TEACHER GUIDE ENGAGE LESSON 8



Module Questions: Why do we get sweaty and thirsty after exercise? Why does the color of our urine change? How does milk help us recover from these effects?

What We Figure Out:

We figure out that exercise can cause changes in the body's temperature, the amount of sweat produced, and the color of urine. Drinking milk seems to help an athlete recover from these changes by returning body conditions back to their original state.

3D Learning Objective:	Time estimate:	Materials:
Students construct an explanation for how a living system's internal conditions change within some range and how mechanisms in the body act to stabilize the system.	50 minutes	Lesson 8 Student Guide <u>Workout Video</u> (Module Phenomenon Video) Lesson 8 Student Handout Urine Color Chart

Targeted Elements

SEP:	DCI:	CCC:
Pre-Assessment CEDS-H2: Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today	Pre-Assessment LS1.A-H4: Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or	Pre-Assessment SC-H3: Feedback (negative or positive) can stabilize or destabilize a system.



as they did in the past and will continue to do so in the future.	discourage (negative feedback) what is going on inside the living system.	
Directions		
Part 1: Our Motivation		

USE OF PHENOMENA

Students ended the previous lesson by identifying questions that need further investigation to understand the Anchor Phenomenon and revisiting the Driving Question Board. Students identified questions related to how the nutrients in milk, once they reach the bloodstream, help athletes recover from exercise. Therefore, in this module, students will start by observing a Module Phenomenon that asks students to observe specific physiological changes that happen during exercise. Students will then try to figure out how milk nutrients help the athlete recover from exercise-induced changes. Figuring out this Module Phenomenon will help students progress on answering their questions about the overall Anchor Phenomenon and Driving Question for the unit, *How can milk help athletes recover from physical exercise*?

To introduce this module to students, return to the Driving Question Board. Ask students what questions seem like the most pressing questions to investigate next. Build off student responses to point to the questions related to the effects of exercise on hydration/dehydration and how milk helps athletes recover from these effects.

Students should record the questions they are investigating on their Lesson 8 Student Guide Part 1: Our Motivation. This will help students understand how this lesson connects to what they were trying to figure out about the Anchor Phenomenon. Sample student questions might include:

- Why does a body need to hydrate as part of exercise recovery?
- How does water in milk help with recovery?
- What happens in the body after it is hydrated?
- Does the amount we sweat impact the amount of fluids we need to replenish?
- Does drinking specific items, like milk, increase hydration only? Are there other effects?

Build off student questions to confirm that, next, students will set out to figure out how milk helps the body recover from exercise and its role in hydration. To do so, they will first observe the changes to hydration that happen within an athlete's body when exercising and how milk helps an athlete recover from these changes.

Part 2: Observing the Module Phenomenon

Introduce the <u>Workout Video</u> by telling students, "We previously shared some experiences we have had with intense exercise (in Lesson 1), including sweating and getting overheated. To help us figure out how athletes recover from the effects of exercise, we will watch a video of an athlete exercising and see what we notice about these effects and how milk helps an athlete recover."

Distribute the Lesson 8 Student Handout Urine Color Chart for students to access while they watch the video. Play the Workout Video. As students watch, ask them to record their observations from before the athlete exercises, during exercise, and after. Students can record this on their Lesson 8 Student Guide Part 2: Observing the Module Phenomenon.

STUDENT SUPPORT

If students need additional support making observations from the video, consider replaying the video at specific moments when the athlete discusses the changes happening to her body. Additionally, the video can be periodically paused to provide students time to capture the details of the changes or when the data tables are displayed on the screen.

Use a Think-Pair-Share Strategy to have students share what they noticed from the video.

- 1. Students are given time to think independently about their responses.
- 2. Students find an elbow partner.
- 3. Students take turns sharing their thoughts with their partner. Each student should be given time to respond.

As students share, use a Domino Share Routine to have them build off each other's contributions.

