Question Type	Total number of Questions	Number of Question to be answered	Marks for each Questions	Total Marks
Very short answer type(One word to Maximum of 2 sentences)	10	10	1	10
Short answer(Not to exceed one paragraph)	12	8	2	16
Short essay(Not to exceed 120 words)	9	6	4	24
Long essay	4	2	15	30
Total	**35**	**26**		**80**

SYLLABUS FOR B.Sc. CHEMISTRY PROGRAMME
Core Course No. - 1 Course Code– CH1141
Semester – I Credit-4
<u>Inorganic</u> Chemistry I

Lecture -Tutorial-Lab: 2-0-2   <u>**36**</u> <u>*hrs.*</u>
Module I - Atomic Structure   *6 hrs.*

        Introduction to the structure of atom - Dual nature of electron - de Broglie   equation - matter waves and electromagnetic waves - experimental verification of de Broglie relation - Heisenberg's uncertainty principle - expression and significance. Wave mechanical concept of the atom - Schrodinger equation - Charge cloud and probability concepts - orbitals, radial and angular probability distribution curves, shapes of orbitals. Particle in a one-dimensional box. eigen functions and eigen values. Particle in three dimensional box.

Module II - Electronic Configuration and Periodicity   *6 hrs.*

        Quantum numbers - Pauli's exclusion Principle - aufbau Principle – Hund's rule - Electronic configuration of atoms - classification of elements into s, p, d, f blocks - atomic radii, ionization enthalpy, electron gain enthalpy and electronegativity- Pauling's scale, Mulliken and Alred - Rochow scale- ionic character - periodicity - horizontal, vertical and diagonal relationships - anomalous behaviour of the first element of a group.

Module III - Analytical Principles - I   *6 hrs.*

        Inorganic qualitative analysis - Common ion effect - solubility product - principle and procedure of elimination of interfering anions - precipitation of cations. Microscale analysis – Advantages

Quantitative Analysis - Calibration and use of apparatus and weights for titration. Theory of titration - acid-base, redox, precipitation and complexometric titrations. Theory of indicators - acid-base, redox, adsorption and metallochromic indicators. Two Burette Method of titration – Principle and advantages.

Module IV - Analytical Principles – II   *6 hrs.*

Gravimetric Analysis - Mechanism of precipitate formation - Factors affecting solubility of precipitates – co-precipitation and post precipitation - Effect of digestion - washing, drying and ignition of precipitates. Chromatography - classification of methods - Elementary study of adsorption, paper, thin layer, ion exchange and gas chromatographic methods.

Module V Environmental Chemistry - Air Pollution   *6 hrs.*

Environmental segments - Lithosphere, Hydrosphere, Biosphere, Atmosphere - Composition and structure of atmosphere - Troposphere, Stratosphere, Mesosphere, Thermosphere Air pollution - 3 types of classification, types of pollutants - CO, CO_2, NO, SO_2, H_2S, Cl_2, CFC, particulate matter, metals, fly ash, asbestos, hydrocarbons - their source and influence - ozone layer depletion, ozone hole, protection of ozone umbrella - acid rain, green house effect, smog - management of air pollution.

Module VI - Environmental Chemistry - Water and Soil Pollution   *6 hrs.*

Water pollution: Classification of pollutants - organic, inorganic, suspended solids and sediments, radioactive materials, Heat, industrial waste, sewage water, detergents, agricultural pollutants - treatment of industrial waste water - Quality of drinking water - Indian standard and W H O standard - Dissolved oxygen - BOD, COD.

Soil pollution - Pesticides, Fertilizers, Industrial waste, plastics - Control of pollution

Time: Three Hours   **Maximum Marks: 80**
Section- A,
Answer all Questions.
Answer in one word to maximum of two sentences
Each question carries one mark
1. What is de Broglie's relationship?
2. State Heisenberg's uncertainty principle.
3. Give one example for a redox titration.
4. Name an indicator used in complexometric titrations.
5. Which quantum number determines the orbital angular momentum of the electron?
6. What is the role of ozone layer in protecting earth?
7. Which part of the atmosphere is ionized by solar radiation?
8. Which is the main chemical present in photochemical smog which causes irritation to eyes?
9. Dissociation of acetic acid is suppressed on adding sodium acetate. Explain.
10. Name a carrier gas used in gas chromatography.

                                                                        10x1 = 10 marks

Section B
Short answer type (Not to exceed one paragraph)
Answer any 8 questions from the following.
Each question carries two marks

11. Draw all the d orbitals.
12. Write the Schrodinger wave equation. Explain the terms.
13. State and illustrate Pauli's Exclusion Principle.
14. Arrange F, Cl, Br and I in the increasing order of their electron gain enthalpy values. Give appropriate reason.
15. What are the factors affecting precipitation?
16. What is two burette titration? What are the advantages?
17. Describe the effect of temperature on precipitation.
18. What is meant by R_f value? What is its use in chromatography?
19. Name the major pollutants in air?
20. What are the factors affecting the purity of water?
21. How will you find out the BOD of a sample of water?
22. Write short note on the pollution by plastics.

