RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

SECOND YEAR

B.A./B.SC. FOURTH SEMESTER (January – June) 2013

Mid-Semester Examination, March 2013

Date : 04/03/2013 **CHEMISTRY (Honours)**

Time : 2 pm – 4 pm Paper : IV Full Marks : 50

[Use Separate Answer Books for each group]

Group – A

(*Answer **any one** question*)

1. a) The average covalent bond energies of N–N, P–P and As–As are 160, 209 and 180 KJ mol^{-1}. Explain [2½]

   b) Nitrogen is diatomic but phosphorous is tetratomic. Explain it chemically and thermodynamically. The bond dissociation energy of $N \equiv N$ and $P \equiv P$ are 946 and 490 KJ mol^{-1} and the P – P, N – N are 209 and 160 KJ mol^{-1}. [2½]

   c) Substitution reaction in four coordinate silicon compounds occurs with inversion or retention of configuration. Justify [2]

   d) Fluoro carbons usually possess lower melting point than corresponding hydrocarbons. Explain [2]

   e) SiF_4 is incompletely hydrolysed. Explain [2]

   f) Explain with example the symmetrical and unsymmetrical cleavage of B_2H_6. [2]

   g) Why borazol is referred as inorganic benzene. [2]

   h) Boronnitride is sometimes called inorganic graphite. Explain. [3]

2. a) Comment on the dipolemoment of R_3PO and R_3NO [2]

   b) Discuss briefly the donor properties of the hydrides of group VA with special emphasis on NH_3 and PH_3. [3]

   c) Diamond is thermodynamically less stable than graphite; yet conversion rate is negligible. Justify [2]

   d) Explain the bonding of $SnCl_2.2H_2O$ [2]

   e) $E_{C-H} = 435\ KJ\,mol^{-1}$; $E_{C-F} = 515\ KJ\,mol^{-1}$; but $r_{C-H} < r_{C-F}$ Justify. [2]

   f) Give a brief introduction of gr. 13 element with respect to their— (i) oxidation state, (ii) Hydride [2+2]

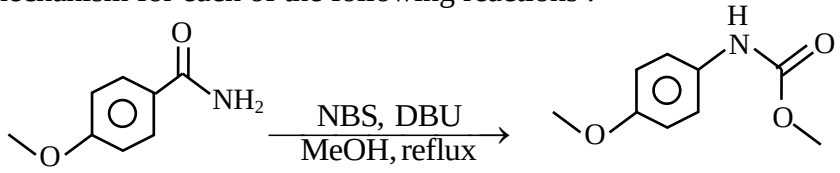
   g) Reduction of boron halides might be expected to produce borane, BH_3. However, it is impossible to isolate the monomer, all synthesis resulting in diborane, B_2H_6. Explain. [2]

   h) What happens when diborane is dissolved in strong alkali? [1]

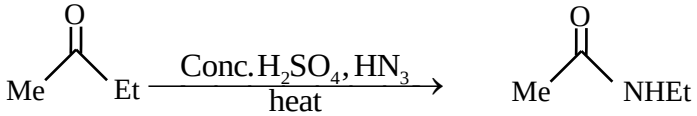
Group – B

(*Answer **any one** question*)

3. a) Give mechanism for each of the following reactions : [4×2]

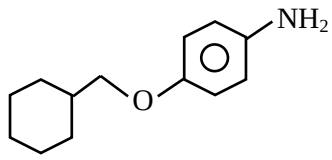
   i) 

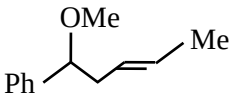
   ii) $EtCOCl \xrightarrow[ii)\,heat]{i)\ NaN_3} EtNH_2$

   iii) 

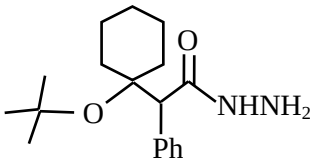
iv) (R) – $PhCHMeCONH_2 \xrightarrow[NaOH]{Br_2}$

b) Give retrosynthetic analysis and efficient synthesis of the following compounds [4×2]

