M.Sc. Previous (Chemistry) Examinations,
December 2017

(Directorate of Distance Education)

Paper: DPA – 510: DECHEM-1.1: Analytical Chemistry – I

Time: 3 hrs] *[Max. Marks: 75/85*

Note: 1) **Scheme 75 Marks** – Answer **Part – A** (any **TEN** subdivisions).
Any **TWO** questions from **Part – B** and **THREE** questions from **Part – C**.

2) **Scheme 85 Marks** – Answer **Part – A** (any **TEN** subdivisions).
Any **TWO** questions from **Part – B** and **THREE** questions from **Part – C**
and **ONE** question from **Part – D**.

PART – A

1. *Answer any TEN subdivisions* 10 x 2 = 20 Marks

   a) What are determinate and indeterminate errors? Give examples.

   b) In the titration of NaOH with HCl, the pH at the equivalence point is 7.0, but when acetic acid is titrated with NaOH, the pH at the equivalence point is greater than 7.0. Explain.

   c) Bring out the differences between distribution coefficient and distribution ratio.

   d) Give the difference between precipitation and co-precipitation.

   e) What are self-ionization reactions? Give examples.

   f) Define the terms 'retention time' and 'retention volume'.

   g) Indicate the sources of NO_x in the atmosphere. Mention the effect of NO_2 and NO_3 on vegetation.

   h) What is ion-exchange chromatography? Mention the requirements of an ion-exchange resin.

   i) What is meant by temperature-programming as used in GC? Why is it required?

   j) Mention the requirements of a matrix for an ideal affinity chromatography. Give any two examples for such matrices.

   k) Differentiate between gel-filtration and gel-permeation chromatography.

   l) What is HPLC? Mention its advantages over other GC.

   m) Define COD and mention its significance.

   n) What is meant by desalting? Explain with an example.

   o) Mention the advantages of liquid ammonia as a solvent in organic synthesis.

PART – B

Answer any TWO questions: 2 x 8 = 16

2. a) What are the sources of methodic systematic errors? Explain any two methods for reducing such errors.

   b) Give reasons for the following observations: i) Gelatinous precipitates are not digested, ii) Occluded impurities are not removed by washing.   (4 + 4 = 08)

3.   a) Derive the equation that relates the column resolution to capacity factor, selectivity factor and column efficiency.

   b) Describe the principles upon which the FID is based. Mention its advantages and limitations?   (4 + 4 = 08)

4.   a) Discuss the theory of acid-base indicators with suitable examples.

   b) A chemist obtained the following results for replicate determinations of iron in iron ore: 54.35, 54.38, 54.41, 44.40 and 54.42%. What is the confidence interval at the 90% confidence level? (Given : t = 2.884).   (4 + 4 = 08)

PART – C

Answer any THREE questions: 3 x 13 = 39

5.   a) Write down the Van-Deemter's equation. Explain how eddy diffusion. longitudinal diffusion and mass transfer coefficients affect the column resolution.

   b) Write the schematic diagram of a modern HPLC instrument and explain the role of each component involved.   (6 + 7 = 13)

6.   a) Describe the principles of separation by GC. Discuss the instrumentation and applications of GC.

   b) What are indicators? Write the indicator action of: i) Phenolphthalein in the titration of acetic acid with NaOH, ii) Potassium chromate in the titration of chloride with Ag^+.   (7 + 6 = 13)

7.   a) Describe the term water pollution. Discuss how do industrial, domestic and agricultural activities contribute to water pollution.

   b) With the help of schematic diagram discuss the working principles of TCD and FID.   (6 + 7 = 13)

8.   a) Discuss the various reactions possible in liq. SO_2 and liq. NH_3.

   b) Mention the sources and biological effects of Pb, As and Hg.   (7 + 6 = 13)

9.   a) What are ion-exchange resins? Discuss the factors affecting ion-exchange equilibria.

