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Assumptions:

That students have had an introduction to the scientific method and to the concepts of basic stoichiometry, types of chemical reactions, and atoms, molecules, and ions. Just prior to this lesson they will have discussed the 1st law of thermodynamics and should know that energy can be transferred, have various forms and that one of those forms is heat. The day prior to this lesson will cover chemical systems and surroundings.

Next:

This lesson will be followed by the concepts of Enthalpy, Calorimetry, and Hess's Law.

Goal:

That students would come to an understanding of exothermic and endothermic reactions as examples of heat transfer and that these reactions follow the law of conservation of energy.

	Monday	Tuesday	Wednesday	Thursday	Friday
Nature of Energy					
1 st Law of Thermodynamics					
Energy Transfer/Heat					
Exothermic/Endothermic	Introduction to Systems and Surroundings	Prewriting and Thinking Activity Goal: Have students create a hypothesis about how heat energy is transferred and develop a plan to test hypothesis	Laboratory Experiment Goal: Students would test hypothesis using their own plan for experimentation and record observations concerning heat transfer	Reflection of Experiment and Introduction of Endo/Exothermic Goal: Define what occurred in lab, relate this to the concepts of Endo/Exothermic reactions and Heat Transfer and assess whether students have learned.	
Enthalpy					
Calorimetry					
Hess's Law					
ΔH_f /Fuel Sources					
Project: Fuel and Us: investigation of how one fuel source is used.					

Prewriting and Thinking Activity

Propose to students the question “If we already know that energy is transferred and that heat is a form of energy, then what are the ways that heat (specifically) can be transferred in reference to a chemical system (a reaction)?”

Each student then writes individually (5-10 minutes) their ideas in answer to this question. (This allows both the student and teacher to see their preconceived notions).

They then meet with their lab group (2-4 people), compare their ideas and pick two that they will then share with the class as a whole (10 minutes).

These ideas are shared and the entire group develops a hypothesis about energy (heat) transfer in chemical reactions. The teacher then asks students how they could go about testing this hypothesis in the lab tomorrow. (20 – 25 minutes)

Laboratory Experiment

The actual format of this day will vary between classes of students because their proposed experiments will be different.

But here is one idea that we think would work well and that you could help students develop!!

Lab Concept: a variety of chemicals (4-6) that can systematically be combined in pairs (SAFELY) to produce some chemical reactions that are exothermic, endothermic and energy neutral. Teacher provides chart to help students organize observations and be consistent. Observations should definitely include changes in temperature but should not be limited to just these.

After students have completed their lab the whole class discusses their results to look for inconsistencies.

Reflection of Experiment and Introduction of Endo/Exothermic

Review results from previous day’s lab as entire class.

As lab groups, students then discuss observations and develop a conclusion about how heat transfer occurs within a specific system. Collectively they write a paragraph explaining this. This paragraph will most likely be in layman’s terms however the teacher will want to participate in these discussions and might suggest terms like absorb and release.

Whole class then discusses whether their hypothesis was correct and if not why. What about our previous ideas contradicted what we observed and what may we have done wrong?

Teacher then introduces terminology of exothermic and endothermic; this way, students already understand these concepts but now have a specific name for it.

In class if time allows or as homework students individually revise lab group's paragraph incorporating the terms of exothermic and endothermic.

Short Term Assessment

Students are required to turn in prewriting assignment, lab observation sheet, group paragraph (graded for completion) and individual revision (for a numeric/letter grade).

This allows the teacher to recognize progress in individual understanding.