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**Question Paper Code: 54904**

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2019

Fourth Semester

Chemical Engineering

15UCH404 – PHYSICAL CHEMISTRY

(Regulation 2015)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

- An increase in the temperature of the reactants causes an increase in the rate of reaction. The best explanation for this behavior is that as the temperature increases CO1- R
  - the concentration of reactants increases
  - the activation energy decreases
  - the collision frequency increases
  - the fraction of collisions with total kinetic energy  $> E_a$  increases
- For what order reaction does the half-life get longer as the initial concentration increases? CO1- R
  - Zeroth order
  - First order
  - Second order
  - None of them
- The one which decreases with dilution is CO2- U
  - Conductance
  - Specific conductance
  - Equivalent conductance
  - Molar conductance
- Which of the following reactions in aqueous solution does not result in the formation of a precipitate? CO2- U
  - Reaction of  $ZnCO_3$  with HCl.
  - Reaction of  $BaCl_2$  with  $Na_2SO_4$
  - Reaction of  $AgNO_3$  with KBr
  - Reaction of  $Pb(NO_3)_2$  with NaI

5. Degrees of freedom at triple point will be CO3- R  
 (a) 0 (b) 1 (c) 2 (d) 3
6. Ideal solutions obey CO3- R  
 (a) Raoult's law (b) The distribution law (c) Oswald's law (d) All of these
7. Rate of physical adsorption increase with CO4- R  
 (a) Increase in temperature (b) Decrease in pressure  
 (c) Decrease in temperature (d) Decrease in surface area
8. Which of the following is an example of homogeneous catalysis? CO4- R  
 (a) Enzyme catalysis (b) Hardening of animal and vegetable oils  
 (c) Haber's process (d) Cracking of heavy oils for a synthesis of gasoline
9. The \_\_\_\_\_ of colloids are of maximum importance since the interaction CO5- U  
 of the particles with each other and the principal phase is of primary concern.  
 (a) Magnitude (b) Surface (c) Size (d) Shape
10. Polymer formation from monomers starts by CO5- R  
 (a) condensation reaction between monomers  
 (b) coordination reaction between monomers  
 (c) conversion of monomers to monomer ions by protons  
 (d) hydrolysis of monomers

PART – B (5 x 2= 10 Marks)

11. What are parallel reactions? Give an example. CO1- U
12. State Kohlrausch's law of independent mobility of ions. CO2- R
13. Determine the number of degrees of freedom in each of the following CO3- Ana  
 systems.  
 (i) Liquid water and water vapour in equilibrium.  
 (ii) Liquid water and water vapour in equilibrium at a pressure of 1 atm.
14. Compare the catalytic poisons with catalyst inhibitors. CO4- Ana
15. What are sols and gels? Give examples. CO5- R

PART – C (5 x 16= 80 Marks)

16. (a) (i) What is meant by order of a reaction? Derive the rate expression for second order reaction when the reactants are different. CO1- U (12)
- (ii) Explain half-life time of a reaction CO1- U (4)
- Or
- (b) Elucidate the influence of ionic strength on the rates of ionic reactions. CO1- U (16)
17. (a) (i) State and explain Kohlrausch's law. Discuss any of its two applications. CO2- U (8)
- (ii) What is pH? How is pH of an electrolyte determined with hydrogen electrode. CO2- U (8)
- Or
- (b) (i) Derive Oswald's dilution law for weak electrolytes CO2- U (8)
- (ii) Explain any four types of conductometric titrations with suitable diagrams. CO2- U (8)
18. (a) (i) Explain how the phase diagrams can be drawn with the help of cooling curves. CO3- U (8)
- (ii) Draw a phase diagram for simple eutectic system and write its application in Pattinson's process. CO3- U (8)
- Or
- (b) State the distribution law. Under what conditions is the law valid? Discuss the practical applications of the distribution law. CO3- U (16)
19. (a) (i) Discuss Langmuir theory of adsorption and derive expression for Langmuir's monolayer adsorption isotherm. CO4- U (12)
- (ii) Write the application of adsorption. CO4- U (4)
- Or
- (b) (i) Derive Michaelis –Menten equation and explain the method of determining the constants  $K_m$ ,  $V_m$  and write the limitations of Michaelis –Menten kinetics. CO4- U (12)
- (ii) Differentiate between homogeneous and heterogeneous catalysis. CO4- U (4)

20. (a) (i) Write briefly on the preparation, properties and industrial applications of emulsions. CO5- U (8)
- (ii) What is the origin of electrical charge on colloidal particles? Explain the concept of electrical double layer and zeta potential. CO5- U (8)

Or

- (b) Discuss the method based on measurements of osmotic pressure of solution of polymers for the determination of their molar masses. CO5- U (16)