FISH CAMP PACKAGING *(MODIFIED FOR ADEED)*

Science Concept:

Energy can be transferred.

Objectives:

The student will:

- compare and contrast energy transfer of three materials;
- make predictions; and
- write to describe and explain the reasoning behind his or her predictions.

GLEs Addressed:

Science

[10] SB2.1 The student demonstrates an understanding of how energy can be transformed, transferred, and conserved by examining energy (i.e., nuclear, electromagnetic, chemical, mechanical, thermal) transfers, transformations, and efficiencies by comparing useful energy to total energy.

[10] SA1.1 The student demonstrates an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, analyzing data, developing models, inferring, and communicating.

Writing

[10] W4.1.2 The student writes about a topic by writing in paragraphs that included relevant details and evidence that support the main idea of the paragraph and thesis statement, grouping ideas logically within the paragraph, and placing paragraph breaks logically.

Vocabulary:

control - a standard of comparison; a test or experiment established as a check of other experiments, performed by maintaining identical conditions except for the one varied factor, whose causal significance can thus be inferred

efficiency - the state or quality of being or performing satisfactorily with the least wasteful time and effort

freezing point - the temperature at which a liquid turns into a solid when cooled

heat - the process of energy transfer from one body or system to another as a result of a difference in temperature

insulation - the action of insulating something: i.e., covering, lining, or separating with a material that prevents or reduces the passage, transfer, or leakage of heat, electricity, or sound <keep your home warmer through insulation>

melting point - the temperature at which a solid changes into a liquid

mixture - a substance made by mixing other substances together

solute - the minor component in a solution, dissolved in the solvent

solution - a homogeneous mixture of a liquid (the solvent) with a gas or solid (the solute)

temperature - the degree or intensity of heat present in a substance or object, especially as expressed according to a comparative scale and shown by a thermometer or perceived by touch

thermal energy – energy, or power, as a result of heat

variable - anything that is subject to variation

FISH CAMP PACKAGING

Materials:

- Water
- Ice cubes
- Thermometers (two per student)
- 500-milliliter beakers (two per student)
- Stopwatches (one per student)
- Balances
- Stirring rods or plastic knives (one per student)
- Scoops or plastic spoons (one per student)
- Measuring boats or Dixie cups (one per student)
- Goggles (one per student)
- Aprons (one per student)
- NaCl [table salt]
- MgCl2 [ice melt salt]
- MgSO4 [Epsom Salt]
- Sawdust
- Sand
- Peat
- Sugar
- STUDENT WORKSHEET: "Data Table for Observation of Temperature Changes"

Activity Procedure:

Please refer to the assessment task and scoring rubric located at the end of these instructions. Discuss the assessment descriptors with the class before teaching this lesson.

Gear Up

Process skills: questioning, observing, measuring, collecting data, and analyzing data

1. Distribute aprons and goggles to students and model proper safety procedures.
2. Distribute two 500-milliliter beakers, an apron, goggles, ice, two thermometers, a scoop, a stirring rod, a measuring boat, a stopwatch, and a sample of one of the salts (17.5 grams or larger) to each student. Ask students to fill two 500-milliliter beakers to approximately the 400-milliliter level with ice, and then add fresh water to fill the spaces between the ice pieces until the water level is at 500 milliliters.
3. Instruct students to use the balance to measure 17.5 grams of one of the salts and add it to one of their beakers. They should not add anything to the second beaker; it will serve as a control.
4. Ask students to predict the temperature change for the saltwater solution and control beakers.
5. Instruct students to record the temperature of each solution. Students should stir the contents of each beaker with the stirring rod (not the thermometer) for 5 minutes (using the stop watch) and record the temperature every 30 seconds during those 5 minutes. Students should describe any other observations as well as the temperature changes.
6. As a class, discuss what happened to the temperature, what happened to the volume of ice. Ask students what they think is happening. Discuss.

Explore

Process Skills: questioning, observing, measuring, collecting data, inferring, predicting, analyzing, hypothesizing, controlling variables, and investigating.

7. Instruct students to clean the beaker that contained the variable (salts). Distribute the STUDENT WORKSHEET: "Data Table for Observation of Temperature Changes," make materials available to students, and guide students through the activity.

Generalize

Process skills: communicating, making generalizations, analyzing data, and describing

8. Ask students the following questions. Discuss as a class.
    a. Which materials dissolved in the ice water?
    b. If any materials did not dissolve, did the temperature change?
    c. Did all the materials that dissolved produce a temperature change?
    d. Was one material more efficient at changing the temperature of the solution than the others?
    e. If there was a temperature change, was energy brought into the solution or was energy released? Where did the energy come from or go to?
    f. Did the materials that had temperature changes change temperature at the same rate?

