M.G.S.UNIVERSIYTY

BIKANER

SYLLABUS

SCHEME OF EXAMINATION AND

COURSE OF STUDY

FACULTY OF SCIENCE

B.Sc. Part- I Examination, 2019

B.Sc. Part- II Examination, 2020

B.Sc. Part- III Examination, 2021

(10+2+3 Pattern)

Edition: 2018

B.Sc. Part- I Examination, 2019

CHEMISTRY

Scheme

Three papers	Min. Pass Marks: 48	Max. Marks: 135
Paper I	3 Hours Duration	45 Marks
Paper II	3 Hours Duration	45 Marks
Paper III	3 Hours Duration	45 Marks

Practical : 5 Hrs. Duration, Min. Pass Marks :24, Max. Marks 65

Marking scheme

1. Each theory paper will be of 45 marks (minimum passing marks 16). There will be three theory papers total marks in theory will be 145 (minimum passing marks 48). Time duration for each paper will be 3 hours
2. The practical paper will be of 65 marks (minimum passing marks 23). Practical exam will be of 5 Hrs.
3. Each theory question paper will be divided into three sections i.e. A, B and C.
4. Section A will contain 10 Questions (Two questions from each unit), all questions are compulsory carrying 1.5 marks each question (Answer limit-50 words).

5. Section B will contain 10 10 Questions (Two questions from each unit), Student will have to answer total 5 questions (attempting 1 question from each unit) carrying 3 marks each question (Answer limit- 200 words).
6. Section C will contain 5 Questions (One questions from each unit). Student will have to answer total 3 questions out of these 5 as per their choice carrying 5 marks each question (Answer limit - 500 words).

PAPER-I : INORGANIC CHEMISTRY

Time : 3 Hours **Max. Marks:45**

60 Hours (2 Hours/ week)

Unit-I

(a) Atomic Structure :

Idea of De-Broglie matter/waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, significance of

psi(ψ) and psi*(ψ*), quantum numbers, radial and angular wave function and probability distribution curves, shapes of s, p,d orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configurations of the elements, effective nuclear charge.

(b) Periodic Properties :

Atomic and ionic radii, ionization energy, electron affinity and electronegativity, different, methods of determination, trends in

periodic table and applications in predicting and explaining the chemical behavior.

Unit-II

(a) Chemical Bonding :

Covalent Bond - Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions. Valence shell electron pair repulsion (VESPR) theory to NH_3, H_3O^+, SF_4, CIF_3, ICI_2^- and H_2O.

(b) MO theory-Homonuclear and heteronuclear (CO and NO) diatomic molecules, multicentre bonding in electron deficient molecules, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference.

Unit-III

(a) Ionic Solids - Ionic Structures, radius ratio effect and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy and Born-Haber Cycle, solvation energy and solubility of ionic solids, polarizaing power and polarizability of ions. Fajan's rule. Metallic bond - Free electron, valence bond and band theories.

(b) Weak interaction-Hydrogen bonding, Vander waals forces.

Unit-IV

(a) **s- Block Elements** - Comparative study, diagonal relationship, salient features of hydrides, solvation and complexation tendencies including their function in biosystems and introduction to alkyls and aryls.

(b) **Chemistry of Noble Gases**-Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.

(c) **p-Block elements**-Comparative study (Including diagonal relationship) of groups13-17 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13-17.

Unit-V

Chemistry of the following Compounds : Hydrides of Boron, diborane and higher boranes, borazine, fullerenes, carbides, flurocarbons, silicates, tetrasulphur tetranitride, basic properties of halogens, interhalogens and polyhalides.

PAPER-II : ORGANIC CHEMISTRY

Time : 3 Hours **Max. Marks : 45**

60 Hours (2 Hours/ week)

Unit-I

(a) **Structure and Bonding:**

Hybridization, bond lengths and bond angles. Bond energy, localized and delocalized chemical bond, vander waals interactions, inclusion

compounds, clatherates, charge transfer complexes, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.

(b) Mechanisms of Organic Reactions :

Curved arrow notation, drawing electron movements with arrows, half headed and double headed arrows, homolytic and heterolytic bond breaking. Types of reagents-electrophiles and nucleophiles. Type of organic reactions, energy considerations.

Reactive intermediates- carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples) Assigning, formal charges on intermdiates and other ionic species.

Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects. Kinetic and stereochemical studies).

Unit-II

Stereochemistry of Organic Compounds-Concept of isomerism, types of isomerism. Optical isomerism- elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and recemization.

Relative and absolute, configuration, sequence rules, D& L and R & S systems of nomenclature.

Geometric isomerism- Determination of configuration of geometricisomers E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds.

Conformational isomerism- conformational analysis of ethane and n-butane. Conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatieves, Newman projection and sawhorse fourmulae, Fischer and flying wedge formulae.

Difference between configuration and conformation.

Unit-III

Alkanes and Cycloalkanes-IUPAC nomenclature of branched and unbranched alkanes, the alky group, classification of carbon atoms in alkanes. Isomerism in alkanes, sources, methods of formation (With special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids). physical properties and chemical reactions of alkanes.

Mechanism of free radical halogenation of alkanes : orientation, reactivity and selectivity. Cycloalkanes - nomenclature, methods of formation, chemical reactions. Baeyer's strain theory and its limitations, ring strains in small rings (cyclopropane and cyclobutane), Theory of strainless rings, the case of cyclopropance ring : banana bonds.

Unit-IV

(a) Alkenes, Cycloalkenes, Dienes and Alkynes-Nomenclature of alkenes, methods of formation. Mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regio selectivity in alcohol dehydration. The saytzeff rule, Hofmann elimination, physical propertes and relative stabilities of alkenes.

(b)Chemical reactions of alkenes- mechanism involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration-oxidation, oxymecuration- reduction, epoxidation, ozonolysis, hydration, dehydoxylation and oxidation with $KMnO_4$, Polymerization of alkenes, Substitution of the allylic and vinylic positions of alkenes. Industrial applications of ethylene and propene

Methods of formation, confirmation and chemical reactions of cycloalkenes.

Nomenclature and classification of Dienes : Isolated, conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formation, polymerization . Chemical reactions- 1,2 and 1,4 additions, Diels- Alder reaction.

Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reaction of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroboration-oxidation, metal ammonia reductions, oxidation and polymerizations.

Unit-V

Arenes and aromaticity-Nomenclature of benezene derivatives. The aryl group. Aromatic nucleus and side chain, structure of benzene : molecular formula and Kukule structure, stability and carbon-carbon bond lengths of benzene, resonance structue, MO picture, Aromaticity : The Huckel rule, aromatic ions.

Aromatic electrophilic substitution- general pattern of the mechanism, role of sigma(σ) and pie(π) complexes. Mechanism of nitration, halogenation sulphonation, mercuration and Friedal- Craft's reactions, energy profile diagrams. Activating & deactivating substituents, orientation and ortho / para ratio, side chain reactions of benzene derivatives. Birch reduction.

Methods of formation and chemical reactions of alkyl benzenes, alkynyl benzenes and biphenyl.

Alkyl and Aryl Halides-Nomenclature and classes of alkyl halides, methods of formation, chemical reactions. Mechanisms, nucleophilic substitution reactions of alkyl halides, S_N2 and S_N1 reactions with energy profile diagrams.

Polyhalogen compounds : Chloroform, carbon tetrachloride.

Methods of formation of aryl halides, nuclear and side chain reactions. The addition-elimination and the elimination-addition mechanisms of nucleophillic aromatic substitution reactions.

Relative reactivities of alkyl vs allyl, vinyl and aryl halides. Synthesis and uses of D.D.T. and B.H.C.

PAPER -III : PHYSICAL CHEMISTRY

Time : 3 Hours **Max. Marks : 45**

60 Hours (2 Hours/ week)

Unit-I

Mathematical Concepts & Computers :

(a) Mathematical Concepts

Logarithmic relations, curve, sketching linear graphs and calculations of slopes, differentiation of functions like K_X, e^x, X^n, sin x, log x; maxima and minima, partial differentiation and reciprocity relations. Intergrations of some useful/relevant functions; permutations and combinations, Factorials. Probability

(b) Computers

General introduction to computers, different components of a computer, hardware and software, input and output devices; binary numbers and arithmetic, introduction to computer languages, Programming operating systems.

Unit-II

(a) Gaseous States : Postulates of kinetic theory of gases, deviation from ideal behaviour, Vander-waals equation of state.

Critical Phenomena : PV isotherms of real gases, continuity of states, the isotherms of Vander-waals equation, relationship between critical constants and Vander-waals constants, the law of corresponding states, reduced equation of state.

(b) Molecular Velocities : Root mean square velocity, average and most probable velocities. Qualitative discussions of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Liquification of gases (based on joule - thomson effect).

Unit-III

(a) Liquid State:

Intermolecular forces, structure of liquids (a qualitative description). Structural differences between solids, liquids and gases,

Liquid Crystals : Difference between liquid crystal, solid and liquid. Classification, structure of nematic and cholestric phases.

Thermography and seven- segment cell.

(b) Colloidal State:

Definition of colloids, classification of colloids.

Solids in liquids (sols) properties - Kinetic, optical and electrical stability of colloids, protective action, Hardy - Schultze law, gold number.

Liquids in liquids (emulsions) : Type of emulsions, preparation and properties of Emulsions.

Liquids in solids (gels) : Classification, preparation and properties, inhibition, general applications of colloids.

Unit-IV

Solid State

Definition of space lattice, unit cell.

Laws of crystallography- (i) Law of constancy of interfacial angles, (ii) Law of rationality of indices, (iii) Law of symmetry. Symmetry elements in crystals.

X-ray diffraction by crystals. Derivation of Bragg equation. Determination of Crystal structure of NaCl, KCl and CsCl (Laue's method and powder method).

Unit-V

Chemical kinetics and catalysis

Chemical kinetics and its scope, rate of reaction, factors influencing the rate of reaction-concentration, temperature, pressure, solvent, light, catalyst, concentration dependence of rates, mathematical characteristics of simple chemical reactions: zero order, first order, second order, pseudo order, half life and mean life. Determination of the order of reaction-differential method, method of integration,

method of half life period and isolation method. Radioactive decay as a first order phenomenon.

Experimental methods of chemical kinetics : Conductometric, potentiometric, optical methods, polarimetric and spectrophotometeric.

Theories of chemical kinetics: Effect of temperature on rate of reaction, Arhenius concept of activation energy.

Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis). Expression for the rate constant based on equilibrium constant and thermodynamic aspects.

Catalysis, characteristics of catalyzed reactions, classification of catalysis, miscellaneous examples.

PRACTICAL

Max Marks 65 **Min Marks 24**

Time : 120 Hours (4 Hours / Week)

(A) INORGANIC CHEMISTRY

Semi micro and Macro analysis , Separation and Identification of Four radicals - two acidic and two basic in a given mixture which may include any one interfering radical and/or combinations of radicals.

(B) ORGANIC CHEMISTRY

1.Laboratory techniques:

(i) Determination of melting point (^{0}C)

Naphthalene 80-82 ^{0}C, Benbzoic acid 121.5-133^{0}C

Urea 132.5-133^{0}C, Succinic acid 184.5-185^{0}C

Cinnamic acid 132.5-133^{0}C , Salicylic acid 157.5-158^{0}C

Acetanilide 113.5-114^{0}C, m-Dinitrobenzene 90^{0}C

p- Dichlorobenzene 52 ^{0}C ,Aspirin 135^{0}C

(ii) Determination of boiling point

Ethanol 78^{0}C, cyclohexane 81.4^{0}C, toluence 110.6^{0}C, Benzene 80^{0}C

(iii)Mixed melting point determination

Urea-cinnamic acid mixture of various compositions(1:4,1:1,4:1)

(iv) Distillation

Simple distillation of ethanol-water using water condenser,

Distillation of nitrobenzene and aniline using air condenser

(v)Green Chemistry - Identification of Safety Symbols

2. Purification Methods

(i).**Crystallization**

Phthalic acid from hot water (using fluted filter paper and stemless funnel)

Acetanilide from boiling water,Naphthalene from ethanol,Benzoic acid from water

(ii)..**Decolorisation & Crystallization using charcoal**

Decolorisation of brown sugar (sucrose) with animal charocoal using gravity filtration, Crystallzation and decolorisation of impure naphthalene (100g of naphthalene mixed with 0.3 g of Congo red using 1 g decolorizing carbon) from ethanol.

(iii) **Sublimation (Simple and Vacuum)**

Camphor, Naphthalene, phthalic acid and succinic acid.

3.Qualitative analysis

Identification of an organic compound through the functional group analysis, determination of melting point and preparation of suitable
Derivatives

(C) PHYSICAL CHEMISTRY

(i) C**hemical Kinetics**

1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
2. To study the effect of acid strength on the hydrolysis of an ester.
3. To compare the strengths of HCI and H_2SO_4 by studying the kinetics of hydrolysis of ethyl acetate.
4. To study kinetically the reaction of decomposition of iodide by H_2O_2.

(ii) Distribution Law

1. To study the distribution of iodine between water and CCl_4
2. To study the distribution of benzoic acid between benzene and water

(iii) Colloids

1. To prepare arsenious sulphide sol and compare the precipitating power of mono- ,bi- and trivalent anions.

(iv) Viscosity & Surface Tension

1. To determine the percentage composition of given mixture (non interacting system) by viscosity method.
2. To determine the viscosity of amyl alcohol in water at different concentrations and calculate the viscosity of these compositions.
3. To determine the percentage composition of a given binary mixture by surface tension method (acetone & ethyl- ketone)

Spotting

Spotting will include Safety symbols, laboratory instruments, techniques etc.

During examination in spotting there should be 5 spots related with instruments, techniques, safety etc. from the syllabus ; time of spotting is 20 minutes and a separate copy shall be used for the purpose.

PRACTICAL-SCHEME OF EXAMINATION

Max. Marks: **65** **Min.Marks:24**

Time 5 hours

INORGANIC CHEMISTRY

1. Analysis: One Exercise **15 Marks**

ORGANIC CHEMISTRY

1.Lab Techniques: One experiment from any one techniques- 2.**5 Marks**

2-Purifiction Methods: One experiment from any one methods- 2.**5 Marks**

3.Qualitative Analysis: One Compound **10 Marks**

PHYSICAL CHEMISTRY

Any One experiment **15 Marks**

SPOTTING **10 Marks**

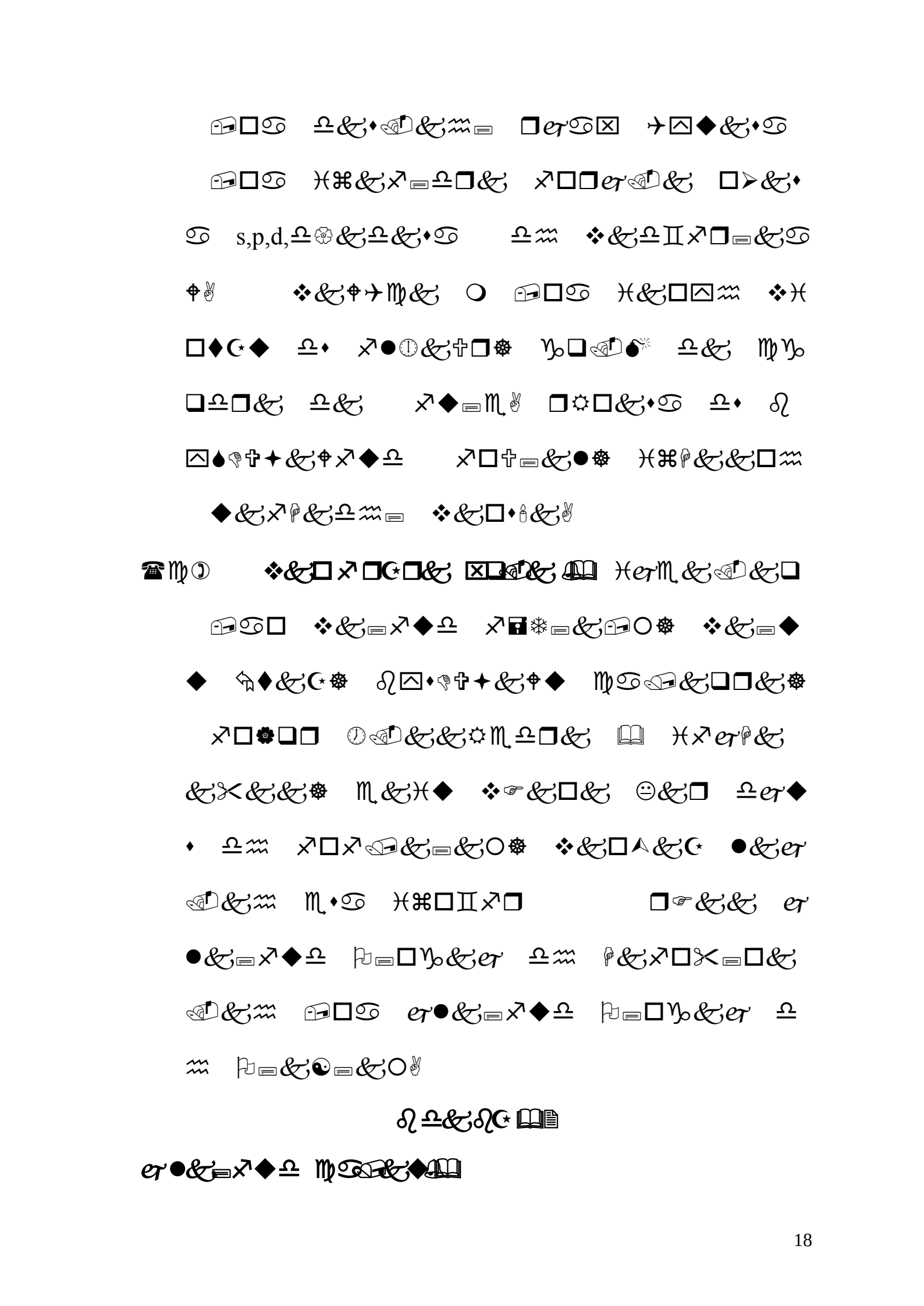
(5 spots)

VIVA **5 Marks**

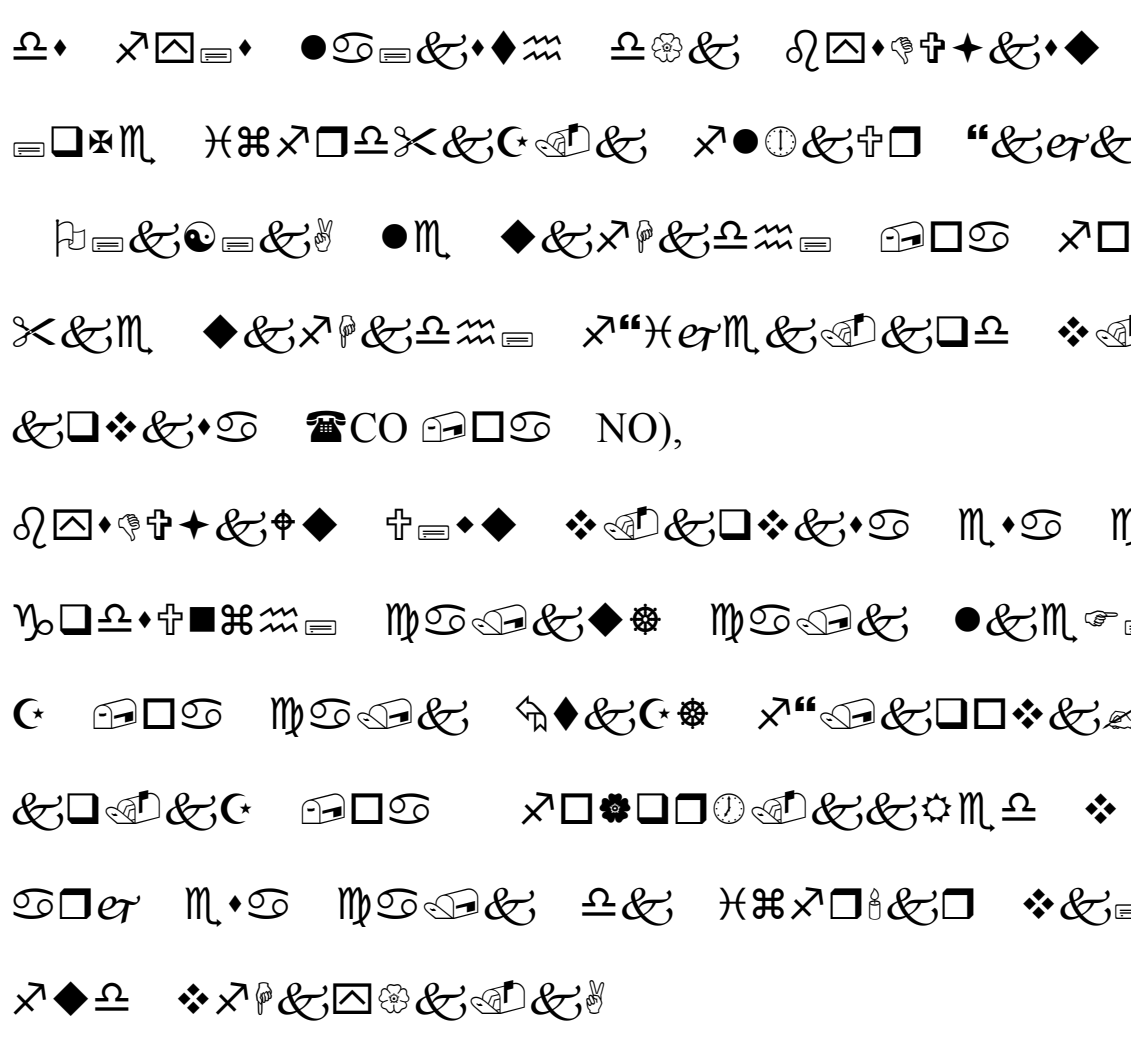
RECORD **5 Marks**

समय 3 घण्टे पूर्णांक : 45

60 घण्टे (दो घण्टे प्रति सप्ताह)



NH_3, H_3O^+, SF_4, ClF_3, ICl_2^- , ^1H_2O



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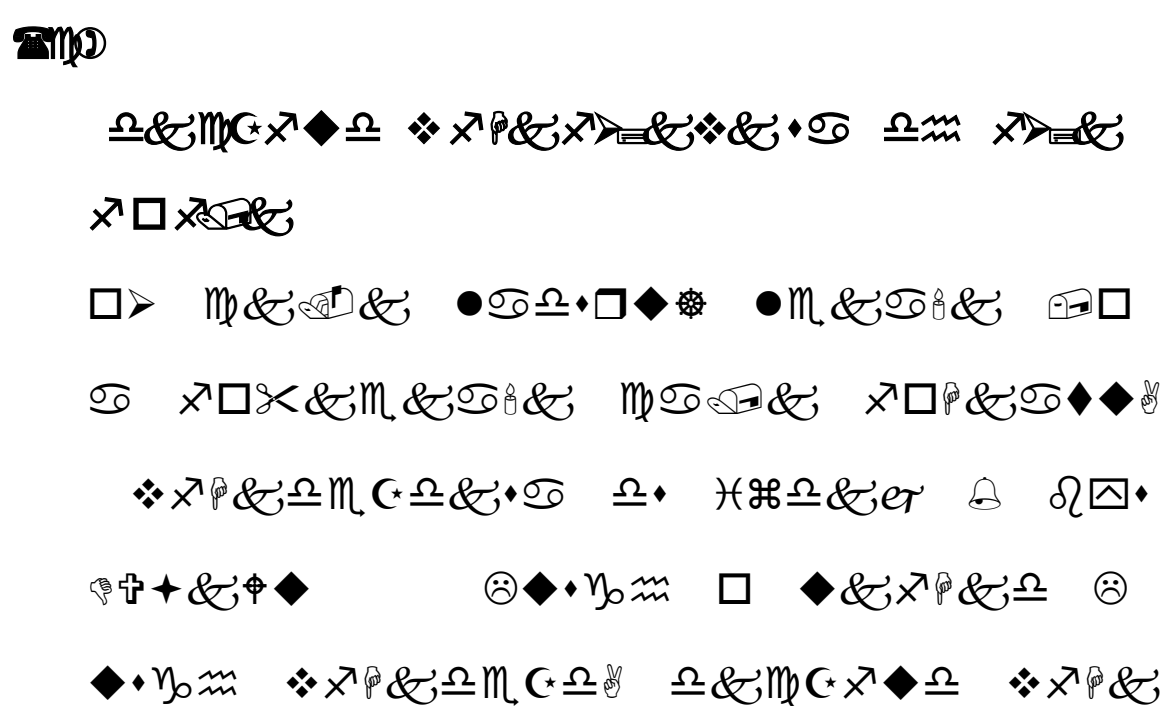

