Climate Change (Pre)(Post) Test

Last Name, first: _____ Date _____

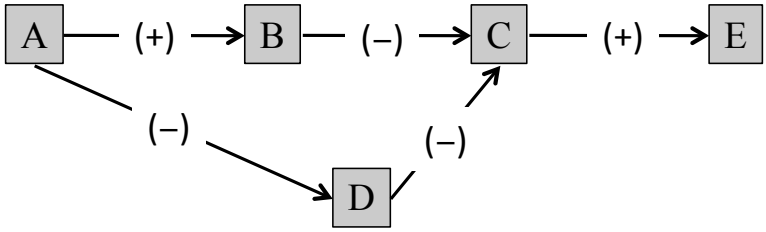
Teacher: _____ Class Period ____

The purpose of this test is to find out what you know about climate change.

Please answer all of the questions. If you aren't sure about an answer just put your best guess.

Thank you – working with you we hope we can find better ways to help you learn about science!

Causal Reasoning Questions



Use the concept map above to answer questions 1-6.

1. **If A *increased*, what would happen to B?**

   ☐ It would increase, ☐ It would decrease, or ☐ No change or no effect

2. **If B *increased*, what would happen to C?**

   ☐ It would increase, ☐ It would decrease, or ☐ No change or no effect

3. **If B *decreased*, what would happen to E?**

   ☐ It would increase, ☐ It would decrease, or ☐ No change or no effect

4. **If D *increased*, what would happen to E?**

   ☐ It would increase, ☐ It would decrease, or ☐ No change or no effect

5. **If A *increased*, what would happen to C?**

   ☐ It would increase, ☐ It would decrease, or ☐ No change or no effect

6. **Write out step by step in words. If A *decreased*, what would happen to E?**

If A decreases then B decreases. If B decreases then ….._____

_____

_____

(Fill in the rest).

biswas 12/25/10 1:38 PM
Comment [1]: Simple: One link +

Answer: Increase

biswas 12/25/10 1:38 PM
Comment [2]: Simple: One link –

Answer: Decrease

biswas 12/25/10 1:39 PM
Comment [3]: Two links: - + start: +

Answer: Increase

biswas 12/25/10 1:39 PM
Comment [4]: Two links -- + start: -

Answer: Decrease

biswas 12/25/10 1:40 PM
Comment [5]: Two paths – aggregation

Answer: No change

biswas 12/25/10 1:42 PM
Comment [6]: Two paths aggregation then project to next concept. Write out reasoning in words.

Answer: No change

A decreases; B decreases; C increases; E increases
A decreases; D increases; C decreases; E decreases

Two paths – One says E increases, other says E decreases. Net effect: no change in E,

Knowledge of Climate Change

Part 1 – Multiple choice questions

7. **What is the greenhouse effect?**
   a. **The atmosphere of the earth traps some radiated heat energy and reflects it back to the earth. This makes the earth warmer.**
   b. The atmosphere of the earth is reflective and keeps sunlight away from the earth's surface. This light reflection keeps the earth from getting too hot.
   c. The atmosphere acts like a magnifying glass. This makes the light stronger and makes the earth hotter.
   d. The atmosphere traps pollution from cars and factories. Over time, the air will become more polluted and the earth will get warmer.

biswas 12/25/10 11:46 AM
Comment [7]: General definition. Primary concept of study. Tests general understanding of topic.

8. **Light from the sun is absorbed by the earth and the atmosphere as light energy. What is the relation between absorbed light energy and absorbed heat energy?**
   a. **Absorbed light energy increases the amount of absorbed heat energy.**
   b. Absorbed light energy decreases the amount of absorbed heat energy.
   c. Absorbed light energy does not change the amount of absorbed heat energy.
   d. Absorbed light energy is the same as absorbed heat energy.

biswas 12/25/10 11:18 AM
Comment [8]: Concept map: one link answer

9. **When you think of water vapor in the clouds how does condensation of water vapor affect precipitation?**
   a. Condensation and precipitation are not related.
   b. A decrease in condensation should increase precipitation.
   c. **An increase in condensation should increase precipitation.**
   d. A decrease in condensation may increase or decrease precipitation.

biswas 12/25/10 11:19 AM
Comment [9]: Concept map: one link

10. **When you think of landfills what is the primary greenhouse gas that comes to mind?**
    a. Carbon dioxide
    b. **Methane**
    c. Oxygen
    d. All of the above

biswas 12/25/10 11:20 AM
Comment [10]: Concept map: one link (indirect)

