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DATE: 23-04-2018

**ST. JOSEPH’S COLLEGE (AUTONOMOUS), BENGALURU-27**

**B.Sc., Chemistry : IV SEMESTER**

**SEMESTER EXAMINATION – APRIL 2018**

**CH 412: Chemistry**

**(*For supplementary candidates only)***

***Attach this question paper with the answer script***

Time : 3 hrs Maximum marks : 100

***Note:*** *This question paper has 3 printed pages and 3 parts. Give chemical equations wherever necessary.*

Useful data: h = 6.626 x 10-34 Js ; c = 3 x 108 ms-1 ; mass of electron = 9.11x10-31 kg.

**PART-A**

**Answer any TEN of the following:** 10 x 2 = 20 marks

1. What are promoters? Give an example.
2. What is heterogeneous catalysis? Give an example.
3. State Nernst distribution law.
4. Mention the effect of addition of NaCl on the critical solution temperature of phenol-water system.
5. What is an operator in quantum mechanics? Give an example.
6. What is an important requirement for a molecule to be microwave-active? Give an example for a microwave-active molecule.
7. How are primary alcohols prepared by the reaction between an epoxide and a Grignard reagent?
8. How do you prepare organolithium compounds? Mention the precautions.
9. Explain the variation of the metallic character on descending the group of the nitrogen family.
10. Write the structure of Marshall’s acid.
11. Give the composition of borosilicate glass.
12. Define the PCE of a refractory.

**PART-B**

**Answer any TEN of the following:** 10 x 6 = 60 marks

1. Derive an expression for the rate of specific hydrogen ion catalysed reaction.
2. (a) Taking a suitable example, explain homogeneous catalysis with the help of intermediate compound formation theory.

(b) Draw vapour pressure-composition curves for type II and type III non-ideal solutions. (3+3)

1. Discuss the fractional distillation of a binary liquid solution of type-I.
2. Derive the expression for the energy of a particle moving in a one-dimensional box (normalization of wave function is not required).
3. (a) Using energy level diagram explain the origin of Stokes’ lines and anti-Stokes’ lines in Raman spectra.

(b) How does diethyl ether react with (i) one mole of HBr (ii) excess of HBr (4+2)

1. What is zero point energy? What is its significance? Force constant of HF molecule is 9.7 X 102 Nm-1. Calculate its fundamental vibrational frequency in cm-1 and its zero point energy (atomic masses : H = 1.008 X 10-3 kgmol-1 ; F = 19.0 X 10-3 kgmol-1 )
2. Calculate the total number of vibrational modes in i) water ii) carbon dioxide. Sketch these modes of vibration for both and indicate which of these modes are Raman active and IR active.
3. (a) Outline all steps involved in the mechanism for the formation of tert-butyl alcohol [(CH3)3COH) by the acid catalysed hydration of 2-methylpropene.

(b) How does an alcohol react with phosphorous tribromide? (4+2)

1. Explain the acid-catalysed addition of water to (i) terminal alkynes and (ii) internal alkynes with identical alkyl groups and with different alkyl groups.
2. With the help of an energy profile diagram, explain the difference in the reaction between 1,3-butadiene and one mole of hydrogen bromide when the reaction is carried out at (i) - 80⁰C and (ii) 40⁰C. Give the mechanism and identify which of them is the kinetic product and which is the thermodynamic product.

1. (a) What are zeolites? Give the general formula representing their chemical composition. Mention any two applications.

(b) What is an abrasive? Give the names of two natural abrasives and two synthetic abrasives. (3+3)

1. (a) Discuss the trends in the oxidation states of halogens.

(b) Using the concept of hybridization, discuss the structure of XeF4 molecule.

(3+3)

1. (a) What are the basic raw materials required for the manufacture of cement? Give any two chemical equations involved in the setting of cement.

(b) Write the structures of (i) phosphorus trioxide and ii) bromine pentafluoride.

(3+3)

**PART-C**

**Answer any FIVE of the following:** 5 x 4 =20 marks

1. a) A weak organic acid is allowed to equilibrate between equal volumes of water and benzene. The volume of 0.1 N NaOH required for neutralization of 10cm3 of each layer in three different trials were tabulated. Assuming that the weak acid is not dissociated in water, determine the molecular state of the acid in benzene.

Volume of NaOH required for 10cm3 of

Water layer (cm3) 1.5 2.0 2.9

Benzene layer (cm3) 24.2 41.4 97.0

b) Mention the heat (energy) changes that are involved in the following process which represents the oxidizing action of bromine. (3+2)

1. Calculate the degeneracies of a particle of mass ‘m’ in a three-dimensional cubical box with width ‘a’ having energies equal to i) 6 ii) 9 iii)12 and iv) 14 in units of h2/8ma2.
2. a) Arrange the following in the order of increasing spacing in the rotational spectra:

HF, HCl, HI, HBr

 b) Which of the following molecules will show IR spectrum? Justify.

 Cl2, N2O, CO2, SO2  (2+3)

1. Two organic compounds A and B have the molecular formula C6H10. Compound A reacts with Br2 in CCl4 to yield a product with the formula C6H10Br4 whereas B gives C6H10Br2. When A is oxidized with hot basic KMnO4 and the resulting solution acidified, the organic products isolated were CH3COOH and HOOC-COOH. Under similar conditions B gives only HOOC(CH2)4COOH. Identify A and B and write chemical equations for the reactions mentioned.
2. a) i) How do you prepare the following organic compound by the reaction of a Grignard reagent with any other suitable reagent/s?

ii) Give a combination of another Grignard reagent and other suitable reagent/s that can be used to get the same product.

b) Identify a diene and a dienophile that react together to give the adduct given below. (3+2)

 (2.5 + 2.5)

------ End of questions ------