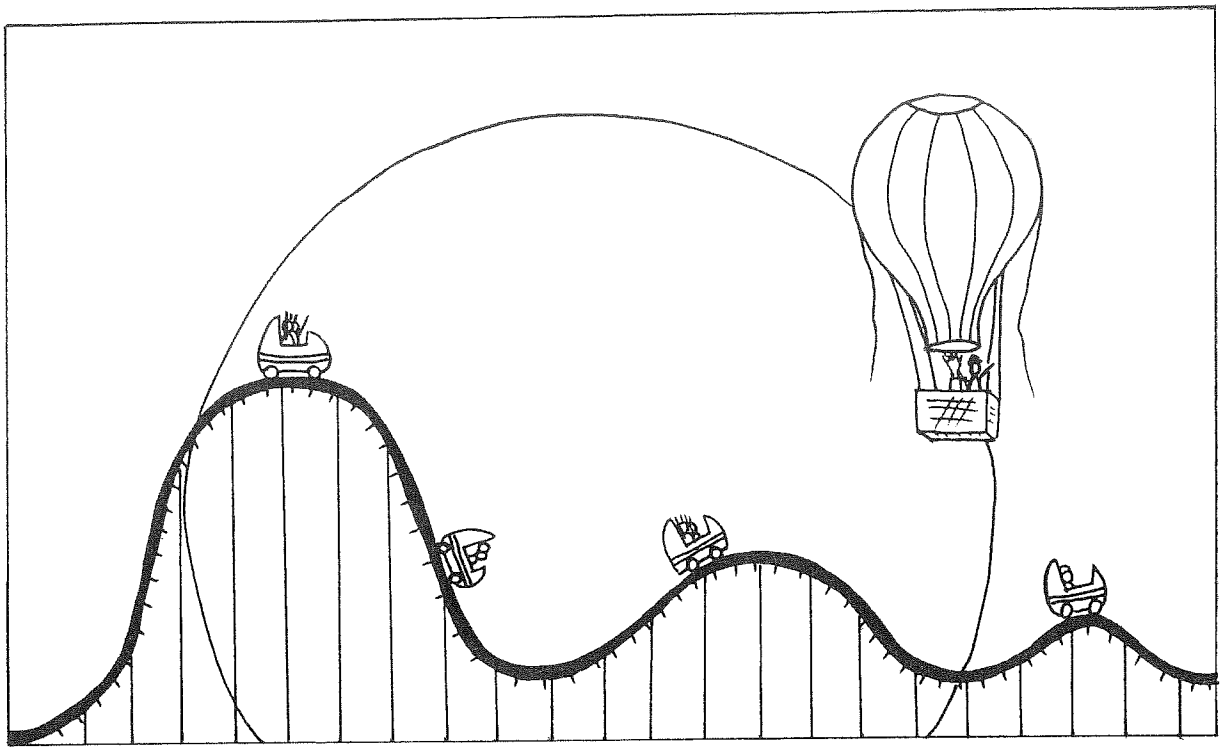
BATTLE CREEK AREA
Mathematics & Science Center

Student Journal
6PS

Energetic Connections



A Sixth Grade Unit
supporting the
Michigan Science K-7 Content Expectations

Name: _____

Name: _____

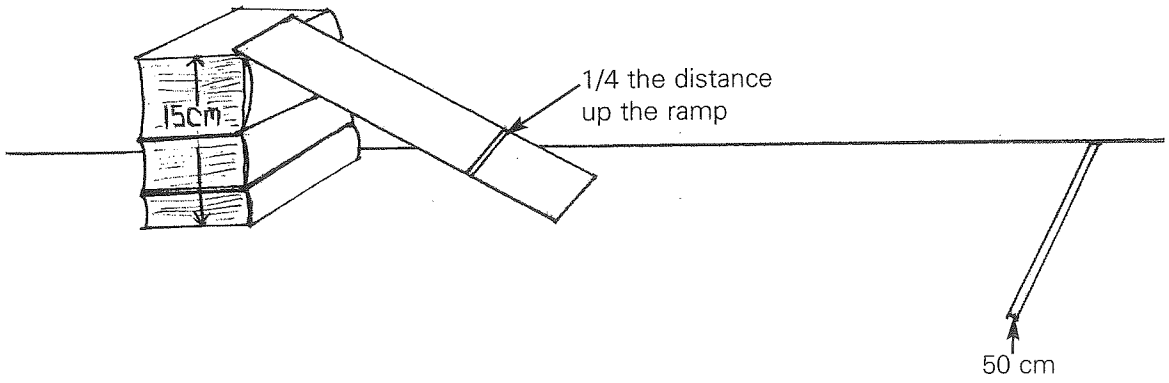
Date: _____

ACTIVITY

Running on Energy

1

1. Use classroom books to support your ramp at a height of approximately 15 cm.
2. Measure 50 cm from the bottom edge of the ramp and mark with masking tape.
3. Place a piece of tape on the ramp 1/4 the distance up the ramp from the bottom. (See illustration.)



4. Test the amount of time it takes for the ball to roll from the bottom of the ramp to the 50 cm line when released from the top of the ramp. (Run at least 3 trials.)
5. Repeat the trials at the 1/4 mark up the ramp.
6. Make a chart to record your data. Run multiple trials of your investigation.

Name: _____

Date: _____

1

1. Write the question you are investigating.

_____

_____

_____

2. Write what you think your investigation will demonstrate.

_____

_____

_____

_____

3. List the materials you will use.

4. Write the steps you took.

Name: _____

Date: _____

5. Make a chart and record your findings.

6. Write what you found out. (Use the terms *potential* and *kinetic energy* in your response.)

_____

_____

_____

_____

_____

_____

_____

7. List any further questions that developed during your investigation.

_____

_____

_____

_____

_____

_____

J O U R N A L

Running on Energy (cont.)

