Five Year Integrated M.Sc. Examination, 2019

Semester - VI

Course: CH-3-6-2 (New)

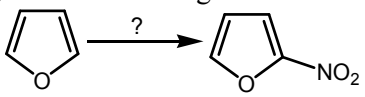
(Chemistry)

Time: Four Hours **Full Marks: 80**

Questions are of value as indicated in the margin.

Group-A

1. Answer ***any ten*** of the following: 10×2=20
   a) Explain effective atomic number (EAN) rule for organometallic compounds.
   b) What are heteroboranes? Give example.
   c) Draw structure of organometallic compounds with (i) bridging nitrosyl and (ii) bent nitrosyl.
   d) Draw the various representations of three-center bonds in boron compounds.
   e) Write the aromaticity order of benzene, thiophene and pyrrole.
   f) Write the proper reagent(s) for the following reaction:



   g) Between pyrrole and pyridine, which one is more basic and why?
   h) Pyrrole-2-aldehyde does not undergo Cannizaro reaction whereas furan-2-aldehyde does.
   i) What is a standard cell? Write down the half cell reaction for saturated calomel electrode.
   j) What is van't Hoff factor? van't Hoff factor for NaCl is 1.97. Explain why?
   k) What is concentration cell? Discuss with suitable example.
   l) What is polarization? How many types of polarization are generally observed?

Group-B

Answer ***any two*** questions.

2. a) What are styx numbers? Find out the styx numbers for B_5H_9 and hence establish the structure of the compound. 2+4
   b) Write the name of a homogeneous catalyst for hydrogenation of alkene. Hence describe the catalytic cycle for an alkene hydrogenation reaction using this catalyst. 1+3

3. a) Classify boron hydride clusters based on their chemical formula. 2
   b) Rationalize the stretching frequencies of $MnCO)_6^+$, $Cr(CO)_6$ and $V(CO)_6^-$ observed at 2090, 2000 and 1860 cm^{-1} respectively. 3
   c) Predict the number of M-M bonds in $Fe_3(CO)_{12}$ and $Co_4(CO)_{12}$ and draw their structures. 3
   d) What are the Friedel Craft acylation and alkylation products of ferrocene when it is treated with excess of the reagents? 2

4. a) What is Zeise's salt? How is it prepared? Discuss its structure and explain the bonding model for the compound. 1+1+3
   b) What is water gas shift reaction? What is its utility? Name two compounds which can catalyze the shift reaction. Draw the Tolman's catalytic loop for the reaction in presence of a suitable catalyst. 1+1+1+2

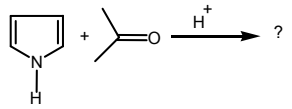
Group-C

Answer ***any two*** questions.

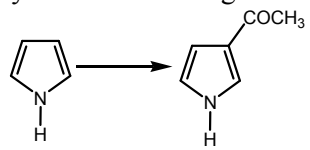
5. a) Pyrrole is acidic like phenol — Explain. 3
   b) Pyrrole becomes protonated on the carbon atom adjacent to the nitrogen atom rather than on nitrogen atom—Account for the fact. 3

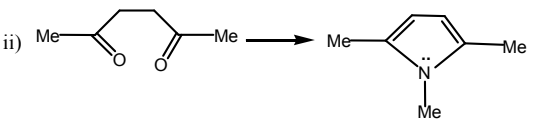
P.T.O.

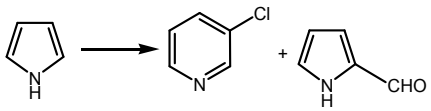
c) Write the product with mechanism of reaction of formation of the product: 4



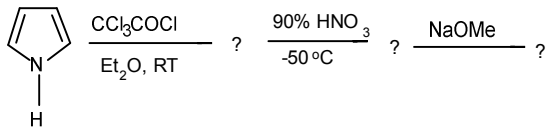
6. Carry out the following conversions: 3+3+4

i) 

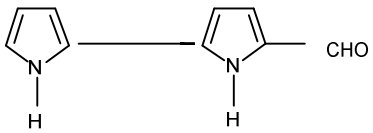
ii) 

iii) 

7. a) Give the products: 3



b) How can you carry out the following conversion? Give the mechanism of the reactions involved. 4



c) Thiophene is more aromatic compared to furan and pyrrole — Explain. 3

Group-D

Answer ***any two*** questions

8. a) Explain why calomel electrode saturated with KCl is preferred over unsaturated one? 2
   b) For the reaction; $Zn(s) + 2AgCl(s) = ZnCl_2\ (0.555m) + 2Ag(s)$, the emf of the cell (E) is 1.015 volts, and the temperature co-efficient of the cell $(dE/dT)_p = -4.02 \times 10^{-4}$ Volt.deg^{-1}. Find ΔH and ΔS of the reaction. 4
   c) Write the cell reaction and calculate the potential of the following cell:
   $Zn|Zn^{2+}$ (a = 0.01) ‖ Fe^{2+} (a= 0.001), Fe^{3+} (a = 0.1), Pt 4
   [Given $E^{o}_{Zn/Zn^{2+}} = 0.7618$ V, $E^{o}_{Fe^{3+}/Fe^{2+}} = 0.771$ V]

9. a) Write the individual electrode reactions and the total cell reaction of the following cell: 3
   $Pb|PbSO_4(s), SO_4^{2-} \| Cu^{2+}|Cu$. The negative electrode is at left.
   b) What is lead acid accumulator? Write down the cell configuration for a lead acid accumulator. What are the individual electrode reaction and the overall cell reaction for such a cell? Why it is advised to store lead acid battery in charging condition? 2+1+3+1

10. a) What is colligative property? Discuss with suitable examples. 2
    b) Show that the relative lowering of vapour pressure is directly proportional to the molality of the solution. What is the name of this equation? 3
    c) 4.50 g of a substance dissolved in 125 g of CCl_4 leads to an elevation of the boiling point by 0.65 K. Calculate the molecular weight of the substance and the freezing point of depression. The values of K_b and K_f of CCl_4 are 4.95 K.Kg.mol^{-1} and 30 K.Kg.mol^{-1}, respectively. 5

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