

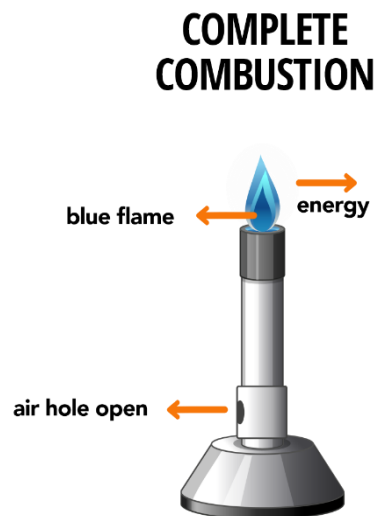
Complete and Incomplete Combustion Guided Notes – Student Edition

What is a Combustion Reaction?

Combustion is the chemical reaction between a _____ and _____ in the air. This is an _____ reaction as it releases a lot of energy. Burning wood, petrol, _____, and _____ are all examples of combustion reactions. Many fuels are made up hydrocarbons (compounds consisting only of _____ and _____ atoms), which means that whenever they burn, the products of the reaction are always the same. There are two types of combustion reaction. These depend on the amount of _____ available to the fuel during the reaction.

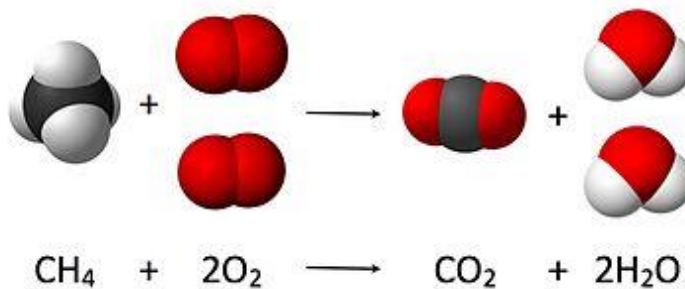
1. Complete Combustion

When fuels burn in a _____ supply of oxygen, they release a lot of _____. This reaction produces _____ and _____. Complete combustion occurs each time a _____ flame is used to heat a substance with a Bunsen Burner. Opening the _____ on the Bunsen allows for maximum _____ supply. Complete combustion reaction can be summarized using the following word equation:



Example:

Methane and oxygen react in a plentiful supply of oxygen, the reaction will be:



Activity 1:

For each of the following complete combustion reactions, add in the missing reactants and products. Then write the balanced chemical equation for each reaction.

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a) The complete combustion of ethane:

Word Equation: Ethane + _____ → Carbon dioxide + _____

Chemical Equation: $2\text{C}_2\text{H}_6 + \text{_____} \rightarrow 4\text{CO}_2 + \text{_____}$

b) The complete combustion of propane:

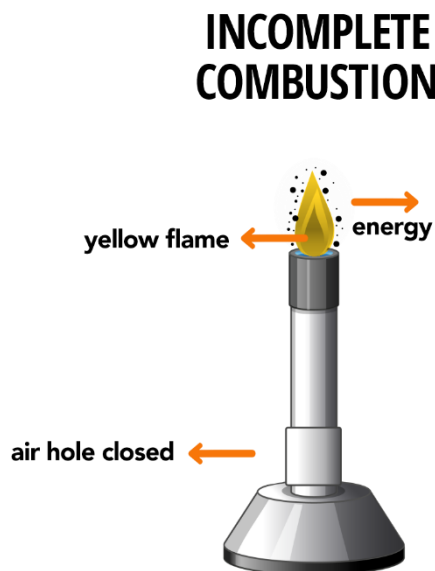
Word Equation: Propane + Oxygen → _____ + _____

Chemical Equation: $\text{C}_3\text{H}_8 + 5\text{O}_2 \rightarrow \text{_____} + \text{_____}$

2. Incomplete Combustion

When a fuel burns in a _____ supply of oxygen _____ combustion occurs. This reaction results in different _____ to complete combustion due to the lack of _____ available. We see incomplete combustion occurring when the air hole on the Bunsen burner is left _____.

The oxygen atoms will first combine with the _____ atoms from the _____, producing _____, which is why it is a product in both _____ and _____ combustion reactions. Some of the carbon atoms will not be able to react with oxygen and will be released as gaseous carbon or _____ which collects on glassware e.g., beakers and test tubes as they cool. In some cases, small particles of soot flicker around the _____. Hot carbon atoms glow with a _____ light which gives the safety flame its yellow color. If there is enough oxygen, the poisonous gas _____ is formed, either as well as, or instead of carbon.



Incomplete combustion reaction can be summarized using the following word equation:



For example, when methane is burnt in limited oxygen the equation will be:



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The balanced chemical equation for this reaction will therefore be:



Activity 2:

For each of the following incomplete combustion reactions, add in the missing reactants and products. Then write the balanced chemical equation for each reaction

- a) Water and carbon monoxide are produced when pentane reacts with limited oxygen:

Word Equation: _____

Chemical Equation: _____

- b) Octane is ignited when a match is burnt, producing soot.

Word Equation: _____

Chemical Equation: _____

The Dangers of the Products of Incomplete Combustion:

The products of incomplete _____ are extremely dangerous to humans and animals. Carbon particles (_____) can affect the _____ if they are inhaled and may trigger medical issues such as _____. Repeated exposure can lead to the formation of lung cancer. There is also evidence that suggests that soot can enter the _____, leading to heart disease.

The effects of carbon monoxide are more _____ and deadly, due to it being _____ and _____. Carbon monoxide can quickly enter the _____ and bind to hemoglobin in the place of _____ which starves the body of oxygen leading to _____ cell and tissue death, and death of the individual.