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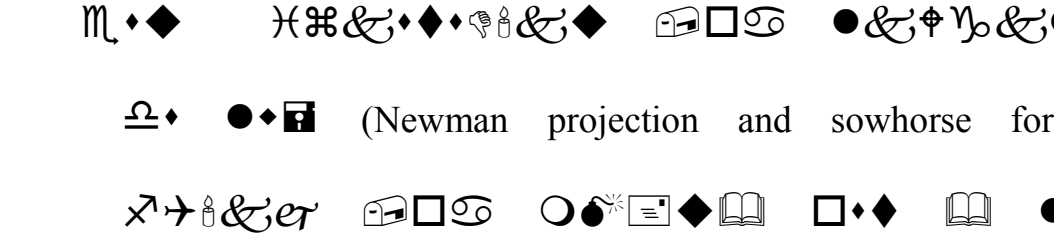

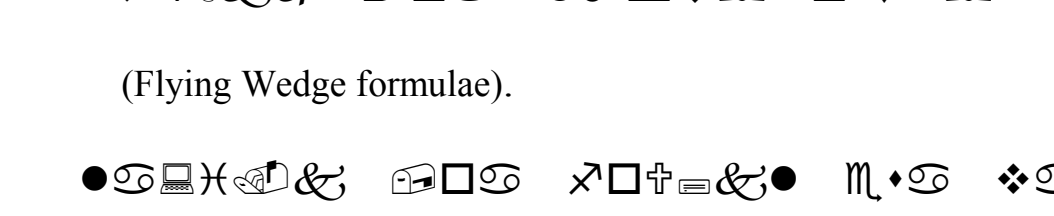

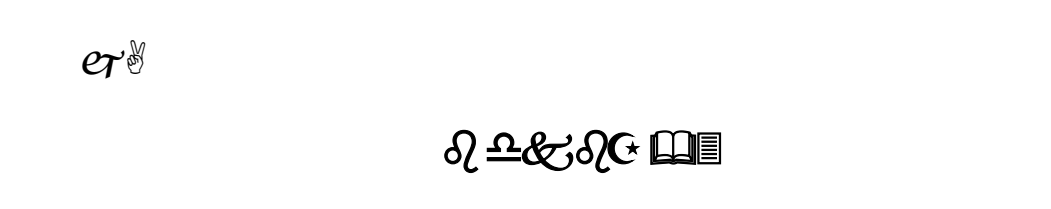

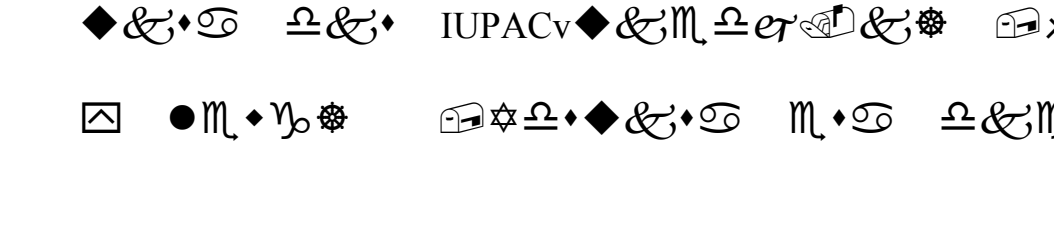

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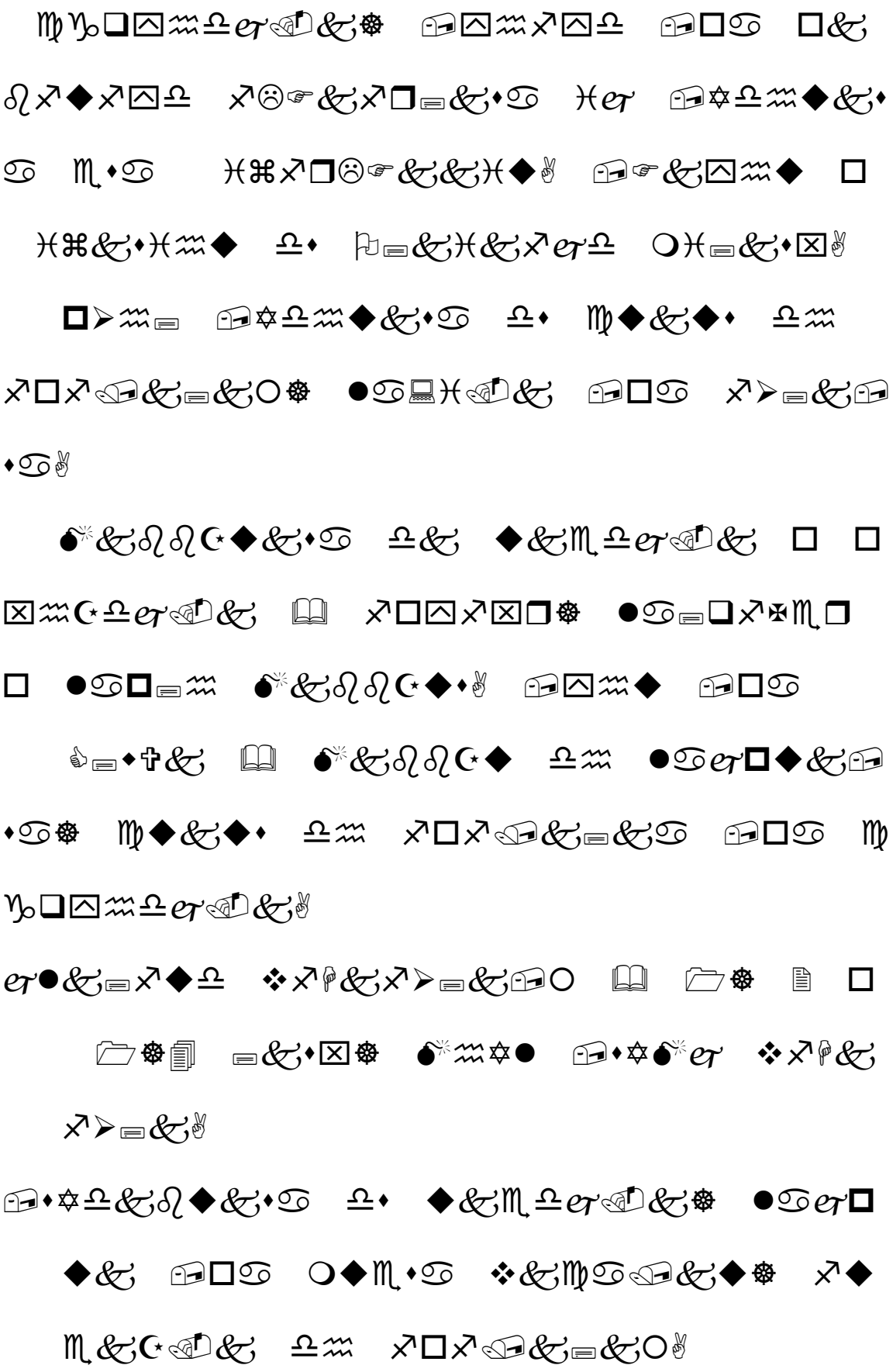

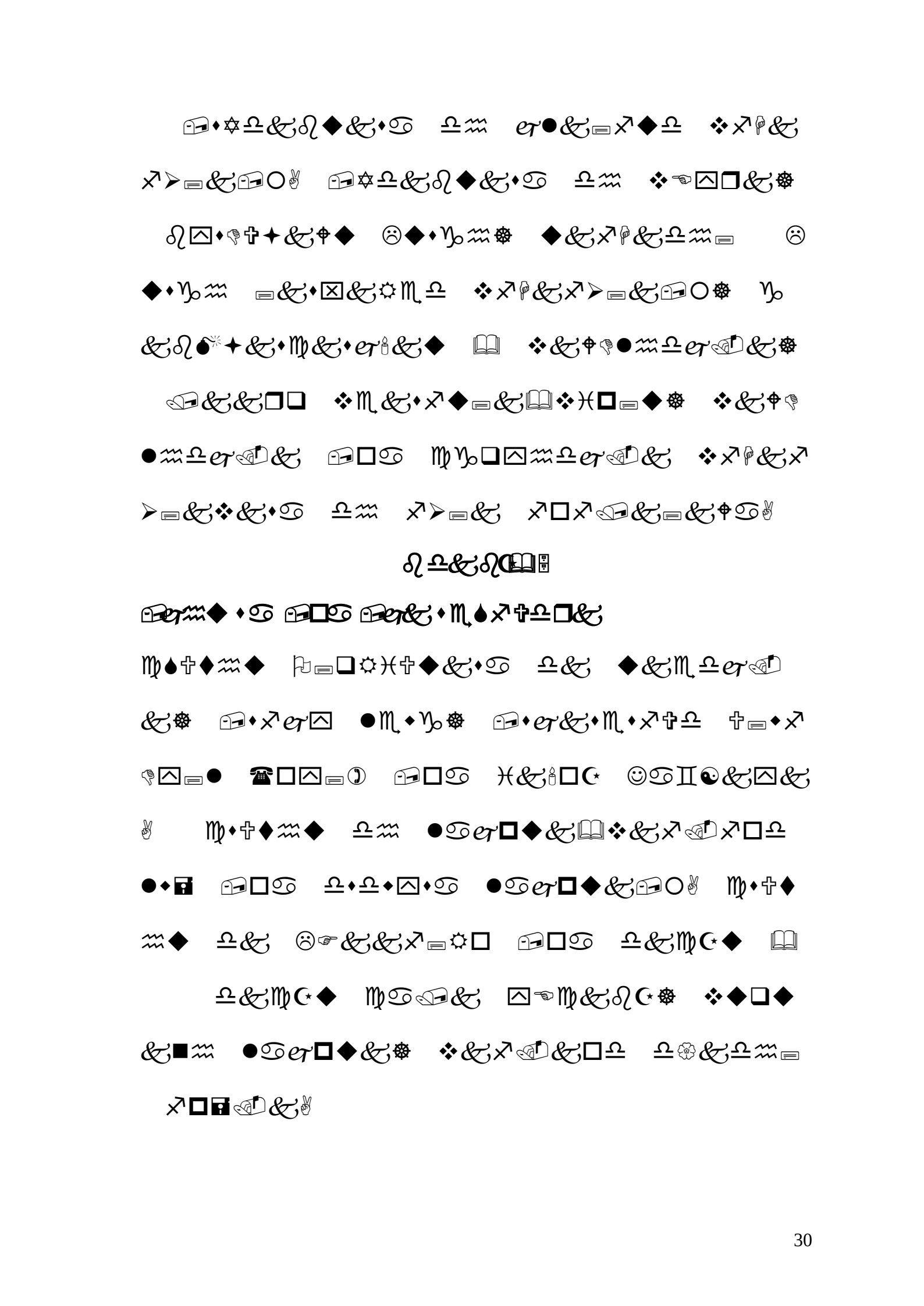

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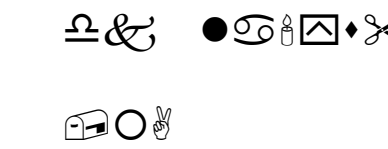

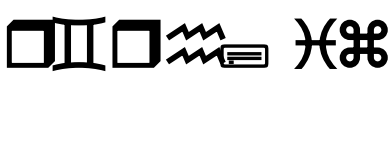

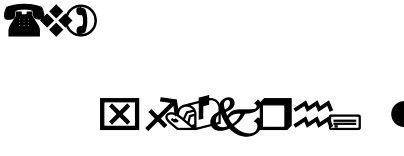

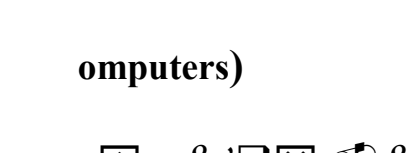

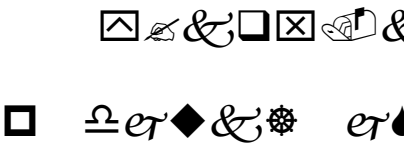

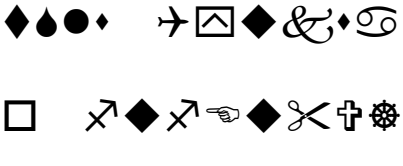

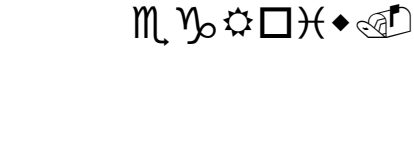

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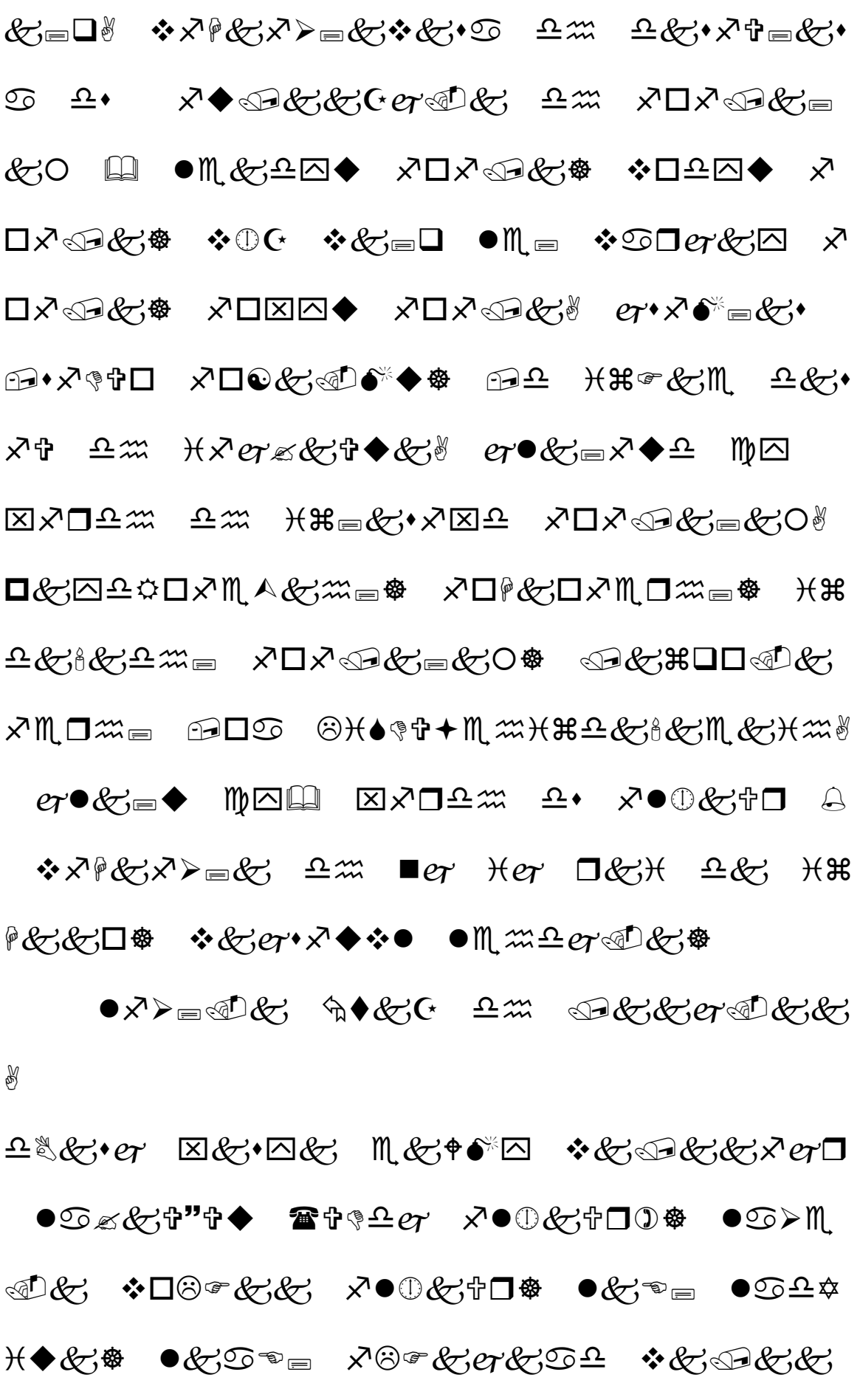

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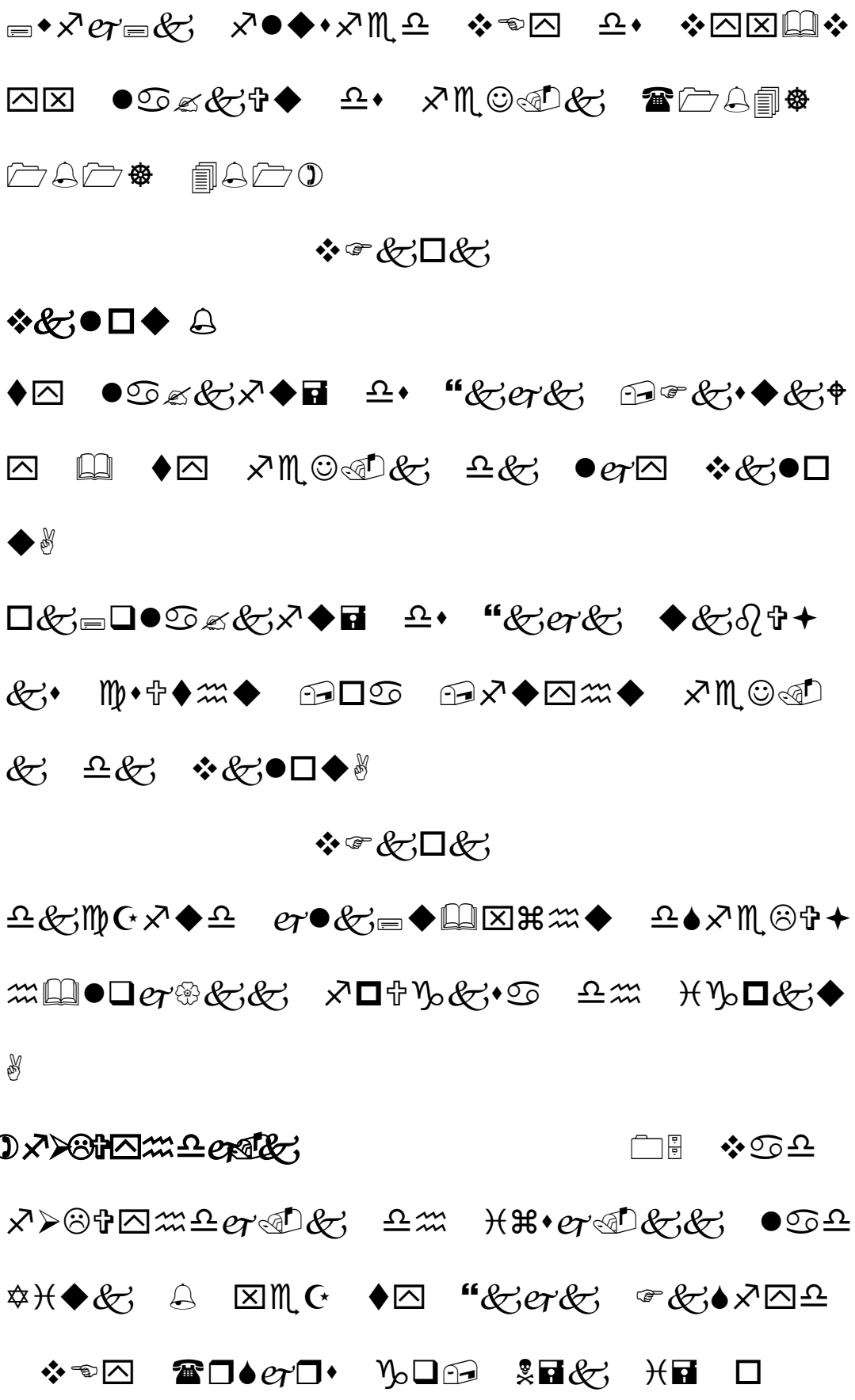

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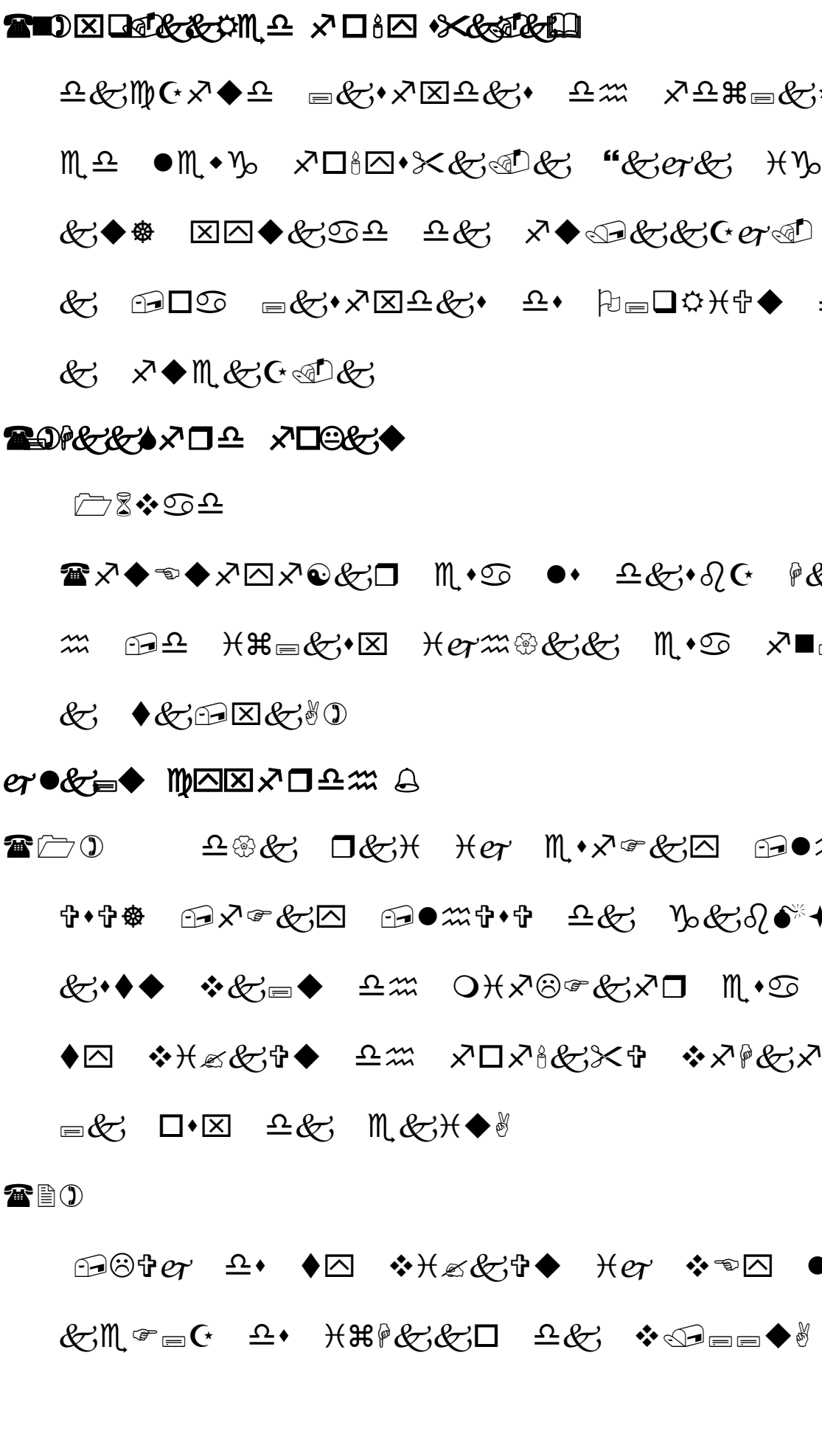

