

BITS, PILANI – DUBAI CAMPUS

FIRST SEMESTER 2013 – 2014

II Year CHEM ENGG

COMPREHENSIVE EXAMINATION (CLOSED BOOK)

Course Code: CHE F214

Date: 8.1.2014

Course Title: Engineering Chemistry

Max Marks: 40

Duration : 3 hrs

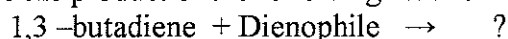
Weightage: 40%

1. Answer all questions sequentially.

2. Show stepwise calculation indicating the units wherever it is required.

3. $R = 8.314 \text{ J/K/mol}$, $F = 96500 \text{ C}$

1.(i) Write the product of the following reaction



(ii) What is meant by Pinacol-pinacolone rearrangement? Write the mechanism of this rearrangement.

(iii) In an experiment 4.27 g of boiling isopropanol is vaporized when a current of 0.812A from a 11.5 V source is passed for 303 s. What is the enthalpy of vaporization of isopropanol at its boiling point?

(iv) Define the flashpoint of a liquid.

[0.5+2+1+0.5M]

2.(i) Draw the phase diagram of water system indicating the temperature and pressure corresponding to the various points.

(ii) Write the principle involved in paper chromatography.

(iii) For the cell $\text{Fe} | \text{Fe}^{2+} (0.1 \text{ M}) || \text{Cd}^{2+} (0.01 \text{ M}) | \text{Cd}$, the standard reduction potential for Fe and Cd electrodes are -0.44 V and -0.40 V respectively. Find E_{cell}° , ΔG and predict if the cell reaction is spontaneous or not.

(iv) Explain the working of a dry cell with a diagram and redox reactions taking place in the cell.

[2+1+2+2M]

3. (i) Discuss Freundlich adsorption isotherm with a model graph.

(ii) What is meant by autocatalysis? Give an example.

(iii) Describe the method of production of biogas with a neat diagram mentioning its advantages and composition.

(iv) Explain the principle involved in the complexometric titration method using EDTA.

How will you determine the total hardness using EDTA method?

[2+1+2.5+2M]

4.(i) With a suitable block diagram explain the working of NMR spectrometer.

(ii) Explain the term overtones and predict the possible electronic transitions in Chlorine molecule.

(iii) What is meant by condensation polymerisation? Give an example.

(iv) Write the mechanism of wet corrosion.

[2+1.5+2+2M]

- 5 .(i) What are greases ? Give its constituents.
(ii) Describe the extraction of iron from the haematite ore with a neat diagram. Write the steps and the basic reactions involved in the extraction.
(iii) Write any two important characteristics of a refractory.
(iv) Give one example each for a natural and artificial abrasive. Write its composition and use.
[1+2+1+2M]
6. (i) What is meant by caustic embrittlement ? Write any one method of preventing it.
(ii) Explain the Zeolite process of water softening with a neat diagram .
(iii) Calculate the amount of lime and soda required to soften 10,000 litres of water containing the following salts.
Ca(HCO₃)₂ = 8.7 ppm, Mg(HCO₃)₂ = 7.3 ppm, CaSO₄ = 14.6 ppm, MgSO₄ = 10.8 ppm,
NaCl = 58.4 ppm.
(iv) Discuss the manufacture of Portland cement with a neat diagram.
(v) Calculate the degree of polymerization of styrene, if the number average molecular weight of the polymer is 3.4×10^4 g/mol.
[1+2+2+2+1M]

BITS, PILANI – DUBAI CAMPUS
FIRST SEMESTER 2013 – 2014
II Year CHEM ENGG
TEST-2 (OPEN BOOK)

Course Code: CHE F214

Date: 10.12.2013

Course Title: Engineering Chemistry

Max Marks: 20

Duration : 50 min

Weightage: 20%

1. Answer all questions sequentially. 2. Show stepwise calculation indicating the units wherever it is required.

3. Useful Data: $h = 6.626 \times 10^{-34}$ J.s, $c = 3 \times 10^{10}$ cm/s, $1 \text{amu} = 1.660 \times 10^{-27}$ Kg

- 1.(i) Write the balanced ionic equation for the reaction of potassium permanganate with oxalic acid in acidic medium. (1M)
- (ii) Draw the pH curve for the titration of acetic acid versus sodium hydroxide and indicate the stoichiometric point. (2M)
- (iii) Concentrated hydrochloric acid contains 37% (by mass) HCl. The density of its solution is 1.18g/ml. Calculate the molarity and molality of the solution. (3M)
- (iv) A monochromatic radiation is incident on a solution of 0.05 molar concentration of an absorbing substance. The intensity of the radiation is reduced to one-fourth of the initial value after passing through 10 cm length of the solution. Calculate the molar extinction coefficient of the substance. (1.5M)
- 2.(i) State the harmful effects of silica when present in water. (1M)
- (ii) A water sample using $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ as a coagulant at the rate of 278 ppm gave following data on analysis of raw water.
 $\text{Ca}^{2+} = 240$ ppm, $\text{Mg}^{2+} = 96$ ppm, $\text{CO}_2 = 44$ ppm, $\text{HCO}_3^- = 732$ ppm.
Calculate the lime and soda required to soften 250,000 litres of water. (4M)
- (iii) Differentiate between lime soda process and zeolite process. (1M)
- (iv) The force constant of HI is 310 Nm^{-1} . Calculate the vibrational frequency in cm^{-1} . (2M)
- 3.(i) Based on NMR spectra, identify the different types of protons and specify the no of signals, splitting pattern expected for 2-pentanone. (2.5M)
- (ii) Explain the term slaking. (1M)
- (iii) In the manufacture of Portland cement C_4AF does not contribute much to the strength of the cement. Justify. (1M)

