Investigation 2:
Hot Water, Cold Water

Big Question:
What happens to water as it is heated and cooled?
Standard 1: Mathematical Analysis

M1.1 Use mathematical notation and symbolism to communicate in mathematics and compare and describe quantities and relationships

M2.1 Use simple logical reasoning to develop conclusions, recognizing that patterns and relationships assist them in making conclusions

M3.1 Explore and solve problems using concrete objects and manipulatives such as a balance, graduated cylinder, ruler

Standard 1: Scientific Inquiry

S1.1 Ask “why” questions in attempts to seek greater understanding of events they have observed or heard about

S1.2 Question the explanations they hear from others and read about, seek clarification, and compare to their own

S1.3 Develop relationships among observations to construct tentative explanations for what they have observed

S2.1 Develop written plans for exploring phenomena or for evaluating explanations guided by questions

S2.2 Share their research plans with others and revise based on suggestions

S2.3 Carry out plans for exploring phenomena using appropriate inquiry and process skills

S3.1 Organize observations and measurements through classification and preparation of charts and tables

S3.2 Interpret observations and measurements and recognize relationships

S3.3 Share findings with others and seek their ideas

S3.4 Adjust understandings based on findings or new ideas

Standard 1: Engineering Design

T1.2 Investigate prior solutions and ideas from various resources

T1.3 Generate ideas for possible solutions, apply math and science skills, evaluate and determine the best solution, and justify your choices

T1.5 Discuss how best to test the solution, perform, record, discuss, summarize, and suggest improvement
Alignment with New York State Science Standards & Performance Indicators

Standard 4: Physical Environment

2.1c Water is recycled by evaporation, condensation, precipitation, runoff, and groundwater
2.1d Erosion and deposition result from the interaction among air, water, and land
2.1e Extreme natural events may have positive or negative impacts on living things

3.1b Matter has properties that can be observed through the senses
3.1c Objects have properties that can be observed, described, and/or measured
3.1d Measurements can be made with standard metric units and nonstandard units (meteorology)
3.1e The material an object is made up of determines some specific properties of the object. Properties can be observed.
3.1f Objects and/or materials can be sorted or classified according to their properties
3.1g Some properties of an object are dependent on the conditions of the present surroundings

3.2a Matter exists in three states: solid, liquid, gas; each with distinct properties
3.2b Temperature can affect the state of matter of a substance
3.2c Changes in the properties of materials can be observed and described

4.1d Energy and matter interact: water is evaporated by Sun’s heat; a bulb is lighted by electricity

5.1a The position of an object can be described by locating it relative to another object or the background

Standard 6: Interconnectedness

1. Through systems thinking, they recognize commonalities that exist and how parts of a system interrelate and combine to perform special functions
2. Models are simplified representations
3. Grouping by magnitudes into a series provides a useful way to deal with the immense range and changes in scale
4. Equilibrium is a state of stability
5. Identifying patterns for change is necessary for making predictions about future behavior and conditions
Standard 7: Interdisciplinary Problem Solving

1. The knowledge and skills of mathematics, science, and technology are used together to make informed decisions and solve problems.

2. Solving interdisciplinary problems involves a variety of skills and strategies such as effective work habits, gathering information, generating ideas, making connections, and presenting ideas.
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What do you know about water when it gets hot and cold?

I think...

Now I know...
FOCUS QUESTION

What happens to water as it gets warmer and colder?

CLAIM

EVIDENCE
BUILD A THERMOMETER

What happened when you put the bottle-and-straw setup in a cup of hot water?
• Record what you observed on the "Hot water" picture below.
• Describe what you observed on the lines below.

What happened when you put the bottle-and-straw setup in a cup of ice water?
• Record what you observed on the "Cold water" picture below.
• Describe what you observed on the lines below.

What could you do to make the straw thermometer more useful?
Part 2: Sinking and Floating Water

FOCUS QUESTION

How do you know if an object is less or more dense than the water?

CLAIM

EVIDENCE
SINKING AND FLOATING WATER

Draw a picture of what happened when you lowered **hot** water into a cup of room-temperature water.

Draw a picture of what happened when you lowered **cold** water into a cup of room-temperature water.

Which is denser, hot water or cold water?

How do you know?
Part 2: Sinking and Floating Water
Science Content/Inquiry
Part 2: Sinking and Floating Water

Directions: Read, “The Pond” (pgs. 5-7), and answer the questions below.

1. What are some of the plants and animals that live in the pond water?

2. What are some of the animals that live both in the pond water and out of the pond water?

3. Describe one food chain from the story?

4. Read, “Ice Floats” on pg. 7, and explain why ice on a pond or lake floats.
FOCUS QUESTION

What happens to water when it freezes?

CLAIM

EVIDENCE
OBSERVING ICE

WATER IN VIALS

Draw a picture of a vial of liquid water. Draw a picture of a vial of frozen water.

WATER IN SYRINGES

What was the volume of liquid water in the syringe before it froze?______________________

What was the volume of the ice after you froze the water? _________________________

What was the difference in volume after you froze the water?_____________________

Write a sentence to describe what happens to the volume of water when you freeze it.

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________
Part 3: Blue Ice Cubes

What do you think will happen when a blue ice cube is put in a cup of room temperature water?

**Prediction:**

Temperature of water at the bottom: ____________________

Temperature of water at the top: ____________________

1. What happened when blue ice was placed in water?

2. Why did the blue go to the bottom?

3. Which is colder, the blue water that melted from the ice or the clear water?
Part 3: Water as Ice

Directions: Read, “Ice Is Everywhere” (pgs. 8-9), and answer the questions below.

1. What is a glacier?

2. What is an iceberg?

3. What continent has no glaciers?

4. How much of an iceberg is underwater?

5. Why might this fact be dangerous to ships?
Part 3: Water as Ice

Directions: Read, “Ice History” (pgs. 10-11), and answer the questions below.

1. What were the earliest ways people refrigerated food?

2. Why do some water pipes burst in the winter? How do your investigations help explain what happens inside the pipes?

3. How did water play a part in the development of the metric system?
Last January it got very cold in a town in Wisconsin. The temperature was below –15°C for more than 7 days in a row. Students came into class on the third day, telling stories about water pipes bursting in their neighborhood.

Their teacher asked them to think about why this happened.

Write a note to this teacher. Explain why you think the pipes broke during this freezing cold weather.
BIG QUESTION

What happens to water as it is heated and cooled?

Explain: Use evidence from the investigations notebook to support your answer.