CHEMISTRY 1A (CHEM1101) June 2006

2006-J-2

- (a) When filling orbitals of equal energy, the lowest energy configuration has the maximum number of unpaired electrons with parallel spins.

  (b) The enthalpy change that occurs when a gaseous atom gains an electron.

  ΔH for the reaction $X(g) + e^- \rightarrow X^-(g)$

  (c) The fusion of one nuclide with another. Energy is produced.

  eg ${}^{1}_{1}H + {}^{2}_{1}H \rightarrow {}^{3}_{2}He$

  (d) Description of a species with no unpaired electrons.

  (e) A semiconductor made by doping with Group 13 atoms with vacant orbitals of slightly higher energy than the top of the valence band. Electrons can be excited into these vacant orbitals leaving "positive holes" in the valence band to produce the primary conductance mechanism.

  (f) A bond formed by the overlap of parallel p-orbitals. The electron density is in two lobes, above and below the σ-bond axis.

2006-J-3

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

  ${}^{53}_{25}Mn$

  ${}^{29}_{15}P$

- 4.84×10^{-18} J 41.0 nm

2006-J-4

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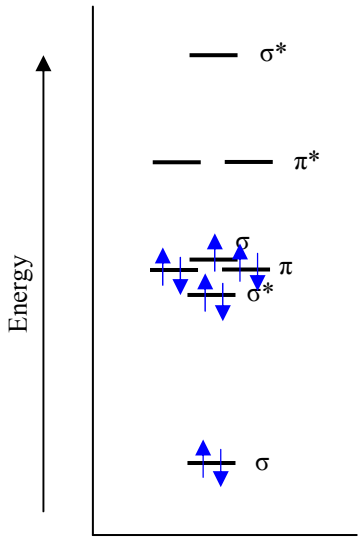

  2.5

  $\pi \rightarrow \sigma$

  3.17 eV

2006-J-5

0	3	trigonal planar
2	2	bent
0	2	linear

- The wave nature of the electron.
  The restricted motion of the electron caused by the electrostatic attraction of the nucleus.

2006-J-6

- 8.2×10^2 L
- From Cu to Fe
  36.4 °C

2006-J-7

- -1304 kJ mol^{-1}
  Ethane (52 kJ g^{-1}) is most efficient, then ethylene (47 kJ g^{-1}).
  Ethanol (30 kJ g^{-1}) is least efficient.

2006-J-8

- -657 kJ mol^{-1} $+32.9$ kJ mol^{-1}
  $2C(s) + 2H_2O(g) + 2Cl_2(g) \rightarrow 2CO(g) + 4HCl(g)$ -106.6 kJ mol^{-1}

2006-J-9

- The pressure of $O_2(g)$ is the same in both cases. This pressure is the equilibrium constant K_p for the reaction, as the other products and reactants are all solids.

2006-J-10

- $H_2 < CH_4 < H_2O < NaCl < SiO_2$
  H_2 and CH_4 have weak dispersion forces. CH_4 is larger molecule with more electrons so is more easily polarised than H_2 and therefore CH_4 has greater dispersion forces and the higher m.p. H_2O has hydrogen bonds. NaCl is ionic compound with strong coulombic attraction between the Na^+ ions and the Cl^- ions. Silica is covalent network solid. Melting requires breaking of the very strong covalent Si–O bonds, so it has the highest m.p.
  Only NaCl conducts when molten, due to having mobile Na^+ and Cl^- ions that can carry the charge.

2006-J-11

- $3HBrO_3(aq) + 2Bi(s) \rightarrow 3HBrO_2(aq) + Bi_2O_3(s)$

  $HBrO_3$

  Br

  +V

  loses 3

- Salt bridge completes the circuit by allowing electrical neutrality to be maintained via the movement of ions.

  By the sulfuric acid solution which provides the H^+ and HSO_4^- ions to conduct the current. Note that the reactants (Pb and PbO_2) and products ($PbSO_4$) are all solids so no physical separation other than initial placement is required.

2006-J-12

- Highly exothermic oxidation reaction.

  The oxidant is contained in the explosive.

  A large number of moles of gas are produced.

  Contains nitrogen (as formation of N_2 gas is highly exothermic).

  Reaction has low activation energy.