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HPAS (Main)—2017

CHEMISTRY

Paper II

Time : 3 Hours

Maximum Marks : 100

Note :— Attempt five questions in all. Question No. 1 is compulsory. All parts of a question must be answered in continuation at one place.

1. Answer all of the following:

(a) An organic compound having molecular formula $C_{10}H_{12}O_{2}$ exhibits the following spectral data:

IR : 3400 (br), 1600 cm$^{-1}$. $^1H$ NMR : δ 1.85 (3H, $d$, $J = 6.0$ Hz), 3.8 (3H, s), 5.0 (1H, s, D$_2$O exchangeable), 6.0 (1H, dq, $J = 18$ and 6 Hz), 6.28 (1H, $d$, $J = 18$ Hz), 6.75 (1H, $d$, $J = 8$ Hz), 6.8 (1H, s), 6.90 (1H, $d$, $J = 8$ Hz) ppm. Identify the product.
(b) Explain the following trends of acidity:  

(i) 

(ii) 

(iii) 

(iv) 

(c) What products are formed in the following reaction, and explain with suitable mechanism:  

(i)
2. Answer all of the following:

(a) Identify A and B and suggest the mechanism for the following reaction:

(b) Give significance of Wittig reaction with suitable examples.

(c) β-Hydroxy esters are prepared by organo-zinc and not by organo-magnesium reagents. Explain.

3. Answer the following:

(a) How will you monitor the following reaction
sequence by IR? Suggest the reagents a, b, and c.

(b) Write the products of the following reaction and propose suitable mechanism for their formation: 8
(c) Azulene ($C_{10}H_8$) is a deep blue compound. Explain: (i) Aromaticity (ii) Dipole moment of 1.0 D

4. Explain the following:

(a) Identify and propose the mechanism of the product obtained in the following conversion:

(b) Write the mechanism of the following reaction:

(c) Which form of ethylene glycol is stable and why?
5. Answer the following:

(a) Which of the following compounds are chiral? Explain with reason.

(i) Trans-cyclopentane 1, 2-dicarboxylic acid.

(ii) Cis-cyclopentane 1, 2-dicarboxylic acid.

(b) In the following reaction, identify the structure of the product and propose the reaction mechanism:

\[
\text{Product} \quad \frac{-\text{PhCOOCOPh}}{-\text{CHCl}_3} + \text{Product}
\]

(c) Identify the product and write the mechanism in the following reaction:

\[
\text{Product} \quad \frac{(i) \text{SOCl}_2}{(ii) \text{CH}_2\text{N}_2}\]

\[
\text{Product} \quad \frac{-\text{PhCOOCOPh}}{-\text{CHCl}_3} + \text{Product}
\]
6. Answer the following:

(a) Write down the mechanism for the major product formed in the sulphuric acid mediated rearrangement of compound:

(b) How many stereoisomers are possible in the following reaction? Discuss about their optical activity.

(c) Trans-4-\textit{t}-butylcyclohexanol is more strongly absorbed on alumina then cis-isomer. Explain.

7. Answer the following:

(a) Suggest the mechanisms for both the following indole synthesis:
(b) Explain the $SN_2$ mechanism with relevant equations and examples. Explain pseudo first order kinetics in this context.

(c) Discuss Beckman and Hofmann rearrangement with suitable example.
8. Answer the following:

(a) What is polymethanes? What is the principal linkage in polymethanes? Classify the following polymers on the basis of action of heat on them:

(i) Bakelite
(ii) Teflon.

(b) Write short notes on the following:

(i) Applications of supramolecular chemistry
(ii) Excited electron transfer.

(c) Write the product of the reactions with a suitable mechanism:

\[ \begin{align*}
A \xleftarrow{\rm MeS-CH_2} \quad \text{O} \quad \xrightarrow{\rm Ph_3P-CH_2} \quad B
\end{align*} \]