

9. Choose the intensive property from the followings
- a. Mass
 - b. Volume
 - c. Heat energy
 - d. Specific heat capacity
10. In which equilibria, in which either P or T can be changed independently?
- a. Invariant
 - b. Univariant
 - c. Divariant
 - d. All of the above
11. Consider the Arrhenius equation given below and mark the correct option

$$k = A. e^{-\frac{E_a}{RT}}$$

- a. Rate constant increases exponentially with increasing activation energy and decreasing temperature.
 - b. Rate constant decreases exponentially with increasing activation energy and decreasing temperature
 - c. Rate constant increases exponentially with decreasing activation energy and decreasing temperature.
 - d. Rate constant increases exponentially with decreasing activation energy and increasing temperature.
12. Which of the following statements is not correct about order of a reaction.
- a. The order of a reaction can be a fractional number.
 - b. Order of a reaction is experimentally determined quantity
 - c. The order of a reaction is always equal to the sum of the stoichiometric coefficients of reactants in the balanced chemical equation for a reaction.
 - d. The order of a reaction is the sum of the powers of molar concentration of the reactants in the rate law expression
13. An assumption of Steady State Approximation is ____
- a. Reaction occurs without the formation of intermediates
 - b. Catalyst does not accelerate reaction rate
 - c. One of the intermediates in the reaction is consumed as quickly as it is generated
 - d. Equilibrium state is attained at the end of a reaction
14. Which of the following statements is incorrect about the collision theory of chemical reaction?
- a. It considers reacting molecules or atoms to be hard spheres and ignores their structural features
 - b. Number of effective collisions determines the rate of reaction
 - c. Collision of atoms or molecules possessing sufficient threshold energy results into the product formation

- d. Molecules should collide with sufficient threshold energy and proper orientation for the collision to be effective.
15. Activation energy of a chemical reaction can be determined by
- | | |
|--|--|
| a. Determining the rate constant at standard temperature | b. Determining the rate constants at two temperatures. |
| c. Determining probability of collision | d. Using catalyst |
16. Which of the following statements is false?
- | | |
|--|---|
| a. The repeating unit in natural rubber is isoprene. | b. Both starch and cellulose are polymers of glucose. |
| c. Artificial silk is derived from cellulose | d. Nylon-6,6 is an example of elastomer |
17. Which of the following act as an initiator in free-radical polymerisation?
- | | |
|---------------------|--------------------|
| a. Grignard reagent | b. Lewis acids |
| c. Benzoyl peroxide | d. Potassium amide |
18. Which type of polymers cannot be recycled:
- | | |
|-----------------|---------------------|
| a. Thermoplasts | b. Thermosets |
| c. Elastomers | d. All of the above |
19. The monomers used in the production of nylon-66 are
- | | |
|---|--|
| a. Adipic acid and hexamethylene diamine | b. Hexamethylene diamine and ethylene glycol |
| c. Dimethyl terephthalate and ethylene glycol | d. Adipic acid and ethylene glycol |
20. The unit of rate constant for first order reaction is
- | | |
|------------------------|-------------------------|
| a. S^{-1} | b. $Mol. L^{-1} S^{-1}$ |
| c. $mol^{-1} L S^{-1}$ | d. None of the above |

(Descriptive)

Time : 2 hrs. 30 mins.

Marks : 50

[Answer question no.1 & any four (4) from the rest]

1. a. The free energy change (ΔG) accompanying a given process is - 85.77 kJ at 25°C and -83.68 kJ at 35 °C. Calculate change in enthalpy (ΔH) for the process at 30 °C. 3+4+3
=10
- b. What is entropy production? Derive it for the heat flow in a system.
- c. What is steady state approximation? Explain its applications.
2. a. What is Oscillating Chemical Reactions? Discuss the kinetics of one Oscillating Chemical Reactions. 5+2+3
=10
- b. Match the items of Column I and Column II.

Column I	Column II
(i) Mathematical expression for rate of a reaction is	(a) rate constant
ii) Rate of reaction for zero order reaction is equal to	(b) rate law
(iii) Units of rate constant for zero order reaction is same as that of	(c) order of slowest step
(iv) Order of a complex reaction is determined by	(d) rate of a reaction

- c. Write the postulates of collision theory? For a bimolecular elementary reaction, write the expression for the rate constant in terms of collision number?
3. a. What is activation energy and threshold energy? 2+3+2+
3=10
- b. What do you understand by the number average molecular weight, Weight average molecular weight and Viscosity average molecular weight?
- c. What is Polydispersity Index? What are the information one can get from polydispersity index value?

d. An equal number of protein mixture containing hemoglobin 15 kg/mol, Ribonuclease 10 kg/mol, myoglobin 25 kg/mol. Calculate mass average and weight average molecular weight.

4. a. What are the basic differences between step growth and chain growth processes? 2+3+5
=10

b. Give one example of condensation and addition polymerisation and write their reaction.

c. What are the polymerization initiators? Write the free radical mechanism for polymerisation of polythene?

5. a. What do you understand by ring opening polymerisation? 2+4+2+

b. Write a short note on Emulsion polymerisation and suspension polymerisation technique. 2=10

c. Explain the terms fugacity and activity.

d. C_v for uranium metal is $3.04 \text{ JK}^{-1}\text{mol}^{-1}$ at 20 K. Calculate absolute entropy of the metal in $\text{JK}^{-1}\text{mol}^{-1}$ at 20 K.

6. a. Differentiate between precision and accuracy. 2+5+3=

b. Describe five elements of hypothesis test. 10

c. Differentiate between correlation and regression.

7. a. Fit the following data with the equation $y = a x^b$ 4+2+4
=10

x_i	1	2	3	4	5
y_i	0.5	1.7	3.4	5.7	8.4

b. What are Seebeck and Thomson effects?

c. Derive Gibbs-Helmholtz equation for a process at constant pressure.

8. a. Explain the various thermodynamic criteria of phase equilibrium. 5+5=10

b. Draw schematically the phase diagram for the water system and apply Gibbs phase rule to it.

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