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Core Curriculum/Texas 4th Grade

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§112.15. Science, Grade 4.
(b) Knowledge and skills.

(1) Scientific investigation and reasoning. The student conducts classroom and outdoor investigations, following home and school safety procedures and environmentally appropriate and ethical practices. The student is expected to:

(A) demonstrate safe practices and the use of safety equipment as described in the Texas Safety Standards during classroom and outdoor investigations; and

(B) make informed choices in the use and conservation of natural resources and reusing and recycling of materials such as paper, aluminum, glass, cans, and plastic.

(2) Scientific investigation and reasoning. The student uses scientific inquiry methods during laboratory and outdoor investigations. The student is expected to:

(A) plan and implement descriptive investigations, including asking well-defined questions, making inferences, and selecting and using appropriate equipment or technology to answer his/her questions;

(B) collect and record data by observing and measuring, using the metric system, and using descriptive words and numerals such as labeled drawings, writing, and concept maps;

(C) construct simple tables, charts, bar graphs, and maps using tools and current technology to organize, examine, and evaluate data;

(D) analyze data and interpret patterns to construct reasonable explanations from data that can be observed and measured;
(E) perform repeated investigations to increase the reliability of results; and
   - Ruler Ramps
   - Geo-Fliers
   - Slingshot Sedans
   - Drop Zone
   - Slip, Sliding Away

(F) communicate valid, oral, and written results supported by data.
   - A Crazy Combo
   - Matter Jeopardy
   - Eggsploring Attributes
   - Cups ‘n’ Stuff
   - Some Like It Salty
   - Evening Out Temperatures
   - Ice Change: The Meltdown
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   - The Electromagnetic Connection
   - Electromagnetic Explorations
   - Slingshot Sedans
   - Drop Zone
   - Slip, Sliding Away
   - Through It All

(3) Scientific investigation and reasoning. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:
(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;
   - It’s a Matter of Stuff and Space
   - Matter Jeopardy
   - Eggsploring Attributes
   - Cups ‘n’ Stuff
   - Some Like It Salty
   - Evening Out Temperatures
   - Ice Change: The Meltdown
   - Hanging Out to Dry
   - Kool Kups
   - Cool and Calculating
   - Snake Warmers
   - Electromagnetic Explorations
   - Slingshot Sedans
   - Drop Zone
   - Slip, Sliding Away

(4) Scientific investigation and reasoning. The student knows how to use a variety of tools, materials, equipment, and models to conduct science inquiry. The student is expected to:
(A) collect, record, and analyze information using tools, including calculators, microscopes, cameras, computers, hand lenses, metric rulers, Celsius thermometers, mirrors, spring scales, pan balances, triple beam balances, graduated cylinders, beakers, hot plates, meter sticks, compasses, magnets, collecting nets, and notebooks; timing devices, including clocks and stopwatches; and materials to support observation of habitats of organisms such as terrariums and aquariums; and

   - It’s a Matter of Stuff and Space
   - Matter Jeopardy
   - Eggsploring Attributes
   - Cups ‘n’ Stuff
   - Some Like It Salty
   - Evening Out Temperatures
   - Ice Change: The Meltdown
   - Hanging Out to Dry
   - Kool Kups
   - Cool and Calculating
   - Snake Warmers
   - Electromagnetic Explorations
   - Slingshot Sedans
   - Drop Zone
   - Slip, Sliding Away
(B) use safety equipment as appropriate, including safety goggles and gloves.

Safe Science
Geo-Fliers
Slingshot Sedans

(5) Matter and energy. The student knows that matter has measurable physical properties and those properties determine how matter is classified, changed, and used. The student is expected to:

(A) measure, compare, and contrast physical properties of matter, including size, mass, volume, states (solid, liquid, gas), temperature, magnetism, and the ability to sink or float;

What’s the Matter?
It’s a Matter of Stuff and Space
A Crazy Combo
Matter Jeopardy
Eggsploring Attributes
Cups ‘n’ Stuff
Life’s Ups and Downs
Some Like It Salty
Bears Afloat
Evening Out Temperatures
Kool Kups
Mixed-Up Matter

(B) predict the changes caused by heating and cooling such as ice becoming liquid water and condensation forming on the outside of a glass of ice water; and

Ice Change: The Meltdown
Hanging Out to Dry
Kool Kups
Bagging Up Changes
Cool and Calculating

(C) compare and contrast a variety of mixtures and solutions such as rocks in sand, sand in water, or sugar in water.