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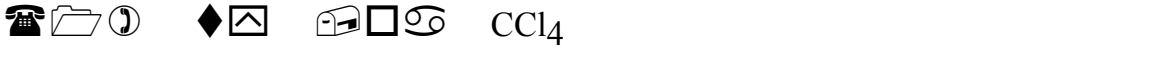

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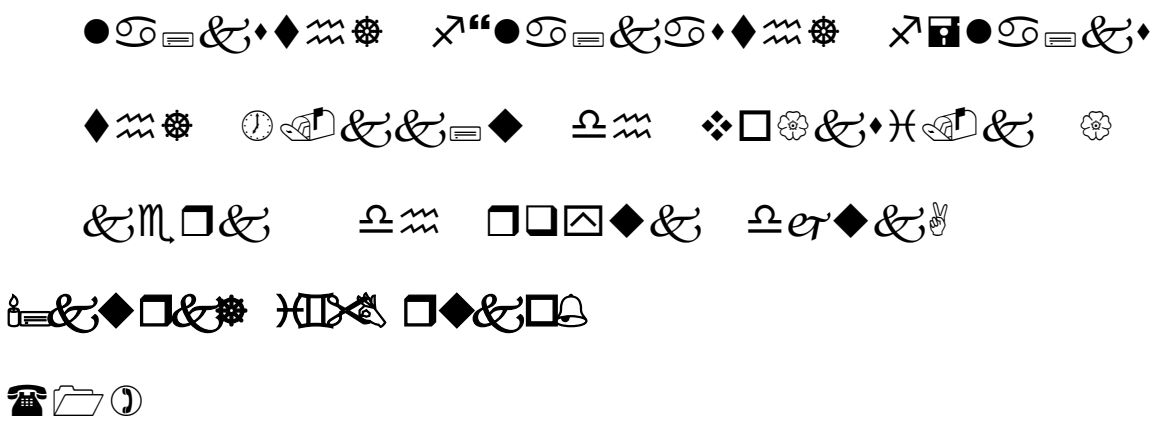
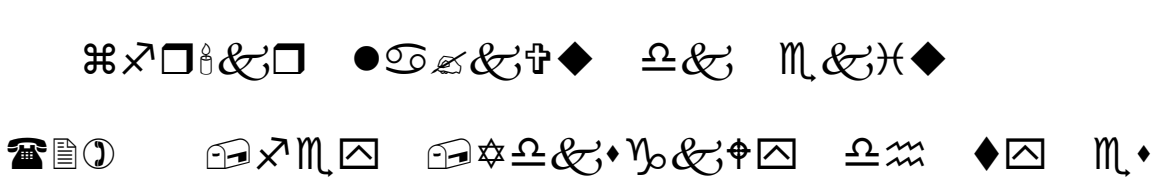
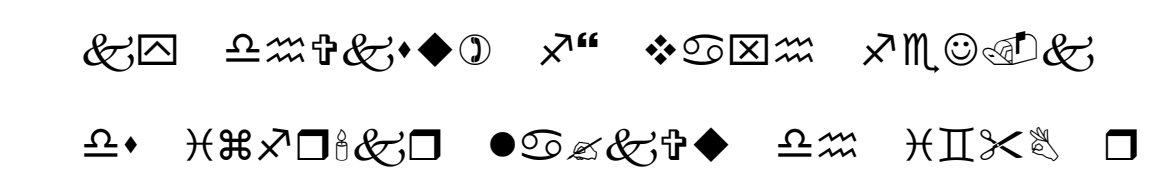
CCl_4







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B.Sc. Part- II Examination, 2020

CHEMISTRY

Scheme

Three papers	Min. Pass Marks: 48	Max. Marks: 135
Paper I	3 Hours Duration	45 Marks
Paper II	3 Hours Duration	45 Marks
Paper III	3 Hours Duration	45 Marks

Practical : 5 Hrs. Duration, Min. Pass Marks : 24, Max. Marks 65

PAPER-I –INORGANIC CHEMISTRY

Time: 3 Hours **Max. Marks: 45**

60 Hours (2 Hours/ week)

Unit-I

Chemistry of Elements of First Transition Series:

(a) Characteristic properties of d-block elements.

Properties of the elements of first transition series, their binary compounds and complexes , illustrating the relative stabilities of oxidation states, coordination number and geometry.

(b) Chemistry of elements belonging to II and III transition series comparative study of post lanthanide transition metals with the members of

4d series with special emphasis on ionic radii, oxidation states, magnetic & spectral properties. Stereochemistry of their compounds.

Unit-ll

(a) Oxidation and reduction :

Use of redox potential data-Analysis of redox cycle. Redox stability in water. Frost, Latimer and Pourbaix diagram . Principles involving in the extraction of elements.

(b) Chromatography – Definition, classification, Rf-value , law of differential migration eluant and elution, Paper, TLC, Chromatographies and their applications.

Unit-III

Coordination Compounds:

Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes.

Unit-IV

(a) Chemistry of Lanthanide Elements :

Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation of lanthanide compounds.

(b) **Chemistry of Actinides** :

General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, similarities between the later actinides and the later lanthanides.

Unit-V

(a) Error, Statistical data analysis and presentations : Types of errors**,** Making and Recording Measurements. SI Units and their use. Scientific method and design of experiments. Choosing and using statistical tests. Chemometrics. Analysis of variance (ANOVA), Correlation and regression, Curve fitting, fitting of linear equations, simple linear cases, weighted linear case, analysis of residuals, General polynomial fitting, linearizing transformations, exponential function fit, *r* and its abuse. Basic aspects of multiple linear regression analysis.

(b) Laboratory guidelines Awareness about material safety data sheet (MSDS), storage, transportation, usages; handling of special chemicals / reagents, such as perchloric acids, formaldehyde, mercury, corrosives, flammables, toxins / poisons, peroxides, labeling of chemicals, Chemical waste. Safety equipments, such as ventilation, fume-hood, fire extinguishers, eye washes, safety showers, first aid kit. Emergency response in case of fire, injury, spills, incident reports, evacuation.

PAPER II: ORGANIC CHEMISTRY

Time : 3 Hours **Max. Marks : 45**

60 Hours (2 Hours/ week)

Unit-I

Electromagnetic Spectrum : Absorption Spectra

Ultraviolet (UV) absoption spectroscopy-absoption laws (Beer-Lambert law), molar absoptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathchromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones. Infrared (IR) absoptions pectroscopy, molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, measurements of IR spectrum, fingerprint region, characteristic absorption of various functional groups and interpretation of IR spectra of simple organic compounds.

Unit-II

(a) Alcohols

Classification and nomenclature.-Monohydric alcohols-nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding. Acidic nature. Reactions of alcohols.

Dihydric alcohols-nomenciature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [$Pb(OAc)_4$ and HIO_4] and pinacol-pinacolone rearrangement.

Trihyd ric alcohols-nomenclature and methods of formation, chemical reactions of glycerol.

(b) **Phenols:**

Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols-electrophilic aromatic substituion, acylation and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement, Gatterman synthesis; Hauben-Hooesch reaction, Lederer-Manasse reaction and Reimeer-Tiemann reaction.

Unit-IlI

(a) Ethers and Epoxides

Nomenclature of ethers and methods of their formation, physical properties.

Chemical reactions-cleavage and autoxidation, Ziesels method.

Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides.

(b) Aldehydes and Ketones

Nomenclature and structure of carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1, 3-dithianes, synthesis of ketones from nitriles and from carboxylic acid. Physical properties.

Mechanism of nucleophilic addition to carbonyl group with particular emphasis on benzoin, Aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Witting reaction. Mannich reaction.

Use of acetate as protecting group. oxidation of aldehydes, Baeyer-villiger oxidation of ketones, Cannizzaro reaction. MPV, clemmensen, Wolff-kishner, $LiAlH_4$ and $NaBH_4$ reductions, Halogenation of enolizable ketones.

An introduction to α, β unsaturated aldehydes and ketones.

Unit- IV

(a) Carboxylic Acid :

Nomenclature, structure and bonding, physical properties, acidity Carboxylic acids, effect of substituftnts on acid strength. Preparation of carboxylic acids. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation

Methods of formation and chemical reactions of halo acids, hydroxy acids: malic, tartaric and citric acids.

Methods of formation and chemical reactions of unsaturated monocarboxylic acids.

Dicarboxylic acids : Methods of formation and effect of heat and dehydrating agents.

(b) Carboxylic Acid derivatives

Structure and nomenclature of acid chlorides, esters, amides (urea) and acid anhydrides. Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substition.

Preparation of carboxylic acid derivatives, chemical reactions. Mechanisms of esterfication and Hydrolysis,(acidic and basic).

Unit-V

Organic Compounds of Nitrogen

Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media. Picric acid.

Halonitroarenes : Reactivity; Structure and nomenclature of amines, physical properties. Stereochemistry of amines. Separation of a mixture of primary, secondary and teritary amines. Structural features affecting basicity, of amines. Amines salts as phase-transfer catalysts. Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles), reductive amination of

aldehydic and ketonic compounds. Gabriel-phtnalimide reaction, Hofmann bromamide reaction.

Reaction of amines, electrophilic aromatic substitution in aryl amines, reaction of amines with nitrous acid. Synthesis, transformation of aryl diazonium salts, azo coupling.

PAPER-III: PHYSICAL CHEMISTRY

Time: 3 Hours **Max. Marks : 45**

60 Hours (2 Hours/ week)

Unit-I

Thermodynamics-I : Definition of thermodynamics terms : system, surroundings etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work.

First Law of Thermodynamics: statement, definition and internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law-joule-Thomson coefficient and inversion temperature. Calculation of w, q, dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

Thermochemistry: Standard state, standard enthaply of formation-Hess's'Law of heat summation and its applications. Heat of reaction at constant pressure and at constant volume. Enthalpy of neutrilization. Bond dissociation energy

and its calculation from thermo-chemical data, temperature dependence of enthalpy, Kirchhoffs equation.

Unit-II

Photochemistry

Interaction of radiation with matter, difference between thermal and photochemical processes, laws of photochemistry: Grothus- Drapper law, Stark-Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluroscence, phorescence, non-radiative processes (internal conversion, inter system crossing), quantum yield, photosestitized reactions-energy transfer processes (simple examples)

Unit-III

(a) Chemical Equilibrium :

Equilibrium constant and free energy. Thermodynamic derivation of law of mass action, Le Chatelier's principle.

Reaction isotherm and reaction isochore-Clapeyron equation and Clausisus-Clapeyron equation, applications.

(b) Phase Equilibrium:

Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system-water, CO2 and S systems.

Phase equilibria of two component system-solid-liquid equilibria .simple eutectic-Bi-Cd, Pb-Ag systems, desilverisation of lead.

Solid solutions-compound formation with congruent melting point (Mg-Zn) and incongruent melting point, (NaCI-H_2O), ($FeCI_3$-H_2O) and ($CuSO_4$-H_2O) system. Freezing mixtures, acetone-dry ice.

Liquid-liquid mixtures-Ideal liquid mixtures, Raoult's and Henrys law. Non-ideal system-azeotropes-HCl-$H_2$0 and ethanol-water systms.

Partially miscible liquids-Phenol-water, trimethylamine, nicotine-water systems. Lower and upper consulate temperature. Effect of impurity on consulate temperature

Immiscible liquids, steam distillation.

Nernst distribution law-thermodynamic derivation, applications.

Unit - IV

Electrochemistry-l

Electrical transport-conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution.

Migration of ions and Kohlrahusch law, Arrehenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law its uses and limitations.

Debye-Huckel-Onsagar's equation for strong electrolytes (elementary treatment only).

Transport number- Definition and determination by Httorf method and moving boundary method.

Applications of conductivity measurements : Determination of degree of dissociation, determination of K_a of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

Unit-V

Electrochemistry-II

Types of reversible electrodes-gas-metal ion, metal-insoluble salt anion and redox electrodes. Electrode reactions, Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode reference electrodes, standard electrode potential, sign conventions, electrochemical series and its significance.

Electrolytic and Galvanic cells-reversible and irreversible cells, conventional representation of electrochemical cells.

EMF of a cell and its measurements. Computation of cell EMF. Calculation of thermodynamic quantities of cell reactions ($\triangle$G, $\triangle$H and K) polarization, over potential and hydrogen over voltage.

Concentration cell with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations.

Definition of pH and pK_a determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods.

Buffers-mechanisrn of buffer action, Henderson-Hazel equation. Hydrolysis of salts.

Corrosion-Types, theories and methods of combating it.

PRACTICALS

INORGANIC CHEMISTRY

1.Calibration & Preparation of solutions

Calibration of fractional weights, pipettes and burettes. Preparation of standard solutions. Dilution 0.1 M to 0.001 M solutions. '

2.Analysis

For examination, alternatively, one exercise either from (I) or (II) be given

(I) Volumetric Analysis

(i) Determination of acetic acid in commercial vinegar using NaOH.

(ii) Determination of alkali content-antacid tablet using HCI.

(iii) Estimation of calcium content in chalk as calcium oxalate by permanganatometry.

(iv) Estimation, of hardness of water by EDTA. (v) Estimation of ferrous and ferric by dichromate method, (vi) Estimation of copper using thiosulphate.

(II) Gravimetric Analysis

(i) Analysis of Cu as CuSCN.

(ii) Analysis of Ba as $BaSO_4$

ORGANIC CHEMISTRY

1.Chromatography:Determination of R_f values and identification of organic compounds.

(i) Preparation and separation of 2, 4-dinitrophenylhydrozone of acetone, 2-butanone, hexan-2- and 3-one using toluene and light petroleum (40 :60). (Thin layer chromatography)

(ii) Separation of a mixture of dyes using cyclohexane and ethyl acetate(8.5 : 1.5). (Thin layer chromatography)

(iii) Separation of a mixture of phenylalanine and glycine. Alanine and aspartic acid. Leucine and glutamic acid. Spray reagent-ninhydrin. (Paper chromatography : Ascending and Circular),

(iv) Separation of a mixture of D, L-alanine, glycine and L-Leucine using n-butanol: acetic acid : water (4:1:5), spray reagent-ninhydrin. (Paper chromatography : Ascending and Circular).

(v) Separation of monosachharides-a mixture of D-galactose and D-frutose using n-butanol: acetone: water (4:5:1) spray reagent-aniline

hydrogen phthalate. (Paper chromatography: Ascending and Circular).

2.Qualitative Analysis:

Analysis of given organic mixture containing two solid components Using water ,$NaHCO_3$ or NaOH for separation and preparation of suitable derivatives.

PHYSICAL CHEMISTRY

1 - Determination of the transition temperature of the given substance by thermometric/dialometric method (e.g. $MnCl_2.2H_2O/SrBr_22H_2O$.)

2. To study the effect of a solute (e.g. NaCI, suecinic acid) on the critical solution temperature of two partially miscible liquids (e.g. phenol-water system) and to determine the concentration of that solute in the given phenol water system.

3. To construct the phase diagram of two component (e.g. diphenylamine-benzophenone) system by cooling curve method.

4. To determine the solubility of benzoic acid at different temperatures and to determine ΔH of the dissolution process.

5.. To determine the enthalpy of neutralisation of weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionisation of the weak acid/weak base.

6. To determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber cycle.

Note : Similar exercise may be set in question paper as per availability

PRACTICAL-SCHEME OF EXAMINATION PRACTICAL

Max. Marks: **65** **Min. Marks:- 24**

Time: 5 hours

INORGANIC CHEMISTRY

1. Calibration and preparation of solution –	5 Marks
2. Analysis: One Exercise from 2(i) or 2(ii)	10 Marks

ORGANIC CHEMISTRY

1-Chromatography: One Exercise	5 Marks
2-One Organic mixture	10 Marks

PHYSICAL CHEMISTRY

Any One experiment	15 marks
VIVA	10 Marks
RECORD	10 Marks

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ईकाई IV

इकाई की रूपरेखा

- प्रस्तावना
- उद्देश्य
- प्रयोगशाला में सुरक्षा के उपाय
- प्रयोगशाला में प्रयुक्त होने वाले उपकरण
- प्रयोगशाला में प्रयुक्त होने वाले रसायन
- सारांश
- शब्दावली
- अभ्यास

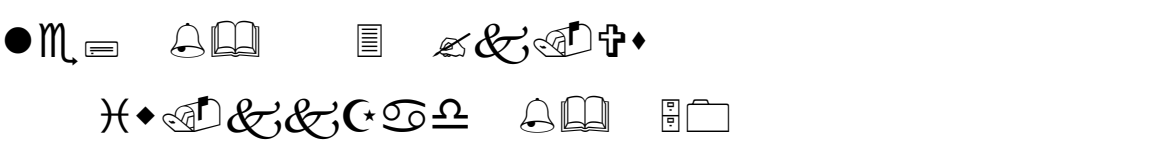
ईकाई V

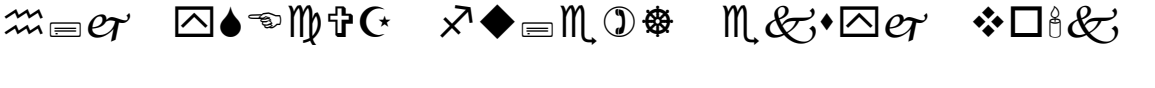
इकाई की रूपरेखा

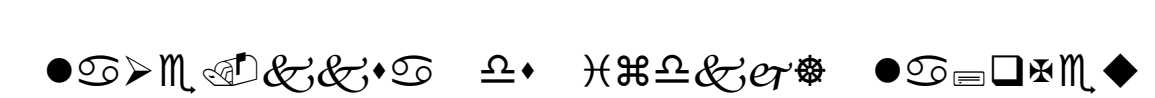
- प्रस्तावना
- उद्देश्य
- त्रुटियां, सांख्यिकी आंकडे एवं उनका प्रदर्षन
- सारांश
- शब्दावली
- अभ्यास

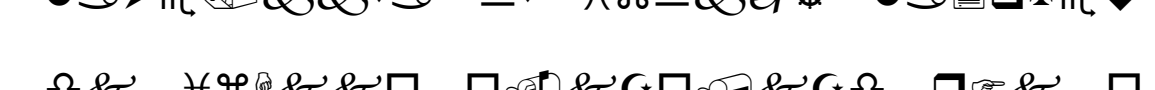
ईकाई V

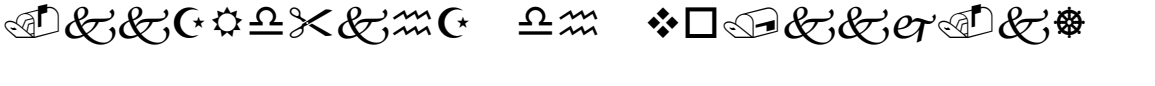
(अ) **त्रुटियां, सांख्यिकी आंकडे एवं उनका प्रदर्षन** – त्रुटियों के प्रकार, मापन अंकन, एस आई ईकाई व इनका उपयोग, वैज्ञानिक विधियां व प्रयोगों का प्रस्तुतिकरण, सांख्यिकी टेस्ट का उपयोग कीमोमिटूक, ANOVA, आंकड़ो का सहसंबध (Correlation), पुर्नउत्पादन, रेखीय समीकरण, ग्राफ, पालीनामिअल आदि द्वारा प्रदर्षन। रेखीय प्रतीपगमन विष्लेषण के मूलभूत सिद्वान्त











(ब) **प्रयोगशाला निर्देष** – पदार्थो के आदि के बारे में विभिन्न जानकारियां, मेटिरीयल सेफ्टी डेटा शीट (MSDS), संग्रहण, परिवहन, उपयोग रासायनिक पदार्थो जैसे – परक्लोरिक अम्ल, फार्मलडिहाइड, पारा, संक्षारक, ज्वलनषील, जहरीले इत्यादि विभिन्न रासायनिक पदार्थो एवं प्रयोगषाला उपकरणों में सुरक्षा चिन्ह सुरक्षा पद्वतियां एवं उपचार। आपातकालीन परिस्थिति में सूरक्षा विधियां।

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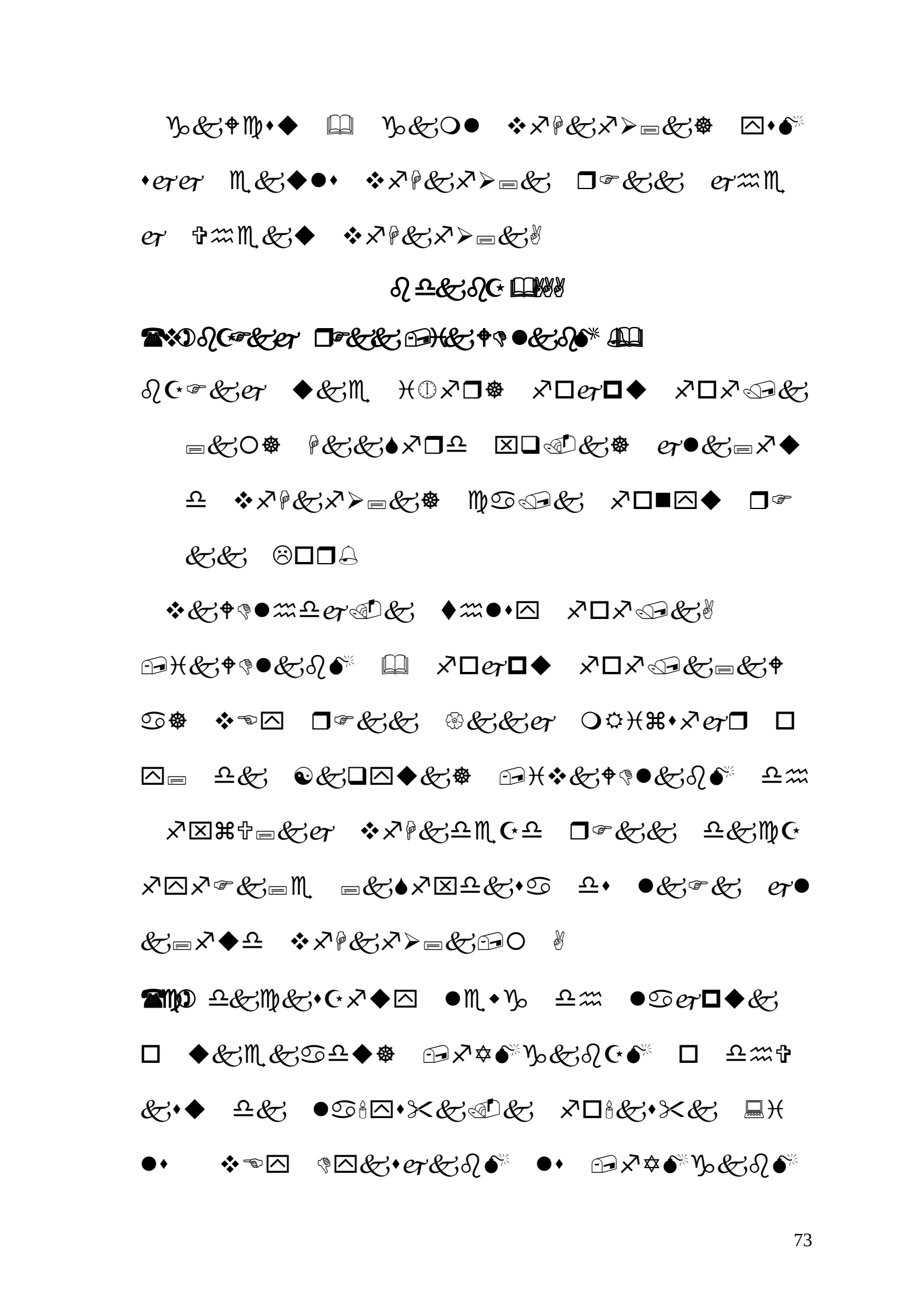

