

DRK-12 Carbon Assessment, Form C

Fall, 2011

Please don't include this first sheet in student copies.

This assessment is designed to elicit middle school or high school students' accounts of carbon-transforming processes.

Items 3, 5, 6, 12, and 15 were developed by AAAS Project 2061 and are available on their assessment website: <http://assessment.aaas.org/>.

This assessment was developed with support from the National Science Foundation, Grant number DRL 1020187: A Learning Progression-based System for Promoting Understanding of Carbon-transforming Processes. Prior development of some items was supported by grants from the National Science Foundation: Learning Progression on Carbon-Transforming Processes in Socio-Ecological Systems (NSF 0815993), and Targeted Partnership: Culturally relevant ecology, learning progressions and environmental literacy (NSF-0832173), and CCE: A Learning Progression-based System for Promoting Understanding of Carbon-transforming Processes (DRL 1020187). Additional support comes from the Great Lakes Bioenergy Research Center. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation or the United States Department of Energy.

Teacher: _____ Period: _____ Date: _____ Your Initials: _____

Form C—Introduction

This test will not affect your grade, but it is important. Your teacher is participating in a research project focusing on science learning. We are trying to learn how to teach science better. You can help us by answering these questions and explaining your ideas carefully.

Practice Question

You will have several questions on this test that ask you to make two different choices about something. This is a practice question to help you understand how you should answer those questions. Try doing this practice question, then talk with your teacher if you have questions about it.

This question is about the 25 letters below:

A A A A A
A B A A B
A B A d A
A B A A A
A A A A E

Which of the following statements is true? Circle the letter of the correct answer.

- a. ALL of the letters are capital letters, OR
- b. SOME of the letters are lower case letters.

Circle the best choice to complete each of the statements about the capital letters.

How many of the capital letters are A's?	All or most	Some	None
How many of the capital letters are B's?	All or most	Some	None
How many of the capital letters are C's?	All or most	Some	None
How many of the capital letters are E's?	All or most	Some	None

Correct answers

Did you answer the questions this way?

Which of the following statements is true? Circle the letter of the correct answer.

- a. ALL of the letters are capital letters, OR
- b. SOME of the letters are lower case letters.

Note that you have to choose either a or b.

Circle the best choice to complete each of the statements about the colored rectangle.

How many of the capital letters are A's?	All or most	Some	None
How many of the capital letters are B's?	All or most	Some	None
How many of the capital letters are C's?	All or most	Some	None
How many of the capital letters are E's?	All or most	Some	None

Note that you can make a different choice for each color

Teacher: _____ Period: _____ Date: _____ Your Initials: _____

1. A mature oak tree can have a mass of 500 kg, or more, even after all the water in the tree is removed. Yet it starts from an acorn that weighs only a few grams. Where did this huge increase in mass come from?



Which of the following statements is true? Circle the letter of the correct answer.

- a. ALL of the increase in mass came from matter that was originally outside the tree, OR
- b. SOME of the increase in mass came from matter that the tree made as it grew.

Circle the best choice to complete each of the statements about possible sources of mass from outside the tree.

How much of the dry mass comes from the AIR?	All or most	Some	None
How much of the dry mass comes from SUNLIGHT?	All or most	Some	None
How much of the dry mass comes from WATER?	All or most	Some	None
How much of the dry mass comes from SOIL NUTRIENTS?	All or most	Some	None

Explain your choices. How does the oak tree gain mass as it grows?

2. A scientist is investigating plant growth. She planted seeds in soil with different fertilizers. She weighed the seeds and the containers full of soil. After two months she wants to know which plants have grown the most.

Which is the **best** way to measure the growth of the plants?

- a) measure each plant's height
- b) weigh each plant in its container
- c) remove the soil from each plant's roots, dry the entire plant and weigh it
- d) measure the number and size of each plant's leaves

Explain your choice. Why is the method you chose better than the others?

3. As an animal grows, what happens to the food that it eats?

- a. All of the food is changed into waste that leaves the animal's body.
- b. All of the food is changed into energy in the animal's body and so the food is used up.
- c. Some of the food is changed into energy, and the rest leaves the animal's body as waste.
- d. Some of the food is changed into new substances that become part of the animal's body.

Teacher: _____ Period: _____ Date: _____ Your Initials: _____

4. Suppose you are doing an investigation of how a plant uses different materials (such as water, air, and soil minerals) when it grows. You start with seeds. If you have to choose **ONLY ONE** method to measure how much the plants in your investigation have grown after a month, which method do you think would be best?

- a. Measure the height of the plants.
- b. Count the number of leaves on the plants.
- c. Measure the weight of the plants.



Explain your answer. Why is your method better than the others?

5. When a mouse is alive it has energy stored in its living parts (muscles, fat, blood, etc.). When the mouse dies all the parts are still there, but no longer alive. How much of the energy stored in the living mouse is still there in the dead mouse?

- a. ALL of the energy
- b. MOST of the energy
- c. SOME of the energy
- d. A LITTLE of the energy
- e. NONE of the energy



Explain your answers.

What kinds of energy are stored in the living mouse? Where did they come from?

What kinds of energy are stored in the dead mouse (if any)? How are they connected to the energy in the living mouse?

6. Here are four explanations for how food contributes to people's body heat. Choose the explanation that you think is **BEST**, and explain why you like it more than the others:

- a. We use food for activities like running and walking, and those activities warm us up.
- b. When we eat hot food, the heat in the food makes us warm.
- c. We convert energy stored in the food to heat energy.
- d. Our bodies burn the food and transform it into heat.

Explanation: Why do you like your choice better than the others?