                                                                        8×2 = 16 marks

Section C
Short essay (Not to exceed 120 words**)**
Answer any 6 questions from the following.
Each question carries four marks

23. Explain the diagonal relationship of elements with examples
24. What are the environmental problems of long term use of fertilizers.
25. Write a note on (a) redox indicators. (b) elimination of phosphate anion during the analysis of cations
26. Describe briefly co-precipitation and post- precipitation.
27. Explain the source and hazards of fly ash and asbestos.
28. An electron is confined in a one dimensional box of length 1Å. Calculate its ground state energy in eV.
29. Draw the radial probability distribution curves of 2s and 2p electron.
30. Discuss the applications of common ion effect and solubility product in quantitative analysis.
31. Explain the cause and consequences of green house effect.

$6 \times 4 = 24$ marks

Section D
Long essay
Answer any two questions from the following
Each question carries fifteen marks

32. Discuss the principles involved in various chromatographic separations.
33. What are various Environmental segments of earth? Write an essay on air pollution.
34. Explain the electronegativity in terms of Pauling, Mulliken and Alred – Rochow scales.
35. Obtain the solution of Schrodinger wave equation of a particle in a three – dimensional box.

$2 \times 15 = 30$ marks

SYLLABUS OF COMPLEMENTARY COURSE

(For students of Physics Majors)

I B.Sc Complementary CHEMISTRY

PRINCIPLES OF CHEMISTRY

SEMESTER I Complementary Course N o. – 1 Course Code - CH1131 .1 Credit-2

Total Hour 36   **L–T-P2-0-2**

Module – 1: Atomic Structure

Atomic spectrum of Hydrogen – different series, Rydberg equation, Bohr theory – postulates – statement of Bohr energy equation – derivation of spectral frequency from Bohr equation. Schrodinger wave equation (no derivation mention only) concept of orbitals, the four quantum numbers and their significances. Orbital wise electron configuration, energy sequence rule – Pauli's principle, Hund's rule, stability of filled and half filled orbitals

9 Hrs

Module II - Chemical bonding – Energetic of bond formation – Types of Chemical bonds – Energetics of ionic bond formation – Lattice energy – Born Haber Cycle – partial covalent nature of ionic bond – Fajan's rules , polarity of covalent bond its relation with electronegativity – electro negativity scales – Paulings and Mullikan's approaches, factors influencing polarity , dipole moment – its relation to geometry. Hydrogen bond – inter and intra molecular – its consequences on boiling point –volatility and solubility. Hybridisation and structure of molecules – SP, SP2, SP3, dSP2, dSP3, SP3d2, and SP3d3 hybridisation with examples. Explanation of bond angle in water and ammonia VSEPR theory, geometry of molecules with bond pairs of electrons only, geometry of molecules containing bond pairs and lone pairs of electrons, limitations. A brief review of molecular orbital approach, LCAO method – bond order, bond distance and stability of O2, O2 2+,O2 2- ,NO,NO+,COandHF.

9hrs

Module III – Thermodynamics

First law of thermodynamics, mathematical form, intrinsic energy, enthalpy, reversible, process and maximum work, work of expansion of an ideal gas in reversible isothermal process. Heat capacity of gases at constant volume and constant pressure, derivation of CP – CV = R. Second law of thermodynamics, entropy and free energies, significance of DG, DH and available work – criteria of equilibrium, and spontaneity, on the basis of entropy and free energy.

9 Hrs

Module IV Thermochemistry Enthalpies of formation, combustion, neutralization, solution and hydration. Relation between heat of reaction at constant volume and constant pressure, variation of heat of reaction with temperature. Kirchoff's equation, Hess's law

and application – bond dissociation energies and bond energies of different types of bonds, their calculation and enthalpies of reaction.

9 hrs

References
1. Atomic structure and chemical bonding with introduction to Molecular spectroscopy – Manas Chanda.
2. Concise Inorgantic Chemistry – J.D. Lee
3. Elements of Nuclear Chemistry – Arnikar
4. Environmental Chemistry – A.K. De
5. Principles of Physical Chemistry Puri, Sharma, Pathania.
6. Physical Chemistry - N. M. Kapoor.

Model Question.

B.Sc. complementary Chemistry - offered to Physics majors

Course Code - CH1131 .1 Semester I Course - I

Principles of Chemistry

Time : Three Hours   **Maximum Marks: 80**

Section A
Answer all Questions. Answer in one word to maximum of two sentences
Each question carries one mark

1. The angular momentum of the electron according to the Bohr model is an integral multiple of ………
2. Write Rydberg equation.
3. State first law of thermodynamics
4. What is Gibbs energy?
5. What is isothermal expansion?
6. What is the thermodynamic criteria of a spontaneous process?
7. Why BCl_3 is planar?
8. Which is more stable O_2 or O_2^{2+} ?
9. What is the enthalpy for elementary substances in their standard state?
10. What is the unit of dipole moment?