   b) What is meant by PFHS? Explain with suitable example, how does this procedure lead to both larger and purer particles of precipitate?   (6 + 7 = 13)

PART – D

Answer any ONE question:

10.   a) What is paper chromatography? Mention the sequence of procedure involved in paper chromatography.

   b) Reactions in anhydrous H_2SO_4.   (5 + 5 = 10)

11.   a) Write a note on green house effect and its consequences.

   b) Sampling methods for solids and gases.   (5 + 5 = 10)

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M.Sc. Previous (Chemistry) Examinations,
December 2017
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Paper: DPA – 520: DECHEM: 1.02: Inorganic Chemistry – II

Time: 3 hrs]   *[Max. Marks: 75/85*

*Note: 1) **Scheme 75 Marks** – Answer **Part – A** (any **TEN** subdivisions).*
   *Any **TWO** questions from **Part – B** and **THREE** questions from **Part – C**.*

   *2) **Scheme 85 Marks** – Answer **Part – A** (any **TEN** subdivisions).*
   *Any **TWO** questions from **Part – B** and **THREE** questions from **Part – C***
   *and **ONE** question from **Part – D**.*

PART – A

1. ***Answer any TEN subdivisions***   10 x 2 = 20 Marks
    a) What are colour centres? Give example.
    b) Define polarizability and polarizing power.
    c) What are n – and p – type semi conductors? Give examples.
    d) What is meant by partial ionic character of covalent bonds?
    e) Give the structure of $X_eO_2F_2$ and X_eO_4.
    f) What is the concept of valence tautomerism?
    g) Give the shapes of d - orbitals.
    h) What are the defects of CFT?
    i) What are Wade's rules?
    j) List out the short comings of VBT.
    k) What are interesticial carbides? Give examples.
    l) Give the preparation of X_eOF_4.
    m) What are psuedohalogens? Give examples.
    n) What are Zeolites? Mention their applications.
    o) How borophosphate glasses prepared?

PART – B

Answer any TWO questions: 2 x 8 = 16

2. a) What are the factors that determine the covalent or ionic radii?
    b) What is the VSEPR theory of directed valance? Give the shapes of AB_4F_2 and
       AB_2E_2 types.   (4 + 4 = 08)

3. a) How does electro negativity depend upon:
       i) The size of the atom   ii) hybridization

    b) What are the factors affecting CFSE?   (4 + 4 = 08)

4.   a) Explain the role of Wade's rules, bonding and topology in determining the structure of higher boranes.

      b) Give the preparation and properties of xenon oxy fluorides. $(4 + 4 = 08)$

PART – C

Answer any THREE questions: 3 x 13 = 39

5.   a) Explain the high melting points of silica, diamond and graphite even though these are covalent compounds.

      b) State Fajan's rules. Which of the compounds in the pairs of compounds is more covalent: CuO or CuS ; $AgCl$ or AgI ; $PbCl_2$ or $PbCl_4$.

      c) What is a M.O? Give the MO configuration of CO and NO. Mention the bond order and magnetism in each. $(4 + 4 + 5 = 13)$

6.   a) When do the metal ions use the outer orbitals and when do they form inner orbital complexes on the basis of VBT?

      b) Explain how σ and π bondings help each other synergistically in stabilizing the compound.

      c) Draw the MO energy levels for $\left[C_0 F_6 \right]^{2-}$ and $\left[C_0 \left(NH_3 \right)_6 \right]^{3+}$ complex. Predict the magnetic behaviour of the complexes with the number of d electrons present on the metal ion. $(4 + 4 + 5 = 13)$

7.   a) Discuss in detail the nature of bonding involved in $B_5 H_9$ and $B_5 H_{11}$.

      b) What are the causes and consequences of Schottky defects and Frankel defects in solids.

      c) Write a short note on Carboranes. $(5 + 4 + 4 = 13)$

8.   a) Give the structure and properties of Covalent and interstical carbides.

