

Name: \_\_\_\_\_

Date: \_\_\_\_\_

# AQA A-LEVEL CHEMISTRY

## Alkanes as Fuels: Complete & Incomplete Combustion

### Learn Pack

*This pack is designed to be completed alongside the video to help you build a secure understanding of this topic before moving on to revision and exam practice.*

WATCH THE LESSON



## Alkanes as Fuels

Short chain alkanes are often used as fuels.

This is because they release a Large amount of energy per gram of fuel.

A fuel is substance that releases energy when it is burned.

### Lesson Objectives:

- Know that alkanes are used as fuels.
- Know that the combustion of alkanes and other organic compounds can be complete or incomplete.
- Be able to write equations for complete and incomplete combustion reactions.

Explain why short chain alkanes are generally preferred over longer chain alkanes as fuels.

Short chain alkanes are more volatile, so they evaporate more readily allowing them to mix with oxygen and ignite more easily.

## Complete Combustion

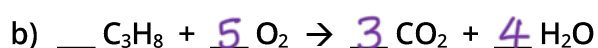
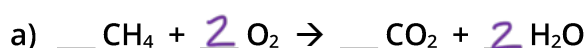
When fuels combust, they react with oxygen in the air and release energy, usually in the form of heat. Complete combustion occurs when fuels burn in a plentiful supply of oxygen:



When balancing equations for combustion reactions:

1. Balance the carbons; the number of carbon atoms in total on the left equals the number of carbon dioxide molecules formed.
2. Balance the hydrogens; divide the total number of hydrogen on the left by two and this equals the number of water molecules formed.
3. Balance the oxygens; work out the total number of oxygen atoms in your products, subtract the number of oxygen atoms, if any, in your fuel and then half this value, this equals the number of oxygen molecules required.

Balance the following equations:

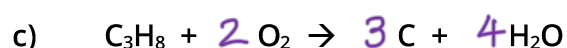
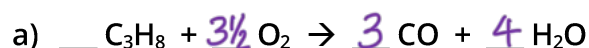


## Incomplete Combustion

Incomplete combustion occurs when fuels are burned in an insufficient supply of oxygen. During incomplete combustion the hydrogen atoms are always oxidised to form water, but the carbon atoms are only partially oxidised forming either:

- Carbon monoxide
- Carbon monoxide + Carbon
- Carbon

Balancing equations for incomplete combustion reactions follows the same process as complete combustion. Balance these equations:



What are the two problems associated with incomplete combustion:

1. It can release poisonous carbon monoxide.
2. It is less efficient so releases less energy per gram of fuel.

## Carbon Monoxide

Carbon monoxide is a colourless, odourless, poisonous gas.

Explain the effect of carbon monoxide on the body.

Carbon monoxide binds irreversibly to the haemoglobin in our red blood cells, preventing it from binding with oxygen. This reduces the oxygen carrying capability of your red blood cells which can be fatal.

## Practise Questions – Fact Recall

1. What is a fuel?

Substances that release energy when they are burned.

2. Why are short chain alkanes often used as fuels?

They are volatile and so are easier to ignite. They also, like all alkanes, release large amounts of energy per gram.

3. What are the products of complete combustion?

Carbon dioxide and water.

4. State the conditions necessary for incomplete combustion.

Insufficient oxygen.

5. What are the problems associated with incomplete combustion?

Can release poisonous carbon monoxide  
less energy efficient than complete combustion.

## Practise Questions – Application

1. Write the equation for the complete combustion of hexane ( $C_6H_{14}$ ).



2. Write the equation for the incomplete combustion of hexane ( $C_6H_{14}$ ) that produces gaseous products only.



## What next?

The next step in the Learn, Revise, Practise Method is Revise, where you'll strengthen your memory through retrieval practice exercises before moving on to Practise and applying your knowledge to exam questions.