CHEMISTRY 1B (CHEM1102) - June 2008

2008-J-2

- The electronic configuration of the Group 1 metals is ns^1. They are big atoms (atomic size decreases across a period as shielding decreases) and hence the outermost electron is far from the nucleus. They therefore have low ionisation energies.
  They are powerful reducing agents as they lose a single electron very easily.

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  Fe^{2+} (d^6)

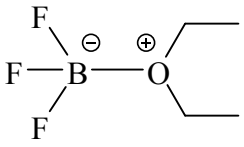
  

  Fe^{3+} (d^5)

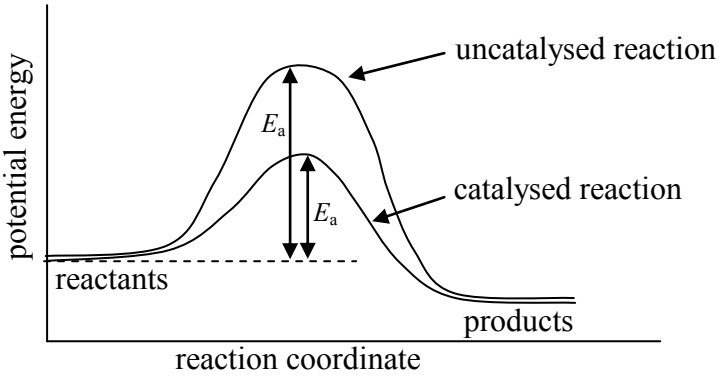
  Paramagnetism arises as a result of the presence of 1 or more unpaired electrons.

2008-J-3

- A Lewis acid is an electron pair acceptor. BF_3 possess an empty p-orbital on B. $CH_3CH_2OCH_2CH_3$ possess a lone pair on O.



- A catalyst is a substance that increases the rate of a reaction without being consumed in the reaction. A catalyst works by providing an alternative reaction pathway of lower activation energy, E_a.



- The critical temperature (T_c) is the temperature above which a substance cannot exist as a liquid. Thus methane cannot be liquefied at 25 °C.
- Allotropes are different structural forms of the same element.

  white phosphorus and red phosphorus, O_2 and O_3, many other examples

2008-J-4

II	III	II
4	6	6
7	3	8
2–	3+	0
tetrahedral	octahedral	octahedral
Cl	O and N	Cl and N

2008-J-5

- 8.24
- 0.26 mol

2008-J-6

- Rate = $k[H_2][NO]^2$

  $k = 2.9 \times 10^2\ M^{-2}\ s^{-1}$

  $4.1 \times 10^{-5}\ M\ s^{-1}$

  $NO + NO \rightleftharpoons N_2O_2$ (fast equilibrium) Eq 1

  $H_2 + N_2O_2 \rightarrow N_2O + H_2O$ (slow) Eq 2

  $2NO + H_2 \rightarrow N_2O + H_2O$ Overall stoichiometry is consistent

  As Eq 1 is an equilibrium, $K_{eq} = \frac{[N_2O_2]}{[NO]^2} \Rightarrow [N_2O_2] = K_{eq}[NO]^2$

  From Eq 2: Rate = $k[H_2][N_2O_2]$

  $= k[H_2]K_{eq}[NO]^2 = k_1[H_2][NO]^2$ so rate equation is satisfied

2008-J-7

- constitutional isomers

  conformational isomers

  diastereoisomers

  same compound

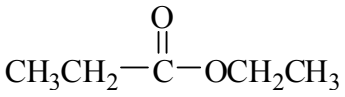
  diastereoisomers

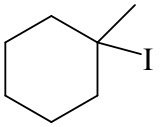
  (*E*)-2-butene

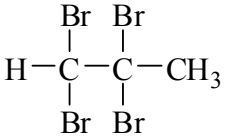
  (*R*)-2-bromopropanal or (*R*)-2-bromopropionaldehyde

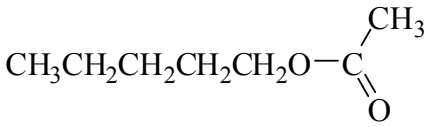
  No. It's a *meso* isomer and has a plane of symmetry.

