DEPARTMENT OF CHEMISTRY
NAMBOL L. SANOI COLLEGE, NAMBOL

QUESTION BANK FOR CHEMISTRY (ELECTIVE)
PREVIOUS 3 YEARS (2017, 2018 & 2020)

SEMESTER - VI
PAPER-X / CH- 610 :

PHYSICAL CHEMISTRY

UNIT-1: Computer Applications in Chemistry

Very Short Answer Type Carrying 1 mark
(1 MARK QUESTIONS)

(a)	What is algorithm?	**(2017)**
(b)	Give two types of processors used in supercomputers.	**(2017)**
(c)	What is microprocessor?	**(2018)**
(d)	What are integrated soft-wares?	**(2020)**
(e)	What is a computer program?	**(2020)**
(f)	What is meant by backup copy?	**(2020)**

SHORT ANSWER TYPE
(2 MARKS QUESTIONS)

(a)	What do you understand by integrated software?	**(2017)**
(b)	Write a flowchart for a program to reverse the number 2463 to 3642.	**(2017)**
(c)	What are superconductors? Write the drawback of fourth generation computers.	**(2018)**

SHORT ANSWER TYPE
(3 MARKS QUESTIONS)

(a)	Write a flowchart to calculate the molality of a solution.	**(2018)**
(b)	Write a flowchart to calculate the molality of a solution.	**(2020)**

UNIT-2: Quantum Chemistry - II

Very Short Answer Type Carrying 1 mark
(1 MARK QUESTIONS)

(a)	What is wave function?	**(2017)**
(b)	What is node of the wave function?	**(2018)**
(c)	Give the total probability of finding the particle within the box.	**(2018)**
(d)	What is degeneracy?	**(2020)**
(e)	Set up Schrödinger wave equation for a particle in a potential well.	**(2020)**

SHORT ANSWER TYPE
(2 MARKS QUESTIONS)

(a)	What is a normalized wave function? Draw the radial distribution function of the electron in 2s orbital.	**(2018)**
(b)	What is the physical significance of wave function?	**(2020)**

SHORT ANSWER TYPE
(3 MARKS QUESTIONS)
(a)   Set up the Schrödinger equation for a particle in one-dimensional box.   **(2018)**
(b)   Plot E, , ^{2} of a particle in a box for quantum no., n = 1, 2 and 3.   **(2020)**

(6 MARKS QUESTIONS)
(a)   Write the physical interpretation of the wave function   and give its limitations.   **(2017)**

UNIT-3: Spectroscopy

SHORT ANSWER TYPE
(2 MARKS QUESTIONS)
(a)   The three consecutive lines in the rotational spectrum of HBr are observed at 84.54 cm^{-1}, 101.82 cm^{-1} and 118.21 cm^{-1}. Assign these transitions in terms of rotational quantum number.   **(2018)**
(b)   Show that the spacing between any two nearest absorption signals of rotational spectrum is constant.   **(2020)**

SHORT ANSWER TYPE
(3 MARKS QUESTIONS)
(a)   Write the essential criteria for a molecule to exhibit rotational spectrum. Give one example of a microwave inactive molecule.   **(2017)**
(b)   What are Stokes and anti-Stokes lines?   **(2017)**
(c)   Write P, Q and R branch of the spectrum.   **(2017)**
(d)   Discuss the effect of isotopic substitution on the rotational spectra.   **(2017)**

(6 MARKS QUESTIONS)
(a)   The fundamental and first overtone transitions of NO are observed at 1876.06 cm^{-1} and 3724.20 cm^{-1} respectively. Calculate the anharmonicity constant and the zero-point energy of the molecule.   **(2018)**
(b)   The fundamental and first overtone transitions of NO are at 1876 cm^{-1} and 3724 cm^{-1}. Calculate the anharmonicity constant, equilibrium vibration frequency and zero-point energy of the molecule.   **(2020)**