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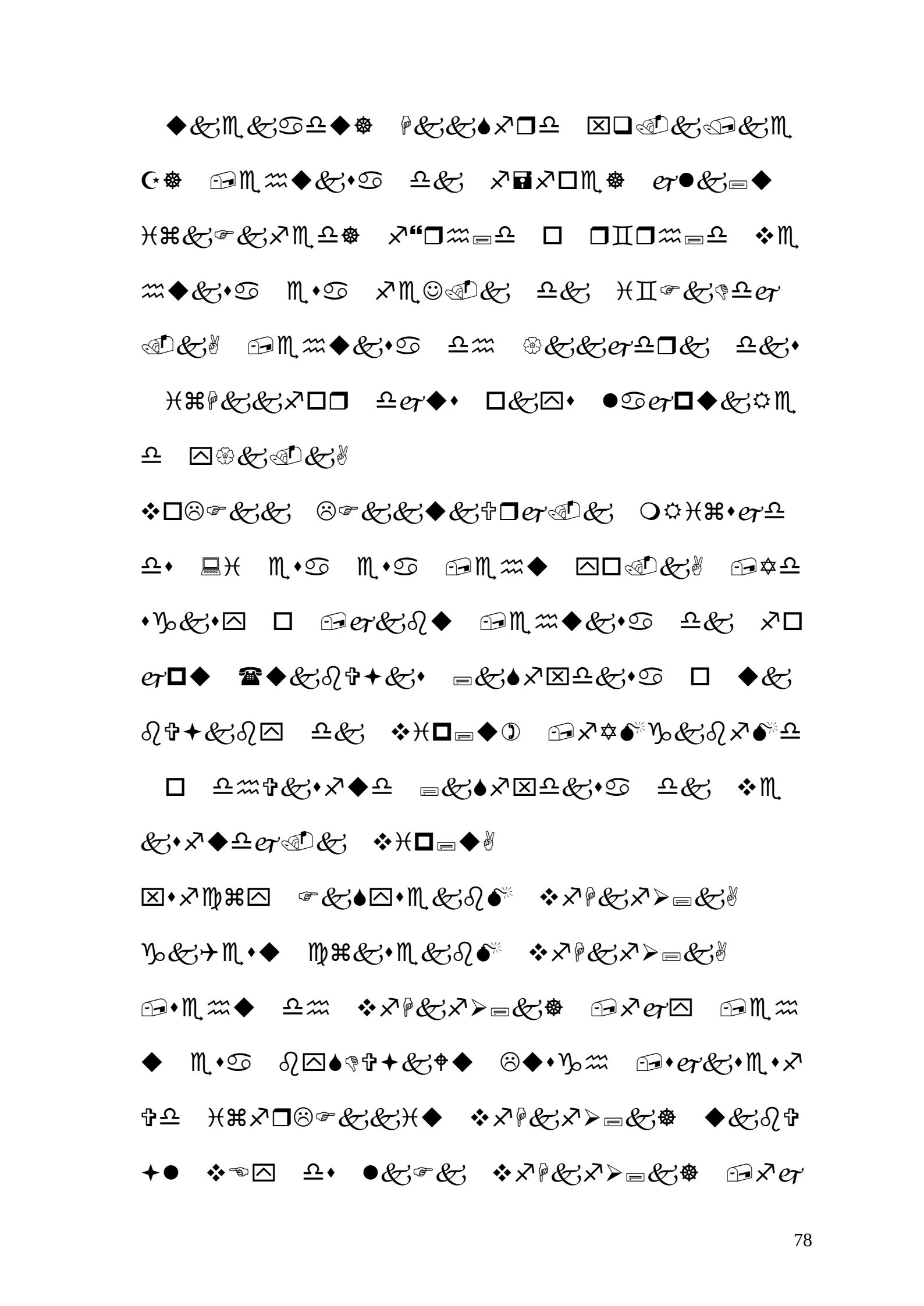

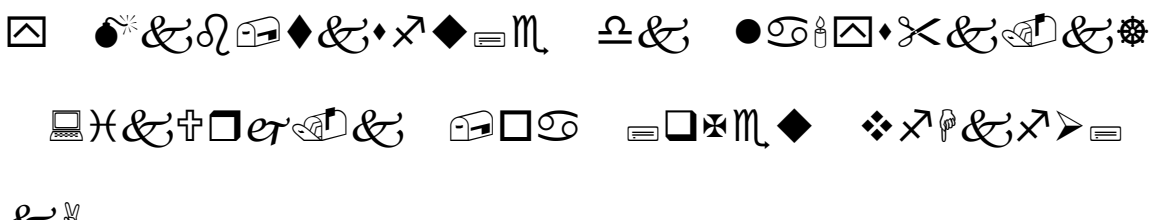

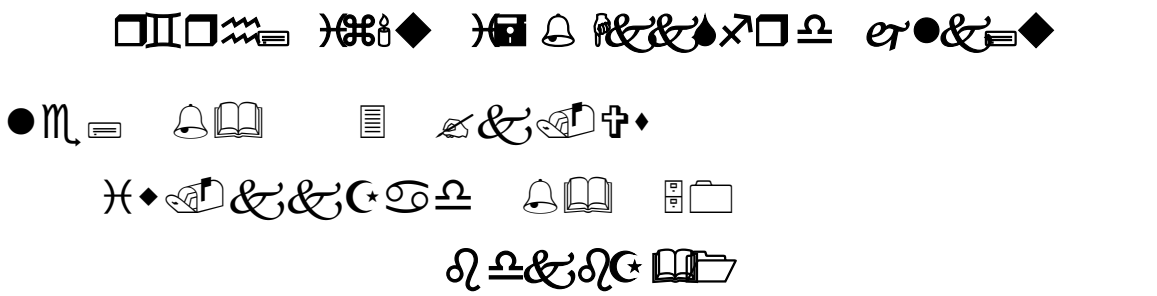

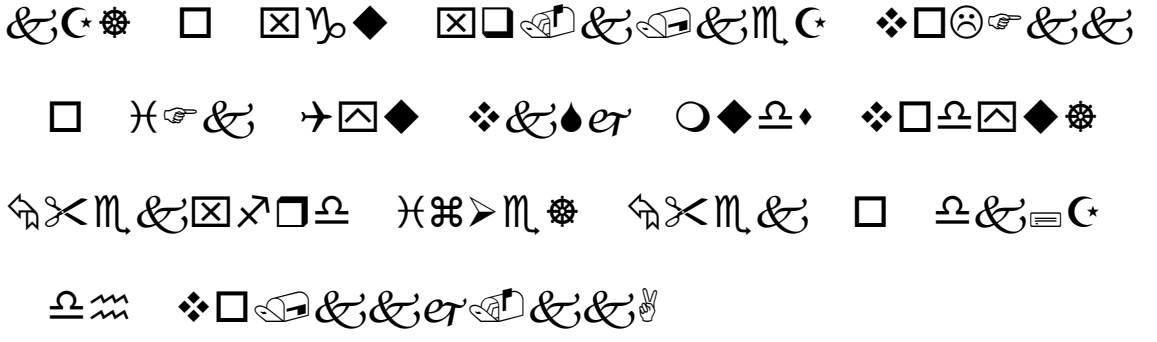

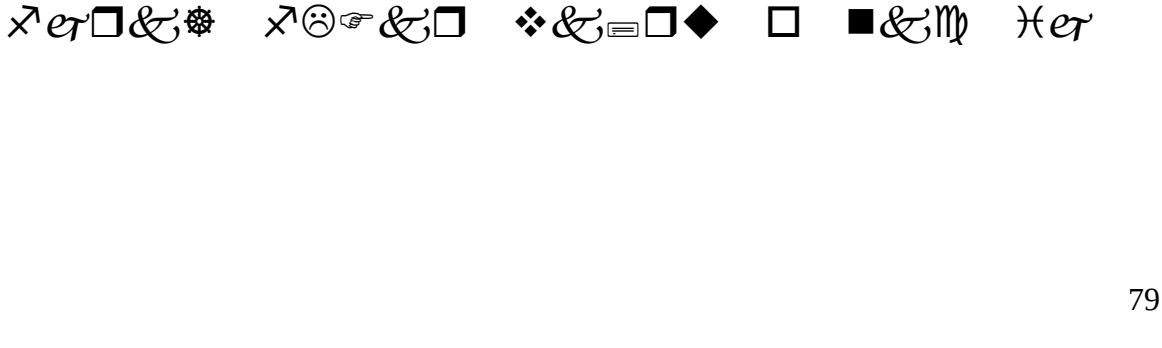

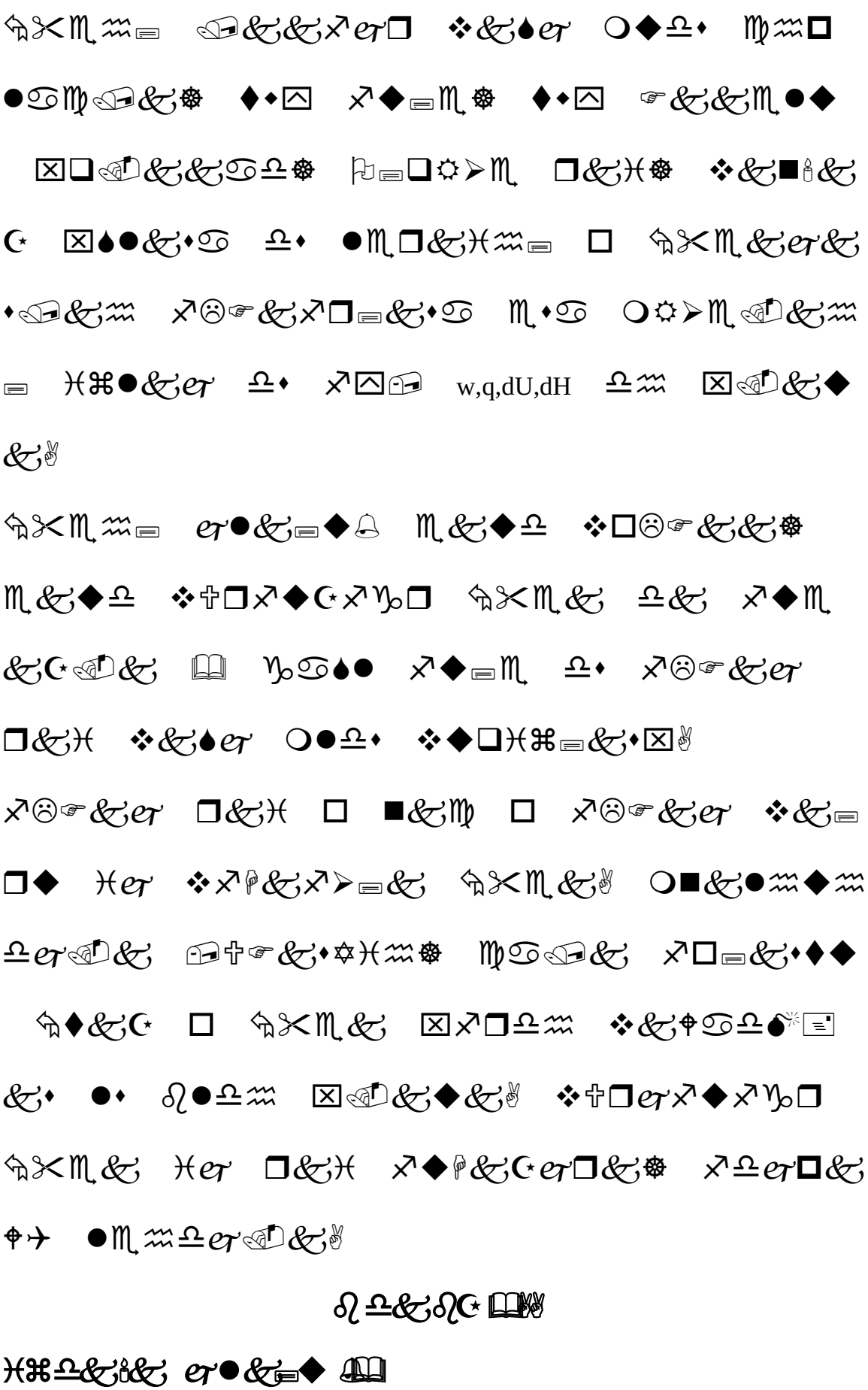

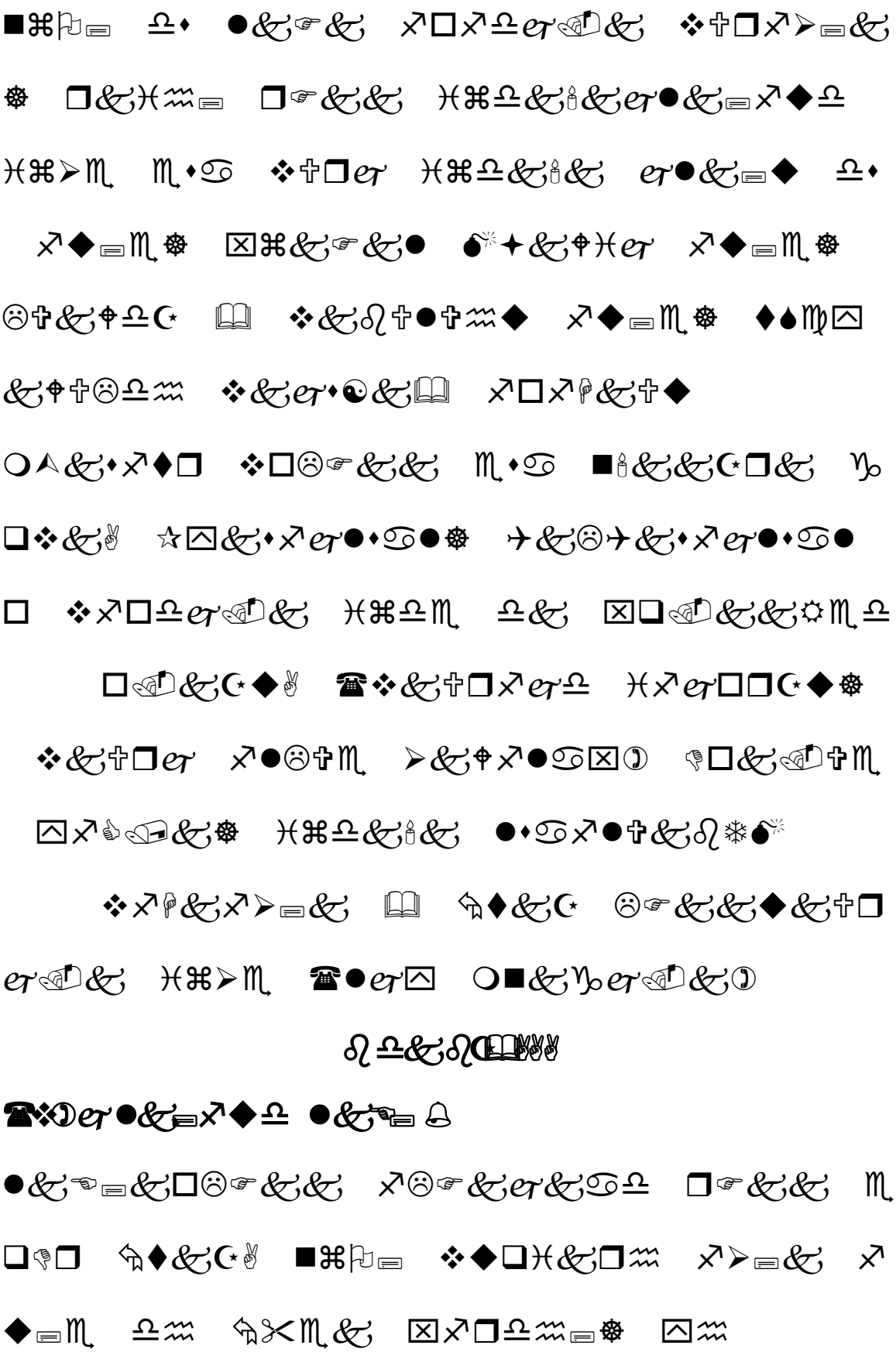

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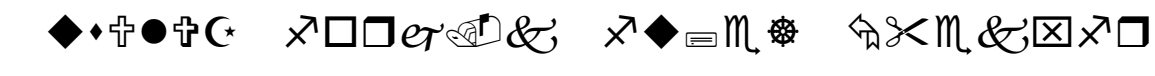

