

Taking it Further: Alkenes

Answer the questions below.

1. State the two products of cracking.

An alkane and an alkene.

2. Describe the difference between ethane and ethene.

Ethane is an alkane so contains all single bonds while ethene is an alkene so contains a C=C double bond.

3. Describe how to test for an alkene.

Add bromine water, alkenes turn bromine water colourless.

4. State the general formula for the alkanes.

C_nH_{2n+2}

5. State how many pairs of electrons are shared in a double covalent bond.

2



Taking it Further: Alkenes

Do Now:

1. State the two products of cracking.
2. Describe the difference between ethane and ethene.
3. Describe how to test for an alkene.
4. State the general formula for the alkanes.
5. State how many pairs of electrons are shared in a double covalent bond.

Drill:

1. Draw the structural formula for ethane.
2. Draw the structural formula for ethene.
3. Name the type of compound that alkanes and alkenes are.

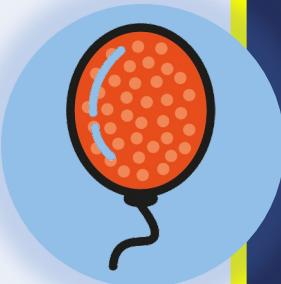


Taking it Further: Alkenes

Read Now:

The alkenes are a homologous series of hydrocarbon compounds. Their functional group is a double bond between carbon atoms, which gives them their reactivity. Because of this double bond, alkenes are described as unsaturated. This also means that they are very useful in many chemical reactions in the petrochemical industry, used to make many different polymers and plastics. The smallest of the alkenes is ethene, as there is no such thing as methene, because there could not be a carbon=carbon double bond when there is only one carbon atom present. Alkenes can be very large and branched molecules, and the properties of each molecule determine what the molecule may be useful for.

1. Identify the functional group of the alkenes.
2. Explain why the alkenes are described as unsaturated.
3. Identify the smallest alkene.
4. Explain why there is no such thing as methene.
5. Describe what alkenes are used for.



Taking it Further: Alkenes

C5.1.6

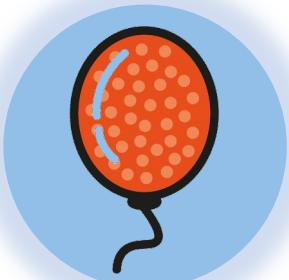
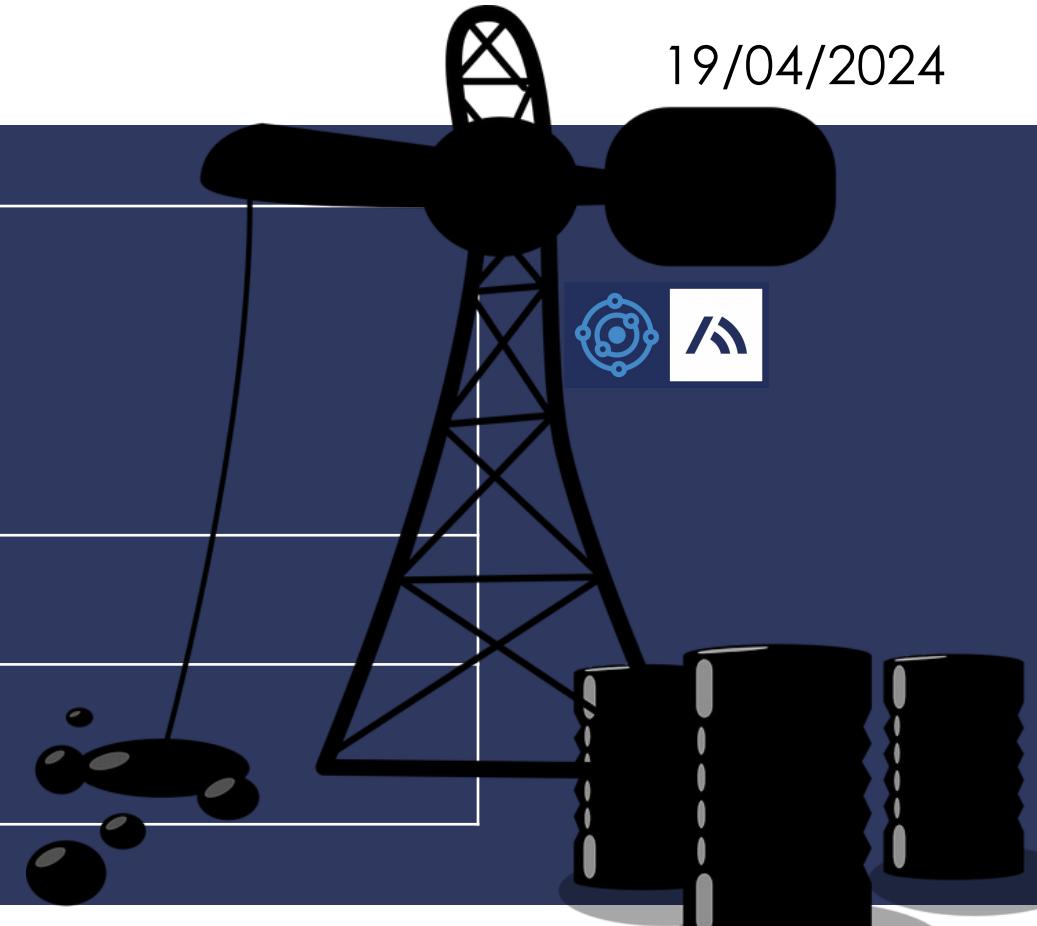
Science
Mastery