Name: _____

Date: _____

1

Write a scientific statement or conclusion to your investigation. Include the claim, evidence, and reasoning in your conclusion.

Name: _____

Date: _____

ACTIVITY
Get the Ball Rolling

2

1. Write the question you are investigating.

_____

_____

_____

2. Write what you think will happen.

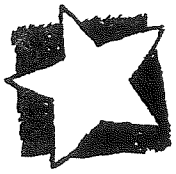
_____

_____

_____

3. List the materials you are using.

4. Draw a picture of your ramp set-up and write the steps you took.



ACTIVITY

Get the Ball Rolling (cont.)

Name: _____

Date: _____

2

5. Make a chart to organize your data.

6. Write a scientific statement or conclusion based on your findings. Include a claim, evidence, and scientific reasoning in your conclusion.

Name: _____

Date: _____

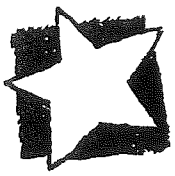
JOURNAL

Get the Ball Rolling (cont.)

2

1. Draw and label a picture of your ramp and ball set-up. Include the different heights of the ramp and the position of the ball when it has potential energy and kinetic energy. Label the transformation between potential and kinetic energy.

2. Describe the force that starts the ball moving. Identify the potential energy, kinetic energy, balanced forces, and unbalanced forces in the investigation.



ACTIVITY

What About Mass?

Name: _____

Date: _____

3

1. Write the question you are investigating.

_____

_____

_____

2. Write what you think will happen.

_____

_____

_____

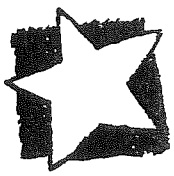
_____

3. List the materials you will use.

4. Write the steps you will take.

Name: _____

Date: _____



ACTIVITY

What About Mass? (cont.)

3

5. Make a chart to organize your data.

6. Write a scientific statement or conclusion based on your results. Include the claim, evidence, and scientific reasoning for your conclusion.

J O U R N A L

What About Mass? (cont.)

Name: _____

Date: _____

3

Describe how your investigation, and the teacher demonstration, relates the mass of an object and the force of gravity to the gravitational potential energy and kinetic energy.

Name: _____

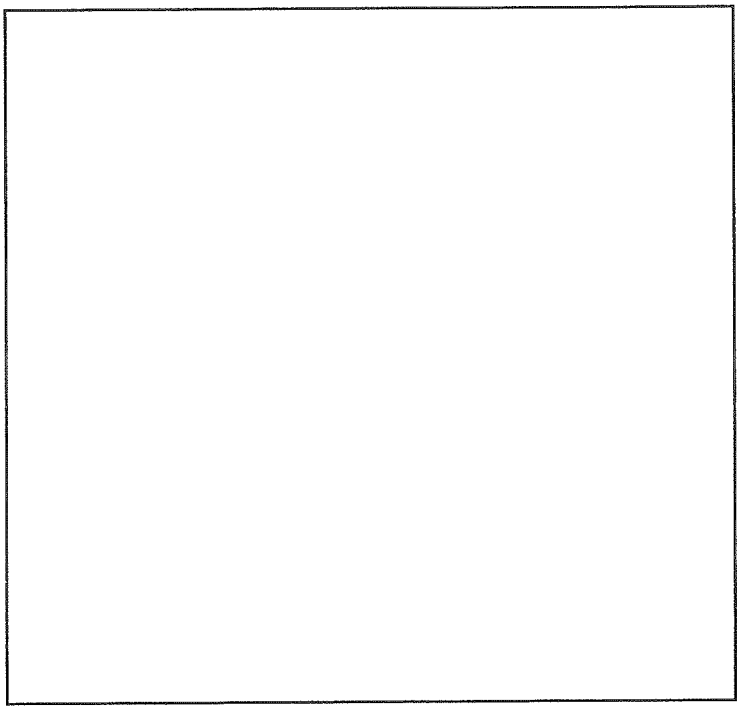
Date: _____

JOURNAL

The Ups and Downs of Potential and Kinetic Energy

4

Draw and label a picture of your roller coaster. Write an article for the local paper that will describe your roller coaster ride and will attract visitors to the ride. Explain the gravitational potential energy and kinetic energy transformations that were used to produce the loops, ups, and downs of the ride.



ACTIVITY

Discovering More About Potential Energy

Name: _____

Date: _____

5

Complete the chart using your observations and investigations into the energy of each item.

Item	Describe the potential energy in the toy; what gives the toy potential energy?	Describe the position that changes to produce kinetic energy in the toy; what does the item use its energy to do?	Record or describe the distance moved
1.			
2.			
3.			
4.			
5.			

Name: _____

Date: _____

ACTIVITY 5

Discovering More About Potential Energy (cont.)

Potential Energy Toy Product Descriptor

Your toy invention must:	Yes	No
1. demonstrate at least one example of potential energy. a. gravitational potential energy b. elastic potential energy c. magnetic potential energy		
2. demonstrate an example of kinetic energy.		
3. include a labeled diagram.		
4. include a set of "how-to" instructions.		
5. be creative and interesting!		
Your toy invention presentation must:		
1. demonstrate the motion of the toy.		
2. include an oral explanation of the potential energy.		
3. include an oral explanation of the kinetic energy.		
4. an advertisement that will convince people to purchase your toy.		

