Activity 8: Are You Climate Literate?

What You Will Do: Play the Essential Principles Challenge

Big Idea

A climate-literate person understands the essential principles of Earth's climate system.

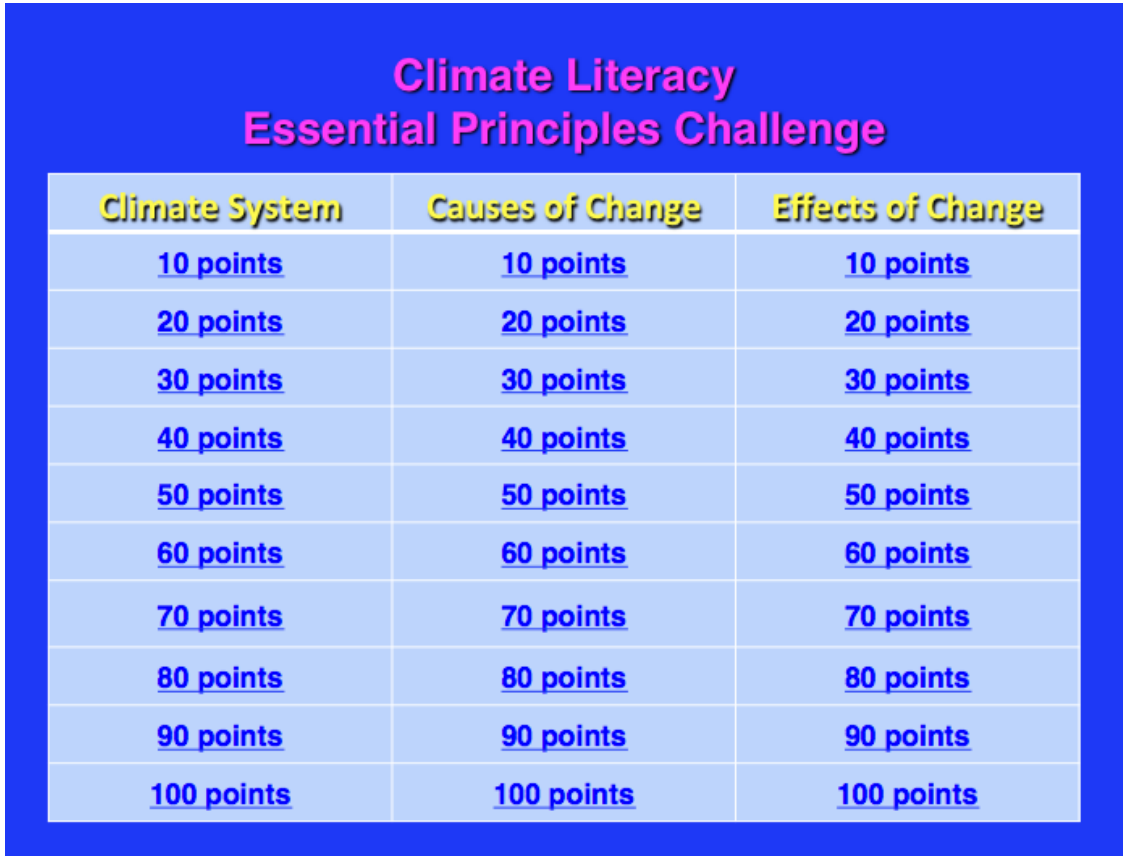
What You Will Need

- Copies of Essential Principles Challenge Cards (pages 33 and 34)
- Glue (spray glue or rubber cement is best)
- Scissors
- (Optional) desk bells or buzzer (see Step 6)
- (Optional) Copy of the Essential Principles Challenge PowerPoint® file (PrinciplesChallenge.ppt) downloaded from [*oceanservice.noaa.gov/education/discoverclimate/areyouclimateliterate.ppt*]
- (Optional) Computer with Microsoft PowerPoint® installed
- (Optional) One or more partners to play the game

Climate Science Literacy means understanding how you affect climate and how climate affects you and the society in which you live.

