Lesson 11: Answer Key

Tweet Claims Assessment Key

Allow your students to choose the modality for communicating their thinking. Offer oral administration to those students who would benefit from this modality. Guidance is provided depending on tweet options provided to students.

This assessment can be used to assess student progress on the LLPE. This LLPE is an integration of elements from the three dimensions.

11.B Construct an argument supported by science ideas to refute and clarify claims through an explanation of the causal chain of events between the changing climate and water resources.

SEPs	DCIs	CCCs
7.3 Construct, use, and/or present an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. Students work individually, in small groups, and as a class to construct a diagrammatic representation of how fossil fuels lead to changes in water resources. This knowledge is used to dissect a tweet as a class and determine claims being made by the author. The class works to create an oral and written argument (written down by the teacher) to refute inaccurate claims and provide clarifying explanations. During this assessment task, students use their knowledge of identifying claims to dissect a tweet and identify claims that are supported and refuted by the science ideas they have figured out. Students work to craft an argument to refute the claims by crafting an explanation of the inaccuracies made within the claim. Students also have the option of completing this assessment orally. Look for how students use evidence and science ideas to refute the claims that are not supported. Students should be able to clearly trace their argument to the science ideas from our Model Ideas list. Students may also bring in ideas from the first lesson set or other units to expand upon their reasoning that may or may not be included in the Model Ideas list. These ideas have been identified by a double plus sign below.	**ESS2.D** ~~Weather and~~ climate are influenced by interactions involving sunlight, the ocean, the atmosphere,~~ ice, landforms, and living things.~~ These interactions vary with ~~latitude, altitude, and~~ local and regional geography, all of which can affect oceanic and atmospheric flow patterns. **ESS3.D** Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). ~~Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding human behavior and applying that knowledge wisely in decisions and activities.~~ (MS-ESS3-5) **ESS3.C** Typically, as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth,~~ unless the activities and technologies involved are engineered otherwise~~. (MS-ESS3-3), (MS-ESS3-4) Students should use their understanding of Earth's carbon system and its effects on the water system to complete this assessment. Students should identify that the release of carbon dioxide (greenhouse gas) from human activities, such as the burning of fossil fuels (combustion), leads to increases in temperatures in the atmosphere by increasing greenhouse gases that absorb and re-emit energy in the atmosphere. This increase in temperature has ripple effects on the processes of evaporation, atmospheric flow patterns, and precipitation over various land forms and types. Students should identify that this trend has emerged with the use of fossil fuels and that the carbon dioxide imbalance will increase with consumption. Students should use these ideas to identify claims that need refuting and to explain the needed clarifications to each claim.	**2.1** Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. In this assessment students use their science ideas to refute claims that do not scientifically explain the causal relationship between human activities, the increase in carbon dioxide, the increase in temperatures, and changing climate. Students should make clear in their clarifications and explanations that human activities that release greenhouse gases are causing changes in our climate, and these changes are negatively affecting communities. Students should communicate these ideas specifically on the last question of this assessment, in writing explanations to clarify the inaccurate claims.

The scoring guidance provided below uses a + and ++ notation that can help you identify different ideas that students should (or could) include in their responses.

- If several of the ideas marked with a + are missing from a student's response, this may indicate that the student has not mastered the science ideas or that the student may be struggling to bring those ideas together in a written explanation or model. Additional probing of their thinking can provide insight about whether the student is struggling with a science practice or science idea or both.
- If all or almost all of the ideas marked with a + are present in a student's response, this may indicate that the student has mastered the science ideas and is able to use them in a written explanation or explanatory model.
- If the ideas marked with a ++ are present in a student's response, this indicates that the student is bringing a deeper understanding of the science ideas or a deeper engagement with the practice to their response. Students should not be marked off if ideas marked with a ++ are not present in their response.

Version 1: Social Media Post Assessment Key

Read the tweet above. Identify the claims in the tweet and record them in the space below.

- We are putting more carbon dioxide into the air.
- Carbon dioxide has nothing to do with climate change.
- Carbon dioxide has nothing to do with global warming (this may be combined with the statement above).
- Carbon dioxide has always been in our atmosphere.
- We have always had periods of droughts and floods.