11. **How does vegetation affect the amount of carbon dioxide in the atmosphere?**

biswas 12/25/10 11:48 AM
Comment [11]: Concept map: one link; also checks understanding of photosynthesis process.

a. Vegetation produces carbon dioxide through the process of photosynthesis, which increases the amount of carbon dioxide in the atmosphere.

b. Vegetation releases water vapor through the process of photosynthesis. The vapor bonds with carbon dioxide, which reduces the amount of carbon dioxide in the atmosphere.

c. Vegetation absorbs carbon dioxide as part of the process of photosynthesis, which reduces the amount of carbon dioxide in the atmosphere.

d. Vegetation produces oxygen because of photosynthesis, but it does not affect the amount of carbon dioxide in the atmoshpere.

12. Why does a change in carrying capacity affect precipitation?

biswas 12/25/10 11:21 AM
Comment [12]: Concept map: two links

a. If carrying capacity of the atmosphere increases, its ability to hold moisture also increases. If the ability of the atmosphere to hold moisture increases, it is easier to make it condense, so the amount of precipitation will increase.

b. **If carrying capacity of the atmosphere increases, its ability to hold moisture also increases. If the ability of the atmosphere to hold moisture increases, it is harder to make it condense, so the amount of precipitation will decrease**.

c. If carrying capacity of the atmosphere increases, its ability to hold moisture decreases. If the ability of the atmosphere to hold moisture decreases, it is easier to make it condense, so the amount of precipitation will increase.

d. If carrying capacity of the atmosphere increases, the temperature of the air increases. If the temperature of the air increases, it is harder to make the moisture in the air condense, so the amount of precipitation will decrease.

13. How does an increase in carbon dioxide affect sea ice?

biswas 12/25/10 11:29 AM
Comment [13]: Concept map: 4 links

a. Carbon dioxide, a greenhouse gas, is absorbed by sea ice. This decreases the melting point of sea ice and less sea ice melts.

b. Carbon dioxide is a greenhouse gas, which reflects heat radiated from the earth back to earth. This radiation keeps the earth cool, and so it decreases the amount of sea ice that melts.

c. Carbon dioxide is a greenhouse gas that forms a shield around the earth. This protects solar energy from heating the ice caps, so less sea ice melts.

d. **Carbon dioxide is a greenhouse gas, which reflects heat radiated from the earth back to earth. The trapped radiation increases the earth's temperature, and so it increases the amount of sea ice that melts.**

14. Why does driving more cars result affect global temperature?

biswas 12/25/10 11:44 AM
Comment [14]: Concept map: 5 links; but the explanations skips absorbed heat energy so only 4 links used.

a. Car engines run hot. This increases the surrounding temperatures. The more cars we drive the higher the global temperature.

b. Cars burn fossil fuels, which emits carbon dioxide, a greenhouse gas. Greenhouse gases act as a shield, and prevent solar energy from entering the earth's atmosphere. This reduces global temperature.

c. **Cars burn fuels, which emits carbon dioxide, a greenhouse gas. Greenhouse gases act as a reflector, and prevent radiated heat energy from escaping from the earth's atmosphere. This increases global temperature.**

d. Cars burn fossil fuels, which emit carbon dioxide, a greenhouse gas. But the carbon dioxide cools quickly, and it does not affect the global temperature.

15. How is an increase in the earth's temperature due to the greenhouse effect changing our climate?

a. Increasing temperatures on the earth are melting sea ice, and this is cooling the earth.

b. Rising temperatures on the earth are helping vegetation grow. More vegetation means more shade, and cooler climates.

c. Rising temperatures on the earth are increasing condensation. This is making our winters longer.

d. Rising temperatures on the earth are causing more flooding in the coastal areas and drought in inland areas.

16. How is recent human activity contributing to increases in the greenhouse effect?

a. We are becoming more conscious and recycling more of our waste. Less waste means smaller landfills, therefore, less greenhouse gases. Less greenhouse gases means less heat trapped by the earth's atmosphere, and therefore, an increased greenhouse effect.

b. We are clearing forests in some areas of the world to create agricultural land. Crops grown for agriculture do not contribute to photosynthesis. So, replacing forests by agricultural land directly contributes to the greenhouse effect.

c. Human activities, such as driving more cars, building more factories, and producing more garbage are creating more greenhouse gases. More greenhouse gases cause more sea ice to melt. Melting ice cools the earth and this increases the greenhouse effect.

d. We are driving more cars, building more factories, and producing more garbage that goes into our landfills. All of these activities produces more greenhouse gases and they increase the greenhouse effect.

biswas 12/25/10 11:45 AM
Comment [15]: General overview question – maybe inferred from concept map but the choices reflect overall effect not "chain of events" reasoning. Tests general understanding of topic.

biswas 12/25/10 12:02 PM
Comment [16]: Tricky question – should we keep this one?