Why is Climate Science Literacy important? Because in the last 100 years, Earth's average global temperature increased more rapidly than at any other time in the last 10,000 years. In the 21st century, climate scientists expect temperature will continue to increase, probably even more than it did during the 20th century. Increasing global temperature is causing sea level to rise, and heat waves, droughts, and floods to become more frequent and intense. These changes will affect almost every aspect of human society, including economic prosperity, human and environmental health, and national security.

Scientific evidence indicates that human activities are the primary cause of the ongoing global temperature increase. Climate Science Literacy makes it possible for humans to take actions that can reduce climate change and its impacts.



Home screen from PrinciplesChallenge.pptx file.

A climate-literate person:

- Understands the essential principles of Earth's climate system;
- Knows how to assess scientifically credible information about climate;
- Communicates about climate and climate change in a meaningful way; and
- Is able to make informed and responsible decisions with regard to actions that may affect climate.

How It Works

The Essential Principles Challenge is a game based on "Climate Literacy—The Essential Principles of Climate Sciences," which can be downloaded from *http://oceanservice.noaa.gov/education/literacy.html*. The game can be played with the cards included in this activity, or as a PowerPoint®-based game that is somewhat similar to the television game show "Jeopardy." If you are familiar with the PowerPoint® program, you can change the question and answer slides to make your own version of the game.

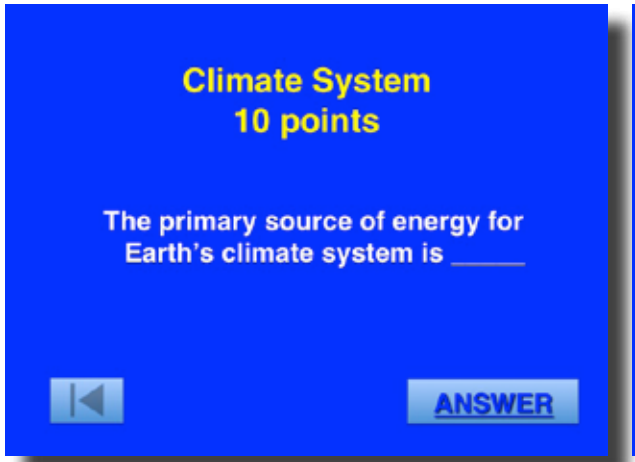
Some of the answers to Challenge questions can be found in this activity book, and all of them can be found in "Climate Literacy – The Essential Principles of Climate Sciences." Each of the answer cards and slides includes Web addresses where additional information can be found.

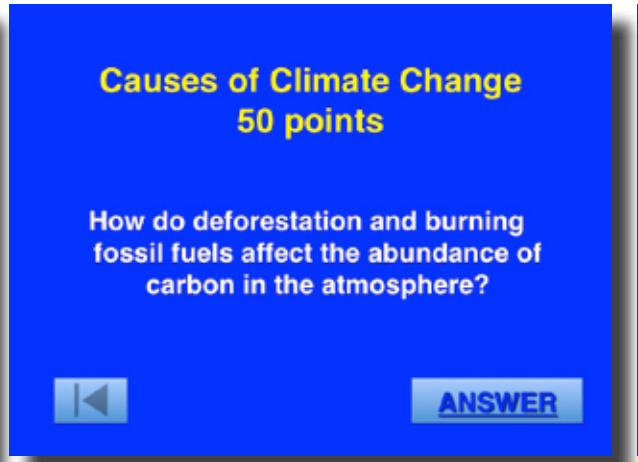
How to Do It

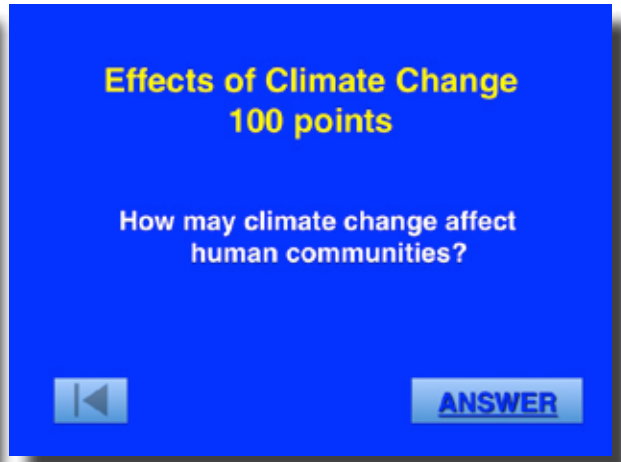
To play the Essential Principles Challenge with the cards included in this activity:

