Name _____ Teacher _____ Date _____

6.4 Grading Plants Unit Posttest

This posttest is the same as the Plants Unit Pretest (Activity 1.1). The file "1.1_Assessing_the_Plants _Unit_Pretest" explains how the unit pretest can be used for formative assessment, providing insight into students' reasoning using the Learning Progression Framework. This file explains how the posttest can be used for grading, holding students accountable for the ideas that they have studied in the Plants Unit.

*Correct responses are in **bold blue italics** below. Red italics suggest ways to grade student responses by giving them points for correct or partially correct answers.*

These are difficult questions, so even the most sophisticated reasoners will miss a few of them. You should decide how to translate the number of points that students earn into grades for report cards. Here are some ideas about levels of points that represent excellent, good, and adequate performance.

Total possible: 33 points	***For higher demand high school courses***	***For middle school or lower demand high school courses***
Excellent	*27 points (~80%)*	*23 points (~70%)*
Good	*23 points (~70%)*	*20 points (~60%)*
Acceptable	*20 points (~60%)*	*16 points (~50%)*

1. The dry wood from a large oak tree can weigh 10,000 pounds. Where do you think the dry wood of an oak tree comes from?

a) Select True or False for the following statements.

		Some of the dry wood:
True	***False***	*is created by the tree.*
True	False	*comes from the air.*
True	***False***	*comes from sunlight.*
True	***False***	*comes from water.*
True	False	*comes from soil nutrients.*

1 point for correctly answering each line. 5 points total. Note there are two possible correct answers for water.

b) Which ONE of the following do you think provides the MOST mass to the dry wood of the tree?

a. Mass created by the tree

b. Air

c. Sunlight

d. Water

e. Soil nutrients

1 point for correct answer.

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c) Explain your choices. Where do you think the dry wood of an oak tree comes from?

Level 4 responses recognize that leaves transform CO_2/air into glucose (through photosynthesis), which is used as a building block for the tree's growth. Level 4 responses recognize that roots take in nutrients (like nitrogen) and/or water from the soil, which provides a small amount of mass to the tree.

1 point for correct answer.

d) How do you think MOST of the matter got into the oak tree? Select ONE of the following:

a. Most of the matter came in through the tree's roots.

b. Most of the matter came in through the tree's leaves.

c. The growing tree made most of the matter when its cells divided to make new cells.

1 point for correct answer.

e) Explain your choice. Why did you choose the answer you did about how most of the matter got in the oak tree?

Level 4 responses recognize that leaves transform CO_2/air into glucose (through photosynthesis) and recognize that roots only provides a small amount of mass to the tree. Also recognizes that matter cannot be created by cell division.

1 point for correct answer.

2. Grass needs energy to live and grow. Where does grass get its energy?

a) Select True or False for the following statements.

		Some of the energy in grass:
True	***False***	*comes from the air.*
True	False	*comes from sunlight.*
True	***False***	*comes from water.*
True	***False***	*comes from soil nutrients.*
True	***False***	*is created by the grass.*

1 point for correctly answering each line. 5 points total.

b) Which ONE of the following do you think provides the MOST energy to the grass?

a. Energy stored in the air

b. Energy from sunlight

c. Energy stored in water

d. Energy stored in soil nutrients

e. Energy that the grass created

1 point for correct answer.

c) Explain your choices. How does the energy get into the grass?

Level 4 responses recognize that grass gets its energy from the sun. This comes in the form of light energy and is transformed to chemical energy in the plant during photosynthesis. The energy is stored in high energy C-H and C-C bonds in organic molecules in the plant's body

1 point for identifying sunlight as the only source of energy for grass

3. A class is investigating how plants grow. The teacher asks the students, "Where does most of the mass of a plant come from?"

a) Three students shared their ideas about what happened. Do you agree or disagree with each student's claim?

Agree	***Disagree***	Mike: "I think a growing plant gains most of its mass from nutrients in the soil."
Agree	Disagree	Lucia: "I think a plant gains most of its mass from gases in the air."
Agree	***Disagree***	Oscar: "I think a plant gains most of its mass from the sunlight."

1 point for correctly answering each line. 3 points total. Note there are two possible correct answers for Mike's claim.

b) Provide an explanation. Why did you agree or disagree with each student's claim?

