BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: MSc /IMSc   SEMESTER : I/VII
BRANCH: CHEMISTRY   SESSION : MO/2022

SUBJECT: CH402/CH402 R1 CHEMICAL KINETICS & SURFACE CHEMISTRY

TIME: 3:00 Hours   FULL MARKS: 50

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a)   Write Arrhenius equation. Derive an expression for temperature variations.   [2]
Q.1(b)   For a given first order reaction k is $2.6 \times 10^{-10} \, S^{-1}$ at 300 ^{0}C and $6.7 \times 10^{-4} \, S^{-1}$ at 500 ^{0}C. Calculate the   [3]
         energy of activation.
Q.1(c)   What do you understand by fast reactions? Illustrate the technique used in studying kinetics of fast   [5]
         reactions.

Q.2(a)   Discuss with a diagram hydrogen oxygen fuel cell in details   [2]
Q.2(b)   What do you understand by corrosion. Discuss a simple model for iron rod corrodes under a drop of   [3]
         water.
Q.2(c)   Discuss the Debye-Hockel limiting law, its   applicability and limitations.   [5]

Q.3(a)   The quantum yield for the reaction   [2]
         $2HI \rightarrow H_2 + I_2$ is 2. Calculate the number of photons absorbed in an experiment in which 0.01 mole of HI
         are decomposed. (N=6.02×10^{23})
Q.3(b)   Define the *Frank-Condon principle*. In a potential energy well, how are the vibrational energy levels   [3]
         and electronic transitions depicted? Draw the electronic transition v'=0 to v'=2 (0→2) for a diatomic
         molecule.
Q.3(c)   Draw and discuss the *Jablonski* diagram to show different photophysical processes.   [5]

Q.4(a)   Based on a well-known equation, what will be effect on Δ G, Δ H, and Δ S as a result of adsorption   [2]
Q.4(b)   What is the assumption and limitations of Langmuir Theory of Adsorption? Write down the BET   [3]
         equation directly and explain graphically BET plot for adsorption of N_2 on silica gel at -183^{0}C.
Q.4(c)   Explain 5 different types of adsorption Isotherms of gases on a variety of adsorbents at different   [5]
         temperatures showing saturation pressure p_0.

Q.5(a)   Differentiate colloidal system, SOL, and emulsion with examples.   [2]
Q.5(b)   Explain peptization, Lyophobic and lyophilic colloids with examples.   [3]
Q.5(c)   What are types of surfactants? What is CMC? Explain the factors affecting CMC in aqueous media.   [5]

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