ACTIVITY

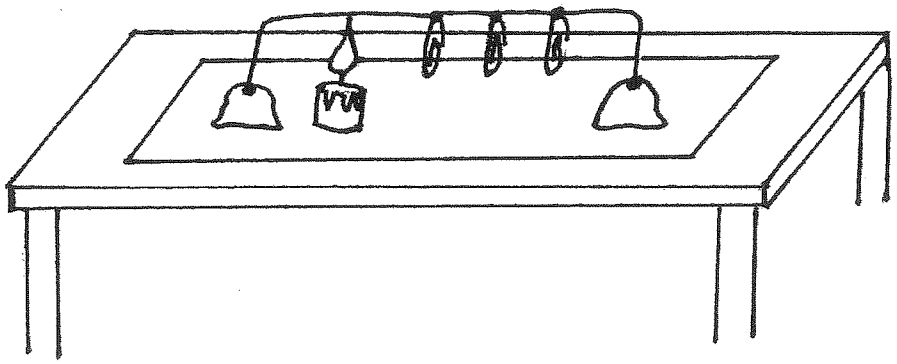
Heat Energy - Conduction

Name: _____

Date: _____

6

1. Build the heat transfer set-up using the illustration below. Label the potential and kinetic energy in the illustration.



2. Construct a data table and record the amount of time it took paper clip #1, #2, and #3 to drop.

3. Write your observations of the order the paper clips dropped.

_____

_____

_____

Name: _____

Date: _____

JOURNAL

Heat Energy - Conduction (cont.)

6

Write a conclusion statement for the candle and wire investigation into heat energy. Include a claim, supported by evidence and scientific reasoning.

ACTIVITY

Heat Energy - Conduction and Convection in Liquids

Name: _____

Date: _____

7

Part 1

1. Write the question you are investigating.

_____

_____

_____

2. Write what you think will happen.

_____

_____

_____

_____

3. List the materials you will use.

4. Write the steps you took.

Name: _____

Date: _____

Heat Energy - Conduction and Convection in Liquids (cont.)

5. Record your data and observations.

6. Write a scientific statement or conclusion for your investigation. Include a clear and concise claim, supported by evidence and scientific reasoning.

ACTIVITY

Heat Energy - Conduction and Convection in Liquids (cont.)

Name: _____

Date: _____

7

Part 2

1. Draw and label a picture of the baby food jar set-up.

2. Make a data chart that demonstrates the change in temperature and appearance of the investigations over time.

Name: _____

Date: _____

JOURNAL

Heat Energy - Conduction and Convection in Liquids (cont.)

7

Write a scientific statement or conclusion that explains the results of the hot and cold water investigation. Include the claim, evidence, and reasoning in your response.

ACTIVITY

Up, Up, and Away

Name: _____

Date: _____

8

Part 1

1. Draw and label a picture of the "popping coin" on the flask. Draw arrows that show the movement of the air in the flask.

2. Explain the heat transfer that took place in the coin and flask investigation.

_____

_____

_____

_____

_____

Name: _____

Date: _____

ACTIVITY

Up, Up, and Away (cont.)

8

Part 2

1. Use a marker and write your name or draw a face on the balloon before it is inflated.

2. Partially blow up the balloon and attach it around the mouth of the flask. Measure the circumference of the balloon. _____

3. Place the flask and balloon in the container of ice.

4. Draw a picture of the flask/balloon set-up.

5. Record your observations. Describe or draw how the flask has changed. Use arrows to show the direction of the energy transfer and air movement.

Name: _____

Date: _____

8

6. Measure the circumference of the balloon in the ice. _____

7. After several minutes in the ice, remove the flask/balloon set-up from the ice and set it on the desk.

8. Record your observations. (Hint: Place your hands around the flask and observe the changes in the balloon.) Describe or draw how the balloon changed when removed from the ice. Use arrows to show the direction of the energy transfer and air movement.