- C5.1.1 Prior Knowledge Review
- C5.1.2 Crude Oil and Hydrocarbons
- C5.1.3 Fractional Distillation
- C5.1.4 Combustion of Hydrocarbons
- C5.1.5 Cracking

➤ C5.1.6 Taking it Further: Alkenes

- C5.1.7 Taking it Further: Alcohols
- C5.1.8 Taking it Further: Producing Ethanol by Fermentation
- C5.1.9 Taking it Further: Producing Ethanol from Ethene

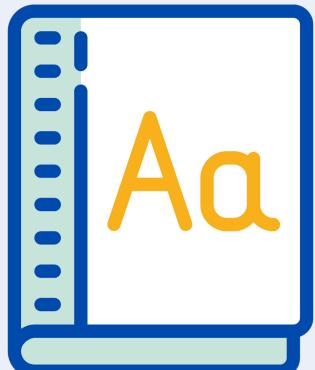
- C5.1.10 Taking it Further: Carboxylic Acids
- C5.1.11 Taking it Further: Esters
- C5.1.12 Polymers
- C5.1.13 Taking it Further: Addition Polymerisation
- C5.1.14 Taking it Further: Condensation Polymerisation
- C5.1.15 Taking it Further: Naturally Occurring Polymers



Following this lesson, students will be able to:

- State the general formula of the alkenes
- Use chemical formulae to determine numbers of atoms in molecules
- Describe chemical reactions of the alkenes

Key Words:



alkene

double bond

unsaturated

functional group

homologous series

This is the fix-it portion of the lesson

The **fix-it** is an opportunity to respond to gaps in knowledge, especially those identified by the **pre-unit quiz**.

- The teacher should customise this slide as needed, to facilitate
 - **reteach, explanation, demonstration or modelling** of ideas and concepts that students have not yet grasped or have misunderstood.
 - **practise** answering specific questions or of key skills.
 - **redrafting** or **improving** previous work.

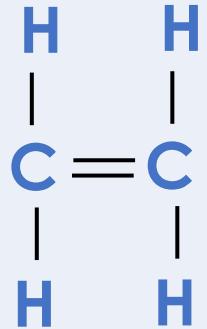
Answer the questions below.

1. Which explains why cracking is useful?
 A. It increases demand for shorter hydrocarbon chains
 B. It increases supply of shorter hydrocarbon chains
 C. It separates crude oil into different useful fractions
2. What is the formula of the other product of this cracking reaction?
 $C_{10}H_{22} \rightarrow C_8H_{18} + \underline{\hspace{2cm}}$
 A. C_2H_4
 B. C_2H_6
 C. $C_{18}H_{40}$
3. What is the difference between alkanes and alkenes?
 A. Alkanes have a $C=C$ double bond
 B. Alkenes have a $C=C$ double bond
 C. Alkenes contain more hydrogen atoms

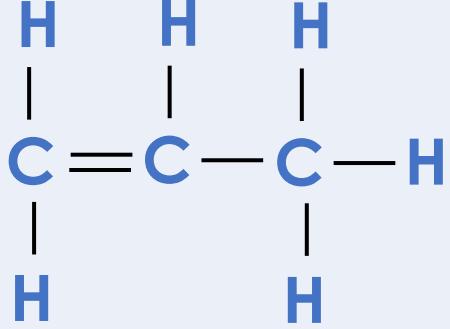
Alkenes

The **alkenes** are a homologous series that contain a **Carbon=Carbon double bond**.

