

University of Kerala
Model Question Paper of B.Sc. Chemistry Programme
2017 onwards

Semester -I Core Course-1 Course Code - CH1141 Credit-

4INORGANIC CHEMISTRY I Time: Three Hours

Maximum Marks: 80

SECTION A (Answer **all** questions in one word/one sentence. Each question carries **1** mark)

1. Mention about the flame colouration of II group elements.
2. Write an example of classic smog.
3. State Heisenberg's uncertainty principle.
4. What are matter waves?
5. Which is the conjugate base of HF.
6. Define covalent radius.
7. Write the reason for eutrophication?
8. In the stratosphere, fluorine from the CFC's change to which compound.
9. What is active hydrogen?
10. Mention any use of alkali metals.

(1 X 10 = 10marks)

SECTION B (Answer any **8** questions. Each question carries **2** Marks)

11. Calculate the wavelength of electron moving with a velocity of 10^6 ms^{-1} .
12. A cricket ball weighing 100g is to be located within 0.1 \AA . What is the uncertainty in its velocity?
13. What are eigen values and eigen functions?
14. How first element differs from other elements in a group?
15. What is COD?
16. What are ortho and para hydrogens.
17. Write SHAB principle?
18. Comment about the hydration of alkali metals?
19. State and illustrate Pauli's Exclusion Principle.
20. Distinguish between levelling solvents and differentiating solvents.
21. Write a note on green house effect.
22. What is acid rain? Explain the various types of hydrogen bonds.

(2 X 8 = 16marks)

SECTION C (Answer any **6** questions. Each question carries **4** Marks)

23. Discuss the following reactions in liquid SO_2 ? (i) Solvation (ii) acid- base reaction
24. Discuss the structure of beryllium chloride
25. Derive Schrodinger wave equation.
26. Briefly explain about the Davisson and Germer's experimental verification of wave nature of electron.
27. What is smog? What are the different types of smog?
28. How ozone layer is depleted?
29. What is the trend of Ionization enthalpy and electron gain enthalpy in the periodic table?
30. What are hydrides? Explain.
31. Discuss about the redox property of alkali metals

(4 X 6 = 24marks)

SECTION D

(Answer any **2** questions. Each question carries **15** Marks)

32. (a) Briefly discuss about the various air pollutants (5 Marks)
(b) Write a note on Ozone depletion (5 Marks)
(c) Explain about the various water quality parameters (5 Marks)
33. (a) What are quantum numbers? Explain (5 Marks)
(b) Write a note on various electronegativity scales (5 Marks)
(c) Explain about the various rules for writing electronic configuration. (5 Marks)
34. (a) What is the difference between inter and intra molecular hydrogen bonding with example.
(b) Discuss the topic hydrogen as next generation fuel
(c) Liquid ammonia is a better solvent for organic compounds. Why?

- 35.(a) What are the common characteristics of solvents?
(b) Discuss the various methods for removal of permanent hardness
(c) Compare the solubility products of hydroxides and sulphates of alkaline earth metals.
(15 X 2 = 30marks)

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Model Question Paper of B.Sc. Chemistry Programme

2017 onwards

Semester II Foundation Course 2 Course Code CH1221 Credit-2 Methodology and Perspectives of Sciences and General Informatics Time: Three Hours

Maximum Marks: 80

Section- A

Each question carries one mark

Answer **all** Questions. Answer in one word / sentence. Each question carries 1 mark.

1. Who is the father of modern chemistry?
2. Define null hypothesis.
3. What is NPTEL?
4. What do you mean by plagiarism?
5. What are the contributions of Dmitri Mendeleev?
6. What are variables?
7. Define common ion effect
8. What are redox indicators?
9. Define accuracy
10. Write the name of two toxic chemicals used in chemistry laboratory.

Section B (short answer type)

(Answer any 8 questions from the following. Each answer carries 2 mark)

11. What is co-precipitation?
12. Define standard deviation.
13. Write a short note on a chemical which is skin irritant.
14. What is meant by data representation?
15. Name four chemistry related softwares?
16. Mention the toxicity of strong acids
17. What is a chemical database?
18. Explain basic concepts of IPR?
19. What are the features of modern personal computer?
20. What are acid base indicators ?
21. What is TLC?
22. Which are the factors affecting solubility of precipitates. **Section C (Short essay type)**

Answer **any 8** from the following. Each question carries **4** marks.

23. What is meant by revision of scientific theories and laws?
24. Explain documentation of experiments.
25. Explain the applications of cheminformatics.
26. Explain copy right and patents.
27. Explain enquiry vs discovery approach?
28. Discuss about the carcinogenic chemicals used in the laboratory.
29. What is the scope of chemical science?
30. Write a short note on the theory of an acid base indicator
31. Explain the principle of gravimetric titration with an example.

Section D.

Answer **any 2** from the following. Each question carries **15** marks

32. (a) Explain the various types of file formats. (5 marks)
- (b) databases used in cheminformatics ? (5 marks)
- (c) Write the SMILES of Methane, Benzene and cyclohexane. (5 marks)

33. (a) Discuss about chemical safety.
(b) Discuss about the theory of titration.
(c) Write a note on the knowledge of hazard warning informations.
- 34.(a) Write a short note on the evolution of modern chemistry.
(b) Write a note on induction-deduction methods in knowledge transfer process.
- 35.(a) Explain the applications of common ion effect and solubility product in analysis of cations. (10 marks)
(b)Write a short note on method to avoid accidents in chemical laboratory. (5marks)

**Model Question Paper of B.Sc. Chemistry Programme
2017 admissions onwards**

**Semester -III Core Course-II Course Code – CH1341 Credit-
3INORGANIC CHEMISTRY ITime: Three Hours**

Maximum Marks: 80

SECTION A

(Answer **all** questions. Each question carries **1** mark)

1. What is the bond order of O_2^+ .
2. What is fullerenes?
3. What are nano sensors?
4. Name the hydrogen bonding in salicylaldehyde.
5. What is inorganic benzene?
6. Write an example for inter halogen compound.
7. Example for phosphorus based polymer.
8. Name a naturally occurring radioactive element.
9. Write an example of carboranes?
10. What is zeolite.