- 1. Each group nominates a spokesperson.
- 2. As a student from group one shares, all other students serve in a "listener" role, noting patterns or ideas that emerge as the group continues to share.
- 3. Spokespersons from each group continue to share ideas until all groups have shared.
- 4. The facilitator holds a whole-class discussion and invites the remaining students to share what they heard that was similar across all the responses or a unique response they want to elevate.

In student responses, look for the following ideas:

- The athlete's body temperature increases and then goes back down after they stopped working out.
- Sweat was produced during the workout, but the athlete eventually stopped sweating after they stopped working out.
- They felt thirsty during the workout, drank milk when they were done working out, and reported they were no longer feeling thirsty.
- The athlete's urine color started out lighter, got slightly darker during the workout, and then was lighter again after drinking milk.

After agreeing on their observations from the video, introduce the Module Questions, Why do we get sweaty and thirsty after exercise? Why does the color of our urine change? How does milk help us recover from these effects?

Then, ask students to share their experiences of times when they have exercised and had similar experiences to those that the athlete in the video described, such as their experiences being sweaty, thirsty, or having a change in urine color. Acknowledge and welcome the range of student responses that they will share here based on their varied backgrounds. Throughout this conversation, press students to try to explain why they think these changes happened to their bodies as they were exercising.

Part 3: Creating an Initial Explanation

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Share with students that they will now try to explain what they currently know about the Module Questions. Use a first Think-Pair-Share to ask students why they think the exercise-induced changes they observed (sweat, urine color-change, and thirst) occur. Then, use a second Think-Pair-Share and ask students to use their understanding of milk digestion and nutrients from the previous module to share how they think milk helps an athlete recover from getting sweaty, feeling thirsty, and having a urine color change after exercise. Allow students to share their responses and build off each other's thinking. There are no specific consensus ideas to develop at this time, so honor and elevate the current thinking of your students.

STUDENT SUPPORT

Allowing students space to reflect individually and then share their thoughts in small groups increases access for all learners who are not comfortable speaking in front of large groups. For their thoughts and opinions to get elevated to large group discussions, you can alter this whole-group share-out by instructing speakers to share what they heard their partners share instead of repeating their own thoughts and questions.

After this brainstorming session, student groups will create an initial explanation that describes how they would currently answer the Module Questions on their Lesson 8 Student Guide Part 3: Creating an Initial Explanation. Share that students should explain what is happening inside the athlete's body before exercise, during exercise, and after recovery. Share that their explanations might currently seem incomplete, but as they explore this module they will feel more confident in knowing the mechanisms that cause these responses in the body. Students will use their observations from the video and their understanding of body systems to construct initial explanations for the observed changes during exercise, laying the groundwork for using evidence later in the module.

CCC SUPPORT

SC-H3: Feedback (negative or positive) can stabilize or destabilize a system.

In middle school, students learn that system stability is due to a balance of inputs and outputs that maintain dynamic equilibrium. This unit builds on this middle school knowledge by focusing on how feedback can stabilize or destabilize a system. In this module, students figure out that the body uses negative feedback mechanisms to help it return to a stable state in response to an external or internal change in temperature or water availability due to exercise.

Allow students time to create their explanations.

As students work, circulate the room to elicit and probe student thinking. Ask questions such as:

- Can you tell me more about what you think causes (sweat, thirst, urine color change)?
- What I read in your explanation is _____. Can you say more about that?
- How do you think sweat, thirst, and urine color could be related?
- What do you think water has to do with each of these effects?
- What do the nutrients in milk do to help the body recover from (sweat, thirst, urine color change)?

CCSS SUPPORT

WHST 9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Students will make choices about development, organization, and style in their explanations to best produce a coherent explanation. Utilize the questions above to provide additional support. If needed, meet individually with students to offer specific feedback in regard to the writing process.

PRE-ASSESSMENT OPPORTUNITY

Students construct an explanation for how a living system's internal conditions change within some range and how mechanisms in the body act to stabilize the system.

Assessment Artifacts:

• Students' initial presentation drafts that describe how they would answer the Module Questions, *Why do we get sweaty and thirsty after exercise? Why does the color of our urine change? How does milk help us recover from these effects?* (Lesson 8 Student Guide Part 3: Creating an Initial Explanation).

