EX/ChE/Chem/T/126/2019(Old)

BACHELOR OF ENGINEERING IN CHEMICAL ENGINEERING EXAMINATION, 2019

(1st Year, 2nd Semester)

PHYSICAL CHEMISTRY

Time: Three hours Full Marks: 100

(50 marks for each Group)
Use separate answer script for each Group

GROUP - A

1 a) "pH at the end point of a titration of a weak acid with a strong base is not 7" – Justify or criticize.

b) How would you experimentally determine the equivalent conductance of sodium chloride solution at infinite dilution?

c) Explain Grotthuss mechanism. What is its impact?

d) For the reaction $AB + CD \rightarrow AD(\downarrow) + CB$, predict the variation of conductance when CD solution is gradually added to a solution of AB.
(Given: The medium is water. AB, CD and CB are water soluble salts and AD is water insoluble)

5 + 5 + (3+2) + 6 = 21

2 a) Draw, with justification, the variation of conductance of a NH_4OH solution as a function of volume of hydrochloric acid solution gradually added to it from the burette.

b) To determine the transport number of K^+ ion in 0.1 N KCl solution by moving boundary method $CdCl_2$ solution is used as the indicator electrolyte. The solutions are taken in a capillary of internal diameter 2.124 mm. The cationic boundary shifts by 100 mm when a steady current of 14 mA is passed for 497 sec. Find out the transport number of K^+ ion.

5 + 8 = 13

3 a) Represent the Daniell cell and write the overall reaction taking place in the cell.

b) A real electrochemical cell can not have a negative potential – Explain.

c) For the cell $Zn \mid Zn^{2+}$ ($a_{\pm} = 0.05$) $\mid\mid Cu^{2+}$ ($a_{\pm} = 0.01$) $\mid Cu$, calculate at 25 °C E^0_{Cell}, ΔG^0 and the equilibrium constant for the cell reaction. Given: Standard oxidation potentials of Zn/Zn^{2+} and Cu/Cu^{2+} systems at 25 °C are 0.776 and -0.337 volts respectively.

(3 + 2) + 3 + (2 + 3 + 3) = 16

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B. E. Chemical Engineering First Year Second Semester (Old) – 2019

Physical Chemistry

Part – II

1. a) Define surface tension. Give its unit.
   b) What is capillary action?
   c) Calculate the height to which a liquid will rise in a glass capillary if the radius of the tube is 0.02 cm. The surface tension of liquid is 56.7 dynes cm^{-1}.
   d) Deduce Laplace equation of excess pressure acting a bubble.

   3+4+3+3

2. a) Write down Eotvos equation. At what temperature the surface tension will be zero?
   b) How does surface tension of water vary when a surfactant is dissolved?
   c) What is CMC?
   d) Draw the curve – surface tension vs. concentration of surfactant and explain.

   3+4+2+4

3. a) What is zeta potential?
   b) What is coagulation? State Hardy-Schulze rule for power of coagulation. Arrange the following in increasing order of flocculation value for a positively charged sols $MgCl_2$, $Al_2(SO_4)_3$, Na_3PO_4.
   c) What is Gold Number? 2+5+2

4. a) Distinguish between physical adsorption and chemisorptions.
   b) How can you show Freundlich adsorption isotherm is a special case of Langmuir isotherm?
   c) Volume of nitrogen gas (measured at S.T.P.) required to cover a sample of silica gel with unimolecular layer is 129 $cm^3\ g^{-1}$. Calculate surface area per gram of silica gel if each nitrogen molecule occupies $16.2 \times 10^{-20}\ m^2$.
   d) What do you understand by positive and negative adsorption?

   3+2+2+2

5. What are nano-dispersions? How does nanodispersion get stability? What are the applications of nanodispersions?

   2+2+2