



'সমানো মন্ত্র: সমিতি: সমানী'

**UNIVERSITY OF NORTH BENGAL**

B.Sc. Honours 3rd Semester Examination, 2021

**CC7-CHEMISTRY**

**PHYSICAL CHEMISTRY**

Time Allotted: 2 Hours

Full Marks: 40

*The figures in the margin indicate full marks.  
All symbols are of usual significance.*

**Answer any four questions from the following**

10×4 = 40

1. (a) What is half life of a reaction? 1
- (b) Derive expression for half-life of a zero order and 1<sup>st</sup> order reactions. How do the  $t_{1/2}$  values depend upon the initial concentration of these reactions? 4
- (c) Describe the Lindemann theory of unimolecular reactions.  $2\frac{1}{2}$
- (d) Calculate activation energy for a chemical reaction whose velocity constant is tripled when temperature is raised from 22 to 32°C.  $2\frac{1}{2}$
  
2. (a) What is an adsorption isotherm? 1
- (b) Discuss the behaviour of Langmuir adsorption isotherm at very low and very high pressure. 2
- (c) The efficiency of contact catalyst increases with the subdivision of the catalyst. — Explain. 2
- (d) Explain the following with example:  $2\frac{1}{2} + 2\frac{1}{2}$ 
  - (i) Catalytic poison
  - (ii) Auto catalysis
  
3. (a) What is optimum temperature in case of enzyme catalysis? 2
- (b) What are co-enzymes? 2
- (c) What do you understand by average rate of a reaction? 3
- (d) For a first order reaction, half life period is 100 seconds. How much time will it take for the reaction to be 75% completed? 3
  
4. (a) Define component and degree of freedom. 3
- (b) State the phase rule. 2
- (c) Draw a well labelled diagram for water system. Discuss its salient features. 5

5. (a) Define temperature co-efficient of a reaction. 2  
 (b) What do you understand by steady state principle? 2  
 (c) What is threshold energy? Explain diagrammatically the relationship between threshold energy, activation energy and heat of reaction. 4  
 (d) What is an activated complex according to transition state theory? 2

6. (a) What is eutectic point? 2  
 (b) For the equilibrium  $L$  (liquid)  $\rightleftharpoons$   $G$  (Gas), show that 3

$$\ln\left(\frac{P_2}{P_1}\right) = -\frac{\Delta H_V}{R} \left[ \frac{1}{T_2} - \frac{1}{T_1} \right], \text{ symbols have their usual meaning.}$$

- (c) Ether boils at 33.5°C at one atmosphere pressure. At what temperature will it boil at a pressure of 750 mm, given that the heat of vapourisation of ether is 369.86 Joules per gram? 3  
 (d) What is Nernst distribution law? 2

7. (a) Discuss in detail the Collision theory of bimolecular reactions. 4  
 (b) At a certain temperature, the half life periods for the catalytic decomposition of ammonia at its various initial pressure were found to be as below: 4

	Expt 1	Expt 2	Expt 3
Pressure in mm Hg	50	100	200
Half life periods in hrs	3.52	1.92	1.00

Find the order of the reaction.

- (c) What are parallel reactions? 2
8. (a) Determine the number of components, number of phases and degrees of freedom of the following systems: 3  
 (i)  $H_2O(s) \rightleftharpoons H_2O(l) \rightleftharpoons H_2O(g)$   
 (ii)  $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$   
 (b) What are the limitations of phase rule? 3  
 (c) Derive Duhem-Margules equation. 4

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