$10x1 = 10$ marks

Section B
Short answer type (Not to exceed one paragraph)
Answer any 8 questions from the following.
Each question carries two marks

1. State and explain Pauli's exclusion principle.
2. Name two types of hydrogen bonding with example.
3. State and explain Fajan's rule.
4. Define (i) work function (ii) Gibb's free energy function.
5. State and explain Hess's law.
6. Define standard enthalpy of formation of a compound.
7. Calculate the wavelength of radiation emitted when the electron in the hydrogen atom jumps from n=4 to n=2 level
8. Define the terms Cp and Cv of an ideal gas. How are they related.?
9. Define enthalpy of neutralization.
10. Give Schrodinger wave equation and explain the terms.
11. Explain VSEPR theory with examples of regular and irregular geometry.
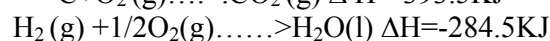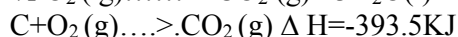12. State and explain the second law of thermodynamics.

Section C
Short essay (Not to exceed 120 words)
Answer any 6 questions from the following.
Each question carries four marks

13. Distinguish between bond dissociation energy and bond energy.
14. Distinguish between diathermic work and adiabatic work.
15. Derive Kirchoff's equation. Calculate the heat of formation of ethane from the following data

$$C_2H_6(g) +3 \tfrac{1}{2} O_2 (g)\ldots\ldots>2CO_2 (g) +3H_2O(l) \; \Delta H=-1560KJ$$
$$C+O_2 (g)\ldots>.CO_2 (g) \; \Delta H=-393.5KJ$$
$$H_2 (g) +1/2O_2(g)\ldots\ldots>H_2O(l) \; \Delta H=-284.5KJ$$

16. Explain Born Haber Cycle with example.
17. Explain dsp^2 and dsp^3 hybridisation with examples.
18. Write the postulates of Bohr theory.
19. Explain reversible process and maximum work.
20. Explain electronegativity scales of Pauling and Mulliken.
21. Explain the structure of SF_6.

6× 4 = 24 marks

Section D
Long essay
Answer any two questions from the following
Each question carries fifteen marks

22. What are the postulates of M.O.T. Compare bonding molecular orbital and antibonding molecular orbital.
23. Write briefly on the four quantum numbers and their significances.
24. Derive an expression for the work done in reversible isothermal expansion of an ideal gas. Calculate the work done when 5 moles of an ideal gas is expanded isothermally and reversibly from a pressure of 10 atm to 2 atm at 27^0 c.
25. Write briefly on bond order, bond distance and the stability of NO and CO on the basis of molecular orbital approach.

2×15 = 30 marks

Complementary Chemistry offered to Geology Majors

SYLLABUS OF COMPLEMENTARY COURSE

(For students of Geology Majors)

PRINCIPLES OF CHEMISTRY

SEMESTER I Complementary Course N o. – 1 Course Code - CH1131 .2

Credit-2

TotalHours36   **L–T-P2-0-2**

Module – 1: Atomic Structure
Atomic spectrum of Hydrogen – different series, Rydberg equation, Bohr theory – postulates – statement of Bohr energy equation – derivation of spectral frequency from Bohr equation. Schrodinger wave equation (no derivation mention only) concept of orbitals, the four quantum numbers and their significances. Orbital wise electron configuration, energy sequence rule – Pauli's principle, Hund's rule, stability of filled and half filled orbitals

9 Hrs

Module II - Chemical bonding – Energetic of bond formation – Types of Chemical bonds – Energetics of ionic bond formation – Lattice energy – Born Haber Cycle – partial covalent nature of ionic bond – Fajan's rules , polarity of covalent bond its relation with electronegativity – electro negativity scales – Paulings and Mullikan's approaches, factors influencing polarity , dipole moment – its relation to geometry. Hydrogen bond – inter and intra molecular – its consequences on boiling point –volatility and solubility. Hybridisation and structure of molecules – SP, SP2, SP3, dSP2, dSP3, SP3d2, and SP3d3 hybridisation with examples. Explanation of bond angle in water and ammonia VSEPR theory, geometry of molecules with bond pairs of electrons only, geometry of molecules containing bond pairs and lone pairs of electrons, limitations. A brief review of molecular orbital approach, LCAO method – bond order, bond distance and stability of O_2, O_2^{2+}, O_2^2 ,NO,NO+,CO and HF.

9hrs

Module III – Thermodynamics
First law of thermodynamics, mathematical form, intrinsic energy, enthalpy, reversible, process and maximum work, work of expansion of an ideal gas in reversible isothermal process. Heat capacity of gases at constant volume and constant pressure, derivation of CP – CV = R. Second law of thermodynamics, entropy and free energies, significance of DG,DH and available work – criteria of equilibrium, and spontaneity , on the basis of entropy and free energy.

