

2024

CHEMISTRY — HONOURS

Paper : CC - 8

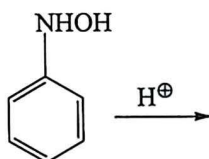
(Organic Chemistry - 4)

Full Marks : 50

*The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.*Answer *question no. 1* and *any eight* questions from the rest (*question nos. 2-13*).1. Answer *any ten* questions :

1×10

(a) Give the product of the following reaction :

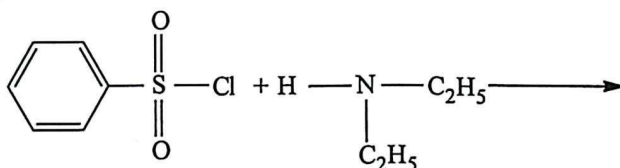
(b) Define chemical shift (δ).

(c) Explain why nitromethane is soluble in NaOH solution.

(d) Name one methodology by which you can ascertain whether a rearrangement is intramolecular or intermolecular. (Name only)

(e) What synthetic equivalent would you use for the acyl anion synthon ($R - CO^{\ominus}$) in a retrosynthetic analysis?

(f) Write down the product of the following reaction and state whether this product is soluble in alkali or not.



(g) What do you mean by synthetic equivalent? Give one example.

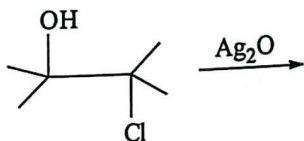
(h) Distinguish chemically between PhCN and PhNC (Write only one difference).

(i) Explain why but-2-yne does not show $C \equiv C$ stretching frequency in its IR spectrum.

(j) Give one example of an illogical electrophile.

Please Turn Over

- (k) Predict the product of the following reaction :



- (l) Give two reasons for choosing TMS as internal standard in ^1H NMR spectroscopy.

2. (a) The ^1H NMR spectrum of a compound having molecular formula $\text{C}_4\text{H}_8\text{O}_2$ has the following signals :

^1H NMR : δ 4.2 (2H, q)

1.9 (3H, s)

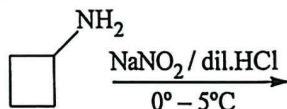
1.3 (3H, t)

The IR spectrum recorded an absorption band at 1740 cm^{-1} (s) and several strong bands in the range $1333 - 1035\text{ cm}^{-1}$.

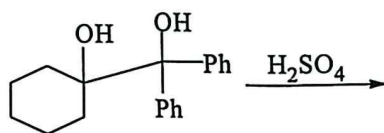
Identify the compound and explain its spectra.

- (b) The α , β -unsaturated Ketone, mesityl oxide shows λ_{max} 230 nm ($\epsilon = 12,600$) and 329 nm ($\epsilon = 41$) in hexane and λ_{max} 243 nm ($\epsilon = 10,000$] and 305 nm ($\epsilon = 60$) in water. Explain. 3+2

3. (a) Predict the product(s) of the following reaction with plausible mechanism :

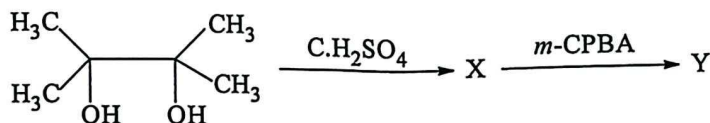


- (b) Predict the major product of the following reaction with mechanism :



3+2

4. (a) Find the major products X and Y in the following reaction sequence. Depict the probable mechanism for the transformation of X to Y :



- (b) An organic compound exhibits following spectral data :

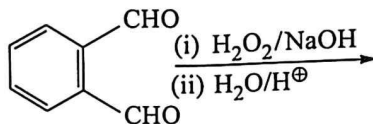
UV : λ_{max} 2292 nm, IR : 1738 cm^{-1} (s), 2720 cm^{-1} (w), 2820 cm^{-1} (w).

Which one of the following is the most likely the structure of the above compound and why?

$\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$, CH_3COCH_3 , $\text{CH}_3\text{CH}_2\text{OCH}_3$, $\text{CH}_3\text{CH}_2\text{CHO}$.