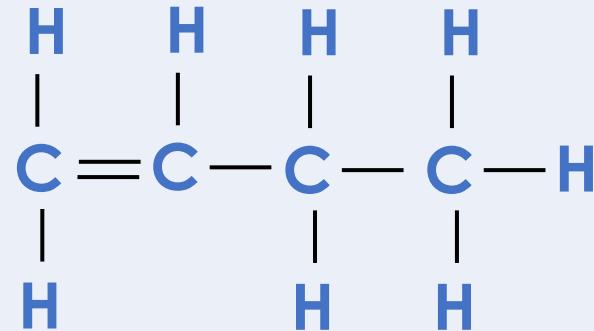
Ethene



Propene



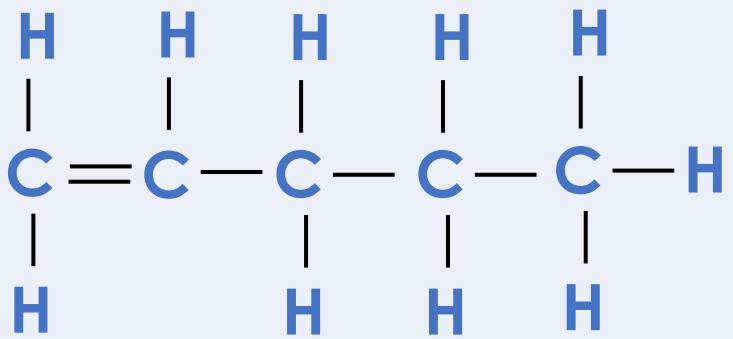
Butene



The general formula for the alkenes is C_nH_{2n} .

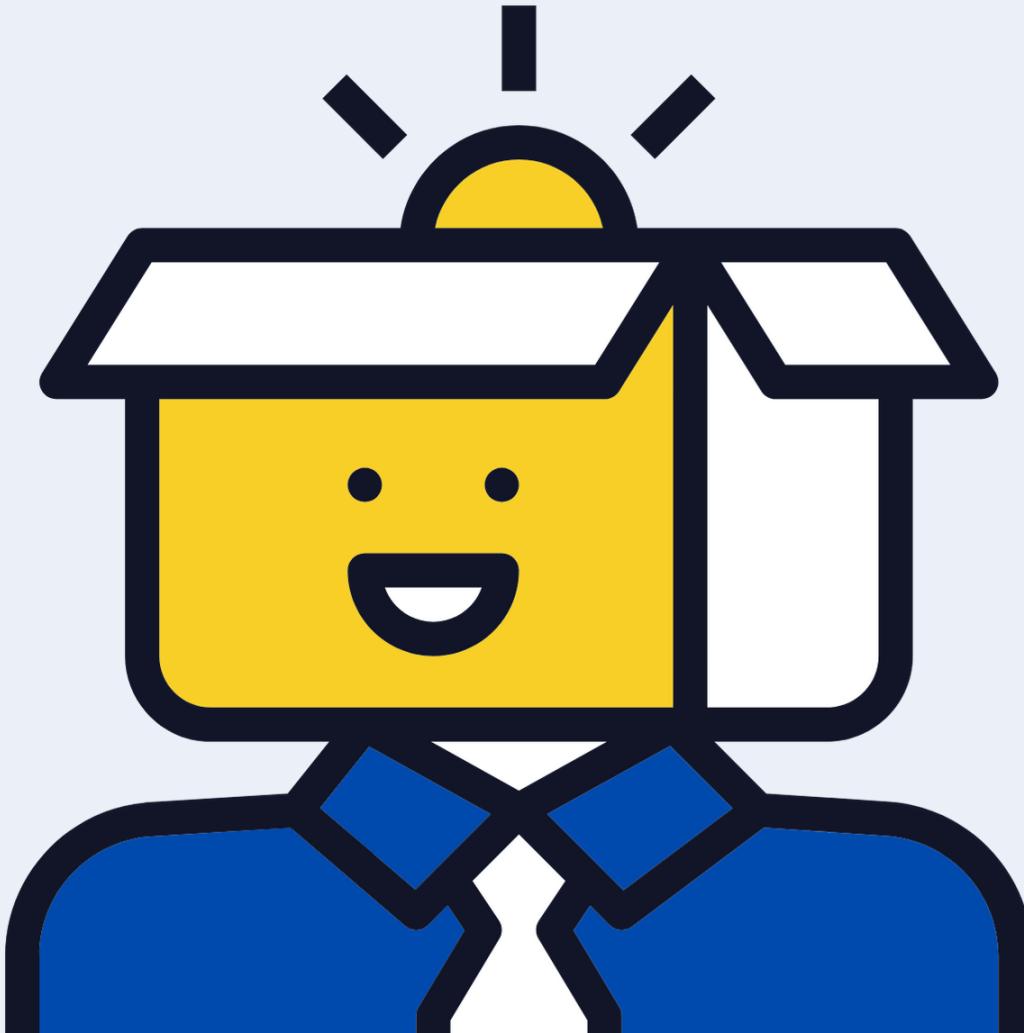
The alkenes are **unsaturated**.

