CHEM1405 (Vet. Science) - June 2008

2008-J-2

- (a) A biological catalyst.

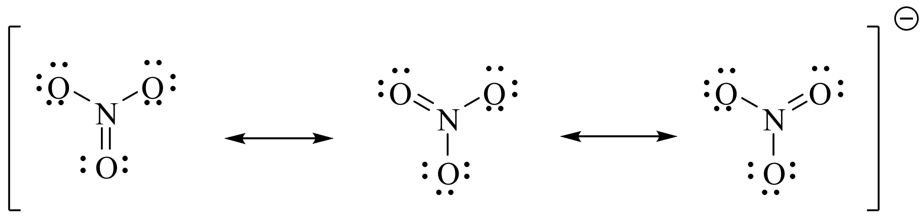
  (b) A non-protein part of an enzyme (eg haem group in haemoglobin) that is required for the enzymic activity.

  (c) A sequence of amino acids linked by peptide bonds (amide functional group).

- The intermolecular forces in I_2 and CH_4 are weak dispersion forces. Iodine is a much larger atom that H or C and hence has more electrons and a much more polarisable electron cloud, so I_2 has stronger dispersion forces and higher melting point. NaCl has relatively strong ionic bonds. SiO_2 is a covalent network compound with very high melting point as covalent bonds need to be broken.

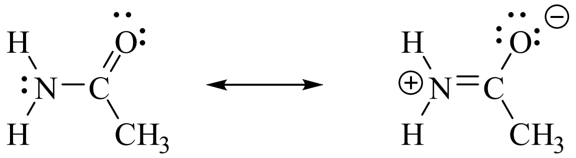
2008-J-3

- The NO_3^- ion is resonance stabilised as shown.



  The bond order is 4/3 = 1.33

- The molecule has two major resonance contributors as shown.



  As a consequence of resonance, the CN bond has partial double bond character. This causes the peptide bond to be planar with restricted rotation.

2008-J-4

- $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$

  $n = 3$, $l = 1$, $m_l = 1$, $m_s = +½$

- 1.2×10^3 g mol^{-1}

2008-J-5

- 1.03 V

  1.51×10^{35}

  –201 kJ mol^{-1}

  Reaction is spontaneous as $\Delta G < 0$.

  Ni(s) | Ni^{2+}(aq) || Ag^+(aq) | Ag(s)

2008-J-6

- –128.8 kJ mol^{-1}

  Reaction is spontaneous as $\Delta G < 0$.

  113.7 K

2008-J-7

- Cu does not dissolve in dilute HCl because of relevant electrode potentials.

  $Cu(s) \rightarrow Cu^{2+}(aq) + 2e^-$ $E°_{ox} = –0.34$ V

  $2H^+(aq) + 2e^- \rightarrow H_2(g)$ $E°_{red} = 0$ V

  Cu dissolves in dilute HNO_3 because reduction of NO_3^- ion occurs.

  $Cu(s) \rightarrow Cu^{2+}(aq) + 2e^-$ $E°_{ox} = –0.34$ V

  $NO_3^-(aq) + 4H^+(aq) + 3e^- \rightarrow NO(g) + 2H_2O$ $E°_{red} = 0.96$ V

- $+3.7 \times 10^{34}$

  Exothermic. Increasing the temperature reduces the K_p, ie pushes the reaction to the left. It is therefore exothermic (from Le Chatelier's principle).

2008-J-8

- Rate = $k[CO][Cl_2]$

  1.3×10^{-2} L mol^{-1} s^{-1}

  2.2×10^{-2} mol L^{-1} s^{-1}

2008-J-9

- 10.26
- 4.89

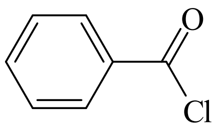
  5.09

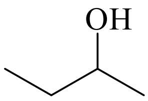
2008-J-10

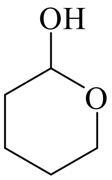
- **A**: NaOH or Na or $NaNH_2$ or other strong base

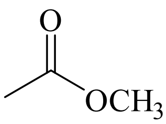
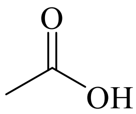
  B: I_2

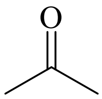
  C: Zn / H^+

- 

   + 

   + CH_3CH_2OH

2008-J-11

- Tollens' reagent, $[Ag(NH_3)_2]/OH^-$
  The first compound will cause a silver precipitate to form. No reaction with the second compound as it does not contain hemi-acetal group.

  $Cr_2O_7^{2-}/H^+$
  Orange reagent will go green with first compound. No reaction with the second compound.

  Br_2 solution.
  First compound will decolourise the orange/brown Br_2 solution. No reaction with the second compound.

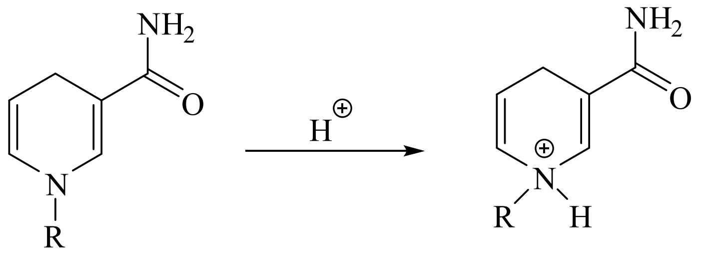
- ^{1}H nmr will detect different numbers of H's attached to the ring. The first compound has 3 olefinic resonances (each 1H) and 1 aliphatic resonance (2H) whilst the second compound has 4 aromatic resonances (each 1H).

  IR. The first compound will give intense absorption at about 1740 cm^{-1} due to the C=O group. The second compound will have no absorption in that region.

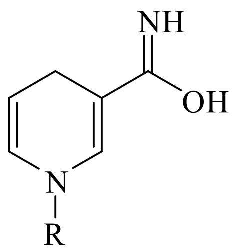
2008-J-12

- Aromatic compound must be cyclic, planar, conjugated, and have 4*n*+2 π electron NAD+ is aromatic. NADH is not.

  Only NADH will react.



NAD+ will not react as the amide N is not basic and the ring N has no lone pair of electrons.



2008-J-13

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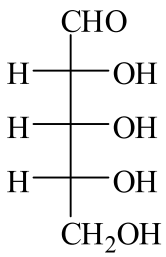
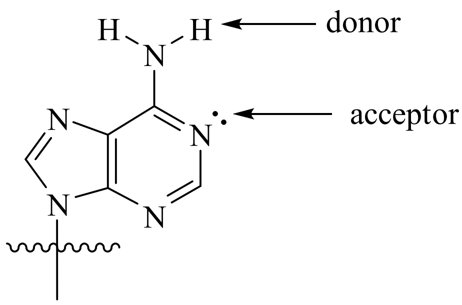
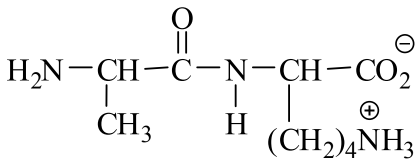




2008-J-14

- 

  Yes. Strong H-bonding and ion-dipole forces enable the peptide-water interactions to be more stable than interactions within either substance.

  Basic. Due to the side chain on lysine, there is a greater number of basic groups than acidic groups overall.

  10.2

2008-J-15

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