2008-J-8

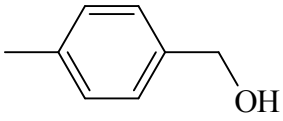
- 

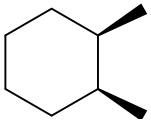






CH_3COOH





2008-J-9

- **A**: hot concentrated H_2SO_4

  B: dilute H_2SO_4

  C: $Cr_2O_7^{2-}$ / H^+

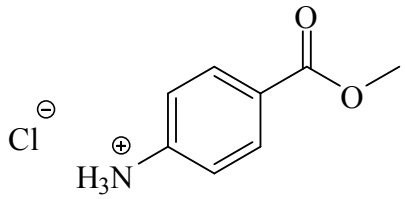
  D: hot concentrated HCl or $SOCl_2$

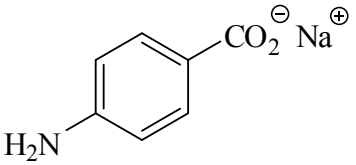
  E: hot concentrated KOH in ethanol solvent

2008-J-10

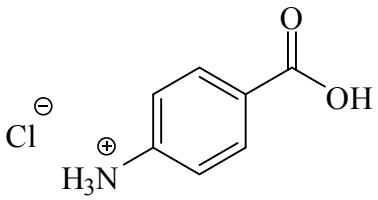
- $C_8H_9O_2N$

  amine (primary) ester





+ CH_3OH



+ CH_3OH

2008-J-11

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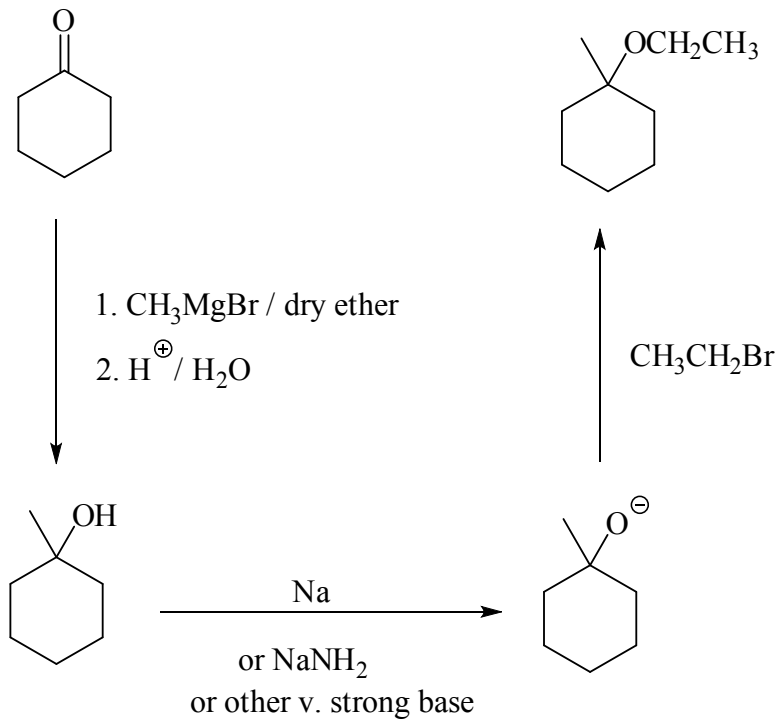
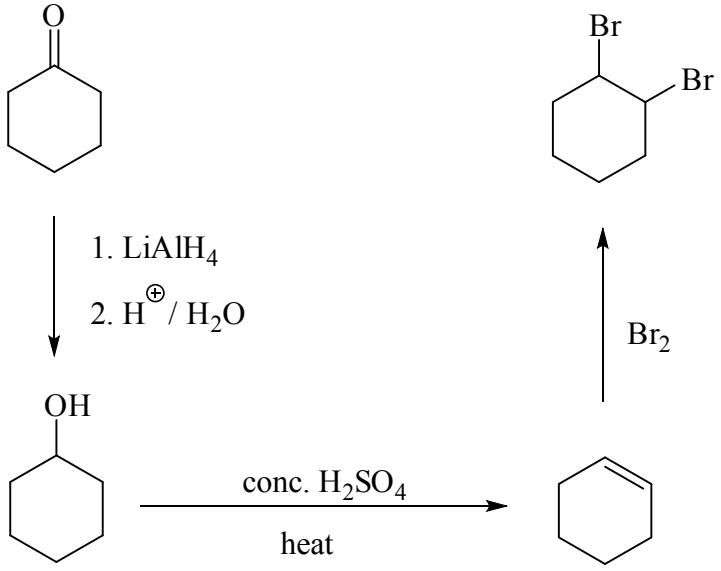

O
OCH2CH3
1. CH3MgBr / dry ether
2. H⊕ / H2O
CH3CH2Br
OH
O⊖
Na
or NaNH2
or other v. strong base