What would the structural formula for pentene be?



Think outside the box!

Why is there no such thing as **methene**?



Reactions of Alkenes

Like the alkanes, the alkenes show patterns in physical properties, such as boiling points.

The **alkenes** have similar chemical properties because of their C=C double bonds, which makes them reactive.

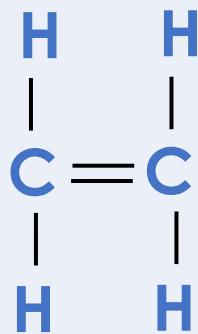
Alkenes react with **oxygen** in combustion reactions in the same way as other hydrocarbons, but they tend to burn in air with **smoky** flames because of **incomplete combustion**.



Reactions of Alkenes

The **functional group (C=C)** of the alkenes allows them to undergo addition reactions.

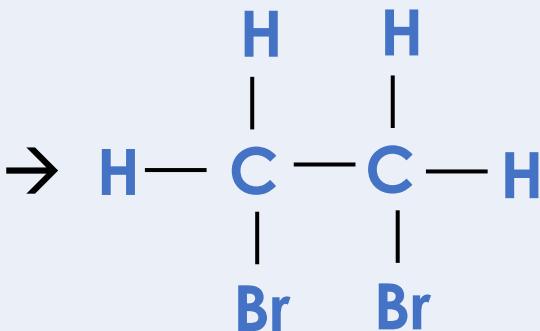
Ethene



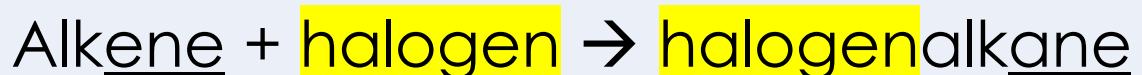
Bromine



1,2-dibromoethane



Alkenes react with other **halogens** in the same way:

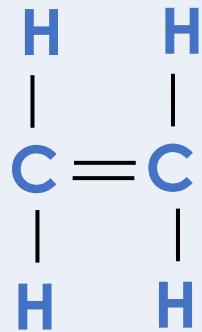


Reactions of Alkenes

Alkenes can also react with hydrogen in a specific addition reaction called **hydrogenation**.

These reactions are not spontaneous and require a **catalyst**.

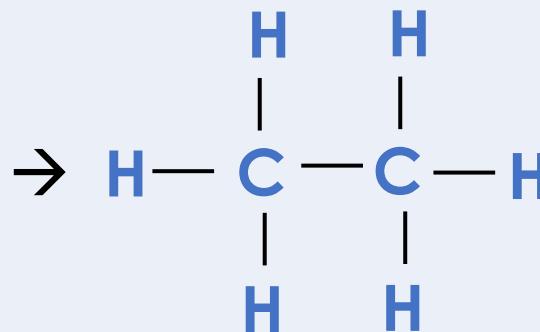
Ethene



Hydrogen



Ethane



Which statements do you agree with?

