Oxidation numbers

- Oxidation number is a purely formal concept, which regards all compounds as ionic and assigns charges to the components accordingly. You know that not all compounds are ionic.

- Oxidation numbers can be useful for helping us to understand redox reactions.

- There are some general rules.

Rules for assigning oxidations states

- 1) The oxidation state of an element is always zero.
- 2) In an uncharged compound, the sum of all the oxidation states is always zero.
- 3) Treat the compound as totally ionic. If it is ionic then the charges on the ions are the oxidation numbers, e.g. in KCl O.N. of K is +1 and O.N. of Cl is –1.
- 4) The most electronegative atom in an element is assigned a negative oxidation number according to how many electrons it needs to gain a full outer shell, e.g in H_2O, oxygen is the most electronegative atom, and so it has an O.N.of –2.
- 5) The maximum possible oxidation number for an element will be its group number for elements in groups 1 and 2 and the group number –10 for elements in group 13 – 17. It is not possible to lose more electrons than are in the outer shell, e.g. the maximum possible O.N. for a group 16 element is + 6.

Rules for assigning oxidations states

- For ions containing more than one element, the sum of all the oxidation states is equal to the charge on the ion.
- In compounds and ions, some elements have oxidation states that rarely change:
- F: –1 (always);
- O: –2 (except in O_2^-, OF_2, O_2F_2, and some metal oxides);
- H: +1 (except when combined with metals as H^-);
- Cl: –1 (except when combined with O and F);
- Group 1 metals: +1,
- Group 2 metals: +2.

Answers to HW questions

- $BaBr_2$
- Ba +2 and Br –1
- CuF
- F –1 and Cu +1
- NH_3
- N –3 and H +1
- PH_3
- N –3 and H +1
- NH_4Cl
- Cl –1 and (NH_4^+) therefore N –3 and H +1
- CO_2
- O –2 and C +4
- $NaHCO_3$
- Na +1 and (HCO_3^-) therefore O –2 and H +1 and C +4

Assign oxidation numbers to:

- 1) SO_4^{2-}
- 2) $Cr_2O_7^{2-}$
- 1) O -2 and S +6
- 2) O -2 and Cr +6

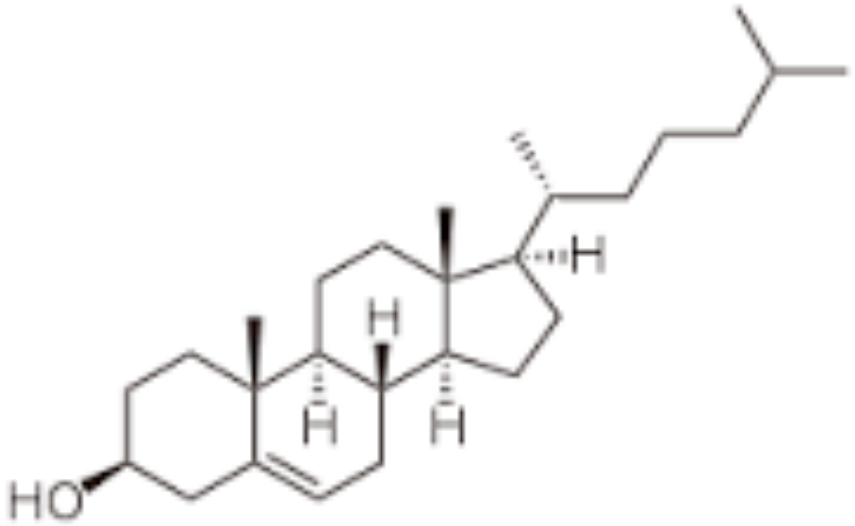
Organic Chemistry

- What is organic chemistry?

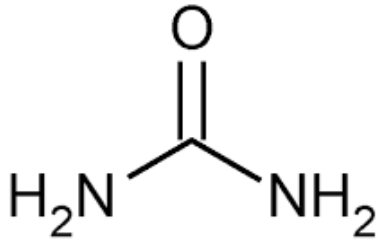
- The study of compounds that contain carbon, specifically those with a C-H bond.

- Organic chemistry is a major branch of chemistry. What is so special about carbon?

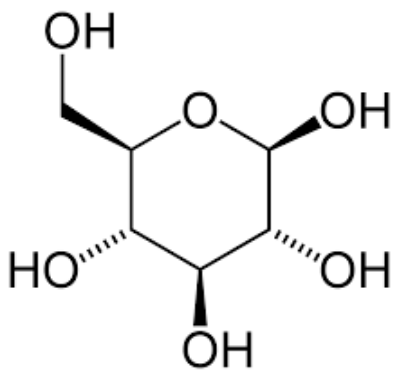
- Carbon can share electrons to form covalent bonds with other carbons as well as many other elements such as hydrogen, oxygen and nitrogen. Importantly carbon atoms can bond together to form chains rings and branches.



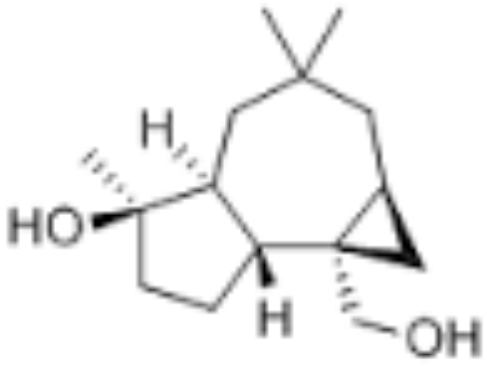
cholesterol



urea



glucose



Pyxidatol c

Alkanes

- The alkanes are family of hydrocarbons (a compound containing only carbon and hydrogen)

- You need to know how to draw the molecular formula, empirical and structural formula (full and condensed) for

- Methane, ethane, propane, butane, pentane and hexane.

- Make 3D models of methane, ethane, propane, butane, pentane and hexane.

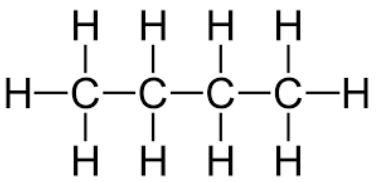
Homologous series

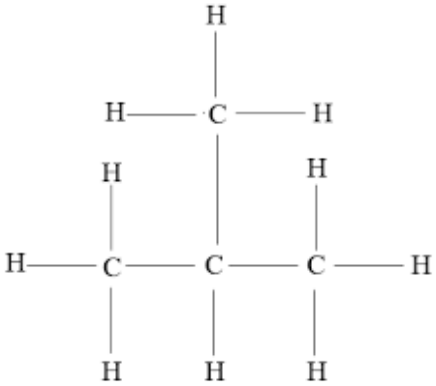
- The alkanes represent a homologous series
- Methane, ethane, propane, butane, pentane and hexane are part of the alkane homologous series.
- A homologous series is a series of compounds that have the same functional group. Each member differs by CH_2.
- A functional group is the atom or group of atoms in a molecule that gives it its characteristic chemical properties.

Isomers

- Structural isomers are two or more compounds that have the same molecular formula but different structural formulae – the atoms are joined together in different ways.

- E.g butane and 2-methylpropane are both isomers of C_4H_{10}





- Make 3D models of all the structural isomers of C_6H_{14} and draw the full structural formula.

Combustion

- The most important reaction of alkanes is combustion.

- These compounds form the basis of fuels such as petrol and natural gas.

- Complete combustion requires the presence of excess….?
- …..air/oxygen
- The products of complete combustion are….?
- …..carbon dioxide and water

- Draw a balanced symbol equation for the complete combustion of ethane.