

Total number of printed pages-7

14 (CHM-1) 102

2021
(Held in 2022)

CHEMISTRY

Paper : CH-102

(Organic Chemistry-1)

Full Marks : 60

Time : Three hours

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

Part-A

Answer **any four** questions from the following :
5×4=20

1. Draw a labelled reaction profile diagram for the following reaction :

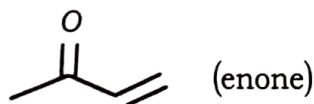


Assuming that 'B' is an unstable intermediate, suggest a hypothetical structure of the transition states. What is the basis of your suggestion ?

Contd.

Write down the mechanistic pathway of the thermal decarboxylation reaction of acetoacetic acid. Why does this reaction occur readily? 2+3=5

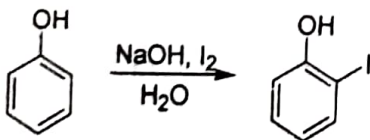
2. Why do some compounds give two different products under thermodynamic and kinetic control? Illustrate your answer considering the reaction of cyanide (NaCN) with the following enone in the presence of an acid (HCN) at 10°C and 80°C . 1+4=5



3. A substrate undergoes C-H bond cleavage in the slowest step of a multistep reaction. What will be the effect on the rate of the reaction if the hydrogen is substituted with deuterium? Name this phenomenon.

In the iodination of phenol in basic medium, it was observed that $k_H/k_D = 4.1$. Suggest a mechanistic explanation for this observation.

2+3=5



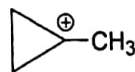
4. What is the Hammett constant σ (sigma)? Point out the significance of the concave upward deviation of the Hammett plot. Illustrate your answer using appropriate example(s). 1+1+3=5

5. State the Curtin-Hammett principle. Using a suitable reaction profile diagram, briefly explain the significance of this principle. 5

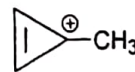
Part-B

Answer **any five** questions from the following : 5×5=25

6. Show how carbocationic intermediates can be generated from alcohols and amines. Arrange the following carbocations in order of increasing stability : 3+2=5



(6a)

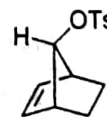


(6b)

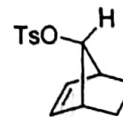


(6c)

7. Acetolysis of anti-tosylate (A) is 10^6 times faster than the syn-tosylate (B). Provide a mechanistic explanation for this observation. 5

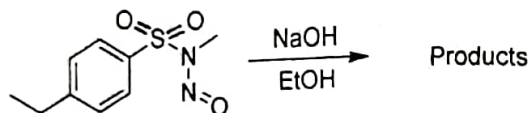


(7a)

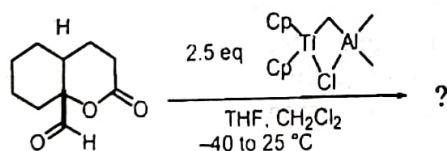


(7b)

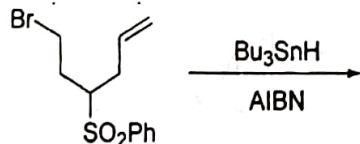
8. Describe the distinguishing features of different carbenes. Predict all possible products of the following transformation and write the mechanism. 1+1+3=5



9. Describe a method for the preparation of Tabbe's reagent. Predict the products of the following reaction and write a reasonable mechanism. 1+1+3=5

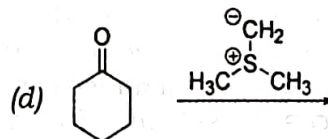
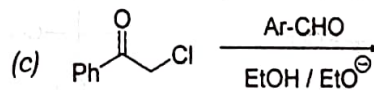
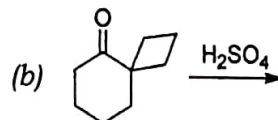
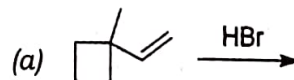


10. Predict the products of the following reaction and write the mechanism. Provide a reasonable explanation regarding the selectivity of the product formation. 1+3+1=5



11. Using illustrative examples, distinguish between stabilized and non-stabilized phosphorus ylides. Examine how stabilized and non-stabilized phosphorus ylides react with aldehyde, RCHO and comment on the stereochemistry of the products. 2+3=5

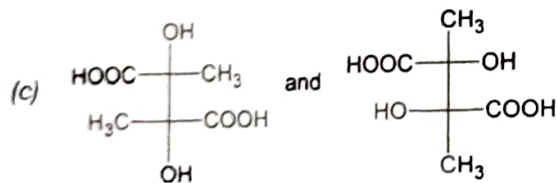
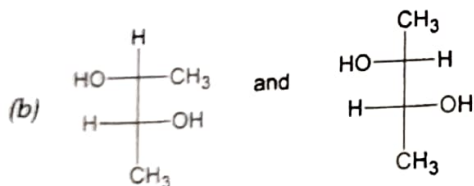
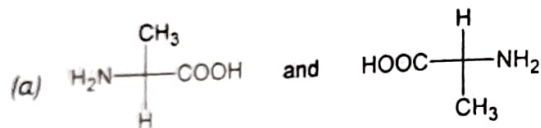
12. Identify the major products for the following reactions, and suggest plausible mechanism in each instance : (*any two*) 2.5×2=5



Part-C

Answer **any three** questions from the following :
5×3=15

13. Define the terms enantiomers and diastereomers. Show if the structures in each pair are identical, enantiomers or diastereomers. 2+3=5



14. Draw the Saw-horse and Newman projections of cis and trans-decalin. Justify the statement : "Cis-decalin undergoes ring-inversion whereas trans-decalin does not". 2+3=5

15. In cyclobutanone (assuming planar structure) there are homotopic, constitutionally heterotopic and enantiotopic pairs of hydrogen atoms. Identify them with appropriate structures and explanation. 5

16. It is observed that cis-1,2 dibromocyclohexane is achiral whereas its trans-isomer is chiral. Justify this observation using appropriate structures. 5
