

Summer 2005 Lesson plan study

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*using LBC Fire lessons I-3, I-4, I-5

I-3: Point of View—heat transfer

I-4: Cheeto Lab—temperature change, mass/temperature/heat relationship

I-5: Fat Calories—calories and Calories

When teaching

Kim: spring 2006

Dana: ? (probably spring 2006)

Katie: maybe not this year (student teaching)

Five Probing Questions

Lesson 3—Point of View

1. How did you determine which direction heat was being transferred in each case?
2. Can you say that something *is* cold, or that it just *feels* cold? Why?
3. As the temperature increase, does the degree of motion increase or decrease? Explain.
4. What do you think the concept of equilibrium has to do with the transfer heat?

Lesson 4—Cheeto Lab

1. Is the burning of the cheeto an exothermic or endothermic reaction? Why?
2. Why does the temperature of the water rise?
3. Is all the heat transferred to the water? Explain.
4. What happens to the temperature of the water when you increase the mass of the Cheeto?
5. What happens to the temperature of the water when you increase the amount of water?

Lesson 5—Fat Calories

1. What do we mean when we say that a substance has a certain number of calories/gram?
2. What do we mean when we say food has Calories?
3. What is the difference between calories and Calories?
4. Compare what happened to the burning Cheeto to how your body digests a Cheeto (in terms of energy).
5. What does the specific heat of water tell you?

Inquiry Elements

Cheeto lab is inquiry—they don't know the equation yet, and the students are discovering the relationships between mass, temperature change, and heat. When we did this lab in Boston, and we thought it was very effective at teaching the concepts without basing on or forcing equation memorization. We understood the concepts better after doing the lab!

Student Understanding

Lesson 3—Point of View

Goal: Students will understand heat transfer based on specific points of view.

-The students will think and discuss a few specific examples that show the transfer of heat is dependent on how you look at the system. This also reinforces the idea that *heat* is flowing out, not that *cold* is flowing in. Also gives discrepant examples to show that something that feels cold can be absorbing heat.

Lesson 4—Burning Cheeto

Goal: Students will understand how heat is transferred when a fuel is burned. Also understand how to analyze a situation with multiple variables.

-The students will change several different variables during this lab to find the relationships among fuel mass, water mass, and temperature change. The students will be able to see the relationships through the data instead of being spoon-fed the equation ($q=cm\Delta T$). They will also draw diagrams similar to lesson 3 where they will determine the heat transfer from a system that they saw first-hand.

Lesson 5—Fat Calories

Goal: Students will understand that a calorie/Calorie is a method of measuring amount of heat transferred. They will also understand the relationship between chemist calories and food Calories.

-They are introduced to $q=cm\Delta T$ and calculate q for the different experiments with the Cheetos. In order to do this, they are introduced to specific heat (c). They compare the q they calculated for the Cheeto lab to the numbers on the Cheeto nutritional information.

Assessment

We will use the worksheets developed for LBC as our assessment for this sequence. They are very well-developed and we feel they will address the topics we want to know that our students are understanding.

Classroom materials to show

We plan to videotape the lessons and bring copies of student work. There is a prelab assigned for homework containing the procedure, data tables, and a drawing of the experimental set-up. This would be useful to show that the students are thinking about the lab the night before performing it. We will also write reflections on how the lesson went, what we would change, and what we would keep doing.