

Your Roll No

BSc-MSc INTEGRATED PROGRAM (CHEMISTRY)
SEMESTER II EXAMINATION- 2018
PHYSICAL CHEMISTRY-II
Paper Code- BCH-CC6

Time: Three Hours

Maximum marks: 75

(Write your Roll No. at the top immediately on receipt of this question paper)

Attempt all questions. All parts of a question must be attempted in continuation. Start answer of a fresh question on a new page. Cite examples and draw labeled diagrams wherever necessary.

Q.1. Answer all the questions given below:

(15x 1= 15)

- a. State the condition for chemical equilibrium.
- b. At $F=0$ the numbers of phases of the system are.....
- c. What is polymorphism?
- d. Write the equation for reduced phase rule.
- e. What is meant by the term rate constant?
- f. Give any two examples for second order reactions.
- g. State the Arrhenius equation.
- h. The reaction $2\text{NO}(\text{g}) + 2\text{H}_2(\text{g}) \longrightarrow \text{N}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l})$ was studied at 1100 K and the following data was obtained

	[NO] mol/lit	[H ₂] mol/lit	Rate of the reaction (r)
1.	5×10^{-3}	2.5×10^{-3}	3×10^{-5}
2.	15×10^{-3}	2.5×10^{-3}	9×10^{-5}
3.	15×10^{-3}	10×10^{-3}	36×10^{-5}

What is the order of reaction with respect to NO, H₂ and the overall reaction order?

- i. Differentiate between homogenous and heterogeneous catalysis?
- j. State the factors influencing the enzyme activity.
- k. What is catalytic poison?
- l. The catalyst does not initiate the reaction. State true or false.
- m. Differentiate between adsorption and absorption
- n. What is desorption?
- o. What is molar enthalpy of adsorption?

Q.2. Answer any three of the following:

(3x5=15)

- A. State the phase rule. Explain the various terms involved and discuss the derivation of the phase rule.
- B. Draw and discuss the phase diagram for the water system and apply the Gibbs to it.
- C. Draw the phase diagram for two component systems involving eutectic melting point.
- D. Write a short note on Nernst distribution law.
- E. Determine the number of degrees of freedom in each of the following systems. Suggest the variables that could correspond to degrees of freedom.
 - (a) Liquid water and water vapour in equilibrium.
 - (b) Liquid water and water vapour in equilibrium at a pressure of 1 atm.

Q.3. Answer any three of the following:

(3x5=15)

- A. Differentiate between molecularity and order of the reaction.
- B. How do you determine the order of ester hydrolysis?
- C. Integrate the rate expression for a first order reaction.
- D. Derive expressions for half life time of first-order, second-order, third-order and n^{th} order reactions.
- E. Discuss the kinetics of consecutive reactions.

Q.4. Answer any three of the following

(3x5=15)

- A. Illustrate the lowering of Gibbs free energy of activation of a reaction by a catalyst.
- B. In the acid hydrolysis reaction $A + H_2O + H^+ \longrightarrow \text{Products}$, where $[H^+] = 0.1 \text{ mol dm}^{-3}$ and H_2O is present in large excess, the apparent rate constant is $1.5 \times 10^{-5} \text{ s}^{-1}$. Calculate the true rate constant.
- C. Discuss the kinetics of unimolecular reactions.
- D. Derive Michaelis –Menten equation.
- E. Discuss the kinetics of an acid-base catalysed reaction.

Q.5. Answer any three of the following

(3x5=15)

- A. Derive an expression for Langmuir's adsorption isotherm.
- B. Discuss the factors influencing the adsorption of a gas on a solid with a special emphasis on Freundlich adsorption isotherm.
- C. How does chemisorption differ from physisorption?
- D. Calculate how long a hydrogen atom will remain on the surface of a solid at 1000 K if its desorption activation energy is 15 kJ mol^{-1} . (Assume that $\tau_0 = 10^{-13} \text{ s}$).
- E. A sample of charcoal weighing 6.00 g was brought in to contact with a gas contained in a vessel of one litre capacity at 27°C . The pressure of the gas was found to fall from 700 to 400 torr. Calculate the volume of the gas (reduced to STP) that is adsorbed per gram of the adsorbent under the conditions of the experiment. The density of the charcoal sample was 1.5 g cm^{-3} .

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