

2018

(May)

CHEMISTRY

(Major)

Course : 605

(Organic Chemistry)

(New Course)

Full Marks : 48

Pass Marks : 14

Time : 2 hours

The figures in the margin indicate full marks for the questions

1. Choose the correct answer from the following :

1×5=5

(a) $\text{CH}_3\text{—CH}_2\text{—OH}$ has an —OH broad absorption near

(i) 1560 cm^{-1}

(ii) 1700 cm^{-1}

(iii) 2100 cm^{-1}

(iv) 3400 cm^{-1}

(b) Which of the following is not the synthetic equivalent of R^\oplus ?

(i) RBr

(ii) ROMe

(iii) ROTs

(iv) RMgBr

(c) Which one of the following nuclei is NMR inactive?

- (i) ^{12}C
- (ii) ^{13}C
- (iii) ^{31}P
- (iv) ^{19}F

(d) Which of the following is natural polymer?

- (i) Nylon
- (ii) Cellulose
- (iii) Dacron
- (iv) Bakelite

(e) Green chemistry is about

- (i) increasing waste
- (ii) reducing hazard
- (iii) increasing cost
- (iv) pollution air

2. Answer any five from the following :

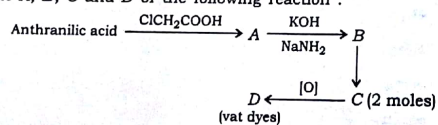
2×5=10

(a) Mention the retrosynthetic procedure of the following compound so that ethylacetoacetate can act as a reagent for synthesizing the compound :

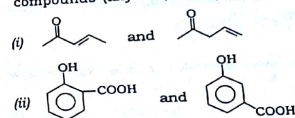


(b) What are the advantages of Ziegler-Natta polymerization over free radical polymerization?

(c) Find out A, B, C and D of the following reaction :



(d) How can you use IR spectroscopy to distinguish between the following compounds (any one)?



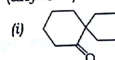
(e) What do you understand by the term 'designer solvents'? Give example.

(f) What do you mean by the term 'shielding and deshielding protons'?

(g) What is hydrogenation of oil? What is its importance in lipid chemistry?

UNIT-I

3. Synthesize the following compound with proper retrosynthetic analysis (any one) :

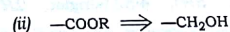
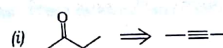


Or

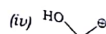
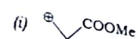
What is Wittig reaction? How would you synthesize the following compound by using Wittig reaction? Give retrosynthesis and synthetic pathways :



4. How can the following FGIs be carried out?

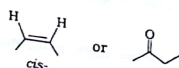


Write the synthetic equivalent of the following compounds :



Or

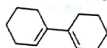
5. How is the following compound synthesized? Give proper retrosynthetic analysis :



UNIT—II

Answer any one question

6. (a) Calculate the λ_{max} value in UV spectrum for the following compound :



(b) How would you distinguish between *p*-xylene (CH_3) and mesitylene (CH_3) with the help of $^1\text{H-NMR}$ spectroscopy?

(c) An organic compound having molecular formula $\text{C}_7\text{H}_8\text{O}$ gives effervescence with sodium metal and can easily oxidized to a crystalline compound (m.p. 122°C). It gives the following spectroscopic data :

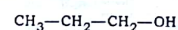
(i) UV spectrum : $\lambda_{\text{max}} = 255\text{ nm}$, $\epsilon_{\text{max}} = 202$

(ii) IR spectrum : 3406 cm^{-1} (broad), 3075 cm^{-1} , 1496 cm^{-1} and 1460 cm^{-1}

(iii) NMR spectrum : $\delta = 7.26$ (singlet, 5H), 4.52 (singlet, 2H), 3.80 (singlet, 1H)

Assign the structure of the compound.

7. (a) Draw the $^1\text{H-NMR}$ spectra of the following compound indicating their nearby chemical shift value :



(b) Why is TMS used as reference standard in NMR spectroscopy?

(c) An organic compound having molecular formula $\text{C}_4\text{H}_9\text{NO}$ gives the following data :

UV : $\lambda_{\text{max}} 220\text{ m}\mu$, $\epsilon_{\text{max}} 63$

IR : 3500 (m) , 3402 (m) , 2960 (w) , 1682 (s) , 1610 (s)

NMR value : 1 doublet (6H), 2.1 septet (1H), 8.1 singlet (2H)

Determine the structure of the compound.

UNIT—III

8. Answer any two questions :

(a) What are triglycerides and phosphoglycerides? Give example of each with structure.

(b) What is lipid bilayer? How is it formed?

(c) Explain why melting point of unsaturated fatty acids is lower than those of saturated fatty acids.

UNIT—IV

Answer any one question

9. (a) Give a method of preparation and uses of methyl orange.

(b) What is dye? How are dyes classified on the basis of their structures?

10. (a) Write the difference between dyes and pigments. What are food dyes?

