2000 CHEM1403 & CHEM1907/1908 (1LS Courses)

2000-J-2

- $H_2O_2 \rightarrow O_2(g) + 2H^+ + 2e^-$
  $MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$
  $2MnO_4^- + 5\,H_2O_2 + 6H^+ \rightarrow 2Mn^{2+} + 5O_2(g) + 8H_2O$
  2.99×10^{-2} g
  2.15×10^{-2} L

2000-J-3

- 2.84×10^{-19} J
  35.0%

- iron
  $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^6$
  12
  6
  1

- 1- Butanol has H-bonds as major intermolecular force. Diethyl ether has much weaker intermolecular forces, *viz*. dispersion forces.

2000-J-4

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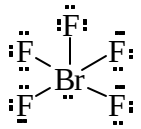
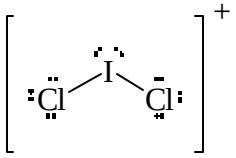
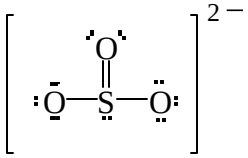


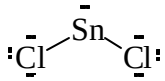
square pyramidal
sp^3d^2



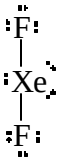
bent
sp^3



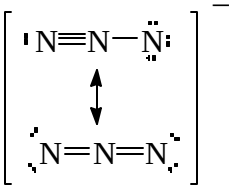
trigonal pyramidal
sp^3



bent
sp^2



linear
sp^3d

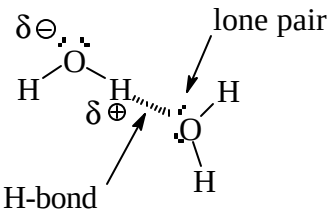


linear
sp

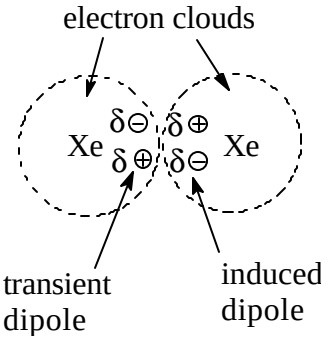
BrF_5 and $SnCl_2$

2000-J-5

- When H is bonded to the very electronegative and small atoms F, O and N, a very polarised bond forms. The small nature of the atoms involved means that the atoms can approach very close to each other and an anomalously strong intermolecular bond (H-bond) is formed.



Slight variations in the electron density of molecules cause transient dipoles in the electron cloud. These can induce dipoles in neighbouring molecules and the two dipoles can attract each other (dispersion force). The larger atoms have more polarisable electron clouds and hence larger dispersion forces.

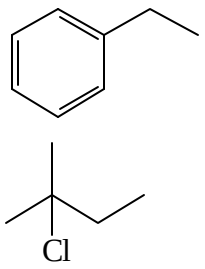


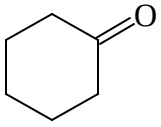
- hexaamminecobalt(III) bromide
  $[Fe(H_2O)_5Cl]Cl_2$
  $[Cr(NH_3)_4Cl_2]NO_3$
  sodium tetrachlorocuprate(II)

