

## Crude Oil and Hydrocarbons

**Answer the questions below.**

1. State the type of elements that form covalent bonds.

**Non-metals**

2. Describe what happens to electrons when a covalent bond is formed.

**Electrons are shared between atoms to give each atom a full outer shell.**

3. Define a compound.

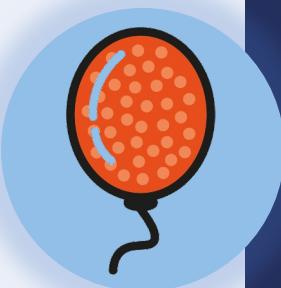
**Two or more elements chemically bonded together.**

4. Define a molecule.

**A group of non-metal atoms covalently bonded together.**

5. Calculate the relative formula mass of methane ( $\text{CH}_4$ ). C=12, H=1

**$12+(4\times 1)=16$**



## Crude Oil and Hydrocarbons

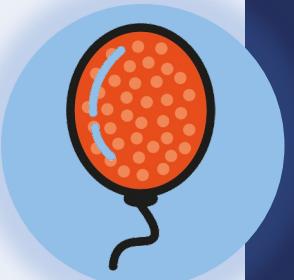
### **Do Now:**

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2. Describe what happens to electrons when a covalent bond is formed.
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4. Define a molecule.
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### **Drill:**

Here are some common chemical formulae:  $\text{CO}_2$ ,  $\text{H}_2\text{O}$ ,  $\text{O}_2$ ,  $\text{NaCl}$ ,  $\text{Ca}(\text{OH})_2$ .

1. Identify which of these formulae represent elements.
2. Identify which of these formulae represent compounds.
3. Identify which of these formulae would form molecules.

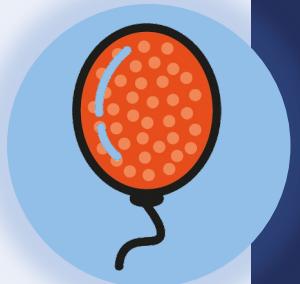


# Crude Oil and Hydrocarbons

## **Read Now:**

Crude oil is one of the most important energy sources in the world and is used in many aspects of everyday life, from fuel and heating, to petrochemicals, tarmac for roads and plastics. Crude oil is a fossil fuel found deep underground rocks, so it is a finite or non-renewable resource. It is made of the remains of ancient biomass that lived and died millions of years ago. It is mainly from plankton, which was buried under many layers of mud. Crude oil itself is a mixture of different compounds called hydrocarbons. Crude oil is a very valuable resource, sometimes described as 'liquid gold' because it is so valuable. 5 countries are responsible for nearly half the global production of crude oil: the USA, Saudi Arabia, Russia, Iran and Canada.

1. State how crude oil is used in everyday life.
2. Describe where crude oil is found.
3. Describe what crude oil is made from.
4. Explain whether crude oil is a renewable or non-renewable resource.
5. Name the countries that are the largest producers of crude oil.