UNIT-4: Symmetry and Point groups

Very Short Answer Type Carrying 1 mark
(1 MARK QUESTIONS)
(a)   What is the point group of H_2O_2 molecule?   **(2017)**
(b)   Show the symmetry element i in the molecule, trans-1,2-Dichloroethene.   **(2017)**
(c)   Write the principal axis of SF_5Cl molecule.   **(2017)**
(d)   Give the symmetry elements of SOClF molecule.   **(2017)**
(e)   What is a symmetry operation?   **(2018)**

SHORT ANSWER TYPE
(2 MARKS QUESTIONS)
(a)   Construct the group multiplication table of point group C_{3^-}.   **(2017)**
(b)   What is a point-group? Give the point group of a molecule containing a C_2 axis and a $†_h$.   **(2018)**
(c)   On the basis of symmetry, CH_4 molecule can have dipole moment. Give reason.   **(2020)**
(d)   Construct group multiplication table of $CHCl_3$ molecule.   **(2020)**

(e)   What is a point group? Write all symmetry elements present in the point group D_{3d}.   **(2020)**

SHORT ANSWER TYPE
(3 MARKS QUESTIONS)

(a)   Giving the point group of $CHCl_3$ molecule, construct group multiplication table.   **(2018)**

UNIT-5: Electrochemistry I

Very Short Answer Type Carrying 1 mark
(1 MARK QUESTIONS)

(a)   For a reversible cell, what will be the value of ΔG^0 ?   **(2018)**
(b)   What are irreversible cells?   **(2020)**

SHORT ANSWER TYPE
(2 MARKS QUESTIONS)

(a)   Describe the construction of calomel electrode.   **(2018)**
(b)   Glass electrode is most convenient than any other electrodes used in the measurement of pH values of solutions. Explain why.   **(2020)**

SHORT ANSWER TYPE
(3 MARKS QUESTIONS)

(a)   The e.m.f. of the cell with transference

Ag | AgCl | HCl ($a_{\pm} = 9.01 \times 10^{-3}$) || HCl

($a_{\pm} = 4.5 \times 10^{-2}$) | AgCl Ag

at 25 °C is 0.028 V.

The e.m.f. of the corresponding cell without transference is 0.017 V. Calculate the liquid junction potential and the transference number of H^+.   **(2017)**

(b)   Discuss the use of glass electrode in pH measurements.   **(2017)**

(c)   Derive Nernst equation relating the e.m.f. of a cell with the concentrations of the reactants and the products of the reaction.   **(2017)**

(d)   The e.m.f. of the cell

Cd | $CdCl_2$ $2.5H_2O$ (saturated) || AgCl (s) | Ag is 0.0675 volt at 25 °C and 0.691 volt at 0 °C. Calculate the enthalpy change of this cell at 25 °C.   **(2018)**

(e)   A cell is represented as

Zn | Zn^{+2} (a = 1) || Cu^{+2} (a = 0.01) | Cu

Calculate the e.m.f. of the cell. Given $E^o_{Zn^{+2}} = -0.762$ V and $E^o_{Cu^{+2}} = +0.337$ V.   **(2020)**

UNIT-6: Electrochemistry II

Very Short Answer Type Carrying 1 mark
(1 MARK QUESTIONS)

(a)   What is decomposition potential?   **(2017)**
(b)   What is Debye-Falkenhagen effect?   **(2018)**

SHORT ANSWER TYPE
(2 MARKS QUESTIONS)

(a)   What are the factors affecting over voltage?   **(2018)**
(b)   What is over voltage ? Give its significance.   **(2020)**
(c)   What are the postulates of Debye-Hückel theory of strong electrolytes?   **(2020)**

SHORT ANSWER TYPE
(3 MARKS QUESTIONS)

(a)   Discuss the validity of Onsager's equation for aqueous solutions.   **(2017)**

(b)   Write the basic principle of moving boundary method for the determination of transference numbers.   **(2020)**

UNIT-7: Statistical Thermodynamics - II

Very Short Answer Type Carrying 1 mark
(1 MARK QUESTIONS)

(a)   Define rotational partition function.   **(2018)**

SHORT ANSWER TYPE
(2 MARKS QUESTIONS)

(a)   What do you mean by partition function? Give its physical significance.   **(2018)**

