M.Phil/Ph.D. IN CHEMISTRY
(MPHILCHEM/PHDCHEM)

Term-End Examination

⊓⊓275   **June, 2018**

RCHE-003 : ADVANCES IN PHYSICAL CHEMISTRY

Time : 3 hours   *Maximum Marks : 100*

Note : *Answer **all** the questions.*

1. Identify the role of Fe, Cu, I, Co and K in biological processes.   *10*

2. Discuss the methods based on evaporation for synthesising nanoparticles.   *10*

3. How has nanotechnology taken over the field of electronics ?   *10*

4. For gas-phase chemical reactions, derive the first order rate law. What would be the rate law for the reaction $2NO\ (g) + O_2\ (g) \rightarrow 2NO_2\ (g)$? Can you derive it from the balanced equation ? Justify.   *10*

5. (a) The reaction $2NO$ (g) $+ Cl_2$ (g) $\rightarrow 2NOCl$ (g) is second order in NO and first order in Cl_2. In a volume of 2 dm^3, 5 mol of nitric oxide and 2 mol of Cl_2 were brought together, and the initial rate was $2 \cdot 4 \times 10^{-3}$ mol dm^{-3} s^{-1}. What will be the rate when one half of the chlorine has reacted ? 5

(b) Discuss the steady-state approximation for complex reactions with the help of a suitable example. 5

6. (a) Describe the physical significance of the partition function. 5

(b) Calculate the proportion of I_2 molecules in their ground, first excited, and second excited vibrational states at 25°C. The vibrational wave number is $214 \cdot 6$ cm^{-1}.

(kT/hc is $207 \cdot 226$ cm^{-1} at $298 \cdot 15$ K) 5

7. Give the classification and preparation of colloids. 10

8. Briefly describe how micelles are formed. 10

9. What is controlled potential coulometry ? Discuss its applications. 10

10. Discuss the advantages and disadvantages of stripping voltammetry. Also, derive the polarographic equation. 10