



'সমানো মন্ত্র: সমিতি: সমানী'

UNIVERSITY OF NORTH BENGAL
B.Sc. Honours 2nd Semester Examination, 2022

GE1-P2-CHEMISTRY

Time Allotted: 2 Hours

Full Marks: 40

*The figures in the margin indicate full marks.
All symbols are of usual significance.*

Use Separate Answer Scripts for each Section

SECTION-A

Marks: 22

PHYSICAL CHEMISTRY

GROUP-A

1. Answer any *two* questions from the following: 1×2 = 2
- (a) Write an example of a reaction for which $K_p = K_c$.
- (b) Among the quantities which one is state function?
 Q , W , Q_{rev}/T
- (c) Mention the thermodynamic processes when (i) $Q = 0$ and (ii) $T = \text{constant}$.

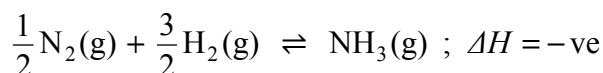
GROUP-B

2. Answer any *two* questions from the following: 5×2 = 10
- (a) (i) State and explain Hess's law of constant heat summation. Mention one application of this law. (2+1)+2
- (ii) Explain common ion effect with suitable example.
- (b) (i) Distinguish between chemical equilibrium and thermodynamic equilibrium. 2+3
- (ii) Derive Kirchhoff's equation.
- (c) (i) State the second and third law of thermodynamics. 2+3
- (ii) Derive thermodynamically the relationship between C_P and C_V for n mole of ideal gas.

GROUP-C

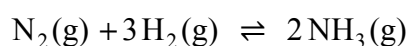
3. Answer any *one* question from the following: 10×1 = 10
- (a) (i) Derive the relation $PV^\gamma = \text{constant}$, mentioning the assumption for the derivation. 3+2+3+2
- (ii) Draw the indicator diagram for a reversible Carnot cycle mentioning the processes.

- (iii) A Carnot engine working between 0° C and 100° C takes up 840 J from the high temperature reservoir. Calculate the work done, heat rejected and the efficiency of the engine.
- (iv) Define with example 'Buffer solution' and 'Buffer capacity'.
- (b) (i) Derive the equation for pH due to hydrolysis of a salt of weak acid and strong base. 4+2+2+2
- (ii) Discuss the effect of pressure and temperature on the following reaction:

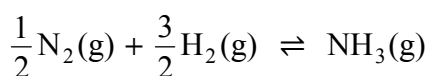


(iii) Define 'entropy of a system' and 'inversion temperature'.

(iv) Find out the relation between K_p s for the following reactions:



and



SECTION-B

Marks: 18

ORGANIC CHEMISTRY

GROUP-A

4. Answer any *three* questions from the following: 1×3 = 3
- (a) AlCl_3 is used in the generation of
 (i) Nucleophile (ii) Electrophile (iii) Carbanion (iv) Free radical
- (b) Which of the following will give nucleophilic substitution by $\text{S}_{\text{N}}1$ mechanism
 (i) CH_3Cl (ii) $\text{C}_6\text{H}_5\text{Cl}$
 (iii) $\text{CH}_2 = \text{CH} - \text{Cl}$ (iv) $\text{CH}_3 - \text{CH} = \text{CH} - \text{Cl}$
- (c) The migratory order of alkyl or aryl group to intermediate carbocation in pinacol pinacolone rearrangement is
 (i) $p\text{-anisyl} > p\text{-tolyl} > \text{phenyl} > \text{R}$ (ii) $\text{R} > \text{phenyl} > p\text{-anisyl} > p\text{-tolyl}$
 (iii) $p\text{-tolyl} > \text{phenyl} > p\text{-anisyl} > \text{R}$ (iv) $\text{phenyl} > \text{R} > p\text{-tolyl} > p\text{-anisyl}$
- (d) α, β -unsaturated carbonyl compound can be obtained by
 (i) Aldol condensation (ii) Cannizzaro reaction
 (iii) Iodoform reaction (iv) Benzoin condensation
- (e) When phenol is treated with neutral FeCl_3 , it has
 (i) Yellow colour (ii) Violet colour (iii) Red colour (iv) None of these

