

B.Sc. CHEMISTRY  
ORGANIC CHEMISTRY-V  
SIXTH SEMESTER  
BSC – 602

( Use Separate Answer Scripts for Objective & Descriptive )

Duration : 3 hrs.

Full Marks : 70

( PART-A: Objective )

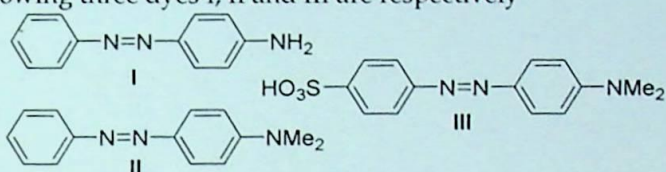
Time : 20 min.

Marks : 20

Choose the correct answer from the following:

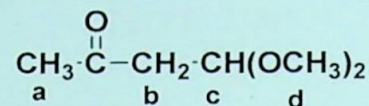
1X20=20

1. The following three dyes I, II and III are respectively

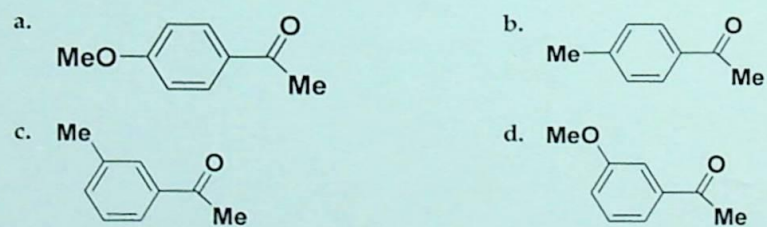
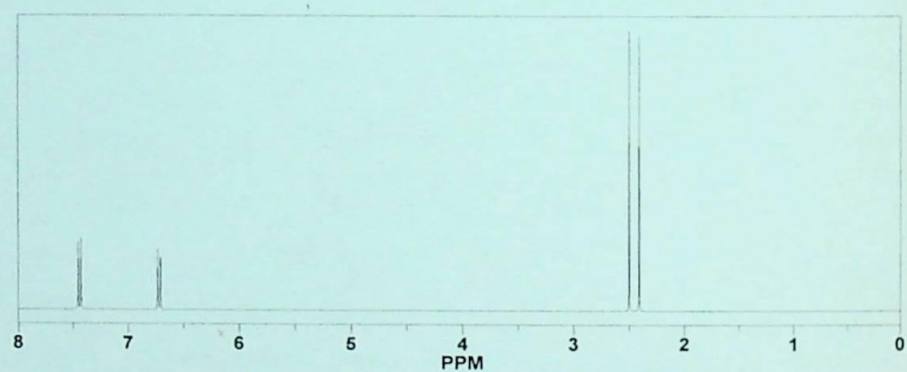


- aniline yellow, methyl orange and butter yellow
  - methyl orange, aniline yellow and butter yellow
  - butter yellow, methyl orange and aniline yellow
  - Aniline yellow, butter yellow and methyl orange
2. Malachite green is a
- azo-dye
  - phthalein dye
  - triphenyl methane dye
  - nitroso dye
3. Chromophore in phenolphthalein is
- p-quinonoid group
  - o-quinonoid group
  - azo-group
  - extended conjugation
4. IR spectroscopy studies transition in:
- Translational energy levels
  - Rotational energy levels
  - Vibrational energy levels
  - Electronic energy levels
5. IR spectrum of an organic compound shows a clear sharp peak at  $2200\text{ cm}^{-1}$ . Which of the functional group is most likely to be present?
- COOR
  - $\text{-C}\equiv\text{N}$
  - either  $\text{-C}\equiv\text{N}$  or  $\text{-C}\equiv\text{C-}$
  - $\text{-CONH}_2$
6. Correct order of stretching frequency of the following:
- $\text{C-C} < \text{C=C} < \text{C}\equiv\text{C}$
  - $\text{C-C} > \text{C=C} > \text{C}\equiv\text{C}$
  - $\text{C-C} < \text{C=C} > \text{C}\equiv\text{C}$
  - $\text{C-C} > \text{C=C} < \text{C}\equiv\text{C}$