Teacher: _____ Period: _____ Date: _____ Your Initials: _____

7. Which of the following describes how energy is transferred between the sun and a tree
- a. Energy is transferred as light is radiated from the sun and directly absorbed by the tree.
 - b. Energy is transferred as an electrical current travels from the sun to the tree.
 - c. Energy is transferred as thermal energy is given off from the sun and directly absorbed by the tree.
 - d. Energy is not transferred between the sun and the tree.

8. A student places a living plant in a jar and seals it so nothing can get in or out. He determines the total mass of the jar and everything inside it. Several weeks later, the plant is dead.

What will happen to the total mass of the jar and everything inside it after the plant dies?

- a. The mass will stay the same.
- b. The mass will increase.
- c. The mass will decrease.
- d. It depends on the type of plant.

9. A scientist started sorting materials into two groups. Here are the first materials that she put into each group:

Group A: Gasoline, alcohol, wood

Group B: Sand, water, steel

a. Which group would you put these materials in?

Salt	Group A	Group B
Sugar	Group A	Group B
Pork	Group A	Group B
Carbon dioxide	Group A	Group B
Soil minerals that help plants grow	Group A	Group B
Leaves of a living tree	Group A	Group B

. Explain how you decided. How are the materials in Group A different from the materials in Group B?

c. Is there a different way of grouping the materials that makes more sense to you? YES NO

d. Explain your answer. How would you group the materials differently, or why do you like these groups?

10. Milk contains water, carbohydrates, proteins, minerals, and fat. Is milk food for people?

- a. No, because liquids cannot be food, and milk is a liquid
- b. No, because for something to be food it must provide both energy and building materials, and milk does not provide energy
- c. Yes, because for something to be food it must provide energy, and the minerals in milk provide energy
- d. Yes, because food is a source of energy and building materials, and milk provides energy and building materials

Teacher: _____ Period: _____ Date: _____ Your Initials: _____

11. A student was studying how mice grow. He collected these data:

Mass of mouse at the beginning of the experiment: 50 g

Mass of mouse one week later: 60 g

Mass of water that the mouse drank: 30 g

Mass of food that the mouse ate: 30 g

The student said, "The food and the water weighed the same amount, so growing mice get half of their weight from food and half from water."

Do you think that the student's conclusion is correct? Yes No

Explain your reasoning. Why is the student's conclusion correct or incorrect?

12. Two boys were having an argument about what a candle flame needs in order to burn:

John: The flame needs air to burn.

Sandy: The flame just needs one of the gases in air to burn: oxygen.

Describe an experiment you could do that would provide evidence about which boy is right.

What results would show that John is right?

What results would show that Sandy is right?

13. Is water a source of food for plants and animals? Why or why not?

- a. Yes, because food is anything that is needed by plants and animals, and water is needed by plants and animals
- b. Yes, because food is anything that provides energy to plants and animals, and water provides energy to plants and animals
- c. No, because liquids cannot be food for plants and animals, and water is a liquid
- d. No, because food must contain molecules that have carbon atoms linked to other carbon atoms, and water molecules do not have carbon atoms linked to other carbon atoms

Teacher: _____ Period: _____ Date: _____ Your Initials: _____

14. When a baby was five months old, she weighed 8 kg. After 7 years, the baby has grown into a big girl, weighing 25 kg. Where did her increase in mass come from?



Which of the following statements is true? Circle the letter of the correct answer.

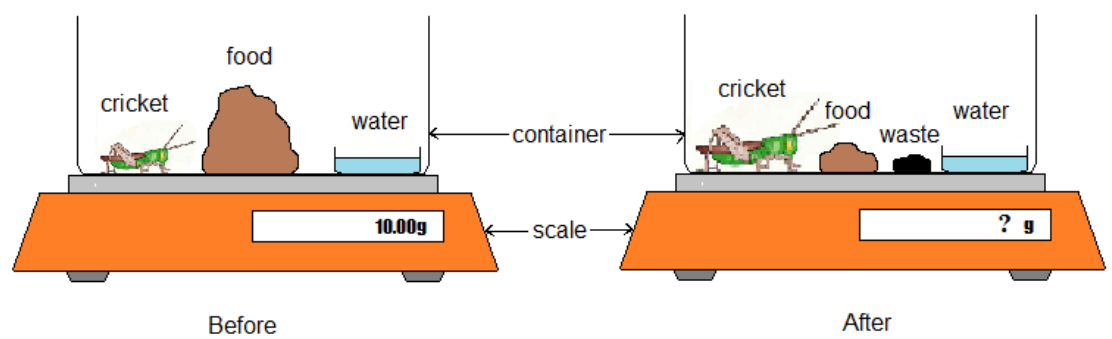
- a. ALL of the mass came from matter that was originally outside the girl, OR
- b. SOME of mass came from matter that the girl made as she grew.

Circle the best choice to complete each of the statements about possible sources of mass from outside the girl.

How much of the girl's mass came from the AIR?	All or most	Some	None
How much of the girl's mass came from SUNLIGHT?	All or most	Some	None
How much of the girl's mass came from WATER?	All or most	Some	None
How much of the girl's mass came from FOOD?	All or most	Some	None

Explain your choices. How does the girl gain mass as she grows?

15. The following is an experiment regarding animal growth.



What is your prediction of the outcome of this experiment? Suppose we put a cricket in a container with plenty of food and make sure that it always has the same amount of water. Nothing can get in or out of the container except gases and water. At the beginning of the experiment, the container with cricket, water, and food weighs exactly 10 g.

At the end of the experiment, the cricket has eaten some of the food and gotten bigger. Some of the cricket's waste (feces or poop) is also in the container. How much would you expect the container (with cricket, food, water, and waste) to weigh?

- a. More than 10 g.
- b. Still exactly 10 g.
- c. Less than 10 g.

Explain the reason for your prediction.