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BTECH
(SEM I) THEORY EXAMINATION 2021-22
CHEMISTRY

Time: 3 Hours**Total Marks: 100****Note: 1.** Attempt all Sections. If require any missing data; then choose suitably.**SECTION A****1. Attempt all questions in brief.****2 x 10 = 20**

Qno.	Question	Marks	CO
a.	Which species out of H_2 , H_2^{2+} and H_2^{2-} are paramagnetic and why?	2	1
b.	Why Lithium exists as diatomic while beryllium remains as monoatomic?	2	1
c.	How will you distinguish between benzene and anthracene by UV spectroscopy?	2	2
d.	How many vibrational modes are there in a linear and non-linear molecule having n number of atoms?	2	2
e.	Why Iron Nail present on the door undergoes corrosion?	2	3
f.	What is salt bridge? Mention its function in an electrochemical cell.	2	3
g.	What is the difference between Gross calorific value and Net calorific value of a fuel?	2	4
h.	Temporary hardness is removed by boiling. Write chemical reactions in support of your answer.	2	4
i.	What is Bio-degradable polymers? Discuss their importance.	2	5
j.	Define functionality. What is the minimum functionality required for a compound to act as monomer?	2	5

SECTION B**2. Attempt any three of the following:**

Qno.	Question	Marks	CO
a.	Draw the Molecular Orbital diagram of NO. Calculate the bond order and predict the magnetic behaviors of NO, NO^+ , NO^- .	10	1
b.	Illustrate Finger print region in IR spectroscopy. Two Isomers I and II of the molecular formula C_3H_6O give I.R. absorption band near 3550 cm^{-1} and 1717 cm^{-1} respectively. Assign structural formula to A and B consistent with their IR absorption bands.	10	2
c.	Define Phase, Component and Degree of freedom with examples. Also outline the salient features of the phase diagram of water system highlighting the name of system (areas, curves and points), phase in equilibrium and degree of freedom in each case.	10	3
d.	What are Resins? How hard water can be purified by Ion exchange resins? Compare its merits and demerits over lime –soda process.	10	4
e.	Give preparation, properties and applications of following polymer: (i) Buna-S (ii) Dacron (iii) Nylon 6 (iv) Neoprene	10	5

SECTION C**3. Attempt any one part of the following:**

Qno.	Question	Marks	CO
a.	What are the Anisotropic crystals? How they are classified on the basis of temperature? Also mention their important applications.	10	1
b.	Discuss preparation, properties, structure and applications of an allotrope of carbon having truncated icosahedron geometry.	10	1



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4. Attempt any one part of the following:

Qno.	Question	Marks	CO
a.	Discuss the quantum theory of Raman Spectroscopy. What technological advances have enabled the routine use of Raman Spectroscopy? How the Stokes, anti-Stokes and Rayleigh lines appear in the Raman Spectroscopy?	10	2
b.	Discuss electronic transitions involved in UV- visible spectroscopy. Illustrate, the effect of polar solvent on $n - \pi^*$ transition in acetone. Also describe Absorption and Intensity shift in the UV spectroscopy with the help of examples.	10	2

5. Attempt any one part of the following:

Qno.	Question	Marks	CO
a.	What is battery? Differentiate between primary and secondary batteries. Explain the construction and working of secondary battery by taking an account of Lead Storage battery.	10	3
b.	Outline the mechanism involved in Electrochemical theory of corrosion. How corrosion is prevented by anodic and cathodic inhibitors?	10	3

6. Attempt any one part of the following:

Qno.	Question	Marks	CO
a.	With the help of neat sketch, explain continuous cold Lime soda process for softening of hard water. Also write the chemical reactions involved. Calculate the quantity of lime (74% pure) and soda (90% pure) for softening 50,000 liters of water containing the following salts: $Mg(HCO_3)_2 = 50 \text{ mg/L}$, $MgCl_2 = 6 \text{ ppm}$, $Ca(HCO_3)_2 = 81 \text{ mg/L}$, $CO_2 = 44 \text{ ppm}$, $Na_2SO_4 = 10^\circ \text{Fr}$, $HCl = 73 \text{ mg/L}$, $Al_2(SO_4)_3 = 57 \text{ mg/L}$.	10	4
b.	With the help of a neat diagram, explain the construction and working of bomb calorimeter. A sample of coal contain C=80%, H=15% and ash=5%. The following data were obtained when the above coal was tested in bomb calorimeter: Weight of coal burnt=0.98 g Weight of water taken=1000 g Water equivalent of bomb and calorimeter= 2500 g Rise in temperature= 2.5°C Fuse wire correction =8.0 cal Acid correction= 50.0 cal Cooling correction= 0.02°C Calculate gross and net calorific values of the coal.	10	4

7. Attempt any one part of the following:

Qno.	Question	Marks	CO
a.	Write short notes on: (i) Polymer Blends (ii) Preparation and applications of Grignard reagent	10	5
b.	What are conducting polymers? Classify conducting polymers and mention their important applications.	10	5



