



# Combustion Reactions

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# What is combustion?

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- A chemical reaction in which a fuel reacts quickly with oxygen gas
  - Exothermic
  - Products are  $\text{CO}_2$  and  $\text{H}_2\text{O}$  and energy
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# Combustion of Hydrocarbons

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- Hydrocarbons are molecular compounds made up of hydrogen and carbon (who'd a thunk?)
- The combustion of hydrocarbons fuels powers our cars, warms our homes, and generates electricity
- Most hydrocarbons are from fossil fuels

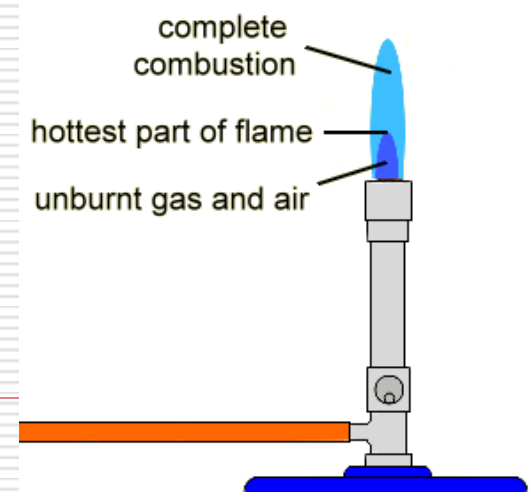


- May be **complete** or **incomplete**, depending on **oxygen supply**
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- Complete combustion gives the **same two products** all the time:

**carbon dioxide** and **water**

- Results in an **'invisible' blue flame**



# Combustion of Hydrocarbons

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- Word equation for complete combustion:

Hydrocarbon + oxygen  $\longrightarrow$  carbon dioxide + water

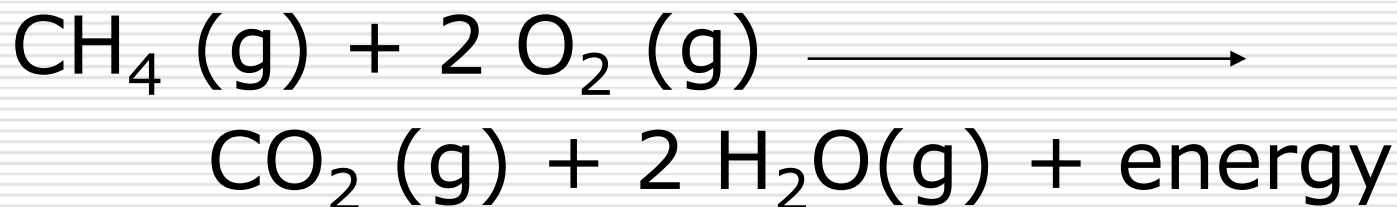
- General equation:



# Combustion of Hydrocarbons

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- Natural gas is mostly comprised of methane, CH<sub>4</sub>



- During complete combustion, the fuel **burns cleanly**, leaving no soot or other residue
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# Incomplete Combustion

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- ❑ Results when **oxygen supply** is **limited**
- ❑ As well as carbon dioxide and water, products also include **carbon monoxide** and **soot** (carbon)
- ❑ Signs of incomplete combustion are an orange, flickering flame, and soot.

Ex. Portable stoves using butane gas

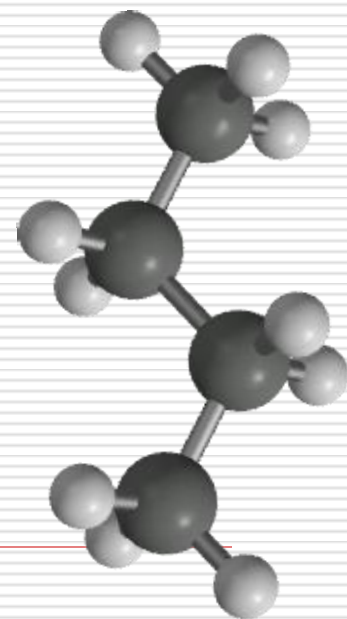
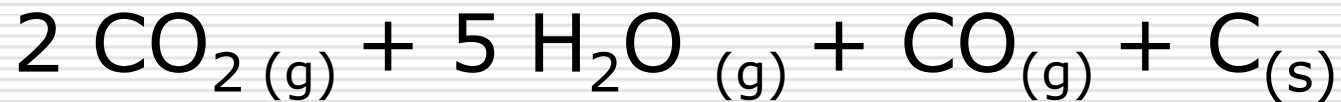
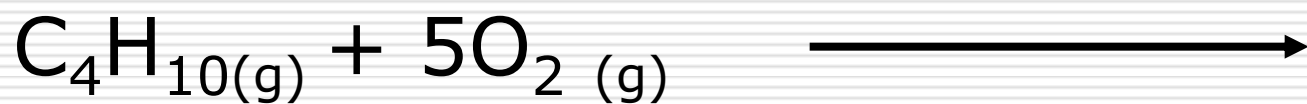
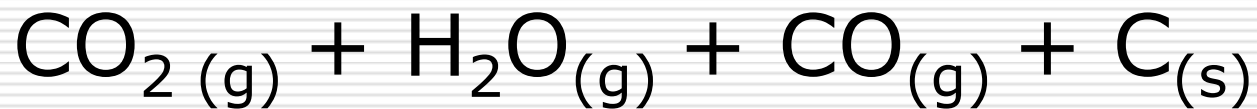
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# Incomplete Combustion of Butane