9 Hrs

Module IV Thermochemistry Enthalpies of formation, combustion, neutralization, solution and hydration. Relation between heat of reaction at constant volume and constant pressure, variation of heat of reaction with temperature. Kirchoff's equation, Hess's law and application – bond dissociation energies and bond energies of different types of bonds, their calculation and enthalpies of reaction.

9 hrs

References
1.Atomic structure and chemical bonding with introduction to Molecular spectroscopy – Manas Chanda.
2.Concise Inorgantic Chemistry – J.D. Lee
3.Elements of Nuclear Chemistry – Arnikar
4.Environmental Chemistry – A.K. De
5.Principles of Physical Chemistry Puri, Sharma, Pathania.
6.Physical Chemistry - N. M. Kapoor.

Model Question.

B.Sc. complementary Chemistry - offered to Geology majors

Course Code - CH1131 .2 Semester I Course - I

Principles of Chemistry

Time : Three Hours   Maximum Marks: 80

Section A
**Answer all Questions. Answer in one word to maximum of two sentences
Each question carries one mark**

1. The angular momentum of the electron according to the Bohr model is an integral multiple of ………
2. Write Rydberg equation.
3. State first law of thermodynamics
4. What is Gibbs energy?
5. What is isothermal expansion?
6. What is the thermodynamic criteria of a spontaneous process?
7. Why BCl_3 is planar?
8. Which is more stable O_2 or O_2^{2+} ?
9. What is the enthalpy for elementary substances in their standard state?
10. What is the unit of dipole moment?

$10x1 = 10$ marks

Section B
Short answer type (Not to exceed one paragraph)
Answer any 8 questions from the following.
Each question carries two marks

11. State and explain Pauli's exclusion principle.
12. Name two types of hydrogen bonding with example.
13. State and explain Fajan's rule.
14. Define (i) work function (ii) Gibb's free energy function.
15. State and explain Hess's law.
16. Define standard enthalpy of formation of a compound.
17. Calculate the wavelength of radiation emitted when the electron in the hydrogen atom jumps from n=4 to n=2 level
18. Define the terms Cp and Cv of an ideal gas. How are they related.?
19. Define enthalpy of neutralization.
20. Give Schrodinger wave equation and explain the terms.
21. Explain VSEPR theory with examples of regular and irregular geometry.
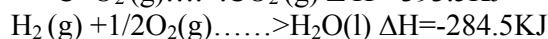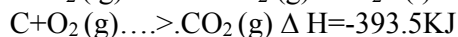22. State and explain the second law of thermodynamics.

Section C
Short essay (Not to exceed 120 words)
Answer any 6 questions from the following.
Each question carries four marks

23. Distinguish between bond dissociation energy and bond energy.
24. Distinguish between diathermic work and adiabatic work.
25. Derive Kirchoff's equation. Calculate the heat of formation of ethane from the following data

$$C_2H_6 (g) +3 \frac{1}{2} O_2 (g)……>2CO_2 (g) +3H_2O(l) \Delta H=-1560KJ$$
$$C+O_2 (g)….>.CO_2 (g) \Delta H=-393.5KJ$$
$$H_2 (g) +1/2O_2(g)……>H_2O(l) \Delta H=-284.5KJ$$

26. Explain Born Haber Cycle with example.
27. Explain dsp^2 and dsp^3 hybridisation with examples.
28. Write the postulates of Bohr theory.
29. Explain reversible process and maximum work.
30. Explain electronegativity scales of Pauling and Mulliken.
31. Explain the structure of SF_6.

6× 4 = 24 marks

Section D
Long essay
Answer any two questions from the following
Each question carries fifteen marks

32. What are the postulates of M.O.T. Compare bonding molecular orbital and antibonding molecular orbital.
33. Write briefly on the four quantum numbers and their significances.
34. Derive an expression for the work done in reversible isothermal expansion of an ideal gas. Calculate the work done when 5 moles of an ideal gas is expanded isothermally and reversibly from a pressure of 10 atm to 2 atm at 27^0 c.
35. Write briefly on bond order, bond distance and the stability of NO and CO on the basis of molecular orbital approach.

2×15 = 30 marks

Complementary Chemistry offered to Botany Majors

SYLLABUS OF COMPLEMENTARY COURSE

Theoretical Chemistry (For Students of Botany Majors)

SEMESTER 1 Complementary Course No. - 1 Course Code -CH1131 .3 Credit-2

L-T-P 2-0-2   **36 Hours**

Module I – Atomic Structure   **(9 hrs)**
Atomic spectrum of hydrogen - different series, Rydberg equation, Bohr theory – postulates – statement of Bohr energy equation – derivation of spectral frequency from Bohr equation. Schrodinger wave equation (mention only, no derivation), concept of orbitals, the four quantum numbers and their significances. Orbitalwise electron configuration, energy sequence rule – Pauli's principle, Hund's rule, Stability of filled and half filled orbitals. Electronic configuration of lanthanides and actinides, Lanthanide contraction

Module II – Chemical Bonding   **(9 hrs)**
Energetics of bond formation – Born-Haber cycle. Hybridisation and structure of molecules – sp, sp2, sp3, dsp2, dsp3, sp3d2 and sp3d3 hybridisation with examples. Explanation of bond angle in water and ammonia. VSEPR theory with regular and irregular geometry –. Hydrogen bond – inter and intra molecular – its consequences on boiling point – volatility and solubility. Partial covalent character of the ionic bond – Fajan's Rules. A brief review of molecular orbital approach – LCAO method – bond order, bond distance and stability of O2, O2 2+, O2 2-, NO, NO+, CO and HF.