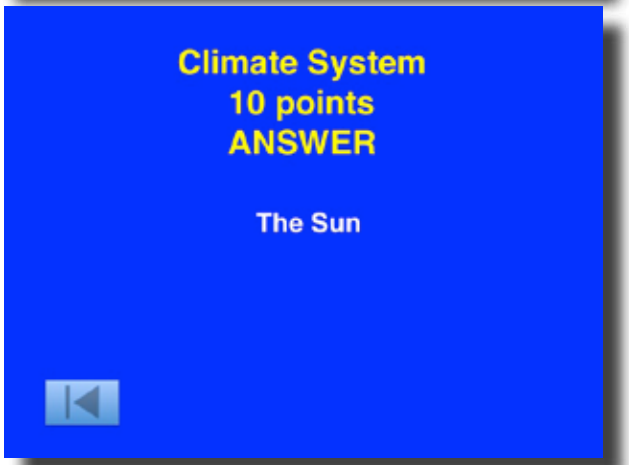
1. Glue the first two pages of the Essential Principles Challenge Cards back-to-back so that the 10 point "Climate System" question card is exactly behind the 10 point "Climate System" Answer card. Cut the cards apart along the dotted lines.

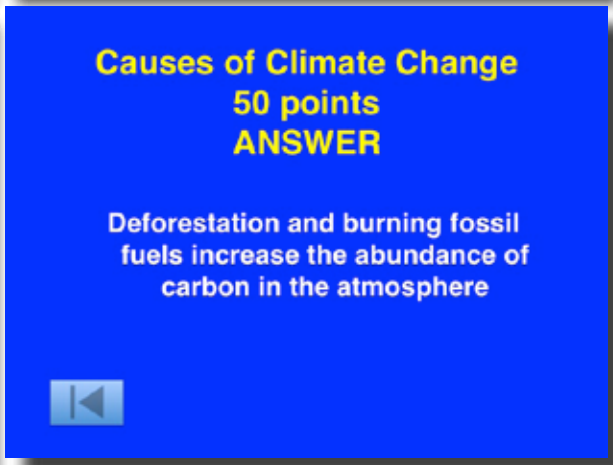
2. Glue the remaining two pages of the Essential Principles Challenge Cards back-to-back so that the 10 point "Effects of Climate Change" question card is exactly behind the 10 point "Effects of