(b) Give the synthesis of the following dyes :

- (i) Crystal violet
- (ii) Anthraquinone dye

2

UNIT-V

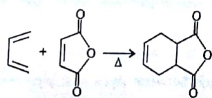
Answer any one question

11. (a) Discuss the mechanism of a peroxide initiated chain growth polymerization process involving any vinyl monomer. 3
- (b) What does 6,6 indicate in Nylon-6,6? In what way it is different from Nylon-6? 1+1=2
- (c) Write the structures of (i) copolymer from styrene and methyl acrylic acid and (ii) polyurethane. 1+1=2
12. (a) Does ethylene polymerize under mild condition in the absence of a catalyst? 1
- (b) How are polymers classified on the basis of their structures? 2
- (c) How does vulcanization change the properties of natural rubber? 2
- (d) What are the structural differences between novolak and bakelite polymer? 2

UNIT-VI

13. Answer any one question :

- (a) What are microwave and solid-state reactions? Why are they used in organic synthesis? 2+1=3
- (b) What do you understand by the term 'atom economy' and 'green solvents'? Calculate the % atom economy of the following reaction : 2+1=3



(Old Course)

Full Marks : 48

Pass Marks : 19

Time : 3 hours

The figures in the margin indicate full marks for the questions

1×5=5

1. Choose the correct answer from the following :

- (a) Which of the following (to be converted by FGI) is not a good alternative target for the synthesis of a carboxylic acid?

- (i) R-OH
- (ii) R-CHO
- (iii) $\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_3$
- (iv) R-CN

- (b) In infrared spectroscopy, which frequency range is known as the fingerprint region?

- (i) 400 cm^{-1} – 1400 cm^{-1}
- (ii) 1450 cm^{-1} – 500 cm^{-1}
- (iii) 900 cm^{-1} – 600 cm^{-1}
- (iv) 600 cm^{-1} – 250 cm^{-1}

- (c) The unsaturated groups present in an organic compound are called

- (i) chromogens
- (ii) auxochromes
- (iii) No specific name
- (iv) chromophores

- (d) Terylene is the polyester of

- (i) hexamethylenediamine and adipic acid
- (ii) vinyl chloride and formaldehyde
- (iii) melamine and formaldehyde
- (iv) ethylene glycol and terephthalic acid

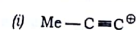
(e) Which of the following is among the 12 principles of Green chemistry?

- (i) Design commercially viable products
- (ii) Use only new solvent
- (iii) Use catalyst, not stoichiometric reagent
- (iv) Re-use waste

2. Answer the following questions :

2×5=10

(a) Write the synthetic equivalents of the following synthons :



(b) What is chemical shift? What are the units for expressing chemical shift?

Or

Why is TMS used as internal standard in NMR studies?

(c) Every coloured compound cannot be used as a dye. Explain with suitable example.

(d) Give the names of the monomer unit that are used to produce the following :

(i) Terylene

(ii) Nylon-6

(e) What is E-factor? How is it related to the efficiency of a reaction?

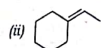
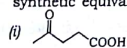
Or

Write two green technologies in chemical synthesis. Give example.

UNIT-I

3. (a) Make a retroanalysis of the following molecules to identify the starting synthetic equivalents :

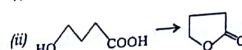
3



Or
What do you mean by FGI? Give the importance of FGI in retrosynthetic analysis. 1+2=3

(b) Synthons may or may not be reaction intermediate of a synthesis. Explain. 2

(c) How will you carry the following conversions? 1×2=2



UNIT-II

4. (a) Why is CH_3OH a good solvent for UV but not for IR spectroscopy? 2

(b) *cis*-1,2-dichloroethylene is IR active while *trans*-1,2-dichloroethylene is IR inactive. Explain. 2

Or

"Increase in polarity of the solvents shifts $\pi-\pi^*$ band to longer wavelength but $n-\pi^*$ and $n\rightarrow\delta^*$ bands to shorter wavelength." Comment on the statement.

(c) An organic compound having the molecular formula $\text{C}_4\text{H}_8\text{O}$ gives a characteristic band at 275 nm ($\epsilon_{\text{max}} 17$) in its UV spectrum. Its IR spectrum exhibits two important peaks at 2940 cm^{-1} , 2855 cm^{-1} and 1715 cm^{-1} . NMR spectrum shows $\delta 2.5$ (q, 2H), $\delta 2.12$ (s, 3H) and $\delta 1.07$ (t, 3H). Assign a structural formula to the compound. 3

UNIT-III

5. (a) What are phospholipids? Mention one important use for them. 1+1=2

Or

What are *trans*-fatty acids? How do they act in the body? 1+1=2

- (b) Name the product with chemical reaction formed by the reaction between glycerol and long-chain fatty acid. 2
- Or
- What are called lipids? What are the main biological functions of lipids? 1+1=2

UNIT—IV

6. (a) Give an example of each type of the following dyes with their structures : 1+3=3
- Acidic dye
 - Mordant dye
 - Azo dye

Or

How are triphenylmethane dyes prepared? Discuss their colour change theory. 1+2=3

- (b) How are the following compounds synthesized in the laboratory? 1+1=2

- Malachite green
- Fluorescein

Or

What is Congo red? How is it prepared? 1+1=2

UNIT—V

7. (a) Write a stepwise mechanism for the polymerization of propylene in the presence of sulphuric acid. 2
- (b) What are urea-formaldehyde resins? Give their preparation and uses. 1+2=3

Or

Chemically what is a natural rubber? To increase the utility of natural rubber, which modification can be made? 1+2=3

- (c) What are the advantages of Ziegler-Natta polymerization over free radical polymerization? 2
- Or
- Write the structure and method of preparation of butyl rubber. 2

UNIT—VI

8. Define atom economy. Give an example of a reaction with high yield but with low atom economy. 1+2=3

Or

Write the advantages of using water as green solvent. Give an example of phase-transfer catalyst. 2+1=3
