Teacher's Guide: Continental Drift: What's the Big idea?

Recommended Grade Level: 5–8
(also applicable to grades 9–12 for students requiring significant support in learning)

Suggested Time: About 50–60 minutes spread over one or more class periods, plus additional time to complete a writing assignment

Goals

Following are the big ideas that students should take away after completing this lesson:

- The continents are in slow but constant motion, riding on top of pieces of Earth's crust called tectonic plates
- The scientific community often refuses to accept new scientific theories that challenge existing ones
- Scientists often use new evidence to build on other scientists' work and strengthen theories

Vocabulary

(See definitions on page 6.)

- continent
- evidence
- fossils
- geologist
- theory

Key Literacy Strategies

Following are the primary literacy strategies students will use to complete this activity:

- Identifying and using text features (screens 2, 4, and 6)
- Determining important information (screens 4, 6, and 7, writing assignments 1 and 2)
- Categorizing basic facts and ideas (screen 7)

Note: In addition to using the key literacy strategies listed above, students will use each of the strategies below to complete this lesson:

- Monitoring comprehension
- Synthesizing
- Making predictions
- Developing vocabulary
- Connecting prior knowledge to new learning
- Developing a topic in writing
- Identifying and using text features (photographs, captions, diagrams, and/or maps)

Overview

Continental Drift: What's the Big Idea? is a student-directed learning experience. However, while students are expected to work through the lesson on their own, teachers should be available to keep the lesson on track, organize groupings, facilitate discussions, answer questions, and ensure that students meet all learning goals.

The following is a summary of the lesson screens:

Screen 1: Students learn that they will explore how scientific ideas become theories.

Screen 2: Students read about how evidence is used to develop and support a theory. They also read about Alfred Wegener and his theory that continents drifted, or moved, over long periods of time.

Screen 3: Students learn what the goals are for the lesson, which strategies they will be using to complete the lesson, and the important vocabulary words they will use during the lesson.

Screen 4: Students watch a video about evidence Wegener used to support his theory and the problems he experienced getting his idea accepted by the scientific community. They also answer four multiple-choice questions to show their comprehension of what they've learned so far about Wegener's theory.

Screen 5: Students read a passage on research conducted after Wegener's death that both legitimized his findings and built on them to develop a stronger theory, known as plate tectonics. After they have finished reading, they write one to two sentences to answer each question about Wegener's theory to demonstrate their understanding.

Screen 6: Students complete an interactive vocabulary activity, and then choose two words from the vocabulary list and write a new sentence for each word. These tasks demonstrate their understanding of the meanings of the words.

Screen 7: Students use an interactive activity to categorize different pieces of evidence on a concept map that support an idea or theory related to the movement of the continents.

Final Assignment: Students select and complete a writing assignment about the lesson topic.

Before the Lesson

- ❑ Go through each screen of the lesson, including all the interactive activities, so that you can experience ahead of time what students will be doing. As you go through each screen, jot down your own expectations for students' responses.
- ❑ Determine if students will be working individually or in pairs on the lesson. Some students may be able to work independently with little or no support. Students who are less familiar with the subject area or who struggle with literacy skills may benefit from working with another student. An effective way to do this is to pair a stronger student with a less able reader. You can also have students work individually on certain tasks and in pairs on others, depending on their experience and needs. If students will be working in pairs on any portion of the lesson, let them know if they will be expected to type in their notes individually or together.
- ❑ Provide instruction on key vocabulary (vocabulary words are defined in the lesson on screen 3, and on page 6 of this guide).

❑ Determine what students already know about the theories of continental drift and plate tectonics. You may want to start a discussion with questions such as: How many continents are there? What separates the continents? Looking at a map of the world, what do you notice about the shapes of the continents? How do you think islands formed? How do you think mountains formed? Why do you think different animals live on different continents? Record their ideas on a chart, highlighting the words that may come up in the lesson. This will give you a sense of the background knowledge and possible misconceptions that students have before beginning this lesson. If time allows, return to the chart after students have completed the lesson to add new learning and correct misconceptions. Note: You may want to record their new learning in a different-colored ink so they can see how much they've learned.

❑ Arrange computers with Internet access so students can work individually or in pairs.

❑ Before students begin, suggest a timeline for completing the lesson, mention the different types of media they will encounter, and let them know how you expect them to submit their work. You may want to provide an outline of this information on a chart, chalkboard, or whiteboard, or as a handout.

Lesson Assessments

The following are descriptions of the lesson features that will be part of the packet of materials that they will submit. Students will use the packet for reference when writing their final assignment. It also serves as a formative assessment tool to monitor students' work as they're progressing through the lesson.

- **Notes** – Students take notes on screen 5. If time allows, review their notes before students begin their writing assignment.
- **Multiple-choice questions** – Students complete the four questions on screen 4. Walk around to make sure students answer all three questions before they continue. If students click to go to the next screen before they finish, their work will not be saved.
- **Match It!** – Students complete an interactive vocabulary activity on screen 9. They begin by placing the vocabulary terms into the correct sentences. After they finish and save their work, they will be able to check their answers against an answer key. When they are done, they will be asked to choose two vocabulary words and write a new sentence for each word. Sentences should demonstrate a clear understanding of the meaning of each word. An inappropriate response would be "The museum contained many fossils." An appropriate response would be "Scientists dig in the ground to find fossils of animals that lived millions of years ago."
- **Arrange It!** – Students complete the categorizing activity Arrange It! on screen 7. They will assign information on a concept map to show how different pieces of evidence support an idea or theory. Students will not be able to check their answers online, so you will need to provide them with correct answers when they are finished with the lesson. You can choose to review the answers as a class or return the corrected packet of materials to students before they begin the final assignment.

