

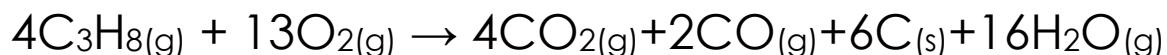
## 1.3 Reactions of Hydrocarbons

### Symbols and Functional Groups

- alkyl group  $\rightarrow$  R, R', R''
- halogen atom (ex.Cl)  $\rightarrow$  X
- phenyl group (benzene ring)  $\rightarrow$   $\emptyset$

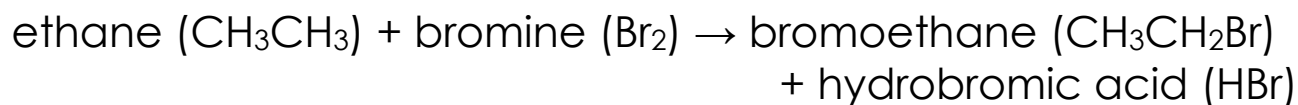
### Combustion

- All hydrocarbons are combustible and the reaction gives off light and energy.
- complete combustion: common oxides of elements  
 $2\text{C}_2\text{H}_2 + 5\text{O}_2 \rightarrow 4\text{CO}_2 + 2\text{H}_2\text{O}$
- incomplete combustion (one possible equation of many)



### Substitution Reactions (alkanes)

- The C – C bond is difficult to break therefore the primary reaction for alkanes is substitution (an H is replaced by something else).
- A typical reaction:  
*alkane + diatomic halide  $\rightarrow$  alkyl halide + hydrogen halide (acid)*



- With additional exposure additional bromine may be added to produce 1,2-dibromoethane, 1,1,2-tribromoethane, 1,1,2,2-tetrabromoethane, 1,1,1,2,2-pentabromoethane, 1,1,1,2,2,2-hexabromoethane

## Addition Reactions (alkenes and alkynes)

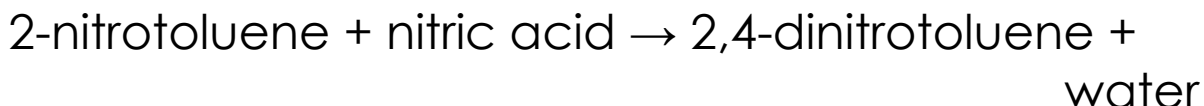
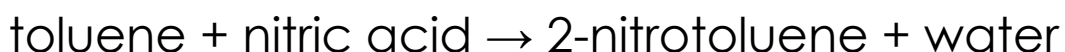
- A double and triple bonds are highly reactive and can be easily broken and additional atoms added.
- Good tests for saturated and unsaturated fats
- Halogenation  
ethene + bromine  $\rightarrow$  1,2-dibromoethane
- Hydrogenation  
ethyne + hydrogen  $\rightarrow$  ethane
- Hydrohalogenation  
propene + hydrogen bromide  $\rightarrow$  2-bromopropane
- Hydration  
propene + water  $\rightarrow$  2-hydroxypropane (2-propanol or isopropanol)

- Markovnikov's Rule: ("the rich get richer") When a hydrogen halide or water is added to an alkene or alkyne, the hydrogen bonds to the carbon atom within the double bond that already has more hydrogen atoms.

### **Substitution Reactions (aromatics):**

- Similar to alkanes, hydrogen is lost and is replaced by another atom.
- E.g. benzene + bromine  $\rightarrow$  bromobenzene + hydrogen bromide

- If the reaction is allowed to continue, the substitutions tend to alternate carbon atoms.
- E.g. The scientist who developed the following reaction mechanism became quite rich and rewards other scientists for their work...who was it and what did he make?



### **Homework**

- Practice 1,2,3,4      Questions 1,2,3,4