May also be considered an overview question. Tests their ability to read as much as their understanding. Have to choose the answer that has no incorrect statement.

Maybe useful in terms of their thinking of their bigger challenge problem.

biswas 12/25/10 11:54 AM
Comment [17]: Problem here: less landfills → increased greenhouse effect. Issue: incorrect defn. of greenhouse effect,

biswas 12/25/10 11:59 AM
Comment [18]: Made things a little more obvious from the original choice. Now there is clearly an incorrect statement that is easy to identify.

biswas 12/25/10 12:00 PM
Comment [19]: Error here – melting ice cooling the earth, therefore, increased greenhouse effect. The final conclusion is right, but the reasoning step listed above is wrong.

biswas 12/25/10 12:01 PM
Comment [20]: Correct answer

Part 2 – Short Answer Questions

17. We now know that deforestation, i.e., cutting of a large number of trees increases global temperature.

Can you clearly list step-by-step the chain of events that explains how deforestation increases global temperature.

_____

_____

_____

_____

_____

_____

biswas 12/25/10 12:07 PM

Comment [21]: Can be directly inferred by long chain of reasoning from map.

The challenge in addition to the long chain of reasoning is for the students to write down this reasoning in words.

Answer steps when reasoning with expert map: Cutting down trees → decreased vegetation → less CO2 absorbed (decreased photosynthesis) → more heat reflected back to earth by CO2, a greenhouse gas → more heat energy absorbed by the earth → increase in global temperatures.

Question for James and Babs: How would you grade such a question?

18. Scientists and engineers have invented exciting new ways to make more affordable powerful batteries! This makes it possible for more people to use electric cars, instead of regular cars that use gasoline and produce carbon dioxide.

Please explain, step-by-step, how this invention could influence the earth's climate.

_____

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_____

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_____

biswas 12/25/10 12:17 PM

Comment [22]: This is a long question, covers most of the map. It also has indirect common sense knowledge components. Use of electrical cars implies less use of fossil fuels and, therefore, less CO2 produced.

Rest can be directly inferred from structure of map. Like last question, however, student has to describe the chain of reasoning in words.

Start with electric cars will burn less fossil fuels.

Rest from map:
Less fossil fuels burned → less CO2 produced → less heat reflected back to earth → less absorbed heat energy → decrease in global temperature → less sea ice melting → less rise in ocean levels → less chance of flooding.

Similarly, decrease in global temperature → decreased carrying capacity → more condensation → more precipitation → less drought.

Question for James and Babs: If you were to ask students such a question in a test, how would you grade the question?

Name:_____ **Date:_____**

Using Betty's Brain

In the following questions, please answer as best as you can. Please use complete sentences.

1. **While you are teaching your student in Betty's Brain, you ask your student a question. Why is it good to ask your student questions?**

   _____

   _____

2. **If your student got the question right, what do you know about the links your student used to answer the question?**

   _____

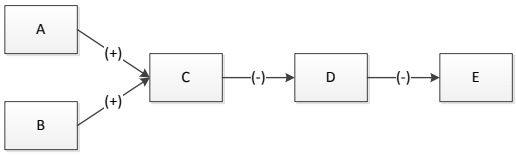
   _____

3. **If your student got the question wrong, what might be wrong with the map that your student used to answer the question? (Hint: There is more than one correct answer to this question. List as many as you can)**

   _____

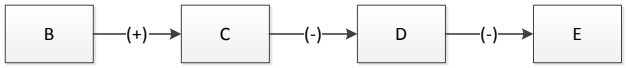
   _____

4. **Your student's current concept map is:**



She took a quiz and got some questions right and others wrong. You asked her to explain one of her right answers, and she used this chain of links:

When you asked her to explain one of her wrong answers, she used this chain of links:



Which links should you check to see if they are right, and why?

_____

_____

5. **If you are not sure about one of the links you taught your student, how can you check to see if it is right?**

   _____

   _____