Read the claims you have identified. What claims match our science ideas?

- We are putting more carbon dioxide into the air.
- We have always had periods of droughts and floods. (Note that this is true but is misleading as written. Do not count off if this claim is not listed in this section. While this claim could fall under this section of claims that match our science ideas, it should be identified by students in the next section of the assessment that asks for additional explanation or clarification.)

What claims **do not** match our science ideas and/or need to be explained or clarified?

- Carbon dioxide has nothing to do with climate change.
- Carbon dioxide has nothing to do with global warming (this may be combined with the statement above).
- Carbon dioxide has always been in our atmosphere.
- We have always had periods of droughts and floods.

Start by picking 2 claims from the list you created that **do not** match our science ideas and/or need to be explained or clarified. Rewrite the ones you pick below.

- Students should identify 2 claims from the above section.

Rewrite each claim that you have chosen so that they are scientifically accurate.

Each original claim identified above has been rewritten to reflect a version of the claim that is scientifically accurate. Students may phrase these ideas in different ways and should be counted correct if they contain the same general ideas.

- Carbon dioxide has nothing to do with climate change.
    - *should be changed to* Carbon dioxide is causing climate change *OR* Carbon dioxide is causing global warming, which causes climate change.
- Carbon dioxide has nothing to do with global warming.
    - *should be changed to* Carbon dioxide is causing global warming.
- Carbon dioxide has always been in our atmosphere.
    - *should be changed to* Carbon dioxide has always been in our atmosphere, and we have caused it to increase at a rate that is causing climate change.
- We have always had periods of droughts and floods.
    - *should be changed to* We have always had periods of droughts and floods, but the frequency, intensity, and severity of the droughts and floods are being worsened by climate change.

Look at your rewritten scientifically accurate claims. What evidence or model ideas do we have to support why these newly rewritten claims are more accurate than the original claim?

Each original claim has been broken down individually to show matching supporting evidence and science ideas below.

- Carbon dioxide has nothing to do with climate change.
    - Carbon dioxide traps energy and causes an increase in temperatures on average known as global warming.
    - Weather changes daily, while climate is a measure of average conditions over time. Climate change is the change in climate we are seeing due to the increase in temperatures.
    - The increase in temperatures causes evaporation rates to increase.
    - The extra evaporation dries some areas out more and causes droughts.
    - The dry areas get drier because they experience a decrease in precipitation due to increased temperatures.
    - The extra water moves to places that normally receive this water, and they get more precipitation than normal causing floods.
    - Because of the increase in temperatures, we are getting more frequent and intense floods and more droughts than before we added extra carbon dioxide to the atmosphere.
    - Climate has had minor changes over time, which we see from our ice core data, but the changes in climate we are experiencing now are occurring at much faster and more dramatic rates than what has happened in the past.
- Carbon dioxide has nothing to do with global warming.
    - Carbon dioxide traps energy and causes an increase in temperatures on average known as global warming.
- Carbon dioxide has always been in our atmosphere.
    - Carbon dioxide has had minor changes over time, which we see from our ice core data, but what we are experiencing now is a much more fast and dramatic change than what has happened in the past.
- We have always had periods of droughts and floods.
    - The increase in temperatures causes evaporation rates to increase.
    - The extra evaporation dries some areas out more and causes droughts.
    - The dry areas get drier because they experience a decrease in precipitation due to increased temperatures.
    - The extra water moves to places that normally receive this water, and they get more precipitation than normal causing floods.
    - Because of the increase in temperatures, we are getting more frequent and intense floods and more droughts than before we added extra carbon dioxide to the atmosphere.

Version 2: Social Media Post Assessment Key

Read the tweet above. Identify the claims in the tweet and record them in the space below.

- Fossil fuels and pollution are causing water cycle problems.
- Carbon dioxide is the problem.
- The increase in temperatures is not a problem.
- Flooding and droughts are increasing because of carbon dioxide.

