CHEMISTRY 1ADV / SSP (CHEM1901/1903) June 2002

2002-J-2

- $-172.4 \text{ kJ mol}^{-1}$
- Visible light from the sun passes through the atmosphere to warm the surface of the Earth. This absorbed energy is reradiated by the Earth at longer wavelengths (in the infrared region) and is absorbed by the greenhouse gases, causing the temperature of the lower atmosphere to rise. This results in warming at the Earth's surface.
- The energy of electrons in atoms is quantised - only discrete energy levels are allowed. Electrons can 'jump' from one energy level to another. If they were pulled continuously towards the nucleus, their energy would change continuously and violate this fundamental law of quantum mechanics.

2002-J-3

- Group I metals have a single electron in an *s* orbital in their valence shell. Gaining a further electron and thus filling this *s* orbital is energetically OK. Group II metals have a completely filled s orbital. Any gained electron would need to go into a higher energy orbital, so the process would be much less favourable.
- $CCl_4 < CCl_3H < CFCl_2H < CF_3H$
- $^{48}_{23}V \rightarrow {}^{48}_{22}Ti + {}^{0}_{1}\beta$

2002-J-4

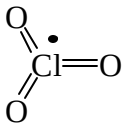
-

4	4	5
bent	trigonal pyramidal	trigonal bipyramidal

- $-55.8 \text{ kJ mol}^{-1}$

  The neutralisation reaction does not merely involve the formation of an OH bond, but also involves the enthalpy of solvation of the H^+ and OH^- ions. The average bond enthalpy refers to homolytic breaking of the OH bond to give the neutral gaseous atoms (not ions). The two processes are completely different.

2002-J-5

- 1.5×10^8 years
- 

  The ClO_3 molecule has an unpaired electron. Such molecules are known as free radicals and are highly reactive as they attempt to form bonds to produce compounds in which all electrons are paired.
- According to the Pauli exclusion principle, no two electrons in an atom can have the same set of quantum numbers. As each orbital can hold two electrons, this can be accommodated if they pair up with opposite spins.

2002-J-6

- "*a*" corrects for intermolecular attractions between the gas molecules.

  "*b*" corrects for the finite volume of the gas molecules.

- 1.04

  6

2002-J-7

- $O_3(g) \rightarrow O_2(g) + O(g)$ slow

  $O(g) + O_3(g) \rightarrow 2O_2(g)$ fast

  5.81×10^3 s

  catalyst is NO(g) intermediate is $NO_2(g)$

  3.03

2002-J-8

- $K_b = 6.4 \times 10^{-5}$ M $pK_a = 9.81$
- 0.95
- 6.79

2002-J-9

- $K = 5.01 \times 10^{18}$ $\Delta G = -107$ kJ mol^{-1} $\Delta S = 9.7$ J K^{-1} mol^{-1}

  Reaction will shift to the left. The reaction is exothermic, i.e. it evolves heat. If the temperature is raised, Le Chatelier principle states that the reaction will move to oppose the production of heat.