

## Science of Cooking Spring 2018 Essay Example Answer

Using colligative properties, describe why we use salt and not sucrose to an ice bath when making ice cream.

So the first thing to consider is what are the key points of this question you should consider when designing your answer. The question came from the lab and the handout was a good source of information as was the milk chapter as per the lab instructions...

Let's reprint the question highlighting the question with some comments:

Using **colligative properties**<sup>1</sup>, describe **why**<sup>2</sup> we use salt and not sucrose to an ice bath **when making ice cream**<sup>4</sup>.

1. Colligative properties. What ARE colligative properties and as the question states "USING colligative properties" a good answer MUST include the definition and use of the theory. As many of you wrote, the colligative property is the change in solvent behavior when a solute is dissolved. More simply put for our use, is the freezing point will change based on the number of particles "molecules, ions, compounds" dissolved in solution. The more particles the larger the decrease in freezing point. From the lab you remember that salt baths had a lower temp than sucrose baths. This concept should be in the answer somehow. Those who wrote about hydrogen bonding or ice crystals or polar water solvating a polar compound... while those were all correct concepts or chemical behaviors, it did NOT answer the question about colligative properties!
2. Why or how vs. what. An observation that salt in an ice bath decreases the temperature of the ice bath is accurate but is a description of WHAT is happening. Such an answer doesn't discuss HOW this is happening or why the observation is happening. AT the molecular level. i.e. what are the molecules doing to explain what is happening! Another term for this is mechanism. What is the mechanism for the behavior? Think of it this way... A question example might be "How does a carburetor work in an automobile?" The *what* answer would be "pressing down on the gas pedal increases the speed of the car". Not a good answer for this question. This version of the answer describes what happens without an explanation of HOW or WHY the carburetor works. The HOW or WHY answer might go like this... "additional fuel entering the carburetor provides atomized gasoline to be ignited by the spark plugs. Increasing the gas expansion and force to the motor giving a higher revolution to the motor and ultimately driving the car faster."
  - For this question WHY is that salt (NaCl) is an ionic compound when dissolved forms two particles Na<sup>+</sup> and Cl<sup>-</sup>. Sucrose is a polar covalent compound that when dissolved in water remains as a single particle. Thus the colligative effect of salt is twice as great as sucrose giving a much colder bath than sucrose.
3. The third important point to a good answer is to put this together to answer "when making ice cream". To understand this you have to remember that ice cream (from our lab) is milk fat and proteins suspended in water. For ice cream to form the water has to freeze. To freeze the temperature has to be below the freezing point – thus the need for an ice bath that is much colder than water!

So the answer to this question is about 1) recognizing a key chemical principle, using that principle and 2) remembering the kinds of compounds in the question, 3) the impact of the compounds on the chemical principle and finally 4) applying the chemistry to the food in question.