SECTION B

(Answer any **8** questions. Each question carries **2** Marks)

11. Compare the properties of Borazole with benzene
12. Explain the method of preparation of gold nano particles
13. Applications of nano particles in medicine and electronics
14. Write a note on Fajans rule
15. Calculate the bond order of N_2 , B_2 , C_2 and O_2
16. What are the limitations of VBT?
17. Explain the structure of diborane
18. What is lattice energy?
19. State Geiger –Nuttal rule.
20. What are carboranes ?
21. Write a note on Born-Haber cycle
22. What is nuclear fission ?

SECTION C

(Answer any **6** questions. Each question carries **4** Marks)

23. Draw the MO diagram for NO and C_2 molecule
24. Give a comparative account of VB and MO theories using relevant examples.
25. What is meant by dipole moment? How it is helpful in explaining the structure of molecules.
26. Write a note on the preparation of nano particles using sol-gel method.
27. Explain the optical, magnetic, thermal and catalytic properties of nanoparticles with examples.
28. Write the hybridisation and structures of Xenon compounds.
29. Explain artificial transmutation with example.
30. Explain mass defect.
31. Write a note on the manufacture of glasses.

SECTION D

(Answer any **2** questions. Each question carries **15** Marks)

- 32.(a) Explain VSEPR theory with example (5 marks)
 (b) Write a note on solvation energy and solubility of ionic solids (5 marks)
 (c) Write a note on secondary bond forces (5 marks)
33. (a) Explain the optical, magnetic, thermal and catalytic properties of nanoparticles with examples (b)
 Write a note on radio carbon dating.
34. (a) Write a note on the manufacture of glass.
 (b) Explain the preparation and bonding of noble gases.
35. (a) Write a note on carbon nanotubes and fullerenes
 (b) Explain inorganic polymers
 (c) Write a note on band theory

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Model Question Paper of BSc Chemistry Programme

2017 Admission onwards

SEMESTER IV Core Course III Course Code CH1441Credit-3

ORGANIC CHEMISTRY I

Time: 3 hours Max. Marks : 80

SECTION - A

(Answer **all** questions. Answer in **one** word to maximum **two** sentences. **Each** question carries **one** mark)

1. What is the product formed when a bond undergoes homolytic fission?
2. Give one example for each (i) substitution reaction and (ii) elimination reaction.
3. Write an example for electrocyclic reaction.
4. Name two reagents used for cis-hydroxylation.
5. What are the products obtained when naphthalene undergoes sulphonation at different temperatures?
6. Identify the orienting effect of the following functional groups $-\text{CH}_3$, $-\text{NO}_2$, $-\text{CHO}$ and $-\text{OH}$.
7. What are chromophores?
8. What are conformers?
9. What is geometrical isomerism?
10. Explain the term chirality. **(1 X 10 = 10 Marks)**

SECTION - B

(Short answer type. Answer **any 8** questions from the following. **Each** question carries **two** marks.)

11. What are electrophiles and nucleophiles? Give examples
12. Write the structure of the following compounds (i) 3,3,4-trimethyl-4-heptene (ii) 2-ethyl-3-methyl hexanal.
13. Phenol is acidic while ethanol is not. Why?
14. Arrange the following in the decreasing order of stability. Justify your answer.
 $(\text{CH}_3)_2\text{CH}^+$, CH_3^+ , $(\text{C}_6\text{H}_5)_2\text{CH}^+$, $\text{C}_6\text{H}_5\text{CH}_2^+$
15. Give an example and state Hofmann rule.
16. What is Walden Inversion?
17. What is Kharasch effect? Illustrate with an example.
18. When toluene is nitrated the major products are ortho and para substituted products. Why?
19. Define Huckel's rule.
20. Explain photosensitization with an example.
21. What is enantiomeric excess?
22. Explain with examples the importance of dipole moment measurements in distinguishing geometrical isomerism.

(2 X 8 = 16 Marks)

SECTION - C

(Short essay type. Answer **any 6** questions from the following. **Each** question carries **four** marks.)

23. What is inductive effect? How is it affected the acidity and basicity of organic acids and bases?
24. Explain the mechanism of E1 and E2 eliminations.

25. o-chloro toluene when treated with sodamide in liquid ammonia gives o-toluidine and m-toluidine. Explain this observation with relevant mechanism.
26. Explain Norrish I and Norrish II reactions.
27. Determine the R & S notations of the asymmetric carbon atoms in (+)-tartaric and (-) tartaric acid
28. Explain the conformational analysis of n-butane.
29. Give a brief account on optical activity due to restricted rotation.
30. Explain any two methods of determination of reaction mechanism.
31. What are non-benzenoid aromatics compounds. Explain their aromaticity with examples

(4 X 6 =

24marks) SECTION – D

(Answer any 2 question. Each question carries 15 marks)

32. (a) Explain SN1 and SN2 mechanisms.
 (b) Write the influence of structure of the substrate and polarity of the solvent on nucleophilic substitution reactions. (c) Explain Baeyer's strain theory.
33. (a) Explain the mechanism of (i) nitration (ii) halogenation of benzene.
 (b) Discuss the orientation of influence of –NO₂ and –OH group in aromatic electrophilic Substitution.
 (c) Discuss the classification of dyes on the basis of structure.
34. (a) What is resolution? Explain different methods of resolution.
 (b) What are carbenes? How are they generated? Comment on the structure of carbene.
 (c) Draw conformers of dimethyl cyclohexane and discuss their comparative stability.
35. (a) Write the synthesis and uses of the following dyes (i) Malachite green (ii) Methyl Orange.
 (b) Explain the geometrical isomerism of maleic and fumaric acid.
 (c) Explain the elimination-addition mechanism in halo benzenes.

(15 X 2 = 30marks)

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Model Question Paper of B.Sc. Chemistry Programme

(2017 admissions onwards)

Semester V- Core Course-5 Course Code 1541 Credit-4

Physical Chemistry –I

Time: 3 Hrs Total marks: 80

Section A. Answer all the questions. Each question carries 1 mark

- Write down the van der Waal's equation for n moles of a gas.
- In which type of liquid crystals, the colour of the material is sensitive to temperature changes?
- What are isotonic solutions?
- Write down the conditions at which real gases tend to approach ideal behaviour.
- Define the term fluidity.
- What is inversion temperature?
- Write down the efficiency of Carnot engine.
- The average speed of a certain gas at 27°C is 400ms⁻¹. Calculate the temperature at which the speed will be 800ms⁻¹.
- What is meant by unit cell in crystallography?
- What is the physical significance of entropy? (1 x 10 = 10 marks)

Section B

Each question carries 2 marks (Short answer). Answer any **8** questions

- What are colligative properties?
- Write the point group to which NH₃ belongs and mention the symmetry elements present in NH₃.
- Explain van't Hoff factor
- Explain first law of thermodynamics.