SHORT ANSWER TYPE
(3 MARKS QUESTIONS)

(a)   What are the basic assumptions of Maxwell-Boltzmann distribution of molecular speeds? Write the expression of the above distribution law and give its physical significance.   **(2018)**

(b)   Calculate the translational partition function of oxygen molecule at one atmosphere (assuming this gas behaves ideally).   **(2020)**

(c)   According to Maxwell-Boltzmann distribution law, discuss the distribution of molecular speeds of a gas at different temperatures.   **(2020)**

(6 MARKS QUESTIONS)

(a)   Derive Maxwell-Boltzmann distribution law of molecular velocities.   **(2017)**

UNIT-8: Surface Active Agents

Very Short Answer Type Carrying 1 mark
(1 MARK QUESTIONS)

(a)   Give an example of a zwitterionic surfactant.   **(2018)**

SHORT ANSWER TYPE
(2 MARKS QUESTIONS)

(a)   Write the difference between the structures of the surfactant in the polar and non-polar solvents.   **(2018)**

SHORT ANSWER TYPE
(3 MARKS QUESTIONS)

(a)   Surface active agents decrease the surface tension of the solvent. How will you explain this?   **(2017)**

(b)   Draw a neat spherical micelle and explain its various regions.   **(2017)**

(c)   Discuss the thermodynamics of micellization.   **(2018)**

(d)   What are micelles? Draw and explain various regions in it.   **(2020)**

(e)   Give a note on thermodynamics of micellization.   **(2020)**

UNIT-9: Chemical kinetics II

Very Short Answer Type Carrying 1 mark
(1 MARK QUESTIONS)

(a)   What are branched chain reactions?   **(2020)**

(b)   Define temperature coefficient of reaction rates.   **(2020)**

SHORT ANSWER TYPE
(3 MARKS QUESTIONS)

(a)   For a consecutive reaction, $A \rightarrow B \rightarrow C$, calculate the time when the concentration of B is maximum.
                                                                                                                                (2017)

(b)   Discuss Lindemann's theory of unimolecular reactions.   **(2017)**

(c)   Show that, for a parallel reaction, the ratio of the amount of products formed is constant at any given instant of time.   **(2017)**

(d)   In what ways transition state theory of reaction rate is superior to collision theory of reaction rate?
                                                                                                                                (2018)

(e)   The mechanism of the reaction between
         H_2 and Br_2 is
         $Br_2 \rightleftharpoons 2Br$
         $Br + H_2 \rightleftharpoons HBr + H$
         $H + HBr \rightarrow H_2 + Br$
         Show that the rate of formation of HBr is first order with respect to the concentration of hydrogen molecule.   **(2018)**

(6 MARKS QUESTIONS)

1.   Discuss in detail the transition state theory of reaction rates. In what way this theory is superior to the collision rate theory?   **(2020)**

UNIT-10: Phase equilibria II

Very Short Answer Type Carrying 1 mark
(1 MARK QUESTIONS)

(a)   What is incongruent melting point?   **(2017)**

(b)   What is eutectic point?   **(2018)**

(c)   Define peritectic point.   **(2020)**

(6 MARKS QUESTIONS)

1.   Two pure substances A having melting point 630 °C and B having melting point 400 °C form a compound X containing 0.2 mol of A. The compound melts at 630 °C and has two eutectic points at 200 °C containing 0.2 mol of A and 360 °C containing 0.7 mol of A. Construct the phase diagram and identify the phases present in the diagram.   **(2017)**

2.   Giving a suitable example, construct the phase diagram of the formation of compound with congruent melting points.   **(2018)**

3.   Discuss Debye-Hückel theory of strong electrolytes.   **(2018)**

4.   Construct a phase diagram of a system containing two solids A and B forming a stable compound A_2B with congruent melting point from the following data at constant pressure :

Mole % of B :	100	80	70	60	50	40	30	15	0
Temp (°C) :	540	420	380	400	410	200	250	300	350

         Identify the different phases present in the different regions of the diagram and state the degree of freedom at eutectic point.   **(2020)**

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