EX/CHE/CHEM/T/126/2018

BACHELOR OF ENGINEERING IN CHEMICAL ENGINEERING EXAMINATION, 2018

(1^{st} Year, 2^{nd} 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) A cell contains decinormal aqueous KCl solution which has an equivalent conductance of 129 $ohm^{-1}cm^2eq^{-1}$. The measured resistance was 28.44 ohm. When the same cell was filled with 0.5 N aqueous NaOH solution, the resistance was 31.6 ohm. Find the equivalent conductance of the aqueous NaOH solution.

b) "In aqueous medium, ionic conductance values of H^+ and OH^- ions are remarkably higher than all other ions" – Justify or criticize.

c) Describe a method of determination of transport number in electrolytes. "In exceptional cases transport number may be negative" – justify or criticize.

6 + 4 + (5 + 3)

2 a) 10 mL 0.2 N NaOH was mixed with 10 mL of 0.2 N acetic acid. The pH of the resulting solution was determined not to be equal to 7.0. – Explain
(Given, at the experimental temperature K_a of acetic acid is 1.75×10^{-5}).

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

c) Explain and draw the variation of equivalent conductance of an aqueous solution of NH_4OH with a variation of concentration of the solution.

6 + 5 + 4

3 a) Describe saturated quinhydrone electrode. How can we determine the pH of a solution using this electrode?

b) Giving an example describe the characteristics of a standard cell.

c) From thermodynamics, establish that a real cell must have a positive potential.

d) Write down the individual electrode reactions and also the total cell reaction for the electrochemical cell: $Zn \mid Zn^{++}\ H^+\ H_2\ (g),\ Pt$

(4 + 3) + 4 + 3 + 3

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Ex/ChE/Chem/T/126

Chemical Engineering – First Year – Second Semester – New Syllabus – Regular Examination – 2018

Physical Chemistry

Group – B

1. a) Define surface tension. Give its unit.
b) Explain capillary action.
c) Calculate the height to which water will rise in a glass capillary if the radius of the tube is 0.02 cm. The surface tension of water is 72.8 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) Calculate the energy required to disperse one spherical water drop of radius 3.0 mm into droplets of radius 3.0×10^{-3} mm. Given surface tension of water is 72.8 dynes cm^{-1}.

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 aspecial 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 nanodispersions? How does a nanodispersion get stability? What are the applications of nanodispersions?

2+2+2