15. Derive the expression for Joule Thomson coefficient
16. Explain any two statements of second law of thermodynamics.
17. Maximum work is obtained from a reversible process. Substantiate.
18. What are the proper and improper axes of symmetry?
19. Draw the group multiplication table of C_{2v} point group. Define the terms collision frequency and collision number.
21. Explain virial equation of state.
22. Explain elements of symmetry of crystals. ($2 \times 8 = 16$)

Section C

Each question carry 4 marks (Short essay) **Answer any 6 questions**

23. Derive root most probable velocity and average velocity from Maxwell- Boltzmann equation.
24. An aqueous solution containing 0.25 g of a solute dissolved in 20 g of water froze at -0.42°C . Calculate the molar mass of the solute. Molar heat of fusion of ice at 0°C is 6.025 KJ and $R = 8.314 \text{ JK}^{-1}\text{mol}^{-1}$
25. Deduce the relationship between C_p and C_v by thermodynamics.
26. Explain different types of semi-conductors and their uses.
27. What is the law of corresponding states? How is it derived from van der Waals equation.
28. Explain Gibbs - Helmholtz equation and its significance
29. What is chemical potential and derive Gibbs Duhem equation?
30. Explain Hess's law and its applications
31. Derive the relation between depression of freezing point and lowering of vapour pressure.

(4 x 6 = 24 marks)

Section D

Each question carries 15 marks (essay), **Answer any two questions**

32. a) Derive Bragg's equation. (5 marks)
b) The edge length of the unit cell of NaCl crystal lattice is 564 pm by X-ray diffraction. Compute the interionic distance between sodium and chloride ions. (5 marks)
c) Explain point defects in a crystal. (5 marks)
33. a) What is meant by reversible process? Derive an expression for work done in the reversible isothermal expansion of an ideal gas. (5 marks) b) Calculate the work done in expanding one mole of an ideal gas from a volume of 2 to 20 dm^3 at 27°C (5 marks) c) Derive the relation between C_p and C_v . (5 marks)
34. a) Calculate T_c , P_c and V_c for C_2H_2 . Given $a = 4.390 \text{ atm litre mol}^{-2}$, $b = 0.05136 \text{ litre mol}^{-1}$. (5 marks)
b) Do all gases obey gas laws? Discuss some experimental results to explain deviation and point out the causes which accounts for this behaviour. (10 marks)
35. a) Derive thermodynamically the relation between the elevation of boiling point of a solvent and molal concentration of an electrolyte dissolved in the solvent. (5 marks) b) The surface tension of water at 293 K is $72.75 \text{ dyne cm}^{-1}$. How high will a column of water rise in a capillary tube with a radius of 0.005 cm. (5 marks) c) Illustrate the operation improper rotation. (5 marks)

(15x2=30)

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Model Question Paper of B.Sc. Chemistry Programme

2017 admissions onwards

Semester V Course VI Course Code CH1542 Credit-4

Inorganic Chemistry III

Time: Three Hours Maximum Marks : 80

Section A

Answer all questions, each question carries 1 mark (answer in a word \ sentence)

1. Which is more basic; $\text{La}(\text{OH})_3$ or $\text{Lu}(\text{OH})_3$?
2. Give the general outer electronic configuration of a transition element.
3. Which is the catalyst used in the oxidation of SO_2 to SO_3 in contact process?
4. Name the element obtained by the bombardment of ^{238}U with an α - particle.
5. What is the coordination number of Ag in $[\text{Ag}(\text{CN})_2]$?
6. Give the IUPAC name of $\text{Na}_3[\text{Co}(\text{CO}_3)_3]$ 7 What is the unit of magnetic moment?
8. Give the example for a tridentate ligand.
9. Write the structure of ferrocene.
10. Give the formula of a metal carbonyl which does not obey 18-electron rule. (1 x 10 = 10)

Section B

Answer any 8 questions, each question carries 2 marks (short answer questions)

11. Explain zone refining.
12. Name the metal ion, other than magnesium, involved in photosynthesis.
13. Give an example of phosphorus based polymer.
14. What is inorganic graphite?
15. What is the oxidation number of P in H_3PO_4 ?
16. Give the formula of a methanide.
17. Transition metals are less reactive than the alkali and alkaline earth metals - Justify.
18. Which is more stable: Cu^{2+} or Cu^+ in aqueous solution. ? Substantiate your answer.
19. Which has got greater tendency to form complexes; lanthanides or actinides ? Give reasons. 20. Write the difference between calcinations and roasting 21. What is an ambidentate ligand ? Give example.
22. Explain geometrical isomerism in metal complexes with suitable example.

(2x8=16)

Section C

Answer any 6 questions, each question carries 4 marks (short essay type)

23. What is Ziese's salt ? Give its structure.
24. State and explain 18-electron rule.
25. How haemoglobin differ from myoglobin.
26. What are carboranes ?
27. Purification of crude metals by Mond's process and van Arkel processes
28. What happens when orthophosphoric acid is heated ?
29. What is lanthanide contraction ? Explain its consequences .
30. What are the factors that affect stability of metal complexes ? 31. Give an account of the applications of coordination compounds in quantitative and qualitative analysis.

Section D

(Answer any 2 questions, Each question carries 15 marks) (essay type)

- 32.a. Describe the ion exchange method for the separation of lanthanides from monazite. (5 marks)
 - b. Describe the splitting of d-orbitals in tetrahedral and octahedral fields according to crystal field theory. (5 marks)
 - c. Comment on the magnetic properties of lanthanides . (5 marks)
- 33.a. Give an account of the preparation, properties, structure and bonding of noble gas compounds. (10 marks)

b. Discuss the nature of bonding in metal carbonyls. 34.a. How silicones are prepared ? Discuss their structure and uses.	(5 marks)
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- b. Give an account of sodium-potassium pump in biological systems.
 - c. Explain the principle of TG with example.
- 35.a. Starting from pyrolusite, how KMnO_4 is prepared ?
 - b. Explain the principle and working of AFM.

