

QUESTION BANK

CHP -4101

SECTION -1

A) Multiple choice question

- 1) In a cyclic process-
 - a) Work done is zero.
 - b) Work done by the system is equal to the quantity of heat given to the system.
 - c) Work done does not depend upon quantity of heat given to the system.
 - d) The internal energy of the system increases.
- 2) For a thermodynamic system, work done in a process depends upon
 - a) The path
 - b) State of the system
 - c) External pressure
 - d) Nature of the system
- 3) In a reversible process entropy of the system
 - a) Remains constant
 - b) Increases
 - c) Decreases
 - d) Sometime increases or decreases
- 4) the first law of thermodynamics is related to
 - a) Internal energy
 - b) Enthalpy
 - c) Entropy
 - d) Gibbs free energy
- 5) Third law of thermodynamics implies that
 - a) $T=0K$ cannot be attained by infinite number of processes
 - b) T cannot be negative
 - c) Even at $T=0K$, there is non-zero entropy
 - d) None of the above
- 6) The combined form of first and second law of thermodynamics is given by
 - a) $TdS = dU + PdV$
 - b) $dQ = TdS + PdV$
 - c) $dU = TdS + dQ$
 - d) $TdS = dU - PdV$
- 7) If W is work done by a system against
 - a) Work done on the system by surrounding
 - b) Work done by system on its surrounding
 - c) Work done is zero
 - d) None of the above

- 8) Which of the following is fully fluorinated polymer?
 - a) Polyethylene
 - b) Teflon
 - c) PVC
 - d) Polystyrene
- 9) General gas equation is
 - a) $PV = mRT$
 - b) $PV = nRT$
 - c) $PV^n = C$
 - d) $C_p - C_v = R$
- 10) Carnot cycle consist of
 - a) Two constant volume and two reversible adiabatic processes
 - b) Two isothermal and two adiabatic processes
 - c) Two constant pressure and two reversible adiabatic processes
 - d) One constant volume, one constant pressure and two reversible adiabatic processes
- 11) The efficiency of Carnot cycle may be increased by
 - a) Increasing highest temperature
 - b) Decreasing the highest temperature
 - c) Increasing the lowest temperature
 - d) Decreasing the lowest temperature

B) One sentence answer

- 1) What is a state function?
- 2) What is a path function?
- 3) Enlist colligative properties.
- 4) Write a equation of Vant Hoff's factor.
- 5) State Raoult's law and write the equation.
- 6) Define heat and work.
- 7) Write down Schrödinger equation for particle in one dimensional box.
- 8) Write down photoelectric effect.
- 9) Define polymer and enlist it's types.
- 10) State second law of thermodynamics.
- 11) State third law of thermodynamics.
- 12) Define entropy and enthalpy.
- 13) Write down combined form of first and third law of thermodynamics.
- 14) State phase rule.
- 15) Draw a vapour-pressure phase diagram.
- 16) What is mean by the triple point of water?
- 17) How number average molecular weight of polymer is calculated?
- 18) Define partial molar volume.
- 19) Define osmosis and osmotic pressure
- 20) Write a mathematical form of first law of thermodynamics.
- 21) Draw diagram of Carnot cycle.
- 22) Enlist the steps of polymerisation chain reaction.
- 23) Define monomer and polymer.

- 24) Define rate and rate laws.
- 25) What is mean by pseudo-first order reactions. Give example.
- 26) Write a equation of efficiency of Carnot engine.

C) Short notes

- 1) Write a short note on black body radiation.
- 2) Write a short note on photoelectric effect and work function.
- 3) Write a short note on Gibbs function.
- 4) Write a note on depression in freezing point.
- 5) Write a note on elevation in boiling point
- 6) Write down Heisenberg uncertainty principle.
- 7) Write a note on Gibbs energy of mixing.
- 8) Write a note on exact and inexact differentials.
- 9) Write a note on Eigen value and Eigen function.
- 10) Write a note on Carnot cycle.

D) Short answer question.

- 1) Derive Schrödinger equation for particle in 1-D bore.
- 2) Enlist postulates of quantum mechanics.
- 3) Calculate stabilization energy of ethylene & Butadiene.
- 4) Write a short note on Helmholtz & Gibbs function.
- 5) Write a note on Gibbs energy of mixing.
- 6) Explain why entropy of adiabatic process is zero.
- 7) Define vapour pressure of liquids. How does it vary with temperature?
- 8) Define Helmholtz free energy. Show that it is state function.
- 9) Derive equation for Gibbs Helmholtz equation.
- 10) Derive Gibbs- Duhem equation.
- 11) Calculate the maximum work that can be done by reversible heat engine operating between.

