CHEM1909 (1LS Advanced Course) - November 2002

2002-N-2

- $C_6H_{12}O_6(s) + 6O_2(g) \rightarrow 6CO_2(g) + 6H_2O(l)$

  $\Delta H° = -2800 \text{ kJ mol}^{-1}$

  $\Delta S° = 261 \text{ J K}^{-1} \text{ mol}^{-1}$

  $\Delta G° = -2880 \text{ kJ mol}^{-1}$

  $\Delta H° = -4.13 \text{ kJ min}^{-1}$

2002-N-3

- 0.35

  2.6 kJ mol^{-1}

  0.16 M

2002-N-4

- 3.11

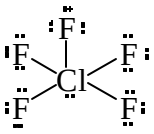
  5.40

  8.87

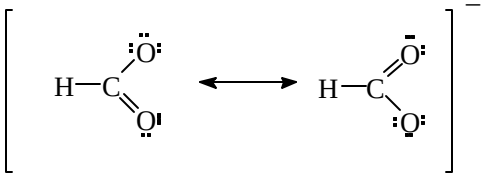
  12.10

2002-N-5

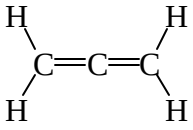
-



sp^3d^2 square pyramidal



sp^2 trigonal planar



sp linear

- 179 kJ mol^{-1} $4.48 \times 10^{14} \text{ s}^{-1}$

2002-N-6

- 5.7×10^{-5} mol L^{-1}

  Limestone has a very low solubility in water, the following equilibrium lying very much to the left. $CaCO_3(s) \rightleftharpoons Ca^{2+}(aq) + CO_3^{2-}(aq)$
  Acid rain has a relatively high concentration of H^+, which reacts with the CO_3^{2-} to give carbon dioxide gas. This upsets the equilibrium of the above reaction and more limestone must dissolve. $2H^+(aq) + CO_3^{2-}(aq) \rightarrow CO_2(g) + H_2O(l)$

- 5.6 °C

2002-N-7

- 4.5×10^2 s (7.5 minutes)
- –0.024 V
- –195 kJ mol^{-1}

2002-N-8

- Sodium laurate would have the highest CMC since it disrupts the least number of water-water bonds when it is dissolved in the aqueous phase.
  Sodium stearate and oleate have the same number of hydrophobic atoms and hence would be likely to disrupt the same number of water-water bonds. However, the stearate will have the lowest CMC because it is a straight chain molecule and can pack more easily into a micelle.

- An enzyme is a biological catalyst which provides a low energy alternative pathway for a chemical reaction.
  Advantages: Efficient (up to 10^{20} times faster than uncatalysed reaction)
  Specific (only a single substrate will react)
  Disadvantages: Low tolerance to changes in temperature and pH.

2002-N-9

- 44.3 kJ mol^{-1}
- 50×10^2 s (8.3 minutes)

2002-N-10

- Odd numbered nuclei are less stable than even number nuclei - hence the zig-zag nature of curve.
  Heavier elements are synthesised from lighter ones and hence are less abundant.
  Fe (atomic number 26) is the most stable nuclide and hence has a higher than expected abundance. It has a stable *A*/*Z* ratio of approximately 2 and a very high binding energy.

- ^{20}Ne is stable.

  $^{19}_{10}Ne \rightarrow {}^{19}_{9}F + {}^{0}_{1}\beta$

  $^{23}_{10}Ne \rightarrow {}^{23}_{11}Na + {}^{0}_{-1}\beta$