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Model Question Paper of BSc Chemistry Programme
2017 Admission onwards
SEMESTER V Core Course VII Credit 4 Course Code CH1543
ORGANIC CHEMISTRY II

Time: 3 hours Max. Marks : 80

SECTION – A

(Answer **all** questions. Answer in **one** word to maximum **two** sentences. **Each** question carries **one** mark)

1. What is Williamson's synthesis?
2. Which reagent is used for the oxidative cleavage of 1,2-diols?
3. Give a test to distinguish aliphatic aldehydes from aromatic aldehydes.
4. What is atom economy.
5. What is HVZ reaction?
6. What happens when aniline is treated with bromine?
7. Identify the types of electronic transitions in CH_3CHO .
8. What is base peak?
9. What is PTC?
10. Write the frequency range useful for the identification of organic compounds.

(10 X 1 = 10 Marks)

SECTION - B

(Short answer type. Answer **any 8** questions from the following. **Each** question carries **two** marks.)

11. Why phenol is more acidic than methanol?
12. How can you convert isopropanol to tert. butyl alcohol?
13. What is iodoform test?
14. What is MPV reduction?
15. How coumarin is prepared?
16. How will you convert acetic acid to propionic acid?
17. Explain Nef's reaction.
18. Write the mechanism of Benzidine rearrangement?
19. What is finger print region? Give its importance.
20. Differentiate bathochromic and hypochromic shifts.
21. What is TMS? Why it is selected as a reference compound in H-nmr spectroscopy?
22. What is DIBAL? What is its use?

(8 X 2 = 16 Marks)

SECTION - C

(Short essay type. Answer **any 6** questions from the following. **Each** question carries **four** marks.)

23. Explain Zeisel's method of estimating methoxy group?
24. How can you distinguish primary, secondary and tertiary alcohol?
25. Write the importance of LiAlH_4 and NaBH_4 in carbonyl chemistry.
26. Comment on Clemmensen and Wolff-Kishner reduction.
27. How cinnamic acid is prepared? Explain its important properties.
28. Discuss Hoffmann elimination?
29. Explain microwave synthesis with examples.
30. (i) How can you distinguish inter and intra molecular hydrogen bonding using IR spectroscopy?
(ii) Predict the regions where salicylaldehyde give IR absorptions.
31. Explain spin-spin coupling with an example.

(6 X 4 = 24 marks)

SECTION – D

(Answer **any 2** question. Each question carries 15

marks) 32. (a) Write the mechanism of the following reactions: (a) Aldol condensation and (b) Benzoin Condensation.

(b) Discuss the mechanism of (i) Reimer-Tiemann reaction and (ii) Claisen Condensation.

(c) Comment on the following (i) Biodiesel and (ii) Crown ethers.

33. (a) Explain the synthesis and applications of saccharin.
 (b) How diazonium chloride is prepared? How is it useful to synthesis the following compounds phenol, iodobenzene, azocompounds,
 (c) How can you effect the following conversions (i) aniline to para-bromo aniline (ii) Benzamide to aniline.
34. (a) Discuss the Woodward-Fieser for calculating λ_{max} of dienes.
 (b) Explain the principle of nmr spectroscopy.
 (c) A compound with molecular formula $\text{C}_8\text{H}_8\text{O}$ shows the following absorptions:
 (i) IR Spectrum: 3050, 2950, 1700, 1620, 1550, 690 cm^{-1} .
 (ii) pmr spectrum: δ 7-8ppm (multiplet, 5H), 2.5ppm (singlet, 3H).
 Identify the structure of the compounds.
35. (a) How primary, secondary and tertiary amines are separated?
 (b) Discuss the preparation and important reactions of benzene sulphonic acid.
 (c) Discuss the different types of non covalent interactions in molecules.
- (15 X 2 = 30marks)**

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Model Question Paper of B.Sc. Chemistry Programme

2017 admission onwards

Semester VI Core Course-VIII Course Code CH1641 Credit-4

Physical Chemistry II

Time: 3 Hrs Total marks: 80

Section A.

Answer all the questions. Each question carries 1 mark

- Which of the following will give pure rotational spectrum? H_2 , N_2 , CO_2 , HCl .
- Write the mathematical definition of Laplacian operator.
- Which branch of spectroscopy is used for the identification of free radicals?
- What is the significance of polarizability of a molecule?
- What is responsible for the stability of a lyophilic sol?
- State The Heisenberg uncertainty principle.
- Give the expression for Freundlich adsorption isotherm.
- Give the expansion of STM.
- Give the selection rule for rotational spectroscopy.
- What is the unit of dipole moment?

Section B,

(2 marks each), [Short answer]. **Answer any 8 questions**

- What is meant by Critical Micelle Concentration (CMC)?
- What is sedimentation?
- What is the significance of wave function of a particle?
- Give any two applications of ESR spectroscopy.
- What do you mean by the term 'parachor'?
- What is meant by normal modes of vibrations?
- What is zeta potential ?
- Calculate the number of fundamental modes of vibrations of CO_2 and SO_2 molecules.
- How does stokes and anti stokes lines originate in Raman spectrum.
- Explain chemical shift.
- Explain blackbody radiation
- What is hyperfine splitting in esr?

Section C

Each question carries 4 marks(Short essay), **Answer any 6 questions**

- What is an ensemble, explain the different types of ensembles.
- Discuss the postulates of quantum mechanics.
- Explain the underlying principle of NMR spectroscopy.
- What is meant by Optical Exaltation? Calculate the optical exaltation of 2,6-dimethylhepta-2,5-dien-4-

- one.
27. Compare physisorption and chemisorptions
 28. What are the consequences of unharmonicity in vibrational spectroscopy?
 29. What is Debye equation ? Explain its significance.
 30. Explain mutual exclusion rule with examples.
 31. The fundamental vibrational frequency of carbon monoxide molecule is $2170. \text{ cm}^{-1}$ Calculate the force constant of the molecule.

