MAKING A HYPOTHESIS

INTRODUCTION: Do you know what will happen if you mix vinegar and baking soda? Will the temperature change? Will bubbles form? Guessing what will happen is called making a hypothesis.

OBJECTIVE: A hypothesis is a “best guess” because the outcome of a question is guessed using only what is known before the question is tested. The hypothesis is then tested using experiments. During the experiment, data or information is collected to check the accuracy of the hypothesis. Finally, using the results of the experiment, the hypothesis may be supported as correct or it may be changed. In this activity, we will make hypotheses about how combining liquids with two different chemicals will affect the temperature of each liquid.

PROCEDURE: CHEMICAL A AND WATER
1. Place your hypothesis for “Chemical A and Water” below. What do you think will happen?

2. Measure 5 mL of water in the graduated cylinder and pour it into a test tube.
3. Place the test tube in the test tube rack and gently place the thermometer in the water in the test tube.
4. After 1 minute, record the temperature of the water and record this temperature in the chart on page 13 under “Start.”
5. Using the metal spatula, add 3 pellets of “Chemical A” to your test tube. DO NOT TOUCH THE PELLETS WITH YOUR SKIN!
6. Observe and record the temperature of the water every 15 seconds for 3 minutes.
7. At the end of 3 minutes, remove the thermometer, pour the contents of the test tube down the drain, and rinse the test tube and thermometer.
8. Graph the data from the chart on the graph sheet on the next page. Use a SOLID LINE to connect the dots of data.

CHEMICAL B AND VINEGAR
9. Place your hypothesis for “Chemical B and Vinegar” below. What do you think will happen?

10. Repeat the exact procedure used for Chemical A, EXCEPT:
    a. In #2 above, begin with 5 mL of vinegar.
    b. In #5 above, add 1/2 teaspoon of “Chemical B.”
11. Graph the data for Chemical B on the graph on the next page. Use a BROKEN LINE to connect the data points.
<table>
<thead>
<tr>
<th></th>
<th>Start</th>
<th>15</th>
<th>30</th>
<th>45</th>
<th>60</th>
<th>75</th>
<th>90</th>
<th>105</th>
<th>120</th>
<th>135</th>
<th>150</th>
<th>165</th>
<th>180</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEMICAL A</td>
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<tr>
<td>CHEMICAL B</td>
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</tbody>
</table>

**TEMPERATURE CHANGE (DEGREES CELSIUS)**

**TEMPERATURE VERSUS TIME**

**TEMPERATURE (CELSIUS)**

**TIME (SECONDS)**

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Date: __________________ Names: __________________

QUESTIONS:

1. What happened to the water temperature when Chemical A was added?

2. What happened to the vinegar temperature when Chemical B was added?

3. How did your hypothesis for Chemical A compare to your results?

4. How did your hypothesis for Chemical B compare to your results?

5. What do scientists need to do before accepting their hypotheses?

6. Why was a starting temperature needed?

7. What are the two most noticeable observations about what happens when baking soda (Chemical B) and vinegar are mixed?
READING THERMOMETERS

What temperature is indicated on each of these thermometers?

a) ________

b) ________

c) ________

d) ________

e) ________

f) ________

g) ________

h) ________

i) ________
MEASURING TEMPERATURE WITH FAHRENHEIT, CELSIUS, AND KELVIN SCALES

In science, the use of temperature is very important. To understand temperature, it is important to know about temperature scales. Temperature scales may be Fahrenheit, Celsius, or Kelvin scales:

• The Fahrenheit scale is calibrated so the temperatures can be read from 0° to +212° and from 0° to -459°. Two important temperatures on the Fahrenheit scale are +32° and +212°. The temperature at which water will freeze is +32°. The temperature at which water will boil is +212°.

• The Celsius scale is calibrated so the temperatures can be read from 0° to +100° and from 0° to -273°. Two important temperatures on the Celsius scale are 0° and 100°. The temperature at which water will freeze is 0°. The temperature at which water will boil is 100°.

• The Kelvin scale is calibrated so temperatures can be read from 0 K to +273 K. Notice the numbers on the Kelvin scale are followed by the letter “K”, not “°”, the symbol for degrees. Zero is the coldest temperature that can be recorded on the Kelvin scale.

Complete the blanks in the following selection with the correct words from the paragraphs above.

The three temperature scales are the (1) ____________ , (2) ________, and (3) ________ scales. The Fahrenheit scale and (4) ________ scale measure temperature in degrees. The Kelvin scale uses the letter (5) “____” following each number on the scale. The (6) ____________ scale is calibrated so that water freezes at a temperature of 32° and boils at a temperature of (7) ______ °. The (8) ________ scale is calibrated so that water freezes at 0° and boils at (9) ______ °.

Read the following and circle the correct answers to the questions below.

Two important temperatures on the Fahrenheit scale are +32° and +212°. The temperature at which water will freeze is +32°. The temperature at which water will boil is +212°. Two important temperatures on the Celsius scale are 0° and 100°. The temperature at which water will freeze is 0°. The temperature at which water will boil is 100°.

10. The number of degrees between the freezing and boiling points on the Celsius scale is (a) 50° (b) 100° (c) 80° (d) 10°.
11. The number of degrees between the freezing and boiling points on the Fahrenheit scale is (a) 100° (b) 50° (c) 180° (d) 80°.
12. Place the answer in #11 over the answer in #10 to make a fraction. The fraction is (a) $\frac{50}{8}$ (b) $\frac{50}{10}$ (c) $\frac{80}{8}$ (d) $\frac{80}{10}$.
13. The answer in #12 equals the simple fraction (a) $\frac{5}{8}$ (b) $\frac{5}{10}$ (c) $\frac{8}{8}$ (d) $\frac{8}{10}$.
14. One degree in Celsius equals (a) 2.0 (b) 1.8 (c) 4.0 (d) 5.0 on the Fahrenheit scale.
**TEMPERATURE AND ITS MEASUREMENT**

Temperature (which measures average kinetic energy of the molecules) can be measured using three common scales: Celsius, Kelvin and Fahrenheit. We use the following formulas to convert from one scale to another. Celsius is the scale most desirable for laboratory work. Kelvin represents the absolute scale. Fahrenheit is the old English scale which is never used in lab.

\[
\begin{align*}
{^\circ}C &= K - 273 \\
K &= {^\circ}C + 273 \\
{^\circ}F &= \frac{9}{5}{^\circ}C + 32 \\
{^\circ}C &= \frac{5}{9}({^\circ}F - 32)
\end{align*}
\]

Complete the following chart. All measurements are good to 1° C or better.

<table>
<thead>
<tr>
<th>°C</th>
<th>K</th>
<th>°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0° C</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>212° F</td>
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<tr>
<td>3</td>
<td>450 K</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>98.6° F</td>
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<tr>
<td>5</td>
<td>-273° C</td>
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<tr>
<td>6</td>
<td></td>
<td>294 K</td>
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<tr>
<td>7</td>
<td></td>
<td>77° F</td>
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<tr>
<td>8</td>
<td></td>
<td>225 K</td>
</tr>
<tr>
<td>9</td>
<td>-40° C</td>
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