Name _____ Teacher _____ Date _____

1.1: Assessing Plants Unit Pretest

This pretest is designed to help students to express a wide range of ideas, even if they are incorrect. Ideally, students will come to recognize that they have many different ideas about animal growth, as well as unanswered questions.

*Level 4 responses are in **bold blue italics** below. Remember Level 4 is the eventual learning goal; we do not expect most, possibly any, students to produce these responses at this point in the unit. We also have suggestions based on our research about likely Level 2 and Level 3 responses. This worksheet has "assessing" in the title because we do NOT recommend giving your students a grade based on the scientific accuracy of their responses at this point in the unit. It is designed to be used as a tool for formative assessment.*

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.*

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

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. *Level 3 responses may describe the reactants or products of photosynthesis (e.g., CO_2, glucose, water) without explaining that these directly contribute to the tree's mass. They may also suggest photosynthesis generates energy for tree growth. Level 3 responses explain roots take in nutrients and water. Level 2 responses may suggest that the more leaves the tree has, the more mass it has, or explain that the leaves*

make food for the tree. Level 2 responses may suggest that the more roots the tree has, the more mass it has.

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.

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. *Level 3 responses may suggest photosynthesis generates energy for tree growth but may also explain roots take in nutrients and water. Level 2 responses may suggest that the more leaves the tree has, the more mass it has or suggests that the more roots the tree has, the more mass it has.*

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.*

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

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. *Level 3 responses may suggest that a plant can make its own energy, or that some of the energy comes from air, water, or soil nutrients. Level 2 responses may suggest that the plant needs energy from all of these sources to grow.*

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."

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. *Level 3 responses says: i) sunlight is a source of matter for plants (agrees with Oscar) AND/OR ii) disagrees with Lucia's claim that air could account for the tree's increased mass. Level 2 responses only reason about 1 or 2 of the claims. Level 1 responses reason about the claims in a force-dynamic way; e.g., i) the plant needs light, soil, water to grow, ii) air/gas cannot provide mass to the plant.*

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

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. *Level 3 responses identifies all matter pools, or recognizes missing pools, but agrees with Oscar's claim that violates principles (Matter to Energy conversion), agrees with Mike's claim which is inconsistent with the data, or agrees with Lucia's claim but has flaws in his/her reasoining. Level 2 responses choose Mike's because the mass of the plant growth with added soil nutrients is greater than the increase in mass of the plant growth without soil nutrients. Level 1 responses explain that the more soil nutrients, the more it grew, recognizes relationships among some matter pools but doesn't relate them to the claims (may provide an explanation about food use for rationale), and /or uses the presence of a matter pool (i.e., added soil nutrients) to justify a claim.*

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. *Level 2 responses propose evidence that partially address limitations in the data. Level 1 responses identify aspects of the system that students are curious about independent of the data, they critique the experimental design, or do not recognize that additional evidence needs to 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.

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 recognize that cellular respiration occurs in leaves, even when it's dark, so that oxygen moves into the leaves and CO_2 moves out. *Level 3 responses may suggest gas exchange still occurs but make mistakes in how this occurs. Level 2 responses may suggest that the leaves go dormant during the night so there is no gas exchange.*

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

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. *Level 3 responses may suggest that the energy is stored in the leaves of the tree and that it came from the soil, sun, water, and air. Level 2 responses may suggest that the tree doesn't have energy, or that the tree has energy everywhere because it is a living thing.*

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. *Level 3 responses recognize that the dead tree has energy but are unclear about what kind of energy it is. Level 2 responses associate energy with life, and think that energy disappears when things die.*