Department of Applied Sciences, Institute of Engineering & Technology, Lucknow

IAS-102/BAS-102 [Engineering Chemistry], Ist Class Test [Dec, 2023]

Time: 1Hr

Max Marks: 20

Note: Attempt all Questions. All questions carry equal marks.

Q.1. **(for IAS-102)** What are non-stoichiometric defects? Describe Schottky defect with the help of an example. How does this defect explain electrical conductivity in a material?

OR

Q.1. **(for BAS-102)** Calculate the bond order and magnetic character of O_2, O_2^+, O_2^-, O_2^{2-}. arrange the following molecules/ions in order of their increasing bond lengths, bond stability and electronegativity.

Q.2. Calculate the quantity of lime & soda required for softening 50,000 litres of water containing the following salts per litre;
$Ca(HCO_3)_2$ = 8.1 mg; $Mg(HCO_3)_2$ = 7.5 mg; $CaSO_4$ = 13.6 mg; $MgCl_2$ = 2.0 mg; $MgSO_4$ = 12.0 mg; NaCl = 4.7mg.

Q.3. When a sample of coal containing 80% C, 8% H and 3% ash was tested in the lab for its CV in the bomb calorimeter, the following data were obtained: Wt of coal burnt= 0.85g, Wt of water taken= 650 g, Water equivalent of calorimeter= 2500 g, Rise in temperature= 2.5°C, Cooling correction= 0.03°C, Fuse wire correction= 10 cal, Acid correction= 50 cal and LH= 580 cal/g.

Q.4. What is Atropisomerism? With proper explanation, give examples of compounds showing atropisomerism.

Q.5. Discuss the mechanism of free radical polymerization of styrene. Explain the effect of presence of CCl_4 as impurity during this FR polymerizatio

structure

Department of Applied Sciences, Institute of Engineering & Technology, Lucknow
IAS-102/BAS-102 [Engineering Chemistry], II[st] Class Test [January, 2023]

Time: 1Hr **Max Marks: 20**

Note: Attempt all Questions. All questions carry equal marks.

Q.1. Write conventional and green route for synthesis of paracetamol and calculate its atom economy in both the routes.

OR

Differentiate between 1-bromopropane and 2-bromopropane on the basis of ^{1}H-NMR.. An organic compound with molecular formula C_3H_6O gives strong absorption in IR region at 1715 cm^{-1}, and also gives only one signal in ^{1}H- NMR spectrum around δ 2.1. Predict the structure of the compound and justify your answer.

Q.2. Discuss the preparation and applications of Nomex and Kevlar.

OR

Explain the process of vulcanization of rubber. Discuss the preparation of Buna-S and Buna- N.

Q.3. (IAS-102) Giving suitable examples define the term catalyst, catalysis, +ve catalyst, -ve catalyst, catalytic promoters and catalytic Inhibitors.

OR

(BAS-102) Illustrate various types of stretching and bending modes of vibrations. Also calculate number of Fundamental vibrations for the following molecules: (i) CO_2 (ii) SO_2.

Q.4. Calculate the minimum weight and volume of the air required for complete combustion of 1 Kg of fuel containing C=90%, H=3.5%, O=3%, S=0.5%, H_2O=1% and ash=rest.

Q.5. What are organometallic compounds? How should CH_3MgBr and $LiAlH_4$ be prepared in the laboratory? Discuss at least 08 applications (reactions) of CH_3MgBr or $LiAlH_4$

OR

Write a note on Conducting Polymers.

Printed Pages:02

Subject Code: IAS-102 Roll N

B. TECH.

(SEM I) ODD SEMESTER EXAMINATION 2023-24

ENGINEERING CHEMISTRY

[TIME: 3 hrs.] [Max. Marks: 70]

Note: *Attempt All Questions. All Question carry equal marks.*

Q1. Answer **ALL** parts. Marks

(a) Differentiate between Thermotropic and Lyotropic liquid crystals. Summarize the important applications of Liquid Crystals. 7

OR

What are nanomaterials How the physical and chemical properties of nanoparticles vary with their size? Write important applications of nanomaterials.

(b) Describe the structure and applications of Graphite and Fullerenes. Explain the reasons for electrical and lubricating properties of graphite. 7

Q2. Answer **ALL** parts.