E) Long answer questions

- 1) Write in brief addition & condensation polymerisation.
- 2) Derive Clausius -Clapyron equation.
- 3) Calculate the linear momentum of photons of wavelength 750 nm. What speed does an electron need to travel to have the same linear momentum?
- 4) Calculate the work done for a perfect gas which expands from its initial volume to final volume at 300 K temperature.
- 5) Explain the terms black body radiation ultraviolet catastrophe & Rayleigh-Jeans law.

- 6) Give Eigen function & Eigen value equation for particle in 1-D box.
- 7) Derive the Vant- Hoff reaction isotherm. Give its applications.
- 8) The energy required for the ionisation of certain atom is 3.44×10^{-18} . The absorption of a photon of unknown wavelength ionises the atom & ejects an electron with velocity $1.03 \times 10^{-6} \text{ ms}^{-1}$. Calculate the wavelength of incident radiation.
- 9) For a reaction, $\Delta G = -91.63 \text{ KJ}$ at 25°C & 1 Pascal pressure, find out the temperature coefficient at 25°C , if the heat of reaction is $105.06 \text{ KJ deg}^{-1}$.
- 10) Boiling point of H_2O is 100°C under what pressure will water boil at 102°C . Heat of vaporization of H_2O is 2259 Jg^{-1} .
- 11) Calculate the entropy change of a sample of perfect gas when it expands isothermally from a volume V_i to volume V_f .
- 12) Enthalpy change accompanying the formation of 1 mole $\text{NH}_3(\text{g})$ from its elements at 298 K is -46.1 KJ . Estimate change in internal energy and calculate Δn_g .
- 13) A polymer has the following molar mass distribution, calculate number average molar mass of the polymer-

Number of molecules	Molar mass(g/mol)
50	5000
75	6000

Section II

A) Multiple choice questions

- Which statistics will apply to deuterons and alpha particles?
a) Bose-Einstein b) Fermi –Dirac c) Maxwell – Boltzmann d) All of the above
- The total accessible states of N non interacting particles of spin 1/2 is
a) 2^N b) N^2 c) N d) $2^{N/2}$
- Choose the correct statement
a) The half life of first order reaction is independent of the initial concentration.
b) Order is always equal to molecularity of reaction.
c) The rate constant of reaction decreases with temperature.
d) The unit of second order rate constant are mole $\text{dm}^{-3} \text{S}^{-1}$
- The rate constant $k = 1.2 \times 10^3 \text{ mole}^{-1} \text{LS}^{-1}$ and $E_a = 2 \times 10^2 \text{ KJmole}^{-1}$ when $T \rightarrow \infty$
a) $A = 2 \times 10^2 \text{ KJmole}^{-1}$
b) $A = 1.2 \times 10^3 \text{ L mole}^{-1} \text{S}^{-1}$
c) $A = 1.2 \times 10^2 \text{ L mole}^{-1} \text{S}^{-1}$
d) $A = 2.4 \times 10^3 \text{ KJmole}^{-1}$
- Unit of first order rate constant is ...
a) Time^{-1} b) $\text{L mol}^{-1} \text{S}^{-1}$ c) L mol^{-1} d) none of the above
- The half life period of a first order reaction is 6.93 min. The time required for the completion of 99% of the chemical reaction will be ...
a) 230.3 min b) 23.03 min c) 46.06 min d) 460.6 min
- The frequency factor A in Arrhenius equation is directly related to ...
a) Entropy change in the chemical reaction
b) The free energy change in the reaction
c) The energy of activation
d) All of the above
- Which of the following does not influence the rate of reaction?
a) Nature of the reactant
b) concentration of the reactants
c) Temperature
d) Molecularity of the reaction
- The number of ways of distributing 20 identical objects into the boxes, with the arrangement 1, 0, 3, 5, 10, 1
a) 9.11×10^8 b) 9.31×10^8 c) 8.31×10^8 d) 9.5×10^8
- The steady state approximation is applied only for...
a) Reactant b) Product c) Intermediate d) All of the above

B) One sentence answer

- Define weight of configuration and configuration.
- Write down rule of undetermined multiplier.