Module III – Analytical Principles   **(9 hrs)**
Principles of volumetric analysis – primary standard – standard solutions normality and molarity, theory of acid-base titrations, permagnometric and dichrometric titrations, iodometry and complexometric titrations. Theory of acid-base indicator – redox indicators. Principles of colorimetric titration.

Module IV – Organometallics   **(9 hrs)**
Definition and classification, Organo metallic compounds of Mg, Sn, Li, Hg, Fe and their synthesis, applications. Biological and environmental aspects of organic compounds – Organometallic compounds in medicines – organomercury, organoboron, organosilicon and organo arsenic compounds – outline of preparation and uses. Antitumour drugs, silylated derivatives of bioactive organic compounds in agriculture and horticulture. Environmental aspects of Organometallic compounds.

Reference:
1. Atomic structure and chemical bonding with introduction to molecular spectroscopy – Manas Chanda
2. Concise Inorganic Chemistry – J.D. Lee

3. Environmental Chemistry A. K. De
4. Modern Inorganic Chemistry A.D. Madan
5.Co-ordination Chemistry – Bosolo and Johns
6.Chemistry of Organometallics – Rochoco.

MODEL QUESTION PAPER - CHEMISTRY (Complementary) offered to Botany

majors Course Code – CH1131 .3 Semester I Course- I

Theoretical Chemistry

Time : Three Hours   **Maximum Marks: 80**

Section A,
Answer all Questions. Answer in one word to maximum of two sentences
Each question carries one mark
1. Give the relation between energy and frequency.
2. Write the valence shell configuration of Cu (atomic number 29).
3. Write Bohr wave number equation?
4. Sketch the shape of p_x orbital.
5. What is the hybridization of nitrogen in ammonia?
6. Give an example for a sigma bonded organometallic compound.
7. Draw the structure of a molecule possessing intra molecular hydrogen bonding.
8. Calculate the bond order of a O_2 molecule.
9. Calculate the amount of Mohr's salt (Equivalent Mass = 392) needed to prepare 250 mL of 0.2 normal aqueous solution.
10. Which is the indicator suitable for the titration of $H_2C_2O_4$ against NaOH

                                                                                     10x1 = 10 marks

Section B
Short answer type (Not to exceed one paragraph)
Answer any 8 questions from the following.
Each question carries two marks

11. Mention the type of hybridization in the following compounds.
        i). BF_3 ii) CH_4 iii) PCl_5 iv) SF_6
12. Explain the factors influencing polarity of covalent bond.
13. Explain the different series in the atomic spectrum of hydrogen.
14. State and explain Pauli's exclusion principle.
15. What are redox titrations? Give two examples.
16. How will you prepare 100 ml 0.05 M Mohr's salt solution?
17. What is Ferrocene? How is it synthesized?
18. What are Grignard Reagents? Mention any two uses.
19. What is Cis Platin? Give its structure.
20. Explain Hund's rule of maximum multiplicity.
21. What is a primary standard?

                                                                                     8×2 = 16 marks

Section C
Short essay (Not to exceed 120 words)

Answer any 6 questions from the following.
Each question carries four marks

22. Write a note on the four quantum numbers.
23. What is meant by dipole moment? How it is helpful in explaining the structure of molecule.
24. Explain the theory of acid-base indicators.
25. Explain the bond angles in NH_3 & H_2O using VSEPR theory.
26. Explain the postulates of Bohr theory.
27. Differentiate between bonding and antibonding molecular orbitals. Calculate the bond order of O_2^+ ion.
28. Write a note on the role of organometallic compounds in the field of medicines.
29. Discuss the synthesis and application of any organo lithium compound.
30. What is lanthanide contraction and what are its consequences?

$6\times 4 = 24$ marks

Section D
Long essay
Answer any two questions from the following
Each question carries fifteen marks

31. What is lattice energy? Write a note on Born-Haber cycle.
32. Derive Bohr frequency equation. Calculate the wavelength of the first spectral line of Balmer series.
33. Briefly explain different types of acid- base titrations and their indicators with suitable examples
35. Highlight the environmental aspects of organometallic compounds.

