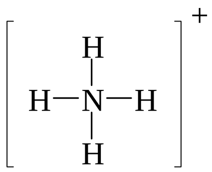
FUNDAMENTALS OF CHEMISTRY 1A (CHEM1001) - June 2004

2004-J-2

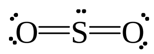
- $^{0}_{-1}\beta$

  $^{4}_{2}He$
- It is ionising
- Iodine consists of discrete I_2 molecules. The intermolecular forces between these I_2 units are weak dispersion forces, so the solid is soft with a low melting point. (The strength of the I-I bond is essentially irrelevant.) Diamond consists of a giant 3-dimensional array of carbon atoms in a tetrahedral arrangement. Each atom is covalently bonded to its neighbour to give one giant molecule (covalent network solid). The C-C covalent bond is very strong, so diamond is hard with a high melting point.

2004-J-3

MgO	magnesium oxide
$BaBr_2$	barium bromide
Na_3N	sodium nitride
K_2O	potassium oxide
- When an ionic solid dissolves, the strong ionic bonds between the constituent ions need to be broken (lattice enthalpy). In water, strong bonds are formed between the ions and the highly polar water molecules to give aquated ionic species. The energy released in this process (enthalpy of solvation) is sufficient to overcome the lattice enthalpy and the solid dissolves. In kerosene, there is little attraction between the ions and the non-polar solvent. The solvation enthalpy is very small in this case, certainly not large enough to overcome the lattice enthalpy, and so dissolution does not occur.
- 

  tetrahedral

  bent (~120°)

2004-J-4

40.0 g

NH_4Cl

2004-J-5

- $OH^{-}(aq) + H^{+}(aq) \rightarrow H_2O$

  exothermic

  $-56.0\ kJ\ mol^{-1}$
- Water is reduced rather than aluminium ions due to the relevant reduction potentials.

  $2H_2O + 2e^{-} \rightarrow 2OH^{-}(aq) + H_2(g)$ $\quad E° = -0.83\ V$

  $Al^{3+}(aq) + 3e^{-} \rightarrow Al(s)$ $\quad E° = -1.68\ V$

2004-J-6

- 886.2 g
- A reaction at equilibrium has not stopped - the rate of the forward reaction is equal to the rate of the backward reaction - a dynamic situation.

  K is the equilibrium constant. For a particular reaction it is dependent on the temperature only. *Q* is the reaction quotient. It can be calculated from the concentrations and pressures of the reactants and products.
  $Q = K$ when the reaction is at equilibrium.

  A catalyst lowers the activation energy of a reaction by providing an alternative reaction pathway or mechanism. It has no effect on the equilibrium position, but it does allow equilibrium to be established faster.

2004-J-7

- $3CuO(s) + 2Al(s) \rightarrow Al_2O_3(s) + 3Cu(s)$

  CuO: 4.09 kJ g^{-1} Fe_2O_3: 3.96 kJ g^{-1}

  CuO/Al is better fuel than Fe_2O_3/Al

2004-J-8

- The reagents are solids or very concentrated solutions.

  Both the anode and cathode are solids so can be placed in the same electrolyte.

  The products are solids so remain trapped in the same electrode. External voltage can therefore reverse the reaction and regenerate the cathode and anode.

- $[Pb^{2+}]/[Sn^{2+}] = 0.5$

2004-J-9

- Zn is the anode

  $Zn(s) + 2e^{-} \rightarrow Zn^{2+}(aq)$

  The graphite electrode is the cathode

  $2MnO_2(s) + 2NH_4^{+}(aq) + 2e^{-} \rightarrow Mn_2O_3(s) + H_2O + 2NH_3$

- 7.1×10^{2} M^{-1}