RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

SECOND YEAR [BATCH 2015-18]

B.A./B.Sc. FOURTH SEMESTER (January – June) 2017

Mid-Semester Examination, March 2017

Date : 16/03/2017 **CHEMISTRY (General)**

Time : 12 noon – 1 pm Paper : IV Full Marks : 25

[Use a separate Answer Book for <u>each group</u>]

Group – A

[*Attempt <u>one question</u> from <u>each Unit</u>*]

Unit – I **[5]**

1. a) Write down expressions of K_P for the following reactions

   i) $N_2(g) + 3H_2(g) = 2NH_3(g)$

   ii) $CO(g) + Cl_2(g) = COCl_2(g)$

   And relate K_P with K_C for these. [2×2]

   b) Show that $K_P = K_C$ for $\Delta\nu = 0$. [1]

2. a) At 400°C and at total pressure of $1{\cdot}013\times10^5$ Nm^{-2}, $COCl_2(g)$ is dissociated to the extent of 20% as shown by the equation $CoCl_2(g) = CO(g) + Cl_2(g)$. Calculate K_P for this reaction. [3]

   b) At equilibrium, free energy change is zero, but $\Delta G° = -RT\ln K_p$. Explain. [2]

Unit – II **[5]**

3. a) Write down the thermodynamic definition of entropy. [1]

   b) Calculate the entropy change when a litre of one mole of a gas at 1 atm, 273 K is expanded reversibly to 2 litres under isothermal condition. [2]

   c) Comment whether the entropy change would be (i) greater (ii) less or (iii) the same if the process mentioned in (b) in carried out irreversibly. [2]

4. a) The efficiency of a Carnot engine can be increased both by increasing the temperature of the source or by lowering the temperature of the sink. Which of the two is more effective and why? [3]

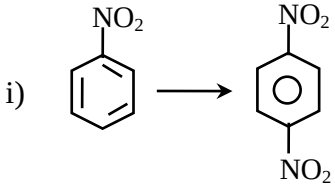
   b) Starting with the Clausius inequality show that the entropy of the universe increases forever. [2]

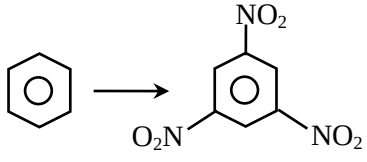
Group – B

[*Attempt <u>one question</u> from <u>each Unit</u>*]

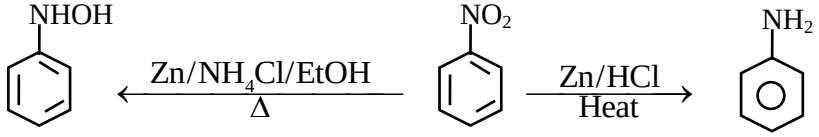
Unit – I **[5]**

5. a) Carry out the following conversions. [2×1·5]

   i) 

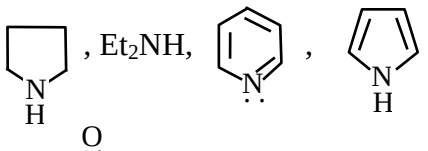
   ii) 

   b) Explain the following observation with mechanism. [2]

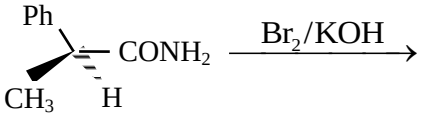


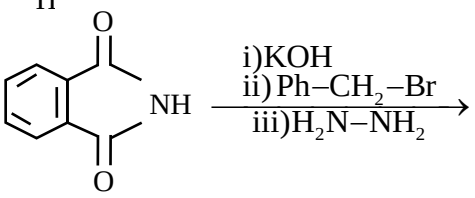
6. a) Arrange the following molecules with increasing order of basicity. [2]

i) NH_3, $EtNH_2$, Et_2NH, Et_3N

ii)  , Et_2NH, ,

b) Predict the product with mechanism [2×1·5]

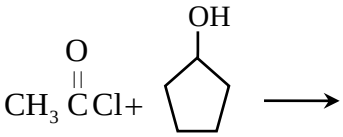
i) 

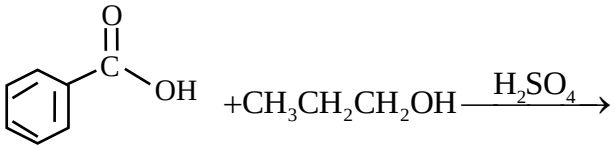
ii) 

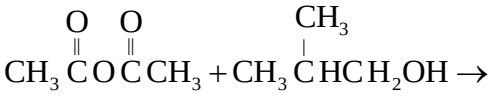
Unit – II **[5]**

7. a) Use concept of charge delocalisation by extended π bonding to explain why RCO_2H is more acidic than ROH (pKa = 15) [2]

b) Show the product of the following reactions : [3]

i) 

ii) 

iii) 

8. Write structures of the organic products for the following reactions and give mechanism. [2+2+1]

a) $(R)-CH_3COOCH(CH_3)CH_2CH_3 + aq.NaOH \rightarrow$

b) $(R)-CH_3COOCH(CH_3)CH_2CH_3 + H_3O^+ \rightarrow$

c) $C_6H_5COOC_2H_5 + NH_3 \rightarrow$

Group – C

[*Attempt any <u>one question</u>*] **[1×5]**

9. a) Write the full name of EDTA, and its chemical formula. Why H_4EDTA is not used in quantitative chemical analysis. [1+1+2]

b) What is the oxidimetric equivalent weight of $KH(IO_3)_2$ [1]

10. a) Name one metal ion indicator in complexometric titration, write its chemical formula. [1+2]

b) Why $KMnO_4$ is not used as primary standard substance? [2]

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