FUNDAMENTALS OF CHEMISTRY 1B (CHEM1002) - November 2008

2008-N-2

- A complex is a species that consists of a central metal ion which acts as a Lewis acid surrounded by a number of ligands that act as Lewis bases. The charge on the complex may be positive, negative or neutral depending on the charge on the cation and the number and charge of all the ligands.

  hexaaquanickel(II) ion

  The ion undergoes hydrolysis because the charge on the Ni^{2+} weakens the O–H bonds in the ligands.

  $[Ni(OH_2)_6]^{2+} + H_2O \rightleftharpoons [Ni(OH_2)_5OH]^{+} + H_3O^{+}$

- Equivalence point is the point where the reaction stoichiometry is exactly satisfied. i.e. for an acid base reaction, where the amount of acid added is exactly equal to the amount of base initially present.

  The endpoint is where the indicator changes colour and the reaction is observed to be completed.

  The endpoint and equivalence point need to be as close to one another as possible.

2008-N-3

- A: solid B: liquid C: gas

  Draw a horizontal line on the phase diagram that passes through all tree regions. This represents an increase in temperature at constant pressure. As the temperature is increased the particles gain more energy and pass from solid to liquid to gas, corresponding to regions A, B and C respectively.

  Boundary conditions where 2 phases co-exist in equilibrium.

  The substance undergoes a phase change.

  The solid is denser because the gradient of the line between A and B is positive. Increasing pressure from within section A (ie travelling upwards along a vertical line) will never causes a phase change from solid to liquid .

2008-N-4

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

  Rate constant = 180 M^{-2} s^{-1}

2008-N-5

- 12.60

  1.99

  5.06

2008-N-6

- In liquid water, each molecule is involved in four H-bonds: two via the H atoms and two via the lone pairs. In ice, the molecules are arranged in a regular 3D network with holes in the lattice - each O is at the centre of a distorted tetrahedron and each molecule is involved in only 2 H-bonds. Water has the greater number of H-bonds, so the molecules are held closer together and it is denser than ice.

  It would be a gas. O_2 and H_2 are gases due to the very weak dispersion forces between molecules. Water would also be a gas for the same reasons.

- $1.0 \times 10^{-10}\ M^2$

  $BaSO_4$ is suitable as it has a very low solubility *i.e.* very few of the toxic Ba^{2+} ions are produced.

  Adding SO_4^{2-} ions would reduce the solubility of $BaSO_4$ even more due to the common ion effect (a specific example of Le Chatelier's principle).

2008-N-7

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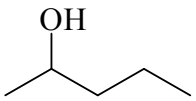
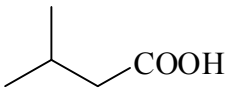
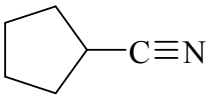
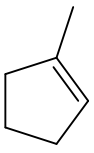
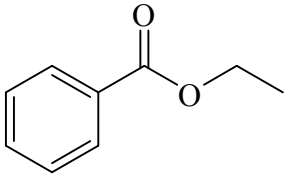
1-pentene 

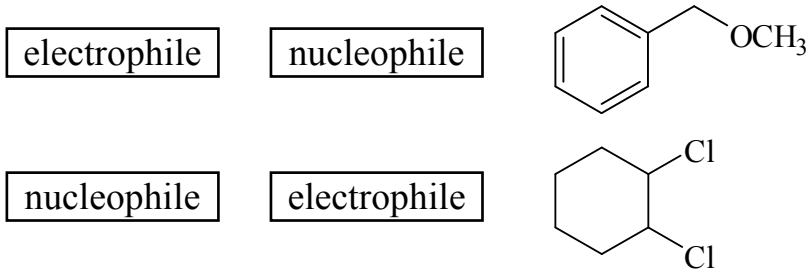
3-methyl-1 butanol 

bromocyclopentane 

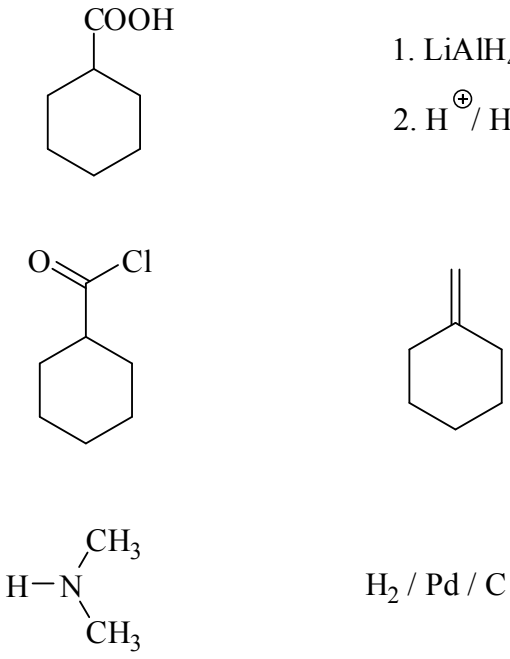




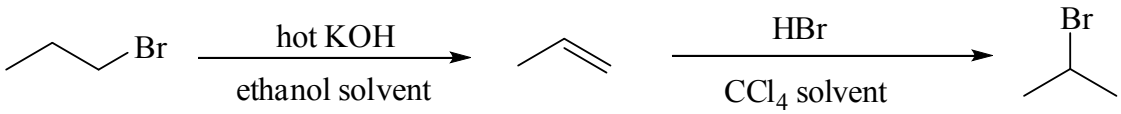
2008-N-8

- 

2008-N-9

- 

2008-N-10

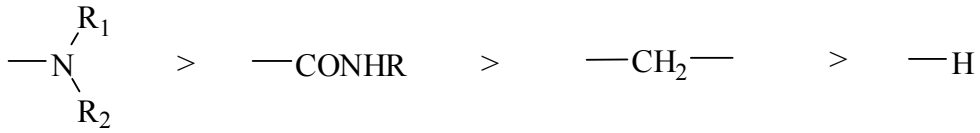
- 

The starting material has 3 resonances; the product has only 2 resonances.

2008-N-11

- $C_{18}H_{28}ON_2$

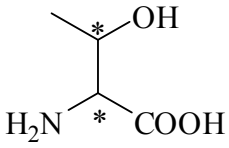
  288.2195

  (*S*)

  (tertiary) amine, amide, aromatic ring

2008-N-12

- 

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