7. Which of the protons a - d in the following molecule will give a singlet signal in its  $^1\text{H}$  NMR spectrum.

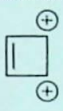


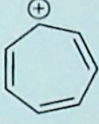


- a. protons a  
b. protons b  
c. protons a and c  
d. protons a and d
8. Which of the following organic compound will exhibit only three signals in the  $^1\text{H}$  NMR spectrum?  
(i) 1,1 dichloro propane      (ii) 1,2 dichloro propane  
(iii) 1,3 dichloro propane      (iv) 2,2 dichloro propane
- a. i only  
b. i & ii  
c. i, ii & iii  
d. ii & iv
9. What do you expect to observe in the  $^1\text{H}$ NMR spectrum of  $\text{CH}_3-\text{CH}_2-\text{Cl}$ ?  
a. a triplet and a quartet  
b. two doublet  
c. a doublet and a quartet  
d. a doublet and a triplet
10. Which of the following molecules will fit in to the given  $^1\text{H}$  NMR spectrum.



11. When a few drops of an acid are added to arylamine, absorption occurs at lower wave length. The reason is:  
a. increase in conjugation  
b. Reduction in conjugation  
c. acid decomposes the compound  
d. Compound remains insoluble



12. Applying Woodward-Fieser rules, the basic value of 215 nm is given to:
- five membered cyclic ketone
  - six membered cyclic ketones
  - $\alpha, \beta$ -unsaturated aldehyde
  - $\alpha, \beta$ -unsaturated ester
13. The value of extinction coefficient increases with
- increase in conjugation
  - Addition of chromophore
  - both of (a) and (b)
  - none of these
14. The catalyst used for olefin polymerization is
- Ziegler-Natta catalyst
  - Wilkinson catalyst
  - Raney nickel catalyst
  - Metrified resin catalyst
15. Among cellulose, PVC, nylon and natural rubber, the polymer in which the intermolecular force of attraction is weakest is
- Nylon
  - PVC
  - Cellulose
  - Natural rubber
16. Quasi-molecular ion peak is represented as
- [M]
  - [M+1]
  - [M+2]
  - [M+4]
17. Which of the following molecule will show a prominent [M+4] peak in EI-MS
- nitrobenzene
  - benzaldehyde
  - 1,4-dibromobenzene
  - 1-chloro-3-nitrobenzene
18. Which of the following will have molecular ion peak less than its molecular weight?
- 
  - 
  - 
  - 
19. Most suitable helping gas for CI-MS analysis to understand molecular weight of an unsaturated hydrocarbon compound is
- Methane
  - hydrogen
  - isobutane
  - All of them
20. Which of the following is utilized in CI-MS for ionization of a saturated sample molecule having electronegative heteroatom?
- $\text{NH}_3$
  - beam of  $\text{Cs}^+$  ions
  - inert gas-Ar
  - proton beam

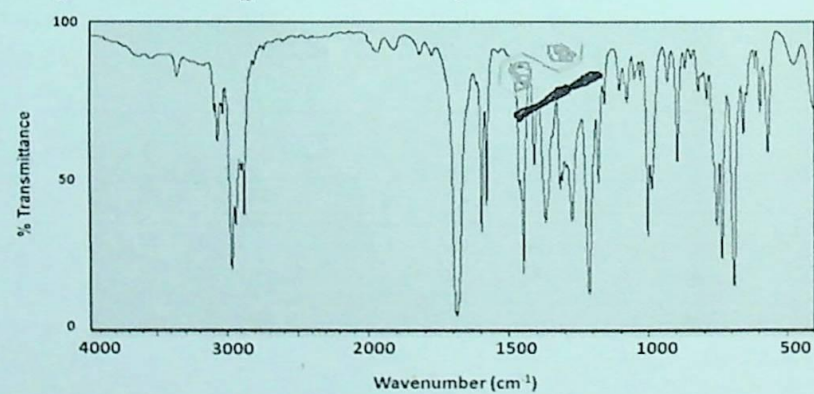
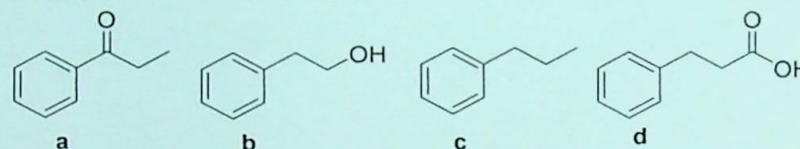
**(PART-B : Descriptive)**

Time : 2 hrs. 40 min.

