Ice Melting Contest

Background Information: One of the ways that energy is transferred is by conduction. **Conduction** is the process by which energy is transferred directly when materials touch other. Any solid, liquid, or gas can transfer energy by conduction. Sometimes an object can change phase because it has absorbed energy by conduction, such as an ice cube that turns from a solid to liquid when it melts in a drink. Materials that have a structure that easily allows energy transfer are conductors. Examples of good conductors are copper and aluminum.

Initial thoughts?
1. What is heat? ________________________________________________________
3. When conduction is slowed down, **insulation** occurs. Insulators are materials that reduce the heat transfer rate. The molecules in a gas are extremely spread out and the molecules in a solid are compacted together. Based on this information, do you think that a gas or a solid acts as a better insulator? Explain using your knowledge of **conduction**. _______________________________________________________________

Question: How can you increase the energy transferred to an ice cube?

Hypothesis:
If I put ice in a container and ________________________________________ it will melt faster because________________________. +3

Materials:
1 50-mL graduated cylinder
1 balance
1 plastic container with lid
1 Timer

Procedure:
1. With your lab partner, discuss the variable you would like to test and things you could do to melt as much of the ice cube as possible in the set time frame (10 min).
   **Ice Melting Variable Options: 3-4 pairs will complete each method**
   - Shaking the container
   - Holding the container in your hands
   - Put container in a beaker of tap water
   - Open lid and breath on the ice
   - Roll container in hands
2. Review ice melting rules.
   **Ice Melting Rules:**
   - Keep ice cube in the container until the end of the contest
   - Keep all water in the container. Water that spills or leaks out of the container will not be measured.
   - Stick to 1 variable. If you use more than one, it will not be a controlled experiment.
3. Fill a container full of ice then put the lid on the jar.
4. Find the mass of the jar, ice and lid to the 100ths place
5. Record mass in data table #1.
6. Start the timer and start your ice melting method.
7. Melt as much of the ice in the time allowed (10 min.)
8. When 10 minutes is up, mass your container with the lid and ice/water again.
9. Now, carefully pour the water from your plastic container into the graduated cylinder and record the volume of water in your data table.
10. Record the volume of water your teacher obtained in the control container.

**Data Table #1: Finding Mass +2**

<table>
<thead>
<tr>
<th>Mass of the jar, ICE and lid (g)</th>
<th>Mass of the jar, WATER and lid (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Data Table #2: Finding the volume of melted ice +3**

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Amount of water (mL) after 10 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class Control:</td>
<td></td>
</tr>
<tr>
<td>Ice cube not touched</td>
<td></td>
</tr>
<tr>
<td><strong>Name of Your Variable</strong></td>
<td>+1</td>
</tr>
<tr>
<td>“**” +1</td>
<td></td>
</tr>
</tbody>
</table>

**Data Table #3: Class Volumes +5**

<table>
<thead>
<tr>
<th>Experiment</th>
<th>(mL)</th>
<th>(mL)</th>
<th>(mL)</th>
<th>(mL)</th>
<th>Average Volume (mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaking the Container</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Holding the Container in Hands</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Put Container in a beaker of water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open lid and breath on Ice</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roll Container in hands</td>
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</tr>
</tbody>
</table>

**Analysis Questions:**

1. What is the difference in volume between the volume of water you collected and the volume of water the control collected? +3 (Show work)
   
2. Why was it important to have a control in this lab? +2
   
3. Which technique transferred the most energy? least energy? +2
   
4. Which variable did you test? How did conduction work to melt the ice with this variable? +2
5. Look at Data Table #1. Did the mass at the beginning of the lab match the mass once the ice melted? Explain using your data. +2

6. Do you think the masses should be the same or different? Explain by using the definition of the Law of Conservation of Matter. +2

7. Look at Data Table #3. Which method conducted the most energy to melt the ice? Why do you think this method was the best? +2

8. What are some potential sources of error in this lab? (Hint: Did everyone have the same exact mass of ice in the beginning? Did everyone take the same amount of time to mass the container and then start the timer?) +2

9. Write a conclusion statement. +3