Name: _____

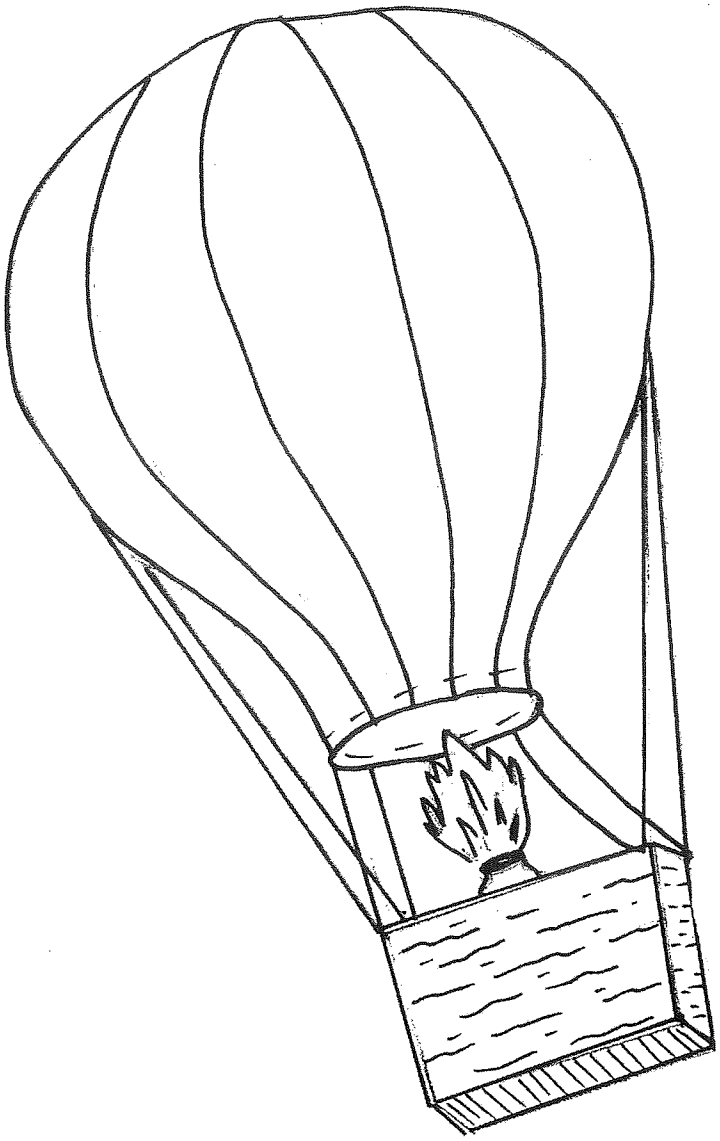
Date: _____

JOURNAL

Up, Up, and Away (cont.)

8

Look at the picture of the hot air balloon. Draw arrows that show the flow of heat energy and explain how the hot air balloon works using convection.