Following are the pieces of evidence students will drag and drop onto the concept map in the appropriate category:

Wegener's evidence for the theory of continental drift:

- Shapes of South America and Africa match up
- Remains of Mesosaurus found in South America and Africa
- Coal deposits found in the Arctic
- Glacial marks discovered in subtropical deserts

Later evidence that showed how continents move:

- Solid rock melts due to heat deep inside Earth
- New crust created at mid-ocean ridges and spreads out
- Old crust destroyed at deep-ocean trenches

- **Final Assignment** – Students complete one final writing assignment. You can choose to let students make their own selection, or assign one according to your goals for the lesson. Use the rubric on page 7 to assess the writing assignments.

Lesson Aids and Extensions

Use the following suggestions to help students if they are stuck on a particular screen, to prepare students for completing their writing assignments, or as follow-up discussions to reinforce learning.

- **Watching Videos** – Encourage students to watch the video more than once. After the initial viewing, provide students with a specific content focus to frame their next viewing(s) of the video. This will help them draw connections between the main topic and the information that the video has to offer.
- **Participating in Discussions** – Organize class discussions or encourage students to talk about their questions in pairs. You may want to use the following discussion starters:
    - o How can even strong evidence not be enough for a scientist or a theory to gain acceptance?
    - o Was the way Wegener was treated by his scientific colleagues justified or fair?
    - o Can you think of other situations in which people's opinions are not accepted by others because they don't "fit in"?
- **Reading the PDF Text** – Before they read the PDF text on screen 9, ask students to review the evidence Wegener had collected and discuss whether this would have been enough to convince them if they were geologists at the time Wegener published his theory.
- **Sharing Student Work** – It may be motivational, and a further learning opportunity, for students to post their final essays so that their classmates, peers, and/or parents can see them. This may also provide an opportunity for students to comment on and discuss each other's essays.

If you do not already have access to an online writing community, Teaching Matters™ provides TeXT, free classroom publishing tools that allow teachers and students to create and publish their own online eZine. More information and a free signup are available at Teaching Matters: TeXT (http://text.teachingmatters.org).

- **Reflection and Self-Assessment** – After students have turned in their writing assignments, you can choose to have them assess their learning. Bring students together as a whole class or in small groups to discuss the questions below. You may want to return to the chart of their ideas developed before the lesson and record their new learning. You may also have students respond individually to the questions and then convene the class to discuss the chart.
    - o What did you learn?
    - o What was surprising?
    - o What questions do you still have?
    - o What was the easiest for you to understand and do?
    - o What was the most difficult?

Vocabulary Definitions

continent

One of several large land areas. Earth's total land area is divided into seven continents: Africa, Antarctica, Asia, Australia, Europe, North America, and South America.

evidence

The objects scientists find and the things they observe in their research that may be used to support a theory. Evidence may take many forms, including fossils (the remains of past life), the speed or path in which an object travels, or physical features of the land.

fossil

Evidence found in rock of any life form that once lived on Earth. Examples include entire bodies or body parts, such as bones, teeth, hair, or scales. They also include impressions, or prints, such as footprints, shell prints, or leaf prints. The *fossil record* is the collection of all fossils that have been discovered.

geologist

A scientist who studies the history and structure of Earth, especially as recorded in rocks.

theory

An explanation of how something occurs in the real world that is supported by a large amount of evidence. Theories may be used to explain everything from how the universe began to why objects fall to the ground.

Final Assignment Rubric
Continental Drift: What's the Big Idea?

1. Explain how Alfred Wegener turned his idea of continental drift into a "real" scientific theory. Be sure to mention the pieces of evidence he collected and how well they supported his idea.

2. Describe the main reasons why the scientific community did not accept Alfred Wegener's idea of continental drift. Be sure to explain what eventually changed their minds.

4	3	2	1
Provides a clear and accurate response to the question. Ideas are elaborated, with three or more relevant supporting details from the reading passage, video, and other materials in the lesson.	Provides an adequate response to the question. Topic and ideas are generally well organized, with two relevant supporting details from the reading passage, video, and other materials in the lesson.	Provides a generally accurate response, with one supporting detail from the reading passage, video, and other materials in the lesson.	Provides an inaccurate response to the question or fails to address the question. May include misinterpretations. Understanding of the topic is not apparent.
Uses at least three vocabulary words (or a form of the vocabulary words) from the lesson, and uses them all correctly.	Uses two vocabulary words (or a form of the vocabulary words) from the lesson, and uses them both correctly.	Uses one vocabulary word (or a form of the vocabulary word) from the lesson, and uses it correctly.	Does not use any vocabulary words, or uses vocabulary words incorrectly.

Scoring the Rubric

Here are two suggestions for scoring the final assignment rubric. Select the option that best meets your needs or develop your own grading system.

Option 1: This option provides one score for each submitted assignment.

Assign a score of 4 or below for the written response (first row of the rubric) and a score of 4 or below for the use of vocabulary (second row of the rubric), for a total maximum score of 8. The interpretation of scores is as follows:

Score	Grade	Narrative Interpretation
7-8	A	Excellent
5-6	B	Good
4	C	Adequate (Fair)
3 or below	D	Minimal

Option 2: This option provides two scores for each submitted assignment: one for written content and one for the use of key vocabulary. An advantage of separate scores is that you can weight students' comprehension and composition differently than you do their knowledge of vocabulary. It can also help you identify specific needs for future instruction.

Assign a score of 4 or below for the written response (first row of the rubric) and a score of 4 or below for the use of vocabulary (second row of the rubric) and then score them separately. The interpretation of scores is as follows:

Score	Grade	Narrative Interpretation
4	A	Excellent
3	B	Good
2	C	Adequate (Fair)
1	D	Minimal

The final grade may look like this: A/B (A for content and B for vocabulary use).