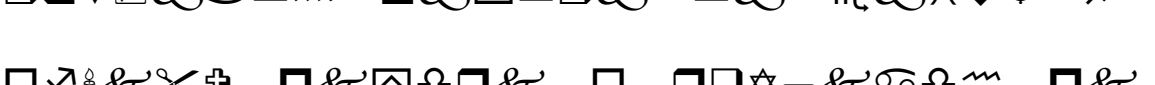

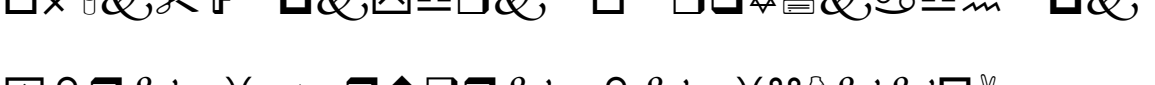

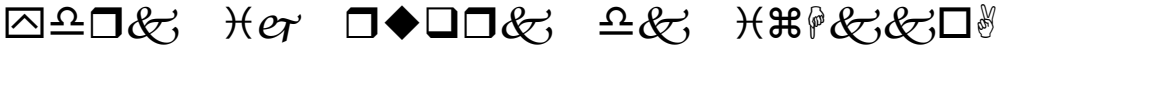

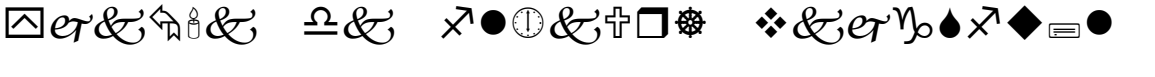

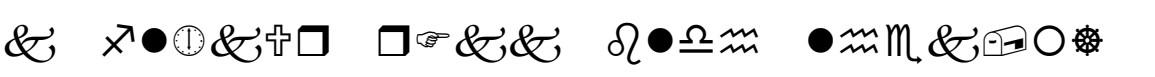

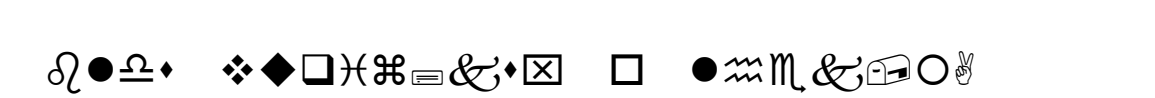

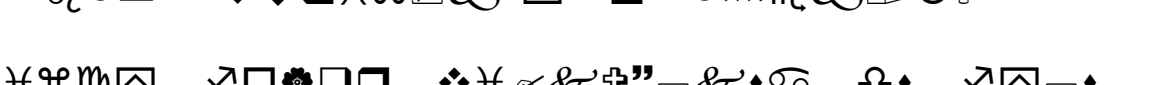

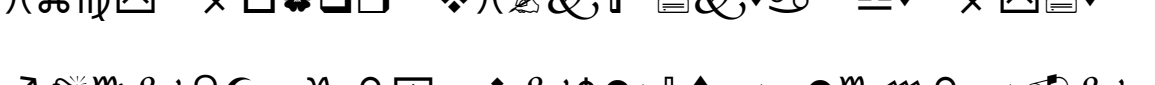

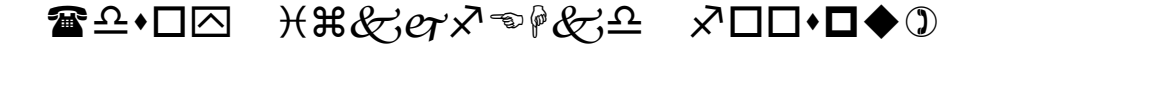

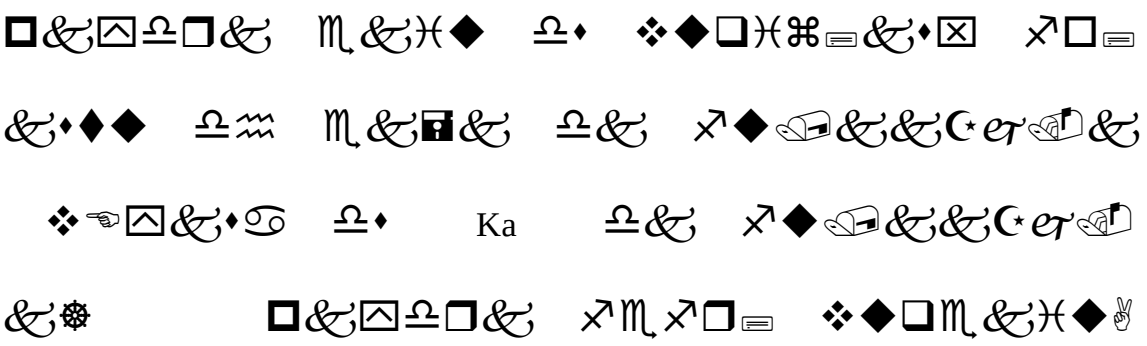

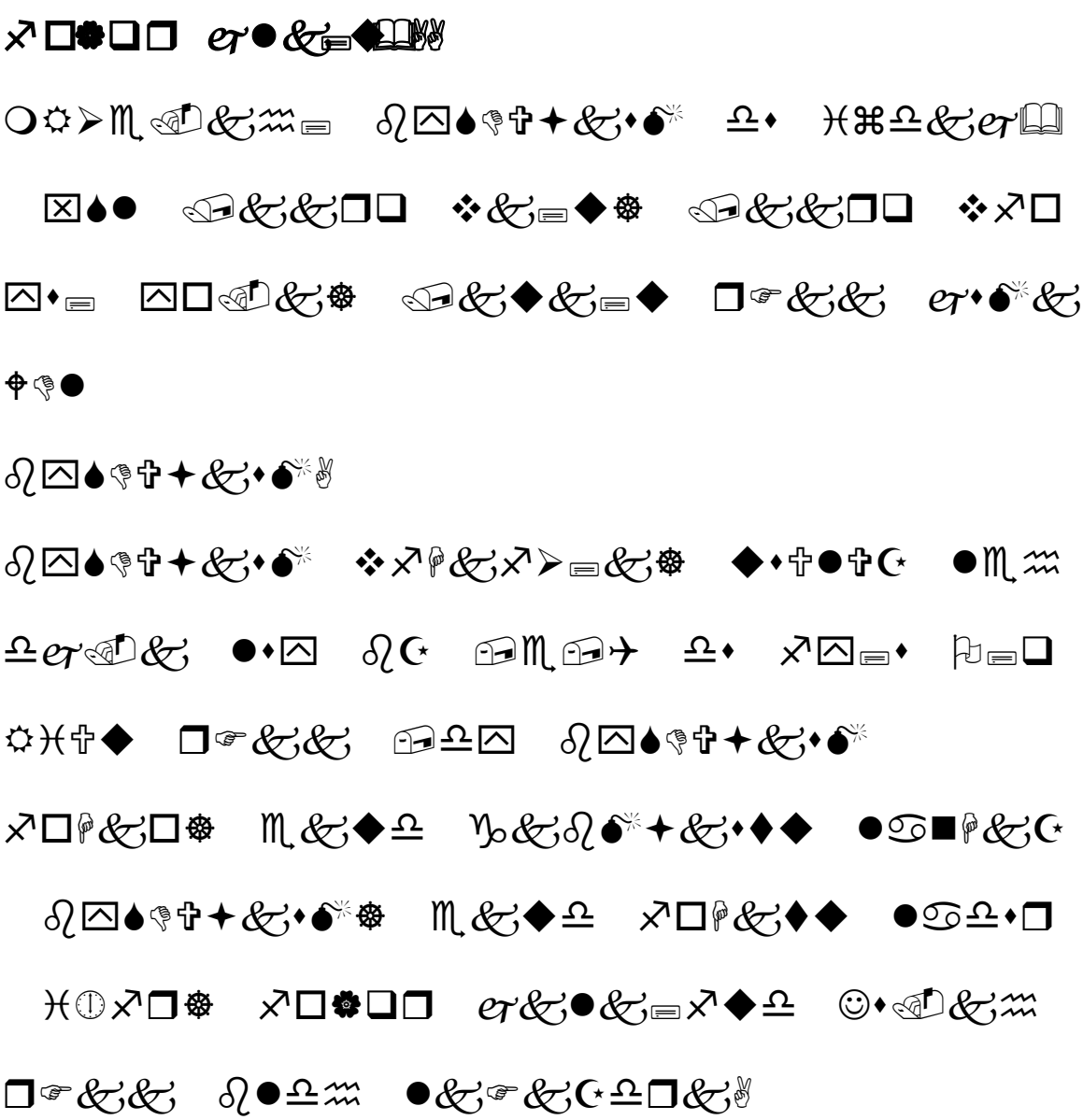

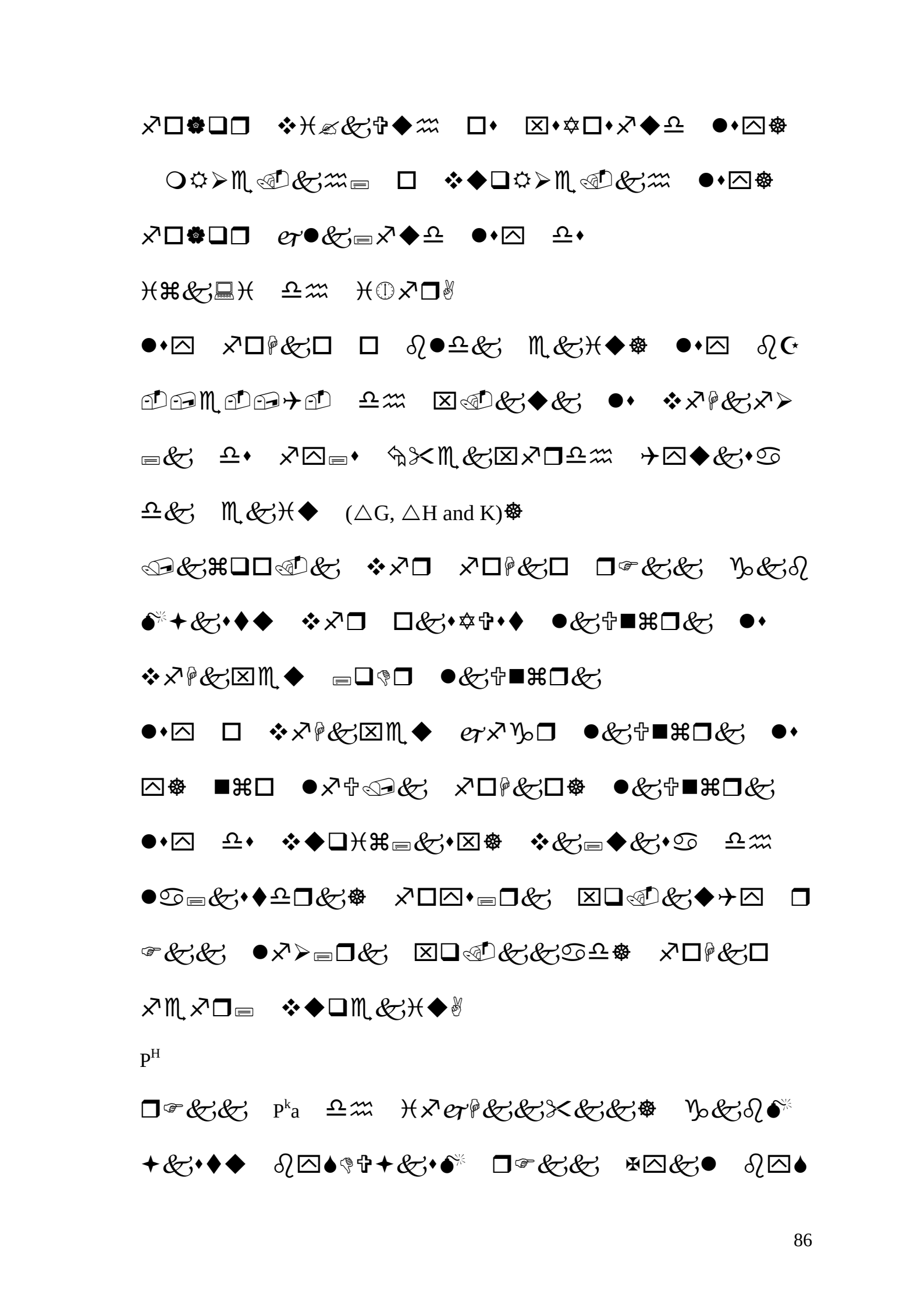

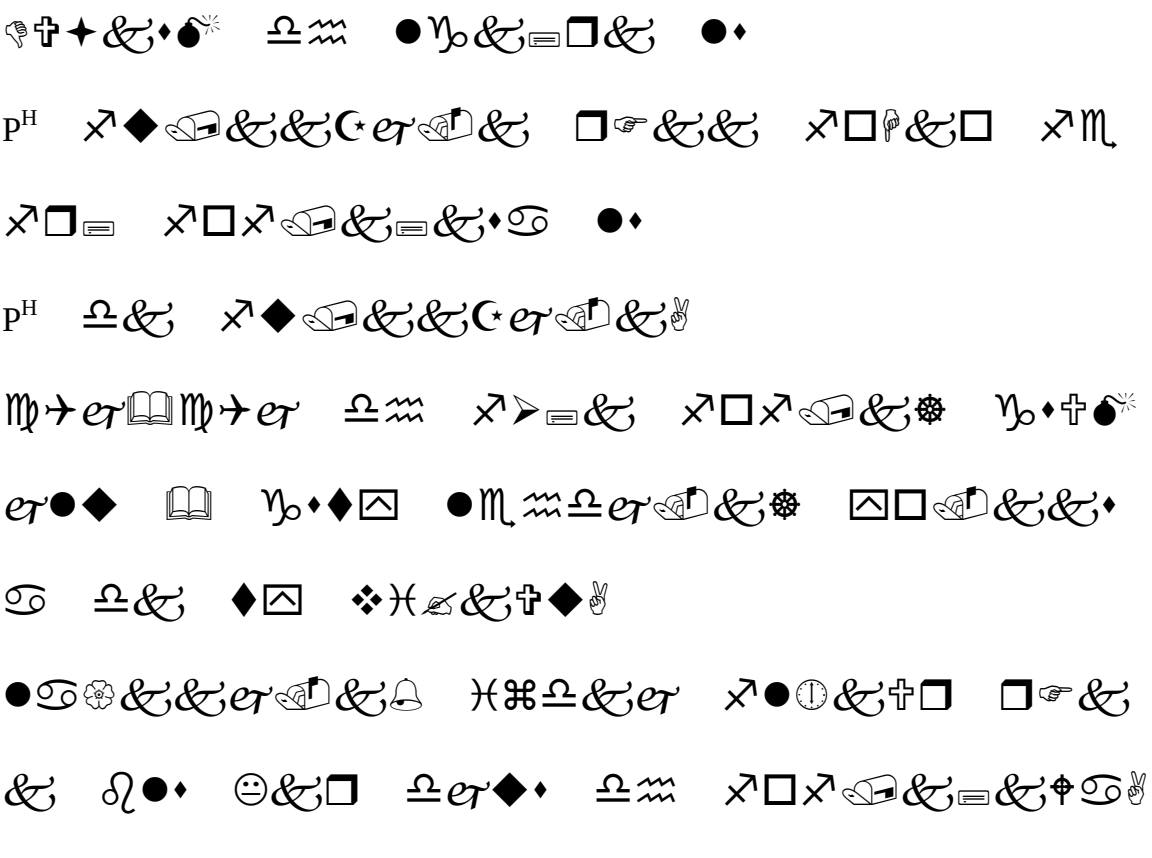

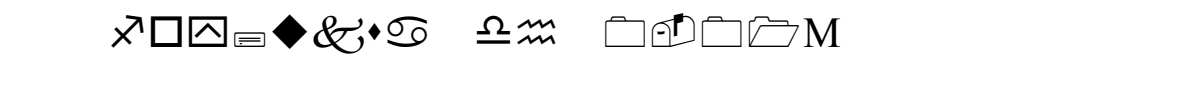

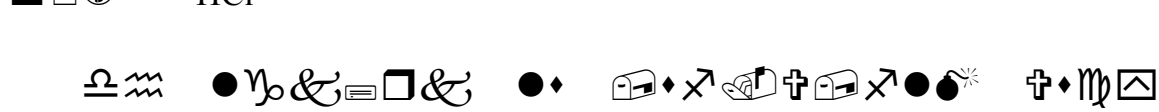

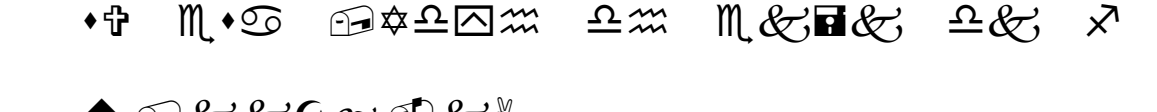

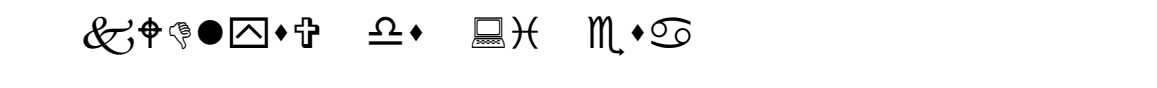

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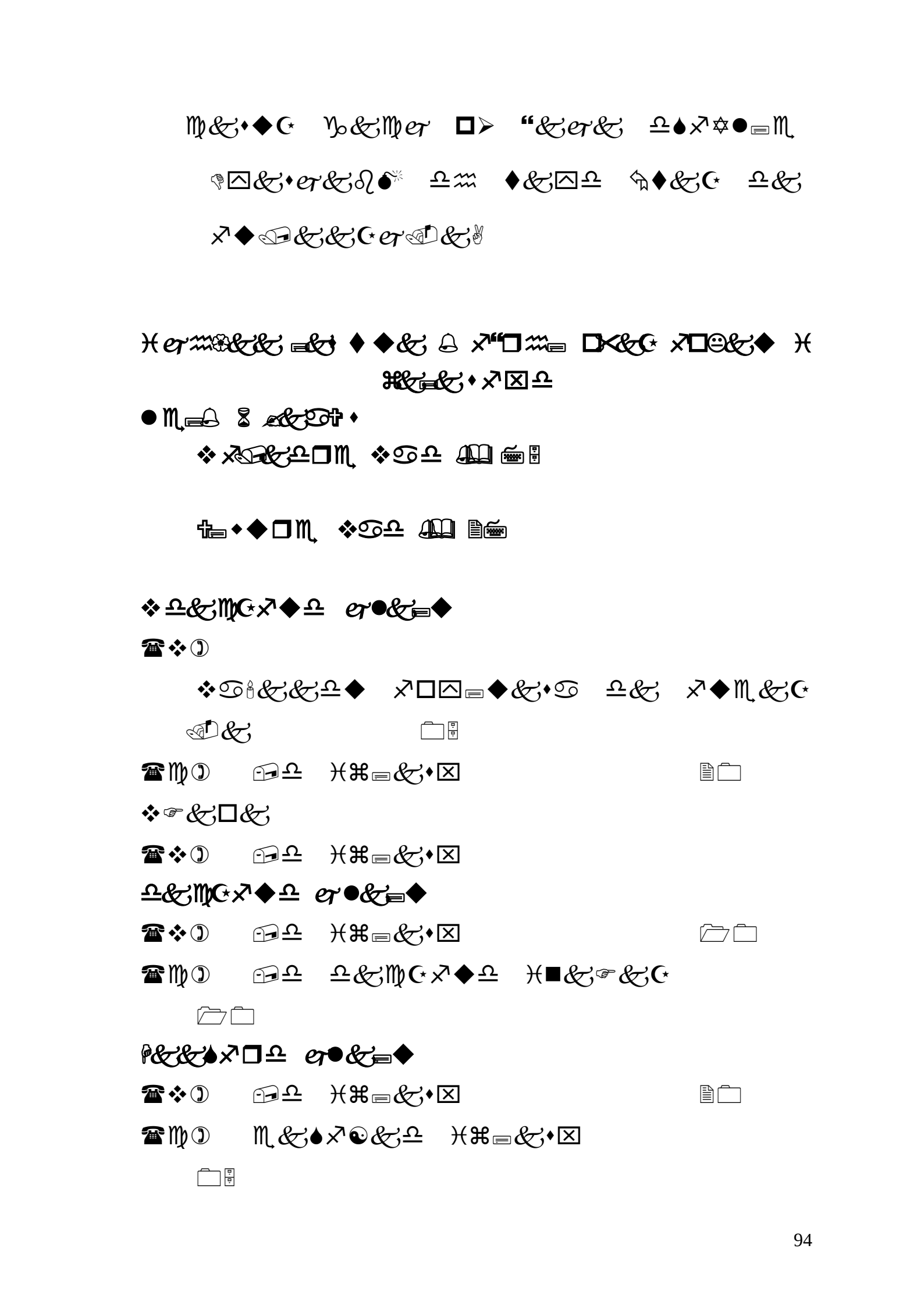

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B.Sc. Part- III Examination, 2021

CHEMISTRY

Scheme

Three papers	Min. Pass Marks: 48	Max. Marks: 135
Paper I	3 Hours Duration	45 Marks
Paper II	3 Hours Duration	45 Marks
Paper III	3 Hours Duration	45 Marks

Practical : 5 Hrs. Duration, Min. Pass Marks : 24, Max. Marks 65

PAPER-I –INORGANIC CHEMISTRY

Time : 3 Hours **Max. Marks : 45**

Unit-I

(a) Metal-ligand Bonding in Transition Metal Complexes

Limitation of valence bond theory, an elementary idea of crystal-field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors. affecting the crystal Field Parameters

(b) Thermodynamic and Kinetic Aspect of Metal Complexes

A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes.

Unit-II

(a) Magnetic Properties of Transition Metal Complexes

Types of magnetic behavior, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of μ_s and μeff values, orbital contribution to magnetic moments, application of magnetic moment data for 3d-metal complexes.

(b) Electron Spectra of **Transition Metal Complexes**

Types of electronic transition, selection rules of d-d transitions, spectroscopic ground state, spectrochemical series. Orgel-energy level diagram for d^1 and d^9 states, discussion of the electronic spectrum of $[Ti(H_2O)_6J^{3+}$ complex ion.

Unit-IlI

Organometallic Chemistry

Definition, nomenclature and classification of organometallic compounds. Preparation, properties, bonding and applications of alkyls and Aryls of Al, Zn, Hg and Ti a brief account of metat- ethylene complexes and homogeneous hydrogenation, mononuclear carbonyls and the nature of bonding in metal carbonyls.

Nuclear Chemistry

Stability of nucleous n/p ratio, Einstein mass –energy relation. Types of Radioactivity, Group displacement law, Disintegration series, Q-values, nuclear corss-section, spallation, Applications of radio activity.

Unit-IV

(a) Bioinorganic Chemistry

Essential and trace elements in biological processes, metallporphyrins with special reference to hemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to Ca^{2+}, nitrogen fixation.

(b) Silicones and Phosphazenes

Silicones and phosphazenes as examples of organic ploymers, nature of bonding in triphosphazenes.

Unit-V

(a) Hard and Soft Acids and Bases (HSAB)

Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and Softness. Lux-Flood concept of acid base and its limitation. Lewis concept and its limitation Usanovich concept. A generalized acid –base concept.

(b) Non-aquenous Solvents:

Physical properties of a solvent, types of solvent and their general characteristics reactions in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2.

PAPER II : ORGANIC CHEMISTRY

Time : 3 Hours **Max. Marks : 45**

Unit-I

Spectroscopy

Nucelear Magnetic resonance (NMR) spectroscopy. Paramagnetic resonance (^{1}H NMR) spectroscopy, nuclear shielding and deshielding chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2,-tribromoethane, ethyl acetate, toluene and acetophenone. Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and NMR spectroscopic techniques.

Unit-II

(a) Heterocyclic Chemistry

Nomenclature , preparation and properties of compounds having one heteroatom with five and six member ring (Pyrrole, Thiophene, Furan and Pyridine)

(b) Fats, Oil and Detergents

Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides. hydrogenation of unsaturated oils. saponification value, iodine value, acid value. Soaps, synthetic detergents, alkyl and aryl sulphonates.

Unit-Ill

(a) Organic Synthesis Via Enolates

Acidity of α-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate:, the Claisen condensation, Keto-enol tautomerism of ethyl acetoacetate. Alkylation of 1,3-dithianes.Alkylation and acylation of enamines.

(b) Amino Acids, Peptides, Proteins and Nucleic Acids

Classification, structure and stereochemistry of amino acids. Acid base behavior, electrophoresis. Preparation and reactions of α-amino acids, structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure .determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis. solid-phase peptide synthesis. Structures of peptides and proteins, level of protein structure. Proteins denaturation/renaturation.

Nucleic acids: Introduction, Constitution of nucleic acids-Ribnonucleosides and ribonucleotides. The double helical structure of DNA. '

Unit IV

Carbohydrates

Classification and nomenclature. Monosaccharides. mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and

chain shortening of aldoses. Configuration of monosacchariedes. Erythro and threo diastereomers. Conversion of glucose into mannose. Formation of glycosides, ethers and esters. Determination of ring size of monosaccharides. Cyclic structure of D(+)-glucose. Mechanism of mutarotation. Structrure or ribose and deoxyribose.

An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides e.g. starch and cellulose (without involving structure determination.)

Unit-V

(a) Synthetic Polymers

Addition of chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegier-Natta polymerization and vinyl polymers.

Condensation or step growth polymerization. Polyesters, polyamides, phenol- formaldehyde resins, urea- formaldehyde resins, epoxy resins and polyurethanes.

(b) Synthetic Dyes

Color and constitution (electronic concept). Classification of dyes. Chemistry and synthesis of Methyl orange, Congo red, Malachite green, Crystal violet, Phenolpthalein, Fluorescein, Alizarin and Indigo.

PAPER III : PHYSICAL CHEMISTRY

Time : 3 Hours **Max. Marks : 45**

Unit-I

Elementary Quantum Mechanics

Black-body radiation, Planck's radiation law, photoelectric effect, heat capacity of solids, Bohr's model of hydrogen atom (no derivation) and its defects, Compton effect.

De Brogile hypothesis, Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiitonian operator, Schrodinger wave equation and its importance, physical interpretation of the **wave** function, postulates of quantum mechanics, particle in a one dimensional box. Schrödinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions.

Unit-II

Molecular orbital theory, basic ideas-criteria for forming. M.O from A.O, construction of M.O's by LCAO,H_2^+ ion, calculation of energy levels from 'wave functions, physical picture of bonding: and antibonding wave functions, concept of σ, σ *, π, π* orbitals and their characteristics. Hybrid orbitals-sp, sp^2, sp^3 , calculation of coefficients of A.O's used in these hybrid orbitals.

Introduction to valence bond model of H_2, comparison of M. O. and V. B. models.

Unit-Ill

Spectroscopy

Introduction: electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom.

Rotational Spectrum

Diatomic molecules, Energy levels of a rigid rotator (semi-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell- Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect.

Vibrational spectrum

Infrared spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of an harmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups.

Raman Spectrum concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selction rules.

Unit – IV

Thermodynamics -ll

Second law of Thermodynamics : Need for the law, different statements of the law. Carnot cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature.

Concept of entropy: Entropy as a statement function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change, Clausius inequality, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases.

Third Law of Thermodynamics : Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions; Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantages over entropy change. Variation of G with A and P, V and T.

Unit-V

Solutions, Dilute Solutions and Colligative Properties

Ideal and non-ideaf solutions, method of expressing concentration of solutions, activity and activity coefficient.

Dilute solution, colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis, law of

osmotic pressure and its measurement, determination of molecular weight form osmotic pressure. Elevation of boiling point and depression in freezing point. Expdwmental methods for determining various colligative properties. Abnormal molar mass, depree of dissociation and association of solutes.

PRACTICALS

Max. Marks: **65** **Min. Marks:- 24** **Time:5 hours**

INORGANIC CHEMISTRY

A. Instrumentation

(i) Colorimetry

(a)To determine Metal- Ligand ratio of complexes by Jobs method

(b) To determine Metal- Ligand ratio of complexes by Mole Ratio method

(c) Determination of adulteration in Food Stuffs.

(d) Effluent or waste water analysis.

(e) Ground Water Analysis.

(ii) Solvent Extraction: Separation and estimation of Mg(II) and Fe(II) ions.

(iii) Exchange Method: Separation and estimation Mg(II) and Zn(II) ions.

B. Synthesis & Analysis

(i)Inorganic Synthesis

(a) Sodium trioxalato ferrate (III), $Na_3 [Fe(C_2O_4)_3]$

(b) Ni-DMG complex, $[Ni (DMG)_2]$

(c) Copper tetrammine complex $[Cu(NH_3)]_4 SO_4$.

(d) Cis-and trans-bisoxalato diaqua chromate (III) ion.

(ii) Analysis

Semi micro and Macro analysis , Separation and Identification of Six radicals - three acidic and three basic from a mixture with one interfering radicals and/or combinations of radicals.

ORGANIC CHEMISTRY

(i)Laboratory Techniques

(a) Steam Distillation

(b) Naphthalene from its suspension in water

(c) Clove Oil form Cloves

(d) Separation of o-and p-nitrophenols

(e) Column Chromatography

(f) Separation of fluorescene and methylene blue

(g) Separation of leaf pigments form spinach leaves

(h) Resolution of racemic mixture of (±) mandelic acid

(ii) Stereochemical Study of Organic Compounds via Models

(a) R and S configuration of optical isomers.

(b) E and Z configuration of geometrical isomers.

(c) Conformational analysis of cyclohexanes and substituted cyclohexanes.

(iii) Determination of following parameters of oils & fats

(a) Saponification Value

(b)Iodine Value and /or

(c)R.M. Value

(iv) Green Chemistry Synthesis – Solventless synthesis of aldol derivative or any other compound

PHYSICAL CHEMISTRY

1. To determent the strength of the given acid conductometrically using standard alkali solution.

2. To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically.

3. To study the saponification of ethyl acetate conductometrically.

4. To determint the ionisation constant of a weak acid conductometrically.

5. To tirate potentiometrically the given ferrous ammonium sulphate solution using $KMnO_4$ /$K_2Cr_2O_7$ as titrant calculate the redox potential of Fe++/Fe+++ system on the hydrogen scale.

6. To verify law of refraction of mixtures (e.g. of glycerol and water) using Abbe's refractometer.

7. To determine the specific rotation of a given optically active compound.

8. Determination of molecular weight of a non-violatile solute by Rast method/Backmann freezing point method.

9. Determination of the apparent degree of dissociation of an electolyte (e.g- Na Cl) in aqueous solution at different concentrations by ebullioscopy.

10. To verify Beer-Lambert law for $KMnO_4/K_2$, Cr_2, O_7 and determine the concentration of the given solution of the substance.

Books Suggested (Laboratory Courses)

1. Vogel's Qualitative Inorganic Analysis, revised, Svehta, Orient Longman.

2. Vogel's Textbook of quantitative Inorganic Analysis (revised), J. Bassett, R.C. Denney, G.H. Heffery and J Mendham, ELBS.

3. Standard Methods of Chemical Analysis, W.W. Scott, The Technical Press.

4. Experimental inorganic Chemistry, W.G. Palmer, Cambridge.

5. Handbook of Preparative Inorganic Chemistry, Vol, I & II Brauer, Academic Press.

6. Inorganic Synthesis, McGraw Hill.

7. Experimental Organic Chemistry Vol. l&ll, P.R.Singh, D.S.Gupta and K.S. Bajpai, Tata McGraw Hill.

8. Laboratory Mannual in Organic Chemistry, R.K. Babsal, Wiley Eastern.

9. Vogel's Textbook of Practical Organic Chemistry, B.S. Fumiss, A.J. Hannaforct, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.

10. Experiments in General Chemistry, C.N.R; and U.C. Agarwal, East-West press.

11. Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGraw hill.