Level 4 responses disagrees with Oscar because matter cannot be converted into energy; agrees/not sure with Lucia that air/gases can provide mass to plants; agrees or disagrees with Mike because soil nutrients and/or water provide mass to plants

1 point for providing a correct explanation for agreement or disagreement with each of the 3 claims. 3 points total.

The class does an experiment to investigate how plants grow. They started by selecting six **identical** plants. Three of those plants were grown in regular soil. The other three plants had extra soil nutrients added to the soil in their pots. The class put all six plants under **identical** conditions (i.e., the same light conditions, the same watering conditions) and let them grow for one month. At the end of the month, the class weighed each of the six plants and recorded their weights in the table below. They also recorded the weight of the soil nutrients added to three of the pots.

Plant	**Initial weight (g)**	**Added soil nutrients (g)**	**Final weight (g)**	**Plant growth (g)**
1	30	0	50	20
2	31	0	52	21
3	29	0	48	19
Average	**30**	**0**	**50**	**20**
4	30	3	68	38
5	31	3	62	31
6	28	3	65	37

Average	**30**	**3**	**65**	**35**

c) Which claim do you think is best supported by the data?

a. Mike's claim

b. Lucia's claim

c. Oscar's claim

1 point for correct answer

d) Explain how the patterns in the data support the claim that you chose.

Level 4 responses recognizes there is an unaccounted for matter pool between the amount of soil nutrients added and their increase in growth; uses this mass discrepancy to explain why Lucia's claim is correct.
1 point for rejecting Oscar's claim due to the data
1 point for choosing Lucia's claim due to mass differences
2 points total

e) What additional evidence would you collect to help show that the claim you chose is the best claim?

Level 3 responses propose questions that target limitations in the data (recognize there is an unaccounted for matter pool, i.e., gas); they focus on matter tracing and are constrained by principles such as matter to energy conversion.

- ***They may also mention other variables not accounted for, such as measuring CO_2 that is taken up by the plant.***
- ***They may suggest other conditions or experimental procedures, such as measuring dry mass rather than wet mass.***

1 point for identifying additional evidence that could be collected

4. In the LIGHT, carbon dioxide gas moves into plant leaf cells and oxygen gas moves out.

a) What do you think happens in the DARK?

a. Carbon dioxide moves into plant leaf cells and oxygen moves out.

b. Oxygen moves into plant leaf cells and carbon dioxide moves out.

c. The leaf cells go dormant, so no gases move into or out of plant leaf cells.

d. Equal amounts of carbon dioxide and oxygen move both in and out of plant leaf cells.

1 point for correct answer

b) Explain your choice. What causes carbon dioxide or oxygen to move in or out of plant leaf cells in the dark?

Level 4 responses will recognize this as a Matter Movement and Matter Change question about cellular respiration. Plant cells must engage in cellular respiration at all times to acquire the energy they need to function. During the day plant cells commonly engage in

photosynthesis at a faster rate than cellular respiration, but cellular respiration continues when photosynthesis stops at night.
1 point for explaining that plants engage in cellular respiration at all times.
1 point for explaining that plants engage in photosynthesis during the day.
2 points total

5. When a tree is alive it has energy stored in its living parts (roots, trunk, branches and green leaves). When the tree dies all the parts are still there (including fallen brown leaves).

a) How much of the energy stored in the living tree is still there in the dead tree?

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

1 point for correct answer. Note there are two possible correct answers.

b) Explain your answer. What kinds of energy are stored in the living tree? Where did they come from?

Level 4 responses suggest the tree stores chemical potential energy in the bonds of the organic molecules in the leaves, trunk, and roots of the tree. This energy remains in the living tree until the tree dies and decomposition occurs and the decomposers release the energy as heat during cellular respiration
1 point for identifying that the tree has chemical energy
1 point for identifying that the chemical energy is in the large organic molecules (in C-C and C-H bonds) that make up the tree
2 points total

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

Level 4 responses recognize that potential chemical energy is stored in the bonds of the organic molecules that make up the mass of the dead tree. This is the same energy that was stored in the living tree.
1 point for identifying that the materials that make up the tree still have the same chemical energy