

M.Sc. DEGREE EXAMINATION, NOVEMBER 2014  
BRANCH IV- CHEMISTRY  
THIRD SEMESTER

REG.NO .....

COURSE : CORE

PAPER : ADVANCED PHYSICAL CHEMISTRY

TIME : 30 MINUTES

MAX.MARKS : 20

SECTION – A

(20x1=20)

Answer all the questions:

I Choose the correct answer:

- The number of ways of putting three objects in 4 containers is  
a) 64                      b) 81                      c) 16                      d) 9
- The number of ways of placing two objects in three separate containers by Boltzmann statistics is  
a) 4                      b) 16                      c) 9                      d) 6
- Pick out the chemical process among the following, in photochemical processes.  
a) Fluorescence                      b) Phosphorescence  
c) Stimulated emission                      d) Isomerisation
- Plot of the logarithm of current density against the \_\_\_\_\_ is called a Tafel plot.  
a) Symmetry parameter                      b) Exchange current density  
c) Over potential                      d) transfer coefficient

II. Fill in the blanks :

- A catalyst \_\_\_\_\_ the activation energy of the reaction.
- Many heterogeneous reactions are \_\_\_\_\_ order reactions.
- The reaction in the formation of edible fats from vegetable and animal oil is catalytic \_\_\_\_\_.
- The catalytically induced fragmentation of the long chain hydrocarbons is called \_\_\_\_\_.

III. State whether True or False:

- The electronic partition function for the substance is given by,  
 $Q_e = \sum g e^{-\epsilon_0/kT}$ .
- Bose-Einstein statistics apply to the particles which are indistinguishable.
- Free radicals are produced in initiation step of chain reaction.
- Catalytic oxidation is widely used in pollution control.

**IV. Match the following:**

- |                              |   |
|------------------------------|---|
| 13. Partition function       | (a) Temperature dependence of reaction rate |
| 14. Pre equilibrium reaction | (b) Bacon cell                              |
| 15. Arrhenius equation       | (c) dimensionless quantity                  |
| 16. $H_2/O_2$ cell           | (d) Michaelis-Menton mechanism              |

**V. Answer in a line or two :**

17. Define microstate.

18. What is steady state approximation?

19. Write Butler-volmer equation for one electron transfer.

20. What is oxygen over voltage?

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**STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI-86**  
(For candidates admitted during the academic year 2011–2012 & thereafter)

**SUBJECT CODE: 11CH/PC/PC34**

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**TIME : 2½ HOURS**

**MAX.MARKS : 80**

**SECTION B**

**Answer ANY FIVE questions**

**( 5 x 8 = 40 )**

1. Evaluate the rotational partition function of ideal gas.
2. Derive Bose-Einstein statistics.
3. Explain consecutive reaction and its rate determining approach.
4. Discuss the effect of ionic strength on reaction rates.
5. Write a brief note on Gouy-chapmann model of electrical double-layer.
6. Draw and explain Oxygen-hydrogen fuel cell.
7. Evaluate BET-isotherm.

**SECTION C**

**Answer ANY TWO questions**

**(2 x 20 = 40 )**

8. a) How will you calculate the following thermodynamic properties in terms of partition function.  
(i) Heat capacities  
(ii) Residual entropies. (7+7)  
b) Write a note on phenomenological equations. (6)
9. a) Explain the kinetics of  
(i) polymerization (ii) Explosion (7+7)  
b) Estimate the second-order rate constant for the recombination of iodine atoms in hexane at 298K. (Viscosity of the solvent is 0.326 cp at 298 K). (6)
10. Write a brief note on  
a) Tafel and Nernst equation (4+3)  
b) Gibb's adsorption isotherm (7)  
c) Any two examples for catalysis (3+3)

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