**Alkanes as Fuels – *Combustion* of Alkanes**

Alkanes, which are made of C-H and C-C *single bonds*, are not very reactive. But alkanes do react under high temperatures or *pressures* *to form* carbon dioxide (CO2) and water (H2O), a reaction called combustion. In Germany, 60% of our energy needs are *covered* by the combustion of natural gas and *petroleum*. Natural gas *contains* mostly methane (CH4) while petroleum is a mixture of several thousand *hydrocarbons* (alkanes and cycloalkanes).

Alkanes react with oxygen (O2) to form carbon dioxide (CO2) and water (H2O) as shown in the following example with the alkane methane:

CH4 (g) + 2 O2 (g) CO2 (g) + 2 H2O(g) ; RHm = - 802 kJ/mol

The *reaction enthalpy* for one mole of methane, RHm, gives the *amount* of energy that is *released* when one mole of methane (6,022 molecules) is *combusted*.

The *unreactive nature* of alkanes can be explained by their structure. Every atom in the molecule *is bound* to a maximum number of atoms. Therefore, before a new bond can be formed with another atom, a bond in the molecule has to be broken which *requires* energy. Also, C-H bonds are very *stable* and the *weaker* C-C bonds are *shielded* by the *surrounding* C-H bonds. Because of this, a lot of energy (high temperatures) is necessary to combust alkanes.

**Questions**

Propane is an alkane and another energy source often used as a fuel for *camping stoves*, engines and for heating homes.

CH3CH2CH3 (g) + O2 (g) CO2 (g) + H2O(g) ; RHm = - 2,2197 x103 kJ/mol

1. *C:\Users\Jana_User\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\GZ0O8FHI\MC900438012[1].wmfBalance* the *reaction equation* of propane with oxygen.

1. C:\Users\Jana_User\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\GZ0O8FHI\MC900438012[1].wmfHow many moles of propane are in 1 L of propane?   
   (*density* (ρ ) of propane: 0,493 g/mL & molar masses: C (12 g/mol), H (1 g/mol))
2. C:\Users\Jana_User\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\GZ0O8FHI\MC900438012[1].wmfHow much energy is released when 1 L of propane is combusted?