

Name: _____ Class: _____ Date: _____

5.1: Grading Tracing Atoms and Energy in Plants

*This worksheet has “grading” in the title because if they discuss these questions in class, students can be held accountable for correct answers. Level 4 (correct) responses to the questions are in **blue bold italics** below. There are also comments about common Level 2 and Level 3 responses to help you with grading and making decisions about what to emphasize in future lessons.*

Red italics suggest ways to grade student responses by giving them points for correct or partially correct answers. There are 25 points total on this worksheet.

Some things you may already know. One thing you already know is that *atoms last forever* in living systems. So all the atoms in a plant must have come from somewhere. Land plants need *water, air, sunlight, and soil nutrients* to live and grow. So those are the sources that the atoms and the energy in plants must come from.

You may not know what kinds of atoms plants are made of. Chemists can take a garden plant like a radish and analyze what kinds of atoms (what elements) it is made of. A lot of a growing plant is water, but if they take the water away and analyze the dry materials in a plant, the first column of the table below shows what they find. Where does each kind of atom in a plant come from?

<i>Kinds of atoms in plants</i>	<i>Where atoms come from</i>		<i>Your reasons for your ideas</i>
Carbon atoms make up about 45% of the dry mass of the plant.	Plants get some carbon atoms from water .	True <i>False</i>	<i>Level 4 responses should trace carbon atoms back to carbon dioxide in the air.</i> <i>There are also carbon atoms in soil, but they are not incorporated into organic molecules in cells.</i>
	Plants get some carbon atoms from air .	<i>True</i> False	
	Plants get some carbon atoms from sunlight .	True <i>False</i>	
	Plants get some carbon atoms from soil .	True <i>False</i>	
Oxygen atoms make up about 45% of the dry mass of the plant	Plants get some oxygen atoms from water .	<i>True</i> False	<i>Level 4 responses should trace oxygen atoms back to water, air, and soil.</i> <i>Pay close attention to student reasoning. The goal is for students to move away from thinking that plants need soil to grow. That said, SOME oxygen will come from the dissolved nutrients in the soil and be incorporated into plant tissues.</i>
	Plants get some oxygen atoms from air .	<i>True</i> False	
	Plants get some oxygen atoms from sunlight .	True <i>False</i>	
	Plants get some oxygen atoms from soil .	<i>True</i> False	
Hydrogen atoms make up about 6% of the dry mass of the plant	Plants get some hydrogen atoms from water .	<i>True</i> False	<i>Level 4 responses should trace hydrogen atoms back to water and soil.</i> <i>Pay close attention to student reasoning. The goal is for students to move away from</i>
	Plants get some hydrogen atoms from air .	True <i>False</i>	
	Plants get some hydrogen atoms from sunlight .	True <i>False</i>	
	Plants get some hydrogen atoms from soil .	<i>True</i> False	

			<i>thinking that plants need soil to grow. That said, SOME hydrogen will come from the dissolved nutrients in the soil and be incorporated into plant tissues.</i>
<i>All other elements (mostly nitrogen, potassium, calcium, magnesium, and phosphorous) make up about 4% of the dry mass of the plant</i>	Plants get some other atoms from water .	True False	Level 4 responses should trace other atoms back to soil minerals.
	Plants get some other atoms from air .	True False	
	Plants get some other atoms from sunlight .	True False	
	Plants get some other atoms from soil .	True False	

You already know is that *energy lasts forever* in living systems. When dry plants burn, they release chemical energy. So that energy must have come from somewhere. Use the table below to show where the chemical energy comes from.

<i>Kinds of energy in plants</i>	<i>Where energy comes from</i>	<i>Your reasons for your ideas</i>
Where does the <i>chemical energy</i> in a plant come from?	Plants get some energy from water .	True False
	Plants get some energy from air .	True False
	Plants get some energy from sunlight .	True False
	Plants get some energy from soil .	True False
		Level 4 responses should explain that plants only get energy from sunlight in the form of light energy. <i>Some Level 2 or Level 3 students may suggest that water, or air have energy because they are essential for life.</i>