

5.3 Grading the Explanations Tool: How does a cow get small organic molecules to its cells?

This worksheet has “grading” in the title because at this point, students can be held accountable for correct answers. Level 4 (correct) responses to the questions are in **blue bold italics** below.

Red italics suggest ways to grade student responses by giving them points for correct or partially correct answers. There are 14 points total on this worksheet.

Carbon TIME Discourse Routine around the Explanations Tool:

1. *Introduction: Students review their Evidence-Based Arguments Tools. Establish the purpose for completing the tool as developing a complete explanation for the unit phenomenon.*
2. *Private thinking and writing: Students complete the Explanations Tool individually.*
3. *Partner or small group work: Students share and compare ideas in pairs/small groups, with the goal of improving their explanations.*
4. *Sharing ideas in whole-class discussion: Class discussions serve to elicit, clarify, and compare explanations from individual students and/or student groups*
5. *Consensus-seeking discussion accompanied by public writing: Class discussions focus on coming to consensus around a correct, coherent explanation that answers the Three Questions while addressing the 4 steps. We recommend that students revise their explanations in a different colored pen/pencil.*

The Matter Movement Question

The diagram shows a cow on the left with a green line representing the digestive tract. A callout box shows a detailed view of the small intestine and blood. Labels include: 'Large Organic Molecules' (entering the small intestine from the left), 'Small Intestine' (the central tube), 'Small Organic Molecules' (leaving the small intestine to the right), and 'Blood' (at the bottom right). A green arrow points from the small intestine into the blood. Another green arrow points from the top of the small intestine into the blood. A third green arrow points from the bottom of the small intestine into the blood. A fourth green arrow points from the bottom of the small intestine into the blood.

Note: digestive cells produce molecules (enzymes) that can break large organic molecules up into small organic molecules.

Draw and label arrows that show how molecules move from the small intestine into the cow's blood

See description below.

- Show and label molecules with carbon atoms that are in the food that the cow eats.
- Show and label the molecules with carbon atoms that move from the intestine to the blood
- Show and label what happens to the molecules that are not digested.

Level 4: Labeled arrows showing:

- **Large organic molecules (or polymers: proteins, fats/lipids and/or carbohydrates) should be moving through the digestive system.**
- **Large organic molecules entering the cellular-scale drawing in the small intestine.**
- **Small organic molecules (or monomers: amino acids, sugars, fatty acids and glycerol) going through the digestive system cells into the blood.**
- **Undigested large organic molecules continuing through the small intestine.**

1 point for each correct arrow/molecule. 4 points total.

Name the chemical change that a cow uses to break down food: **Level 4: digestion**
1 point for correct answer.

The Matter Change Question

What molecules are carbon atoms in before the chemical change?
Level 4: Large organic molecules (or polymers: carbohydrates, fats/lipids, and proteins) .
1 point for each correct response.

What other molecules are needed?
Level 4: Water
1 point for correct answer.

Chemical Change

What molecules are carbon atoms in after the chemical change?
Level 4: Small organic molecules (or monomers: amino acids, sugars, and fatty acids)
1 point for each correct response.

What other molecules are produced?
Level 4: none
1 point for correct answer.

The Energy Question

What forms of energy go into this chemical change?
Level 4: Chemical energy
1 point for correct response.

Energy Transformation

What forms of energy come out of this chemical change?
Level 4: Chemical energy.
1 point for each correct response.

Explain in words: How does a cow get small organic molecules to its cells? (Answer on the back).
 Use this Explanations Tool to help guide your written explanation, being sure to answer the Three Questions.

Remember: **Atoms last forever** (so you can arrange atoms into new molecules, but can't add or subtract atoms).
Energy lasts forever (so you can change forms of energy, but energy units can't appear or go away).

Level 4 responses should include answers to each of the four numbered steps on the Three Questions poster and handout:

1. **Matter movement: Large organic molecules (or polymers: carbohydrates, fats/lipids, proteins) enter into the cow and move through the digestive system to the small intestine.**
2. **Matter change: Large organic molecules are separated into small organic molecules (or monomers: amino acids, sugars, fatty acids, glycerol).**
3. **Energy change: The chemical energy of the C-C and C-H bonds in the large organic molecules remains in the small organic molecules.**
4. **Matter movement: The small organic molecules pass through the intestinal lining into the blood stream.**

Level 2 and 3 responses may describe a digestive process of breaking down food, but will state or imply the food is broken down or turned into energy in the digestive system which is then sent to cells, maybe by blood. Level 3 responses might include more detail confusing digestion with cellular respiration.

*1 point for each correct answer.
 4 points total.*