$2\times15 = 30$ marks

Complementary Chemistry offered to Zoology Majors

SYLLABUS OF COMPLEMENTARY COURSE

Theoretical Chemistry (For Students of Zoology Majors)

SEMESTER 1 Complementary Course No. - 1 Course Code-CH1131 .4 Credit-2

L-T-P 2-0-2   **36 Hours**

Module I – Atomic Structure   **(9 hrs)**
Atomic spectrum of hydrogen - different series, Rydberg equation, Bohr theory –
postulates – statement of Bohr energy equation – derivation of spectral frequency from
Bohr equation. Schrodinger wave equation (mention only, no derivation), concept of
orbitals, the four quantum numbers and their significances. Orbitalwise electron
configuration, energy sequence rule – Pauli's principle, Hund's rule, Stability of filled and
half filled orbitals. Electronic configuration of lanthanides and actinides, Lanthanide
contraction

Module II – Chemical Bonding   **(9 hrs)**
Energetics of bond formation – Born-Haber cycle. Hybridisation and structure of
molecules – sp, sp2, sp3, dsp2, dsp3, sp3d2 and sp3d3 hybridisation with examples.
Explanation of bond angle in water and ammonia. VSEPR theory with regular and
irregular geometry –. Hydrogen bond – inter and intra molecular – its consequences on
boiling point – volatility and solubility. Partial covalent character of the ionic bond –
Fajan's Rules. A brief review of molecular orbital approach – LCAO method – bond
order, bond distance and stability of O2, O2 2+, O2 2-, NO, NO+, CO and HF.

Module III – Analytical Principles   **(9 hrs)**
Principles of volumetric analysis – primary standard – standard solutions normality and
molarity, theory of acid-base titrations, permagnometric and dichrometric titrations,
iodometry and complexometric titrations. Theory of acid-base indicator – redox indicators.
Principles of colorimetric titration.

Module IV – Organometallics   **(9 hrs)**
Definition and classification, Organo metallic compounds of Mg, Sn, Li, Hg, Fe and their
synthesis, applications. Biological and environmental aspects of organic compounds –
Organometallic compounds in medicines – organomercury, organoboron, organosilicon
and organo arsenic compounds – outline of preparation and uses. Antitumour drugs,
silylated derivatives of bioactive organic compounds in agriculture and horticulture.
Environmental aspects of Organometallic compounds.

Reference:
1. Atomic structure and chemical bonding with introduction to molecular
spectroscopy – Manas Chanda
2. Concise Inorganic Chemistry – J.D. Lee

3. Environmental Chemistry A. K. De
4. Modern Inorganic Chemistry A.D. Madan
5.Co-ordination Chemistry – Bosolo and Johns
6.Chemistry of Organometallics – Rochoco**.**

MODEL QUESTION PAPER - CHEMISTRY (Complementary) offered to Zoology

majors Course Code – CH1131 .4 Semester I Course- I

Theoretical Chemistry

Time : Three Hours   **Maximum Marks: 80**

Section A,
Answer all Questions. Answer in one word to maximum of two sentences
Each question carries one mark
1. Give the relation between energy and frequency.
2. Write the valence shell configuration of Cu (atomic number 29).
3. Write Bohr wave number equation?
4. Sketch the shape of p_x orbital.
5. What is the hybridization of nitrogen in ammonia?
6. Give an example for a sigma bonded organometallic compound.
7. Draw the structure of a molecule possessing intra molecular hydrogen bonding.
8. Calculate the bond order of a O_2 molecule.
9. Calculate the amount of Mohr's salt (Equivalent Mass = 392) needed to prepare 250 mL of 0.2 normal aqueous solution.
10. Which is the indicator suitable for the titration of $H_2C_2O_4$ against NaOH

$10x1 = 10$ marks

Section B
Short answer type (Not to exceed one paragraph)
Answer any 8 questions from the following.
Each question carries two marks

11. Mention the type of hybridization in the following compounds.
        i). BF_3 ii) CH_4 iii) PCl_5 iv) SF_6
12. Explain the factors influencing polarity of covalent bond.
13. Explain the different series in the atomic spectrum of hydrogen.
14. State and explain Pauli's exclusion principle.
15. What are redox titrations? Give two examples.
16. How will you prepare 100 ml 0.05 M Mohr's salt solution?
17. What is Ferrocene? How is it synthesized?
18. What are Grignard Reagents? Mention any two uses.
19. What is Cis Platin? Give its structure.
20. Explain Hund's rule of maximum multiplicity.
21. What is a primary standard?

$8\times2 = 16$ marks

Section C
Short essay (Not to exceed 120 words**)**
Answer any 6 questions from the following.
Each question carries four marks

22. Write a note on the four quantum numbers.
23. What is meant by dipole moment? How it is helpful in explaining the structure of molecule.
24. Explain the theory of acid-base indicators.
25. Explain the bond angles in NH_3 & H_2O using VSEPR theory.
26. Explain the postulates of Bohr theory.
27. Differentiate between bonding and antibonding molecular orbitals. Calculate the bond order of O_2^+ ion.
28. Write a note on the role of organometallic compounds in the field of medicines.
29. Discuss the synthesis and application of any organo lithium compound.
30. What is lanthanide contraction and what are its consequences?