# Crude Oil and Hydrocarbons

C5.1.2

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

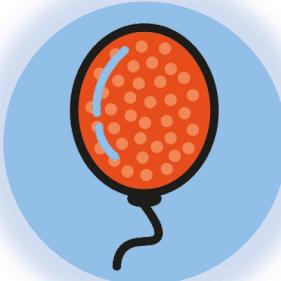
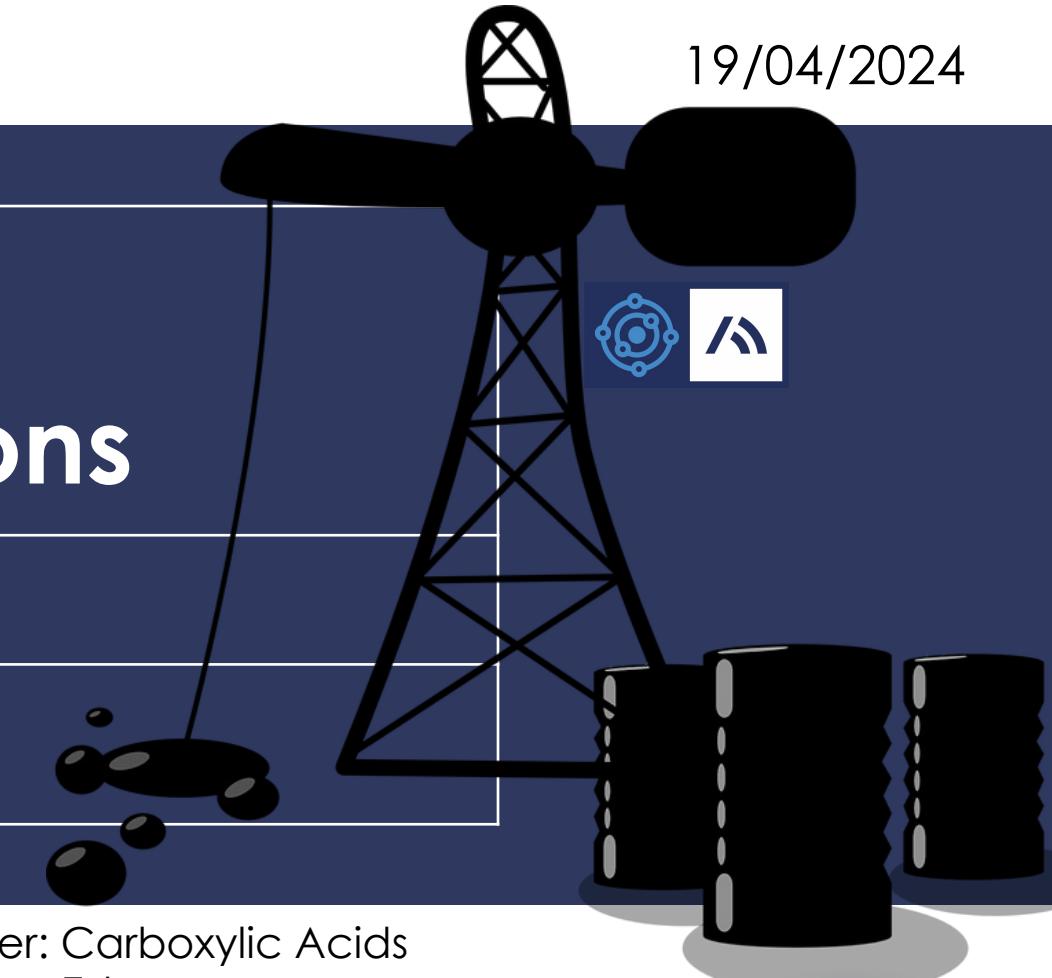
C5.1.11 Taking it Further: Esters

C5.1.12 Polymers

C5.1.13 Taking it Further: Addition Polymerisation

C5.1.14 Taking it Further: Condensation Polymerisation

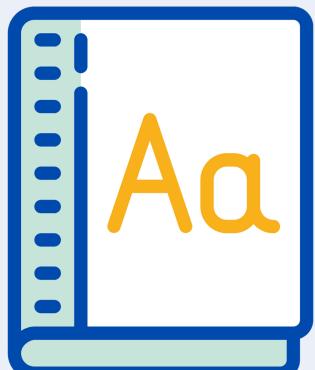
C5.1.15 Taking it Further: Naturally Occurring Polymers



## Following this lesson, students will be able to:

- Describe where crude oil is found and how it was formed
- Identify alkanes from their chemical formulae
- Use the general formula of alkanes to determine the number of atoms in a molecule

### Key Words:



crude oil

hydrocarbons

finite

alkanes

general formula

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
  - **redrafting** or **improving** previous work.