Section D,

15 marks each (Long essay) **Answer any two question**

32. a) Derive and explain Langmuir adsorption isotherm. (5 marksx3 = 15)
- b) What is meant by partition functions? Derive expressions for internal energy and enthalpy.
- c) The acceptable solutions to Schrodinger wave equation must have some special properties. What are these?
Elaborate.
33. a) What is Hardy-Schulze rule and what are the principles involved in the mechanism of coagulation? (5 marksx3 = 15)
- b) Show that for a rigid diatomic rotor, the moment of inertia is given by $I = \mu r^2$
- c) The pure rotational spectrum of a gaseous molecule CN consists of a series of equally spaced lines separated by 3.7978 cm^{-1} . Calculate the internuclear distance of the molecule. The molar masses are;
 $^{12}\text{C} = 12.011$ and $^{14}\text{N} = 14.007 \text{ g mol}^{-1}$.
34. a) How can NMR spectrum distinguish between the isomers: p-xylene and ethyl benzene? (5 marks x3 = 15)
- b) Explain the shielding and deshielding mechanism in NMR.
- c) Give the hyperfine structure of ESR spectrum of hydrogen atom. Calculate the ESR frequency of an unpaired electron in a magnetic field of 0.33T. Given $g_e = 2$ and $\mu_B = 9.273 \times 10^{-24} \text{ JT}^{-1}$.
35. a) Discuss the function of a protective colloid. (5 marks x3 = 15)
- b) What is meant by electro dialysis?
- c) Explain BET theory

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MODEL QUESTION PAPER SEMESTER VI

First Degree Programme in Chemistry

Semester VI Core Course – IX Course Code CH1642 Credit 4

ORGANIC CHEMISTRY III

2017 admission onwards

Time: 3 hours Max. Marks : 80

SECTION – A

(Answer **all** questions. Answer in **one** word to maximum **two** sentences. **Each** question carries **one** mark)

1. Draw the structure of D-Arabinose and D-Ribose?
2. What are epimers?
3. Write the IUPAC name of (i) Furan and (ii) quinoline.
4. Write the structure of chloroquine.
5. What is isoelectric point?
6. What is natural rubber chemically?
7. Write any two biological functions of lipids.
8. What is soap?
9. Write the monomers of the following polymers (i) PTFE (ii) PP.
10. What is Frankland reagent? (**10 X 1 = 10 Marks**)

SECTION - B

(Short answer type. Answer **any 8** questions from the following. **Each** question carries **two** marks.)

11. Explain inversion of cane sugar.
12. Write any two industrial applications of cellulose.
13. Compare the aromaticity of furan and thiophene.
14. Write the structure of pyrimidine bases present in nucleic acids.
15. Define the terms (i) saponification value and (ii) iodine value.
16. What is isoprene rule?
17. What are essential and non-essential amino acids?
18. What is denaturation of protein?
19. Differentiate oils and fats.
20. Define the terms M_n and M_w .
21. What is NBS? What is its use?
22. What are active methylene compounds? Give examples.

(8 X 2 = 16 Marks)

SECTION - C

*(Short essay type. Answer **any 6** questions from the following. **Each** question carries **four** marks.)*

23. How can you interconvert glucose and fructose?
24. What is mutarotation? Explain its mechanism.
25. Explain the synthesis of amino acid by (i) Strecker and amidomalonnate synthesis.
26. What are vitamins? How are they classified? Write the structure of Vitamin A and C.
27. What is tacticity? Explain it by taking poly propylene as an example.
28. What is Bakelite? How is it prepared? Give its important applications.
29. Write a short note on the structure of DNA.
30. Discuss the mechanism of Reformatsky reaction.
31. Elucidate the structure of coniine.

(6 X 4 =

24marks) SECTION - D

*(Answer **any 2** question. Each question carries 15 marks)*

32. (a) Discuss the cyclic structure of glucose
(b) Briefly explain the structure of starch and cellulose.
(c) (i) Why glucose and fructose form same osazone?
(ii) How fructose reacts with the following reagents? (1) Na/Hg and H_2O (2) CH_3OH and dry HCl (3) Fehling's solution.
33. (a) Explain the Fischer-Indole synthesis.
(b) What are sulphadugs? Give examples. Explain the mode of action of sulpha drugs.
(c) What are terpenes? How are they classified? Write the structure of limonene and menthol.
34. Write brief note on the following : (a) Replication of DNA
(b) Merrifield synthesis
(c) Structure of protein
35. (a) Explain the synthetic applications of ethyl acetoacetate.
(b) How Grignard reagent is prepared? Explain its importance in the synthesis of primary, secondary, tertiary alcohols and carboxylic acid. (c) Explain the mechanism of cationic and anionic polymerization.

(15 X 2 = 30marks)

University of Kerala

Model Question Paper of B.Sc. Chemistry Programme

2017 admissions onwards

Semester VI Core Course X: Course Code CH1643 Credit 4

Physical Chemistry – III

Time: 3 Hrs Total marks: 80

Section A

Answer all the questions Each question carries 1 mark

1. Give the Arrhenius equation.
2. Write the integrated rate equation for a first order reaction.
3. Give the relation between hydrolytic constant, dissociation constant and ionic product of water of a salt of strong acid and weak base.
4. The solubility of AgCl in water at 25°C is 0.00179 g/L. calculate its solubility product at 25 °C.
5. Write Debye- Huckel- Onsagar equation.
6. Write the reduced phase rule equation.
7. Give an example for a system having upper and lower CST.
8. Give the Nernst equation for the potential of a copper electrode.
9. What is meant by quantum yield of a photochemical reaction?
10. Represent the electrochemical cell formed when Zn electrode is coupled with Ag electrode.

Section B

Each question carries 2 marks (Short answer) .Answer any 8 questions

11. Define buffer solution and buffer index .
12. Define the term activation energy. Why different reactions proceed at different rates? 13. Give one example each for a consecutive and a parallel reaction
14. What is meant by common ion effect? Explain with an example.
15. Describe with example (i) Triple point (ii) Eutectic point
16. Explain the term congruent melting point with an example
17. Write a note on conductometric titration of acetic acid against sodium hydroxide?
18. What is Debye Falkenhagen effect?
19. How will you construct a calomel electrode?
20. What is meant by liquid junction potential? How can it be almost eliminated?
21. What are azeotropes ? Explain with an example.
22. What is critical solution temperature? How does it vary by the addition of an electrolyte?

