SCH3U1

Combustion Reactions

A combustion reaction involves the reaction of a substance with oxygen to produce heat and/or light. Combustion reactions are a type of simple oxidation reaction.

$$C + O_2 \rightarrow CO_2 + \text{energy}$$

A **hydrocarbon** is a substance that contains carbon and hydrogen. Methane (CH_4) and octane (C_8H_{16}) are examples of hydrocarbons. When a hydrocarbon undergoes combustion, carbon dioxide and water are produced.

Eg. combustion of methane

Other organic compounds (carbon, hydrogen with other elements) also undergo combustion.

Example:Combustion of ethyl alcohol

Complete Combustion

- occurs if enough oxygen is present

HC + oxygen -> carbon dioxide + water

Incomplete Combustion

- occurs if *less* than enough oxygen is present

HC + oxygen -> C + CO + CO_2 + water

Some or all of these may be present amounts may vary.

Incomplete Combustion of Propane

$C_3H_8 + O_2 \rightarrow C + CO + CO_2 + H_2O$

Chemical Reactions and Energy

An energy term can be added to a reaction to a chemical equation to indicate whether energy is released or absorbed. Energy terms are not balanced.

Exothermic reactions involve a release of energy (energy **exits** the reactants):

$$A + B \rightarrow C + D + \text{energy}$$

$$CH_4 + 2\,O_2 \rightarrow CO_2 + 2\,H_2O + E$$

Endothermic reactions involve the absorption of energy (energy **enters** the products):

$$A + B + \text{energy} \rightarrow C + D$$

Combustion Exercise

1. Write the balanced chemical equation for the complete combustion of the following:

- butene (C_4H_8)
- octane (a component of gasoline with chemical formula C_8H_{18})
- kerosene (jet fuel) ($C_{10}H_{22}$)
- methanol (CH_3OH)
- paraffin wax ($C_{22}H_{52}$)

2. Write any chemical equation for the incomplete combustion of each of these compounds:

- butene (C_4H_8)
- octane (C_8H_{18})
- kerosene ($C_{10}H_{22}$)
- paraffin wax ($C_{22}H_{52}$)

Homework: p. 141 # 41-49

Homework

$2KBr_{(l)} \rightarrow 2K_{(l)} + Br_{2(l)}$

$2Al_2O_{3\,(s)} \rightarrow 4Al_{(s)} + 3O_{2(g)}$

$Mg(OH)_{2(s)} \rightarrow MgO_{(s)} + H_{2(g)}$

$Ca(NO_3)_{2(s)} \rightarrow Ca(NO_2)_{(s)} + O_{2(g)}$

$CuCO_{3(s)} \rightarrow CuO_{(s)} + CO_{2(g)}$

$2CrCl_{3(l)} \rightarrow 2Cr_{(s)} + 3Cl_{2(g)}$

$BaCO_{3(s)} \rightarrow BaO_{(s)} + CO_{2(g)}$

$2RbNO_{3(s)} \rightarrow 2RbNO_{2(s)} + O_{2(g)}$

$2LiOH_{\,(s)} \rightarrow Li_2O_{(s)} + H_2O_{\,(l)}$

$MgCl_{2(s)} \rightarrow Mg_{(s)} + Cl_{2(g)}$