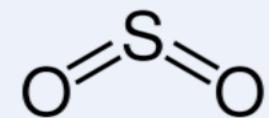
**Answer the questions below.**

3. Why doesn't pure water conduct electricity?
- A. It isn't a solid
  - B. Pure water does conduct electricity
  - C. It does not contain any free electrons

**Answer the questions below.**

1. Which answer correctly defines covalent bonding?
- A. Covalent bonding occurs where two or more non-metal atoms share pairs of electrons in order to achieve a stable electronic configuration
  - B. Covalent bonding occurs where two or more metal atoms share pairs of electrons in order to achieve a stable electronic configuration
  - C. Covalent bonding occurs where electrons are transferred from one atom to another in order to achieve a stable electronic configuration

2. How many pairs of electrons are shared, and how many covalent bonds are shown in this diagram?
- A. 4 pairs of electrons are shared, and there are two single covalent bonds
  - B. 2 pairs of electrons are shared, and there are two double covalent bonds
  - C. 4 pairs of electrons are shared, and there are two double covalent bonds



# Crude Oil

Crude oil is an important resource used for fuel, heating and making plastics, solvents, lubricants and detergents.

It is a **finite** resource formed over millions of years from the remains of **ancient biomass**, mainly **plankton**, that was buried under **mud** and compressed.

Crude oil is a **mixture** of many different compounds.



# Hydrocarbons

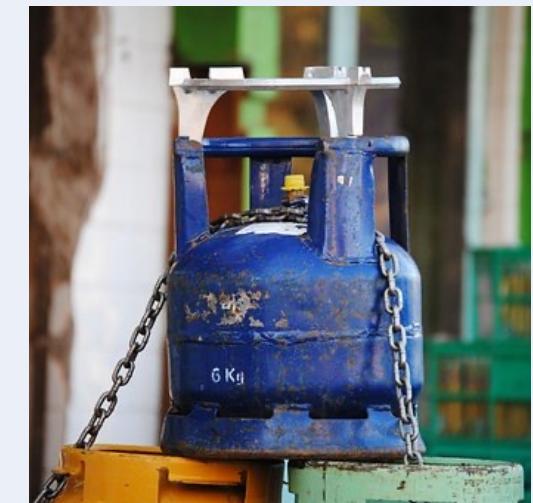
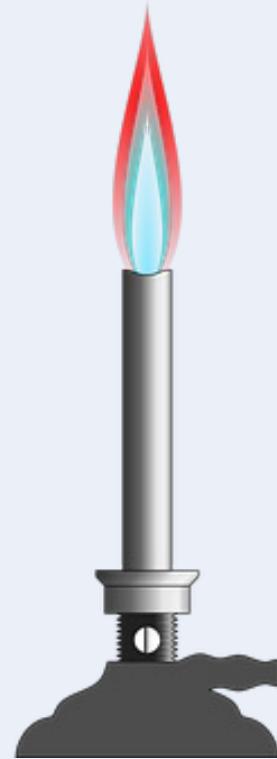
Most of the compounds in crude oil are **hydrocarbons**.

Hydrocarbons are **molecules** made up of **hydrogen** and **carbon** atoms **only**.

Most of the hydrocarbons in crude oil are part of a **homologous series** called the **alkanes**.

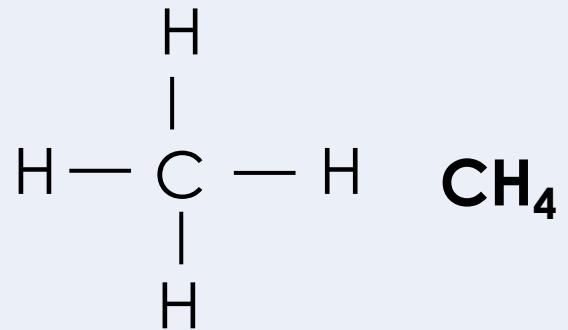
The alkanes include:

- Methane
- Ethane
- Propane
- Butane

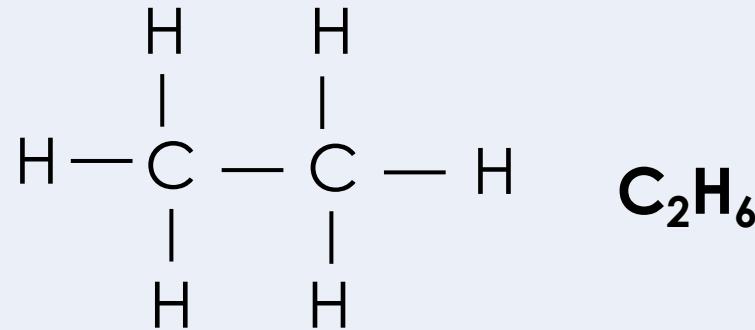


# The Alkanes

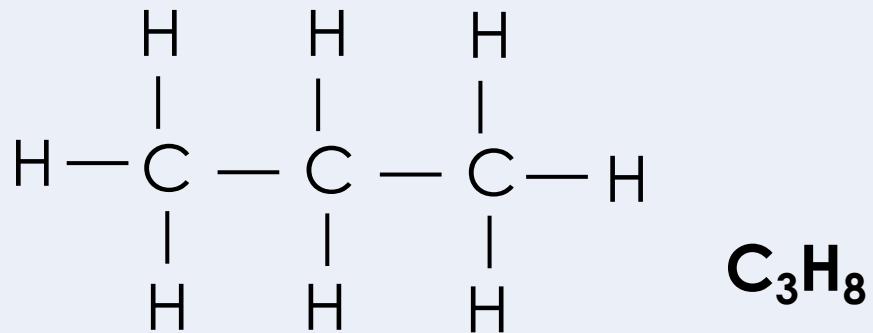
**Methane** Monkeys



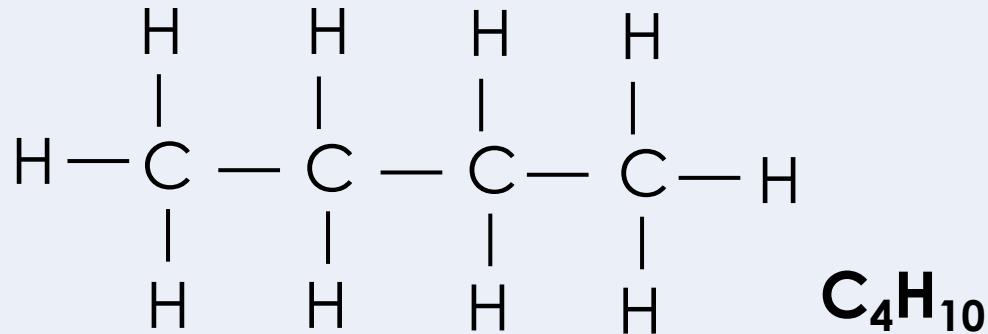
**Ethane** Eat



**Propane** Peanut

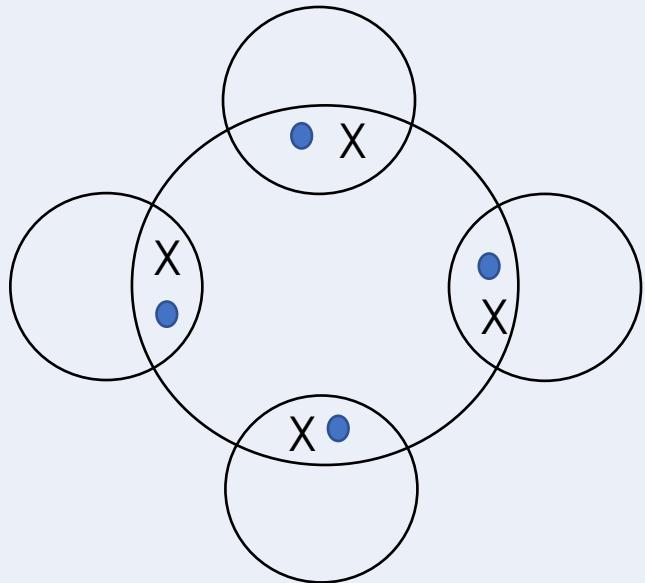


**Butane** Butter

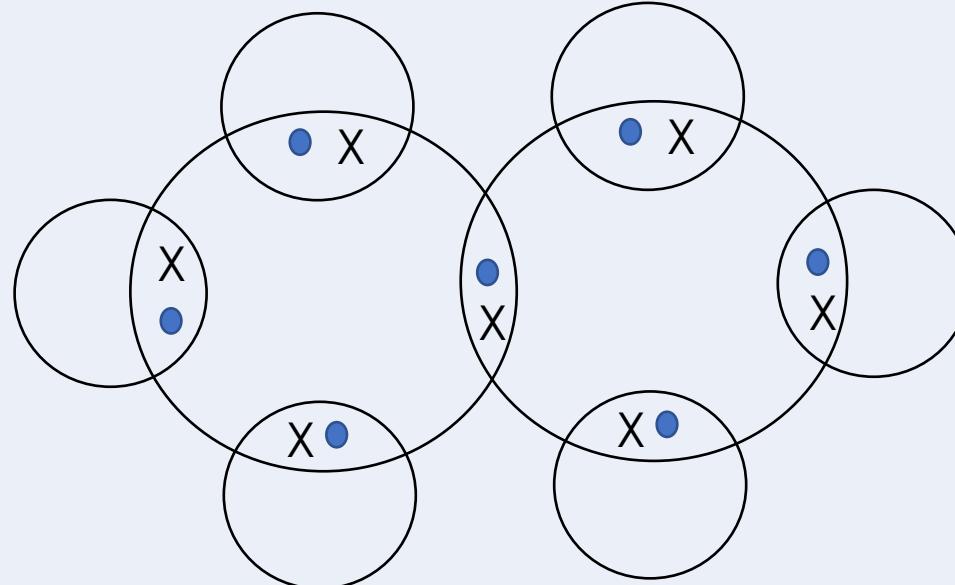


# Bonding in the Alkanes

Methane

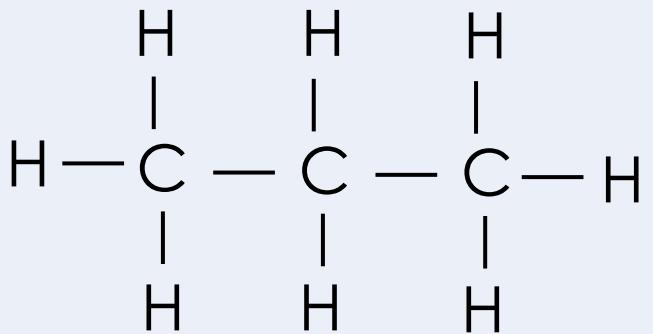


Ethane

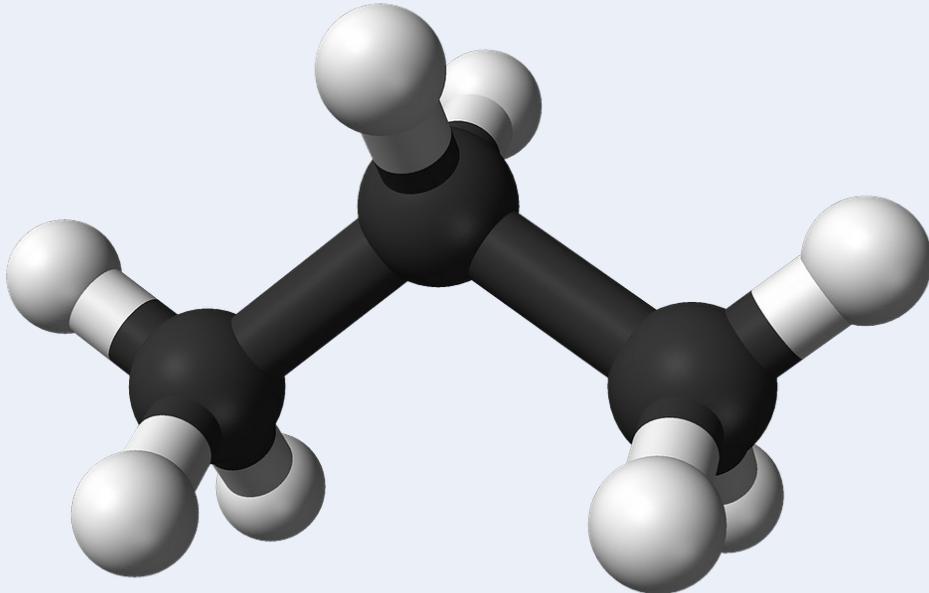


The alkanes are described as **saturated** because they contain **only single bonds**, no double bonds.