Section C

Each question carries 4 marks (Short essay). Answer any 6 questions

23. The rate constant of a second order reaction is $5.70 \times 10^{-5} \text{ dm}^3 \text{ mol}^{-1} \text{ s}^{-1}$ at 25°C and $1.64 \times 10^{-4} \text{ dm}^3 \text{ mol}^{-1} \text{ s}^{-1}$ at 40°C. Calculate the activation energy and the Arrhenius preexponential factor.
24. What would be the pH of a solution obtained by mixing 5 g of acetic acid and 7.5 g of sodium acetate and making the volume equal to 500 ml? Dissociation constant of acetic acid at 25°C is 1.75×10^{-5} .
25. Explain the principle of freezing mixture by taking KI – H₂O system as an example.
26. State and explain Nernst distribution law. What are the limitations of the law?
27. What are fuel cells? Describe H₂ – O₂ fuel cell and its cell reactions.
28. Derive Clausius- Clapeyron equation and mention its applications . 29. Explain the terms (i) Fluorescence (ii) Phosphorescence
30. What are the laws of photochemistry , explain ?
31. Explain the phase diagram of Pb-Ag system.

Section D

Each question carries 15 marks (essay) Answer any two question

32. a) using Le Chatliers Principle, describe the effect of temp, P and concentration for the following systems in equilibria:



PCl ₅	PCl ₃ + Cl ₂	(5 marks x 3 = 15) b) Give the applications
Nernst distribution law.		

- c) Elaborate on azeotropic mixtures.

33. a) How will you determine the transport number of ions using Hittorf method? (10 marks)
- b) Give the construction and working of SHE. (5 marks)
34. a) Derive van't Hoff equation for temperature dependence of equilibrium constant. (10 marks)

b) The equilibrium constant for a reaction is 1×10^5 . Calculate the standard free energy change for the reaction in kilojoules at 25°C . (5 marks)

35. a) What is meant by CST. Explain different types of CST with examples (5 marks)

b) Discuss various types of concentration cells. (10 marks)

University of Kerala

Model Question Paper

2017 admission onwards

Open Course for other Majors Course CH1551.1

Essentials of Chemistry

Time: 3 Hrs Total marks: 80

Section A.

Answer all the questions. Each question carries 1 mark

1. Who discovered radioactivity?
2. Name any unit of radioactivity.
3. What is the expansion of DNA?
4. Write an example of a sex hormone.
5. Name an enzyme.
6. State Aufbau principle.
7. Draw p_x orbital.
8. Give an example of inorganic polymer.
9. Name any compound which causes acid rain.
10. What is the monomer of nylon-6,6?

(1×10 = 10 marks)

Section B

(2 marks each), Short answer **Answer any 8 questions**

11. Name the pollutants in air?
12. What are the factors affecting the purity of water?
13. Explain Hund's rule of maximum multiplicity with an example.
14. Define electron affinity, explain with an example.
15. Distinguish between half life period and average life period.
16. Explain artificial radioactivity.
17. Write the structure and applications of polyhalo olefins.
18. What is vulcanization of rubber?
19. What are corticosteroidal hormones? Explain with example.
20. Distinguish between DNA and RNA.
21. How are dyes classified?
22. Explain cleansing action of soap

(2×8 = 16 marks)

Section C

(Each question carry 4 marks), (Short essay) **Answer any 6 questions**

23. Explain the source and hazards of fly ash and asbestos.
24. Explain briefly soil pollution.
25. What are periods and groups in the periodic table? What is periodicity?
26. Explain Bohr model of atom.
27. Distinguish between nuclear fission and nuclear fusion with examples.
28. What are Nylon 66, Melamine and Terylene?
29. What are the functions and deficiency diseases of Vitamin C, Vitamin D and Vitamin E.
30. Write a note on explosives.
31. Distinguish between addition and condensation polymerization.

(4×6 = 24 marks)

Section D

(15 marks each), (essay), **Answer any two question**

32. a) What are quantum numbers? Explain.
 b) State Pauli Exclusion Principle. Explain their significance.
 c) Explain stability of half-filled and completely-filled orbitals. (5x3 = 15 marks)
33. a) Write a note on Group Displacement law and radioactive decay series.
 b) What is carbon dating? In an archaeological piece of wood ^{14}C activity is 10 % of the activity found in a fresh wood. Calculate the age of the archaeological piece (half life of ^{14}C is 5760 years.).
 c) Write a note on vitamin deficiency disease. (5x3 = 15 marks)
34. a) What are the different methods for the analysis of oils and fats?
 b) What is meant by DNA? Name the sugar unit present in DNA.
 c) Write a note on vat dyes. (5x3 = 15 marks)
35. a) Explain the cleansing action of soap.
 b) What is antibiotic? Give the names of the first antibiotic and the scientist who discovered it.
 c) Give an account of the green house effect. (5x3 = 15 marks)

University of Kerala

Model Question Paper

2017 admission onwards

Open Course for other Majors Course

Semester V Course Code CH1551.2 Credit 2

Fundamentals of Chemistry & Its Application to Everyday Life Time:

Three Hours Maximum Marks : 80

Section A

(answer in a word / sentence) Answer all

questions 1. What is superphosphate?

2. Who is the Father of Modern Chemistry? 3. How many atoms are present in a molecule of ozone?

4. Define isotopes.

5. What is a diamond made up of?

6. Which element has the electron configuration 2,1.

7. Name a liquid element.

8. What is the shape of water molecule? 9. How many valence electrons are there in carbon?

10. Name the main compound present in cooking gas.

Section B

Each question carries 2 marks (Short answer type). Answer any eight questions .

11. Name any two Toxic Chemicals in Cosmetics

12. Obtain the electron configuration for (a) N; (b) F.

13. Explain Hund's rule of maximum multiplicity with an example.

14. Define electron affinity, explain with an example.

15. Which of the following elements Li, Be, B, C, N, O, F and Ne are metals?

16. Explain Bohr model of atom.

17. Why is the electronegativity value of most noble gases equal to zero?

18. What are the Health Effects of Drinking Soda?

19. Which do you expect to have more metallic character, Lead (Pb) or Tin (Sn)

20. What is a Match Head of match stick made of?

21. Explain why graphite conducts electricity whereas diamond doesn't.

22. Is the reactivity of group I metals increasing or decreasing down the group? Explain why? $2 \times 8 = 16$

Section C

Each question carries **4 marks** (Short essay type) *Answer any six questions*

23. Explain the colour of firecrackers.

24. What is the difference between covalent and ionic bonding?
25. What are periods and groups in the periodic table? What is periodicity?
26. What are adulterants.
27. How is Thomson's model of the atom different from Dalton's model of atom?
28. What's the difference between an oxidation number and an ionic charge?
29. Explain the health hazards associated with drinking soft drinks?
30. How can metallic character change across a period?
31. Describe clearly the link between increasing effective nuclear charge across a period and the changes in van der Waals radius.