6× 4 = 24 marks

Section D
Long essay
Answer any two questions from the following
Each question carries fifteen marks

31. What is lattice energy? Write a note on Born-Haber cycle.
32. Derive Bohr frequency equation. Calculate the wavelength of the first spectral line of Balmer series.
33. Briefly explain different types of acid- base titrations and their indicators with suitable examples
35. Highlight the environmental aspects of organometallic compounds.

2×15 = 30 marks

Semester-1 Complementary Course No. - 1 **Course Code-CH1131 .5**
Credit-2 L-T-P 2-0-2
SEMESTER 1
Inorganic and Analytical Chemistry 36 hrs

Module I –Atomic structure 9 hrs

Atomic spectra of hydrogen,-different series, Rydberg equation. Bohr theorypostulates –statement of Bohr energy equation –derivation of spectral frequency from Bohr equation-Schrodinger wave equation(mention only), concepts of orbitals, the four quantum numbers and their significance- Orbitalwise electron configuration,energy sequence rule, Pauli's principle, Hund's rule, stability of filled and half filled orbitals.

Module II- Analytical Principles 9 hrs

Principles of volumetric analysis, primary standards, Standard solutions, normality and molarity, numerical problems, theory of acid base titrations, permanganometric and dichrometric titrations, theory of acid base and redox indicators.(Numerical problems are to be worked out)

Module III- Radioactivity and Nuclear Chemistry 9 hrs

Radioactive equilibrium, , detection of radio activity, Geiger Muller Counter, Wilson cloud chamber, Units of radioactivity-Curie and Rutherford. Applications of radio activity- in medicine and agriculture, biological effects of radiation, pathological and genetic damage, Nuclear Chemistry-stability of nucleus, n/p ratio, artificial transmutation and radioactivity, mass defect, binding energy, neutron activation analysis

Module IV- Organometallics and biomolecules 9 hrs

Organometallic compounds –Definition and classification, Biological and environmental aspects of organometallics-organometallics in medicine ,Organo mercury, boron, silicon and arsenic compounds. Biomolecules –Metallo porphyrins, Haemoglobin and Myoglobin.

References

1. Concise Inorganic Chemistry J. D. Lee
2. Inorganic Chemistry Puri and Sharma
3. Chemistry of Organometallics Rochow
4. Organic Chemistry Vol 2 I.L. Finar
5. Chemistry of natural products Vol. 1 Gurdeep Chatwal
6 The Text Book of Organic Chemistry P.L Soni, H.M. Chowla
7. Modern Inorganic Chemistry R D Madan.

Model Question Paper of Chemistry complementary for Homescience Majors
Semester I CH1131 .6 Course- I
Inorganic and Analytical Chemistry

Time 3 hours   **Marks 80**

Section A,
Answer all Questions. Answer in one word to maximum of two sentences
Each question carries one mark

Answer all questions.
1. State Heisenberg's uncertainty principle.
2. Give one example for a redox titration.
3. Name an indicator used in complexometric titrations.
4. Which quantum number determines the orbital angular momentum of the electron?
5. What is the hybridisation in XeF_4 molecule
6. What are the units of radioactivity?
7. Calculate the amount of hydrated oxalic acid (Eq. Wt = 63)needed to prepare a 0.2N solution of volume 250mL.
8. Name a sigma bonded organometallic compound.
9. Which indicator is used for the titration between strong base and weak acid.
10. Write the stable electronic configuration of Cr.

$$10x1 = 10 \text{ marks}$$

Section B
Short answer type (Not to exceed one paragraph)
Answer any 8 questions from the following.
Each question carries two marks

11. What is packing fraction?
12. Explain artificial transmutation?
13. Name a device used to detect radioactivity.
14. What are Grignard reagents?
15. Draw the shapes of d orbitals
16. Give the names of two redox indicators
17. Write a note on stability of nucleus by n\p ratio.
18. Explain a method of preparation of organo mercuric compound.
19. Draw the structure of Mg Porphyrin
20. Find the volume of 0.1250 N HCl needed to neutralize 20 mL of 0.2250 N NaOH.
21. Why HCl is not used to acidify in permanganometric titrations?
22. Give the structure of two organo arsenic compounds .

$$8 \times 2 = 16 \text{ marks}$$

Section C
Short essay (Not to exceed 120 words**)**
Answer any 6 questions from the following.
Each question carries four marks

23. Define electronegativity, explain Pauling's electronegativity scale.
24. Explain the i) wave nature of material objects. ii)What is uncertainty principle?
25. Write a short note on applications of organometallic compounds in medicine.
26. Explain Geiger Muller Counter
27. Explain nuclear fission and nuclear fusion.
28. Explain normality, molarity and molality.
29. What are quantum numbers? Explain its significance.
30. What are the applications of radioactivity in agriculture ?
31. Derive Bohr frequency equation.

$$6 \times 4 = 24 \text{ marks}$$

Section D
Long essay
Answer any two questions from the following.
Each question carries fifteen marks

