

6/H-23 (vii) (Syllabus-2015) PART-A

2 0 1 8

(April)

CHEMISTRY

(Honours)

(Part—A : Inorganic Chemistry)

(Chem-H-601)

Marks : 38

Time : 2 hours

The figures in the margin indicate full marks for the questions

Answer *any one* question from each Section

SECTION—I

1. (a) What is meant by hapticity of a ligand? Give the structures and indicate the hapticity of an organometallic compound containing ethylene and butadiene as their ligand. 1+2=3
- (b) Give one preparation and one use of Grignard reagent. 1½
- (c) What is vitamin B₁₂? Explain the role of cobalt in vitamin B₁₂. 1+2=3

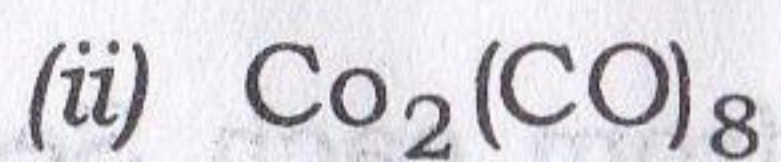
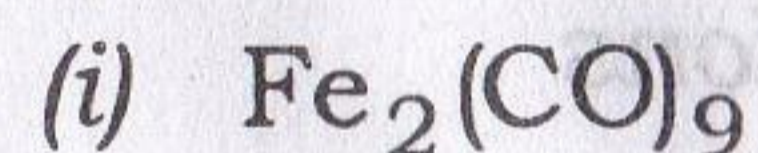
(d) Write the step involved in the hydrogenation of alkenes using Wilkinson's catalyst. 2½

2. (a) Explain the bonding in metal-ethylene complex taking the example of Zeise salt. 3

(b) Give one preparation and one use of R_3SnX . 1+1=2

(c) Explain the importance of Na^+ and K^+ ions in the biochemical process. 3

(d) Draw the structures of the following metal carbonyl: 2



SECTION—II

3. (a) What are π -acid ligands? Describe the bonding in metal carbonyl (M—CO) bond. 1+2=3

(b) What are essential trace elements? Name two essential elements each belong to p -block and d -block elements. 1+2=3

(c) Give the structural isomer of a platinum complex exhibited anti-cancer activity. 2

(d) Match the toxicity effect of the following metals: 2

- | | |
|-----------------|---|
| (i) Mercury | (1) Lung cancer |
| (ii) Lead | (2) Anaemia |
| (iii) Beryllium | (3) Neurological diseases and kidneys problem |
| (iv) Aluminium | (4) Central nervous system |

4. (a) Write the steps or cycle involved in the synthesis of acetic acid using rhodium carbonyl iodide catalyst. 2½

(b) Explain the cooperative binding of oxygen in haemoglobin. 3

(c) Match the deficiency effect of the following metals: 2½

- | | |
|----------|------------------------------|
| (i) Fe | (1) Goiter |
| (ii) Ca | (2) Anaemia |
| (iii) Mg | (3) Rickets |
| (iv) I | (4) Neuromuscular irritation |

(d) Mention two important functions of a metal ions in metalloenzyme. 2

SECTION—III

5. (a) Find the ground state term symbol of a d^2 -octahedral system. 1
- (b) On the basis of IR-spectroscopy, explain the variation of CO stretching frequencies of the following iso-electronic compounds : $2\frac{1}{2}$
- $\text{Ni}(\text{CO})_4$ ($\sim 2060 \text{ cm}^{-1}$)
- $[\text{Co}(\text{CO})_4]^-$ ($\sim 1890 \text{ cm}^{-1}$)
- $[\text{Fe}(\text{CO})_4]^{2-}$ ($\sim 1790 \text{ cm}^{-1}$)
- (c) Discuss the electronic spectra of $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$. $2\frac{1}{2}$
6. (a) Draw the Orgel diagram of an octahedral d^9 system. 1
- (b) Discuss Laporte selection rule and spin selection rule of electron absorption spectroscopy. 2
- (c) Explain the variation of IR stretching frequencies of the following compounds : 2
- $[\text{SnF}_6]^{2-}$ (592 cm^{-1})
- $[\text{SnCl}_6]^{2-}$ (311 cm^{-1})
- $[\text{SnBr}_6]^{2-}$ (190 cm^{-1})
- $[\text{SnI}_6]^{2-}$ (127 cm^{-1})