Marks : 50

**[ Answer question no.1 & any four (4) from the rest ]**

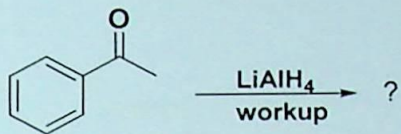
1. a. Define the term chemical shift. Describe the factors which influences it. 5
- b. What is electronic spectroscopy? Give reason why usual electronic technique cannot be used below  $200\text{ m}\mu$ ? 2
- c. If a molecule contains one Cl atom and shows its molecular ion peak in EI-MS is half of its base peak, find the % ratio of M and (M+2) peak. 3
2. a. Define infrared spectroscopy. What are the major requirement for infra-red absorption. 3
- b. A compound gave the following IR spectrum. Which of the following is likely to be the structure of the molecule? Justify your answer. 4





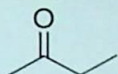
c. How you will monitor the following reaction using IR spectroscopy.

3



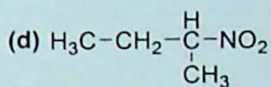
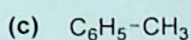
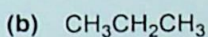
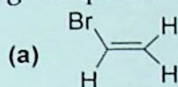
3. a. Draw the pattern of  $^1\text{H}$ NMR spectrum for the following molecule with  $\delta$  value (approximate) and splitting.

3



b. How many proton signals would you expect in the  $^1\text{H}$ NMR spectra of the following compounds?

2



c. Why tetramethyl silane (TMS) taken as a standard for recording chemical shifts?

2

d. An organic compound with molar mass 120, gave following spectroscopic data on analysis.

3

IR spectra showed an absorption peak at about  $1700\text{ cm}^{-1}$ , NMR spectrum gave the peaks at  $\delta$  2.6 (s, 3H),  $\delta$  7.4 (m, 3H) and  $\delta$  7.9 (d, 2H). Assign a structure for the molecule with justification.

4. a. Give the various types of transitions involved in electronic spectroscopy with examples.

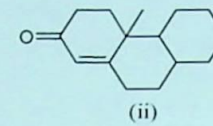
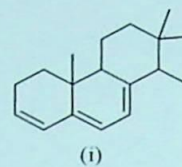
2

b. What is bathochromic shift and hypsochromic shift? Explain with examples.

3

c. Using Woodward-Fieser rules, calculate the absorption maximum for the following compounds.

5



5. a. What is polydispersity index (PDI)? Explain. 2
- b. What are addition and condensation polymers? Explain with examples. 3
- c. What is vulcanization of rubber? Write the advantages of vulcanized rubber. 2
- d. What are liquid crystal polymers? Mention their uses 3
6. a. Write a short account of Witt's theory of colour and constitution. 3
- b. Justify the statement, "All dyes are coloured but all coloured compounds are not dyes". 2
- c. Give synthesis of *any two* of the following dyes: indicate the chromophore there and justify its color. 5
- a. Phenolphthalein
- b. Rosaniline
- c. Congo red
7. a. Define base peak, molecular ion peak related to mass spectrometry. Identify the ion which will show the base peak in EI-MS spectrum of ethyl benzene. 2+2=4
- b. Show the fragmentation of n-pentane and neo-pentane in EI-MS. Depict the most probable EI-MS spectra of these two compounds and explain how to identify them *via* EI-MS analysis. 6
8. a. A compound has molecular formula  $C_{10}H_{13}Cl$ . Assign its structure with the help of following data  $\delta$  1.6 (singlet, 6H),  $\delta$  3.1 (singlet, 2H) and  $\delta$  7.3 (multiplet, 5H) 3
- b. Discuss affect of H-bonding in IR absorption peak. 2
- c. What is meta stable ion peak in mass spectrum? Calculate the value for the m/z of the metastable ion produced related to the fragmentation, from  $m_1 = 200$  to  $m_2 = 151$  2+3=5

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