ANNOTATED Black Bear Hibernation Task

Annotation Key

Criteria 1	Criteria 2 (3 Dimensions)				Criteria 3	Criteria 4
Phenomena Information provided to elicit performances	**SEPs** Opportunities to demonstrate science and engineering practices	**DCIs** Opportunities to demonstrate understanding of disciplinary core ideas	**CCCs** Opportunities to demonstrate understanding of crosscutting concepts	**Sense-making** Opportunities to use all 3 dimensions to reason about phenomena	**Equity** Supports a wide range of diverse students	**Assessment Purpose** Highlights how the task features connect to intended assessment use

Overview

This task is intended to be a summative transfer task at the end of the Metabolic Reactions unit.

This task includes a key with what to look for in student responses and a rubric for evaluating students' models in question two.

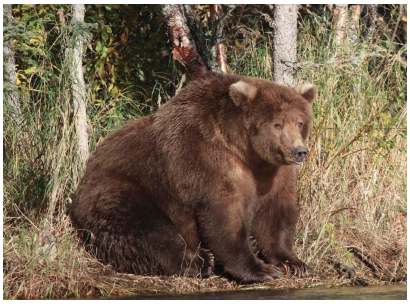
Target PE

MS-LS1-7: Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.

Summary of Task Overall

Strengths	Opportunities for Improvement
Students are using the three dimensions to make sense of how a bear could possibly survive the winter (phenomenon). Phenomena Sense-making Students need to apply their understanding of grade-level DCIs, SEPs, and CCCs to respond to each prompt. SEPs CCCs DCIs The task elicits artifacts of student thinking that are clearly connected to the purpose of the assessment. The key and modeling rubric provide supports for teachers to see key aspects of students' sense-making (summative, transfer task aligned to MS-LS1-7) Assessment Purpose Sense-making The scenario is likely to be engaging to students, most of whom probably have heard of or thought about hibernation in bears. It is also described in accessible language that is easy to understand. Even the data table has some built in supports. Phenomena Equity	Students might not bring CCCs to the task especially if they haven't been explicitly discussed and used in class. The task could explicitly call out CCCs for students to use in the prompts. E.g. Q3: Use your model and ideas about the flow of energy and matter to explain... CCCs Students don't have a lot of choice in how they show their thinking for each prompt. Teachers could give students options to write, draw, or talk about their understanding. Equity There is scaffolding for students to complete the model. Depending on students' needs the other questions might benefit from additional scaffolding to help students put together all the pieces they need to respond to the prompts. Equity

Developed using the resources and examples from Achieve's Task Annotation Project in Science (TAPS)

Item	Annotation
Each winter black bears in North America spend an average of 5 months inside of dens in a low activity state known as hibernation. During this time, they experience drastic body changes. They also do not eat, drink, defecate (poop), or urinate (pee) during this time. It is a wonder that the bears can survive each winter in this state without performing these essential body functions!   Above: This is bear 409, nicknamed "Beadnose," from Katmai National Park in Alaska. The first picture was taken on June 29, and the second picture was taken on September 30. **Average Stats for an Adult Male Black Bear** **Fall - October Going into Hibernation** **Winter During Hibernation** **March - May Coming out of Hibernation** Body Temperature: 100°–101°F; about 88° degrees F; 100°–101°F Breathing Rate & Heart Rate *One way to measure energy used.*: Normal; Very Slow; Normal Heart Rate: 40-50 beats per min; 8-19 beats per min; 40-50 beats per min Weight: about 450 pounds; Not measured; about 250 pounds Body Fat Percentage *Similar to DEXA scans—one way to measure how much fat the bear has stored.*: 30%; Not measured; 15%	The scenario includes a specific, real-world instance of bear hibernation with an example of a bear in Alaska. The phenomenon is set up to be comprehensible to a wide range of students, with limited words and sufficient detail to help students visualize what is going on. It creates a "need to know" setting up the motivation to understand how it is possible that the bears even survive when their bodies shut down like this. The scenario includes text, images, and a data table (3 modalities). The data is a well-crafted data set based on data from a variety of sources. The task is grade appropriate and explainable by grade level SEPs, CCCs, and DCIs. Phenomena Equity Sense-making

Use the data above to explain this phenomenon. 1. During hibernation, bears do not eat for 5 to 6 months in a row. How can the bear stay alive without eating for this long? Use patterns in the data table and science ideas developed throughout this unit to support your answer. _____ _____ _____ _____	In their response to this prompt, students need to make claims about how the bear can survive for this long using patterns from the data table. This is appropriate for grade level constructing explanations where students are using science ideas and evidence to explain a real world phenomenon. Here, students use of the CCC Patterns is intertwined with the science ideas - they need to coordinate the idea with the data to support their claim. For example, Bears can use the stored fat and convert it to energy that their cells need through chemical reactions, which need oxygen, and then release carbon dioxide, water, and usable energy that cells can use. Evidence to support this claim includes the decrease in body fat percentage (bears are burning body fat) and decreased weight (probably related to the decrease in body fat). Sense-making SEPs CCCs DCIs
2. To prepare for winter in the den, a bear will gain up to 30 pounds a week (in extra mass) by eating grass, roots, berries, fish, insects, and small animals. Using everything you've learned from the unit, develop a model that explains, *"How a bear can gain so much weight so quickly?"* Some important components or interactions to include in your model are: food molecules, matter, energy, chemical reactions. Use extra sheets of paper if you run out of space. The **components** you should include in your model are: • Blood, cells • fat stores • Lungs • Oxygen • carbon dioxide • bite of food • food molecules. Some **interactions** you should include in your model are: • Digestion, • Absorption • Eating, • Excretion • delivery to cells • inhaling and exhaling	In this version of the assessment, students are given ample support to create their model that explains how a bear can gain weight so quickly. Students need to bring their ideas about how these components and interactions work for bears to get and store the energy they need from matter (food molecules). The modeling is simplified; however, students still need to put the pieces together to describe the phenomenon. Students are using the three dimensions together to create this model. Sense-making SEPs CCCs DCIs Equity

3. In spring, when the bears emerge from their dens, they have lost between 15% and 30% of their body weight (mass)—that could be around 120 pounds for a large black bear! Using your model above, explain where all the mass went when it was "lost." _____ _____ _____ _____	Students need to use the model to trace the flow of matter to explain what happens to the mass that the bear loses. Students need to bring a molecular level of understanding and explanation to this task. They can use their model of food molecules being processed by the body to do that. It seems important that this question comes after the model and that they use the model and do not just say "matter can neither be created nor destroyed." When students use the DCIs to explain what's going on they are applying their conceptual understanding not just telling about what they know. Sense-making SEPs CCCs DCIs