

2020

(Held in 2021)

CHEMISTRY

(Major)

Paper : 5.3

Full Marks : 42

Time : 2 hours

The figures in the margin indicate full marks
for the questions

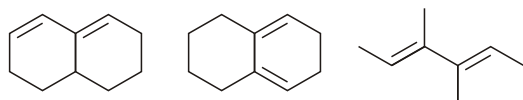
GROUP—A

(Marks : 21)

1. Answer the following :

1×2=2

- (a) Arrange the following diene in order of increasing reactivity in a Diels-Alder reaction :

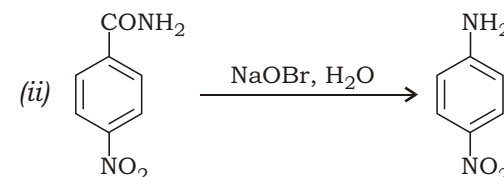
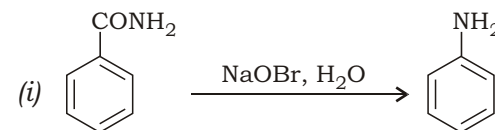


- (b) 2-Methyl-2-nitropropane does not dissolve in alkali whereas 2-nitropropane dissolves. Why?

2. Answer the following :

2×2=4

- (a) In the following reactions (i) is faster than (ii). Give reasons :



- (b) Between 2,4-dimethyl-3,5-heptanedione and 4,4-dimethyl-3,5-heptanedione which compound is more acidic and why?

3. Answer any three of the following :

5×3=15

- (a) How can you carry out the following conversions? Propose mechanisms for the same :

5

(i) Butanone to butan-2-ol

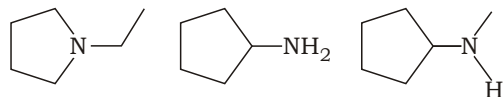
(ii) Cyclohexene to *trans*-cyclohexan-1,2-diol

(3)

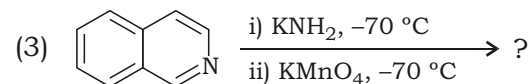
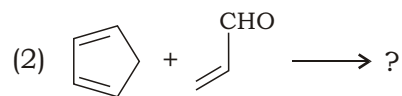
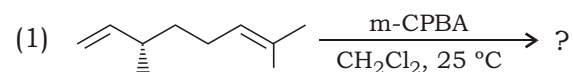
- (b) How can you convert benzophenone to benzanilide using a rearrangement reaction? Propose a mechanism for the conversion. What product will be obtained if *p*-methylbenzophenone were to undergo the same rearrangement?

1+3+1=5

- (c) (i) Arrange the following compounds in order of increasing boiling point and provide an explanation : 2

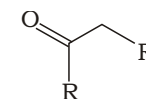


- (ii) Give the major product in each of the following reactions : 1×3=3



(4)

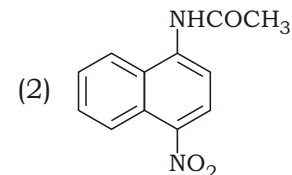
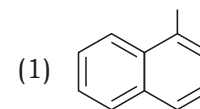
- (d) (i) What product will be obtained when the compound given below reacts with SeO_2 in presence of water? Propose a mechanism for the same : 3



- (ii) Which position of pyrrole is more reactive towards electrophiles and why? 2

- (e) (i) Predict the product when diazoacetone is irradiated in methanol solution. Propose a mechanism. 1+2=3

- (ii) Give the expected dominant product(s) in mononitration of each of the following compounds : 2



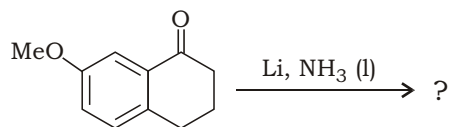
(5)

GROUP—B

(Marks : 21)

4. Answer any *three* of the following : 7×3=21

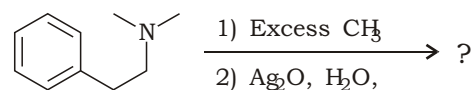
- (a) (i) Predict the major product of the following reaction and propose a mechanism : 1+3=4



- (ii) Write one reaction each to show that anthracene undergoes both electrophilic substitution and addition. Why does anthracene undergo addition reaction comparatively easily than other similar aromatic systems? 1+1+1=3

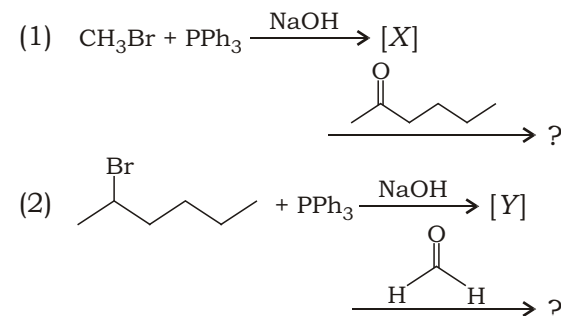
- (b) (i) It is extremely difficult to carry out electrophilic aromatic substitution on pyridine. How can you nitrate pyridine? Write the reactions involved. 2

- (ii) Predict the product and write the mechanism of the reaction : 1+2=3

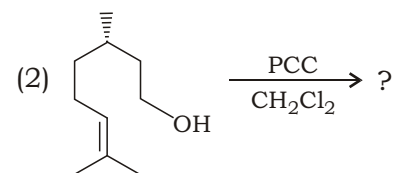
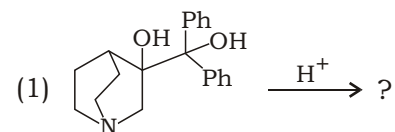


(6)

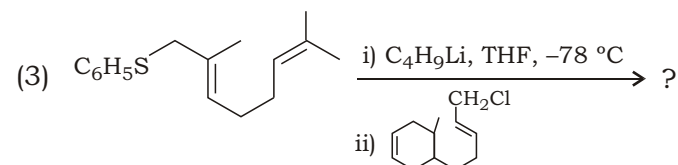
- (iii) Both the reactions shown below give the same alkene. Which one is the favoured route and why? 2



- (c) (i) Write the appropriate products in the following reactions : 2+2+2=6

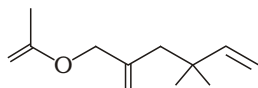


(Take into account the fact that PCC is mildly acidic)

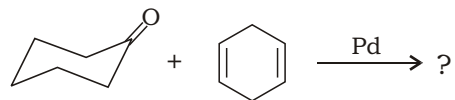


(7)

- (ii) Account for the difference in boiling points between anthracene and phenanthrene. 1
- (d) (i) On reaction with sodium methoxide each of the compounds $\text{PhCH}_2\text{COCH}_2\text{Cl}$ and PhCHClCOMe gives the same product. Use appropriate mechanisms to explain the same. 5
- (ii) How can you convert diethylmalonate to 2-ethylpentanoic acid? Write the steps involved. 2
- (e) (i) The compound given below undergoes Claisen rearrangement followed by Cope rearrangement. Write the expected product : 2



- (ii) Predict the product(s) : 1



(8)

- (iii) When 1,3-dimethyl-isoquinoline is treated with NaOCH_3 in CH_3OD , the protons of the C-1 methyl group are exchanged much more rapidly than those of the C-3 methyl group. Explain. 2
- (iv) What is the active agent which makes mustard gas poisonous? 1
- (v) What happens when hydrazobenzene is placed in strongly acidic solution? 1
