

Twelve Clues About Food: An Evidence Jigsaw on Energy and Matter

Learning target: I can work with a team to sort evidence cards under claims about how organisms release energy from food, store it, and build their bodies from it, and defend which cards support each claim.

Collaborative investigation

About 50 min

Jigsaw

MS-LS1-7 · practice

MS-LS2-3 · supports

collaboration

discussion

data analysis

Name _____

Date _____

Period _____

Directions

Work in home groups of four. Step 1 (expert round, 10 minutes): each member takes one expert set of three cards (Set A: cards 1-3; Set B: cards 4-6; Set C: cards 7-9; Set D: cards 10-12), reads them, and meets with the students from other groups who hold the same set to agree on what each card shows and which claim or claims it supports. Step 2 (home round, 20 minutes): return to your home group, teach your cards to the others in two sentences each, and complete the group task. Step 3 (defense, 8 minutes): present your sort to a neighboring group, who will challenge one placement. Step 4 (individual, 12 minutes): answer Part C alone.

You will need: Twelve cards per group, cut from the card sheet, Group record table, Sticky notes, Pencils

The four claims — Claim 1: Living things release energy from food by reacting it with oxygen, giving off carbon dioxide and water. Claim 2: Producers and other organisms that are not animals carry out cellular respiration too. Claim 3: The matter in food is rebuilt into the body of the organism that eats it; atoms are conserved along the way. Claim 4: Organisms store food energy in molecules such as starch, glycogen and fat for later use.

Twelve evidence cards

1 Card 1: Warm seeds in the dark (teaching data)

A vented vacuum flask of 100 g of sprouting bean seeds, kept in a dark cabinet, rose from 21.0 °C to 25.2 °C in two days; the oxygen inside fell from 20.9% to 18.8% and the carbon dioxide rose from 0.04% to 2.1%. A matching flask of boiled seeds changed by less than 0.1 °C and showed no gas change.

2 Card 2: Yeast and sugar

Yeast is a single-celled fungus. An aquarium pump bubbles air slowly through a flask of warm water, sugar and yeast, and the gas leaving the flask is led by a tube into limewater, which turns cloudy within a few minutes, the standard test for carbon dioxide. An identical flask of warm water and yeast with no sugar takes far longer to cloud its limewater, about as long as plain room air does.

3 Card 3: Where muscle comes from

The proteins in food are taken apart during digestion into small pieces called amino acids. The blood carries the pieces to cells, which link them in new orders to build human proteins, including the proteins that make muscles contract. A child who grows new muscle has built it from the pieces of proteins in meals.

4 Card 4: Flooded roots

Soil has air pockets between its grains. When a garden bed stayed under water for nine days, the air pockets filled with water, and the tomato roots turned brown and soft and the plants wilted even though they had plenty of water. Roots in a raised bed that drained in a day stayed white and firm.

5 Card 5: Heart cells and skin cells

Under a microscope, a heart muscle cell is packed with mitochondria, with hundreds visible in one cell. A skin cell from the same animal has far fewer. Heart muscle contracts about once a second for an entire lifetime and never rests.

6 Card 6: Potato and iodine

A drop of iodine solution on a cut potato turns blue-black, the test for starch. A drop on a lettuce leaf barely changes color. A potato is an underground part of the plant where sugar made in the leaves is linked into starch and kept; in spring, a sprouting potato shrivels as the starch is used up.

7 Card 7: Breath and limewater

The air you breathe in is about 0.04% carbon dioxide; the air you breathe out is about 4%, roughly 100 times more. Blowing through a straw into limewater turns it cloudy in under a minute; pumping room air through the same limewater takes much longer to show any cloudiness.

8 Card 8: Shrinking seeds (teaching data)

Fifty bean seeds were dried and weighed: 20.0 g. Fifty seeds from the same packet were soaked and left to sprout in a dark cupboard for ten days, then dried completely and weighed: 16.4 g. The sprouts had roots and shoots several centimeters long, yet their dry mass was 3.6 g less than the unsprouted seeds.

9 Card 9: Birds before migration

Many small songbirds roughly double their body fat in the weeks before a long migration flight, eating constantly. They arrive at the other end thin. Fat releases about 9 kcal per gram, more than twice as much as the 4 kcal per gram released by carbohydrate or protein.

10 Card 10: The liver's sugar bank

After a meal, the liver links spare sugar molecules into long chains of glycogen and stores them. Between meals, the liver breaks glycogen back down into sugar and releases it into the blood, so the blood sugar stays steady even hours after eating.

11 Card 11: Fungus on a log

A shelf fungus has no mouth and no lungs. Its thin threads grow into a fallen log, absorb the log's molecules, and use them for energy and growth. A chunk of rotting log with its fungus, sealed in a jar with a carbon dioxide sensor, shows carbon dioxide rising steadily, and over the years the log loses mass.

12 Card 12: Breathing during exercise (teaching data)

A student's breathing rate was 14 breaths per minute while sitting and 32 breaths per minute after three minutes of jumping jacks. Her leg muscles felt warm. Working muscles need to release energy from sugar many times faster than resting muscles do.

Part A: Expert round (one set per person)

1. Your expert set: _____. For each of your three cards, write one sentence that says what the card shows and which claim or claims it supports. Your home group will rely on these sentences.

Part B: Home group task

1. Lay all twelve cards on the desk. Place each card under the claim it supports. A card may support more than one claim; if so, note the card number under each claim it supports.
2. For each claim, choose the two strongest cards and write a reason: what observation on the card would be hard to explain if the claim were false?
3. Find at least one card that supports Claim 2 even though the organism on it is not a plant. Agree on why it counts.
4. Decide which claim has the weakest support in this deck. Describe one piece of evidence that would strengthen it.
5. Prepare a one-minute defense of your sort. Every member must be able to explain the placement of any card.

Group record (fill in)

Claim	Card numbers that support it	Two strongest cards and why
Claim 1: energy released by reacting food with oxygen		
Claim 2: producers and non-animals respire too		
Claim 3: food matter is rebuilt into the body; atoms conserved		
Claim 4: energy stored in molecules for later		

2. Group answer: Which claim did your group judge to have the weakest support, and what evidence would strengthen it?

3. Group answer: Write the placement the neighboring group challenged, their argument, and how your group answered it.

Part C: Individual accountability (complete alone)

4. Explain why Card 2 (yeast) and Card 11 (fungus) belong under Claim 2 even though neither organism is a plant, and why they are also evidence for Claim 1.

5. Use Card 8 together with Card 1 or Card 7 to explain where the missing 3.6 g of dry mass went. Your answer must account for the atoms.

6. Which single card is the best evidence that cellular respiration happens inside cells rather than being the same thing as breathing? Explain your choice.

7. Write a three-sentence model statement that describes what happens to the food an organism takes in, covering energy release, storage and growth. Cite at least three different cards by number as evidence for your sentences.

Three questions for every card

If a card is hard to place, ask: (1) Does it show a gas going in or out, or heat appearing? Then it is about energy release (Claim 1), and if the organism is not an animal, also Claim 2. (2) Does it show a food molecule becoming part of a body? Then Claim 3. (3) Does it show a molecule being kept for later and used up afterward? Then Claim 4. Write the question numbers that apply on a sticky note on each card before you sort.

The thirteenth card

Write a thirteenth evidence card about an organism that is not on any existing card (for example, a shark, a cactus or a single-celled alga). The card must describe a specific, realistic observation that could be made with classroom tools or a sensor, label any invented numbers as teaching data, and support exactly one claim. Trade with a partner and have them place it; if they place it under a different claim than you intended, revise the card until the evidence points only one way.