# Using Models



Propane



## Which statements do you agree with?

The general formula for alkanes is  $C_nH_{2n+2}$

The general formula for alkanes is  $C_nH_{2n}$

The general formula for alkanes is  $C_nH_{2(n+2)}$

The general formula for alkanes is  $C_nH_{n+2}$

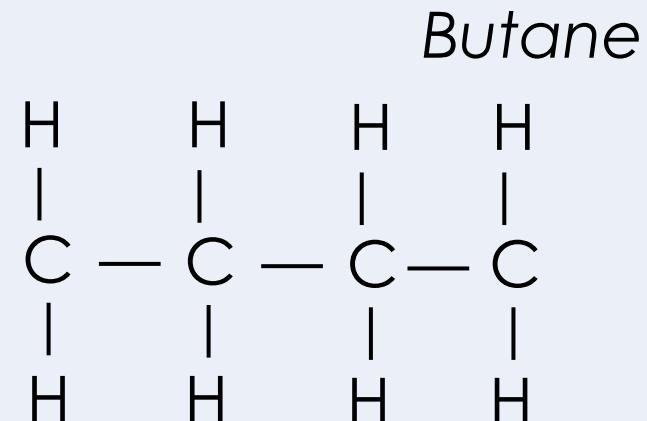
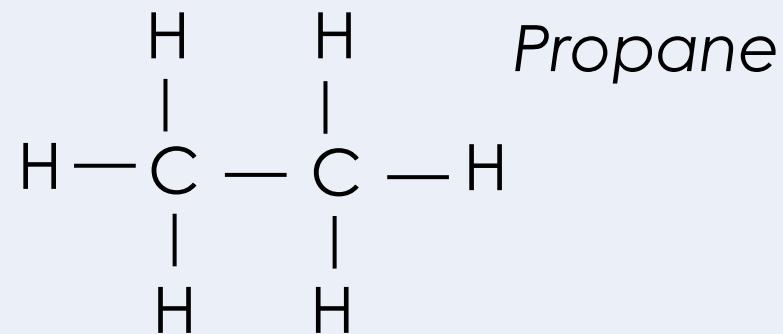
# What mistakes has the student made?

A student has drawn the displayed formulae for two alkanes, propane and butane.

They have made a mistake on each.

What are the two mistakes?

- They have drawn ethane instead of propane
- Butane is missing the hydrogen atoms on either end of the molecule

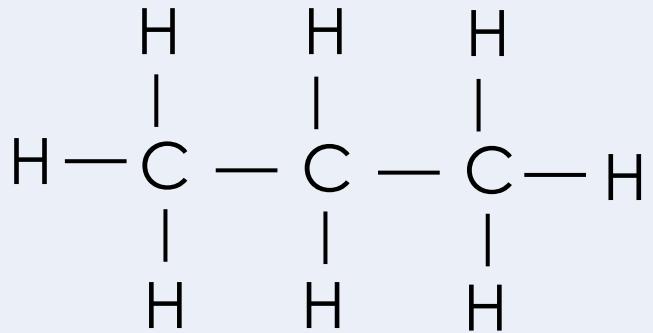


## Drill

1. Describe where crude oil is found.
2. Describe what crude oil is made from.
3. Explain why crude oil is a mixture.
4. Define a hydrocarbon.
5. State the general formula of the alkanes.
6. Name the alkane with 1 carbon.
7. Name the alkane with 4 carbons.
8. Draw the displayed formula for the alkane with 3 carbons.

