Chemistry 1Adv/1SSP (CHEM1901/1903) June 2009

2009-J-2

- a) A covalent bond describes the situation where an aggregation of 2 or more atoms is stabilised by the delocalisation of electrons among these atoms.

  b) A measure of the tendency of an atom to attract electrons within a covalent bond.

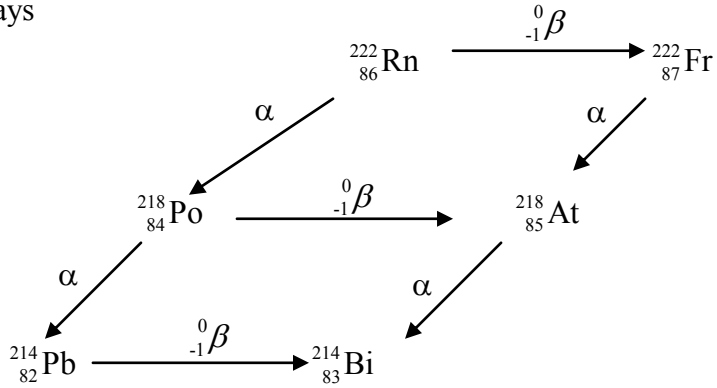
  c) An atom or molecule with one or more unpaired electrons.

  d) The energy gap between the valence and conductance bands (the HOMO-LUMO gap) in a solid.

  e) The strong dipole interaction between a hydrogen bonded to a highly electronegative atom (usually F, N or O) and a lone pair on another atom.

  f) Different physical forms of the same element, brought about by the different types of bonding exhibited by the element in its pure form (*e.g.* diamond and graphite).

2009-J-3

- 4.5 days
- 

2009-J-4

- HBe^-

  NO^-, OF^+, NF, F_2^{2+}, CN^{3-}, N_2^{2-}, etc

  He Be Ne

  The presence of the bond breaks the symmetry of space. The third orientation of the *p* atomic orbital is, in the molecule, associated with a σ orbital.

2009-J-5

- 2 6

  $1s^1\ 2s^1\ 2p^3\ 3s^1\ 3p^3\ 4s^1\ 3d^1$

  The energy difference would be smaller in Universe X because the reduced number of electrons per orbital would provide less shielding from the nucleus.

- The gap would decrease.

  It will become more blue. The energy of the light absorbed decreases as the band gap decreases, so its wavelength increases and it becomes more red. The colour of the compound is complementary to the light absorbed.

2009-J-6

- **A** 4 tetrahedral
  B 3 trigonal planar
  C 2 linear

- 6

2009-J-7

- Diffraction of electron beam OR standing wave structure of atoms

- Oxygen is more electronegative than sulfur.

  HF and NH_3 have fewer H-bonds than H_2O.
  The H-bonds in HF are stronger than those in NH_3 as F is smaller and more electronegative than N.

2008-J-8

- $C_4H_9OH(l) + 6O_2(g) \rightarrow 4CO_2(g) + 5H_2O(g)$

  181 kJ

  36 kJ g^{-1} -2.7×10^3 kJ mol^{-1}

2009-J-9

- 6 K

2009-J-10

3.1×10^{-5} m

C_2H_6

2009-J-11

- Formation of the very stable N≡N triple bond releases a large amount of heat into the surroundings.
  The heat released increases the entropy of the surroundings and therefore the universe by q/T, favouring a spontaneous reaction.

2009-J-12

Oxidation: $Mg(l) \rightarrow Mg^{2+}(Na_2S) + 2e^-$

Reduction: $Sb(l) + 3e^- \rightarrow Sb^{3-}(Na_2S)$

Overall: $3Mg(l) + 2Sb(l) \rightarrow 3Mg^{2+}(Na_2S) + 2Sb^{3-}(Na_2S)$

Cathode is Sb(l). Anode is Mg(l).

Secondary as it is rechargeable.

11 minutes

2009-J-13

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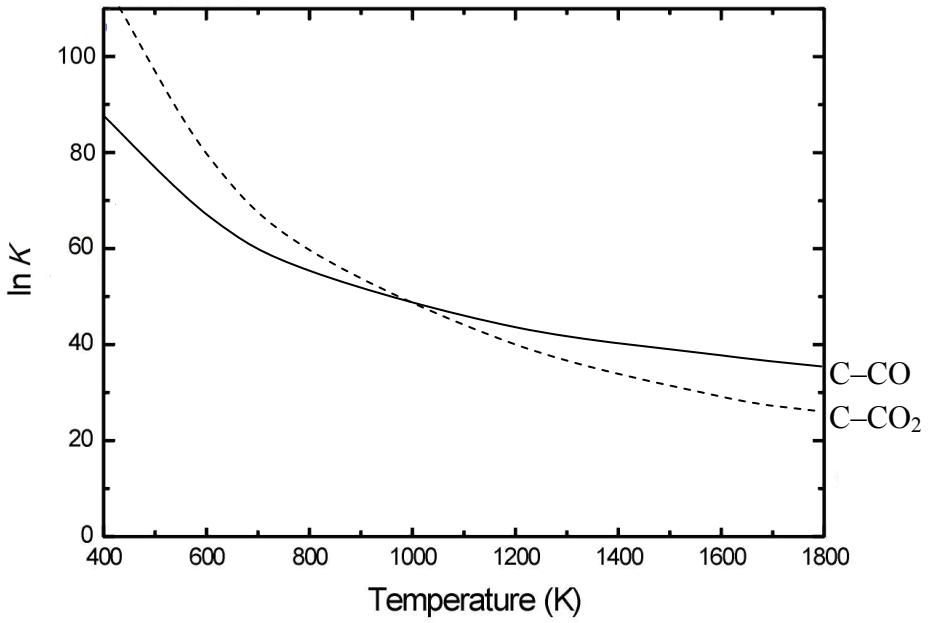
	$2C(s) + O_2(g) \rightarrow 2CO(g)$	$C(s) + O_2(g) \rightarrow CO_2(g)$
ΔH	–222 kJ mol^{-1}	–394 kJ mol^{-1}
ΔS	+179 J K^{-1} mol^{-1}	+3 J K^{-1} mol^{-1}

2009-J-14



CO(g) is favoured at $T > 977$ K