A Crazy Combo
Some Like It Salty
Mix It Up
Mixed-Up Matter
Mixing Up a Solution

(6) Force, motion, and energy. The student knows that energy exists in many forms and can be observed in cycles, patterns, and systems. The student is expected to:

(A) differentiate among forms of energy, including mechanical, sound, electrical, light, and heat/thermal;

Energy Forms
Ruler Ramps
Geo-Fliers
Hear the Vibes
Tuning in to Sound
Crowing Cups
Slinky® Sounds
Tune Thumpers
The Louddown on Light
Prism Play
Heat
Curly Cue
Snake Warmers
Sparky’s Light Kit
Path Finders
Energy Match-Up

(B) differentiate between conductors and insulators;

Conductor or Insulator?
Conductors and Insulators

(C) demonstrate that electricity travels in a closed path, creating an electrical circuit, and explore an electromagnetic field; and

Sparky’s Light Kit
Electrical Circuits
Path Finders
Make a Switch
Conductor or Insulator?
The Electromagnetic Connection
Electromagnetic Explorations

(D) design an experiment to test the effect of force on an object such as a push or a pull, gravity, friction, or magnetism.

Design an Experiment
Slingshot Sedans
Drop Zone
Slip, Sliding Away
Through It All
## At a Glance: TEKS Alignment

### Texas Essential Knowledge and Skills for Science, Grade 4

<table>
<thead>
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<th>AIMS Activity</th>
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* indicates alignment with Texas Essential Knowledge and Skills for Science, Grade 4.
**Topic**
States of matter

**Key Question**
How can you observe a change in state by observing a cup of flavored fruit drink?

**Learning Goals**
Students will:
- observe a change in state in water;
- identify the three states of matter; and
- be able to explain, using evidence from the investigation, where the water on the outside of the cup came from.

**Texas Essential Knowledge and Skills for Science**
4.5A Measure, compare, and contrast physical properties of matter, including size, mass, volume, states (solid, liquid, gas), temperature, magnetism, and the ability to sink or float
4.5B Predict the changes caused by heating and cooling such as ice becoming liquid water and condensation forming on the outside of a glass of ice water
4.2B Collect and record data by observing and measuring, using the metric system, and using descriptive words and numerals such as labeled drawings, writing, and concept maps
4.2D Analyze data and interpret patterns to construct reasonable explanations from data that can be observed and measured
4.2F Communicate valid, oral, and written results supported by data
4.3A In all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student
4.4A Collect, record, and analyze information using tools, including calculators, microscopes, cameras, computers, hand lenses, metric rulers, Celsius thermometers, mirrors, spring scales, pan balances, triple beam balances, graduated cylinders, beakers, hot plates, meter sticks, compasses, magnets, collecting nets, and notebooks; timing devices, including clocks and stopwatches; and materials to support observation of habitats of organisms such as terrariums and aquariums

**Math**
Data analysis
- line graph
Measurement
- time
- temperature

**Science**
Physical science
- states of matter
- condensation

**Integrated Processes**
Observing
Collecting and recording data
Interpreting data
Communicating
Inferring

**Materials**
For each group:
- ice (see Management 2)
- 2 clear plastic cups, 9 oz
- flavored drink mix (see Management 3)
- 2 white paper towels
- 2 thermometers (see Management 4)
- 4 rubber bands
- colored pencils, two colors

**Background Information**
The air around us is made up of different types of gases. One of the gases in air is called water vapor. Energy transfer is needed for a state change in matter. When water is heated, water moves from a liquid state to a gaseous state. When water vapor is cooled, it moves from a gas back to a liquid. This process is called condensation. The air surrounding the cup in this investigation is cooled to the point that the water vapor in the air surrounding the cup moves from a gas back to a liquid state.

The flavored drink mix is important in the activity so that the students will have evidence that the water on the outside of the cup did not come through the walls of the cup—a common misconception. If it had, it would be the same color and flavor as the flavored drink mix.
Management
1. This activity works best in pairs so that the students can drink the flavored drink mix at the end of the investigation. The students can fairly share the ice and drink.
2. Be sure to have sufficient ice so that each student group will have a cup of ice.
3. Prepare enough drink mix so that you will be able to fill two cups for each student group. Select a red or orange colored drink so that the students will be able to clearly see the color.
4. Thermometers are available from AIMS (item number 1976). Use the rubber bands to attach the thermometers to the outsides of the cups so that the scale can still be read.

