Fourth Semester B.Sc. Degree Examinations

MAY/JUNE 2026

(NEP CBCS Scheme)

(New Syllabus 2021 onwards)

CHEMISTRY

NSD 0230: PAPER: INORGANIC AND PHYSICAL CHEMISTRY – II

Time: 2 hrs] *[Max. Marks: 60*

Instructions to Students:

1. ***The Students should legibly write Section number along with question numbers within the margin ONLY.***
2. ***The answer without Section number and question numbers will not be valued.***
3. ***Draw neat and labelled diagram wherever necessary.***
4. ***Use of Scientific non programmed calculator is permitted.***
5. ***Section – I multiple Choice Questions should be answered in the first page of main answer book and same questions shall not be answered repeatedly.***
6. ***Any identifications like marking, ticking, dots etc., in the options of MCQ (Section – I) on the question paper is strictly prohibited. Do not write anything (except register number) on the question paper.***

SECTION – I

Each one the following questions is provided with four answers a, b, c and d. Choose the correct answer among them and write it along with the respective answer in the main answer book: $10 \times 1 = 10$

I - 1) Central metal ion with a coordination number of 4 and a square planar geometry typically involves which type of hybridization?

a) sp b) dsp^2 c) sp^3d d) d^2sp^3

I - 2) The Sidgwick-Powell theory is primarily used to predict the:

a) Bond length between atoms
b) Geometry of simple molecules based on the arrangement of electron pairs around the central atom
c) Polarity of a molecule
d) Strength of a covalent bond

Contd..... 2

I - 3) How does a catalyst alter the rate of a reaction?

a) By forming an intermediate complex b) By increasing the activation energy
c) By lowering the activation energy d) None of the these

I - 4) The fraction of total current carried by an ion is called

a) Avogadro number b) Transport number
c) Gold number d) None of the these

I - 5) Molar conductivity of 0.15 M solution of KCl at 298 K, if its conductivity is 0.0152 S cm^1 will be

a) $124\Omega^{-1}cm^2mol^{-1}$ b) $300\Omega^{-1}cm^2mol^{-1}$
c) $204\Omega^{-1}cm^2mol^{-1}$ d) $101\Omega^{-1}cm^2mol^{-1}$



I - 6) Which of the following sets of ions are isoelectronic?

a) Li^+, Na^+, K^+ b) F^-, Cl^-, Br^- c) O_2^-, F^-, Na^+ d) $Mg^{2+}, Ca^{2+}, Sr^{2+}$

I - 7) Langmuir derived an equation based on which of the following facts?

a) Every active site of the adsorbent acts in the same way
b) Adsorbate is adsorbed on the surface of the solid (adsorbent) to form a monolayer
c) The rate of adsorption is proportional to the concentration of the adsorbate [A] and the number of unoccupied sites available $(1-\alpha)$
d) All of these

I - 8) Which of the following ionic compound is likely to be the most soluble in water?

a) AgCl b) KCl c) $BaSO_4$ d) $PbCl_2$

I - 9) 'The entropy of a perfectly crystalline substance is zero at $0K$'. This statement describes,

a) Zeroth Law of Thermodynamics b) First Law of Thermodynamics
c) Second Law of Thermodynamics d) Third Law of Thermodynamics

I - 10) The Molar conductivity of an electrolyte increases as

a) Dilution increases b) Dilution decreases
c) Temperature decreases d) none of the above

Contd..... 3

SECTION – II

Answer any FIVE of the following: 5 × 3 = 15

II - 1) How does Gibb's free energy varies with temperature and pressure?

II - 2) State and explain First law of thermodynamics.

II - 3) Explain the characteristics of entropy.

II - 4) Define bond order. Calculate the bonder order in Nitrogen molecule.

II - 5) Explain Debye-Huckel-Onsager equation.

II - 6) Explain Fajan's rule.

II - 7) Explain the shape of H_2O on the basis of VSEPR theory.

II - 8) Write a note on collision theory of reaction rates.

SECTION – III

Answer any THREE of the following: 3 × 5 = 15

III - 1) Describe the energy level diagram of O^{2-} ion and calculate the bond order and comment on its magnetic property.

III - 2) Give the salient features of VSEPR theory.

III - 3) Discuss the Born-Haber cycle for the formation of NaCl.

III - 4) Derive an expression for the kinetics of second order rate constant of a reaction when $[a] \neq [b]$.

III - 5) a) Derive an expression for the work done during reversible isothermal expansion of an ideal gas.

b) Calculate the work done during reversible expansion of 2 moles of an ideal gas at 25°C from 5 atm to 10 atm. Given R = 8.314 J/mole/K

SECTION – IV

Answer the following: 2 × 10 = 20

IV - 1) a) i) Discuss the application of conductance measurement in the determination of Ionic product of water. For water at 30°C, the Kw has a value of 1.46×10^{-14}. What will be H^+ concentration at 30°C?

ii) Describe the experimental determination of kinetics of inversion of cane sugar by polarimetric method. (5 + 5 = 10)

Contd..... 4

OR

b) i) Write the expression for Arrhenius equation and explain the terms in it. The rate of a reaction doubles when the temperature changes from 290 to 330K. Find the energy of activation of the reaction assuming that it does not change with temperature.

ii) Define the term catalysis. Explain the Michaelis-Menten mechanism and give the equation (5 + 5 = 10)

IV - 2) a) i) What are ionic compounds? Explain the structure of CaF_2 & CdI_2.

ii) State the radius ratio rule. What are the assumptions and limitations of this rule in predicting the structures of ionic solids? (5 + 5 = 10)

OR

b) i) Explain the Molecular Energy level diagram of Carbon monoxide with a neat diagram and calculate its bond order.

ii) Explain the electrical properties of metals, non-metals and semi-conductors on the basis of band theory. (5 + 5 = 10)

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