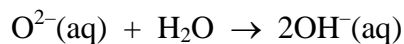


CHEMISTRY 1B (CHEM1102) - November 2008

2008-N-2

- Electronegativity is a measure of an atom's ability to attract electrons.

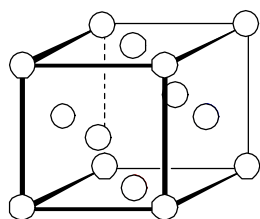
Oxygen forms ionic compounds with the highly electropositive Group 1 and 2 metals. These compounds are basic as the O^{2-} ion reacts with water:



Oxides of electronegative elements react with water to give compounds containing O–H bonds. The electronegative element pulls the electron density towards itself, thus weakening the O–H bond and producing an acidic compound.



Elements with intermediate electronegativities have properties between these two extremes, so may react as either acids or bases (i.e. are amphoteric).



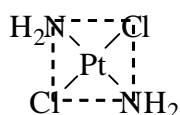
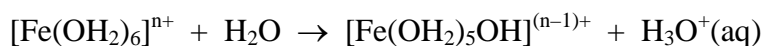
2008-N-3

- $5.0 \times 10^{-12} \text{ M}$
 $5.1 \times 10^{-6} \text{ M}$
 $9.8 \times 10^{-8} \text{ M}$
- 3×10^4

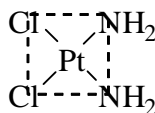
2008-N-4

$[Fe(OH_2)_6]^{2+}$ is the weaker acid so has the larger pK_a .

Fe^{3+} ion has higher charge than Fe^{2+} so is better at attracting electron density from the H_2O ligands. This weakens the OH bonds and facilitates the reaction:



trans



cis

Its anti-cancer activity is due to its reaction with DNA. This requires both of the reactive Cl ligands to be in the *cis* arrangement so that the complex can bond properly to the DNA.

2008-N-5

- 6.95

Added H^+ is consumed by: $H^+(aq) + HPO_4^{2-}(aq) \rightarrow H_2PO_4^-(aq)$

Added OH^- is consumed by: $OH^-(aq) + H_2PO_4^-(aq) \rightarrow H_2O + HPO_4^{2-}(aq)$

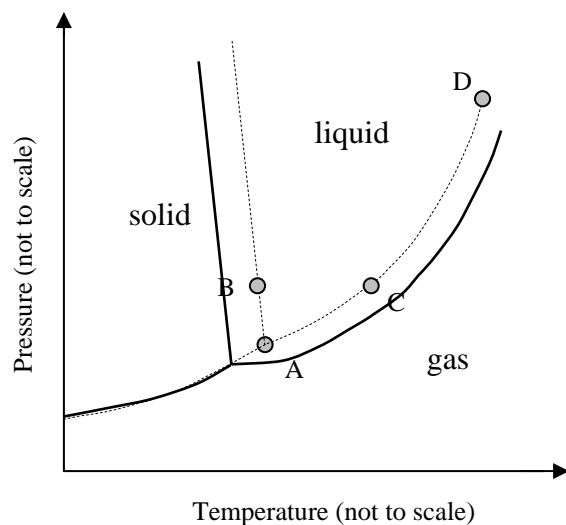
Base. The maximum buffering effect is at pH 7.20. Adding base increases the pH towards this value. (Alternatively, $[H_2PO_4^-(aq)]$ is greater than $[HPO_4^{2-}(aq)]$.)

2008-N-6

- It changes from solid to liquid at $0^\circ C$ and then from liquid to gas at $100^\circ C$.
It changes from a gas to a solid and then from a solid to a liquid.

2008-N-7

-



Boiling water leads to a large increase in its entropy: $\Delta_{sys}S > 0$.

Because boiling requires the breaking of bonds, it is endothermic and requires energy from the surroundings. This lowers the entropy of the surroundings: $\Delta_{surr}S < 0$.

Boiling requires $\Delta_{univ}S$ to be positive. (The boiling point is the temperature at which the gain in the entropy of the water is larger than the loss in the entropy of the surroundings.)

When salt water is boiled, the $Na^+(aq)$ and $Cl^-(aq)$ ions form $NaCl(s)$. This greatly reduces their entropy. Hence, when salt water boils the entropy gain is much smaller than when pure water boils.

Because $\Delta_{sys}S$ is less positive for boiling salt water, a *higher* temperature is required before it is larger than the loss in the entropy of the surroundings.

2008-N-8

- $rate = k(P_{NO})^2(P_{Cl_2})$

$$k = 6.5 \times 10^{-3} \text{ atm}^{-2} \text{ s}^{-1}$$

2008-N-9

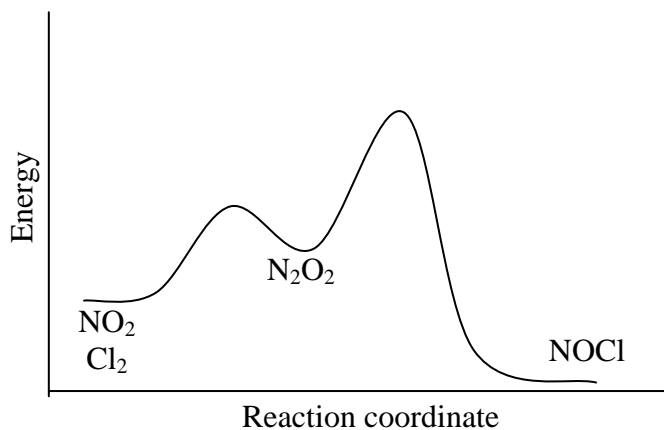
- 1. Adding the two equations shows the reaction stoichiometry agrees.
- 2. From the fast equilibrium: $K = (P_{N_2O_2}) / (P_{NO})^2$