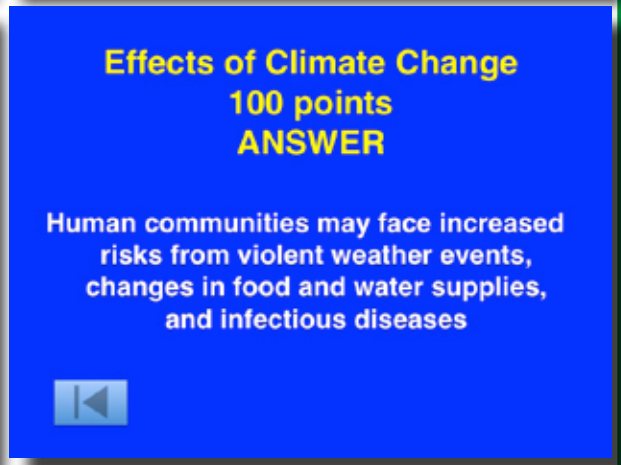












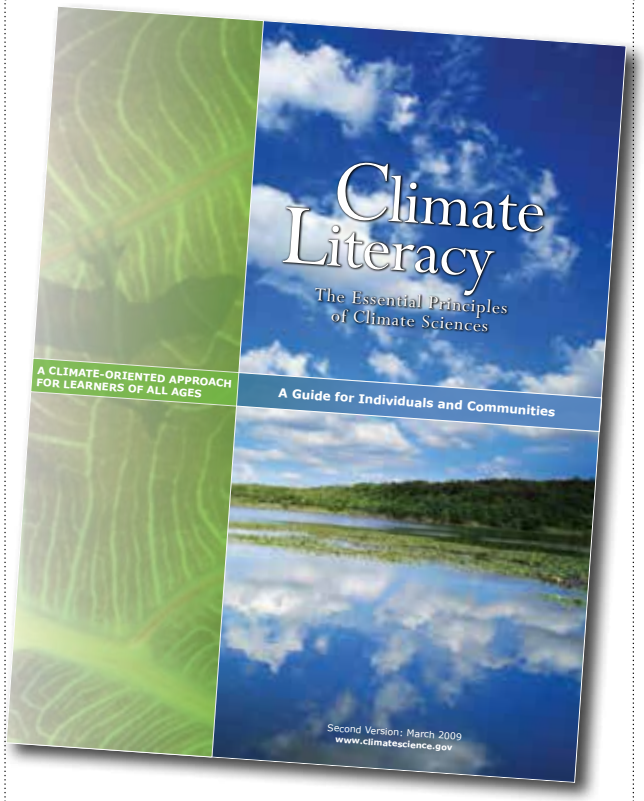
Climate Change" Answer card. Cut the cards apart along the dotted lines.

3. Arrange the cards so that the question sides are all facing up. Shuffle the cards.

4. If you are playing alone, read the question printed on each card, and decide on your answer. Look at the Answer side of the card to find out whether you are correct. Each correct answer is worth the number of points indicated on the card. Write down the number of points you earn for each card, and add these numbers when you have looked at all of the cards. Repeat this step to see if you can improve your score.

5. If you are playing with one or two partners, take turns drawing the top card and stating the answer. Use the Answer side of the card to decide whether a player's statements are correct, and how many points the player receives. When all of the cards have been read, add the points earned by each player to decide a winner.

6. You can also use these cards for a College Bowl type of competition between several players or several teams of players. For this version of the game, one person is the Host, and each player or team has a desk bell or buzzer. To begin the game, the Host reads a Question card and the first player or team to hit their bell or buzzer gets a chance to state the answer. If the answer is correct, the player or teams receives the number of points shown on the card. If the answer is not correct, the team that was second to hit their bell or buzzer gets a chance to answer. If no one provides a



correct answer, no points are awarded and the host moves on to the next card. This process continues until all of the cards have been used. The player or team with the greatest number of points is the winner!

To play the Essential Principles Challenge as a PowerPoint®-based game:

1. Open the PrinciplesChallenge.ppt file in Microsoft PowerPoint®, and select "View Slide Show" from the "Slide Show" drop-down menu.

2. You will see the Home screen, which has three columns labeled "Climate System," "Causes of Change," and "Effects of Change." In each column there are eight boxes labeled with a certain number of points. When you click on one of these labels, a new screen will appear with a question, a box labeled "ANSWER" in the lower right corner, and another box with a rewind icon in the lower left corner. If you click on the 'ANSWER" button a new screen will appear with the answer to the question. Clicking on the rewind icon will return to the Home screen. The ANSWER screens also have a rewind icon.

3. Before beginning a game, players should choose one of the following rules for when the game will end:
   a. When all of the questions have been answered; OR
   b. When each player has answered a certain number of questions from each column: OR
   c. When a certain amount of time has passed since the game started.

4. To play the game, players take turns choosing a question from one of the three columns on the Home screen. One player serves as scorekeeper, and records the number of points each player receives for a correct answer. The object of the game is to accumulate the greatest number of points. When the game ends according to the rule agreed upon in Step 3, the scorekeeper adds up the points earned by each player to decide the winner.

Note: Mention of commercial products or trade names does not imply endorsement by NOAA.

