2026
(Regular)
Chemistry (Core)
Paper Code : CH-CE-4234
Paper Name : Physical Chemistry

Time : 2 hours ***Full Marks : 45***

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

1. Answer the following questions as directed : 1×4=4
   a) Activated complex theory reduces to the hard sphere collision theory when the structure of the molecules is _____. (Fill in the blank with appropriate word)
   b) What is meant by limiting molar conductivity $\left(\Lambda^{\circ}_{m}\right)$?
   c) Write the Nernst equation for a general electrochemical reaction.
   d) What is a concentration cell ?
2. Answer the following questions : 2×3=6
   a) Explain activation energy of a reaction.
   b) State the conditions for a cell to be reversible.
   c) What are consecutive and parallel reactions ? Give one example of each.
3. Answer ***any three*** of the following questions : 5×3=15
   a) What is steady state approximation ? Discuss with example. 2+3=5
   b) Discuss the Arrhenius equation for the effect of temperature on the rate of reaction. 5
   c) Define transference number. How it is determined ? 2+3=5
   d) What is liquid junction potential ? How can it be minimized ? 3+2=5

e) Discuss any approximation method used in reaction kinetics. 5

f) Explain the principle of conductometric titrations. 5

4. Answer ***any two*** of the following questions : 10×2=20

a) What is a Chain reaction ? Name the steps involved in a Chain reaction . Discuss the kinetics of the H_2-Br_2 reaction. 1+2+7=10

b) Derive and discuss the Debye Hückel Onsager equation for strong electrolytes. Explain the significance of each term and its limitations. 7+3=10

c) i) Discuss the differences between galvanic and electrolytic cells. Construct and explain a galvanic cell for the spontaneous reaction : 3+4=7

$$Zn(s)+Cu^{2+}(aq)\leftrightarrow Zn^{2+}(aq)+Cu(s)$$

ii) What are the factors that determine the EMF of a galvanic cell? 3

d) i) What is meant by the electrochemical series ? Explain its significance in predicting the feasibility and direction of redox reactions. 2+6=8

ii) Calculate the standard EMF of the cell :

$$Zn\left|Zn^{2+}\right|\left|Cu^{2+}\right|Cu$$

Given that $E^{\circ}_{\frac{Cu^{2+}}{Cu}} = +0.34V$ $E^{\circ}_{\frac{Zn^{2+}}{Cu}} = -0.76V$

and state whether the reaction is spontaneous. 2

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