electromagnetic induction, proof of $e = d\Phi/dt$, Eddy currents, self and mutual inductance, induction coil earth coil, coil rotating in a uniform magnetic induction, alternating currents, reactance and impedance, power in A.C. circuits with resistance, inductance-and capacitance, Resonance circuits, Electromagnetic oscillations, Electromagnetic spectrum (Elementary facts, uses and applications)

MODERN PHYSICS

Electrons and photons

Discovery of an electron, charge and mass of electron, photoelectric effect, Einstein's equation. Photoelectric cell and its applications.

Atoms, molecules and nuclei.

Rutherford's model of an atom, Bohr model energy quantization, hydrogen spectrum, composition of nucleus, Radioactivity, mass energy relation.

Thermionic emission of solid state devices

Thermionic emission, diode, its construction and use' as a half wave and full wave rectifier. Triode, its construction and use as an amplifier (Qualitative idea).

Semi-conductors

P-type and N-type semi conductors, P-N junction diodes, P-N junction diode as rectifier, transistor as amplifier.

CHEMISTRY

Atomic Structure and Nature of Chemical Bond

i. Introduction, electronic theory of valency, limitations.

ii. VB. Theory-postulates, overlapping of atomic orbitals. a. S-S in H_2 molecule

b. P-P in halogen molecule

c. S-P in Hexmolecule

iii. The concept of hybrid orbitals and geometry of molecules

a. Tetrahedral (SP_3) hybridisation in CH_4, NH_3, H_2O

b. Trigonal hybridisation (SP_2) in BF_3,

and C_2H_4

c. Diagonal hybridisation (SP)in BeF, and C_2H_2

iv. Bond Energy –Average Bond energy, factors affecting bond energy.

v. The uncertainty principle, orbitals and Quantum numbers shapes of orbitals,

Electronic configuration of atoms.

Chemical Thermodynamics and Energetics

i. Introduction

ii. Concepts in Thermodyanamics -System, isolated, closed and open system, Homogenous and heterogeneous system, Thermodynamic equilibrium nature and type of processes, isothermal and adiabatic processes, reversible and irreversible processes.

iii. Nature of work and heat, units of energy and work in thermodynamics, work of pressure, volume, maximum work in reversible isothermal process, simple numerical problems.

iv. First law of Thermodynamics –Relation between mass and energy, internal energy, change in internal energy and mathematical

deduction of the first law of Thermodyanamics. q = E +W, Simple numerical problems Second law of Thermodynamics: Entropy, free energy, spontaneity of a chemical reaction, free energy change and chemical equilibrium, free energy as energy available for useful work.

v. Enthalpy (H) of a system, change in enthalpy, mathematical derivation, numerical problem and conversion of H related to endothermic and exothermic reaction.

vi. Thermochemistry Endothermic and exothermic reaction, heat of

reaction, heat of neutralization, Heat of formation H = [H (Product) – H (Reactant)], effect of temperature on heat of reaction (Kirchoff's equation), numerical problem.

vii. Internal energy and change in internal energy.

viii. Hess's Law of const. heat summation-definition and explanation

ix. H = rHI + H2 + H3+ - Numerical problem of Hess's Law

Electrochemistry

i. Introduction

ii. Electrolysis, electrolytic cells.

iii. Faraday's laws of electrolysis, simple numerical problem.

iv. Electrochemical cells-Construction, working of simple voltaic cell (Daniel Cell), convention used in S the representation of galvanic cell, use of salt bridge, types of electrodes, hydrogen electrode, calomel electrode and measurement of electrode potentials

v. Concept of electrode potential- electronation and de electronation (Nerst Theory), S.D.P. and e.m.f. of a cell e.m.f. series, its applications, simple numerical problems on e.m.f. of cell

vi. Common types of cells-Dry cell, lead accumulator.

Ionic Equilibrium

i. Introduction

ii. Arrhenius theory of acids and bases

iii. Lowry and Bronsted concepts of acids and bases

iv. Lewis concept of acids and bases

v. Strong and weak acid and bases, degree of dissociation, dissociation constant, Ostwald dilution formula. Simple problems.

vi. Ionisation of water, Ionic product of water(Kw).

vii. H ion concentration, pH and pOH – pH + pOH =14 numerical problems.

viii. Commonion effects, Buffer solution, Mechanism of buffer action, solubility product its application numerical problems on solubility product.

ix. Hydrolysis of salts, Hydrolysis constant, Relation between hydrolysis constant and dissociation constant.