Climate System The primary source of energy for Earth's climate system is _____ **10**	**Climate System** Sunlight that reaches Earth may be reflected by **20**	**Climate System** When Earth emits the same amount of energy as it absorbs, what happens to Earth's average temperature? **30**
Climate System When Earth emits the same amount of energy as it absorbs, Earth's energy budget is _____ **40**	**Climate System** The annual cycle of seasons on Earth is the result of _____ **50**	**Climate System** How much of Earth's surface is covered by its ocean? **60**
Climate System True or False: The greenhouse effect is an abnormal condition caused by human activity. **70**	**Climate System** The minute-by-minute variable condition of the atmosphere on a local scale is called ___ **80**	**Climate System** What results from interactions that involve the Sun and Earth's ocean, atmosphere, clouds, ice, land, and life? **90**
Climate System Earth's systems are connected, and a change in one system can influence the entire system. What do we call interactions that amplify the effects of change? **100**	**Causes of Climate Change** A significant increase or decrease in the Sun's energy output will cause Earth to warm or cool. What do satellite measurements over the past 30 years show about the Sun's energy output? **10**	**Causes of Climate Change** What determines the amount of solar energy absorbed or radiated by Earth? **20**
Causes of Climate Change Which is NOT a greenhouse gas: Water vapor Carbon dioxide Methane, or Oxygen **30**	**Causes of Climate Change** Do small increases in carbon dioxide concentration in Earth's atmosphere make much difference to the climate system? **40**	**Causes of Climate Change** How do deforestation and burning fossil fuels affect the amount of carbon in the atmosphere? **50**

Effects of Climate Change What happens to organisms that are exposed to climate conditions outside their normal range? **10**	**Effects of Climate Change** What does evidence from tree rings and scientific observations suggest about Earth's present average temperature? **20**	**Effects of Climate Change** How is increasing atmospheric carbon dioxide affecting Earth's ocean? **30**
Effects of Climate Change The overwhelming consensus of scientific studies on climate indicates that most of the observed increase in global average temperatures in the last 30 years is due to ___ **40**	**Effects of Climate Change** Widespread burning of fossil fuels has increased the concentration of _____ in the atmosphere. **50**	**Effects of Climate Change** Do scientists and economists predict that there will be positive changes from global climate change? **60**
Effects of Climate Change How does global climate change affect fresh water resources? **70**	**Effects of Climate Change** What changes in Earth's ocean may be caused by melting ice sheets and glaciers? **80**	**Effects of Climate Change** How is weather predicted to change as a result of global climate change? **90**
Effects of Climate Change How may climate change affect human communities? **100**	**Causes of Climate Change** How do airborne particulates (aerosols) affect Earth's energy balance? **60**	**Causes of Climate Change** Over the last one million years, what caused the cycles of ice ages and warmer periods between them? **70**
Causes of Climate Change What natural processes reduce the amount of carbon in Earth's atmosphere? **80**	**Causes of Climate Change** How can life affect Earth's climate? **90**	**Causes of Climate Change** How long may greenhouse gases remain in Earth's atmosphere? **100**

Climate System **The average temperature remains stable (stays the same)** *http://earthguide.ucsd.edu/earthguide/diagrams/energybalance/* **ANSWER - 30**	**Climate System** **Earth's surface, clouds, and ice** *http://www.ipcc.ch/publications_and_data/ar4/wg1/en/faq-1-1.html* **ANSWER - 20**	**Climate System** **The Sun** *http://climate.nasa.gov/causes/* **ANSWER - 10**
Climate System **70%** *http://oceanservice.noaa.gov/education/pd/oceans_weather_climate/welcome.html* **ANSWER - 60**	**Climate System** **The tilt of Earth's axis** *http://www.crh.noaa.gov/fsd/?n=season* **ANSWER - 50**	**Climate System** **In balance** *http://earthguide.ucsd.edu/earthguide/diagrams/energybalance/* **ANSWER - 40**
Climate System **Earth's climate** *http://www.epa.gov/climatechange/students/basics/concepts.html* **ANSWER - 90**	**Climate System** **Weather** *http://www.epa.gov/climatechange/students/basics/concepts.html* **ANSWER - 80**	**Climate System** **False** **The greenhouse effect is a natural phenomenon that keeps Earth's surface at a temperature favorable to living organisms.** *http://www.epa.gov/climatechange/students/basics/today/greenhouse-effect.html* **ANSWER - 70**
Causes of Climate Change **The composition of Earth's atmosphere** *http://pa.gov/climatechange/students/basics/today/greenhouse-effect.html* **ANSWER - 20**	**Causes of Climate Change** **Changes in the Sun's energy output are too small to cause recent warming on Earth** *http://www.epa.gov/climatechange/students/scientists/ruled-out.html#one* **ANSWER - 10**	**Climate System** **Positive feedback loops** *http://www.epa.gov/climatechange/students/basics/today/greenhouse-gases.html* **ANSWER - 100**
Causes of Climate Change **Deforestation and burning fossil fuels increase the abundance of carbon in the atmosphere** *http://climate.nasa.gov/causes/* **ANSWER - 50**	**Causes of Climate Change** **Yes; small increases in carbon dioxide concentration have a large effect on the climate system** *education.usgs.gov/lessons/gases.pdf* **ANSWER - 40**	**Causes of Climate Change** **Oxygen** *http://www.epa.gov/climatechange/students/basics/today/greenhouse-gases.html* **ANSWER - 30**

