EASTERN UNIVERSITY, SRI LANKA
SECOND EXAMINATION IN SCIENCE- REPEAT
EXTERNAL DEGREE – 1998/1999
EXCH 203 BORON CHEMISTRY, SILICATES, PHASE RULE AND X-RAY CRYSTALLOGRAPHY

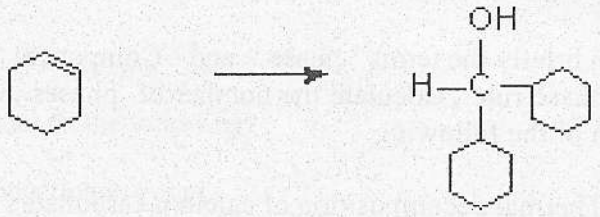
Time: 02 hours

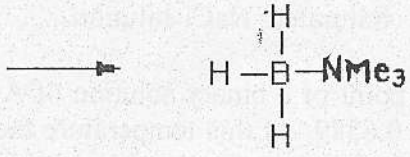
ANSWER FOUR QUESTIONS ONLY

1. (a) Discuss the type of bonding and structures of the following boron compounds using Wade's rule.
   (i) B_5H_{11} (ii) $C_2B_3H_5$

   (b) What are the types of borane that exist, relating their structure with its' composition? Briefly describe each of them.

2. (a) How can the following transformations be effected through organometallic intermediate(s)?

   1. 

   2. B_2H_6 

   (b) Write balanced equations to show the reactions of $B_3N_3H_3Cl_3$ with

   (i) $NaBH_4$ (ii) CH_3MgBr (iii) RNH_2 (iv) $AlCl_3/C_6H_6$

   (c) (i) Derive the 'styx' number for B_4H_{10}
   (ii) Draw the schematic diagram corresponding to the 'styx' number.

3. (a) Describe the structure of 'talc.

   (b) On which basis, silicates are classified? Briefly describe the structure of any two of them.

   (c) Discuss the chemical uses of zeolites.

4. (a) (i) Calculate the Miller indices of planes whose intercepts on a, b and c axes are

(I) a , ∞b ,2 c

(II) αa , $\frac{2}{3}$ b , $\frac{1}{3}$ c

(ii) Show, in clearly drawn diagrams, the positions of the above planes in the cubic unit cell.

(b) Sketch the following types of lattices

(I) a face centered cubic

(II) a body centered cubic.

5. (a) State the phase rule and identify the terms in it.

(b) (i) Explain briefly the terms ' phase ' and ' Component ' of a system.

(ii) Using phase rule , calculate the number of phases , components and degree of freedom of the following ,

(I) Thermal decomposition of calcium carbonate .

(II) Saturated NaCl solution.

(c) Boiling point of a binary solution of A and B is 88° C when the mole fraction of A, $X_A = 0.6589$. At this temperature the vapour pressure of pure A and B are 957 and 379.5 torr respectively.

(i) Find out whether this is an ideal solution or not.

(ii) What is the initial composition of the vapour in the system?

6. (a) Explain , using diagrams the following terms

(i) Triple point

(ii) Eutectic point

(b) Methyl ether (A) and diborane B_2H_6 (B) form a compound AB that melts congruently at 133 K. The system exhibits two eutectics, one at 25 mole percent B and 123 K and a second at 90 mole percent B and 104 K. The melting points of pure A and B are 131K and 110K respectively.

Sketch the phase diagram for this system.
(Assume: Solid-solid solubility is negligible)

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