

# The Energy Transfer in the Production of Ice Cream

Energy plays a key role in chemical processes. According to the modern view of chemical reactions, bonds between atoms in the reactants must be broken, and the atoms or pieces of molecules are reassembled into products by forming new bonds. Energy is absorbed to break bonds, and energy is evolved as bonds are made. When making ice cream, the energy transformations are outlined below. **Mixing Ingredients:** When you mix together ingredients such as milk, cream, sugar, and flavorings, energy is transferred in the form of mechanical energy. You apply force to mix the ingredients, which generates heat due to friction between the particles. **Cooling the Mixture:** After mixing the ingredients, the mixture needs to be cooled down. This is typically done by placing the mixture in an ice cream maker or a bowl surrounded by ice and salt. In an ice cream maker, the mixture is churned while being cooled. The ice and salt create a brine solution with a lower freezing point than ice alone, allowing the mixture to cool below the freezing point of water. Energy is transferred from the ice cream mixture to the surroundings as heat is absorbed from the mixture, causing it to freeze. **Phase Change:** As the ice cream mixture cools, the water content within the mixture begins to freeze and solidify. This process involves a transfer of energy known as latent heat of fusion. The energy is absorbed from the mixture as the water molecules transition from a liquid to a solid state, thereby lowering the temperature of the mixture. **Churning:** Churning the ice cream mixture during the freezing process helps incorporate air into the mixture, resulting in a smoother texture. The mechanical energy applied during churning contributes to the mixing of ingredients and the formation of small ice crystals, which affects the texture of the finished ice cream. **Insulation:** Once the ice cream has reached the desired consistency, it may be transferred to a container and placed in a freezer for further hardening. The freezer acts as insulation, preventing heat from entering and maintaining the low temperature necessary to keep the ice cream frozen. Overall, energy transfer occurs in various forms during the process of making ice cream, including mechanical energy from mixing and churning, heat transfer during cooling and freezing, and latent heat of fusion during the phase change of water. These energy transfers are essential for transforming liquid ingredients into a creamy, frozen dessert.

## Hypothesis:

## Materials:

1Thermometer, 1 sandwich-sized ziploc baggie and 1 screw top container

What's in the ziploc bag?	What's in the plastic container?
I cup of half-and-half or milk	3 cups ice
2 Tbsp sugar	1⅓ cup salt
½ tsp. Vanilla extract	

## Procedure:

1. Insert the ingredients listed above into the ziploc bag.
2. Insert the ingredients listed above into the screw-top container
3. Place the ziploc baggie into the container
4. Shake hard for 5-7 minutes or until the milk mixture is frozen
5. You can eat it if you choose.

## Observations:

Sketch or explain using only what you sensed

## Analysis:

Temperature before combining:

	Temp before shaking	Temp after after shaking
Milk mixture		
Ice		

## Conclusion: