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3 (Sem -3 /CBCS ) CHE HC 3

2024

**CHEMISTRY**

(Honours Core)

Paper : CHE-HC-3036

**(Physical Chemistry-III)**

Full Marks : 60

Time : Three hours

**The figures in the margin indicate  
full marks for the questions.**

1. Answer the following as directed :  $1 \times 7 = 7$

(i) What is the number of phases in ice and water system ?

(ii) What is the unit of  $k$  for 1<sup>st</sup> order reaction ?

Contd.



(iii) At triple point of water, how many phases coexist?

(iv) Give an example of parallel reaction.

(v) Molecularity of a reaction may be zero.  
(State as True or False)

(vi) A catalyst is unchanged chemically at the end of the reaction.  
(State as True or False)

(vii) Give an example of a one-component system.

2. Answer the following questions:  $2 \times 4 = 8$

(i) Distinguish between order and molecularity of a reaction.

(ii) What is an azeotropic mixture?

(iii) State and explain the steady state approximation.

(iv) Why are solid catalysts generally used in the finally divided state?

3. Answer **any three** of the following questions:  $5 \times 3 = 15$

(a) Draw and explain the phase diagram of water system.

(b) (i) Derive an expression of rate constant  $k$  for a first order reaction. 3

(ii) Write **two** characteristics of a first order reaction. 2

(c) (i) What is catalysis? 1

(ii) How many types of catalysis are there? Give examples of each type.  $2 + 2 = 4$

(d) Distinguish between physisorption and chemisorption. Give example of each type. Why chemisorption is stronger than physisorption?  $2 + 2 + 1 = 5$



(e) Write one suitable method of determination of order of reaction. Write one example of reaction where both order and molecularity is same.

$$4+1=5$$

4. Answer **any three** questions from the following :

$$10 \times 3 = 30$$

(a) (i) Define the terms 'phase' and 'components' of a system. How many phases and components are present in the following systems ?

$$3+2=5$$

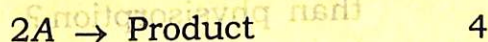
A. Ice, liquid water and water vapours

B.  $\text{CaCO}_3$ ,  $\text{CaO}$  and  $\text{CO}_2$

(ii) Write and derive the phase rule.

$$1+4=5$$

(b) (i) Derive the rate constant  $k$  for 2nd order reaction of type



(ii) Show that half-life period ( $t_{1/2}$ ) of 2nd order reaction is inversely proportional to the initial concentration of the reactant. 2

(iii) Show that the time taken for 99% of the first order reaction to take place is twice the time required for 90% of the reaction. 4

(c) (i) Derive Clausius-Clapeyron equation for liquid  $\rightleftharpoons$  vapour system. How will you obtain the heat of vapourisation using this equation? 4+2=6

(ii) Discuss ideal and non-ideal solutions with examples. 4

(d) Write the assumptions of Langmuir adsorption isotherm. Deduce Langmuir adsorption isotherm by considering these assumptions. Under what condition does Langmuir isotherm will be same as Freundlich adsorption isotherm? 3+5=2=10



(e) I. Explain the following terms used in phase rule study of heterogeneous equilibrium :

(i) Eutectic point

(ii) Triple point

(iii) Eutectic temperature 3

II. Discuss about two-component system of lead-silver system. 5

III. What is solid solution? Give example. 2

(f) (i) What is activation energy of a reaction? How it can be determined using Arrhenius equation? 2+3=5

(ii) What is an enzyme? Give example. 2

(iii) Write about specificity and selectivity of a catalyst. 3

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