Apply

Process skills: predicting and inferring

9. Ask students at what temperature they think sea ice begins to form. Explain.
10. Alternatively, ask students to draw a diagram of a river delta where a freshwater river pours into the sea. Instruct students to label where they think the water will freeze at the highest temperature and where they think the water will freeze at the lowest temperature. Instruct them to write an answer to the following question: Based on the exploration, what do you predict those two freezing temperatures should be?

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RUBRIC

Assessment Task

Ask students to imagine the following situation: You and your family are at a remote fish camp on the Yukon River during the summer. You've been successful and have a great bounty to bring home. Your boat, however, needs a few days of repair time, and you need to find a way to preserve your fish adequately. In your science journal, predict and describe some ways to cool the fish so they won't spoil while you're waiting. Using the knowledge acquired from your investigation of thermal energy transfer, compare and contrast some of the materials you explored to design an efficient fish cooler.

Rubric

Objective	GLE	Below Proficient	Proficient	Above Proficient
The student compares and contrasts energy transfer.	[10] SB2.1	The student compares, contrasts, and/or describes two or fewer materials that can be used in the creation of a fish cooler. The student does not explain the use of these materials in terms of energy transfer.	The student compares, contrasts, and/or describes three materials that can be used in the creation of a fish cooler. The student explains the use of these materials in terms of energy transfer.	The student compares, contrasts, and/or describes four or more materials that can be used in the creation of a fish cooler. The student explains the use of these materials in terms of energy transfer.
The student makes predictions.	[10] SA1.1	The student does not demonstrate understanding by accurately predicting the effect of three materials on the fish cooler, and/or the student does not reference the explore activity.	The student demonstrates understanding by accurately predicting the effect of three materials on the fish cooler. The student references the explore activity.	The student demonstrates understanding by accurately predicting the effect of four or more materials on the fish cooler. The student references the explore activity.
The student writes to describe and explain the reasoning behind his or her predictions.	[10] W4.1.2	The student writes two or fewer paragraphs describing his or her fish packaging design, and/or the student's writing lacks reasoning to explain the system's design. The student does not demonstrate knowledge of energy transfer or does not include a reference to the exploration.	The student writes three paragraphs that describe the design and reasoning behind a packaging system that will preserve fish at fish camp using his or her knowledge of energy transfer. The student includes a reference to the exploration.	The student writes four or more paragraphs that describe the design and reasoning behind a packaging system that will preserve fish at fish camp using his or her knowledge of energy transfer. The student includes a reference to the exploration.

NAME: _____

STUDENT WORKSHEET

DATA TABLE FOR OBSERVATION OF TEMPERATURE CHANGES

Materials:

- Water
- Ice cubes
- Thermometer
- 2 500-milliliter beakers
- Stopwatch
- Balance
- Stirring rods
- Scoops
- Measuring boats
- NaCl [table salt]
- MgCl2 [ice melt salt]
- MgSO4 [Epsom Salt]
- Sawdust
- Sand
- Peat
- Sugar

Procedure:

STEP 1. Clean the beaker that contained the variable (salts) from the Gear Up activity, and refill it with ice to approximately the 400-milliliter level, and then with fresh water to fill the spaces between the ice pieces until the water level is 500 milliliters. Do the same to the control beaker.

STEP 2. Measure 17.5 grams of a sample (salt, sawdust, sand, peat, or sugar) and add it to one of the beakers. In the chart below, predict how the temperature will change for that solution.

STEP 3. Record the type of material, a description of the material, and the beginning temperature.

STEP 4. Stir the contents of the beaker with the stirring rod (**not** the thermometer) for 5 minutes (using the stop watch) and record the temperature every 30 seconds during those 5 minutes. Describe any other observations as well as the temperature changes.

STEP 5. Repeat Steps 2-4 for at least two more materials so that you have observed temperature changes for at least three different materials in addition to the control.

NAME: ______________________________

DATA TABLE FOR OBSERVATION OF TEMPERATURE CHANGES

Solution/mixture	Prediction	Temperature after every 30 seconds: Start	0:30	1:00	1:30	2:00	2:30	3:00	3:30	4:00	4:30	5:00
Control (water and ice only)												
Example variables:		Start	0:30	1:00	1:30	2:00	2:30	3:00	3:30	4:00	4:30	5:00
Variable: ________ Description:												
		Start	0:30	1:00	1:30	2:00	2:30	3:00	3:30	4:00	4:30	5:00
Variable: ________ Description:												
		Start	0:30	1:00	1:30	2:00	2:30	3:00	3:30	4:00	4:30	5:00
Variable: ________ Description:												