- S Sc Ca K
  Li Be S Cl

2000-J-6

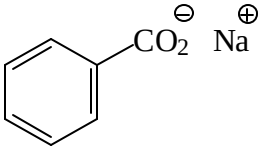
- $SOCl_2$



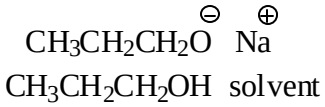


+ CH_3CH_2OH

$(CH_3CH_2)_4N^{\oplus}\ Cl^{\ominus}$

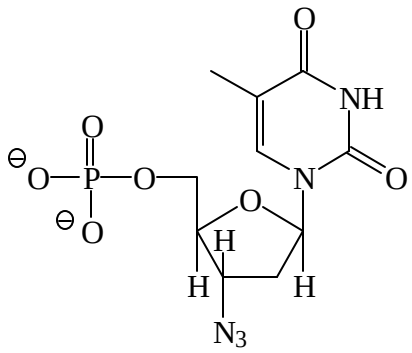


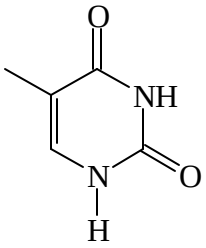
+ CH_3CH_2OH

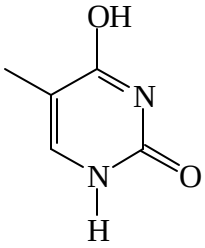

$CH_3CH_2CH_2O^{\ominus}$ $Na^{\oplus}$
$CH_3CH_2CH_2OH$ solvent

2000-J-7

- $C_{10}H_{13}O_4N_5$
  furanose
  β-anomer







- Both heterocycles are aromatic with 6 π electrons. In pyridine, the 5 C atoms and the N atom each provide 1 electron for the aromatic system. The N is sp^2 hybridised with 2 electrons involved in σ bonds to neighbouring carbons and 1 lone pair which is available to act as a proton acceptor in the reaction with HCl.
  In pyrrole, the N is again sp^2 hybridised with 2 electrons involved in σ bonds to neighbouring carbons and 1 electron involved in the σ bond to H. The aromatic system is made up of 1 electron from each of the 4 carbon atoms and 2 electrons from the N. This accounts for N's total complement of 5 electrons and hence there is no lone pair available to act as a proton acceptor.

2000-J-8

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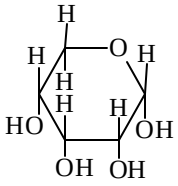
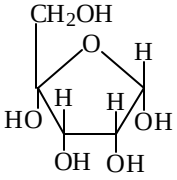
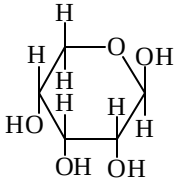
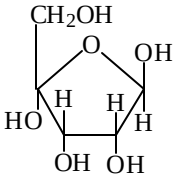
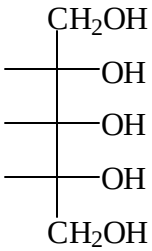




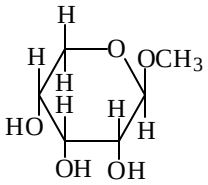




2000-J-8 (cont.)

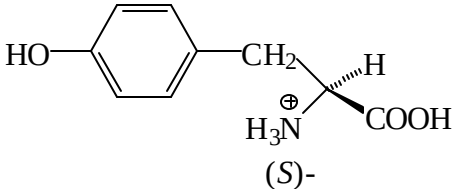


Zero. This compound is a meso isomer. It has an internal plane of symmetry and is superposable on its mirror image. Hence not optically active.

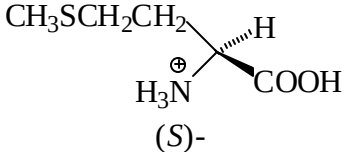


2000-J-9

- alkyl ammonium ion, phenol, amide, aromatic ring (arene), thioether, carboxylate ion



(*S*)-



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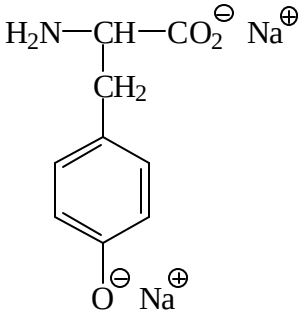
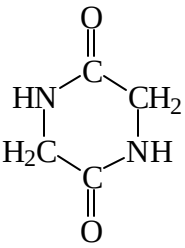


- 

There are no teminal COOH or NH_2 groups, so zwitterion can't form - no intramolecular acid/base reaction can occur.