4×6 =

24Section D

Each question carries 15 marks (essay type) Answer any two questions.

32. a.Explain about the pH changes of aqueous solutions of elements in the third period as the period is crossed.
b. Explain how these changes are directly related to the changes in effective nuclear charge across the period.
c. Describe the metallic character of elements in a period.
33. a.Explain the role of some chemicals in household items.(7.5 marks)
b.Write a short note on food adulteration. (7.5 marks)
34. a.Write a short note on the uses and hazards of fertilisers. (10 marks)
b.Draw the structure of carbon and sodium containing nucleons. (5 marks)
35. a.compare the structure of substances, methane, water, carbon dioxide and iodine, with

ethane and silicon	(10 marks)
b.compare the bonding structures of diamond - graphite.	(5 marks)

University of Kerala

Model Question Paper

2017admission onwards

Open Course for other Majors Course Code CH1551.3 Credit -2

Environmental Chemistry

Time: 3 hours Maximum marks: 80

Section A

Answer all questions (Each answer carries 1 mark)

1. What you meant by Triple R in waste management ?.
2. What type of pollution causes acid rain?
3. What are the misuses of plastics?
4. What are the three major man made sources of air pollution?
5. What kind of materials are discharged into the seas?
6. What increases the amount of carbon dioxide in the atmosphere?
7. Explain the action of zeolites on hard water.
8. What are freons?
9. Define pollution
10. What is fly ash

(10x1=10)

Section B

(short answer type) (Answer any 8 questions, Each answer carries 2 mark)

11. How is pollution related to acid rain?
12. How does ocean pollution affect sea animals?
13. What are the main concepts of Green Chemistry
14. Write short note on Radioactive pollution

15. Discuss the major composition of earth's atmosphere 16. Write about the cause and consequence of Chernobyl incident
17. What is BOD and COD?
18. What causes radioactive pollution?
19. Distinguish between Hard water and soft water.
20. What is the goal of Forest Conservation Act?
21. What is the Greenhouse effect and what is its cause? 22. What are the types of air pollutants ?

(2×8 = 16)

Section C

(Short essay type) each question carries 4 marks. Answer any 6

23. Write short note on volatile organic compounds.
24. How can thermal pollution be prevented?
25. How do you control Radioactive pollution?
26. What is smog? How does smog arise?
27. What is Eutrophication
28. Write a note on Rio-Declaration.
29. Explain the various layers of the Atmosphere
29. What is Air Pollution? How can air pollution be minimized?
30. Briefly explain about the components of atmosphere.

6×4 = 24

Section D.

Answer any 2 from the following. Each question carries 15 marks

32.	(a) Explain Hardness of water and the different types. (5 marks) (b) Discuss about the
various sources of water pollution. (5 marks)	
(c) What are the control measures for water pollution ? .	(5 marks)

33. (a) Write short note on causes and problems of ozone layer depletion? (b) Explain the various types of smog.

(c) Discuss the Ozone Depleting Substances (Regulation and Control) Rules

34. (a) Explain thermal pollution
- (b) Discuss about plastics and their misuses
- (c) Discuss about Chernobyl disasters

3	(a) Discuss about green chemistry
5	(b) Explain Montreal protocol and
.	Kyoto protocol

(c) The water (Prevention and control of pollution) Act

15 × 2 = 30

University of Kerala

Model Question Paper

2017 onwards

B.Sc Chemistry Programme

Elective Course Semester VI Course Code CH1651.1 Credit 2

Supramolecular, Nano Particles and Green Chemistry

Time: Three Hours Maximum marks : 80

Section A.

Answer all questions. Each question carries 1 mark.

1. Define atom economy.
2. Write an example of green catalyst.
3. Between an addition and elimination reaction which is having a better atom economy?

4. Name a colloidal semiconductor.
5. Expand SAMS.
6. What is graphene?
7. Name the different allotropes of carbon.
8. Name any two molecular receptors.
9. What are cryptands?
10. Define π stacking.

Section B.

Answer any eight questions. Each question carries 2 marks.

11. Write a note on Bhopal Tragedy.
12. Define Carbon efficiency.
13. Explain the limitations of conventional waste management.
14. Give any four lab safety signs with its meaning.
15. Write about the wet method of preparing colloidal semiconductors.
16. What are the magnetic properties of nanoparticles.
17. Briefly describe the catalytic properties of nano materials.
18. Explain the different types of SWCNTs.
19. What are the non-covalent bonds involved in molecular recognition?
20. Define host and guest in supramolecular chemistry.
21. Write a note on Cyclodextrins.
22. What are molecular tweezers?

Section C.

Answer any six questions. Each question carries 4 marks.

23. What are secondary electrons?
24. Write a note on safer solvents and auxiliaries.
25. Explain ionic liquids.
26. Write a note on biodiesel.
27. Describe the synthesis of quantum dots and mention its optical properties.
28. Explain the preparation of SAMs.
29. Discuss the potential applications of nanomaterials in computers, sensors, and Medical applications.
30. Discuss the various aspects of molecular recognition involved in the structure of DNA.
31. Write notes on cation and anion receptors.

Section D

Answer any two questions. Each question carries 15 marks.

32. (a) Explain the twelve principles of green chemistry. (10 marks)
- (b) Explain microwave assisted organic syntheses with an example. (5 marks)
33. (a) Explain the principle and working of SEM
- (b) Write a note on synthesis and purification of carbon nanotubes.
34. Write short notes on (a) calixarenes (b) Cyclodextrins (c) cyclophanes.
35. Write short notes on (a) molecular recognition (b) preparation biodiesel (c) non bonded interactions

UNIVERSITY OF KERALA

B.Sc Chemistry Programme, Semester VI

2017 admission onwards

MODEL QUESTION Elective Course- Course Code CH1651 .2 Credit 2 Computational, Combinatorial and Physical Organic Chemistry Time: Three Hours

Max. Marks : 80

Section A

Answer all questions. Each question carries 1 mark.

1. Write Arrhenius expression and explain the terms.
2. What is RHF?

3. What are nucleophilic reagents? Give examples.
4. Name any two structure drawing softwares.
5. Write Hammett equation.
6. Give one example solution phase library synthesis.
7. Write any two examples for poly amide resin.
8. Propene is more stable than ethane. Why?
9. What is combinatorial synthesis?
10. Write any two examples for heterolytic bond breaking reaction. 1 X 10 = 10 Marks **Section B**

Answer any eight questions from the following. Each question carries 2 marks.