Read the claims you have identified. What claims match our science ideas?

- Carbon dioxide is the problem.
- Flooding and droughts are increasing because of carbon dioxide.

What claims **do not** match our science ideas and/or need to be explained or clarified?

- Fossil fuels and pollution are causing water cycle problems.
- The increase in temperatures is not a problem.

++Flooding and droughts are increasing because of carbon dioxide. (This claim is only accepted for this clarification box if students claim that the carbon dioxide is increasing in the argument below. Recognizing that carbon dioxide has always been in the atmosphere may be a higher level connection than just stating carbon dioxide is a problem.)

Start by picking 2 claims from the list you created that **do not** match our science ideas and/or need to be explained or clarified. Rewrite the ones you pick below.

- Students should identify 2 claims from the above section.

Rewrite each claim you have chosen so that they are scientifically accurate.

Each original claim identified above has been rewritten to reflect a version of the claim that is scientifically accurate. Students may phrase these ideas in different ways and should be counted correct if they contain the same general ideas.

- Fossil fuels and pollution are causing water cycle problems.
  - *Should be changed to* The pollution of the atmosphere from carbon dioxide caused by the burning of fossil fuels causes water cycle problems.
- The increase in temperatures is not a problem.
  - *Should be changed to* The increase in temperatures is a problem for our carbon system and our water system.
- Flooding and droughts are increasing because of carbon dioxide.
  - *Should be changed to* Flooding and droughts are increasing because of global warming due to the increased carbon dioxide in the atmosphere.

Look at your rewritten scientifically accurate claims. What evidence or model ideas do we have to support why these newly rewritten claims are more accurate than the original claim?

Each original claim has been broken down individually to show matching supporting evidence and science ideas below.

- Fossil fuels and pollution are causing water cycle problems.
  - Fossil fuels emit carbon dioxide during combustion. The pollution is the carbon dioxide that is being added to the atmosphere.
  - The water cycle problems are caused by an increase in temperatures.
  - Carbon dioxide traps energy and causes an increase in temperatures on average known as global warming.
  - The increase in temperatures causes evaporation rates to increase.

    - The extra evaporation dries some areas out more and causes more frequent and intense droughts.
    - The dry areas get drier because they experience a decrease in precipitation due to increased temperatures.
    - The extra water moves to places that normally receive this water, and they get more frequent and intense precipitation than normal causing floods.
- The increase in temperatures is not a problem.
    - The increase in temperatures causes evaporation rates to increase.
    - The extra evaporation dries some areas out more and causes more frequent and intense droughts.
    - The dry areas get drier because they experience a decrease in precipitation due to increased temperatures.
    - The extra water moves to places that normally receive this water, and they get more frequent and intense precipitation than normal causing floods.
    - Increases in temperatures cause problematic changes to the water system.
- Flooding and droughts are increasing because of carbon dioxide.
    - Carbon dioxide existed in the atmosphere long before humans started to add extra amounts of carbon dioxide to the atmosphere. Floods and droughts are increasing because there is an increase in the carbon dioxide in the atmosphere.
    - Carbon dioxide traps energy and causes an increase in temperatures on average known as global warming.
    - The increase in temperatures causes evaporation rates to increase.
    - The extra evaporation dries some areas out more and causes more frequent and intense droughts.
    - The dry areas get drier because they experience a decrease in precipitation due to increased temperatures.
    - The extra water moves to places that normally receive this water, and they get more frequent and intense precipitation than normal causing floods.

Alternate Tweet Key

This tweet is an alternate tweet that could be used if a third option is needed. This tweet could be used for future reassessment or as an alternate to the *Version 1: Social Media Post Assessment* tweet if it is preferred by students. Note that, if this tweet is used, the tweet will need to be added to an assessment handout for student use.

Read the tweet above. Identify the claims in the tweet and record them in the space below.

- Climate change is not a big deal.
- Climate will eventually balance out.
- The trees will pull the carbon dioxide out of the atmosphere.
- The frequency and severity of droughts is starting to decrease.
- Carbon dioxide helps to stabilize temperatures.

