International Institute of Information Technology, Hyderabad End of Semester Examination: Monsoon 2024

SC1.102: CHEMISTRY TOPICS FOR ENGINEERS

Max. Time Allowed: 1.5 Hr	Max. Marks: 60
Note: 1. Answer all questions. There are SIX questions. 3. Use of nonprogrammable scientific calculators is allowed.	Make appropriate assumptions where required. Additional sheet for rough work is NOT allowed.
Q1. (a) A signal has been reported to occur at 600 Hz downfield from TMS in an NMR spectrometer with a 300-MHz operating frequency. (i) What is the chemical shift of the signal? (ii) What would its chemical shift be in an instrument operating at 100 MHz? [1.5+1.5]	
(b) The low-resolution NMR spectrum of 1 1.04 ppm, 2.07 ppm, and 4.37 ppm. Expla	
(c) Explain why (i) the ¹⁹ F-NMR spectrum equal intensity and (ii) the ⁷⁷ Se-NMR spectriplets. (Given: ¹⁹ F, ⁷⁷ Se, $I = \frac{1}{2}$).	
(d) Mention one application of NMR spectr	oscopy in medical field. [1]
Q2. (a) How is the electron paramagn different from NMR spectroscopy?	etic resonance (EPR) spectroscopy [4]
	[4]
different from NMR spectroscopy?	[4] ctroscopy? [2] xymethyl radical, H ₂ C(OCH ₃). Include
different from NMR spectroscopy? (b) What is 'hyperfine splitting' in EPR spectroscopy? (c) Discuss the hyperfine splitting of method	[4] ctroscopy? [2] xymethyl radical, H ₂ C(OCH ₃). Include coupled and non-coupled nuclei. [4]
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different from NMR spectroscopy? (b) What is 'hyperfine splitting' in EPR spectroscopy? (c) Discuss the hyperfine splitting of method schematic diagram and comments on the disconnection of the difference between a second gives intercalation compounds, graph formula, (C ₂₄)+HSO ₄ Compare the conditional compounds.	ctroscopy? [2] exymethyl radical, H ₂ C(OCH ₃). Include coupled and non-coupled nuclei. [4] semiconductor and a semimetal. [3] hite with a mixture of sulfuric and nitric phite bisulfates with an approximate action property of graphite bisulfates [1.5] CdO are likely to show p- or n-type

- Q4. (a) Compare thermotropic and lyotropic liquid-crystals. Give one example (write name and draw structure) of one thermotropic and one lyotropic liquid-crystal molecule. [2,2]
- (b) All molecules do not exhibit liquid crystalline property. List the criteria for a molecule to exhibit liquid crystalline property. [2]
- (c) Mention two industrial applications of liquid crystals. Mention which liquid crystal phase (nematic/ smectic/cholesteric) is used for the applications you mentioned. [2]
- (d) Often ionic substances are solids and a substance that is liquid at room temperature is likely to be a molecular substance. Name an ionic liquid (at room temperature). Suggest possible reasons for this ionic substance to exist in liquid state, not in solid state, at room temperature. [2]
- Q5. (a) What are inorganic pigments? Write name and chemical formula of one white, one black, and one coloured inorganic pigment. [1,1.5]
- (b) What is meant by high temperature superconductors (HTSs)? [1]
- (c) Draw a plot to show the variation of resistance with temperature of a superconductor. [2]
- (d) What are 'nanomaterials'? Why do nanomaterials show properties that are substantially different from their bulk counterparts? [1,2]
- (e) What are quantum dots? Mention one application of quantum dots. [1.5]
- Q6. (a) Name two conducting polymers and draw the structures of the polymers and their corresponding monomers. [3]
- (b) Discuss the electrical conduction mechanisms in conducting polymers. [4]
- (c) Mention two applications of conducting polymers. [1
- (d) Transition metals have higher melting points and higher hardness, whereas their neighbors like Cu, Ag, Au and Zn are soft and melt at low temperatures. Explain the observations using MO theory. [2]

End of Question Paper