Asorption and Colloids

i. Introduction

ii. Adsorption as a surface phenomenon, difference in types of adsorption and absorption, factors affecting adsorption, types of adsorption.

iii. Freundlich's adsorption isotherm, Applications in water purification, catalyst, adsorption indicate and chromatography

iv. Colloids – Introduction, colloidal state of matter disperse phase, dispersion medium, few examples colloidal solutions.

v. Preparation of colloidal solutions:

a. Dispersion method (electrical and mechanical)

b. Condensation methods (Oxidation and reduction) Properties of colloidal solutions, general properties, optical properties, mechanical, electrical properties, (electrophoresis and electroosmosis) coagulation.

vi. Gels- Definition, example, types, properties and uses.

vii. Emulsion- Definition , examples, types (DIW, W/0) properties and uses

viii. Application of colloids – food, medicine, sewage, precipitation of smoke.

Nuclear and Radiochemistry

i. Introduction

ii. Characteristics of nucleons, mass number, atomic number, isotopes and isobars.

iii. Nuclear stability, mass defect, binding energy, average binding energy, simple numerical problems on binding energy.

iv. Radioactivity- Radioactive decay, nature of radiations, radioactive disintegration constant, half life period, mathematical derivation for the decay constant – and halflife (t1/2), simple numerical problems, Artificia radioactivity and artificial transmutation of elements.

v. Nuclear reactions. Radio isotopes and their uses – carbon dating, production of synthetic elements, medicine, agriculture.

Chemistry of Third Row Elements

i. Introduction

ii. Position of third row elements in periodic table.

iii. Electronic Configuration

iv. Periodic trend – reducing and oxidizing characters, ionization potential;

electropositive and electronegative character and hence metallic and non metallic character

v. Nature of bonding in crystal lattice.

vi. Explanation of properties of metallic solids – conductivity, metallic luster, malleability, ductility.

vii. Acidic and basic character of oxides and hydroxy compounds of third row elements. Hydrogen -Position in periodic table, isotopes, properties, reaction and uses. Oxygen –Position in periodic table, preparation, reaction uses, ozone. Water and hydrogen peroxide structure of Water molecule, Physical and chemical properties of water, hard and soft water. Hydrogen peroxides – Preparation, properties, structure and uses. Nitrogen-Preparation, Properties, uses, compounds of nitrogen.

Fluorine and Hydrogen Fluoride

i. Introduction

ii. Position of halogens in periodic table, electronic configuration; general principles of halogens

iii. Fluorine – Occurrence, preparation, properties, reaction and uses.

iv. Hydrogen- fluoride and hydrofluoric acid – preparation, properties, reactions and uses.

Silicon:

i. Introduction

ii. Position of silicon in periodic table, electronic configuration

iii. Silicon- occurrence, preparation, properties and uses

iv. Silicates, structure of simple silicates, nature of Si-O bond, tetrahedral geometry of $Si0_4$ units in silicates. Halogen

Derivatives of Alkanes

i. Introduction

ii. Classification, Mono, di, tri and tetrahalogen derivatives of alkanes

iii. Monohalogen derivaties (alkyl halides)

a. Nomenclature –Trivial and I.U.P.A.C. system

b. Preparation

Halogenation of alkanes
Addition of Hx to alkanes
Action of P and PXs to Sod2 on alcohols

(Ethyl bromide C_2H_5Br to be taken as a representative member)

iv. Reactions of alkyl halides

a. Substitution reactions with :Alkalies, KCN, Ammonia, Sodium alkoxide,

R-C00Ag
b. Wurtz reaction
c. Formation of Grignards reagent
d. Elimination –Action of alcoholic KOH
v . a. Introduction of Homolytic and heterolytic fission

Explanation of fission taking compound A-B
1. A-B0A+B Homolytic
2. A-B0A+B-Heterolytic
b. Types of reagents
1. Electrophillic with suitable examples
2. Nucleuophillic with suitable examples
c. Mobility of electrons in single and double bonds 1. Inductive effect
2. Electromeric effect
vi. SN_1 and SN_2 reaction mechanism:

a. Mechanism of alkaline hydrolysis of methyl bromide (SN_2 mechanism)
b. Alkaline hydrolysis oft-Butyl bromide (SN1 mechanism)
vii. Optical activity:

Following points are to be emphasized:
Polarisation of light by Nicol prism
Asymmetric carbon atom