ACTIVITY

Solar Energy

Name: _____

Date: _____

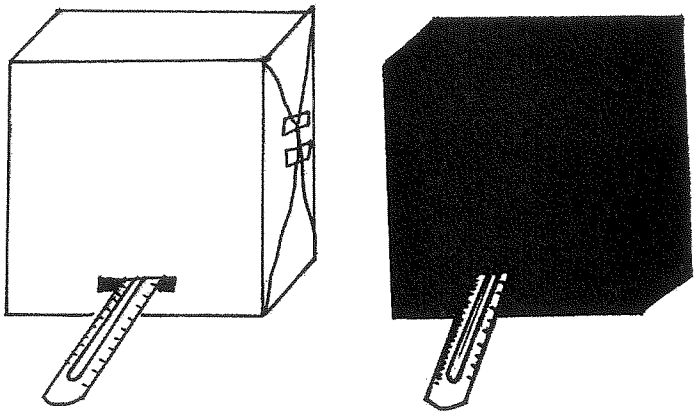
9

Part 1

1. Wrap one box in black paper and one box in white paper. Secure the paper with tape.

2. Cut a slot in the side of the box near the bottom large enough to insert a thermometer.

3. Place the boxes back to back in direct sunlight or under a lamp provided in the classroom.



4. Make a data chart and record the temperature inside the white box and black box at 2 minute intervals for 20 minutes.

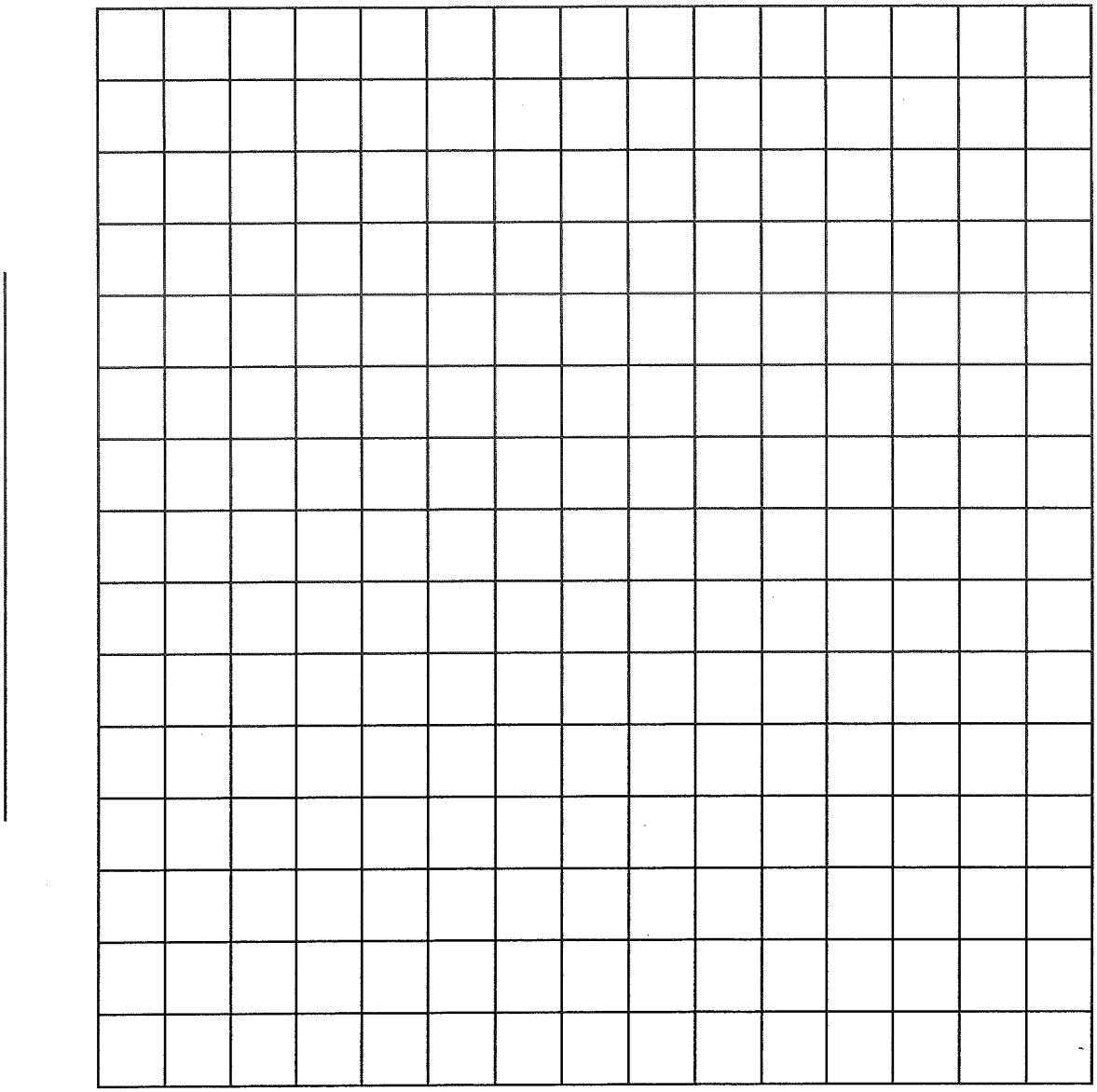
Name: _____

Date: _____

5. Use the data from your chart and make a graph of the temperature readings inside the black box and white box.

_____

Title



_____

ACTIVITY

Solar Energy (cont.)

Name: _____

Date: _____

9

Part 3

1. Write the question you are investigating.

_____

_____

_____

2. Write what you think will happen.

_____

_____

_____

_____

3. List the materials you will need.

4. Write the procedure you will follow.

Name: _____

Date: _____

5. Make a data chart to record your findings.

6. Write a scientific explanation or conclusion for your investigation. Include a claim, supported by evidence and scientific reasoning, in your response.

ACTIVITY

Solar Oven Performance Assessment

10

Name: _____

Date: _____

Solar Oven: Basic Instructions

Follow the directions to make a solar oven from a pizza box. Record the temperature of the solar oven in its original design and then make modifications that will increase the temperature in the oven.

Materials Needed:

1 pizza box

black construction paper

aluminum foil

clear plastic wrap

tape

scissors

ruler

thermometer

Procedure:

1. Measure and draw a 3 cm border on all four sides of the top of the pizza box.

2. Cut along the line on the two sides and the front of the box. Leave the line on the back of the box uncut. (See illustration #1)

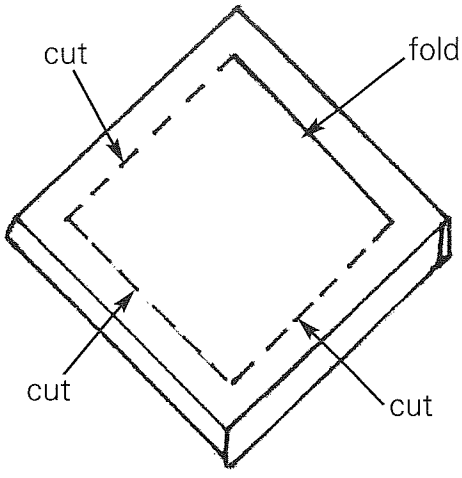


Illustration #1

3. Form a flap by gently folding back along the uncut line to form a hinged lid.

Name: _____

Date: _____

4. Cut a piece of aluminum foil to cover the inside of the flap. Smooth any wrinkles from the foil and tape the foil securely to the top of the lid.

5. Measure a piece of plastic wrap to fit over the opening in the box. Cut the plastic wrap larger than the opening so you can tape it to the inside of the box. Be sure the plastic wrap becomes a tightly sealed window so the air cannot escape from the inside of the box oven. (See illustration #2)

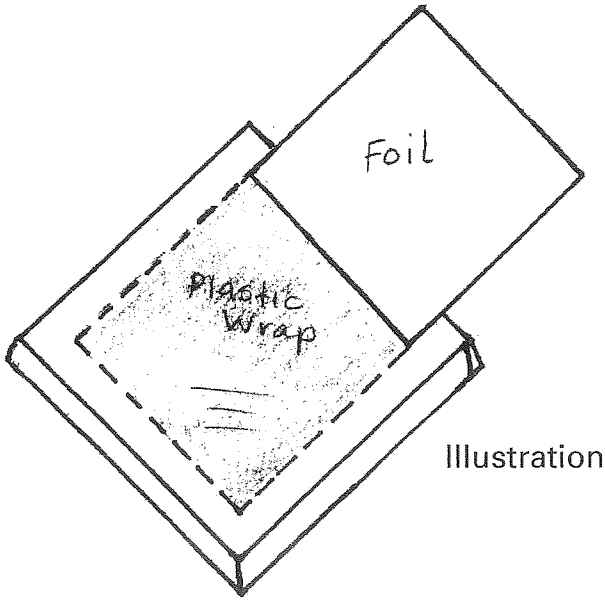
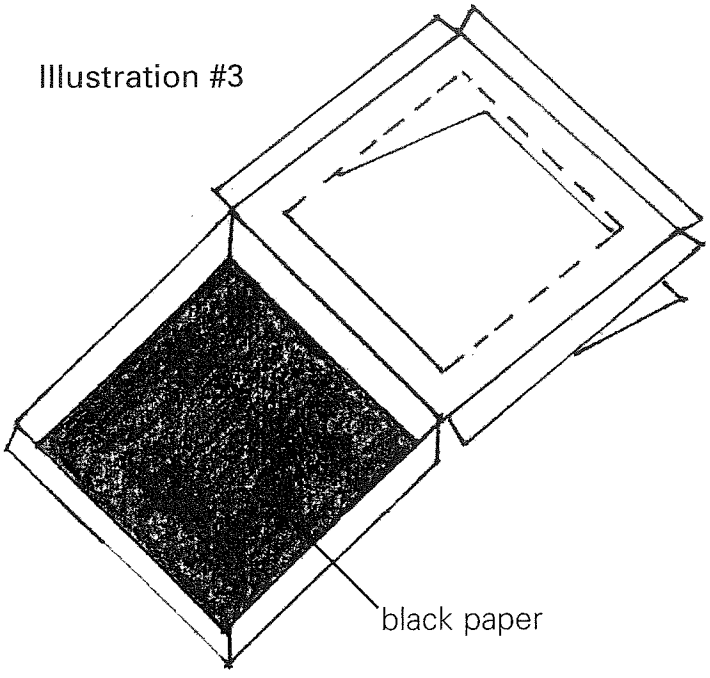


