CHEMISTRY 1B (CHEM1102) - June 2005

2005-J-2

- All three are based on a cubic unit cell. Simple cubic has atoms stacked directly one on top of the other, least dense 52%, 1 atom/unit cell. BCC has one atom at the centre and 8 x 1/8 atoms at the corners of the unit cell, density 68%, 2 atoms/unit cell. FCC is most efficient packing with 74% density and 4 atoms/unit cell.

- $Ca_5(PO_4)_3OH(s) \rightleftharpoons 5Ca^{2+}(aq) + 3PO_4^{3-}(aq) + OH^-(aq)$

  In acidic media, H^+ reacts with both PO_4^{3-} and OH^- to form the conjugate acids and hence shifting the equilibrium to the right.

  Fluoridation can replace OH^- forming $Ca_5(PO_4)_3F(s)$. This is less soluble than hydroxyapatite and does not react with H to the same extent as OH^-.

2005-J-3

- Na_2O - basic; Cl_2O - acidic

  Na_2O - pH increases; Cl_2O - pH decreases

  Sodium oxide is ionic, releasing the very basic oxide ion on dissolution which reacts to form hydroxide. Dichlorine oxide is a covalent molecule and reacts with water to give an oxyacid.

- Alumina is amphoteric and will react with hydroxide to form a soluble complex:

  $Al_2O_3(s) + 2OH^-(aq) + 3H_2O(l) \rightarrow 2[Al(OH)_4]^-(aq)$

  Iron oxide will not react with hydroxide and may now be removed by filtration.

  $2[Al(OH)_4]^-(aq) + 2CO_2(g) \rightarrow Al_2O_3(s) + 2HCO_3^-(aq) + 3H_2O(l)$

  Amphorteric

2005-J-4

- $[Ni(en)_2(H_2O)_2]^{2+}$

  N, O

  $3d^8$

- Rate = $k[NO]^2[Cl_2]$

  k = 180 $mol^{-2}\ L^2\ s^{-1}$

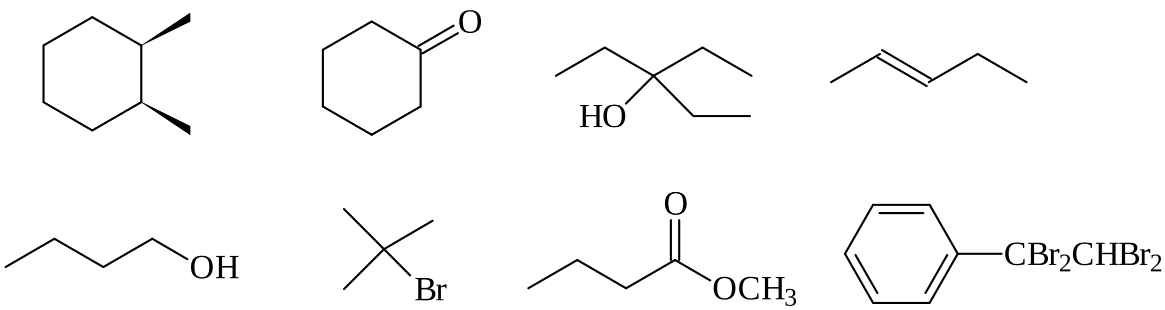
2005-J-5

- 2.73

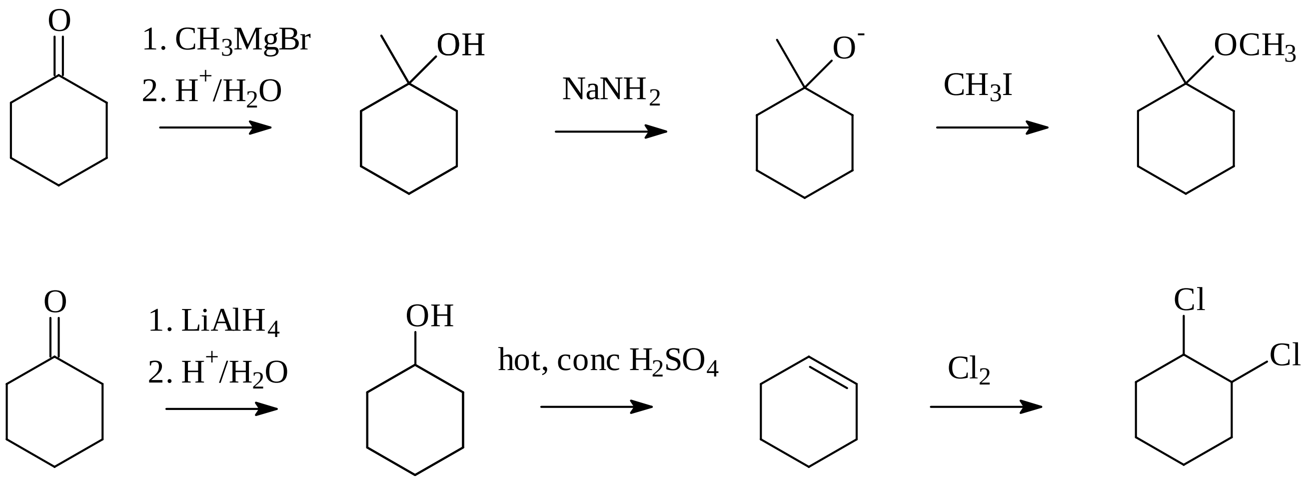
  4.94

  0.024 mol or 1.9 g

2005-J-6

- 

2005-J-7

- 

2005-J-8

- OH^-

  Hot, concentrated H_2SO_4

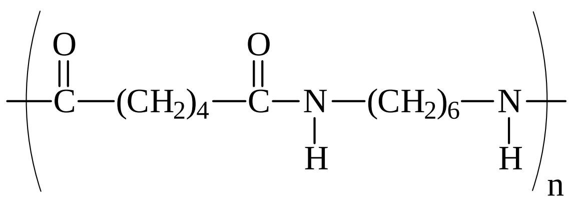
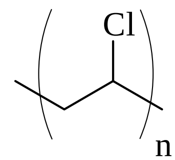
  $NaNH_2$

  CH_3COCl

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

- Phenols are less acidic than carboxylic acids. Phenols react with aqueous hydroxide solution to form the phenoxide ion; carboxylic acids react with either aqueous hydroxide or aqueous hydrogen carbonate to form the carboxylate ion. The difference in stability arises from the relative stability of the conjugate base: there is more delocalisation of the charge in the carboxylate ion which is resonance stabilised.

2005-J-9

-  

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