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BTECH
(SEM I) THEORY EXAMINATION 2021-22
ENGINEERING CHEMISTRY

Time: 3 Hours**Max. Marks: 100**

Notes: Attempt the questions as per the instructions given
Assume missing data suitably

Section – A			
Q.1	Attempt all the parts	(2 x 10 =20)	
(a)	Arrange the following molecules or ions in increasing order of bond length. O₂, O₂⁺ & O₂⁻	CO1	2
(b)	What are nano materials? How they are different from bulk materials?	CO1	2
(c)	With the help of examples differentiate between Microwave active and microwave inactive compounds.	CO2	2
(d)	Explain why CO ₂ is IR active and N ₂ is IR inactive molecule.	CO2	2
(e)	Comment on the use of Al in place of Zn for cathodic protection of iron from rusting.	CO3	2
(f)	Al³⁺ (1.2M) + Fe → Al + Fe³⁺ (2.5M) . Calculate E _{cell} for the reaction if E° _{cell} = -1.62 V.	CO3	2
(g)	Calculate the hardness of water sample containing impurity of Ca (HCO₃)₂ = 81 mg/l . Give your answer in °F also.	CO4	2
(h)	4.2 g of a sample of coal was Kjeldahallized and evolved ammonia gas was absorbed in 30 ml of 0.1N H ₂ SO ₄ . After absorption excess acid required 5 ml of 0.1N NaOH for neutralization. Calculate the % of nitrogen in coal sample.	CO4	2
(i)	Give the structure of vulcanized rubber.	CO5	2
(j)	Give two differences between addition and condensation polymers.	CO5	2
Section – B			
Q.2	Attempt any three parts of the following	(10 x 3 = 30)	
(a)	With the help of molecular orbital diagram, explain the formation of NO & N ₂ . Calculate their bond order and predict their magnetic behaviour.	CO1	10
(b)	Discuss the principle of Raman Spectroscopy. How Stokes and Antistokes lines appear in Raman spectroscopy. Also explain how it differs from microwave spectroscopy.	CO2	10
(c)	Define phase rule. Outline the salient features of the phase diagram of water system highlighting the curves, areas & points. Also explain the importance of triple point.	CO3	10
(d)	Write the different chemical reactions taking place in soda-lime process. A sample of water on analysis give following result: Analysis of Raw water: 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 = 4.3 ppm. Analysis of treated water: CO ₃ ²⁻ = 12 mg/l and OH ⁻ = 34 mg/l. Calculate the quantity of lime (74% pure) and soda (92% pure) needed for softening 50000 L of water.	CO4	10
(e)	Write down the preparation (structure of monomers and polymers) and uses of: (i) Nylon-6,6 (ii) Dacron (iii) BUNA-N (iv) Neoprene Rubber (v) Nylon-6	CO5	10



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Section – C			
Q.3	Attempt any one part of the following		(10x 1 = 10)
(a)	Illustrate the concept of liquid crystals. Classify them on the basis of temperature and mention their important applications.	CO1	10
(b)	Give the structure, preparation, properties & applications of an allotrope of carbon having truncated icosahedron's structure.	CO1	10
Q.4	Attempt any one part of the following		(10x 1 = 10)
(a)	Explain the different types of electronic transitions involved in UV-Vis. Spectroscopy. Also explain the different types of absorption and intensity shifts taking place in UV-VIS spectroscopy.	CO2	10
(b)	Explain the different types of molecular vibrations taking place in IR Spectroscopy. Differentiate between Functional group region and finger print region.	CO2	10
Q.5	Attempt any one part of the following		(10x 1 = 10)
a)	Define the term batteries. Explain the construction of Lead acid battery. Write all the chemical reactions taking place during charging and discharging of lead acid battery.	CO3	10
(b)	Define the term corrosion. Describe the mechanism of electrochemical corrosion with the help of hydrogen evolution and oxygen absorption reactions. How it can be prevented using sacrificial anodic protection?	CO3	10
Q.6	Attempt any one part of the following		(10x 1 = 10)
(a)	Write the chemical name and molecular formula of zeolite. Give different chemical reactions taking place in zeolite process. A zeolite softner was regenerated by passing 50 ltrs of NaCl solution having strength of 14.625 g/l of NaCl. Calculate the hardness of water if 10000 ltrs of hard water was softened by using this zeolite.	CO4	10
(b)	Explain the construction and working principle of Bomb calorimeter. A sample of coal contains 80% C, 15% H, and 5% Ash. The following data were obtained when the above coal sample was tested in bomb calorimeter: Weight of coal burnt = 0.98 g Weight of water taken = 1000 g Water equivalent of bomb calorimeter = 2500 g Observed rise in temperature = 2.5 °C Fuse wire correction = 8 cal Acid correction = 50 cal Cooling correction = 0.02 °C Calculate gross and net calorific value of coal if the latent heat of condensation of water is 580 cal/g.	CO4	10
Q.7	Attempt any one part of the following		(10x1 = 10)
(a)	What are polymer composites? Discuss the classification and applications of polymer composites.	CO5	10
(b)	What are Organometallic compounds? How Grignard reagents are prepared? Write any five synthetic applications of Grignard reagents.	CO5	10