Illustration #2

Illustration #3



6. Cut another piece of aluminum foil to line the bottom of the pizza box and carefully tape it into place. Cover the aluminum foil with a piece of black construction paper and tape into place.

7. Place a thermometer in the interior of the oven. Place the thermometer so that the temperature can be viewed through the plastic wrap, without opening the oven. (See illustration #3.)

Solar Oven Performance Assessment (cont.)

Name: _____

Date: _____

8. Close the pizza box top, and prop open the flap of the box with a stick or straw. Face the flap of the oven toward the sunlight. Adjust the position of the oven and flap so the maximum sunlight is reflected through the window into the interior of the oven.

9. Your oven is ready! You can try heating s'mores, hot dogs, or English muffin pizzas. You may even try baking a small pan of brownies or cookies. (See illustration #4.)

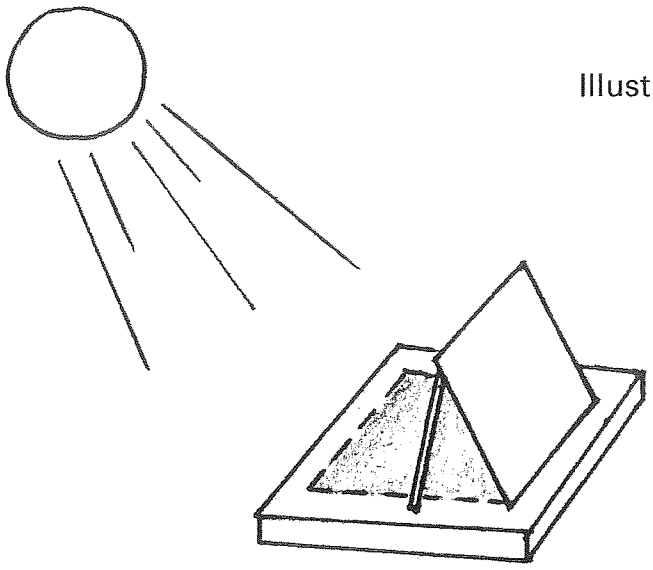


Illustration #4

Name: _____

Date: _____

10. Collect data on the heating of the oven over time. Record your data in a chart.

11. Make modifications to your oven that you think will increase the maximum temperature your oven can read.

    Draw and label a picture of your "modified" oven.

ACTIVITY

Chemical Energy

11

Name: _____

Date: _____

Part 1

1. Work with a partner. Get the following materials from the materials table:

   1 film canister
   vinegar
   baking soda
   1 tissue
   measuring spoon

chemical

2. Pour one teaspoon of water and one teaspoon of vinegar into the film canister. Carefully mix the two together by swirling the canister. Clean and dry the measuring spoon.

3. Tear off a small piece of the tissue (about 1/3) and put one teaspoon of baking soda onto the tissue. Roll the tissue so that the baking soda is inside the tissue and looks like a small package.

4. Predict what you think will happen when you put the baking soda "package" into the film canister and then put the lid on.

_____

_____

_____

5. Now, put the small package of baking soda into the film canister with the vinegar and water. Quickly put the lid on the film canister and step away from the canister. Do not point the film canister towards anyone!

6. Describe what happened to the film canister when the baking soda was added to the vinegar and water.

_____

_____

Name: _____

Date: _____

7. Repeat the Procedure Steps #1- #5. This time, change one part of the set-up. What is it that you are going to change?

_____

_____

8. Was there anything different about the way the film canister reacted? Explain.

_____

_____

_____

9. What evidence do you have that chemical energy was involved? Explain.

_____

_____

_____

Part 2

Prediction: Fill in the blanks with either the word *gumdrop* or *candle*.

There is more energy transferred from the _____ than from the _____ .

Data Table A
Heating the water with the **gumdrop:**

	Before	Prediction	After	Difference
Temperature (C°) of the water				

Time that the gumdrop burned: _____ .

Name: _____

Date: _____

Data Table B
Heating the water with the **candle:**

	Before	Prediction	After	Difference
Temperature (C°) of the water				

Time that the candle burned: _____

Write a conclusion statement for the gumdrop and candle demonstration. Include a claim, supported by evidence and scientific reasoning.

Name: _____

Date: _____

JOURNAL

Chemical Energy (cont.)

11

1. Compare and contrast the experiments in this activity that deal with chemical energy. These include the reaction of the baking soda and vinegar, the burning of the gumdrop, and the burning of the candle.

2. What evidence do you have that chemical energy was involved with the burning gumdrop?

J O U R N A L

Energy in a System

Name: _____

Date: _____

12

1. If you set a top in motion, will the top remain spinning forever? Explain and describe the different forms of energy and energy transfers involved in the spinning top.