      b) Give an account of silicone polymers.

      c) Explain conduction of metals and semi-conductors using Band theory. $(4 + 4 + 5 = 13)$

9.   a) Explain why XeF_4 has planar structure and XeO_4 has tetrahedral structure.

      b) Based on concept of hybridization, account for the shapes of BrF_3 and IF_7 .

      c) Give the preparation of $XeO_2 F_2$. Discuss its bonding and structural aspects. $(4 + 4 + 5 = 13)$

PART – D

Answer any ONE question:

10. a) Explain in brief how MOT could successfully explain the defects of CFT and VBT.

      b) Derive Born – Lande equation for the lattice energy of NaCl solid. $(5 + 5 = 10)$

11. a) What are Clastomers? Discuss the structure and properties of Clastomers.

      b) Give the preparation of $S_4 N_4$. Discuss its bonding and structural aspects.

                                                           $(5 + 5 = 10)$

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M.Sc. Previous (Chemistry) Examinations,
December 2017

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Paper: DPA – 530: DECHEM: 1.03: Organic Chemistry – III

Time: 3 hrs]   *[Max. Marks: 75/85*

*Note: 1) **Scheme 75 Marks** – Answer **Part – A** (any **TEN** subdivisions).*
    *Any **TWO** questions from **Part – B** and **THREE** questions from **Part – C**.*

   *2) **Scheme 85 Marks** – Answer **Part – A** (any **TEN** subdivisions).*
    *Any **TWO** questions from **Part – B** and **THREE** questions from **Part – C***
    *and **ONE** question from **Part – D**.*

PART – A

1. ***Answer any TEN subdivisions***   10 x 2 = 20 Marks
    a) Explain R, S nomenclature with suitable examples.
    b) Draw the structures of D – L – glucose using Fischer formula.
    c) Define the term 'Carbocation' with two examples.
    d) Give the E and Z notations for the following compounds.

$$(i) \quad \begin{matrix} C_6H_5 \\ H_3CH_2C \end{matrix} C=C \begin{matrix} H \\ CH_3 \end{matrix} \qquad (ii) \quad \begin{matrix} H \\ Br \end{matrix} C=C \begin{matrix} Cl \\ F \end{matrix}$$

    e) What are hetroannulenes? Give any one example.
    f) Explain the Hudson's rule.
    g) Give any two applications of 18 – crown – 6 – ether.
    h) What are heterocyclic compounds? Give any two examples with structures.
    i) Give the equation for the conversion of benzene to acetophenone including reaction conditions.
    j) What is cope elimination? Give the equation.
    k) Write the Fischer projection formula of D–fructose.
    l) Give a reaction with equation involving an addition of a nucleophile to acetone.
    m) What is ipso reaction? Explain with an example.
    n) Give the mechanism of E_{1CB} reaction with an example.
    o) What are nucleophilic substitution reactions? Give examples.

PART – B

Answer any TWO questions: 2 x 8 = 16

2. Write an account on formation, stability, structure and reactions involving free radicals with suitable examples.

3. Discuss the similarities and differences between E_1 and E_2 reactions.

4. Describe the elucidation of structure of maltose with suitable equations.

PART – C

Answer any THREE questions: 3 x 13 = 39

5. a) How to determine the configuration of geometrical isomers?
   b) Explain the neighbouring group participation in nucleophilic substitution reactions.