- (d) Write one method for the synthesis of platinum nanoparticles. 1

SECTION—IV

7. (a) What is *trans*-effect? On the basis of *trans*-effect, explain the synthesis of *cis*- and *trans*- $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$ complex. $1+2=3$
- ***
- (b) Explain with a suitable example the $\text{S}_{\text{N}}1\text{CB}$ mechanism in ligand displacement reaction of octahedral complexes. 3
8. (a) What are meant by the terms Inert and Labile complex? Show that inertness of a complex is different from its thermodynamic stability. $1+2=3$
- (b) Write the factors that affect the stability of coordination compounds. Explain. 3

SECTION—V

9. (a) Give the classification of nanoparticle based on their dimension. 2
- (b) Name the different types of nano-materials and mention their uses. 3
- (c) Mention two properties of nanoparticles. 1

10. (a) Explain the application of gold nanoparticles in the field of medicines. 3
- (b) Explain one method for the determination of the composition of metal complex by spectrophotometric method. 3

6/H-23 (viii) (Syllabus-2015)

2018

(April)

CHEMISTRY

(Honours)

(Part—A : Physical Chemistry—II)

(Chem—H—602)

Marks : 38

Time : 2 hours

*The figures in the margin indicate full marks
for the questions*

1. Give the mathematical expression for Boltzmann distribution for degenerate states and define the terms. $2\frac{1}{2}+2\frac{1}{2}=5$

OR

2. Define entropy and probability. How are these related? $2\frac{1}{2}+2\frac{1}{2}=5$

3. (a) What are the postulates of quantum mechanics? 4

(b) Explain Compton effect and its physical significance. What is Compton shift? 4

(c) Give the condition under which an eigenfunction ψ is said to be orthonormal. 2

OR

4. (a) State Planck's radiation law. 3

(b) Mention the physical significances of the quantum numbers n , l and m . 4

(c) An electron is confined in a one-dimensional box of length 1 Å. Calculate its energy in the ground state and first excited state in electron volts. (1 eV = 1.602×10^{-19} J) 3

5. (a) What is electromagnetic radiation? In which regions of electromagnetic radiation do rotational, vibrational and electronic transitions take place for a molecule? 4

(b) Which of the following molecules will show a pure rotational spectrum and why? 2



(c) The pure rotational spectrum of the gaseous molecule CN^- consists of a series of equally spaced lines separated by 3.80 cm^{-1} . Calculate the internuclear distance of the CN^- molecule. The molar masses are $^{12}C = 12.011 \text{ g/mol}$ and $^{14}N = 14.007 \text{ g/mol}$. 4

OR

6. (a) Write an expression for vibrational energy of a diatomic molecule assuming it to behave as simple harmonic oscillator. Sketch the vibrational energy levels of such a molecule and define zero-point energy. $2+2+1=5$

(b) Explain why atoms give rise to line spectra whereas molecules give rise to band spectra. 3

(c) Calculate the theoretical numbers of vibrational degrees of freedom in (i) CO_2 and (ii) H_2O . 2

7. (a) State Einstein's law of photochemical equivalence and explain the concept of quantum yield. 3

(4)

(b) What are photosensitized reactions?
Give example. 2

OR

8. (a) Discuss the photochemical decomposition of HI. 2

(b) A certain substance in a cell of path length x absorbs 10% of the incident radiation. How much of the incident radiation will be absorbed by the same sample in a cell where the path length is $5x$? 3