2. Explain why the top stopped spinning and how the energy remained the same.

Name: _____

Date: _____

ACTIVITY
It's a Matter of State

13

Steps:

1. You will need: 2 plastic cups, warm water, cold water, red food coloring, blue food coloring.
2. Fill one cup 3/4 full of very warm water and the other cup 3/4 full of cold water.
3. At the same time, one group member will drop 2 drops of red coloring into the water of one cup and another member will drop 2 drops of blue coloring into the water of the other cup. Do not move the cups.
4. Observe what happens in each cup over the next 5 minutes.

   What differences do you notice in the movement of color in the two cups at 1 minute? at 2 minutes? at 3 minutes? 4 minutes? 5 minutes?

   Draw and write your observations on the next page. Then complete the following questions:

5. In which cup does the color move into the water more quickly?

_____

6. Explain why the color moved more quickly in one cup than in the other cup. Use the word *molecules* in your explanation.

_____

_____

_____

7. Compare what happened to the color in the water (a liquid) to what happened to the color in the gelatin (a solid). Explain how the color moved more quickly in one cup than in the other.

_____

_____

_____

_____

ACTIVITY

It's a Matter of State (cont.)

Name: _____

Date: _____

13

Write your observations Time	Draw your observations Cold Water	 Warm Water
1 minute		
2 minutes		
3 minutes		
4 minutes		
5 minutes		

Name: _____

Date: _____

Molecular Motion, Distance, and Arrangement in Three State of Matter

Fill in the following information:

State of Matter	State of Matter between Molecules	Distance of Molecules	Arrangement of Molecules	Picture of Model
Solid				
Liquid				
Gas				

1. Using the containers below, draw the arrangement of molecules in a solid, a liquid, and a gas.

Solid

Liquid

Gas

2. Use your understanding of molecules to explain how a liquid has a definite volume but not a definite shape.

3. Explain why you should not depend only on the BB models to understand the three states of matter.

4. Explain how the thermometer works in terms of the motion and arrangement of molecules in the liquid thermometer.

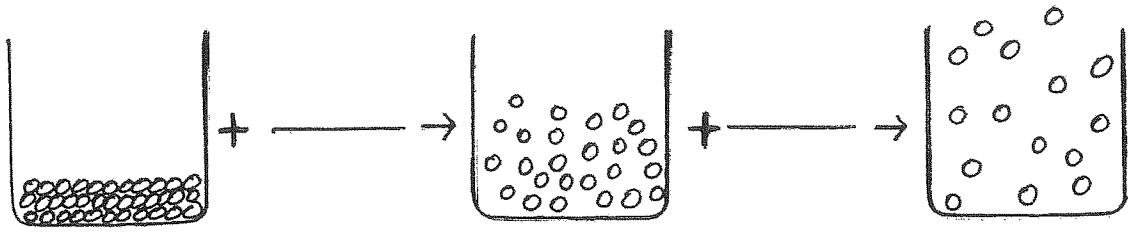
Name: _____

Date: _____

JOURNAL
It's a Matter of State (cont.)

13

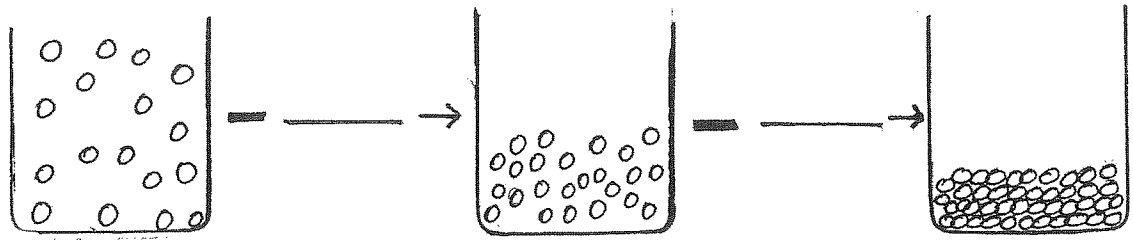
1. Label the drawings to demonstrate phase changes in states of matter. Include what is increased (+) or decreased (-) between states.



_____ (state of matter)

_____ (state of matter)

_____ (state of matter)



_____ (state of matter)

_____ (state of matter)

_____ (state of matter)

2. Describe the relationship between matter and energy when matter goes through a phase change.

_____

_____

_____

_____

ACTIVITY

Matter and Mass

Name: _____

Date: _____

14

1. Write the question you are investigating.

_____

_____

_____

2. Write what you think will happen.

_____

_____

_____

_____

_____

3. List the materials you will use.

Name: _____

Date: _____

4. Draw a diagram of your set-up in your investigation and the steps you followed.

5. Make a data chart for your investigation.

Name: _____

Date: _____

14

6. Write a conclusion based on your evidence. Include a claim, evidence, and scientific reasoning in your conclusion.

Name: _____

Date: _____

JOURNAL
Matter and Mass (cont.)

14

Water molecules are made up of two hydrogen atoms and one oxygen atom. Illustrate a model that demonstrates how the mass of water remains the same as it changes from state to state in a closed system. Write a caption for your illustration.

ACTIVITY

Heat It Up!

15

Name: _____

Date: _____

1. Write down your ideas and observations about how a thermometer works.

2. Explain the materials you will need and the steps you will take to build a classroom thermometer.

Name: _____

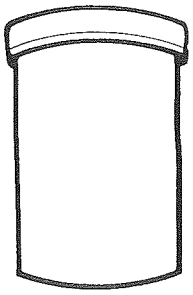
Date: _____

ACTIVITY 15

Heat It Up!