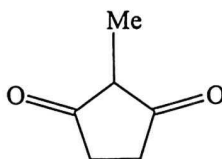
3+2

5. (a) One isomer of dimethoxybenzoic acid has recorded the ^1H NMR spectrum : δ 3.85 (6H, s), 6.63 (1H, t) and 7.17 (2H, d). Which isomer is it? Draw the structure and explain.
- (b) Predict the product of the following reaction along with the plausible mechanism :



3+2

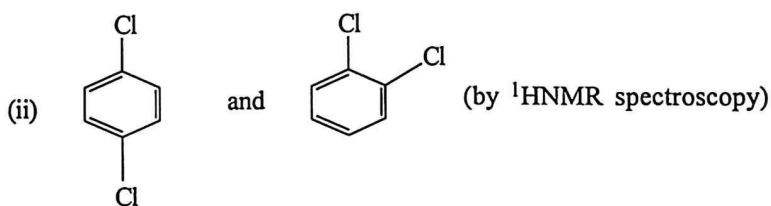
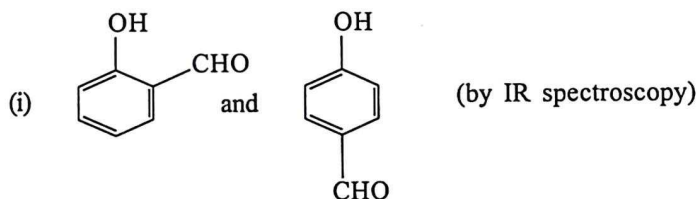
6. (a) Show the retrosynthetic analysis and an efficient synthesis of the following T.M. from DEM.



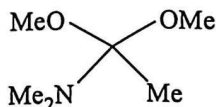
- (b) What is the range of 'finger print region' (in cm^{-1}) in IR spectroscopy? Why is this so called?

3+2

7. (a) Distinguish the following pairs of compounds with the help of spectroscopy as mentioned in the parenthesis :

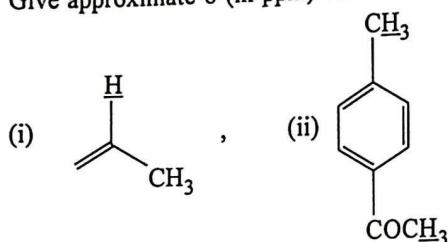


- (b) How many signals will be found in the ^1H NMR spectrum of the following compound? Analyze your answer.

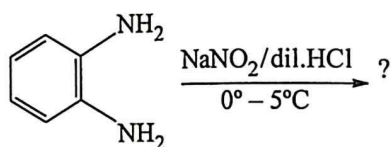


(1½×2)+2

8. (a) Give approximate δ (in ppm) values of the underlined protons of the following compounds.

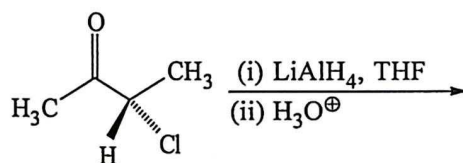


(b) Give the product of the following reaction along with mechanism :

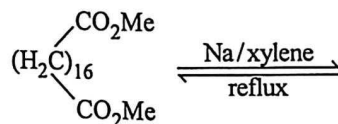


3+2

9. (a) Use Felkin-Anh model to determine the stereochemistry of the major product of the following reaction. Give explanation.



(b) Give the product and mechanism of the following reaction :

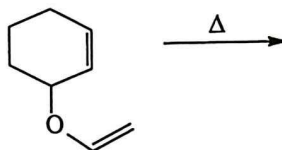


3+2

10. (a) Explain the following observations :

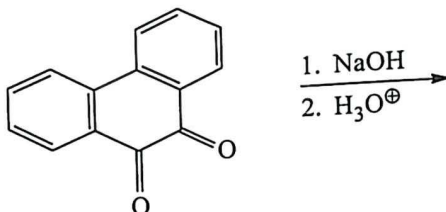
- Ethylene shows UV absorption at 164 nm whereas 1, 3-butadiene shows at 217 nm.
- The UV spectrum of phenol shows a bathochromic shift in presence of alkali.

(b) Predict the product with mechanism :



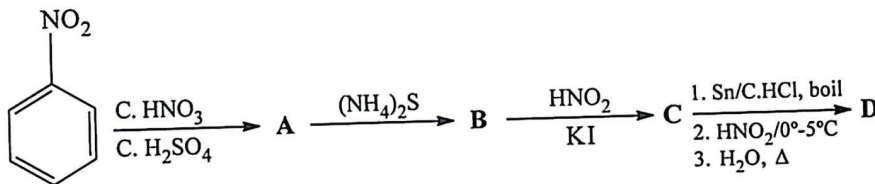
3+2

11. (a) Define stereospecific and stereoselective reactions with one example of each.
 (b) Predict the product with plausible mechanism.



3+2

12. (a) Fries rearrangement is both intramolecular and intermolecular; explain this with supporting evidences.
 (b) Alkaline hydrolysis of benzonitrile affords the salt of an acid but in presence of hydrogen peroxide, an amide is formed. Explain the observation showing mechanisms. 3+2
13. (a) Give the reaction scheme of the following preparation :
 (i) Diazomethane from N-methylurea
 (ii) Ethyl diazoacetate from glycine.
 (b) Identify A – D in the following sequence of reactions :



(1½×2)+2