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Activity 5.5: Grading the Systems and Scale Unit Posttest

This posttest is the same as the Systems and Scale Unit Pretest (Activity 1.1). The file "1.1_Assessing_the_Systems_and_Scale_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 Systems and Scale 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: 36 points	***For higher demand high school courses***	***For middle school or lower demand high school courses***
Excellent	*29 points (~80%)*	*25 points (~70%)*
Good	*25 points (~70%)*	*22 points (~60%)*
Acceptable	*22 points (~60%)*	*18 points (~50%)*

1. When a log burns, there is heat and light energy in the flame. Where does the heat and light energy come from? Select True or False for the following statements.

Some heat and light energy:

T **F** *comes from the air*
T **F** *is created* by the flame
T F *comes from the log*
T **F** *comes from the person* who lit the log
1 point for each correct answer. 4 points total.

Which ONE of the following do you think provides the MOST energy to the flame?
a. Energy stored in the air
b. Energy created by the flame
c. Energy stored in the log
d. Energy from the person who started the fire
1 point for correct answer.

Explain your choices. Where does the heat and light energy in the flame come from?

A level 4 response might state that the energy comes from the bond energy, chemical energy or potential energy in the log (just saying "the log" is not enough).

- *1 point for identifying the wood as the material that provides the energy.*
- *1 point for identifying chemical energy or bond energy as form of energy that is converted to heat and light.*

2 points total.

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2. After a log burns for a while, it weighs less than it originally did before it was burned. What happened to some of the matter that used to be in the log? Select True or False for the following statements.

Some matter from the log *was converted into*

T F *ashes*
T F *carbon dioxide*
T **F** *heat and light energy*
T F *water vapor*
1 point for each correct answer. 4 points total.

Which ONE of the following do you think MOST of the matter in the burning log was converted into?
a. Ashes
b. *Carbon dioxide*
c. Heat and light energy
d. Water vapor[1]
1 point for correct answer.

Explain your choices. What happened to the matter in a log as it burned?
Level 4 responses clearly recognize that the burning log's matter goes to the air in form of CO_2 (and/or H_2O).

- *1 point for identifying CO_2 as a place where the matter goes.*
- *1 point for identifying H_2O as a place where the matter goes.*
- *1 point for identifying that the matter goes into the air.*

3 points total.

3. A scientist has discovered a new living organism: the glubex. He put a glubex on the scale, weighed it, and then returned it to its habitat for one day. The next day he weighed it again. Here is what he found:

Original mass of the glubex: 1.52 grams

Mass of the glubex after one day: 1.64 grams

[1] *Carbon dioxide is definitely the most massive product of combustion, but since most of the oxygen in CO_2 comes from the air rather than the log, about as much of the original mass of the log ends up in water vapor as in CO_2. So there is a justification for giving students credit for water vapor as well as carbon dioxide. Few students, though, will be prepared for the advanced quantitative reasoning that leads to this conclusion.*

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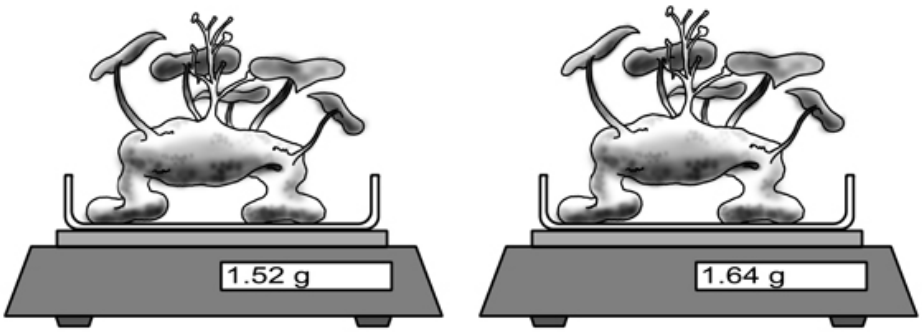

Decide if you agree or disagree with each of the students below.

A student, Patrick, claims: "The **chemical energy** stored in the glubex's fat **was used** to make new **atoms**. These new atoms caused the increase in the mass of the glubex."

Circle one: AGREE **DISAGREE**
1 point for correct answer.

Another student, Joaquin, claims: The increase in the mass was caused by the movement of atoms from outside the glubex to inside the glubex."
Circle one: **AGREE** DISAGREE
1 point for correct answer.

Another student, Devin, claims: The glubex didn't have to take in atoms or make new atoms. Instead the glubex grew because its cells grew and divided.
Circle one: AGREE **DISAGREE**
1 point for correct answer.

Explain your reasoning for your choices.
Level 4 responses will indicate that atoms cannot gain or lose weight, cannot be created or destroyed and that energy cannot create atoms. They will follow all "rules".

- *1 point for indicating that energy cannot change into matter (rejecting Patrick's claim).*
- *1 point for indicating that the process of cell division must follow conservation laws: atoms cannot gain or lose weight and/or that atoms cannot be created or destroyed (rejecting Devin's claim).*

2 points total
Choose ONE claim for which you agree with from above. Explain how this claim could be further tested to offer evidence that better supports the claim.

A Level 4 response might offer a test that "followed all the rules" and that was focused on tracing matter from outside the glubex to inside the glubex.

- *1 point for tests that address the Matter Movement Question, identifying a source for the atoms that entered the Glubex.*
- *1 point for tests that address the Matter Change Question, identifying a process that brings atoms into the Glubex.*

2 points total
4. 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, carbon dioxide*

a. How would the scientist sort the following materials?

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

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

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

A Level 4 response will state that they can be sorted in one of the following ways: Organic/inorganic, contains carbon/does not contain carbon, or contains energy/does not contain energy.

- *1 point for correctly labeling the two groups: Organic/inorganic,*
- *1 point for correctly identifying properties of materials or properties of molecules (see above) that can be used to classify the materials*

2 points total

5. Answer these true-false questions.

True	False	Carbon is a kind of atom.
True	***False***	Carbon is a kind of molecule.
True	False	There is carbon in pure air.
True	***False***	There is carbon in pure water.
True	False	There is carbon in alcohol.
True	False	There is carbon in wood.
True	False	There is carbon in our muscles.

1 point for correctly answering each question. 7 points total.