Effects of Climate Change Increased dissolved carbon dioxide is causing the ocean to become more acidic. *http://www.epa.gov/climatechange/students/impacts/signs/acidity.html* **ANSWER - 30**	**Effects of Climate Change** Earth's average temperature is warmer than it has been for at least the past 1,300 years *http://www.epa.gov/climatechange/students/impacts/signs/temperature.html* **ANSWER - 20**	**Effects of Climate Change** The organisms will adapt, migrate, or die *http://www.epa.gov/climatechange/students/impacts/effects/ecosystems.html* **ANSWER - 10**
Effects of Climate Change Both positive and negative changes are predicted, but negative impacts are likely to be greater than positive impacts. *http://www.epa.gov/climatechange/students/impacts/effects/index.html* **ANSWER - 60**	**Effects of Climate Change** Greenhouse gases *http://www.epa.gov/climatechange/students/basics/today/index.html* **ANSWER - 50**	**Effects of Climate Change** Human activities, primarily burning fossil fuels *http://www.epa.gov/climatechange/students/basics/index.html* **ANSWER - 40**
Effects of Climate Change Strong storms, heat waves, and changes in precipitation patterns are predicted to increase in many locations *http://www.epa.gov/climatechange/students/impacts/signs/index.html* **ANSWER - 90**	**Effects of Climate Change** Sea level will rise, and changing temperatures may affect large current systems in Earth's ocean *http://www.epa.gov/climatechange/students/impacts/signs/glaciers.html* **ANSWER - 80**	**Effects of Climate Change** Changing precipitation patterns and temperatures will reduce access to fresh water for many people. Winter snow and glaciers that provide water are declining. *http://www.epa.gov/climatechange/students/impacts/effects/water.html* **ANSWER - 70**
Causes of Climate Change Ice ages are caused by gradual changes in Earth's rotation and orbit around the Sun *http://oceanservice.noaa.gov/education/pd/climate/factsheets/whatcause.pdf* **ANSWER - 70**	**Causes of Climate Change** Airborne particulates cause cooling by reflecting sunlight, and also cause warming by absorbing and releasing heat energy in the atmosphere *http://epa.gov/climatechange/science/causes.html* **ANSWER - 60**	**Effects of Climate Change** Human communities may face increased risks from violent weather, changes in food & water supplies,and infectious diseases *http://www.epa.gov/climatechange/students/impacts/effects/index.html* **ANSWER - 100**
Causes of Climate Change Greenhouse gases may remain in Earth's atmosphere for hundreds of years. *http://epa.gov/climatechange/science/future.html* **ANSWER - 100**	**Causes of Climate Change** By changing the chemical makeup of the atmosphere *www.nsf.gov/news/nsf09202/nsf09202_life.pdf* **ANSWER - 90**	**Causes of Climate Change** Accumulation of marine sediments and accumulation of plant biomass *http://www.epa.gov/climatechange/students/basics/today/carbon-dioxide.html* **ANSWER - 80**