(a) Why TMS is used as a standard in NMR spectroscopy? Predict the number and splitting pattern of ^{1}H-NMR signals in the following molecules: 7

(i) $CH_3CH_2OCH_3$ (ii) $(CH_3)_2C{=}CH_2$ (iii) $C_6H_5CH_3$ (iv) $(CH_3)_3COCH_3$

A compounds having molecular formula C_4H_9Br gave the following signals in its ^{1}H NMR spectra: δ 1.04 (6H, d); δ 1.95 (1H, m); δ 3.33 (2H, d) Evaluate the given data and assign the structures for the compound.

OR

Giving examples, explain the terms Auxochromes and Chromophores. How do Auxochromes increase the coloring power of Chromophores? A diene (molecular formula C_4H_6) shows an intense peak at λ_{max} 217 nm while another diene (molecular formula C_5H_8) shows an intense peak at λ_{max} 175 nm in their UV spectra. Analyze the data provided and assign the structures to the two dienes.

(b) Explain why asymmetrically substituted compounds having even number of cumulative double bonds exhibit optical isomerism but compounds having odd number of cumulative double bonds exhibit geometrical isomerism. 7

OR

Explain the significance of Fingerprint region in IR spectroscopy. Two Isomers ***X*** and ***Y*** having molecular formula C_3H_6O give IR band near 3550 cm^{-1} and 1717 cm^{-1} respectively. Assign structural formula to ***X*** and ***Y*** consistent with their IR absorption band. How would you distinguish between the compounds in the following pair by IR spectral studies:

(i) *cis* and *trans*-2- butane

(ii) alcohols and phenols

Q3. Answer **ALL** parts.

(a) Explain Homogeneous and Heterogeneous Catalysis giving appropriate examples. Explain the terms: 7

(i) Positive and Negative Catalyst;

(ii) Catalytic Promoters and Inhibitors;

(iii)Auto catalyst.

OR

Explain the mechanism of following reactions:

(i) Aldol Condensation

(ii) Friedel Craft Reaction

(b) Give the mechanism of electrochemical theory of corrosion with absorption of oxygen. What will happen if a zinc rod is half submerged under water? 5 7

OR

Explain the setting and hardening of cement with relevant chemical reactions involved during the process.

Q4. Answer **ALL** parts.

(a) Explain the zeolite process for softening of water. A water sample gave the following analysis: 7

$Ca(HCO_3)_2$= 81.0 ppm;
$Mg(HCO_3)_2$ = 14.6 ppm;
$MgSO_4$ = 24.0 ppm;
$CaSO_4$ = 68.0 ppm;
$CaCl_2$ = 33.3 ppm
NaCl = 25.0 ppm.

Calculate the temporary, permanent and total hardness present in the water sample

(b) Draw a neat diagram and explain the working of a bomb calorimeter. On burning 0.9 g of a solid fuel in a bomb calorimeter, the temperature of 3300g of water increased from 26.4 to 29.1°C. Water equivalent of calorimeter and latent heat of steam are 385g and 587 cal/g respectively. If the fuel contains 0.7% hydrogen, calculate its gross and net calorific value. 7

OR

Explain the stages involved in production of biogas from cattle dung.

A sample of coal was found to have the following percentage composition: C=81%; H=5.2%; O=8.4%; S=1.5% and ash=3.5%. Calculate GCV and NCV of the coal sample using Dulong's formula.

Q5. Answer **ALL** parts.

(a) Differentiate between Chain Growth and Step Growth polymers. 3.5

(b) Outline the preparation and application of Epoxy resins. 3.5

OR

Outline the process of vulcanization of rubber. Describe the preparation and uses of Butyl rubber and Kevlar.

(c) What are Conducting polymers? Explain how can the conductivities of these polymers be increased by doping. 3.5

OR

What are Initiators? Give five examples of compounds that can be used as initiators in free radical polymerization.

(d) Why $LiAlH_4$ is used as a reducing agent? Predict the final product obtained when $LiAlH_4$ reacts with: 3.5

(i) CH_3CN
(ii) $CH_3COOC_2H_5$
(iii) CH_2=CHCOOH