Look Fors:

- Explanations describe students' initial ideas for how the internal conditions of the body change as external conditions change (CEDS-H3, LS1.A-H4, SC-H3).
- Explanations describe students' initial ideas for how the body can return to a stable condition (CEDS-H3, LS1.A-H4, SC-H3).

Assessment Rubric:

	Emerging	Developing	Proficient
Sample Student Response	Drinking milk helps you recover from sweat, thirst, and urine color change because it helps with hydration. It makes the body stronger with its nutrients.	As a person does a long, intense workout, they begin to experience increased heart rate, body temperature, and sweat production. Their urine becomes increasingly darker throughout the workout. All these changes happen inside the body because the body needs to work harder to help you during the workout. When you drink milk, the nutrients get broken down through digestion to help you cool off/recover.	Normal body functions are present before a workout. As a person does a long, intense workout, the internal conditions of the body change, and they begin to experience increased heart rate, body temperature, and sweat production. Their urine becomes increasingly darker throughout the workout. Because your body is getting tired from the workout and running out of water, you become thirsty, and your urine gets darker. All these changes happen in the body throughout the duration of the workout and increase (or remain) until you are done. When you drink milk, the nutrients get broken down through digestion to help you cool off/recover, which helps your body go back to normal. As your body cools off, you become less thirsty and eventually feel satisfied, your heart rate decreases and eventually returns to normal. Once you drink milk, your urine returns to a lighter color.
How to Achieve This Level	Student completes 0 out of 2 Look Fors	Student completes 1 out of 2 Look Fors	Student completes 2 out of 2 Look Fors

To Provide Additional Support for Students

Consider the following supports for students as they create their explanations:

- Ask students to focus on one of the effects of exercise (sweat, thirst, or urine color-change) instead of multiple.
- Ask students which body systems and organs they think are involved in the changes observed during exercise and recovery.
- Ask students to recall times they have worked out for a sport or recreation and think about if/how they experienced sweating or a sensation of thirst. Encourage them to use these ideas to start drafting their initial explanation.
- Engage students in a peer feedback session. Provide students with the Look Fors, and use a protocol such as <u>Tell-Ask-Give</u> or norms such as <u>SPARK</u>. Students can use the Look Fors to provide feedback to each other on how they can improve selected Look Fors in their work.

Part 4: Sharing Initial Explanations

Use the Stay and Stray Strategy to have students share their explanations with their peers.

- 1. After small group explanations are complete, ask groups to have one person "stay" at their table with the explanation they created to share with classmates from other groups.
- 2. The rest of the team members "stray" to the other groups to learn about the other group's explanations. Allot about 2 to 5 minutes per rotation.
- 3. During the rotation time, students can ask questions to help gain clarity on their descriptions. Students can ask questions such as, "What parts of the explanation do we seem to agree on?"
- 4. At every signal to rotate to a new group, a different team member goes back to stay with the group's work, and everyone else (including the person who first stayed) moves on to view the next product. This allows everyone to see all but one product.
- 5. After visiting all groups, initial small groups will regroup and share new information gathered.
- 6. The groups will discuss new ideas and decide whether they will integrate them into their work.

As students share, they should record the parts of the explanations they agree with and those they disagree with on their Lesson 8 Student Guide Part 4: Sharing Initial Explanations.

After all students have had time to share, hold a whole-class share-out to have students work together to make a Class Consensus Explanation. The aim is for students to look across their explanations and present the most common areas of agreement in a class explanation of the Module Phenomenon.

Select a few student groups to share with the whole class. Have the first student group share their explanation.

During the share-out, ask questions and share reminders to help establish what consensus ideas to add to the class explanation, such as:

- What parts of the explanation do we seem to agree on?
- Can anyone suggest ideas we should add to the class explanation?

As parts of the explanation are agreed upon, begin creating a Class Consensus Explanation on the board.

TEACHER SUPPORT

As you build the class explanation, if you find disagreements, follow these steps to help resolve the disagreement.