- 3) Write down the Boltzmann distribution law.
- 4) Define ensemble and enlist its types.
- 5) Define order and molecularity.
- 6) Write down steady state approximation.
- 7) Write down Arrhenius equation and enlist terms involved in it.
- 8) Write down equation of third order rate constant and give its unit.
- 9) What are unimolecular and bimolecular reactions and write its examples.
- 10) Define quantum yield for photochemical reactions.
- 11) Define steric factor P.
- 12) Write equation of Michaels-Menten catalysis constant K_M .

C) Write short notes

- 1) State law of photochemical equivalence.
- 2) Write a note on consecutive reactions.
- 3) Write down the difference between order and molecularity.
- 4) Define partition function and obtain an expression for rotational partition function.
- 5) Write a short note on factors affecting on rate of chemical reaction.
- 6) Explain in short –Explosion.
- 7) Write a short note on flash photolysis.
- 8) Write a short note on radiolysis of water.
- 9) Write in short vibrational partition function.
- 10) Explain in detail translational partition function.
- 11) Describe in short uniform ladder system for molecular energy levels.
- 12) Explain in short temperature dependence of chemical reactions.
- 13) Explain reactions approaching equilibrium.
- 14) Derive equation first order rate constant.

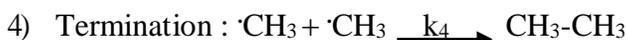
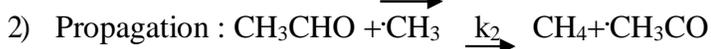
D) Short answer questions

- 1) Calculate translational partition function for hydrogen molecule in a 100 cc vessel at 25°C. Find out the thermal wavelength.
- 2) Plot Line weaver- Burk plots for competitive inhibition.
- 3) Write down the difference between Maxwell- Boltzmann distribution and Fermi-Dirac distribution.
- 4) Explain in detail activated complex theory.
- 5) Explain in detail transition state theory.
- 6) Explain in detail steady state approximation with example.
- 7) State the law of photochemical equivalence and define the term Einstein.
- 8) Plot Line weaver- Burk plots for competitive, uncompetitive and non-competitive inhibition.

- 9) Explain the terms initiation, propagation and termination. Discuss with suitable examples of the phenomenon of the chain reactions.
- 10) In a reaction a decrease in reactant concentration 30% in 30 min and 40% in 40 min calculate order of reaction and rate constant.
- 11) Derive the equation for second order velocity constant and show $t_{1/2} = 1/ak$
- 12) Calculate molecular translational partition function for N_2 at 298K in 24.7 L container.
- 13) Calculate the residual entropy for CO.

E) Long answer questions.

- 1) Derive the equation for Lindeman mechanism for unimolecular reactions.
- 2) Derive the equation for Michaelis - Menten catalysis.
- 3) What are diffusion controlled reactions and derive the equations for it.
- 4) What will be the initial rate of reaction if its rate constant is 10^{-3} min^{-1} and the concentration of the reactant will be converted into product in 200 min.
- 5) The enzymatic conversion of substrate at 25°C has a Michaelis constant 0.035. The rate of reaction is $1.2 \times 10^{-3} \text{ Ms}^{-1}$, when the substrate concentration is 0.11M. What is the rate constant of the enzymolysis of the initial concentration of the enzyme is considered constant.
- 6) Derive the equation for Rotational partition function.
- 7) Define residual entropy and calculate residual entropy for CO_2 molecule.
- 8) Prove that order of pyrolysis reaction of acetaldehyde is 3/2,



Prove that $d[\text{CH}_4]/dt = k[\text{CH}_3\text{CHO}]^{3/2}$ for



- 9) What is the rate constant for the recombination of Iodine atoms in hexane at 298 K, when the viscosity of the solvent is 0.326 CP.
- 10) Estimate the steric factor for the reaction $\text{H}_2 + \text{C}_2\text{H}_4 \rightarrow \text{C}_2\text{H}_6$ at 628K , given that the pre-exponential factor is $1.24 \times 10^6 \text{ L mol}^{-1} \text{ S}^{-1}$.
- 11) Derive equation of Arrhenius complex theory for energy of activation.
- 12) Half life of ^{14}C is 5760 years and 15.3 decay per minutes . Find out each of wood that decay 2.4 events per minute of ^{14}C .