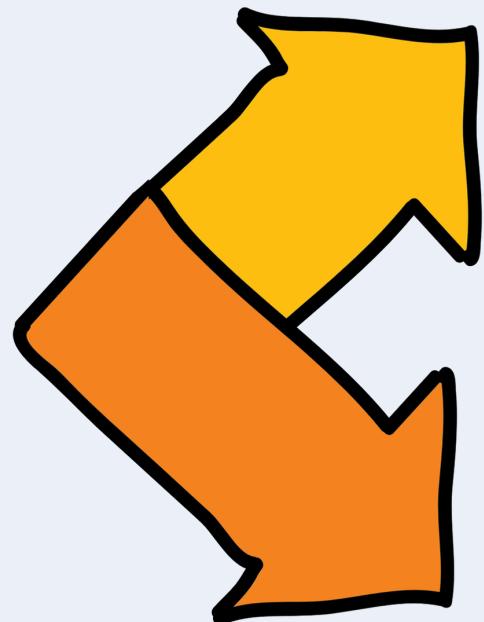
Alkenes are saturated because they contain a double bond

Alkenes are unsaturated because they contain a double bond

The double bond is between two carbon atoms

The double bond is between a carbon atom and a hydrogen atom

Can you explain the difference between these two types of compound?



Alkane

Alkene

What is the general formula of each?

Which is saturated?

How could you tell the difference between them?

Which is more reactive?

What are examples of each?

Drill

1. State the general formula for alkenes.
2. State the chemical formula for ethene.
3. State the chemical formula for butene.
4. Identify the functional group of the alkenes.
5. Explain whether the alkenes are saturated or unsaturated.
6. Describe how to test for the presence of an alkene.
7. Predict the product formed when propene reacts with hydrogen.
8. Predict the product formed when ethene reacts with bromine.

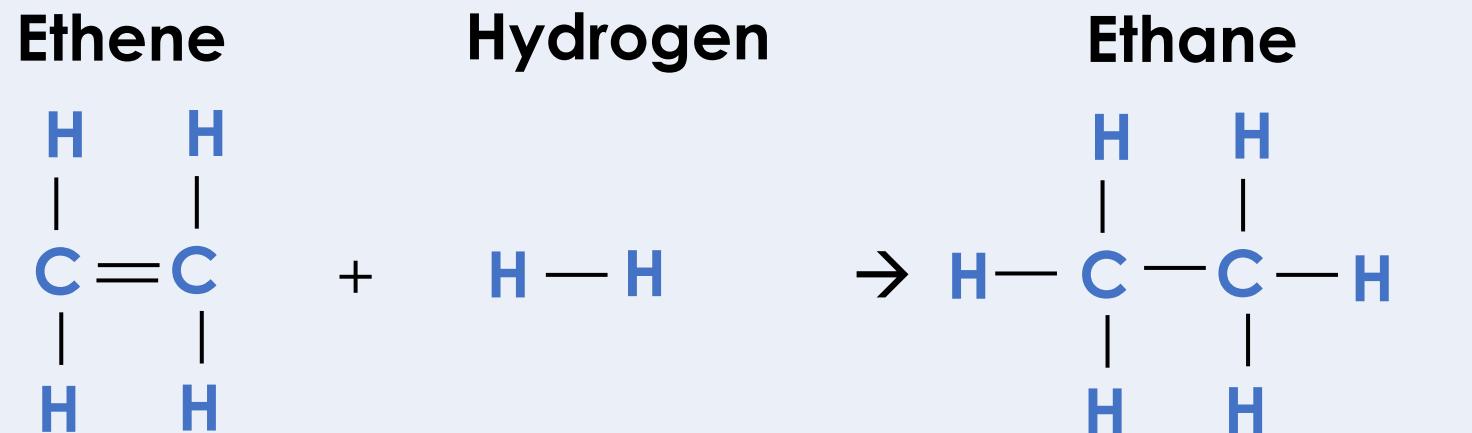
Drill answers

1. C_nH_{2n}
2. C_2H_4
3. C_4H_8
4. $C=C$
5. Unsaturated because they contain the $C=C$ double bond
6. Add bromine water. If an alkene is present, bromine water will turn from orange to colourless.
7. Propane
8. (1,2) dibromoethane