9. (a) Discuss Debye-Hückel-Onsager equation for strong electrolytes. 5

(b) What do you mean by ionic strength? Calculate the ionic strength of 0.2 molal BaCl_2 solution. $1\frac{1}{2} + 1\frac{1}{2} = 3$

OR

10. (a) Derive the expressions for ΔG and ΔH in terms of an e.m.f. of a cell. 4

(b) Write notes on the following : $2 \times 2 = 4$

(i) Liquid junction potential

(ii) Potentiometric titrations

6/H-23 (vii) (Syllabus-2015) PART-B

2018

(April)

CHEMISTRY

(Honours)

(Part—B : Organic Chemistry)

(Chem-H-601)

Marks : 38

Time : 2 hours

*The figures in the margin indicate full marks
for the questions*

1. (a) What are disaccharides? Give two examples of naturally occurring disaccharides. What products are formed when the disaccharides are hydrolyzed with dilute hydrochloric acid? 3
- (b) Write one method for the synthesis of nicotine. 3
- (c) Sucrose does not reduce Fehling's and Tollens' reagents. Explain the reason and draw its structure. 2

(2)

(d) Write a short note on cellulose acetate. 1½

OR

2. (a) Account for the fact that—

(i) sucrose is a non-reducing sugar but reduces Fehling's solution after heating with dilute hydrochloric acid;

(ii) $[\alpha]_D^{20} = (+)66.5^\circ$ of sucrose changes to -19.75° when it is heated with dilute HCl. 1½+1½=3

(b) Comment on the fact that "starch is not a single compound but a mixture of two types of polysaccharides". Also draw the structure of the polysaccharide which is present as a minor component of starch. 2

(c) State the isoprene rule. Write one method for the synthesis of citral. 3

(d) Write a short note on classification of alkaloids. 1½

3. (a) How can vitamin A₁ be synthesized from β-ionone? 2½

8D/1858

(Continued)

(3)

(b) Using carbobenzoxy chloride as an N-protecting agent, sketch the synthesis of glycylalanine. 2½

(c) Write a short note on glycolysis. 2½

(d) Draw the structures of guanine and uracil. 2

OR

4. (a) Write a note on the lock and key model of enzyme action. 2

(b) Give a suitable method for the synthesis of ascorbic acid. 2

(c) Write down the structure of the tripeptide gly-ala-phe. Give the synthesis of the above tripeptide using suitable method. 2½

(d) Write two points of differences between DNA and RNA. 2

(e) Draw the structure of β-carotene. 1

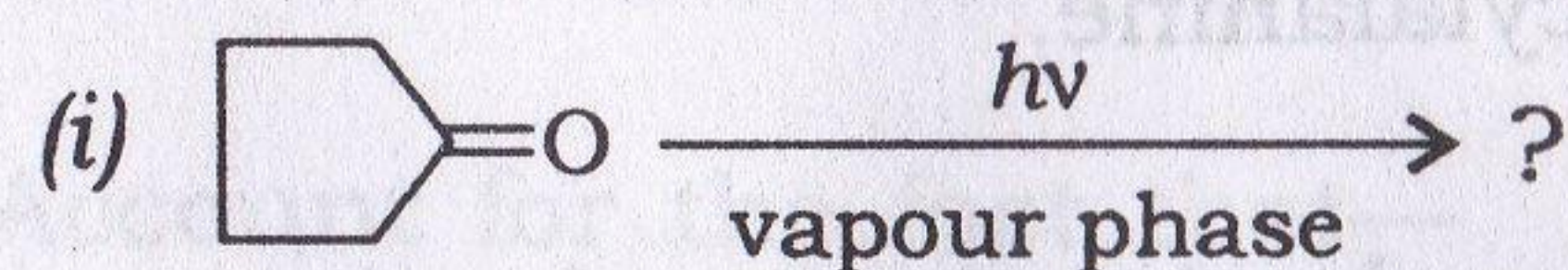
5. (a) What is meant by pericyclic reactions? Give the classification of pericyclic reactions with example. 3