12. Advanced Practical Physical Chemistry, Vol. I-Physical, J.B. Yadav, Goel Publishing House.

13. Advanced Experimental Chemistry, Vol. I-Physical, J.N. Gurju and R. Kapoor, S Chand & Co.

14. Selected Experiments in Physical Chemistry, N.G. Mukherjee. J.N. Ghose & Sons.

15. Experiments in Physical Chemistry, J.C. Ghosh, Bharati Bhavan.

PRACTICAL -SCHEME OF EXAMINATION

Max. Marks: **65** **Min. Marks:- 24**

Time:5 hours

INORGANIC CHEMISTRY

1. Instrumentation: Any one exercise – 8 Marks

2.Synthesis & Analysis: Any one exercise 7 Marks

ORGANIC CHEMISTRY

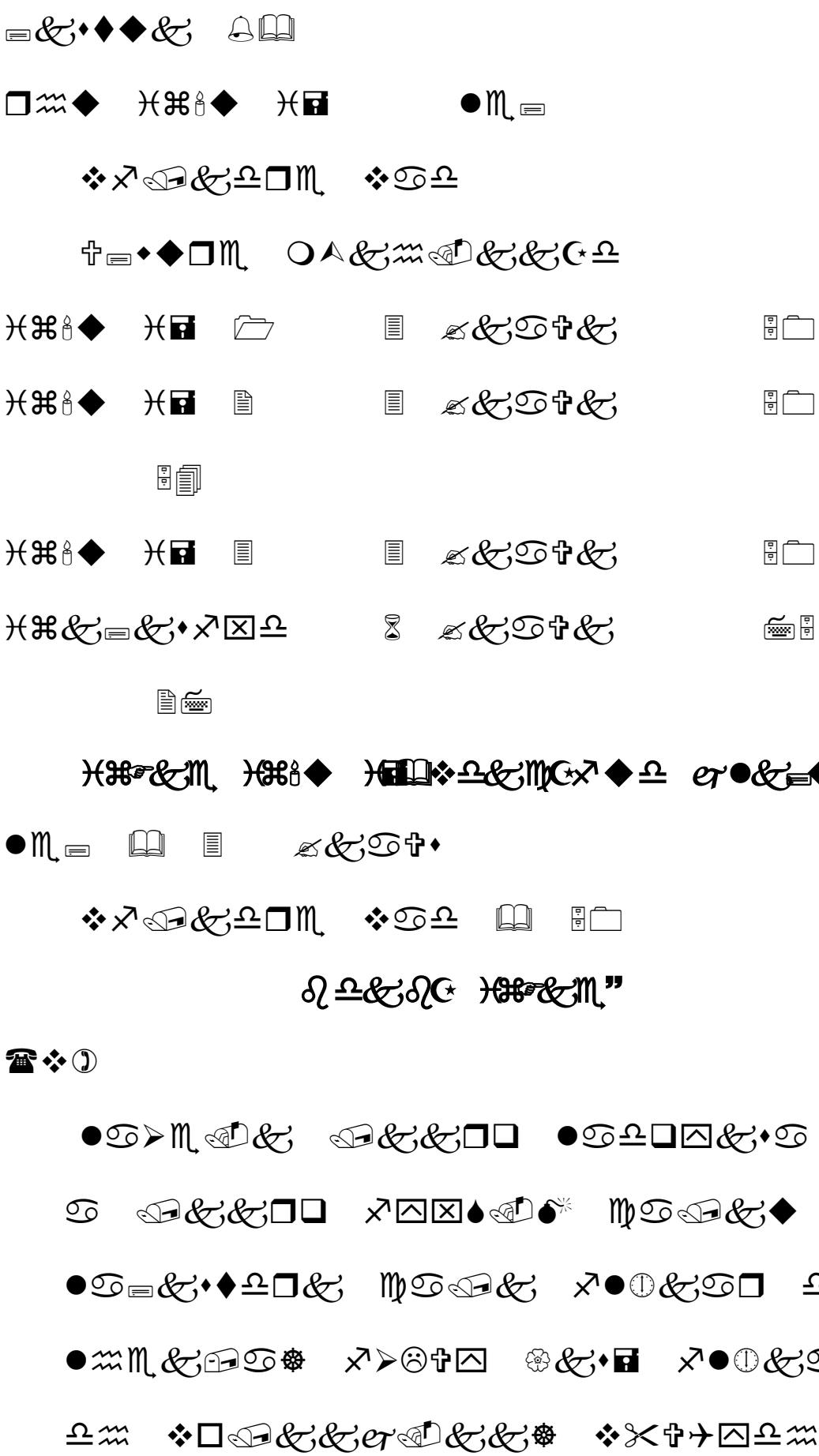
Any Two exercises taking not more than one from (i) to (iv) 5+10Marks

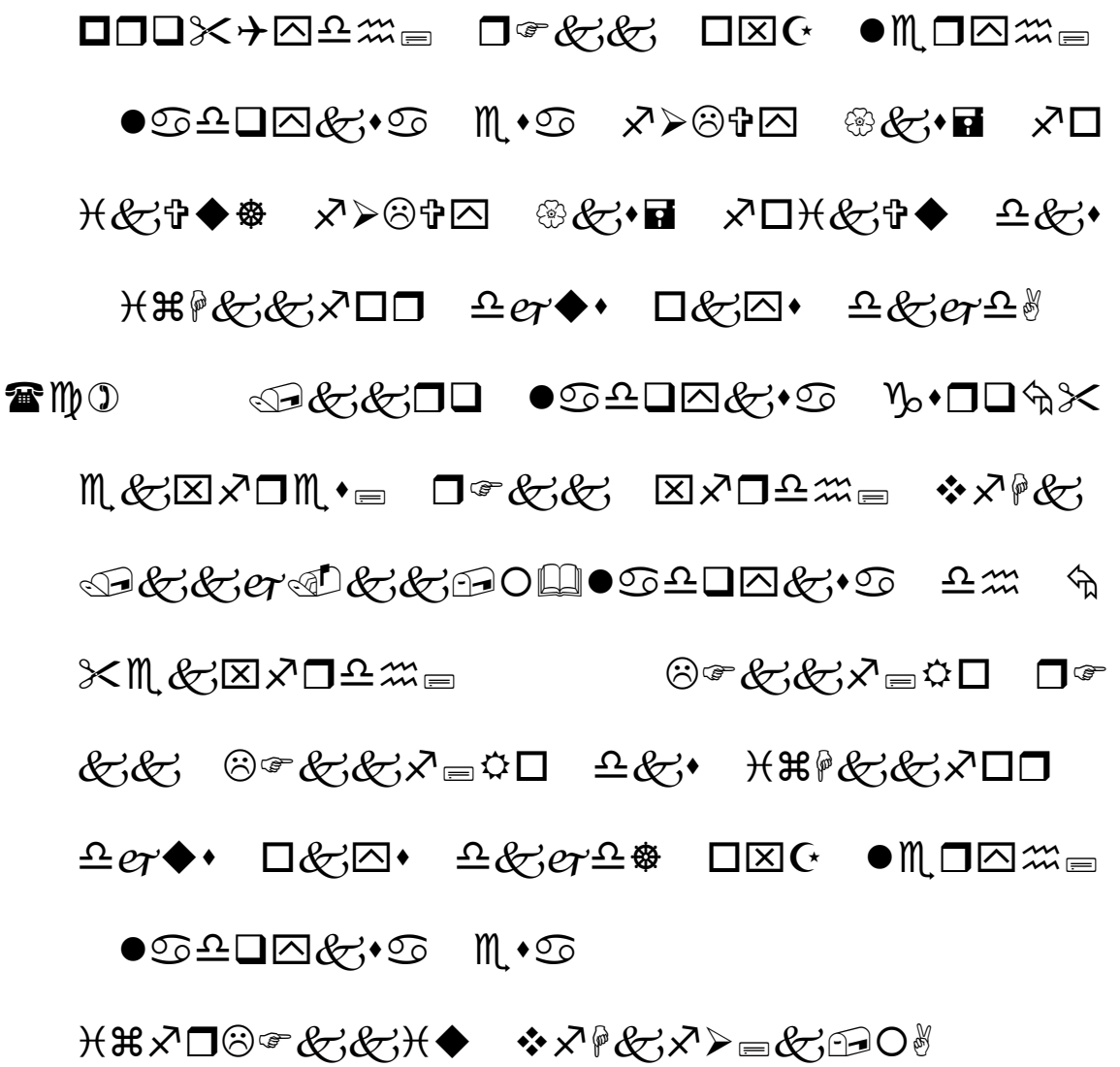
PHYSICAL CHEMISTRY

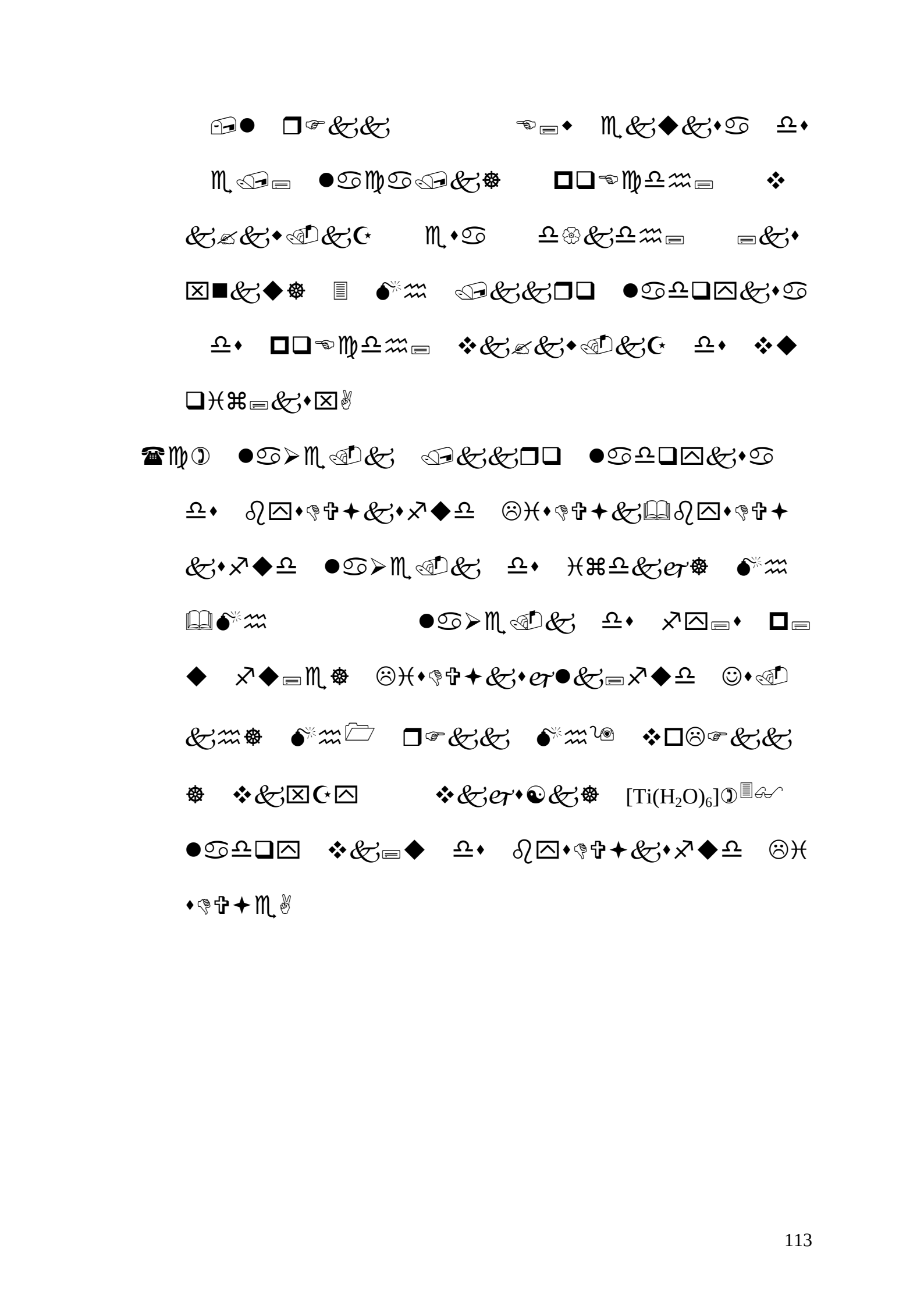
Any One experiment 15 marks

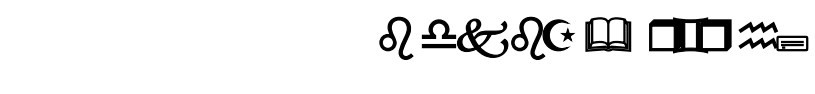
VIVA 10 Marks

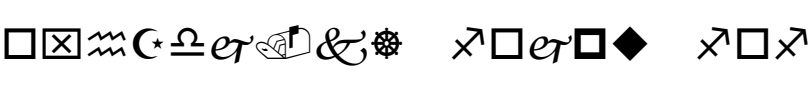
RECORD 10 Marks

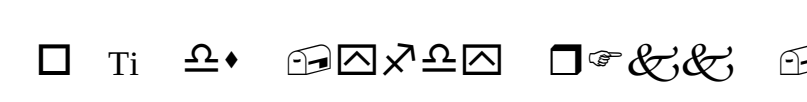


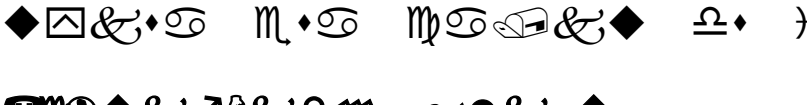


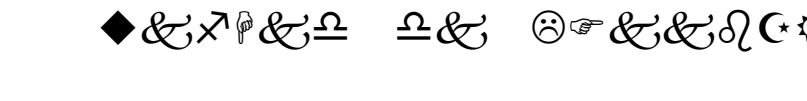


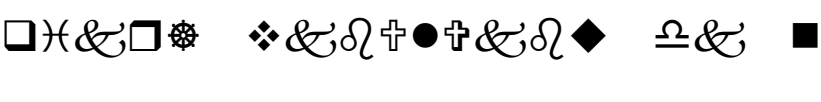


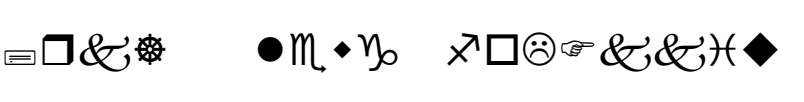












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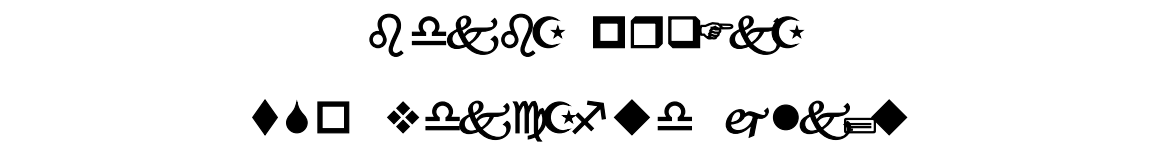

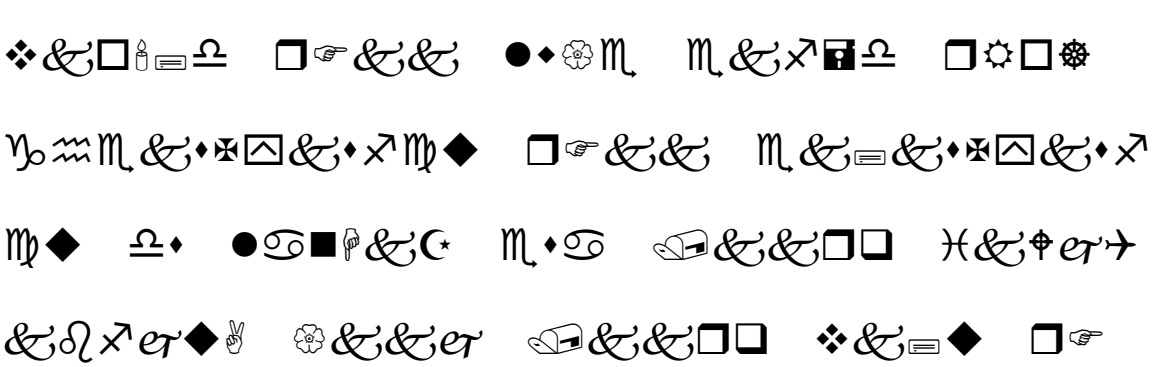

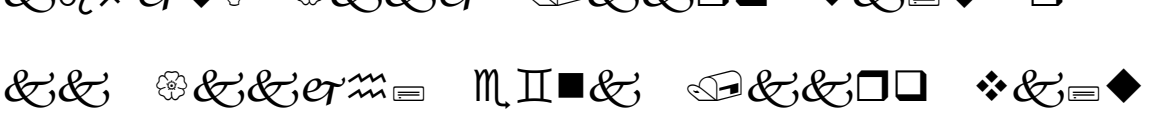

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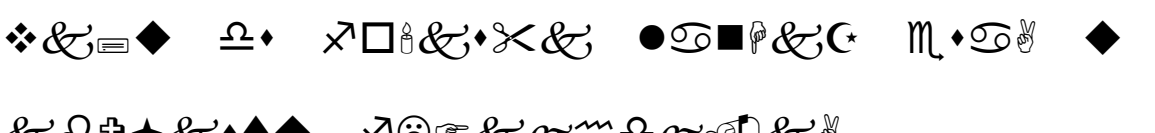

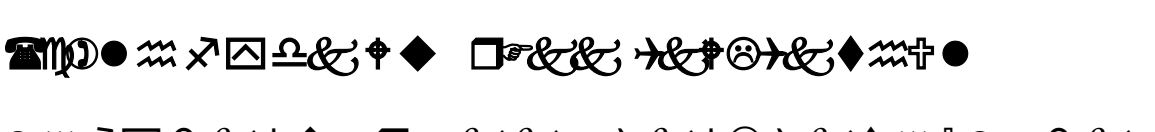

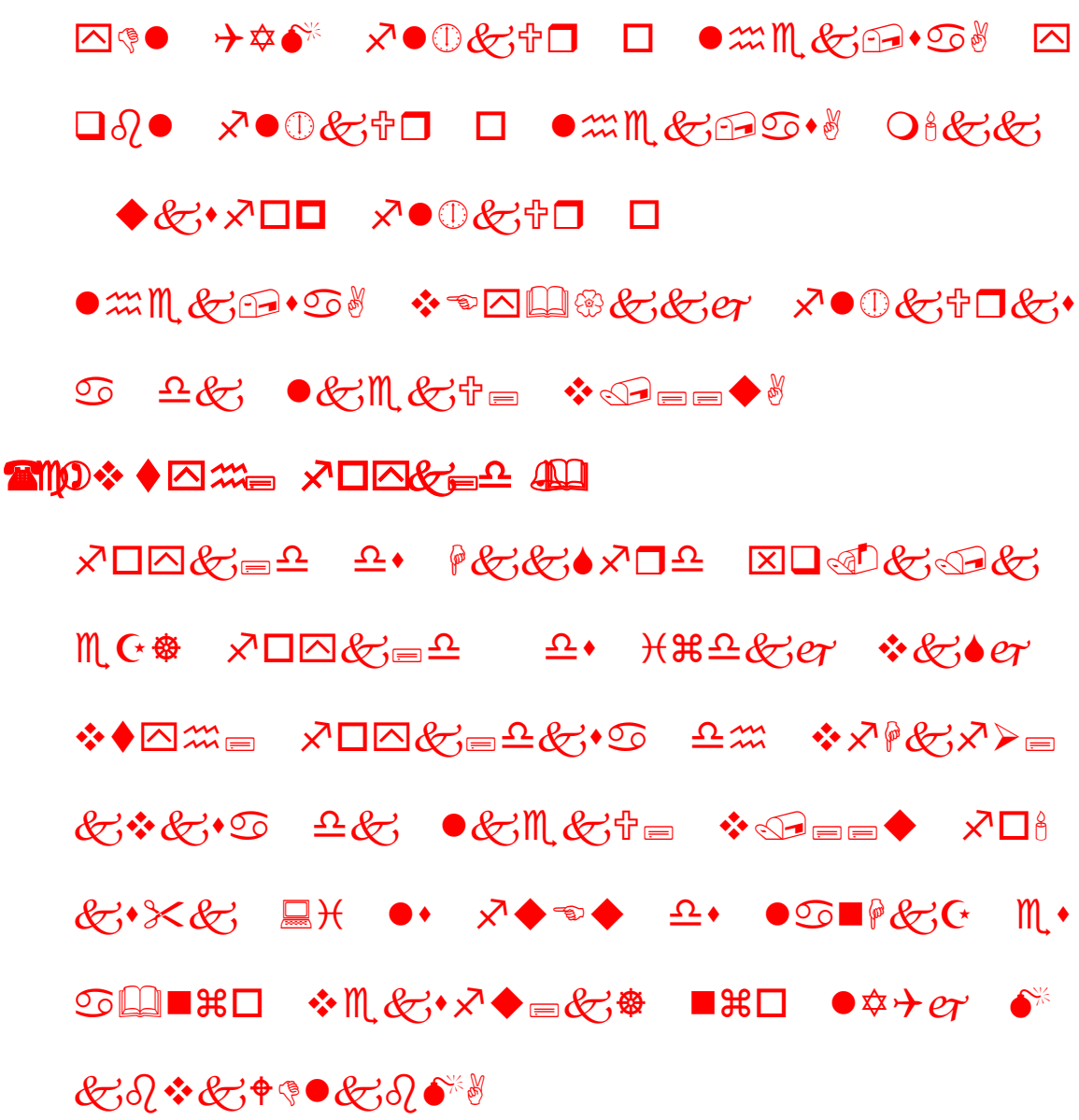

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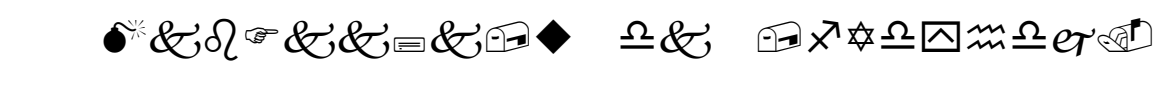

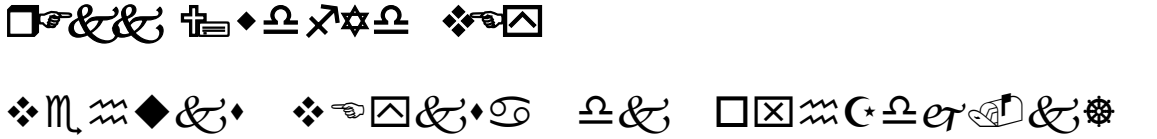

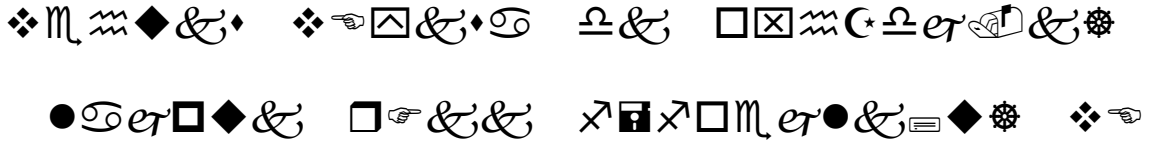

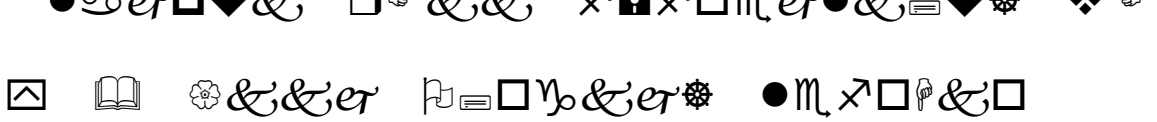

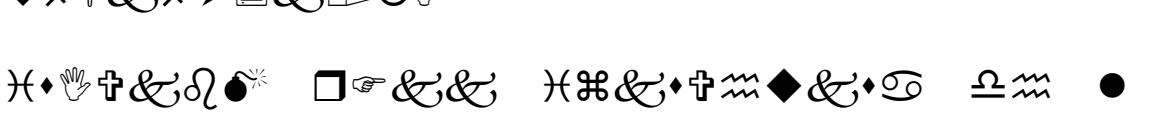

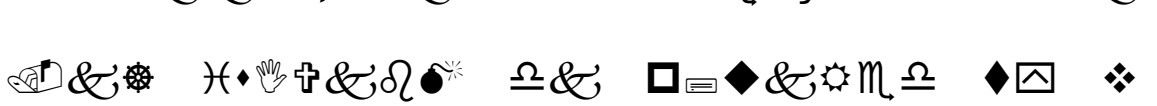

♓✍&✞◆☸ ♓♦✋✞&♌💣 ●♋🕯♎♦✂&👍&☸ 👌& ♦● ❖❑☹☞&& ♓♦✋✞&♌💣 ●♋🕯♎♦✂&👍&☸ ♓♦✋✞&♌💣 ❒☞&& ♓⌘&♦✞♒◆ ●♋♐❑◆& ☸ ♓⌘&♦✞♒◆ ●♋♐❑◆& ♎♦ ☹❒♐☸ ♓⌘&♦ ✞♒◆ ➚❑♎♊➚❒♎♐👍&☸ ♓❑◆&♎♊➚❒♎♐👍 &✌

