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WithOnePlanet

> Module 1: Carbon
> Level: Years 5 to 6
> INQuIRY: Investigate
> Lesson 3: Constructing carbon compounds
> Student worksheet

Lesson 3 – Worksheets

Investigate

Lesson 3
Student worksheet
Constructing carbon compounds

Years 5 to 6

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Constructing carbon compounds

Lesson 3: Student worksheet

Introduction

In this activity, you will be constructing some models of carbon compounds that exist in nature.

Q1: What is a carbon compound?

Q2: What are some carbon compounds that you already know of?

A model is a representation of an actual object when the real object cannot be used for some particular reason.

Q3: Why do we need to make a model of carbon dioxide, for example? Why can't real carbon dioxide be used in this activity?

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Chemical formulas

Carbon compounds can be written in two different ways – either in word form, or as a chemical formula. Below you will find an example of the two different ways that carbon dioxide can be written.

Word form	Chemical form
Carbon dioxide	CO_2

A chemical formula can tell you a lot about a compound as long as you remember two important rules:

Rule 1: The **letters** in the compound stand for the names of the particular chemical elements that make up that compound.

Rule 2: The **numbers** in the compound tell you how many of each element makes up that compound. Numbers are always written as a subscript (a small version slightly below the letter) directly after the letter.

It is also very important to note that, if there are no numbers, this means that the compound contains **one** of that particular chemical *element*.

So, for carbon dioxide, its chemical formula tells us the following information:

There is **one carbon** element in this compound

CO_2

There are **two oxygen** elements in this compound

Equipment

To construct the models of the carbon compounds, you will be using the following materials:

> **Coloured dough** – to represent the elements:

Black = carbon
Red = oxygen
White = hydrogen

> **Toothpicks** – to represent the chemical bonds between the elements.

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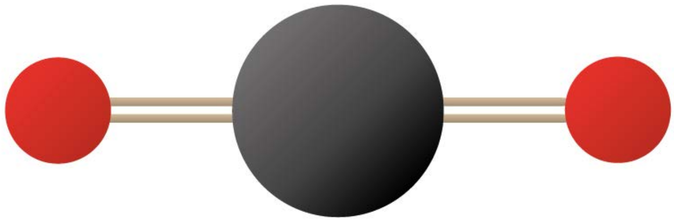
Activity 1: Carbon dioxide – CO_2

1. Mould one black ball, 2 cm in diameter, and two red balls, 1 cm in diameter.
2. Gently poke TWO toothpicks closely parallel halfway into each of the red balls.
3. Line up one red ball on either side of the black ball, and join the balls together.

Your model should look something like this:



4. In the box below, draw a diagram of your carbon dioxide compound and label all the parts.

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Activity 2: Methane – CH_4

Answer the following questions before continuing:

Q1: How many carbon atoms does methane have?

____

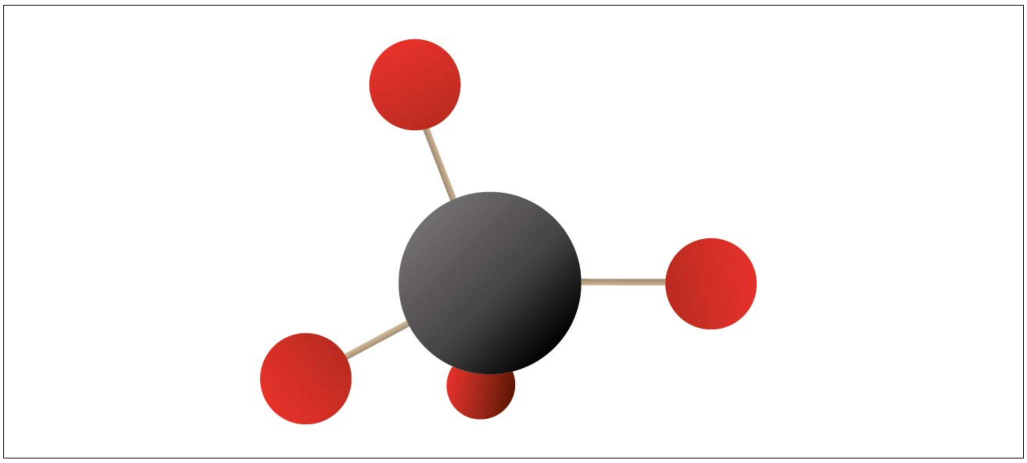
Q2: How many hydrogen atoms does methane have?

____

Instructions:

1. Mould one black ball, 2 cm in diameter, and four white balls, 1 cm in diameter.
2. Gently poke ONE toothpick halfway into each of the white balls.
3. Place the four white balls around the black ball at an equal distance from each other, and join them together.

Your model should look something like this:



4. In the box below, draw a diagram of your methane compound and label all the parts.

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FAQ: (Frequently asked questions)

Q1: Why does carbon dioxide have two chemical bonds connecting the carbon to each oxygen, while methane only has one chemical bond connecting the carbon to each hydrogen?