8D/1858

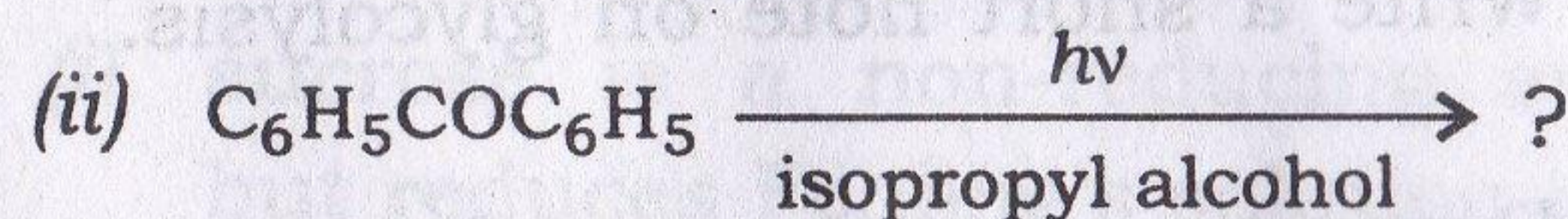
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(4)

(b) What products are expected in the following photochemical reactions?

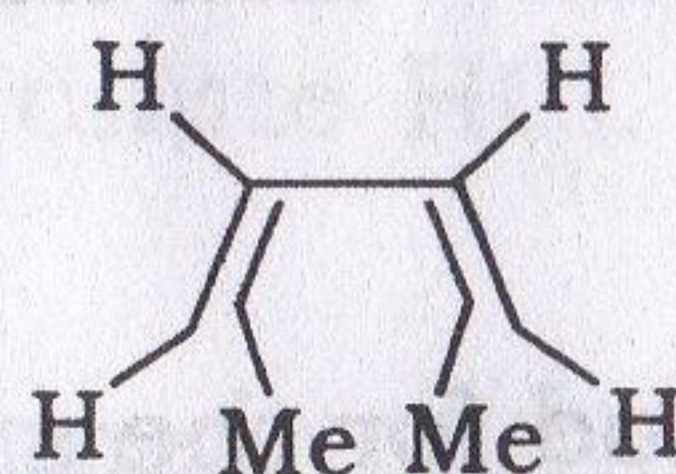


$1\frac{1}{2} + 1 = 2\frac{1}{2}$

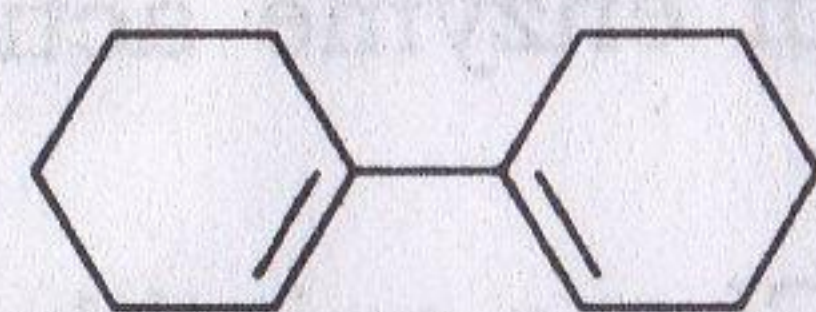


(c) Explain which of the following two compounds A and B do not undergo Diels-Alder reaction :

