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B.TECH
(SEM I) THEORY EXAMINATION 2022-23
ENGINEERING CHEMISTRY

Time: 3 Hours ***Total Marks: 100***

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 10 = 20

(a) State why Graphite is good lubricant in solid state?

(b) Define Impurity defects.

(c) Explain why CO_2 is IR active and N_2 is IR inactive molecule?

(d) Differentiate between inter and intra molecular hydrogen bonding with the help of UV spectroscopy.

(e) Why does part of a nail inside the wood undergoes corrosion easily?

(f) Calculate the EMF of the cell: $Zn(s)|Zn^{2+}(0.2M)||Ag^{+}(0.002M)|Ag(s)$ at 25ºC. The standard EMF of the cell is 1.54V.

(g) Explain why 2 moles of lime required removing temporary hardness due to Magnesium?

(h) What is the gross calorific value of a coal sample having the following composition? C: 82%, O: 5%, S: 2.5% and H: 8%, Ash= 7%.

(i) Classify the polymers on the basis of tacticity.

(j) Explain the term functionality of a polymer. What is the functionality of ethene?

SECTION B

2. Attempt any *three* of the following: 10x3=30

(a) Write the structure, preparation, properties & applications of an allotrope ofcarbon having truncated icosahedron geometry.

(b) Discuss the principle of Raman Spectroscopy. How Stokes and Anti stokes linesappear in Raman spectroscopy. Also explain how it differs from microwave spectroscopy.

(c) Using phase rule, outline the salient features of the phase diagram of water system highlighting the name of system (areas, curves and points),phase inequilibrium and degree of freedom in each case.

(d) Explain the construction, principle and working of bomb calorimeter (with diagram).
A sample of coal contains 92%C, 5% H and 3% ash. When this coal was tested for its calorific value in the bomb calorimeter, the following results were obtained:
Weight of coal burnt=0.95gm
Weight of water taken=700gm
Water equivalent of bomb and calorimeter= 2000gm
Increase in temperature= 2.48ºC
Acid correction=60 cal
Cooling correction=0.02ºC Fuse
wire correction=10 cal.
Calculate the Gross and Net calorific value of coal. [LH=587 Cal/gm].

(e) What are conducting polymers? Classify conducting polymers and mention their important applications.

SECTION C

3. Attempt any *one* part of the following: 10x1=10

(a) Illustrate the band theory of metallic bond and classify the solids on the basis of it.

(b) Compare stoichiometric and non-stoichiometric defects. Explain different Stoichiometric defects with examples.

4. Attempt any *one* part of the following: 10x1=10

(a) Explain the absorption and intensity shift in the UV spectroscopy and supportwith examples. Illustrate, the effect of polar and non-polar solvent on π- π * transition in acetone.

(b) Discuss different modes of vibrations in IR spectroscopy. Also signify the importance of finger print and functional group region.

5. Attempt any *one* part of the following: 10x1=10

(a) Differentiate between primary and secondary batteries. With the help of labeled diagram, illustrate the construction and working of lead-acid storage cell. Also summarize the electrode reactions involved in the working of lead-acid storage cell.

(b) Illustrate the electrochemical theory of corrosion on the basis of hydrogen evolution and oxygen absorption mechanism. Also discuss the methods of prevention of corrosion by metallic coating and impressed current cathodic protection.

6. Attempt any *one* part of the following: 10x1=10

(a) A water sample on analysis give the following result: Ca^{2+} = 80 mg/L,Mg^{2+} = 24 mg/L, CO_2 = 33 mg/L, HCO_3^- = 132 mg/L, H^+ = 10 mg/L, NaCl = 4.3mg/L, $MgCl_2$ =19.0 mg/L and $Mg(OH)_2$= 34 mg/L. Calculate the quantity of lime (74% pure) and soda (92% pure) needed for softening 50000 Liters of water.

(b) What are ion exchange resins? How water can be softened by demineralization process. State the merits and demerits of the process.

7. Attempt any *one* part of the following: 10x1=10

(a) Explain the preparation, properties and applications of the following polymers:
(i) Nylon 6,6
(ii) Dacron
(iii) Buna-N
(iv) Neoprene

(b) Illustrate the preparation of Grignard Reagents with their applications.