CHEMISTRY 1A (CHEM1101) June 2004

2004-J-2

- No two electrons in an atom can have the same quantum numbers.

  An atom with a specific number of protons and neutrons.

  Empty MOs that are higher in energy than the valence band. The valence and conductance bands are contiguous in metals. The energy gap between them is small in semi-conductors and large in insulators.

  The energy required to remove an electron from an atom in the gas state.

2004-J-3

- $^{55}_{25}\mathrm{Mn}$

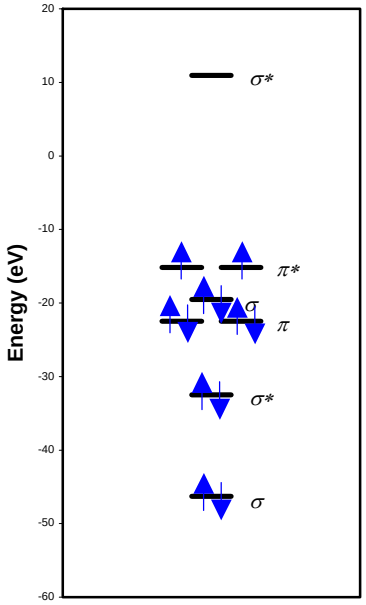
  γ

  $^{1}_{0}\mathrm{n}$

- 28.09
- 2.916×10^{3} Ci mol^{-1}

2004-J-4

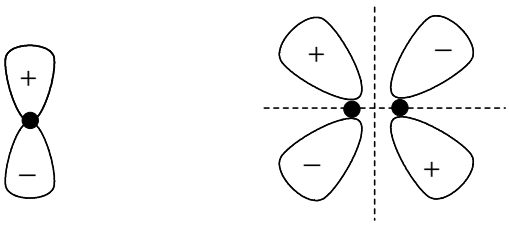
- 12



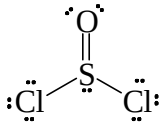
2

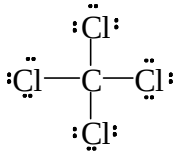
Yes. It has two unpaired electrons (in the π* orbital).

-



2004-J-5

- 26  trigonal pyramidal

  32  tetrahedral

  $SOCl_2$

- MgO and ZnO are ionic. Electronegativity difference > 2 is classified as ionic.

2004-J-6

- 3.37×10^{-19} J

  299 kJ mol^{-1}

2004-J-7

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

  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

  Al_2O_3 has a very high melting point. Adding cryolite (Na_3AlF_6) produces a mixture of much lower melting point (an important energy consideration in industrial processes) and provides a source of ions, Na^+ and $[AlF_6]^{3-}$, so that the melt conducts a current.

2004-J-8

- $2C_3H_6N_6O_6(s) + 3O_2(g) \rightarrow 6H_2O(l) + 6CO_2(g) + 6N_2(g)$

  There is no $O_2(g)$ as one of the reactants. The products will be slightly different, eg $H_2(g)$, $H_2O(g)$, CO(g).

  High nitrogen content results in large $-\Delta H$ for combustion/explosion reaction.
  $\Delta H_f°$ of +65 kJ mol^{-1} results in large $-\Delta H$ for combustion/explosion reaction.
  Large number of moles of gas produced per mole of explosive.
  High oxygen content promotes explosive reaction.

  948 kJ mol^{-1}

2004-J-9

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

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

  CuO/Al is better fuel than Fe_2O_3/Al

2004-J-10

- Zn is the anode

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

  The graphite electrode is the cathode

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

2004-J-11

- 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-12

- $7.1 \times 10^2\ M^{-1}$

2004-J-13

- 34%

  none