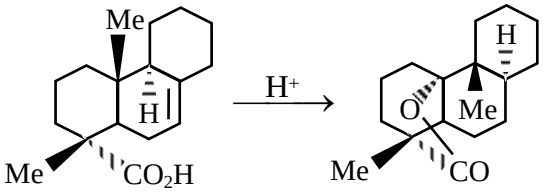
i) 

ii) 

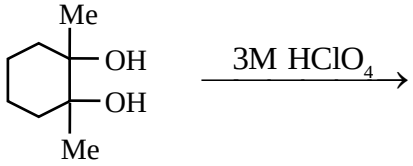
iii) 

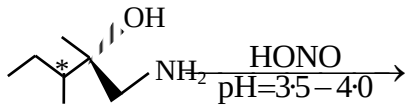
iv) 

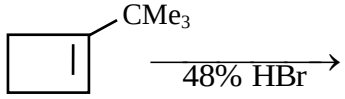
4. a) Give mechanism for each of the following reactions : [2]



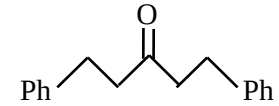
b) Give product(s) of the following reactions with mechanisms. [3×2]

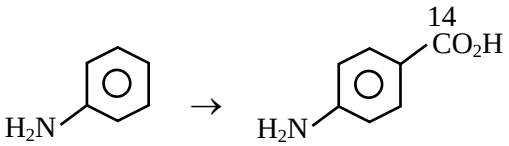
i) 

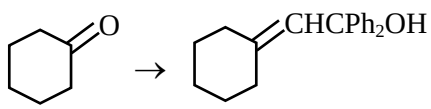
ii) 

iii) 

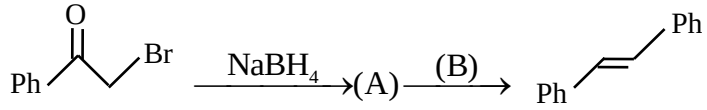
c) Carry out the following conversions. Mechanism is not necessary. [3×2]

i) $PhMgBr \rightarrow$ 

ii) 

iii) 

d) Predict (A) and (B) in the following reaction sequence. [2]



Group – C

(*Attempt all questions***)**

5. a) Define specific and equivalent conductances of a solution. State, with reasons, how equivalent conductance of a strong electrolyte changes with dilution. [1+1+2]

   b) Equivalent conductances at infinite dilution of HCl, NaCl and CH_3CO_2Na are 426·2, 126·5 and 91 $ohm^{-1}\ cm^2\ equiv^{-1}$ respectively at 25°C. A conductance cell filled with 0·01N KCl has a resistance of 257·3 ohm at 25°C. The same cell filled with 0·2 N acetic acid has a resistance of 508·6 ohm. Calculate the dissociation constant of the acid. (Specific conductance of 0·01 N KCl = $1{\cdot}41\times10^{-3}$ $ohm^{-1}cm^{-1}$) [4]

Or

6. a) State Kohlrausch's law of independent migration of ions. [2]

   b) Discuss how the solubility and the solubility product of CaF_2 can be determined experimentally from conductance measurements. [3]

   c) Conductance of a 0·1N HCl solution is found to be B units, using a cell having cell constant 1·0 cm^{-1}. Equal volume of 0·1 N NaOH solution is added to it and the new conductance is found to be A units. What is the sign of the quantity (A – B)? Find out the equivalent conductance of the resulting solution. [3]

7. a) What is 'photoelectric effect'? [1]

   b) Mention (with the help of a quantitative relation) how the kinetic energy of an emitted photoelectron depends upon frequency of the incident radiation. Explain this on the light of Einstein's theory of quantized radiation. [1+3]

   c) Mention how the rate of emission of photoelectrons depends upon intensity of the incident radiation. Explain this on the light of Einstein's theory of quantized radiation. [1+2]

Or

8. a) Write down the Schrodinger Equation for a system with a potential energy V(x), able to move in only one dimension. [1]

   b) i) Solve the Schrodinger equation for a 'free particle'. [3]

   ii) Explain why none of the particular solutions can be accepted as well-behaved 'wave function'. What is the way out then? [3+1]