32. Write a note on the theory of acid base titrations and indicators.
33. What are biological effects of radiation? What is the use of radioactive isotopes in medicine
34. Give a comparative account of the structure and functions of Myoglobin and Haemoglobin
35. Write short notes on i) Rydberg equation. ii) neutron activation analysis iii) Pauli's exclusion principle

$$2 \text{ x } 15 = 30 \text{ marks}$$

Syllabus for complementary courses
(for Bio Chemistry Majors)
Semester-1 Complementary Course No. - 1 Course Code-CH1131 .6
Credit-2 L-T-P 2-0-2
SEMESTER 1
Inorganic and Analytical Chemistry 36 hrs

Module I –Atomic structure 9 hrs
Atomic spectra of hydrogen,-different series, Rydberg equation. Bohr theorypostulates
–statement of Bohr energy equation –derivation of spectral frequency from
Bohr equation-Schrodinger wave equation(mention only), concepts of orbitals, the four
quantum numbers and their significance- Orbitalwise electron configuration, energy
sequence rule, Pauli's principle, Hund's rule, stability of filled and half filled orbitals.
Module II- Analytical Principles 9 hrs
Principles of volumetric analysis, primary standards, Standard solutions, normality
and molarity, numerical problems, theory of acid base titrations, permanganometric and
dichrometric titrations, theory of acid base and redox indicators.(Numerical problems are
to be worked out)
Module III- Radioactivity and Nuclear Chemistry 9 hrs
Radioactive equilibrium, , detection of radio activity, Geiger Muller Counter, Wilson
cloud chamber, Units of radioactivity-Curie and Rutherford. Applications of radio
activity- in medicine and agriculture, biological effects of radiation, pathological and
genetic damage, Nuclear Chemistry-stability of nucleus, n/p ratio, artificial transmutation
and radioactivity, mass defect, binding energy, neutron activation analysis
Module IV- Organometallics and biomolecules 9 hrs
Organometallic compounds –Definition and classification, Biological and
environmental aspects of organometallics-organometallics in medicine ,Organo mercury,
boron, silicon and arsenic compounds. Biomolecules –Metallo porphyrins, Haemoglobin
and Myoglobin.
References
1. Concise Inorganic Chemistry J. D. Lee
2. Inorganic Chemistry Puri and Sharma
3. Chemistry of Organometallics Rochow
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6 The Text Book of Organic Chemistry P.L Soni, H.M. Chowla
7. Modern Inorganic Chemistry R D Madan

Model Question Paper Chemistry complementary for Biochemistry Majors
Semester I CH1131 .6 Course - I
Inorganic and Analytical Chemistry

Time 3 hours   **Marks 80**

Section A,
Answer all Questions. Answer in one word to maximum of two sentences
Each question carries one mark

Answer all questions.
1. State Heisenberg's uncertainty principle.
2. Give one example for a redox titration.
3. Name an indicator used in complexometric titrations.
4. Which quantum number determines the orbital angular momentum of the electron?
5. What is the hybridisation in XeF_4 molecule
6. What are the units of radioactivity?
7. Calculate the amount of hydrated oxalic acid (Eq. Wt = 63)needed to prepare a 0.2N solution of volume 250mL.
8. Name a sigma bonded organometallic compound.
9. Which indicator is used for the titration between strong base and weak acid.
10. Write the stable electronic configuration of Cr.

                                                                                                   $10x1 = 10$ marks

Section B
Short answer type (Not to exceed one paragraph)
Answer any 8 questions from the following.
Each question carries two marks

11. What is packing fraction?
12. Explain artificial transmutation?
13. Name a device used to detect radioactivity.
14. What are Grignard reagents?
15. Draw the shapes of d orbitals
16. Give the names of two redox indicators
17. Write a note on stability of nucleus by n\p ratio.
18. Explain a method of preparation of organo mercuric compound.
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Section C
Short essay (Not to exceed 120 words)
Answer any 6 questions from the following.
Each question carries four marks

23. Define electronegativity, explain Pauling's electronegativity scale.
24. Explain the i) wave nature of material objects. ii)What is uncertainty principle?
25. Write a short note on applications of organometallic compounds in medicine.
26. Explain Geiger Muller Counter
27. Explain nuclear fission and nuclear fusion.
28. Explain normality, molarity and molality.
29. What are quantum numbers? Explain its significance.
30. What are the applications of radioactivity in agriculture ?
31. Derive Bohr frequency equation.

6 × 4 = 24 marks

Section D
Long essay
Answer any two questions from the following.
Each question carries fifteen marks

32. Write a note on the theory of acid base titrations and indicators.
33. What are biological effects of radiation? What is the use of radioactive isotopes in medicine
34. Give a comparative account of the structure and functions of Myoglobin and Haemoglobin
35. Write short notes on i) Rydberg equation. ii) neutron activation analysis iii) Pauli's exclusion principle

2 x 15 = 30 marks