Read the claims you have identified. What claims match our science ideas?

- None

What claims **do not** match our science ideas and/or need to be explained or clarified?

- Climate change is not a big deal.
- Climate will eventually balance out.
- The trees will pull the carbon dioxide out of the atmosphere.
- The frequency and severity of droughts is starting to decrease.
- Carbon dioxide helps to stabilize temperatures.

Start by picking 2 claims from the list you created that **do not** match our science ideas and/or need to be explained or clarified. Rewrite the ones you pick below.

- Students should identify 2 claims from the above section.

Rewrite each claim that you have chosen so that they are scientifically accurate.

Each original claim identified above has been rewritten to reflect a version of the claim that is scientifically accurate. Students may phrase these ideas in different ways and should be counted correct if they contain the same general ideas.

- Climate change is not a big deal.
  - *Should be changed to* Climate change is causing large problems with our water cycle.
- Climate will eventually balance out.
  - *Should be changed to* Climate change will continue to get worse unless we change our combustion habits.
- The trees will pull the carbon dioxide out of the atmosphere.
  - *Should be changed to* Trees pull carbon dioxide out of the atmosphere, but the photosynthesis rate is much lower than the rate of respiration and combustion.
- The frequency and severity of droughts is starting to decrease.
  - *Should be changed to* Droughts and floods are increasing in intensity, frequency, and severity.

Model Ideas List

1. Normal precipitation = long-term trends in total amount, timing, intensity, and type of precipitation.
2. Precipitation during individual years may be different from the long-term trend and this is normal.
3. Not normal precipitation is a trend toward a change in precipitation that is outside of a typical range for a place.
4. Climate is a measure of weather conditions for an area over a long period of time.
5. ↑ temperatures = ↑ evaporation rates = ↑ water vapor in atmosphere.
6. Wet areas = ↑ evaporation; dry areas = ↓ evaporation.
7. ↑ temperature & wind affects where/how much precipitation falls.
8. ↑ temperature the type of precipitation that falls.
9. Changes to sources of water affect communities in different ways.
10. A small change in temperature in the atmosphere has big changes in Earth's water system.

- Carbon dioxide helps to stabilize temperatures.
    - *Should be changed to* Carbon dioxide is causing an increase in global temperature.

Look at your rewritten scientifically accurate claims. What evidence or model ideas do we have to support why these newly rewritten claims are more accurate than the original claim?

Each original claim has been broken down individually to show matching supporting evidence and science ideas below.

- Climate change is not a big deal.
    - Climate change is a big deal because it is affecting many lives negatively.
    - Data from our past lessons show that there is an increase in droughts and floods frequency, intensity, and severity that is affecting cities everywhere.
    - The increase in temperatures causes evaporation rates to increase.
    - The extra evaporation dries some areas out more and causes more frequent and intense droughts.
    - The dry areas get drier because they experience a decrease in precipitation due to increased temperatures.
    - The extra water moves to places that normally receive this water, and they get more frequent and intense precipitation than normal causing floods.
- Climate will eventually balance out.
    - The climate will not eventually balance out.
    - According to our carbon system model, the trees cannot pull that much carbon dioxide out of the atmosphere. We are adding carbon dioxide at a much higher rate than the trees are absorbing it.
    - Our combustion of carbon dioxide is adding more than the natural system can balance out.
- The trees will pull the carbon dioxide out of the atmosphere.
    - According to our carbon system model, the trees cannot pull that much carbon dioxide out of the atmosphere. We are adding carbon dioxide at a much higher rate than the trees are absorbing it.
- The frequency and severity of droughts is starting to decrease.
    - The increase in temperatures causes evaporation rates to increase.
    - The extra evaporation dries some areas out more and causes more frequent and intense droughts.
    - The dry areas get drier because they experience a decrease in precipitation due to increased temperatures.
    - The extra water moves to places that normally receive this water, and they get more frequent and intense precipitation than normal causing floods.
- Carbon dioxide helps to stabilize temperatures.
    - Carbon dioxide traps energy and causes an increase in temperatures on average known as global warming.