

WithOnePlanet

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Carbon
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Years 7 to 8
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Carbon is energy;
carbon is life
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Investigate

Lesson 3

Teacher notes

Carbon is energy; carbon is life

Years **9 to 10**



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Carbon is energy; carbon is life

Lesson 3: Teacher notes

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This document provides the teacher with the details of the lesson.

At a glance

To provide students with hands-on, shared experiences of carbon as an element and a molecule, including the properties that enable it to store and release energy.

To provide students with hands-on, investigation experiences of some of the different molecules that contain carbon.

To support students to represent and explain their understanding of carbon as an element and a molecule, as well as an energy storage and release chemical.

Lesson 3a: Carbon under the microscope

Students:

Investigate some of the more common carbon-containing molecules.

Lesson 3b: Carbon – the great provider

Students:

Investigate a number of chemical reactions where a carbon-based molecule stores or releases energy.

Lesson focus

The *Investigate* phase is designed to provide students with hands-on experiences of the science phenomenon. Students explore ideas, collect evidence, discuss their observations and keep records, such as science journal entries. The *Investigate* phase ensures all students have a shared experience that can be discussed and explained.

In the *Investigate* phase students develop a literacy product to represent their developing understanding. They discuss and identify patterns and relationships within their observations. Students consider the current views of scientists and deepen their own understanding.

Assessment focus

This assessment guide supports teachers in identifying the types of assessment that are appropriate for this lesson.

Formative assessment is an important aspect of the *Investigate* phase. It involves monitoring students' developing understanding and giving feedback that extends their learning. It involves monitoring students' developing understanding of:

- > molecules that contain carbon
- > how carbon stores and releases energy.

You will also monitor their developing science inquiry skills.

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Summative assessment of the science inquiry skills is another important focus of the *Investigate* phase. Rubrics can be used to gauge the level of student achievement on performance tasks.

Key lesson objectives

Science

Students will be able to:

- > observe a variety of carbon-based molecules
- > understand how carbon containing molecules store and release energy.

Literacy

Students will be able to:

- > contribute to discussions about carbon-based molecules and how they can store and release energy
- > record ideas and explanations in words and diagrams in a variety of written modes including experimental report templates.

This lesson also provides opportunities to monitor the development of students' general capabilities.

Teacher background information

A molecule stores energy within the bonds that exist between its atoms. When these bonds are created, energy is stored within them. When these bonds are broken, the stored energy is released. Chemical reactions can be categorised into energy storing (or energy absorbing) reactions (endothermic) or energy releasing reactions (exothermic). Often the energy released from exothermic reactions is heat energy. Conversely, heat can be used as the energy source in an endothermic reaction.

In any chemical reaction, whether bonds are broken, made or both, the elements that are involved in the reaction are present at the beginning and at the end of the reaction. Elements are neither created nor destroyed in a chemical reaction. They are always present, but can be found in different forms, and bonded to different elements. This is known as the Law of Conservation of Matter.

Similarly, the energy involved in a reaction is neither created nor destroyed. It may be taken from the surrounding environment or released into it, and may be transferred to a different object and/or transformed into a different energy type – for example from chemical energy in chemical bonds into heat energy, or vice versa. However, it exists in the same amount before, during and after the reaction has taken place. The forms energy can take are many, including but not limited to, chemical energy (present in chemical bonds), heat energy, light energy, sound energy, movement (kinetic) energy, potential energy and so on. Energy transformations can be measured both quantitatively and qualitatively. A reduction in the temperature of an object, for example, indicates that heat energy has been transformed into another type of energy or transferred to another object.

Activity 1: Carbon under the microscope

Equipment

For each student (or pair of students)

- > a strip of paper cut from A4 paper (about 30 cm long) per pair of students
- > a pair of scissors
- > a ruler
- > access to the internet
- > students will each require a copy of both student worksheets.

Preparation

- > For Experiments 1, 2 & 3:
 - Read through both student worksheets
 - Prepare all the equipment for *How small is a carbon atom?* – *Student worksheet*
 - Access the three online videos so that they are fully loaded before they are required
 - Check that the *Build a Molecule* program is able to be downloaded from the internet.

Lesson steps

1. Students to complete Activity called 'How small is a carbon atom?' using the *How small is a carbon atom?* – *Student worksheet*.
2. Students to watch three online videos:
 - > 'A Boy and His Atom: The World's Smallest Movie' - <http://youtu.be/oSCX78-8-q0>
 - > 'Moving Atoms: Making the World's Smallest Movie' - <http://youtu.be/xA4QWwaweWA>
 - > 'Close up at carbon fiber' - <http://youtu.be/eGKaa1c1pX0>
3. Students to build a model of a carbon atom using the online *atom builder*, which can be downloaded from here: <http://phet.colorado.edu/en/simulation/build-an-atom>. They are to complete the *Carbon under the microscope* - *Student worksheet* – Part A: Atoms section as they use the animation.
4. Students are to build a model of some carbon compounds using the online molecule builder that can be downloaded from here: <http://phet.colorado.edu/en/simulation/build-a-molecule>

Activity 2: Carbon – the great provider

Equipment

For each Student

- > Refer to student worksheets for Experiments 1 and 2 for all equipment
- > students will each require a copy of each of the student worksheets.

Preparation

- > For Experiments 1 and 2:
 - Read through each student worksheet
 - Familiarise yourself with the safety precautions
 - Prepare all the equipment
 - Conduct a test of each experiment in advance of the lesson.

Lesson steps

1. Students conduct two experiments – one exothermic and one endothermic – with carbon-based molecules. The information for each experiment is contained in the relevant student worksheet.

Sources:

IBM 2013, *A Boy and His Atom: The World's Smallest Movie*, viewed 24 December 2013, <<http://youtu.be/oSCX78-8-q0>>
 IBM 2013, *Moving Atoms: Making the World's Smallest Movie*, viewed 24 December 2013, <<http://youtu.be/xA4QWwaweWA>>
 Linkoroo 2010, *Close up at carbon fiber*, viewed 24 December 2013, <<http://youtu.be/eGKaa1c1pX0>>
 PhET Interactive Simulations 2013, *Build an Atom*, viewed 24 December 2013, <<http://phet.colorado.edu/en/simulation/build-an-atom>>
 PhET Interactive Simulations 2013, viewed 24 December 2013, <<http://phet.colorado.edu/en/simulation/build-a-molecule>>