✞▭♦➚👎♎♎ ❖☜♎ 🔔🕮 ♓➚♐❑▭☸ ●♋✍&✞◆☸ ♐&♌♍&♦✞▭♦➚👎♎❖&♦👎●&♌💣 ❒☞&& ♐ &♌♍&♦✞▭♦➚👎♎❖&♦✞&♌💣☸ 💣♒👍🖃◆👍🖃 ♎♒ ➚“♎❑👍💣♎♒ ●♋♐❑◆& ✌

♌♎&♌♋ ❑❒❑☞&♋

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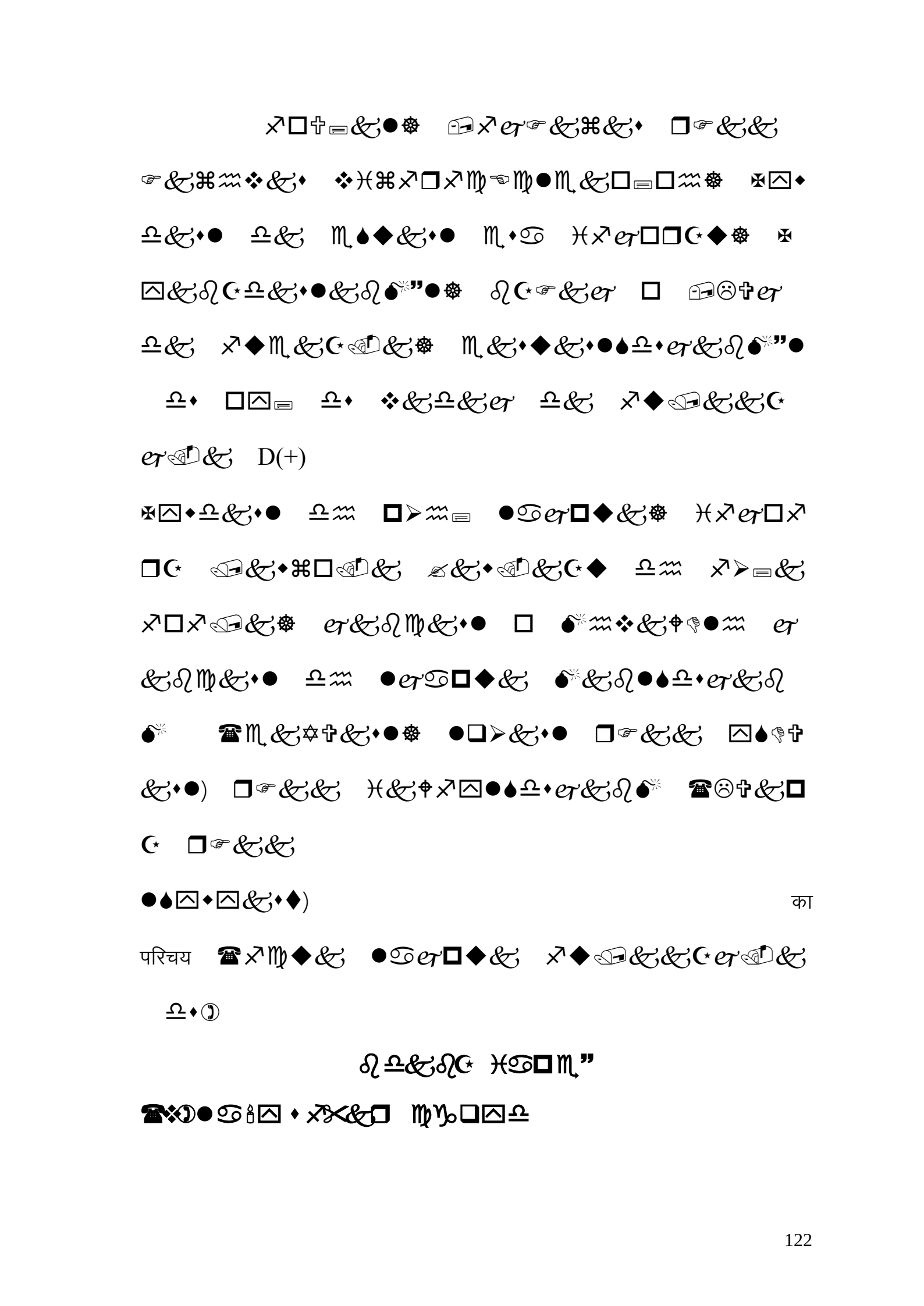
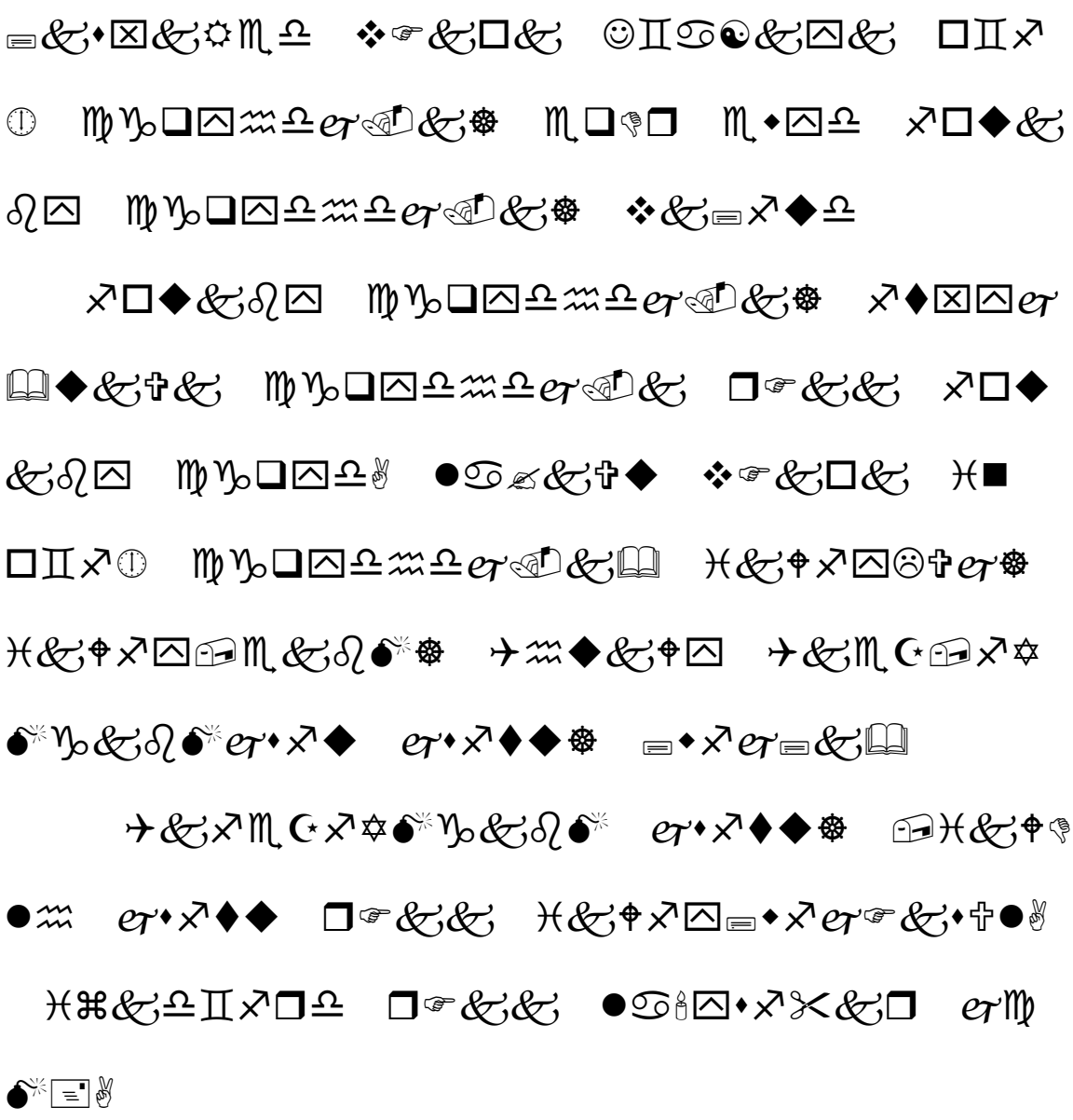
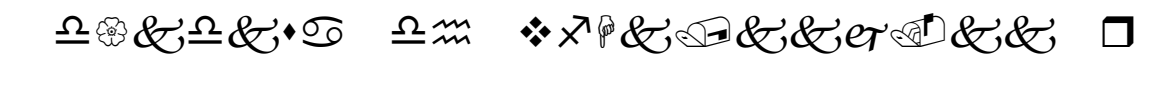
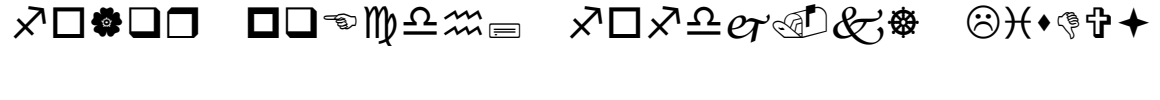
❑☒♒♋♎👍& ❒☞&& ◆&♏♎♐👍&☸ ♏&♦ ◆&♦●♦♎♦♐&♌💣”●☸ ❖&♦●&♦◆ ➚◆♏& ♋👍& ➚♎ ➚➢▭&➚❑➚👍&☸ ✠♎♦♎&♦● ❒ ☞&&

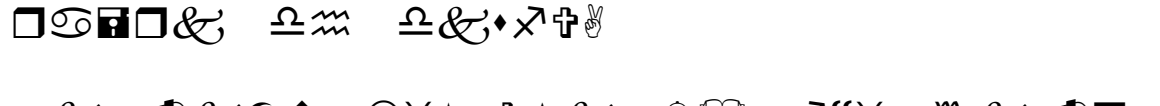
❶👎✞&♦● ♎& ❖✞❒♓➚♐❑❒♋◆☸ 🖃✡💣&♦● ♎♒ ☺♋♊☯&♎& ❖&♐&♦♑👍& ❑ ❖❑♐ &♦♑👍&☸ ♏&♦◆&♦●♦♎♦♐&♌💣”● ♎&











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●♋♎♐🙵❒ ♎❀🙰♎⬧♋ 🕭🕮 sp, sp^2, sp^3 ●♋♎♐🙵❒ ♎❀🙰♎🙰⬧♋ ♏⬧♋ ♓⌘🖮❑👎❒ ♓🙵♏ 🙰📬🙰□♒♎ ♎❀🙰♎🙰⬧♋ ♎⬧ 📪📫❖🙰⬧📫 ⌧ ❑📬🙰🙰♋♎🙰⬧ ♎♒ ⌧📬🙰◆🙰☸ H_2 ♎⬧ ●♋ 🖮🙰⬧⧫♎❒🙰 ♍🕆📪🙰 ♏🙰🕈💣⍓ ♎🙰 ♓♐🙵□ 🖮☸ 📪♏📫❖🙰⬧ ❒☞🙰🙰 □♒📫♍♒📫 ♏🙰🕈💣 ⍓🙰⬧♋ ♎♒ ❒❑⍓◆🙰✌

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♐□✿❑❒ □❑☞♍♎♒🖮 ♐□♐♎🙵📬🙰☸ ☹♓⬧👎🕆✦ ♏ ♎⬧ ❀🙰⬧🖬☸ ♐□♐☟🙰🕆◆ ☹♓⬧👎🕆✦🙰⬧♏♒🕆 🙵🙰⬧♋ ♎🙰 ❖🙰📪🙰🙰🙵☸ ♍🙰🕈◆☪ 🕮 ❖ 🙰🕈♓◆♑🙰⬧♏♎🙵 ❖♐☟🙰📪🙰🙰🙵📬🙰🙰☸ ☹□ ❒♋🖬❒🙰 ♎♒ ♎🙰⬧♐🕆✌

✍🙰⬧📬🙰☪◆ ☹♓💧👎🕆✦🙰 🕭🕮 ♐“♓🙵♏🙰📬□ ♒🖮 ❖📬🙰❑☸ 📪♎ ■♊🖫 ✍🙰⬧📬🙰☪♎ ♎⬧ ⮰⧫🙰☪ ☹❒🙵 🕕❖✆☪🖳🖫🖃 ♐●✆🙰♋❒🕖☸ □🖮 ◆ ♐◆🖮♏☸ ●♓⬧👎🕆✦⍓ ❒♒□⌘❒🙰☸ ❖🙰

♍&■♒ ▭& ●♋☯▭& ♐□❒♐☝& ♎& ❍♓ ▭&♦☒ ♎♐❒♦ ♑❑☜ ♐□❒♐☝& ☎♏♦☟●□♦ ♲🕮 ♍&♦✡✞”♦♏♦◆ ♐□❒♐☝&☽☸ ♍✞☜& ♲☜♍&♌☪ ♎& ♐◆☜&&☪♐☝&☸ ❖■♊ 🖫🖃 ✍&♦☝&☪♎ ♎& ☒❑☝&☼♏♎ ♐□□♐☝&☸ ❖&♌●&♦✞&♦♓ ♓⌘⌘☟&&□✌ ♎☜♓◆ ☹♓♦☟✞✦♏ 🔔 ❖□❒♐☝& ☹♓♦☟✞✦♏ 🔔 ●♐♲ ❖&□❒♒☪ ■&♦♲♎ ♎♦ ↬♦&☪ ☹❒♐☸ □▭◆ ♐◆▭♏☸ 🕯&❑“ ♎☜♓◆ ☹♓♦☟✞✦♏☸ ❒♒□⌘❒&☸ ♍♲ ♐◆▭♏&♋♎ ♎& ♐◆☜&&☪♐☝& ❒☞& & ♍♲ ♐◆▭❒&♋♎ □ ♍♋☜& ↬♦&☪ ♎♦ ♏☜▭ ☒❑☝&&☼♏♎ ●☜♍♋☜&☸ ❖&□❒☪☒♐❒ ♎& ♓⌘☟&&□

♐♏◆ ☹♓♦☟✞✦♏ 🕮 ☜&⌘❑□☝&❒& ♎♒ ❖♐☟&☜&&♐☝&&☸ 🕯&❑🕛 ♎☜♓✞◆ ♐♏◆ ☹♓♦☟✞✦♏ 🔔 ♐“♓♐♏&☝&♐□♎ ❖☝&❑♦ ♎♦

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♐◆▭♏ ♎♒ ❖♐☐🕯▭♎❒♐❁ ♐◆▭♏ ♎♒ ♐☐ ♐☝♐✝◆ ❖♐☝♐✍♐♐♐♓✍♐♐♋🕮

♎♐◆♐♦♑◘♎ ❒☞♐♐ ■❀♐❒♐❁ ♎♐◆♐♦♑♓⌘♏♦▭❁ ❒♐♓➢♏ ♎♒ ♋✂♏♐⊠♐❒♎ ♓♁♏♐◆♐❁ ♋✞✞✦♐♦♓♒ ♎♒ ❖♐☝♐✍♐♐♓✍♐♐🕮 ♋✞✞✦♐♦♓♒ ❖♐▭❒◆ ☐ ❒♐♓➢♏ ♎♦♦ ✈⍓◆ ♎♦ 💻♓ ♏♦♋❁ ♋✞✞✦♐♦♓♒ ■♐♍ ☐ ❒♐♓➢♏ ♎♦ ✈⍓◆ ♎♦ 💻♓ ♏♦♋❁ ☝♐♐♁♐➶❒♎ ♓⌘➢♏♐♦♋ ♏♦♋ ♋✞✞✦♐♦♓♒ ♓♐✍◘❒♑◆❁ ☟⍓♐♋➶🕯♐▭♏●🕮❖●♏♐◆❒♐ ♓⌘♏♦▭❁ ☹☐❒🔔 ♓⌘➢♏ ❒☞♐♐ ●♐☜▭♐☐☹☞♐♐ ♎♦ ➶⍓▭♦ ♋✞✞✦♐♦♓♒ ♎♒ ❖☐♋♐♐✍♐♐❁ ❖♐■🕯♐♑ ⊠♁● ❒☞♐♐ ⊠♁●♒▭ ➶♏☺♋♐ ♏♦♋ ♋✞✞✦♐♦♓♒ ♓♐✍◘❒♑◆✌

♓➶✍☐❒♑◆✌

♋✂♏♐⊠➶❒♎♒ ♎♐ ❒♊❒♒▭ ♐◆▭♏ 🔔🕮 ◆♦✝●✝♑ ♋✂♏♐ ♓⌘♏♦▭❁ ❖☐🕯♐♐♦✂♐♒ ♋✞✞✦♐♦♓♒ ♎♒ ❖☐♋♐♐✍♐♐❁ ♋✂♏♐ ♐

♋♐♐➶✍❒♐ ❖♐⌖♋♎💣⍓♐♦ ♏♦♋ ➶◆✍♓♦ ❀♐ ♋✞✞✦♐♦♓♒ ♎♐ ➶◆♋♐♐♑✍♋♐❁ ➶⊠☝● ❒☞♐♐ ♑♦✡♏♐♦✡✝”● ✈⍓◆❁ ➶⊠☝●

✈⍓◆ ❒☞&& ♑♦✡♏&♦✡✞”● ✈⍓◆ ↰✂♏ &⊠➚❒♎ ◘℮ ♎♦ 💻♓ ♏♦♋✌

↰✂♏&⊠➚❒♎♒▭ ●&☜▭ ♎♦ 💻♓ ♏♦♋ A ❒☞&& G

❒☞&& ☹◘❒🔔 ♓⌘◘➚❒☪❒&☸ 🖃✞✞✦&♦♓♒ ♓➚℮◘❒☪◆ ♎♦ 💻♓ ♏♦♋

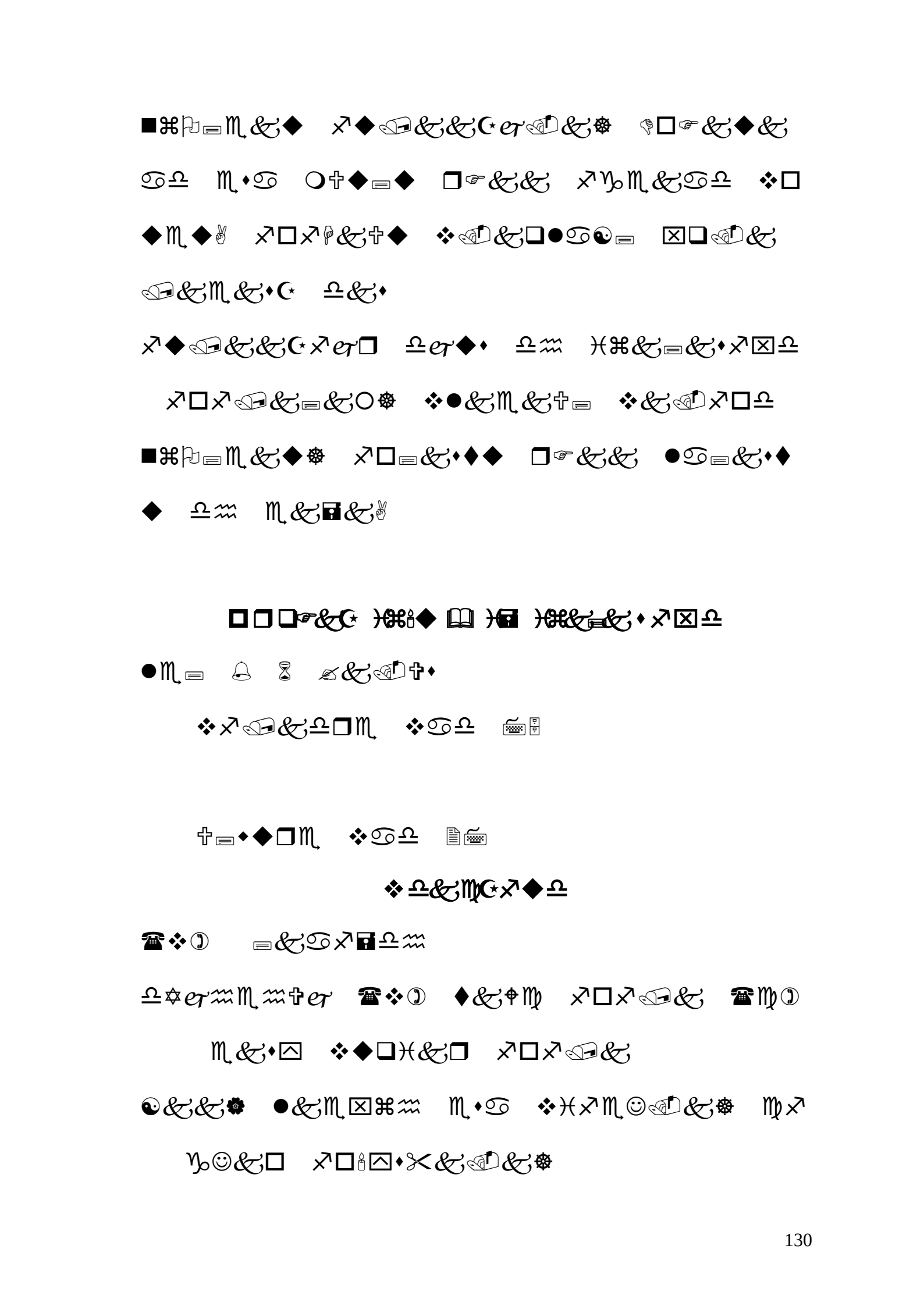
♌●♎♦ ⍓&☝& G, ◘ A ♏♦♋ T, P ◘ V ♎♦ ●&☞& ♓➚℮◘❒☪◆✌

♌♎&♌☪ ♓♋◘♏

➚◘⍓▭◆☸ ❒◆❑ ➚◘⍓▭◆ ❒☞&& ❖☝&❑●♋☯▭ ⊠❑ ☜&✂&♏☪✌

❖&■▯&☪ ❒☞&& ❖◆&■▯&☪ ➚◘⍓▭◆☸ ➚◘⍓▭◆ ♎♒ ●&✞■⌘❒& ♎&♦ ⚐▭☜❒ ♎℮◆♦ ♎♒ ➚◘➚☜&▭&○ ●➚➢▭❒& ❒☞&& ●➚➢▭❒& ⊠❑☝&&♋♎✌

❒◆❑ ➚◘⍓▭◆☸ ❖☝&❑●♋☯▭ ⊠❑☝&☜& ♏☪☸ ℮&❍✡✞ ➚◆▭♏☸ ◘&✂♓■&♍ ♏♦♋ ❖&♓♦➚❀&♎ ❖◘◆♏◆☸ ❖&☝&➚◘♎ ■⌘⚐ ▭♏&◆ ➚◆☜&&☪℮☝&☸ ♓℮&●℮☝&☸ ♓℮&●℮☝& ■&♍ ➚◆▭♏ ❒☞&& ♌●♎ & ➚◆☜&&☪℮☝&☸ ♓℮&●℮☝& ■&♍ ●♦ ❖&☝&➚◘♎



♦♎ ♐□♋♎♦♓&♂& &♂& ♐□♎&♂♎ ♐◆♓♎♓&☪♂& 🔔 Mg (II) & Fe (II) ♎& ♓♊☞&☜♎♂♂& ❒☞&& ❖&♋♎♎◆ ✌ ❖&♂◆ ♂☜●□♦♋♦ ♐□♐♂& 🔔 Mg ❒☞&& Fe (II) ♎& ♓♊☞&☜♎♂♂& ❒☞&& ❖♋&♎♎◆ ✌

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●♋♋♎♦♓&♂& ❒☞&& ♐□♋♎♦♓&♂& ☎♎&♦♌☪ ■&♦☽

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●&♦♐💣♂♍ ✞✦&♌❖&✙☜●♦♎♦✞&♦♋ ✈♦♂ ♦✞ ☎&&&☽ $Na_3 [Fe (C_2 O_4)_3]$