Procedure
1. Ask the Key Question and state the Learning Goals.
2. Distribute the materials to each student group.
3. Direct the students to place a paper towel on their work surfaces and put the cups on the paper towel. Show the students how to attach the thermometers to the outsides of the cups. Have them read the temperature of each cup and record on the student sheet. Tell the students to read and record the temperatures of the cups on the temperature graph on the student page every three minutes.
4. Have the students fill one cup with ice cubes. Do not add any ice to the other cup.
5. Direct the students to fill each cup with the flavored drink.
6. After four or five minutes, ask the students, “Do you notice anything forming on the outside of either cup? What does it look like?” Remind the students to continue recording the temperatures of the cups on the student page every three minutes.
7. Ask the students to touch the outsides of the cups with their fingers. Is there any difference between the way the cups feel? Does either of the cups feel wet? [The cup with the ice should feel wet and should feel cooler. If it doesn’t, wait a few minutes and try again.]
8. Have the students wipe the outside of the cup that does not have the ice in it with the white paper towel. Ask the students, “What do you observe?” Tell the students to wipe the outside of the cup with the ice in it with the paper towel. Ask the students, “What do you observe?” [The students should see a wet spot.] Ask the students, “Is the wet spot the same color as the flavored drink?” Ask the students, “How does this help us see that the water did not come from the cup?” [The spot would be the same color as the drink mix if it came through the side of the cup.]
9. Ask the students “If the water did not come from the cup, where do you think it came from?”
10. Demonstrate how to place a hand close to the cup without touching it. Have each student place his or her hands close to each cup then ask, “What do you notice about the air around the cups? [The students should be able to feel that the air near the cup with ice in it is cooler.]
11. Tell the students that the ice inside the cup has cooled the air around the cup. The water vapor in the air condensed (turned from water vapor to water) on the surface closest to the cooled air and that surface was the outside of the cup.
12. Lead a class discussion so that the students will be able to identify that the ice cubes in the cup are the solid form of water; they can see the liquid form of water on the outside of the cup. They now have evidence that the air was holding the water vapor.
13. Direct the students to label the three states of matter on the second student page.
14. Have the students complete the graph on the first student page using a different color to represent each cup. Discuss what the graphs shows.

Connecting Learning
1. What are the three common states of matter on Earth? [solid, liquid, gas]
2. What evidence do we have that tells us the water came from the air and not the cup? [There is a punch in the cup. What collected on the outside of the cup was not colored or flavored.]
3. Why do you think we used the thermometers in this investigation? [The thermometers gave us numeric evidence of a change in temperature.]
4. What does the graph tell us? [The cup without ice stayed the same temperature; the cup with ice got colder, then evened out; etc.]
5. When have you seen droplets of water on the surface of other objects? (The students should be able to relate this experience to morning dew.]
6. This activity showed us water condensing on the outside of the cup. What is condensation? [The process in which water changes from a gas to a liquid.]
7. What do you think would happen if we used Styrofoam cups instead of plastic cups?
8. What are you wondering now?
Key Question
How can you observe a change in state by observing a cup of flavored fruit drink?

Learning Goals

Students will:

• observe a change in state in water;
• identify the three states of matter; and
• be able to explain, using evidence from the investigation, where the water on the outside of the cup came from.
Complete the table.

**Temperature of Cup With Flavored Drink**

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<th>Start (°C)</th>
<th>3 min (°C)</th>
<th>6 min (°C)</th>
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Use the data in the table to make a line graph. Use a different color line for each cup. Complete the key.

**Key**

- With ice
- Without ice

**Time (minutes)**

0  3  6  9  12  15  18  21
Wipe the outside of the cup with ice. What do you observe?

Wipe the outside of the cup without ice. What do you observe?

What variable do you think caused the water to collect on the outside of the cup?

If the water did not come from the cup, where do you think it came from?

What do you notice about the air around the cups?

Label the three states of matter.
Connecting Learning

1. What are the three common states of matter on Earth?

2. What evidence do we have that tells us the water came from the air and not the cup?

3. Why do you think we used the thermometers in this investigation?

4. What does the graph tell us?

5. When have you seen droplets of water on the surface of other objects?
6. This activity showed us water condensing on the outside of the cup. What is condensation?

7. What do you think would happen if we used Styrofoam cups instead of plastic cups? Why?

8. What are you wondering now?