- Summarize the two sides of the disagreement.
- Ask the students to pause and reflect on their reasoning to be on that side.
- Prompt students to re-discuss the area of disagreement again.
- If students still disagree, suggest that we can represent areas of disagreement on the class explanation with question marks or other annotations of uncertainty.

Continue adding to the Class Consensus Explanation so that every group shares at least one descriptor to add. The Class Consensus Explanation should describe the following:

- There are changes happening inside of the body to the organs that control body temperature, sweat, and urine color.
- There is salt in sweat, so the body loses salt when sweating.
- Each of these changes has to do with the amount of water in the body.
 - Sweat loses water from the body.
 - Thirst is when we don't have enough water.
 - Urine has water in it.
- Milk helps with hydration because it contains water. As you drink it, you are ingesting more water.

SEP SUPPORT

CEDS-H2: Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

In middle school, students construct explanations based on valid and reliable evidence from their own experiments to explain how theories and laws describing the natural world operate the same as they have in the past. In this unit, students build on this middle school understanding to construct explanations now using evidence from a variety of sources. Across the unit, students will develop proficiency in how to add a variety of sources of evidence to their explanations. Here, students are not yet required to have evidence to support their explanations. Rather, they can use their background experiences to support their explanations.

After a Class Consensus Explanation has been drafted, students will reflect on any gaps in understanding present in the explanation. At this point, there will be gaps in the scientific mechanisms of the explanation. This is okay at this point because students will gather evidence to revise these explanations throughout the module. Allow students time to brainstorm gaps in the explanation on their Lesson 8 Student Guide Part 4: Sharing Initial Explanations. As students work, you can ask questions such as:

• Take a closer look at the class explanation. What seems to be missing from our description to help us explain sweat production, thirst sensation, changes to urine color, and how milk helps an athlete recover from these?

In student responses, look for the following ideas:

- We don't know why body temperature goes up during exercise.
- We aren't sure why body temperature goes back down after exercise.
- We don't understand how sweat helps the body cool down.
- We still aren't sure of how we get thirsty during exercise.
- We still don't know how milk can help an athlete recover from exercise.
- We are still unsure of why our urine changes from a lighter to a darker color during exercise.
- We don't know how/if all these changes have to do with changes to water in the body.

STUDENT SUPPORT

If students need additional support in finding gaps in the explanations, consider:

- Having students verbally describe what they think happens in the body during exercise and, as they do so, consider if any component might logically be missing. Say, "Without looking at the explanation, talk me through how your body sweats, how you feel thirsty, and why urine color changes during exercise."
- Reminding them that we are in the beginning stages of the module, and they will learn more and have time to edit their explanation later in the module.

??? Part 5: Asking New Questions

As a final step in this lesson, students will create a new list of questions to help them determine additional information they need to know to help them figure out the changes in sweat, thirst, and urine color during exercise and how milk plays a role in recovery. They can write these questions on their Lesson 8 Student Guide Part 5: Asking New Questions. Add these questions to the "Exercise, Milk, and Hydration" category of the Driving Question Board so they can continue to be referenced in the coming lessons.

To facilitate students asking questions, use the Question Formulation Technique.

1. With their group, students will take 5 minutes to brainstorm questions about what they need to know about how sweat, thirst, and urine color change during exercise and how these responses might change if milk is used in exercise recovery.

- 2. Students will then look at their questions and choose the 3-5 questions they think are most important to be answered to help them figure out the Module Questions.
- 3. A representative from each group will then share their prioritized questions with the whole class. As students share their prioritized questions, they will add them to the Driving Question Board.

LOOK FOR

In student questions, listen for the following ideas:

- Why do we sweat during exercise?
- What does losing water have to do with (sweat, thirst, or urine color change)?
- Why do you feel thirsty while working out, and how does milk help relieve this?
- What causes you to "feel" thirst?
- Why do we get dehydrated when working out?
- How do the nutrients in milk help us recover from being sweaty, thirsty, or changing urine color?