RESULTS PAGE

WATER



Placed in freezer

→

Energy transfer away from molecules

LIQUID

Finger on Thermometer

→

Energy transfer to molecules

Finger off Thermometer

→

Energy transfers away from molecules

SOLID

Placed in candle flame

→

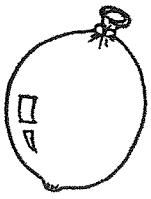
Energy transfer to molecules

Removed from candle flame

→

Energy transfers away from molecules

GAS



Put in freezer

→

Energy transfers away from molecules

Taken out of freezer

→

Energy transfer to molecules

J O U R N A L

Heat It Up! (cont.)

Name: _____

Date: _____

15

1. Explain what often happens to a liquid when it is heated but does not change its state of matter.

2. What happens to the molecules when the liquid is cooled?

3. Explain what often happens to a solid when it is heated but does not change its state of matter.

4. What happens to the molecules when the solid is cooled?

Name: _____

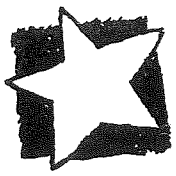
Date: _____

5. Compare what happens in a liquid and in a solid to a gas when it is cooled.

6. Explain and draw a picture to show what happens to the water molecules when water is heated.

7. What happens to the water molecules when water is cooled?

8. What evidence do you have to explain that when 4°C water is cooled, the molecules spread out further and water expands?



Key Terms

absorb - Absorb is the ability to take in. Some materials absorb light.

arrangement of molecules - The arrangement of molecules is the particular way that molecules are organized within a substance.

atom - An atom is the smallest part of an element.

balance - A balance is a tool used to find the mass of an object.

chemical energy - Chemical energy is a form of potential energy related to the molecular structure of a substance.

claim - A claim is a clear and concise statement that tells what is learned or concluded from an investigation.

closed system - A closed system refers to a system where atoms and molecules are not allowed to enter or leave the system. The substances in the closed system do not interact with its surrounding environment.

conduction - Conduction is the transfer of energy through the motion and collision of particles from one substance to another.

conservation of energy - Conservation of energy is the scientific law that energy can never be created or destroyed, only converted into different forms.

conservation of mass - Conservation of mass refers to how the mass within a closed system remains the same regardless of the energy transformations or processes acting within the system.

conserved - Conserved means to remain the same in quantity or amount.

convection - Convection is heat energy moving from one place to another due to the motion of the warm and cold masses of fluid.

data - Data is observations and facts about concepts that can be used to calculate, reason, and draw conclusions.

elastic potential energy - Elastic potential energy is the form of energy an object has when its shape is changed through stretching, compressing, twisting, and bending. Objects with elastic potential energy resist the change in shape and return to their original shape when released.

energy – Energy is the ability to do work or cause change. Things change when there is an energy transfer.

energy transfer - Energy transfer is the transfer of the energy of heat and/or motion from one object or system to another.

evidence - Evidence is what a person observes, reads, or does, that strengthens a belief that something is true. It is important to know what the evidence is for a person to write statements or talk about a science investigation.

food energy - Food energy is an example of chemical energy.

force - A force is a push or pull on something. A force is needed to change the motion of something.

gases - Gases are atoms or molecules that are far apart and that move freely with random motion.

gram - A gram is a metric unit of measurement used for determining the mass of an object or substance.

gravitational potential energy - Gravitational potential energy is the potential energy an object or group of objects have in a system, due to the separation or height above the Earth.

heat energy – Heat energy is energy associated with the difference in the temperatures between objects. Heat energy can change things.

Key Terms (cont.)

heat transfer - Heat transfer relates to the transfer of heat from warmer objects to colder objects due to the motion of molecules.

kinetic energy – Kinetic energy is the energy an object has due to its motion.

liquids - Liquids are atoms or molecules that are close together and that move in random motion.

magnetic potential energy - Magnetic potential energy is the form of energy related to the distance between magnetic materials.

mass - Mass is the measure of the amount of matter in an object. The mass of an object remains the same no matter what the gravitational pull.

molecules - Molecules are two or more atoms that bond together as the basic unit of elements or compounds.

motion - Motion is a changing of position. Motion can be described in changes of distance, time, and/or direction.

motion of molecules - The motion of molecules is the particular way that molecules move.

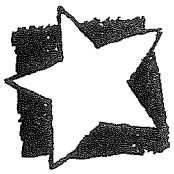
newton - A newton is a metric unit used for measuring force. Weight is the measure of the force of gravity and can be measured in newtons.

potential energy - Potential energy is often described as "stored energy." Potential energy is energy an object has due to its shape or position.

radiation - Radiation is a transfer of energy through electromagnetic waves. Radiation does not require matter to transfer thermal (heat) energy.

reasoning - Reasoning ties what we already know about the concept to the claim and evidence.

reflect - Reflect is the ability to bounce off a surface. Some materials reflect light.



solar energy - Solar energy is energy associated with the light that is generated by the sun. Solar energy can be transferred to heat energy.

solids - Solids are atoms or molecules that are very close together and that move within fixed positions in a rigid structure.

spring scale - A spring scale is a tool used to measure the force on an object.

state of matter - State of matter describes whether a substance is a solid, liquid, or gas.

thermal contraction - Thermal contraction is a physical change in which matter becomes more dense due to temperature changes.

thermal expansion - Thermal expansion is a physical change in which matter increases in size due to temperature changes.

transformation - Transformation of energy refers to the changing or conversion of one form of energy to another.

variables - Variables are the properties of things that can change, be changed, or vary in an investigation. Variables can affect the results of an experiment. Some examples of variables are time, distance, and temperature.

weight - Weight is the force of gravity acting on an object.