   (7 + 6 = 13)

6. a) Give any two substitution reactions at allytic carbon atom with equations.
   b) Explain in detail Hucle's rule of aromaticity. (7 + 6 = 13)

7. a) Give the Saytzeff and Hoffmann rules.
   b) Give any four reactions of pyrimidine. (7 + 6 = 13)

8. a) Give any two methods of preparation of crown ethers.
   b) Describe the synthesis of leucine using melonic ester route. (6 + 7 = 13)

9. a) Describe the classification of amino acids with examples.
   b) Write a note on 'Orientation during elimination reactions'. (6 + 7 = 13)

PART – D

Answer any ONE question:

10. a) Structure and configuration of monosacharides.

    b) Halogenation of benzene. (6 + 4 = 10)

11. Write a note on the following:

    a) Aromaticity of cyclopropyl cation.

    b) Enantiomers and diastereomers.

    b) Anomeric effect. (3 + 4 + 3 = 10)

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M.Sc. Previous (Chemistry) Examinations,
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(Directorate of Distance Education)

Paper: DPA – 540: DECHEM: 1.04: Physical Chemistry – IV

Time: 3 hrs]   *[Max. Marks: 75/85*

*Note: 1) **Scheme 75 Marks** – Answer **Part – A** (any **TEN** subdivisions).*
*Any **TWO** questions from **Part – B** and **THREE** questions from **Part – C**.*

*2) **Scheme 85 Marks** – Answer **Part – A** (any **TEN** subdivisions).*
*Any **TWO** questions from **Part – B** and **THREE** questions from **Part – C***
*and **ONE** question from **Part – D**.*

PART – A

1. ***Answer any TEN subdivisions***   10 x 2 = 20 Marks
   a) What is the importance of deBroglie's equation?
   b) Explain Heisenberg's uncertainty principle.
   c) What are the significance of wave function?
   d) Differentiate between extensive and intensive properties of a system.
   e) State Zeroeth law of Thermodynamics.
   f) Define order and molecularity of a chemical reaction.
   g) Write note on types of catalysis.
   h) Calculate the value of rate constant for first order reaction whose half life period is 300 sec.
   i) What are acid base indicators? Give an example
   j) Define hard and soft acids and bases.
   k) What is over potential? Explain
   l) Explain decomposition potential.
   m) Explain the depolarizing action of nitrate ion at the cathode.
   n) What is half wave potential?
   o) Write the Ilkovic equation. Explain its terms.

PART – B

Answer any TWO questions: 2 x 8 = 16
2. a) Explain Rutherford's atomic model. Mention its limitations.

   b) Briefly discuss the Davisson and Germer experiment.   (4 + 4 = 08)

3. a) Explain with example order and molecularity of complex reactions.

   b) Give an account on general characteristic of catalytic reactions.   (4 + 4 = 08)

4. a) Explain electronic separation of metals and mention the characteristics of deposit.

b) Write note on analytical applications of amperometric titrations. (4 + 4 = 08)

PART – C

Answer any THREE questions: 3 x 13 = 39

5. a) Write a note on the influence of solvent on strengths of acids.
   b) Discuss the effect of substituents on strengths of acids and bases.
   c) How is degree of hydrolysis calculated? Explain. (4 + 5 + 4 = 13)

6. a) Formulate the Schrodinger wave equation and give the conditions for acceptable wave function.
   b) Explain the Compton effect.
   c) Picturise the Bohr's quantum theory of hydrogen atom. (4 + 4 + 5 = 13)

7. a) Derive the ratios between Cp and Cu in gaseous system.
   b) Discuss Joule – Thomson effect.
   c) Write a note on absolute temperature scale. (4 + 5 + 4 = 13)

8. a) Derive an integrated rate expression for the first order reaction.
   b) Formulate Michelis – Menton equation.
   c) Write a note on acid base catalysis (4 + 5 + 4 = 13)

9. a) Mention the advantages of ion selective electrode.
   b) Explain on different kinds of currents contributing to the polarographic wave
   c) Discuss on constant current coulometry. (4 + 5 + 4 = 13)

PART – D

Answer any ONE question:

10. a) Write a note on thermodynamic processes and their types.

    b) Give the postulates of quantum mechanics. (5 + 5 = 10)

11. a) With principle explain the working of polarographic technique.

    b) Sketch and explain cyclic voltammogram taking suitable examples. (5 + 5 = 10)

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