

WithOnePlanet

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Question

Lesson 2

Teacher notes

A burning question about carbon

Years

9 to 10

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INQuIRY

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A burning question about carbon

Lesson 2: Teacher notes

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

At a glance

To use the understandings, information and questions developed during the *Introduce* phase of the *INQuIRY* process to help students to determine the essential questions that will form the basis of their investigation.

Students will:

- > distil the learning from the *Introduce* phase and consider the key questions that arise for them from this learning
- > develop one or more essential questions about carbon for use in the *Investigate* phase of the *INQuIRY* process.

Lesson focus

The focus of the *Question* phase is for students to develop an essential question, or a small number of essential questions that accurately reflect their ideas and thoughts from the *Introduce* phase and can act as a springboard for their learning in the *Investigate* phase.

Key lesson objectives

Science

Students will be able to represent their current understanding as they:

- > develop essential question(s).

Literacy

Students will be able to:

- > reflect on their ideas from the *Introduce* phase
- > contribute to discussions about the key concepts and components of the essential question.

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

Teacher background information

Essential questions

Wiggins & McTighe (1998); OCM BOCES (2013) outline the following core attributes of successful essential questions:

Core-Focused, Inquiry-Based, Reinforce Thinking Skills, Interdisciplinary, and Engaging.

At Years 9 and 10, students should be familiar with the key characteristics of essential questions and, with guidance, should be able to construct their own, either as a whole class, or in small groups.

The development of the essential question(s) is a natural progression from the student-provided understandings, thoughts, observations and questions that have arisen in the *Introduce* phase of the *INQuIRY* process.

Through summarising and paraphrasing student contributions from the *Introduce* phase, as well as through the use of stimulating and clarifying questioning, the teacher can act as a facilitator in the development of the essential question.

The *WithOnePlanet Carbon: Science curriculum* is based on 5 essential questions that are considered at each stage in the students' schooling from F-10. These are shown in Table below. In addition, the specific *WithOnePlanet Big ideas for Years 9 and 10* are also a key stimulus for the development of the essential question(s) at this stage in the *INQuIRY* process. These are also shown in Table 1 below.

Table: WithOnePlanet Big ideas for Years 9 – 10

| Big Ideas | What is carbon? | What is the carbon cycle? | What is climate change and what role does carbon play in it? | What is my carbon footprint and how can I reduce it? | What can be done to mitigate climate change on a regional scale? |
|---------------|---|--|---|--|--|
| Years 9 to 10 | Carbon is involved in many types of chemical reactions. | Carbon can be stored and sequestered, which reduces the concentration of atmospheric carbon. | Some of the consequences of climate change involve a tipping point. Once this tipping point is reached, the change is irreversible. | Through communication and interaction with family, friends and others in my local area, our collective carbon footprints can be reduced. | People in different countries in the Asia-Pacific region can collaborate to reduce the carbon footprint of the region. |

Sources:

Wiggins, G & McTighe, J 1998, *Understanding by design*, Association for Supervision & Curriculum Development, Alexandria, VA.
 OCM BOCES 2013, *Curriculum Mapping Essential Questions Guide*, viewed 1 December 2013, <http://www.ocmboces.org/tfiles/folder1682/OHS_essentialquestions.pdf>.

These essential questions can provide a stimulus for, and form the basis of, the essential questions that students develop in the *Question* phase of the *INQuIRY* process. However, the questions that the students arrive at may not necessarily be exactly the same as these *WithOnePlanet Big ideas* essential questions. This is preferable as it is important that the questions are student-driven rather than provided by the teacher. Student ownership and engagement in the unit is important. However, it is also important that the teacher plays the role of effective facilitator and gently guides the students' thinking in an appropriate direction.

Some examples of possible student-derived essential questions include:

- > Why is carbon such a versatile substance and how does this impact on life on Earth?
- > Why is carbon in all of its forms such a critical component of current and future life on Earth?
- > How can humans manipulate the carbon cycle so that carbon remains in some spheres and not in others?
- > How can we, as humans, ensure the future of life on Earth through our relationship with carbon?
- > Why is the science of carbon and climate change such a controversial issue for many people and many countries?

Equipment

For the Class

A summary of the students' ideas from the *Introduce* phase in Lesson 1.

Preparation

- > Read the Essential questions guide document. OCM BOCES 2013, *Curriculum Mapping Essential Questions Guide*, viewed 1 December 2013, <http://www.ocmboces.org/tfiles/folder1682/OHS_essentialquestions.pdf>
- > Review and summarise students' ideas from the *Introduce* phase, including responses to both the *POE Demonstrations* and the *Student observation activity – Where on earth is carbon?*
- > Using students' ideas and the *WithOnePlanet Big ideas* (see Table on page 2), generate some possible essential questions that can act as a teacher reference guide when facilitating student discussion of the essential question during the lesson

Lesson steps

1. Students to review their own ideas from the *POE Demonstrations* and the *Student observation activity – Where on earth is carbon?* from the *Introduce* phase, using the *POE demonstration – student worksheet*.
2. Provide the class with a brief summary of their ideas from these activities.
3. Explain to students that, in order to investigate their ideas further, it is valuable to come to a consensus about key ideas, thoughts and questions that the students have so far.
4. Use the *Essential Questions Guide* to introduce to students the idea of essential questions - what they are, what role they play in learning and the key attributes that make a good essential question. Provide students with some examples of essential questions, as shown in the *Essential Questions Guide*.
5. Introduce the *A burning question about carbon - Student worksheet* to the students, and facilitate the development of an essential question - related to Lesson 1 and the *WithOnePlanet Big ideas* - with the class.
6. From this essential question, students to form small groups of no more than 3 students. Students to brainstorm a list of the concepts and other questions that they feel they need to research and/or answer in order to answer the essential question.
7. Each student group to provide feedback from their discussions. The teacher can generate a list of the key concepts and questions that students have generated. This will inform teacher planning of the *Investigate* phase of the *INQuIRY* process.