🗎♂ Ni-DMG ●♋♎❑♎

🗏♂ ♎&✙♓♂ ✞♦✞✦♂☜♍♒◆ ●♋♎❑♎

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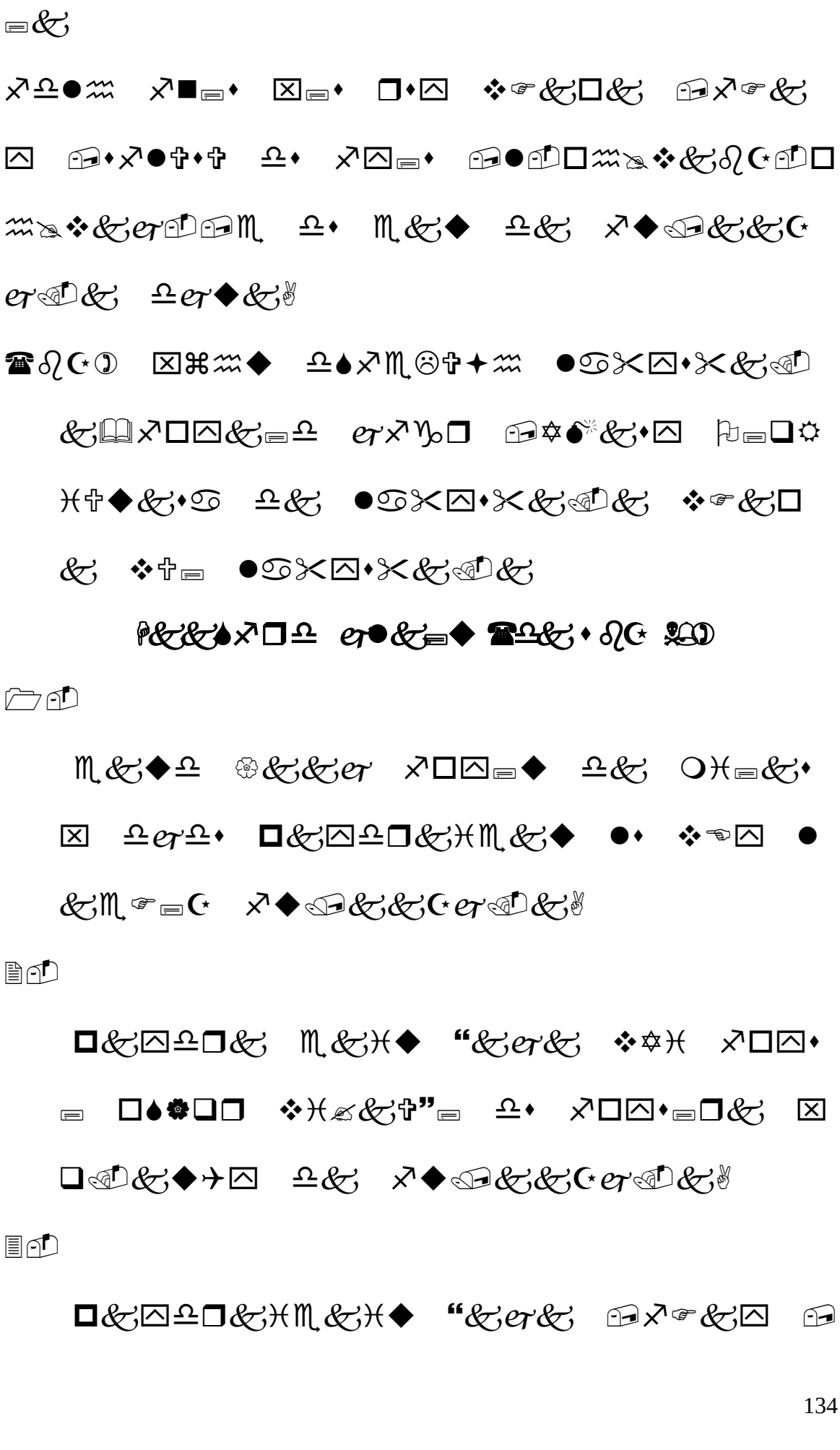

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☜👍♍♦ ❖♓◘❒☪◆♏&♓♒ ♎♦ ♓⌘▭&♦☒ ●♦ ↗♏☺☝& ❖♓◘❒☪◆ ↗◆▭♏ ♎♒ ●☼▭❒ & ↗◆☜&&☪♐☝&

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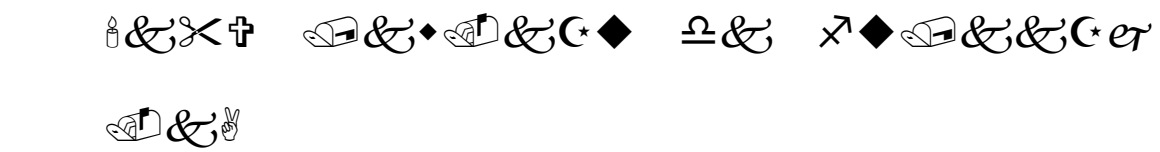
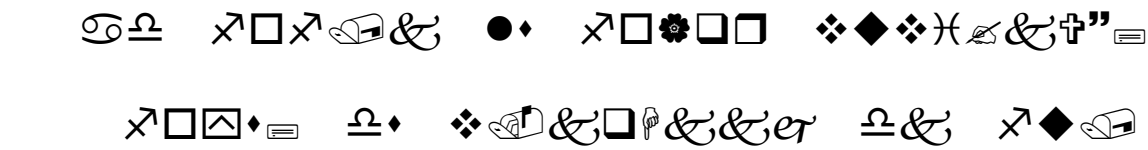
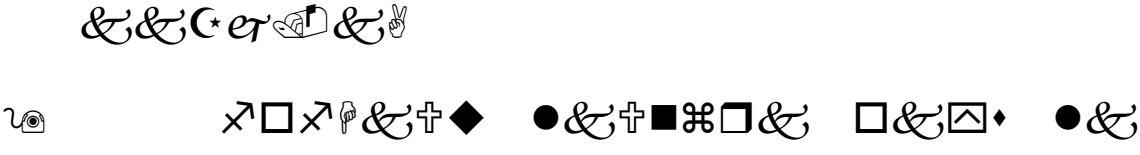
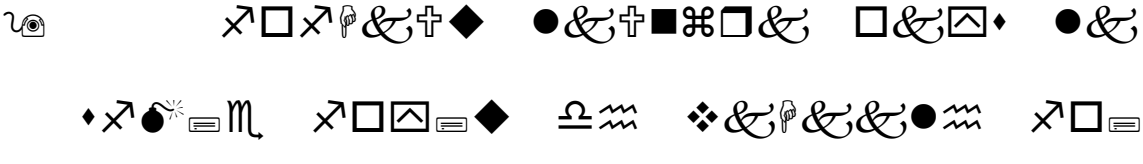
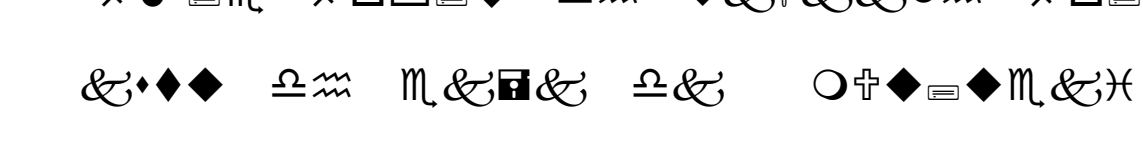
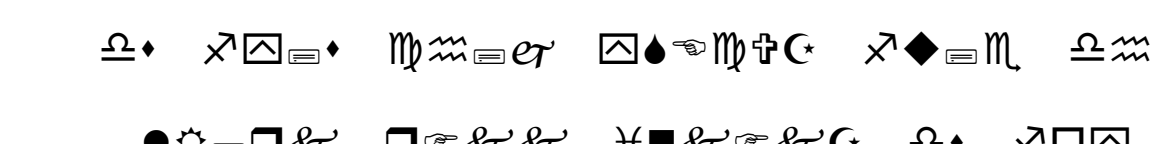


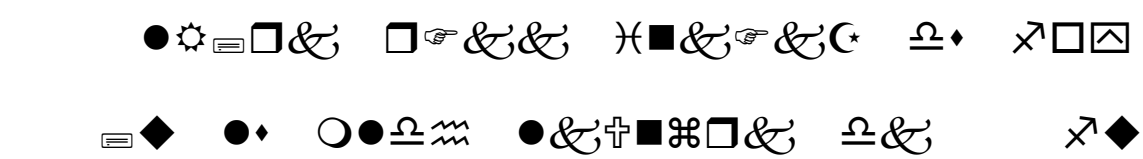


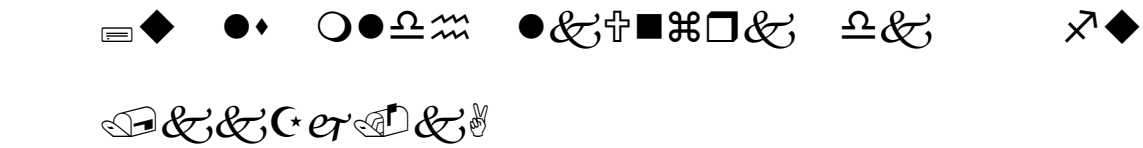




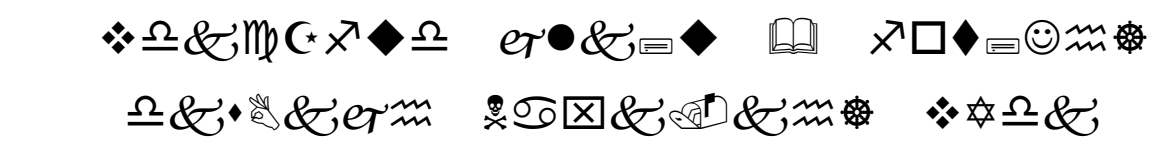


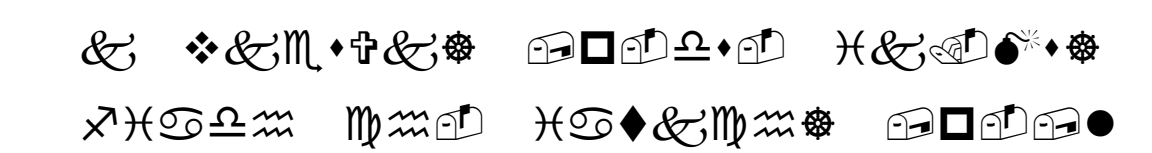


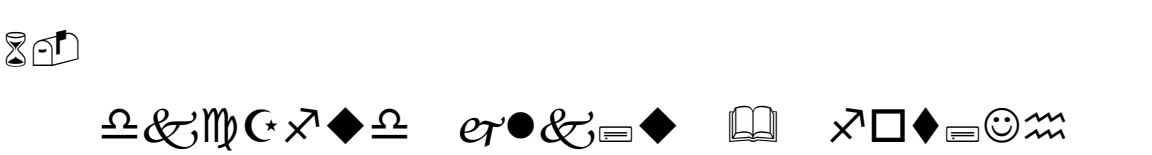


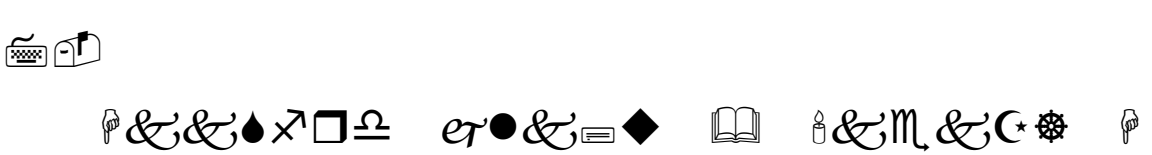


Books Suggested:









to be added in hindi syllabus of practical (the existing is to be replaced with it

बीएससी पार्ट –1

प्रायोगिक पाठ्यक्रम

अ. अकार्बनिक रसायन 15 अंक

अकार्बनिक रसायन–सूक्ष्म विष्लेषा/ स्थूल विष्लेषण– दो अम्लीय एवं दो क्षारकीय कूल चार मूलकों का परीक्षण एवं पृथक्करण (बाधक मूलक एवं युग्मन मूलक दिये जाये)

ब. कार्बनिक रसायन

1 प्रयोगषाला तकनीकें **2,5 अंक**

(i) गलनांक मापन (^{0}C)

नेथलीन 80–82^{0}C बेन्जॉइक अम्ल 121–5–122^{0}C 4यूरिया 123–5–133^{0}C साक्सिनिक अम्ल 184–5–185^{0}C सिनेमिक अम्ल 132–5 &133^{0}C सेलिसिलिक अम्ल, 157–5–158^{0}C एसीटेलिनाइड 113–5–114^{0}C, उ. डाइनाइट्रोबेन्जीन 90^{0}C p– डाइक्लीरो बेन्जीन 52^{0}C ऐस्पिरिन 135^{0}C ।

(ii) क्वथनांक मापनः (^{0}C)

एथेनॉल 78^{0}C, साइक्लो–हेक्सने 81–4^{0}C, टॉलूइन 110–60C, बेन्जीन 80^{0}C ।

(iii) मिश्र गलनांक मापन।

यूरिया सिनेमिक अम्ल के अलग–अलग संघटन के मिश्रण (1:4, 1:1, 4:1)

(iv) आसवनः

जल संघनित्र के द्वारा एथेनॉल– जल मिश्रण की सरल आसवन।
वायुसंघनित्र के द्वारा नाइट्रो बेन्जीन एवं एनिलीन मिश्रण का आसवन।

(v) ग्रीन कैमिस्ट्री–सुरक्षा चिन्हों की पहचान।

2ष्ुद्विकरण तकनीकें **2,5 अंक**

(i) क्रिस्टलीकरण क्रिस्टलीकरण की प्रेरणा संकल्पनाः गर्म जल द्वारा थैलिक अम्ल (तैरते हुए छत्रा पत्र व तना रहित फनल का काम में लेकर)
उबलते हए जल से एसीटेनिलाइड
एथेनॉल से नेथलीन जल से बैन्जाइक अम्ल

(ii) चारकोल के उपयोग द्वारा विरंजन एवं क्रिस्टलीकरण गुरूत्व छनित्र प्रायोगिक विधि द्वारा, जन्तु चारकोल की मदद से भूरी शक्कर का विरंजन।
एथेनॉल द्वारा अष (नैथलीन;1 ग्राम विरंजित कार्बन के प्रयोग से 0.3 ग्राम कांगोरेड युक्त नैथलीन काद्ध का विरंजन एवं क्रिस्टलीकरण।

(iii) ऊर्ध्वपातन; सरल एवं निर्वातद्ध
केम्फर (कपूर) नेथलीन, थैलिक अम्ल एवं सक्सीनिक अम्ल।

3 गुणात्मक विष्लेषण– **10 अंक**

कार्बनिक योगिकों की क्रियात्मक समूह विष्लेषण द्वारा पहचा, गलनांक का निर्धारण एवं योगिकों के व्युत्पन्न का निर्माण

स भौतिक विज्ञान 15अंक

(निम्नलिखित में से कोई भी एक प्रयोग परीक्षा में दिया जायगा)
रसायन बलगतिकी–
1. कक्ष ताप पर मेथिल एसीटेट, एथिल एसीटेट का हाइड्रोजन आयन की उपस्थिति में जल अपघटन की विषिष्ट अभिक्रिया वेग का मापन।
2. एस्टर के जल अपघटन पर अम्ल सामर्थ्य के प्रभाव का अध्ययन
3. एथिल एसिटेट के जल अपघटन की दरों पर HCl व H_2SO_4 की प्रबलता की तुलना।
4. H_2O_2 द्वारा आयोडाइड के विघटन की अभिक्रिया की दर का रसायनिकबल गतिकी अध्ययन।
वितरण का नियम
1. जल एवं CCl4 के मध्य I2 के वितरण का अध्ययन
2. जल एवं बेंजीन के मध्य बेन्जाइक अम्ल के वितरण का अध्ययन
कोलाइडस

आर्सेनियस– सलफाइड सॉल का बनाना एवं (मोनो, बाई व ट्राइवेलेंट एनॉयनों) एक संयोजी, द्विसंयोजी, त्रिसंयोजी) णायन की अवक्षेपण की अवक्षेपण क्षमता की तुलना करना।

श्यानता, पृष्ठ तनाव

1. श्यानता मापन विधि द्वारा, अक्रियाषील तंत्रद्ध मिश्रणों के प्रतिषत संघटन का मापन
2. एमिल एल्कोहॉल की जल में विभिन सांद्रताओं वाले मिश्रणों की श्यानताओं का मापन एवं इन विलयनों की श्यनताओं की गणना
3. (एसीटोन एवं एथिल मैथिल कीटोन) द्वि अंगी मिश्रण के प्रतिषत संघटन की पृष्ठ तनाव विधि से मापन

Spotting (5 spots)	10 अंक
viva	5 अंक
record	5 अंक

बीएससी पार्ट–2

अकार्बनिक रसायन

1. 5 अंक

अ. अंष भारों, पिपेट व ब्यूरेट का अंषाक। मानक विलयन का निर्माण, विलयनों की 0–01 M से 0–001M तक करना।

2. 10 अंक

अ. या ब. में से कोई एक

अ. मात्रात्मक विष्लेषण– आयतनी विष्लेषण

1. NaOH की सहायता से व्यावसायिक सिरके मे एसिटिक अम्ल ात करना।
2. HCl की सहायता से एण्टिएसिड टेबलेट में एल्कली की मात्रा का निर्धारण।
3. परमेंगनामिति द्वारा खक में कैल्षियम की मात्रा कैल्षियम ऑक्सलेट के रूप में ज्ञात करना
4. DETA द्वारा जल की कठोरता ज्ञात करना
5. डाइक्रोमेट विधि द्वारा फेरस व फेरिक का आंकलन
6. कापर का आफपर थाया सल्फेट के रूप में आंकलन

ब. भारात्मक विष्लेषण

1. Cu का CuSCN के रूप में विष्लेषण
2. बेरियम सल्फेट के रूप में

ब. सूक्ष्म अंषे विष्लेषण/ स्थूल विष्लेषण– तीन अम्लीय एवं तीन क्षारकीय कुल छः मूलकों का परीक्षण एवं पृथक्करण (एक बाधक मूलक या युग्मन मूलक अवष्य दिया जाये)

कार्बनिक रयासन–10 अंक

वर्णलेखिकी **5 अंक**

प्रतिमानों का पृथक्करण

टाइलून व हल्के पैट्रोलियम (40:60) द्वारा एसीटोन, 2–ब्यूटोनोन, हैक्सेन–2 तथा 3–ओन के 2,4–डाइनाट्रोफिनेल हाइड्रोजन का निर्माण, पृथक्करण।

1. साइक्लोनहैक्सेल तथा एथिट एसीटेट (8.5 :1.5) द्वारा रंजकों के मिश्रण का पृथक्करण
2. फेनिल ऐलानीन तथा ग्लाइसीन ऐलानीन तथा एस्पार्टिक अम्ल, ल्यूसीन तथा ग्लूमेटिक अम्ल के मिश्रणों का पृथक्करण। स्प्रे अभिकर्मक निनहाइड्रीन।
3. n-ब्यूटेनोल : एसीटिक अम्लः जल (4:1:5) द्वारा D,L – एलानीन, ग्लाइसीन व स–ल्यूसीन के मिश्रण का पृथक्करण। स्प्रे अभिकर्मक निनहाइड्रीन।
4. n-ब्यूटेनोल5 एसीटिक अम्लः जल (4:5:1) द्वारा D-ग्लूकोज, D-फ्रैक्टोज के मिश्रण पृथक्करण। स्प्रे अभिकर्मक– एनीलीन हाइड्रोजन थेलेट।

कार्बनिक पदार्थों की पहचान **10 अंक**

भौतिक रसायन 15 अंक

1. तापमिति, डायलोमिती विधि द्वारा दिये गये पदार्थ का संक्रमण ताप ज्ञात करना MnCl2.4H2O,SrBr2.2H2O
2. दो आंषिक विलेय द्रवों ; फिनोल– जल तंत्र (में क्रांतिक विलयन ताप पर विलेय) e.g. NaCl. सक्सिनिक अम्ल के प्रभाव का अध्ययन तथा इसी तंत्र में विलेय की सांद्रता का निर्धारण।
3. कूलिंग वक्र विधि Cooling curve method द्वारा द्विघटकीय तंत्र e.g. डाइफेनिल एमिन बेंजोफिनोन का प्रावस्था आरेख बनाना।
4. विभिन्न तापों पर बेंजोइक अम्ल के विलेयता ज्ञात करना तथा विलेयता प्रक्रम की ज्ञात करना।

5. दुर्बल अम्ल/ दुर्बल क्षार तथा प्रबल क्षार/ प्रबल अम्ल की उदासीनीकरण एन्थेलप ज्ञात करना तथा दुर्बल द्वाार तथा दुर्बल अम्ल की आयनीकरण की एन्थेलपी ज्ञात करना।
6. ठोस कैल्षियम क्लोराइड की विलयन एनथेलपी ज्ञात कना तथा इन मानों से बोर्न हाबर चक्र द्वारा कैल्षियम क्लोराइड की जालक ऊर्जा का निर्धरण

. मौखिक प्रयोग 10
सत्रीय अभिलेख 10

बीएससी पार्ट–3

अकार्बनिक

1 यांत्रिकी **8 अंक**

कलरीमीटर

अ. जॉब विधि

ब. मोल अनुपात विधि खाद्य सामग्री में अपमिश्रण, बहिश्राव, विष्लेषण, जल विष्लेषण

2 संष्लेषण तथा विष्लेषण 7 अंक

1. सोडियम ट्राइऑक्सेलेटो फैरेट (kkk)Na3 [Fe (C2O4)3]
2. Ni- DMG संकुल
3. कॉपर टेट्रएम्मीन संकुल
4. सम्पक्ष व विपक्ष विब ऑक्सेलेटों डाइएक्वा कोमेट (kkk) आयन
5. अकार्बनिक रसायन–सूक्ष्म विष्लेषा/ स्थूल विष्लेषण– तीन अम्लीय एवं तीन क्षारकीय कूल 6 मूलकों का परीक्षण एवं पृथक्करण (बाधक मूलक एवं युग्मन मूलक दिये जाये)

कार्बनिक 15 अंक

गुणात्मक विष्लेषण– दो ठोस यौगिकों युक्त कार्बनिक मिश्रण का जल, सोडियम बाई कार्बोनेट, सोडियम हाइड्रॉक्साइड द्वारा पृथक्करण एवं व्युत्पन्नों का निर्माण

ग्रीन कैमिस्ट्री संष्लेषण– विलायक रहित एल्डोल व्युत्पननों का संश्लेषण अथवा अन्य संष्लेषण।

भौतिक रसायन (कोई 6) 15 अंक

1. मानक क्षार विलयन का उपयोग करके चालकतापमान से अम्ल सामर्थ्य निर्धारण।
2. चालकता मापन द्वारा अल्प विलेय वैद्युत अपघट्य के विलेयता गुणनफल का निर्धारण।
3. चालकतामापन द्वारा एथिल ऐसीटेट के साबुनीकरण का अध्ययन।
4. चालकतापमापन द्वारा दुर्बल अम्ल के वियोजन स्थिरांक का निर्धारण।
5. विभवमापी के उपयोग द्वारा फैरस अमोनियम सल्फेट विलयन का अनुमापन तथा तंत्र के रेडॉक्स विभव का हाइड्रोजन स्केल का पर निर्धारण।
6. एब्बे अपवर्तनमापी के प्रयोग से मिश्रण अपवर्तन नियम की सत्यता निर्धारण उदाहरण ग्लिसरोल तथा जल।
7. प्रकाषित सक्रिय यौगिक के विषिष्ट घूर्णन का निर्धारण।
8. रास्ट विधि/ बैवामेन हिमांक विधि से विद्युत अनअपघट्य विलेय के अणुभार का निर्धारण।
9. विभिन्न सांद्रता वाले सोडियम विलयन की आभासी वियोजन की मात्रा का उन्नयनमापन से निर्धारण।
10. KMO4/k2Cr2Oy के लिये बीयर लैम्बर्ट नियम की सत्यता तथा पदार्थ के विलयन से उसकी सांद्रता का निर्धारण।

मौखिक प्रयोग 10

सत्रीय अभिलेख 10