$$\Rightarrow (P_{N_2O_2}) = K (P_{NO})^2$$

From the slow (rate determining) step: $\text{rate} = k(P_{N_2O_2})(P_{Cl_2})$

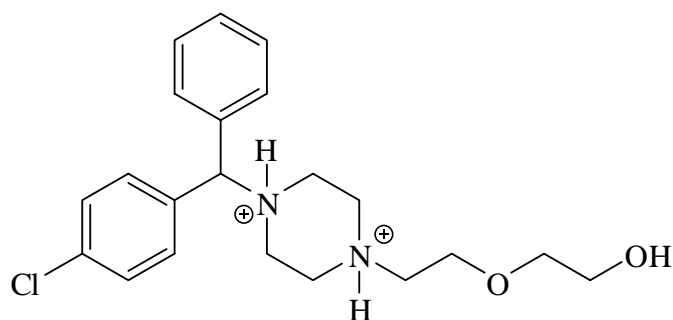
$$= k K (P_{NO})^2 (P_{Cl_2})$$

$$= k K (P_{NO})^2 (P_{Cl_2})$$



2008-N-10

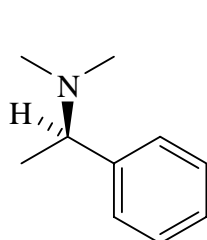
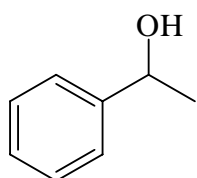
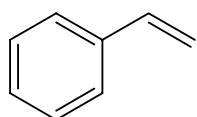
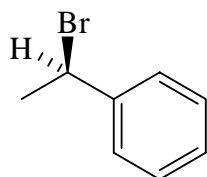
- amine (tertiary amine)
ether
carboxylic acid



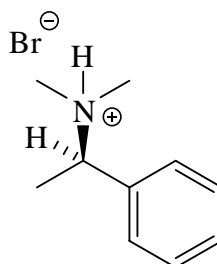
2008-N-11

- Order of priority is $-H < -CH_3 < -C_6H_5 < -Br$

With the lowest priority group pointing away from us, the groups Br, C₆H₅, CH₃ occur in anti-clockwise direction so the configuration is (*S*).



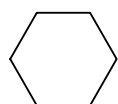
or



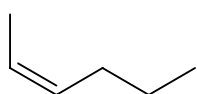
(*R*)-configuration

2008-N-12

- (*E*)-2-hexene

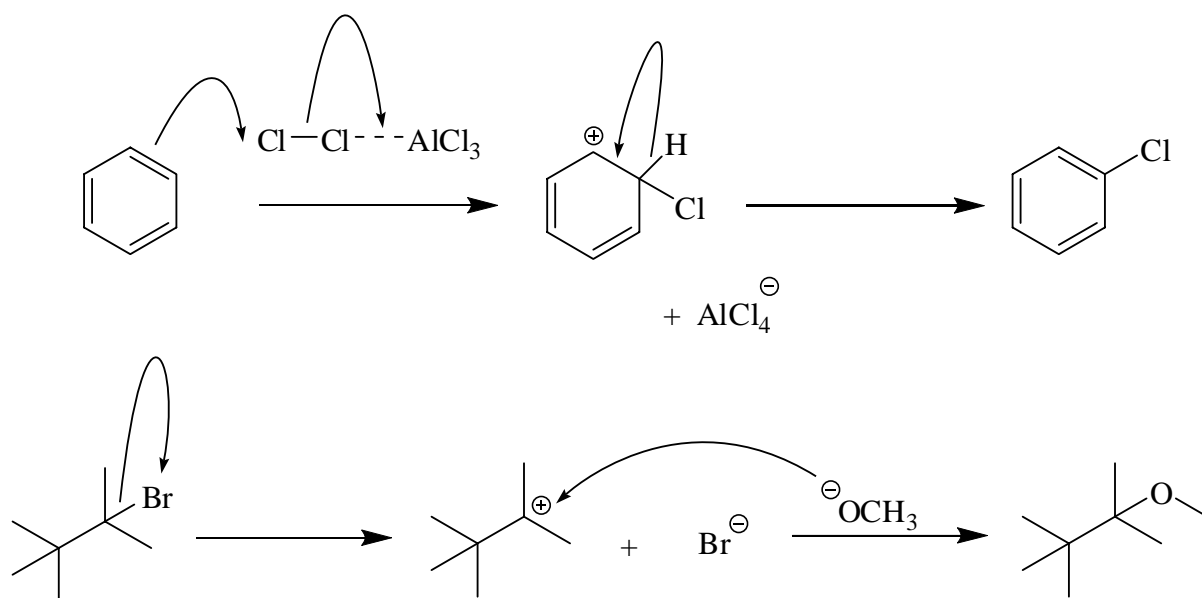


lots of other answers are possible



2008-N-13

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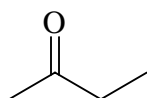


2008-N-14

- From the NMR: singlet at 2.13 ppm is CH_3 group with no H on neighbouring atom and triplet at 1.06 and quartet at 2.47 ppm is due to CH_2CH_3 group.

Absorbance in IR at 1715 cm^{-1} is typical of C=O group.

Molecular formula of $\text{C}_4\text{H}_8\text{O}$ is sum of these three groups, so structure is:



2008-N-15

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