

STUDENT GUIDE

ENGAGE LESSON 15



Part 1: Our Motivation

Record what we were trying to figure out that led to this investigation.

Questions we wanted to figure out more about:

- Do you get energy from milk?
- Is energy involved in exercise?
- What part of milk helps you get more energy to workout?
- How does the body use energy during exercise?
- How do you recover the energy you lose in exercise?



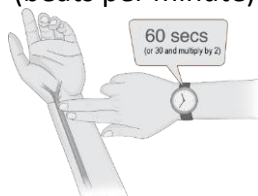
Part 2: Experiencing and Recording the Changes in Our Bodies Between Rest and High-Intensity Exercise

Choose one of the following high-intensity workout options to conduct an experiment:

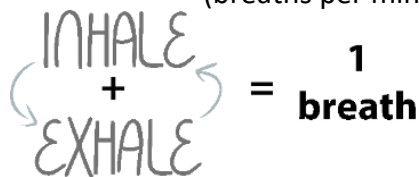
- Choose a combination of bodyweight exercises (for example, five burpees, five pushups, five squats, and five squat jumps) and do them consecutively, as fast as possible, with no stopping. Repeat if necessary to fill the 45 seconds.
- Sprint approximately $\frac{1}{2}$ to 1 lap around a track or about 200 - 400 m
- Do a shuttle run in the gym where you run from the baseline to the free throw line and back, baseline to the half line and back, and baseline to the other baseline and back, or as far as you get in 45 seconds.
- Jump rope as fast as you can for 45 seconds.
- Go all out on an exercise bike, rower, or other stationary fitness equipment for 45 seconds
- Sprint up a flight of stairs, do five bodyweight exercises, jog back down the stairs, and repeat.

Before completing the workout, record your resting heart rate and breathing rate in the “Resting/Before Workout” column in the data table below. Use the graphics below to calculate your rates.

Calculating heart rate/pulse
(beats per minute)



Counting breathing rate
(breaths per minute)



Directions:

1. Complete the high-intensity workout you chose. Exert yourself for 45 seconds at your maximum effort.
2. Immediately after the workout, record your heart rate and breathing rate, as well as any other changes you notice in your body during this time.

High-Intensity Workout

Measurement	Resting/Before Workout	After Workout
Heart rate (beats/min)	73	165
Breathing rate (breaths/min)	15	52
Other Observations	<ul style="list-style-type: none"> • Feel pretty normal. • Breathing at my usual rate and feel rested. 	<ul style="list-style-type: none"> • Leg muscles tired w/in first 15 seconds • Slowed down as workout went on • Leg muscles tired and burning toward end of workout • Out of breath - took a little while to slow breath after completing • Sweating, feel hot (kept sweating for a few minutes)

**Part 3: Identifying Patterns in Data and Observations**

Use the space below to capture the class consensus on the near universal changes noticed during/after high intensity workout.

We experienced:

- Heart rate increased. Heart was pounding!
- Breathing faster/harder
- Tired muscles and sometimes burning muscles
- Hot and sweaty



Part 4: Interpreting and Analyzing Data

Using the Lesson 15 Data Set handout, review the workout data and summarize the investigation plan that researchers used to gather the data.

Soccer players did a fitness test (shuttle run) before participating in the experiments. The players did their morning soccer workout, had a recovery drink, rested for 2 hours, then the same drink again and another 2 hours of rest. Then they did their afternoon soccer practice plus another shuttle run after.

They did this two times on two different days.

They could not see what the drink was.

The data shows how long the athletes could do the shuttle run after the second practice for CM and the other drink.

After reviewing the data, summarize the general findings below.

The results for the CM group showed that men recovered more and had more time to fatigue in their shuttle run when they drank chocolate milk than when they drank the other carbohydrate beverage. For women, there wasn't a significant difference in time between the CM and the CE group.



Part 5: Constructing Initial Explanations

Use prior experiences (including your existing science knowledge or related experiences), data collected during your workout, and evidence from the recovery data set we looked at to construct an initial scientific explanation that answers our Module Questions: *Why are there so many changes to my body during exercise? How does milk help with recovery?* In your explanations, be sure to describe:

- Why do you think breathing rate and heart rate increase during exercise?
- Why do you think muscles fatigue and burn during exercise?
- Where does the body get energy to move the muscles during exercise?
- How does drinking milk help recovery of the body's energy for performance in a second workout?

By the second half of my sprint, I felt out of breath and was breathing faster. I was breathing faster because my body needed more oxygen. When the body is exercising hard, it uses much more energy and oxygen than when resting. The muscles need the energy to move. They get the energy from the food you eat. When they run out of energy, they start to get tired and burn. My heart rate increased because it needed to pump blood to my muscles because they needed more blood when working hard. The blood has nutrients in it that my muscles need. Moving around fast and using muscles burns more energy, which makes me feel hot. Milk helps recovery and provides the body with more energy because it has nutrients in it, like protein, sugars, fats, and electrolytes.

Compare your explanation to that of your classmates, and record areas of agreement and disagreement.

Parts of the Explanation We Agree On	Parts of the Explanation We Disagree On
<ul style="list-style-type: none"> • We breathe faster because we need more oxygen when we exercise. • We breathe even faster during high-intensity exercise because the body is using more oxygen at a time than it used during moderate-intensity exercise. • Oxygen plays a role in making energy • There is sugar/glucose in our body from the foods we eat. The glucose is used to make energy with the oxygen. • Chocolate milk helps our bodies get water and nutrients that it needs to recover to workout again 	<ul style="list-style-type: none"> • Carbon dioxide makes muscles feel like they are burning (some people say lactic acid) • We burn fat for energy during high-intensity exercise



Part 7: Asking New Questions

Record any new questions that you have that might help you:

- Find additional information about why the changes occur in our body during exercise.
- “Fill in a gap” in your explanation or our class explanation.
- Settle an area of disagreement that we’ve identified in our explanations.

- Are my muscles tired because they are not getting enough energy?
- Am I breathing faster to make energy faster for my muscles?
- Do we breathe faster because we need more oxygen when exercising?
- Do glucose, fatty acids, or amino acids from milk play a role in recovery from fatigue and muscle burning?
- Why am I breathing faster/harder?
- Why am I out of breath?
- Am I breathing faster because I am not in shape?
- Am I breathing faster because I need more oxygen when I exercise?
- Which nutrients in milk help athletes recover and perform better in a second workout?
- Does milk help us recover because the protein makes our muscles stronger?