2



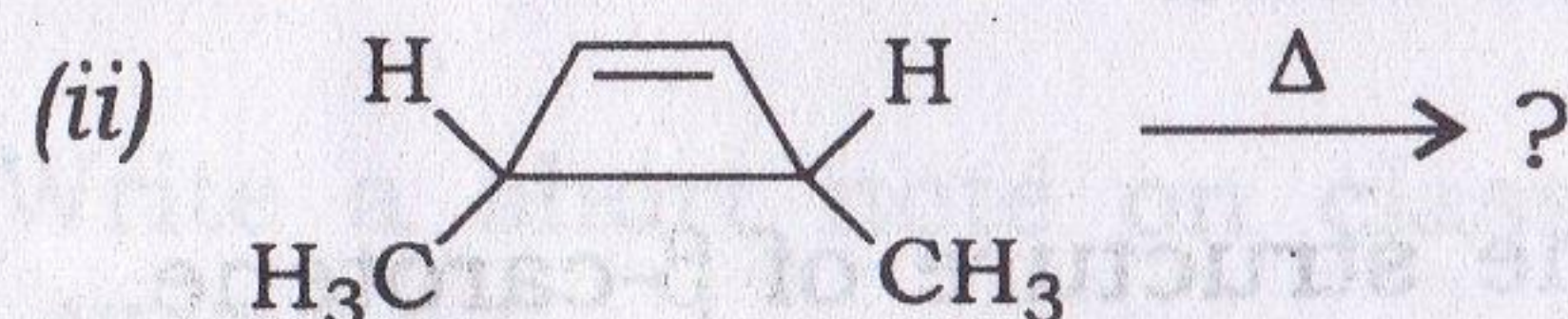
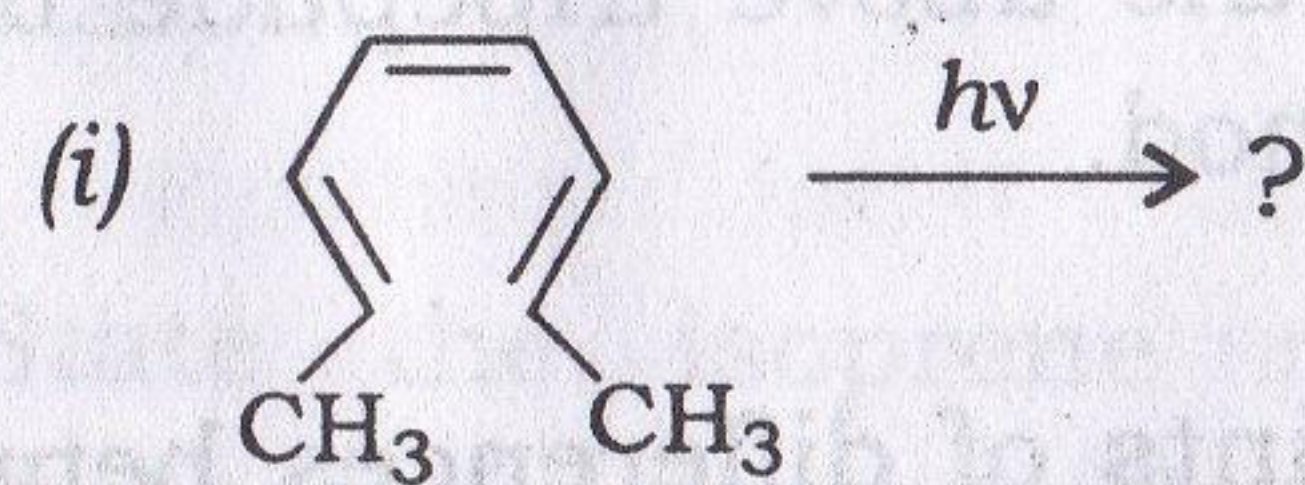
(A)



(B)

(d) Write the product of the following reactions with proper stereochemistry :