BITS, PILANI – DUBAI CAMPUS
FIRST SEMESTER 2013 – 2014
II Year CHEM ENGG
TEST-1 (CLOSED BOOK)

Course Code: CHE F214

Date: 8.10.2013

Course Title: Engineering Chemistry

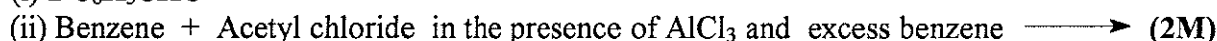
Max Marks: 20

Duration : 50 min

Weightage: 20%

1. Answer all questions sequentially. 2. Show stepwise calculation indicating the units wherever it is required.
3. Useful Data: $R = 1.987 \text{ cal/mol}\cdot\text{K}$ 1 litre. atm = 101.3 J Atomic weight : H=1, O=16.

1. Write the product of the following reactions:



2. Write the mechanism for

(i) the conversion of an unsubstituted amide into a primary amine with suitable example.

(ii) the conversion of acetaldehyde into aldol. (4M)

3. A gas contained in a cylinder fitted with a frictionless piston expands against a constant pressure of 1 atm from a volume of 5 litres to a volume of 10 litres. In doing so, it absorbs 400 J thermal energy from its surroundings. Calculate ΔU for the process. (2M)

4. Calculate the amount of heat necessary to raise 213.5 g of water from 25°C to 100°C .
Molar heat capacity of water is 18 cal/mol/K. (2M)

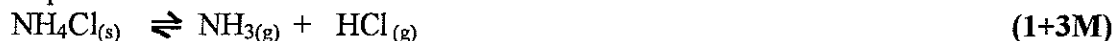
5. Draw the phase diagram of Cd-Bi system indicating the temperature and composition corresponding to various points. Discuss the characteristic features of the Cd-Bi system. (4M)

6. (i) Write any 2 limitations of phase rule.

(ii) Determine the degrees of freedom for the systems given below:

(a) Bromine dissolved in CCl_4 solution

(b) Decomposition of ammonium chloride in vacuum



7. Mention the temperature and pressure corresponding to the critical point and triple point of one component system water. (2M)

BITS, PILANI – DUBAI CAMPUS

FIRST SEMESTER 2013 – 2014

Course Code:CHE F214

SECOND YEAR CHEM ENGG QUIZ-2

Date:21.11.2013

Course Title:Engineering Chemistry

Max Marks:10

Duration : 20 minutes

Weightage: 10%

Name: ID No: Sec / Prog:

Instructions: (if any) Over writing will be taken as wrong answer

1. Give an example for homogeneous catalysis (liquid phase) . **(1M)**

2. Write an appropriate chemical equation indicating the enzyme catalysis. **(1M)**

3. Schematically represent the Langmuir adsorption isotherm and indicate the parameters. **(2M)**

4. Give one example each for an adsorbent that absorbs moisture and organics. **(1M)**

5. Write the chemical reactions that takes place during the demineralization process of water. **(1.5M)**
6. Write the expression representing the relationship between extent of adsorption and pressure at a constant temperature. **(1.5M)**
7. What is the effect of a catalyst on the equilibrium constant of a reaction ? **(1M)**
8. Write the BET equation that was derived considering the multilayer adsorption. **(1M)**

BITS, PILANI – DUBAI CAMPUS

FIRST SEMESTER 2013 – 2014

Course Code:CHE F214

SECOND YEAR CHEM ENGG

Date:31.10.2013

Course Title:Engineering Chemistry

Max Marks:10

Duration : 20 minutes

Weightage: 10%

Name: ID No: Sec / Prog:

Instructions: (if any) Over writing will be taken as wrong answer
F=96500 C, R=8.314 J/K/mol

1. Write the balanced equation for the electrolysis of Aluminium oxide. **(1M)**

2. The resistance of N/10 solution of a salt is found to be 2.5×10^3 ohms. Calculate the equivalent conductance of the solution. Cell constant = 1.15 cm^{-1} . **(1M)**

3. The standard EMF of the electrochemical cell involving the cell reaction
$$\text{Zn}_{(s)} + \text{Cu}_{(aq)} \rightleftharpoons \text{Zn}^{2+}_{(aq)} + \text{Cu}_{(s)}$$
 is 1.10 volts.
Calculate the equilibrium constant of the cell reaction at 25°C . **(1M)**

4. Write the anodic and cathodic reactions taking place in the Lead storage cell. **(1M)**

5. Give the components of the mixture used as electrolyte in Lithium batteries. (2M)
6. Give one example for an electrode concentration cell. (1M)
7. How do we make an ion selective membrane used in the glass electrode. (1M)
8. Why does the lifetime of the dry cell is not indefinite even when the cell is not in use? (1M)
9. Calculate the EMF of the cell
$$\text{Zn} \mid \text{Zn}^{2+}(0.001\text{M}) \parallel \text{Ag}^+(0.1\text{M}) \mid \text{Ag}$$

The standard potential of Ag/Ag^+ half cell is +0.80 V and Zn/Zn^{2+} is -0.76 V. (1M)