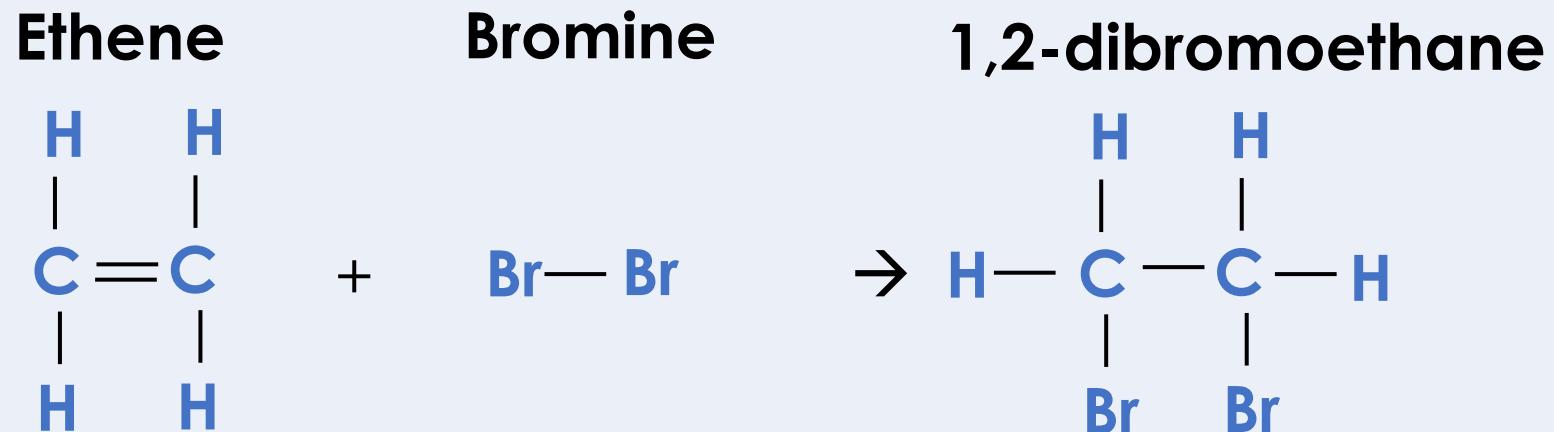
I: Alkene reactions

Ethene can react with bromine or with hydrogen in the presence of a catalyst.

Predict the product of the reaction between ethene and hydrogen.



Predict the product of the reaction between ethene and bromine.

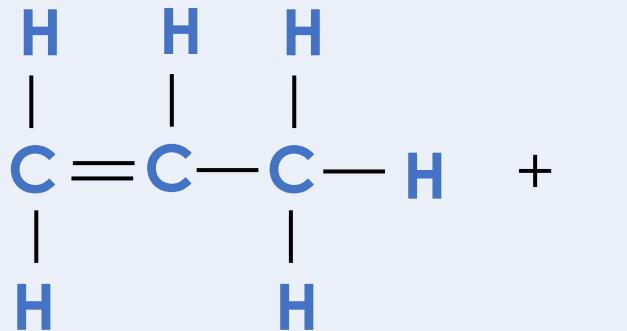


We: Alkene reactions

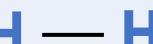
Propene can react with bromine or with hydrogen in the presence of a catalyst.

Predict the product of the reaction between propene and hydrogen.

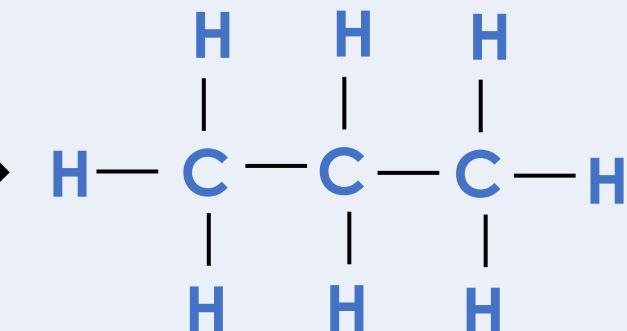
Propene



Hydrogen

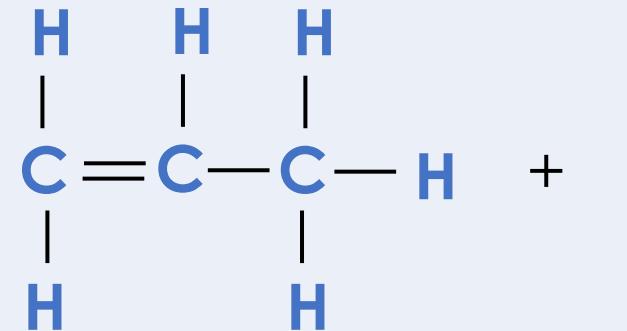


Propane



Predict the product of the reaction between propene and bromine.