$1 \times 2 = 2$



OR

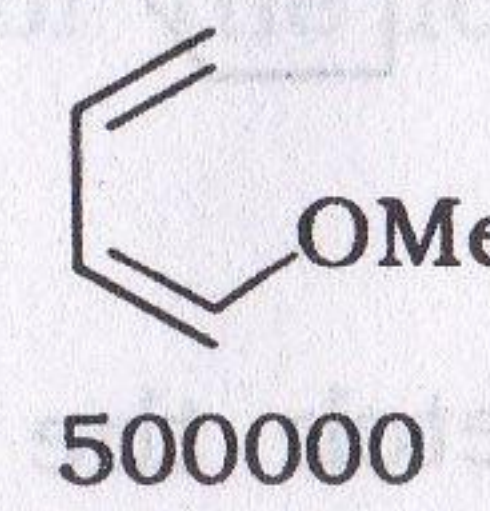
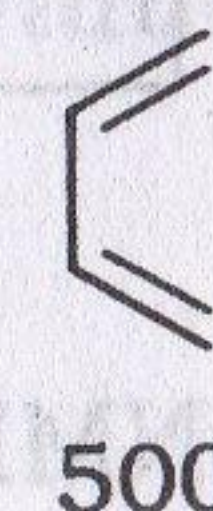
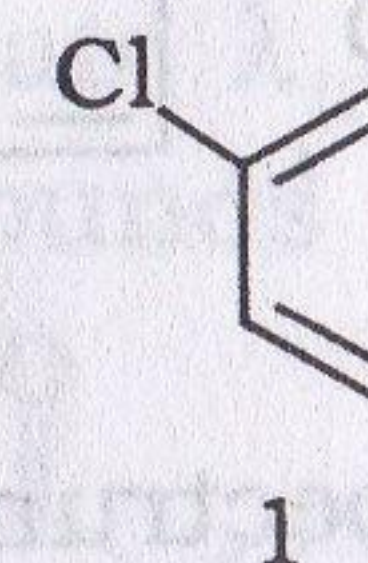
6. (a) Sketch, label and explain all the terms involved in Jablonski diagram.

$3\frac{1}{2}$

(5)