Optically active (compounds, definition with example of lactic acid (Dextro, Laevo and Racemic forms)

Optically activity of 2 –chlorobutane to be discussed on the following points Presence of asymmetric Carbon atom

Two non-superimposable mirror image structures A mixture and its optical inactivity.

viii. Dihalogen Derivatives: Preparation of $C_2H_4Cl_2$ Two isomers
a. Ethylene dichloride
b. Ethylidene chloride
Preparation of ethylene dichloride by
a. Addition of Cl_2 to ethene.
b. Ethylene glycol and PCl_5 Preparation of ethylidene chloride from
a. Acetaledehyde and PCl_5
b. Acetylene and HCl
ix . Trihalogen Derivatives of CH_4 :

Preparation of chloroform and Iodoform General physical and chemical properties
a. Reduction
b. Oxidation
c. Hydrolysis
d. Carbylamine reaction
e. Action of HNO_3

Organic Hydroxy Compounds

i. Introduction

Alcohols –introduction –classification Nomenclature-

1. Trivial system

2. I.U.P.A.C. system

Preparation method

Hydrolysis of alkyl halides

Hydration of Alkene by acid Reduction of Aldehydes and ketones by a. Catalytic method using Nickel

b. Na-Hg / H_2O Properties and Reactions:

General Physical and Chemical Properties Reaction with

a. Na, Hx, PCB, PCl_5

b. Dehydration

c. Oxidation of primary, secondary and tertiary alcohols ii. Phenols :

Aromatic hydroxyl compounds – Phenol as a representative compound

a. Chlorobenzene

b. Benzene Sulphonic acid c. Cumene

iii Physical properties and chemical reactions a. Halogenation,

b. Nitration

c. Sulphonation

Distinction between alcohol and phenol, uses of phenol,

Aldehydes and Ketones:

i. Introduction

ii. Preparation

Oxidation of alcohols

Hydrolysis of gemdihalides

From Grignard reagent,

From calcium salt of acids

iii. Reactions :

a. Addition to Carbonyl compounds HCN, $NaHC0_3$, NH_3, Grignard's reagent

b. Condensation reactions – (NH_20H), $C_6H_5NHNH_2$

c. Aldol condensation, Acetaldehyde with dil. alkali, similar reactions with ketones.

d. Cannizzaro's reaction –Action of conc. Na0H on formaldehyde. e. Reduction of Aldyhydes and Ketones, catalytic hydrogenation. f. Reducing properties of Aldehydes Fehling solution, Tollen's reagent, Schiff's reagent

Acids and Esters

i. Introduction

ii. Preparation (acids)

a. Oxidation of primary alcohols, aldehyde.

b. Hydrolysis of alkyl cyanides

c. Grignard reagent and C02
iii. Reactions
a. Acidic properties
b. Antyride formation by using P205
c. Ester formation iv.
Amide formation
v. Esters
a. Introduction
b. Preparation: Acid and alcohol, Alcohol and acid anhydride Alcohol and Acid chloride Alkylhalide and Ag-salt of acid
c. Reaction of ethyl acetate Hydrolysis with acid and alkali Action of Grignard reagent Uses of esters

Ethers

i. Introduction
ii. Definition: Classification, simple and mixed ethers
Preparations:
a. Williamson's synthesis
b. Continuous etherification process
c. Alcohol and Diazomethane
iii Physical and chemical properties:
a. Action of HI on simple and mixed ethers in cold and hot
b. Hydrolysis by dil.H_2S0_4 uses of diethyl ether

Amines

i. Introduction
ii. Definition: Classification –Nomenclature
iii. Preparation
a. Haloalkanes and Ammonia
b. Reduction of Oxime, nitriles and nitroalkanes.
iv. Properties: Physical and chemical
a. Basic nature on the basis of Lewis concept
b. Acetylation by acetyl chloride and acetic anhydride
c. Action of HNO_2 on primary, secondary and tertiary amines
d. Methylation of primary, secondary and tertiary amines yielding quaternary ammonium salts.

Carbohydrates, Proteins and Fats

i. Introduction
ii. Carbohydrates: Classification, mono, di and polysaccharide, preparation of glucose from sucrose and starch.
iii. Proteins: Classification, simple, conjugated and derived proteins. Hydrolysis of proteins to produce amino acids peptide linkage Colour tests : 1) Biuret test, 2) Millon's test
iv. Fats and Oils:
Glycerol –as a trihydroxy alcohol, fatty acid Esters of glycerol with fatty acids Saponification, Hydrogenation.