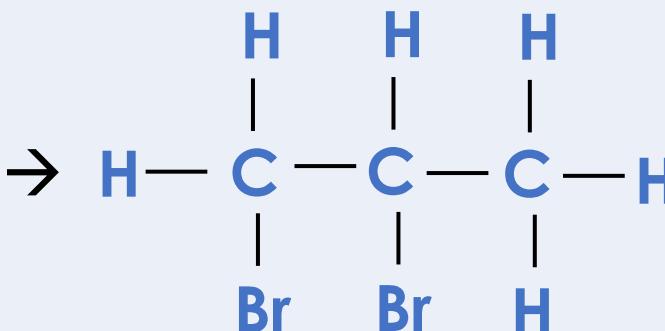
Propene



Bromine



1,2-dibromopropane

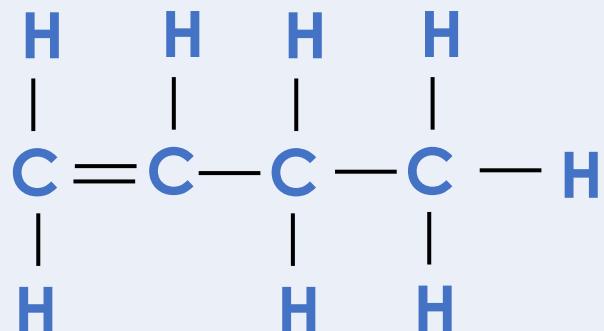


You: Alkene reactions

Butene can react with bromine or with hydrogen in the presence of a catalyst.

Predict the product of the reaction between butene and hydrogen.

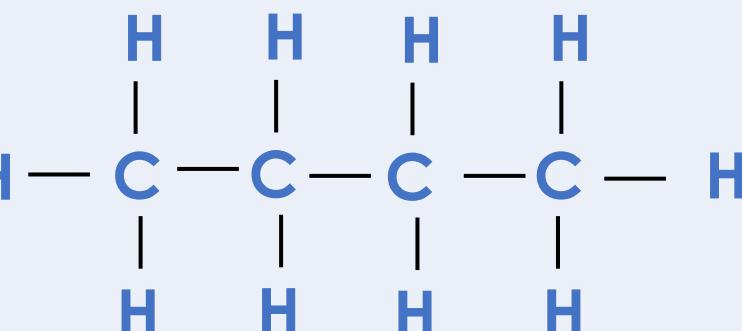
Butene



Hydrogen

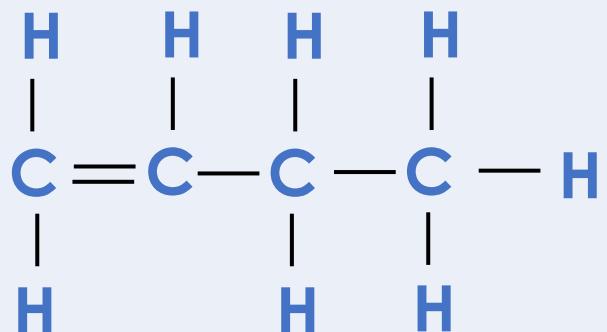


Butane



Predict the product of the reaction between butene and bromine.

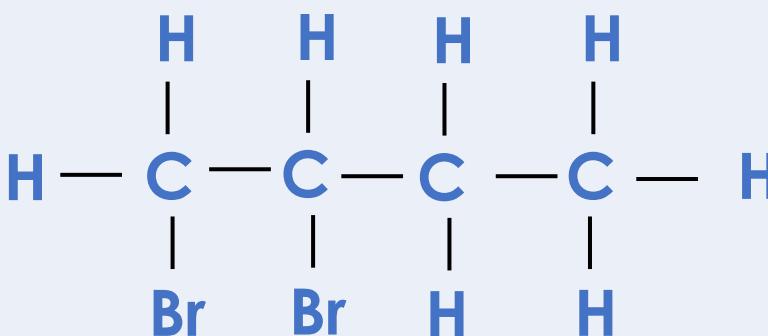
Butene



Bromine



1,2-dibromobutane



Answer the questions below.

1. What is the general formula for the alkenes?

- A. C_nH_{2n}
- B. C_nH_{2n+2}
- C. C_nH_n

2. Which explains why alkenes are reactive?

- A. They are saturated
- B. They are unsaturated
- C. They are small molecules

3. What product would be formed when propene reacts with hydrogen?

- A. Butene
- B. Propane
- C. Hydropropene

Lesson C5.1.6

What was good about this lesson?

What can we do to improve this lesson?

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Thank you!