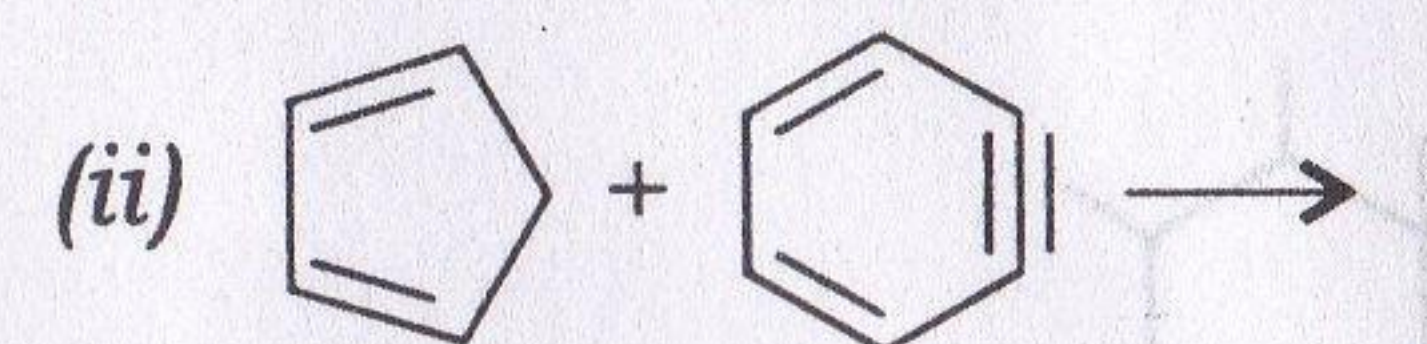
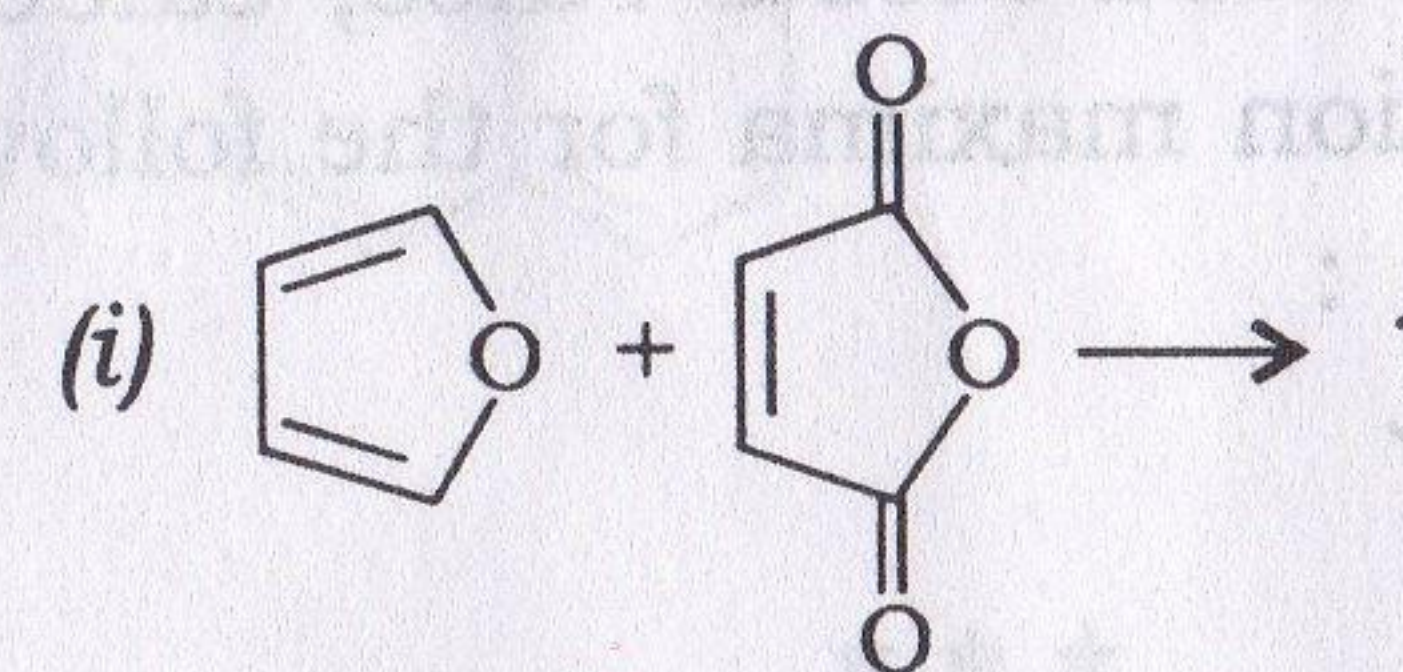
(b) Explain the reactivity order of the following 1,3-butadienes towards tetracyanoethylene as dienophile in the Diels-Alder reaction :

2



(c) Complete the following reactions with proper stereochemistry :

$1 \times 2 = 2$



(d) Explain Norrish type-II reaction with an example.

2

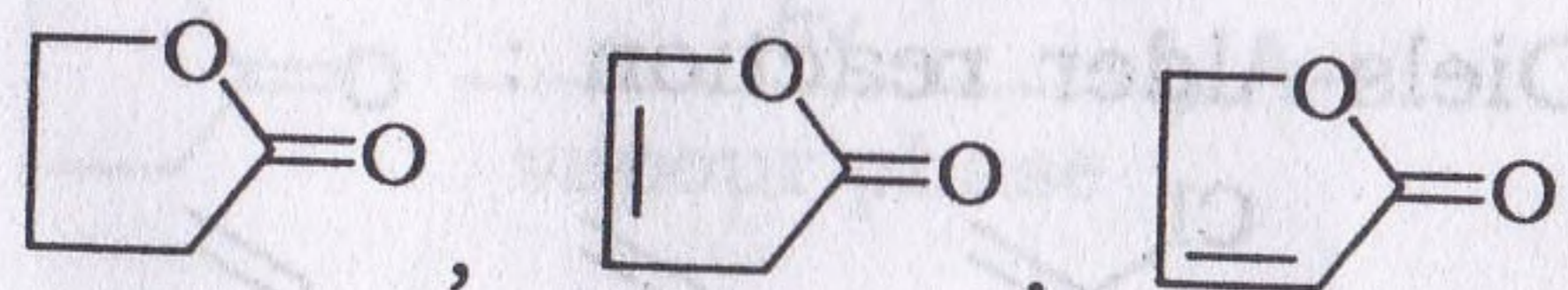
7. (a) Explain the following facts : $1\frac{1}{2} + 1\frac{1}{2} = 3$

(i) Aniline in neutral/basic medium and acidic medium shows different UV spectra.