GROUP-B

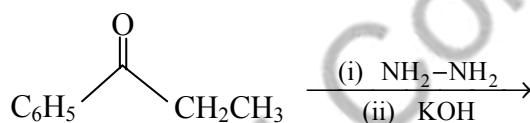
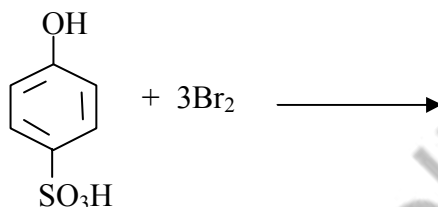
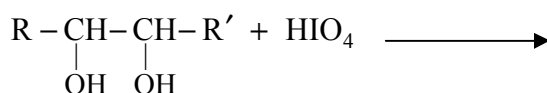
5. Answer any *one* question from the following: 5×1 = 5
- (a) (i) Nitrobenzene or Benzoic acid does not undergo Friedel Crafts reaction. 2+2+1
 — Why?

- (ii) How would you prepare in good yield from Benzene to Ethyl benzene without using Friedel Crafts alkylation reaction?
- (iii) Trimethyl acetaldehyde undergoes Cannizzaro reaction but acetaldehyde does not. — Explain.
- (b) (i) Tertiary alkyl halides are practically inert to substitution by S_N2 mechanism. 2+2+1
Account for the observation.
- (ii) How will you distinguish 1° , 2° and 3° alcohol by Lucas test?
- (iii) What is ambident nucleophile? Give example.

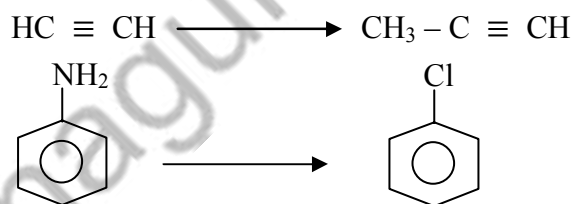
GROUP-C

6. Answer any **one** question from the following: 10×1 = 10

- (a) (i) Predict product(s) from the following reactions: (1+1+1)+
(2+2)+3



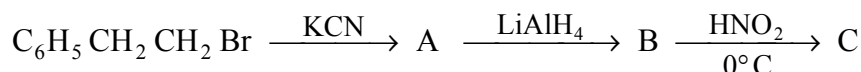
- (ii) Convert the following:



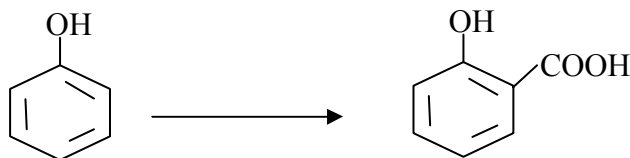
- (iii) Discuss Pinacol-Pinacolone rearrangement with mechanism of the reaction.

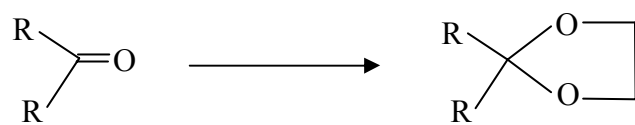
- (b) (i) Discuss the ionic mechanism of nitration of benzene with conc. HNO_3 and conc. H_2SO_4 . What is the role of conc. H_2SO_4 ? *o*-nitrophenol is less soluble in water than *p*-nitrophenol. — Why? (3+1)+3
+2+1

- (ii) Identify the products:



- (iii) Identify the reagents for the following conversions:





(iv) What is Schotten-Baumann Reaction?

—x—