Fun Stuff for Nicole **From Katie P. and Holly ☺**

4 Things that are Different:

- Eliminated student-created data table – Although valuable, this lab is too complicated to ask students to do this extra task w/o prior practice. Given prior experience with lab/data table creations this portion could be "re-added".
- Revised reactions used for lab activity – There were too many for the time allotted, and most of them did not have consistent results. New set of reactions is more concise and are know to produce good results.
- Structured, open-ended questions were added to the lab analysis to connect student understanding of the prior activities to the lab and then to be useful for the follow-up activity.
- More opportunities were created for students to use/complete the energy diagrams, so that follow-up homework is more effective.

4 Things we have learned from this process:

- Having too many objectives for one lesson is problematic – Adding new procedures and new content creates student confusion.
- Creating consistency across a lesson is important to develop student understanding about a topic.
- Asking students to re-explain what the teacher just said to check for understanding is very important (formative assessment).
- What students can tell you orally and what they can put on paper don't always agree. Asking students for explanations in multiple forms can be effective to uncover misunderstandings.
- Actual teaching of a lesson vs. assistance in the creation of the lesson provides a very different view point from which to analyze the lesson materials.

5 Probing questions to use during the instructional sequence:

- What type of information does one need about a system in order to complete an energy diagram? (added to assist students in thinking about procedure for lab even though they won't be creating it themselves)
- What does it mean when something is cold (at the molecular level)? How does something become cold – in terms of molecular motion? Is coldness added to the system or is heat taken away?
- Compare what occurred in the hot pack demonstration with the cold pack demonstration.
- Explain change in each energy account: How do you know if the account stays the same or changes?
- Write a paragraph explaining how energy moved during the cold pack demonstration using the terminology of molecular motion, exothermic or endothermic, system and surroundings. Be sure to include how you know whether it is an exothermic or endothermic reaction (give evidence).

Notes on what areas of your plan include Inquiry

- Students are encouraged to use each other to discuss issues and assist in the learning process rather then relying on the teacher for answers.
- Students are self-collecting, categorizing, labeling, and analyzing a series of data from the lab to further explain a complex chemical process.
- The activity (lab) is framed by an overarching question that connects to students prior experiences.
- This questioning is used to uncover their prior misconceptions about heat transfer and to reshape these thoughts into a more correct framework.

Notes on how you addressed/improved student understanding

- Rather than asking students to synthesize and organize their data just at the end of the series of activities, they are asked to repeat this procedure through out the lab to scaffold their learning, and create a more cohesive lesson.
- Emphasis is put on chemical and physical changes and how they differ as a way to show students when the chemical energy on the energy diagram is relevant.
- More time is spent developing the relationship between temperature, molecular motion, and kinetic energy. Previously these ideas were rather disconnected.
- Students are provided with an opportunity to write what they are observing prior to the final assessment.