## Drill answers

1. Deep underground under rocks
2. Ancient biomass (mainly plankton) that was buried in mud.
3. It contains different compounds.
4. Molecules made of carbon and hydrogen atoms only.
5.  $C_nH_{2n+2}$
6. Methane
7. Butane
- 8.



## I: Alkane Formulae

We can use the general formula of alkanes to determine how many atoms are in a given molecule.

*What is the general formula of the alkanes?*

$$\text{C}_n\text{H}_{2n+2}$$

*How many hydrogen atoms would there be in an alkane with 5 carbons?*

$$\text{C}_n\text{H}_{2n+2}$$

$$n=5$$

$$2n + 2 = (2 \times 5) + 2 = 12$$

$$\text{C}_5\text{H}_{12}$$

*How many carbon atoms would there be in an alkane with 14 hydrogens?*

$$\text{C}_n\text{H}_{2n+2}$$

$$2n + 2 = 14$$

$$2n = 12$$

$$n = 6$$

$$\text{C}_6\text{H}_{14}$$

## We: Alkane Formulae

We can use the general formula of alkanes to determine how many atoms are in a given molecule.

*What is the general formula of the alkanes?*

$$\text{C}_n\text{H}_{2n+2}$$

How many hydrogen atoms would there be in an alkane with 8 carbons?

$$\text{C}_n\text{H}_{2n+2}$$

$$n=8$$

$$2n + 2 = (2 \times 8) + 2 = 18$$

$$\text{C}_8\text{H}_{18}$$

How many carbon atoms would there be in an alkane with 22 hydrogens?

$$\text{C}_n\text{H}_{2n+2}$$

$$2n + 2 = 22$$

$$2n = 20$$

$$n = 10$$

$$\text{C}_{10}\text{H}_{22}$$

## You: Alkane Formulae

We can use the general formula of alkanes to determine how many atoms are in a given molecule.

*What is the general formula of the alkanes?*

$$\text{C}_n\text{H}_{2n+2}$$

How many hydrogen atoms would there be in an alkane with 12 carbons?

$$\text{C}_n\text{H}_{2n+2}$$

$$n=12$$

$$2n + 2 = (2 \times 12) + 2 = 26$$

$$\text{C}_{12}\text{H}_{26}$$

How many carbon atoms would there be in an alkane with 38 hydrogens?

$$\text{C}_n\text{H}_{2n+2}$$

$$2n + 2 = 38$$

$$2n = 36$$

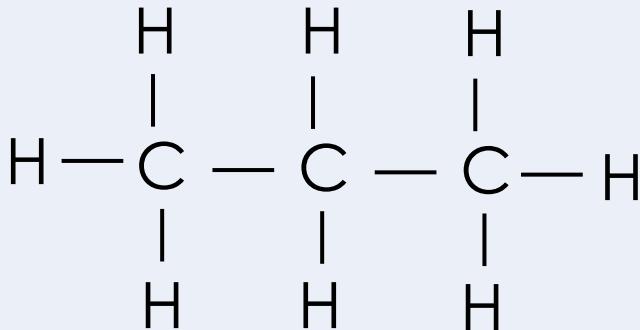
$$n = 18$$

$$\text{C}_{18}\text{H}_{38}$$

## Answer the questions below.

1. Which alkane is this?

- A. Ethane
- B. Propane
- C. Butane



2. An alkane has 15 carbons. How many hydrogen atoms would it have?

- A. 30
- B. 32
- C. 34

3. What is crude oil?

- A. A finite resource formed from ancient plankton biomass
- B. A finite resource formed from rocks
- C. A finite resource containing compounds of carbon and water

## Lesson C5.1.2

What was good about this lesson?

What can we do to improve this lesson?

[Send us your feedback by clicking this link](#)  
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Thank you!