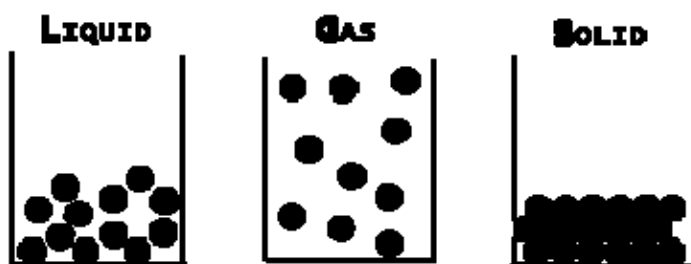


Name _____



Heat Transfer & Phase Changes

Background Information: Molecules with a lot of energy move faster and take up more space than molecules with a smaller amount of energy. For example, in the diagram below, the gas molecules are moving faster (have more energy) and are taking up more space than the solid or liquid molecules.



<http://www.life.uiuc.edu/boast1/sciencelessons/icecream.htm>

These are the three primary phases of matter. Solids are tightly packed atoms that have rigid bonds that do not flow. Solids have a fixed volume and shape. Liquids are bound together, but not as tightly packed and their bonds are more flexible allowing them to flow. Liquids have a fixed volume, but their shape is the same as their container. Gases are loosely packed molecules that flow freely. Gases have an indefinite volume and shape because they take the volume and shape of their container.

Heat is a form of energy. The two types of heat transfer are endothermic and exothermic reactions. Endothermic reactions remove heat from the surrounding environment into the reaction.

Exothermic reactions remove heat from the reaction and transfer it to the surrounding environment.

Heat energy will always flow from areas of higher temperature to areas of lower temperature. In both cases, the **Law of Conservation of Energy** is applied. Since heat is a form of energy it cannot be created nor destroyed in a reaction, it can only change form or location.

Salt dissolves in water and decreases the freezing point (the temperature when water turns to ice). Salt water will freeze below 32 degrees Fahrenheit (0 degrees Celcius).

Materials:

240 mL milk	2.5 mL vanilla or chocolate flavoring	80 mL ice cream salt
cups	50 mL beaker	spoons
45 mL sugar	3.8 L zipper bag (gallon); freezer quality	ice
100 mL graduated cylinder	0.95 L zipper bag (quart); freezer quality	Celsius thermometer

400 mL beaker		
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Procedure:

1. Work with your partner.
2. Place ice cubes in the large Ziploc bag.
3. Add 2 teaspoons of salt in bag with ice.
4. Place milk in the smaller Ziploc bag.
5. Add 45 mL sugar, and 2.5 mL vanilla or chocolate flavoring into the small zipper bag and record the temperature of the mixture.
6. Empty most of air from bag with milk in it. Carefully seal this bag and place it inside the bag with the ice and salt mixture. Seal the outer bag tightly to prevent leaks.
7. 5. Gently shake the sealed baggies back and forth in your hands to make sure that the ice and salt mixture coats the entire surface of the milk mixture bag. Shake for 1 minute and then carefully open the two bags and take the temperature of the inner bag (milk mixture) only. Seal both bags. Keep shaking back and forth for 3 to 10 minutes, recording the milk temperature every minute until a solid product forms.

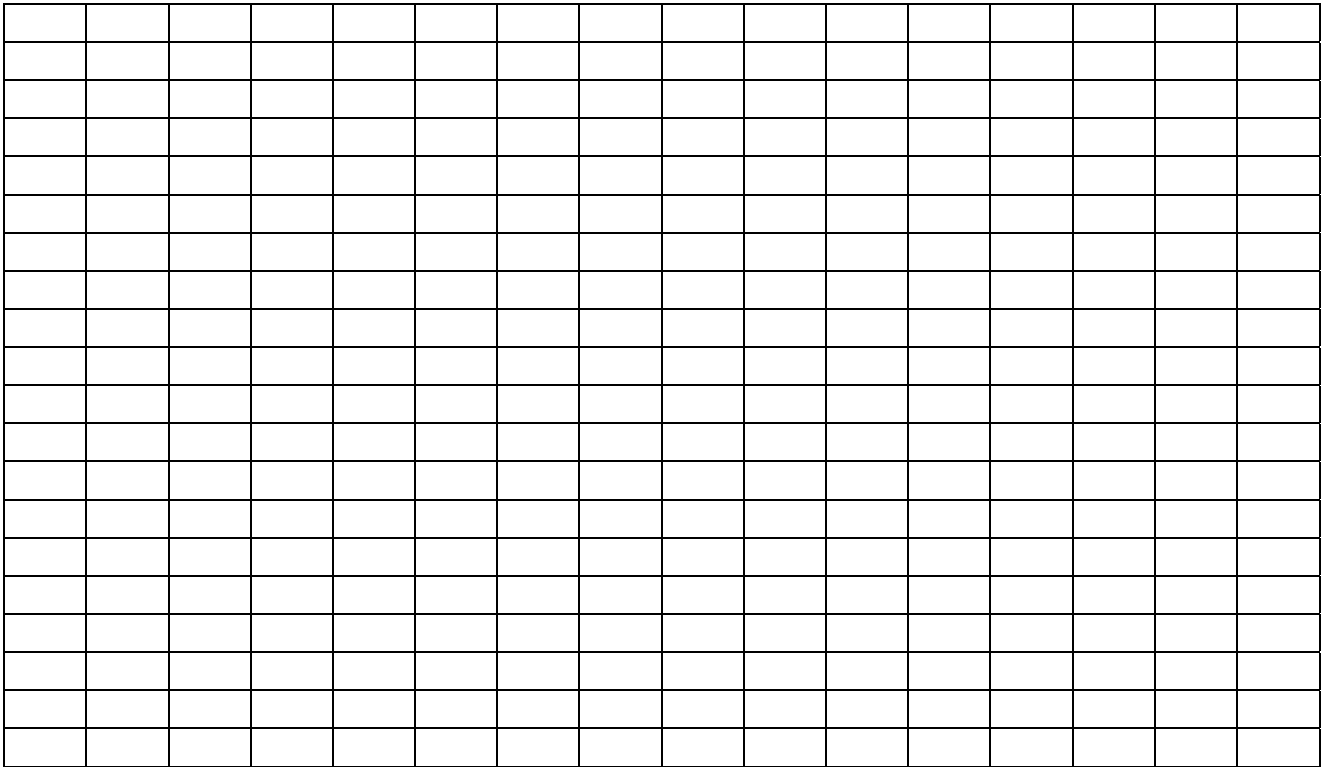
Data:

Time	Temperature of milk mixture (°C)
Start	
1 minute	
2 minutes	
3 minutes	
4 minutes	
5 minutes	
6 minutes	
7 minutes	
8 minutes	
9 minutes	
10 minutes	

Data Analysis: Make graph of your data. Remember TAILS & DRY MIX.

What kind of graph is best for this data? _____

Why? _____



What relationship does this data show? _____

Questions & Conclusion:

Answer using complete sentences.

1. What state of matter was the milk when you began?
2. What state of matter was the milk when you were done?
3. In order to change the phase of the milk, what had to be removed?
4. Why was the salt added to the ice?
5. What provides energy for molecules to move?
6. What happened to the heat energy that left the milk? What type of reaction is this? How do you know?
7. Heat energy is needed to change phase from a solid to a liquid. List the possible sources of the heat needed for this phase change in your baggie. Which source do you think is the best possibility? Explain your answer.