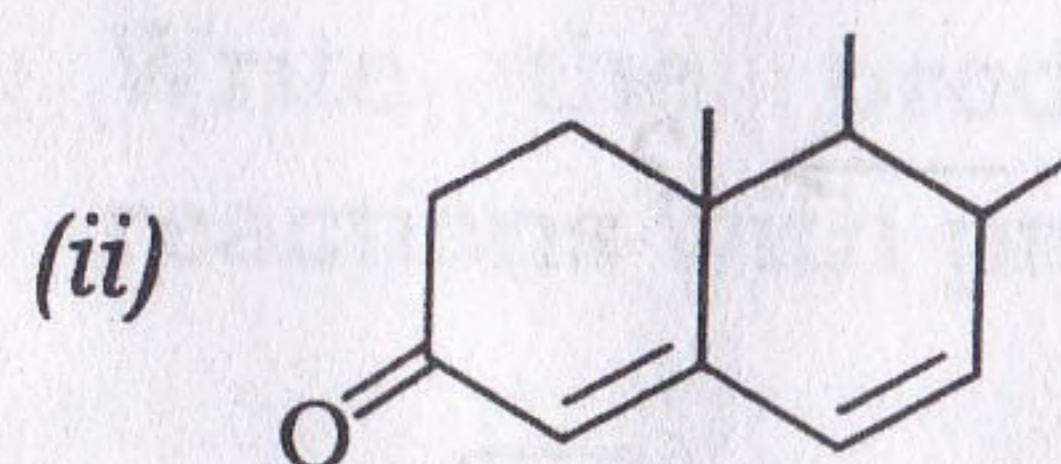
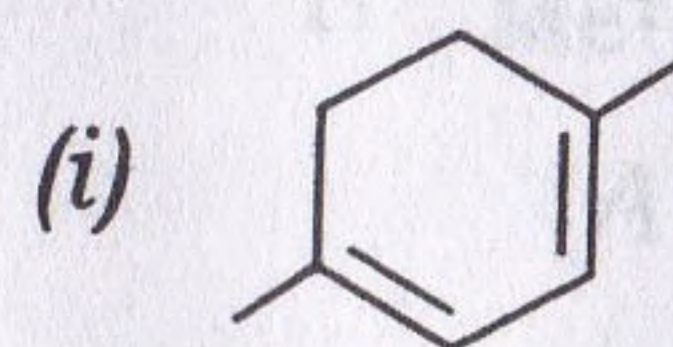
(ii) *cis*-Stilbene and *trans*-Stilbene can be differentiated by UV spectra.

(6)

- (b) Arrange with explanation, the following molecules in order of increasing C=O stretching frequency in cm^{-1} : $2\frac{1}{2}$



- (c) Sketch the $^1\text{H-NMR}$ spectrum of ethyl acetate with expected number of signals with splitting. 2
- (d) Using Woodward-Fieser rules, calculate the adsorption maxima for the following compounds : 2



OR

8. (a) How many signals will you expect in the $^1\text{H-NMR}$ spectrum of ultra-pure ethyl alcohol? Correctly assign the chemical shift of the signals with reasoning. Predict the pattern of the signal. $3\frac{1}{2}$

- (b) Define the terms (i) bathochromic shift and (ii) chromophore. 2

(7)

- (c) How can you differentiate 1° , 2° and 3° amines by IR spectroscopy? 2
- (d) Applying Woodward-Fieser rules, calculate λ_{max} values for the following compounds : 2