11. What are the web resources in learning Chemistry?
12. What is a basis set ?
13. What are the major mechanisms of organic reactions ?
14. Distinguish between STO & GTO.
15. Explain the advantages of combinatorial synthesis.
16. What is meant by electrocyclic reaction. Give one example.
17. What are the applications of combinatorial synthesis. 18. What are multipins used in combinatorial synthesis
19. Explain kinetic requirements of reaction.
20. Explain Hammond postulate.
21. Explain +I and - I effects.
22. Explain isotopic labeling in the study of organic reactions. 2 X 8 = 16 **Section C**

Answer any six questions from the following. Each question carries 4

- marks.** 23. Draw the Z matrix of H₂O & NH₃
24. Why SEM is called parametrisation method
 25. How can a eight - member dipeptide library is synthesized ?
 26. Explain non-peptide libraries.
 27. How are the intermediates detected?
 28. Explain substitution reactions of naphthalene.
 29. Explain the effect of leaving group in aliphatic substitution reactions.
 30. What is self consistent field method.
 31. Explain mix and split library synthesis. 6 X 4 = 24 **Marks**

Section D

Answer any two questions from the following. Each question carries 15 marks

32. (a) Explain MO theory of hydrogen molecule ion. (b) Explain VB theory of hydrogen .
10 + 5 = 15 Marks
33. (a) Explain neighboring group participation with examples. (b) Explain steric effects and B-strain. 7.5 + 7.5 = 15 Marks
34. (a) How does the structure of substrate affect the aliphatic nucleophilic substitution? (b) Comment on the effect of substituent on nucleophilic substitution reaction.
7.5 + 7.5 = 15 Marks
35. (a) Write a brief description of methods (a) ab initio (b) DFT (c) molecular mechanics.
5 + 5 + 5 = 15 Marks

B.Sc Chemistry Programme Model Question Paper

**Elective Course Semester VI Course Code CH1651.3
2017 admission onwards**

Polymer Chemistry

Time: Three Hours Maximum Marks: 80

Section A

Each question carries 1 mark (Answer in one word\sentence)

Answer all questions

1. What are elastomers?
2. How is melamine-formaldehyde resin prepared?
3. Write a note on Nylon 66.
4. Mention the monomer unit of neoprene.
5. Define copolymers.
6. Explain extrusion.
7. Define fibre spinning.
8. Explain emulsion polymerisation
9. Give two examples of natural polymers
10. What is SBR and SAN?

Section B

Answer any eight questions. Each question carries 2 marks.

11. Write a note on Condensation polymerisation.
12. Explain the synthesis of HDPE.
13. Write a note on Polyurethanes.
14. Explain number, weight and viscosity average molecular weight.
15. Define graft copolymers.
16. Explain the preparation of PVC.
17. What are epoxy resins?
18. Explain the vulcanisation of elastomers.
19. Write the mechanism of ionic polymerisation.
20. Explain the chemical methods of degradation of polymers.
21. Explain polymer processing.
22. Distinguish between thermoplastics and thermosetting plastics.

Section C

Answer any six questions. Each question carries 4 marks.

23. Write a short note on silicones?
24. What are the methods of determining molar mass?
25. Write notes on (1) compression (2) moulding (3) casting
26. Discuss the synthesis and application of Teflon
27. Describe the role of initiators and inhibitors in addition polymerisation
28. Distinguish between plastics, elastomers and fibres
29. Describe the TGA of polymers.
30. Discuss the various aspects of molecular recognition involved in the structure of DNA.
31. Explain kinetics of polymerization and Carothers relation

Section D.

Answer any two questions. Each question carries 15 marks.

32. Discuss the methods of (a) Determining molecular weight (b) Practical significance of molecular weight distribution
33. Write a note on (a) vinyl polymers and (b) discuss about the methods of synthesis of PVA, PVB and Polyacetals.
34. (a) Explain crystallinity in polymers (b) Explain thermal, electrical and mechanical properties of polymers.
35. Write notes on (a) compression (b) moulding (c) casting

University of Kerala

B.Sc Chemistry Programme

Model Question Paper

Elective Course Semester VI Course Code CH1651 .4

Biochemistry

2017 admission onwards

Time: 3 hours Maximum marks: 80

Section A.

Answer all questions (maximum two sentences each question carries 1 mark)

1. What is the normal pH of arterial blood?
2. What is the cause of sickle cell anemia?
3. Give an example for plasma protein.
4. What are anticoagulants?
5. Define BMR?
6. What is the renal threshold value of glucose?
7. What is NPN?
8. What is the calorific value of fat?
9. Name the bile pigments.
10. What is GLC?

(10x1=10

marks)Section B

Answer any eight, each question carries 2 marks

11. Define renal threshold and its significance?
12. What are the normal constituents of urine?
13. What are the different types of hemoglobin?
14. Write a short note on protein digesting enzymes.
15. Draw the structure of heme
16. What are the constituents of blood?
17. What are the functions of plasma protein?
18. What is difference between plasma and serum?
19. What is adsorption chromatography?
20. What is the composition of bile?
21. Write about abnormal hemoglobin.
22. Discuss about ion exchange chromatography.

(8 x 2 = 16 marks)

Section C

Answer any six each question each question carries 4 marks

23. Explain Oxygen dissociation curve and factors affecting its shift.
24. Describe gel electrophoresis.
25. Explain thin layer chromatography.
26. Explain briefly the buffers in blood.
27. Give an account of diseases affecting kidney function.
28. Discuss about ultracentrifugation.
29. Discuss the physiological events involved in the transport of oxygen and carbon dioxide.
30. Describe briefly about the various blood cells.
31. Briefly explain about lipoproteins and their functions.

(6 x 4 = 24 marks)

Section D

Answer any two (essay) Each question carries 15 marks 32.

Discuss about (i) Coagulation factors (ii) Anticoagulants (iii) Mechanism of blood clotting. 33. Discuss about the principle procedure and applications of (i) SDS PAGE (ii) Affinity chromatography (iii) Gel filtration chromatography

34. Describe (i) Body water balance (ii) Functions of kidney (iii) Formation of urine.

35. Discuss about the digestion and absorption of (i) Carbohydrate (ii) Protein (iii) Fat

(15 x 2 =30 marks)