O
Br
Br
1. LiAlH4
2. H⊕ / H2O
Br2
OH
conc. H2SO4
heat

2008-J-12

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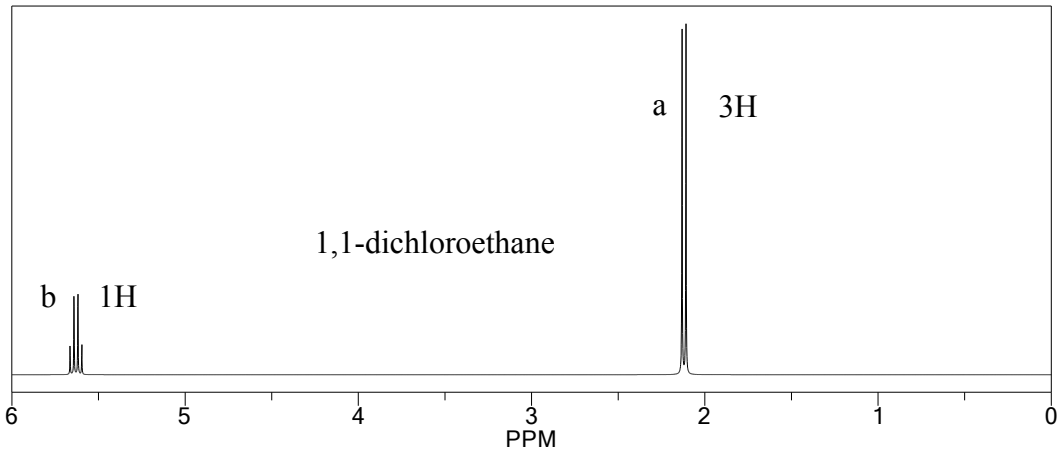

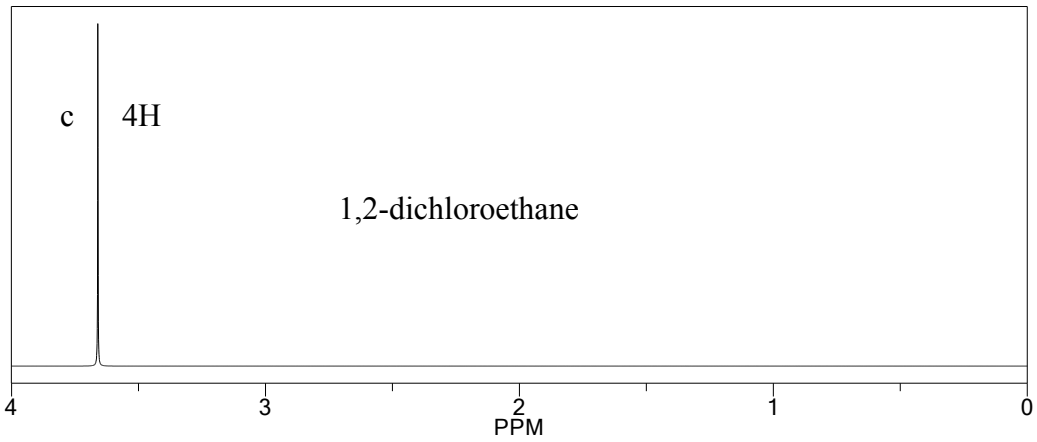

2008-J-13

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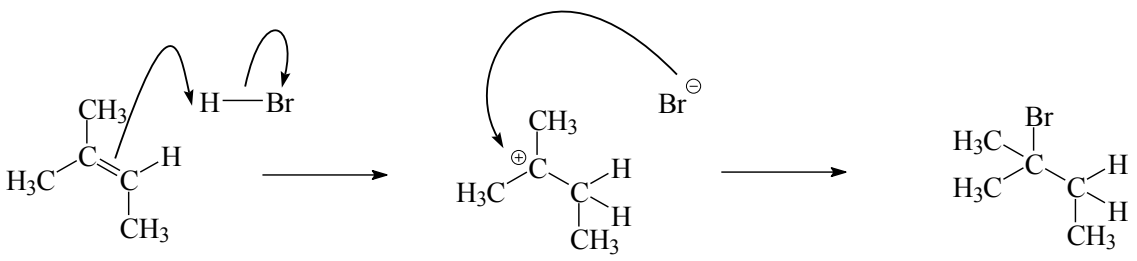

HBr is the electrophile