CHEMISTRY 1B (CHEM1102) - November 2004

2004-N-2

- Blood maintains a constant pH by means of a H_2CO_3/HCO_3^- buffer. It resists any change in pH because any excess H^+ or OH^- is consumed as follows:

  $H^+ + HCO_3^- \rightarrow H_2CO_3$ or $H_2CO_3 + OH^- \rightarrow HCO_3^- + H_2O$

  The buffer is an equilibrium system: $H^+ + HCO_3^- \rightleftharpoons H_2CO_3$

  More CO_2 is produced, so it dissolves in the blood to increase the concentration of H_2CO_3. This in turn pushes the above equilibrium to the left and the $[H^+]$ increases. The pH will therefore go down, but only slightly as the buffer system is highly effective.

  Hyperventilation results in a decrease in the amount of CO_2 in the blood. This pushes the $CO_2 + H_2O \rightleftharpoons H_2CO_3$ equilibrium to the left which in turn pushes the $H^+ + HCO_3^- \rightleftharpoons H_2CO_3$ equilibrium to the right to produce more H_2CO_3. The net effect is thus to lower $[H^+]$ and cause a small increase in pH.
  (The standard treatment for hyperventilation is to get the patient to breath into a paper bag and rebreathe the CO_2 he has exhaled.)

2004-N-3

- Liquid water is more dense than solid water (ice). When pressure is applied to the ice by the wire, it melts and gravity pulls the wire downwards through the liquid water. Once the pressure is removed the water refreezes above the wire. The speeds of the two processes are such that the wire slowly cuts through the block without the block falling apart.

- 1.16×10^{-5} s^{-1}

  4.1%

2004-N-4

- Allotropes are different molecular forms of the same element.

  white and red phosphorus (many other examples possible)

  The covalent lattice network of diamond is very strong. There is a very large energy of activation to convert it to the more stable graphite form and this energy is not available under normal conditions.

II	4	8	K^+(aq), $[Ni(CN)_4]^{2-}$(aq)
III	6	3	$[Cr(NH_3)_5Cl]^{2+}$(aq), Cl^-(aq)
III	6	6	$[Co(en)_3]^{3+}$(aq), Br^-(aq)

2004-N-5

- 0.021 M

  pH = 3.60 pOH = 10.40

2004-N-6

- Al_2O_3 is amphoteric and will dissolve in concentrated NaOH solution.

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

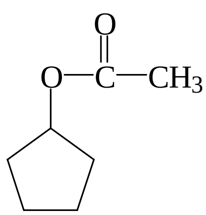
Fe_2O_3 is a basic oxide and will not dissolve in concentrated NaOH solution.
Physical methods (filtration, centrifugation, etc) can now be used to separate the solid containing the Fe from the solution containing the Al.

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

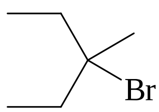
It is amphoteric and dissolves in strongly basic solutions.

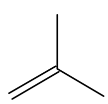
2004-N-7

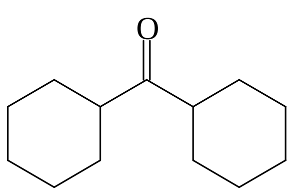
-

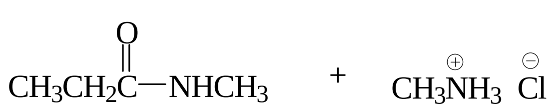


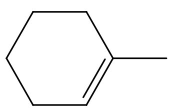
$CH_3CH_2CH_2—O—CH_2CH_3$











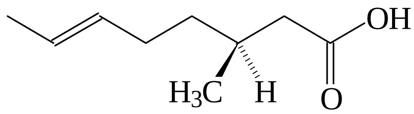
2004-N-8

-

(*E*)

–CH_2CHO –$CH_2CH_2CH{=}CHCH_3$ –CH_3 –H

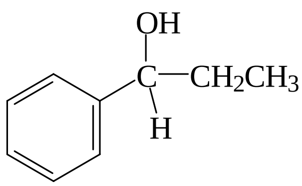
(*S*)

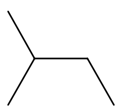


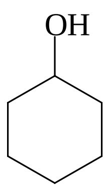
(*S*)-enantiomer

2004-N-9

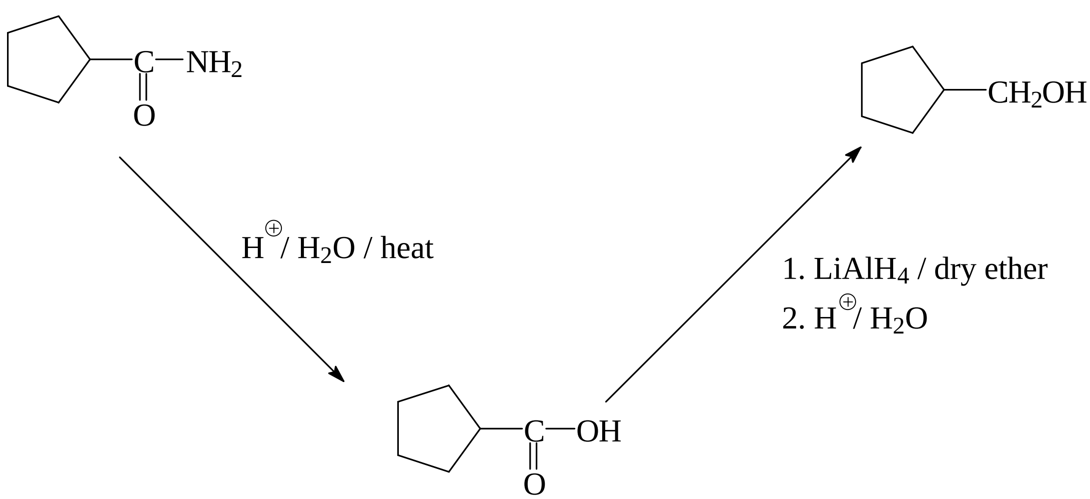
-



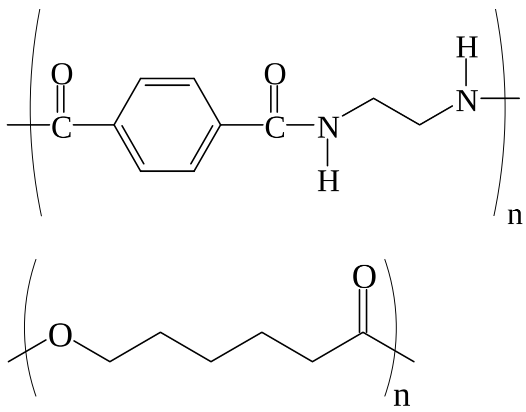




-



2004-N-10

- 

-