Synthetic Fibres

i. Introduction
ii. Definition of fibres: Classification as –natural and artificial fibres
iii. Preparation: properties and uses of Nylon 6, Nylon 66, Terylene, teflon, PVC, Polystyrene.

Biology (BOTONY)
Section (A): General Biology and Botany
General Biology
Continuity of Life

i. Mendel's laws of inheritance, with reference to Mendel's experiments with peas, ideas of factors, Monohybrid and Dihybrid ratio.

ii. Genes – Packaging of hereditary material, prokaryotes, bacterial chromosomes, plasmid and eukarytic chromosomes Genetic material, DNA replication; Genetic Code and Central dogma of protein synthesis.
iii. Cell division –cell cycle, mitosis and meiosis significance.

Applications of Biology

i. Domestication of plants: improvement of crop plants –Principles of plant breeding and technique of hybridization
Application of Tissue: culture.

Use of fertilizers and pesticides – Their advantages and disadvantages; Biological method of Pest control.

ii. Bio-energy: - Bio-gas, plants as sources of hydrocarbons for producing Petroleum. to iii) Bio-technology:-
Meaning and manufacture of Alcohols, Antibiotics and Vitamins.

Multicellularity Plant Life

i. Concept of species – Various taxons and categories, Hierarchial levers of classification, Binomial nomenclature, principles of classification.

ii Conquest of land –Life history- Life of Fern(Nephrolepis), Cycas and angiosperms (Hibiscus, Jowar, Bajra) - Anatomy,

development of seed habit, flower and fruit (Development of Reproductive structures not expected)
iii Physiology

Transpiration: Transpiration and exchange of gases, stomatal Mechanism.

Photosynthesis: Ultra-structure and functions of chloroplast, photochemical and biosynthetic phases, diversity in photosynthetic pathways, significance.

Respiration: Ultra-structure and function of mitochondrion, glycolysis, Krebs cycle, electron transport system, fermentation, significance.
Growth : Plant hormones and growth regulation, action

of plant hormones in relation to seed dormancy and germination , apical dominance.

Reproduction: Asexual and sexual Brief account of mode of sexual reproduction in multicellular lower plants-antheridium and archegonium. Sexual reproduction in angiosperms Pollination, structure of male and female gametophytes, fertilization, formation of endosperm embryo, seed and fruit.

BIOLOGY (ZOOLOGY)

Section (B) – General Biology And Zoology Evolution of Life

Evolution: Definition, Darwin's theory of natural selection (Common origin, recombination as a source of variability, Role of selection on variation, adaptation, reproductive isolation and speciation.)

ii) Human evolution: Paleontological evidences, Brief idea of the Dryopithecus, Australopithecus, Homo-erectus, Homo-meanderthalensis,
Cro-magnon, Homo-sapiens.

Continuity of Life:

i. Sex determination and sex linkage in man.

ii. Domestication of animals – Introduction of poultry, fisheries, Sericulture and apiculture. Principles of animal breeding, major animal diseases and their control

iii. Human diseases and their control + Hepatitis, AIDs, Leprosy, Cancer.

iv. Community Health Services – Blood banks smoking. Alcoholism drug addiction- Physiological symptoms and their measure.

v. Pollution –Air, Water –effect and control

vi. Human population –Growth, problems and control

Multicellularity

Structure and functions of animal life with reference to mammals:

i. Circulation –Closed vascular system, Heart –structure and pumping action, Arterial blood pressures.

ii Excretion and Osmo-regulation: Aminotelism, uriotelism, uricotelism, Excretion of water and urea, with special refernce to man, role of Kidney, in regulation of plasma, osmoregularity on the basis of structure of nephron: role of skin and lungs, in excretion.

iii Hormonal Co-ordination: Morphological and histological structure of pituitary and thyroid glands, important hormones of pituitary and thyroid and their role as messengers and regulators.

iv. Nervous Co-ordination: Central, Peripheral, autonomous nervous system, receptors and effectors, reflex action.

v. Locomotion –Joints, muscle movements

vi. Skeleton-Brief account of human skeleton

vii. Reproduction: Human reproduction, female reproductive cycle, embryonic development up to three germinal layers.

viii. Classification of chordata: Pisces, Amphibia, Reptilia, Aves, Mammals, highlighting major characters with two examples of each class.