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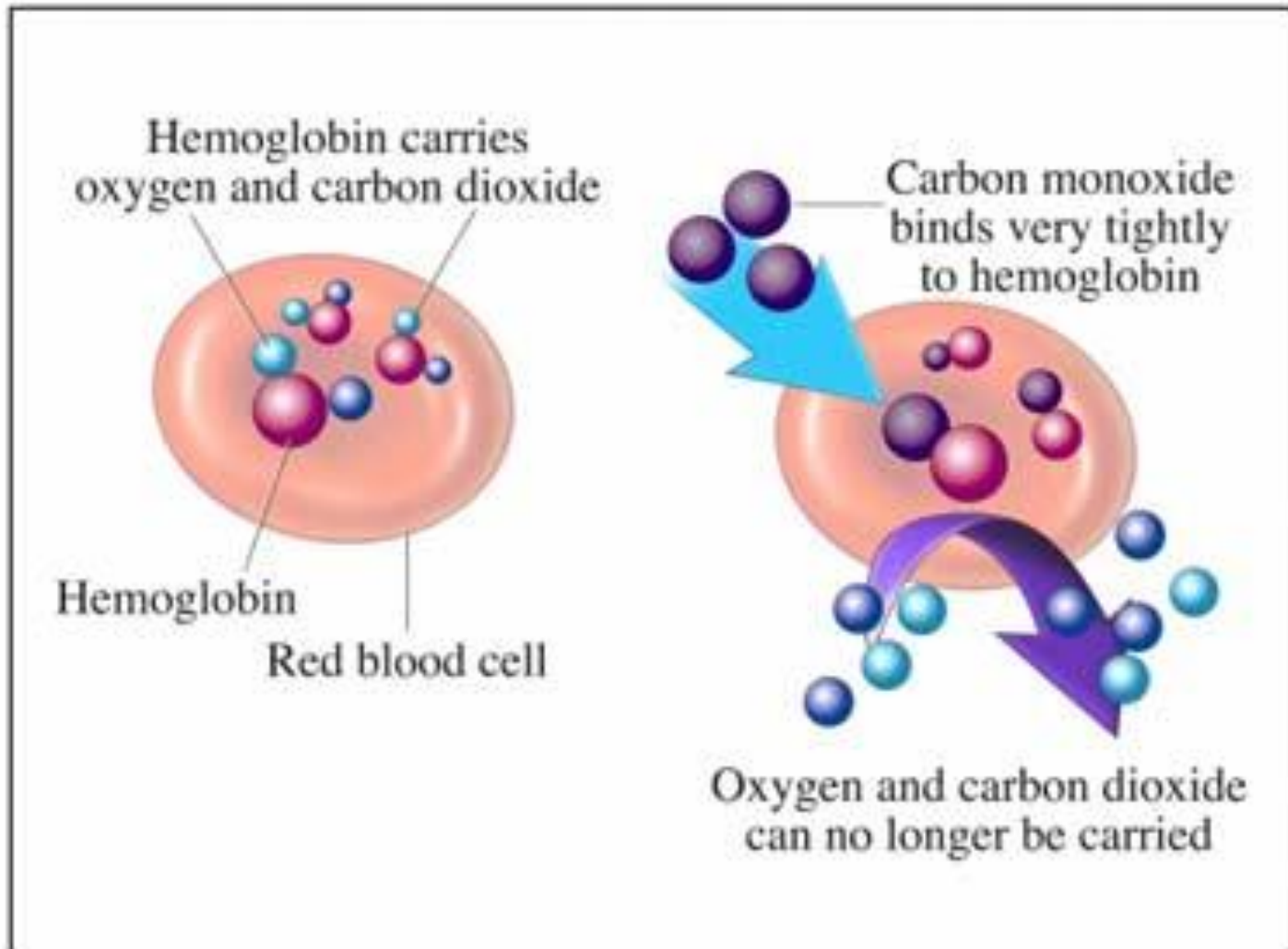


# Carbon Monoxide

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- ❑ Highly **toxic**
  - ❑ Can build up in homes with **poorly ventilated furnaces** or by the combustion of a fuel in an **enclosed space**
  - ❑ Symptoms of CO poisoning include headache, dizziness, nausea and difficulty breathing – **CAN BE FATAL!**
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# Carbon Monoxide



# Soot

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- ❑ Particles of **carbon**
- ❑ Causes **pollution** and **wastes energy**
- ❑ Common in older, poorly maintained fireplaces



# Other fuel sources: Combustion of Hydrogen

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- ❑ Hydrogen can be used as a fuel source
- ❑ Benefit: products are **water vapour** and **energy**
- ❑ **Drawbacks:** costly to produce & store & transport
- ❑ Liability: hydrogen is **explosive**



# Get fired up...

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- Pg 251 # 2 - 3, 7
- Combustion Reactions worksheet

