Reg. No.										

MANIPAL UNIVERSITY

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

IV SEMESTER B.TECH (CHEMICAL ENGINEERING)

END SEMESTER EXAMINATIONS, MAY 2017

SUBJECT: PHYSICAL CHEMISTRY [CHM 2201]

REVISED CREDIT SYSTEM

TIME: 3 HOURS DATE: 28-04-2017 MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.
- Draw diagrams and write chemical equations wherever necessary

1A. Derive the relation between vapour pressure lowering and osmotic pressure of a dilute solution.

1B. Explain how the degree of dissociation of an electrolyte may be determined from the measurement of colligative properties of an aqueous solution.

1C. Explain the effect of temperature and catalyst on the rate of reaction. Derive an expression for rate constant of second order reaction (a>b).

[2+4+4]

2A. Justify the following statements:-

i) Phase diagram is useful in the recovery of pure metals from alloys of different compositions by fractional crystallization.

ii) Ammonium nitrate salt bridge is used in argentometric titrations.

2B. **i)** What is primary salt effect? Derive an expression for rate constant of reaction in solution

ii) The specific conductance of water is 7.6×10^{-2}S m^{-1} and the specific conductance of 0.1M aqueous solution of KCl is 1.1639 Sm^{-1}. A cell has a resistance of 33.20Ω when filled with 0.1M KCl solution and 300Ω when filled with 0.1M acetic acid solution. Calculate the molar conductance of acetic acid.

2C. **i)** Give reason for the following

a) The electrodes of the conductivity cell are coated with finely divided platinum.

b) The two break in the potentiometric titration curve of mixture of acids against strong base.

ii) Write a note on the various factors affecting adsorption of gases on solid surfaces.

[2+4+4]

3A. A solution containing 8.6 g L^{-1} of urea (molar mass 60 g mol^{-1}) is isotonic with a 5% solution of unknown solute.

3B. Discuss the salient features of B.E.T. theory. How is the surface area of a solid determined experimentally?

3C. i) Explain with neat plot the potentiometric titration of complexometric reaction.
ii) Define order and molecularity of a reaction. Show that half life of a first order reaction is independent of initial concentration of reactant.

[2+4+4]

4A. One mole of component A and two moles of component B re mixed at 27° C to form an ideal binary solution. Calculate ΔG_{mix} , ΔS_{mix}, ΔH_{mix}, and ΔV_{mix}.
Assume R = 8.314 $JK^{-1}mol^{-1}$.

4B. **i)** With relavant plot explain the principle involved in cyclic voltametric measurements.
ii) Give reason for the following
a) Conventional method cannot be used for the determination of rate of fast reaction.
b) Precipitation reactions cannot be studied accurately by conductometric titration.

4C. **i)** State and derive Raoult's law for vapour pressure lowering. How is it used for determining the molar mass of a non-volatile compound?
ii) Calculate the mass of the solute of molar mass 342 g mol^{-1} that should be dissolved in 150 grams of water to reduce its vapour pressure to 22.8 torr. The vapour pressure of pure water at 25° C is 23.75 torr.

[2+4+4]

5A. Justify the following statements:
i) Activation energy of desorption is very low in case of physisorption and very high in case of chemisorption.
ii) Melting point of ice is lowered by increase of pressure.

5B. Explain with boiling temperature versus composition diagram why it will not be possible to recover both pure water and pure ethanol during the distillation of water-ethanol system.

5C. **i)** A solution containing 20% ethanol by mass in water has a density of 0.966 kg dm^{-3}. Calculate the mole fraction, molality and molarity of ethanol in this solution.
ii) For the reaction 2A+B →.products, doubling the initial concentration of both the reactants increases the rate by a factor of 8 and doubling the concentration of B alone doubles the rate. Calculate the order of reaction and rate constant of the reaction.

[2+4+4]

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