A chemical bond actually represents the amount of chemical attraction between two elements. The bonds are a bit like magnets that hold the elements together.

In methane, there is **one** chemical bond between each hydrogen element and the carbon element. This type of chemical bond is often called a **single** bond.

In carbon dioxide, there are **two** chemical bonds between a carbon and oxygen element. This type of chemical bond is often called a **double** bond.

This means that the attraction between the elements in carbon dioxide is **twice as strong** as the attraction between the elements in methane.

Q2: Why is the carbon dioxide compound arranged in a straight line while the methane compound is arranged in a pyramid shape?

As you know, elements in a compound are chemically bonded together, and therefore chemically attracted to one another, like magnets. However, also like magnets, they are also repelled by each other – chemically!

How is it possible for elements to be both attracted and repelled by each other at the same time?

Elements like to share electrons. Electrons are super-tiny particles in elements that are negatively charged. When elements share electrons, they are known as electrically stable and therefore very unreactive. However, because electrons are all negatively charged, and *like* charges repel one another, they prefer to be as far away from other electrons as possible.

This means that the elements that make up a compound like to be chemically bonded to each other and also as far apart from each other as possible. This affects the arrangement of the elements in space.

In both the carbon dioxide and the methane compounds, the elements are arranged as far apart as they can possibly be.

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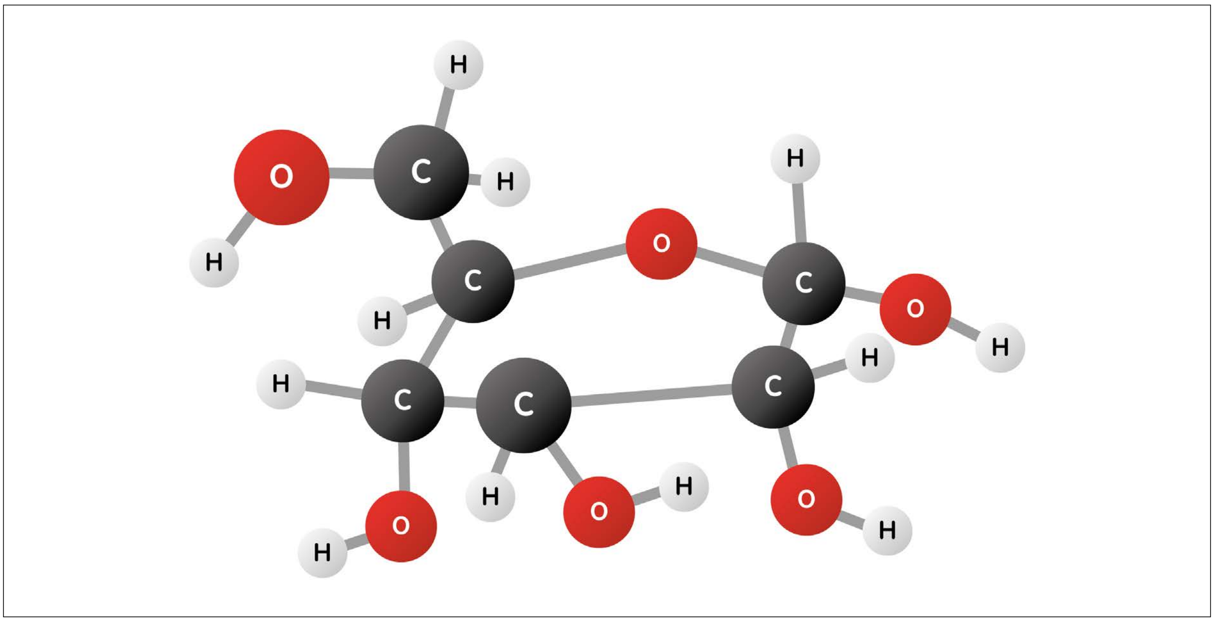
EXTENSION Activity 3: Sugar (Challenging!)

Sugars come in all different shapes and sizes, but all sugars contain carbon, hydrogen and oxygen elements. Simple sugars, such as glucose, contain 6 carbon elements, 6 oxygen elements and 12 hydrogen elements.

The chemical formula for glucose is shown below:

Word form	Chemical form
Glucose	$C_6H_{12}O_6$

The model of a glucose compound can look like this:



Your challenge:

Using the information provided, and remembering which colour represents which element (black = carbon, red = oxygen, white = hydrogen), try to construct your own glucose compound in the space on the next page.

(NOTE: There are only **single** bonds in glucose.)

Try to arrange all the elements, so that they are as far away from each other as possible, without breaking any of the chemical bonds.

Source:
How stuff works 2000, *Glucose*, viewed 29 December 2013, <http://static.ddmcdn.com/gif/food-glucose.gif>

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Challenge space: construct a glucose compound

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