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01 Guide to Student Work in Fire and Ice

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Guide to Student Work produced in *Fire and Ice* course, C. F. Bauer

Any student work that was pertinent to a particular day can be found with that day's videos. This includes team reports and posters. These group products are not anonymized.

Any individual work is in this section is in anonymous form. Each student was given a code name to label their work. All files are organized by assignment, and then alphanumerically by code name.

The assignment prompts (except for exams) are included in this document.

The work that is here includes:

- Standing weekly assignment (ran from beginning to about mid semester)
  What is heat? What is temperature? How are they related?
- Feb 24 reflective writing assignment
  Making ice by evaporative cooling, steam burns, freezing fruit to protect from frost, beehive cooling, sweat, swamp coolers
- Mar 24 reflective writing assignment
  Extension of water mixing experiment to new conditions
  Suggest explanation for different thermal conductivity of metal vs glass, using atomic level structure model of each
- Exam 1 questions and Re-do assignment
  Topics: heating/cooling curves, tilting bird, cloud formation and air temperature, material expansion upon heating, melting plastics in dishwasher, sketch ammonia in phases, thermometer design, natural constants, nerve behavior
- Exam 2 questions
  Oven bread bake vs steak broil, cookie sheet design, boiling water in kettle vs microwave, Bondo car exterior repair, car radiator function, water/mercury thermal exchange, water beds
- Intern Assignment Biology
  Pre-class question, post: summarize adaptation for their animal system, and think of another application
- Intern Assignment Chemical Reactions
  Where is the heat going to/coming from?
- Intern Assignment Refractory Materials
  Write a letter to boss recommending the purchase of refractory materials

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Standing weekly assignment

I would like to add one more thing to your Chem 444 Fire & Ice work agenda, and something important for you and me. Since this course is about heat and temperature, I am curious about how your ideas evolve based on what we do over the semester. So here's a standing, weekly writing assignment. Between each Thursday and the next Tuesday class, write in response to the following prompts:

1) Heat is …. Cold is ….

2) Temperature is….

3) How are these three things related?

4) In the past week, has anything you've done or read or talked about reinforced or changed or extended your understanding of heat, cold, and temperature? Explain why.

I'm not looking for you to do any extra reading or homework in order to provide an answer. I'm not looking for a best possible accurate scientific response. I'm not looking for you to summarize readings. I'm not asking for a meticulous polished essay.

I want you to express your own understanding in your own words at that point in time in a coherent way. Please write in complete sentences. It is entirely possible that one week to the next does not change your ideas. If that is the case, so be it. Just re-express your ideas and indicate this situation in #4.

I will score this simply as

Satisfactory (1), meaning I think you responded honestly to all four prompts

Nothing turned in (0)

You can probably complete this assignment in less than 30 minutes and in less than a page of writing most of the time.

Thanks, CB

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Feb 24 Assignment:

Read: "Making Ice in East Indies" two articles.

1) Write a coherent paragraph on why this ice-making process works, using your understanding of phenomena and descriptions in the article.

2) The article also provides insights regarding sociology, economics, and culture. Write a comment about some aspect that struck you, citing evidence for your observation.

Read: The other linked websites are about various areas of application of the ideas we've been addressing. Choose two different topics from among the websites, read them, then write a paragraph that explains how the concepts we've been working with pertain to the applications you chose.

The choices were about: steam burn safety, protecting fruit crops by spraying with water during a freeze, beehive cooling, sweat, swamp coolers in homes

Each of these counts as a "reflection assignment" – see syllabus. Obviously, you can consult your notes.

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Mar 24 Assignment

Consider the same set up we used for showing thermal equilibrium: a coffee mug with a second smaller container inside. Let there be 20 mL of hot water in the inner container, and 100 mL of cold water outside. Thermometers are used to monitor the temperatures in each.

Part A

Write a description using a molecular-level perspective about the initial conditions for this system and what happens over time until things no longer change. Indicate your estimate for the ending condition. The story must describe exactly how the system gets from starting condition to end condition. [This question requires recalling what we did and talked about in class.]

Part B

Look at the second attachment, which shows an illustration of the way atoms are bonded together in metals, and the way in which atoms are bonded together in a material like glass or sand. Generally, metals conduct heat much more quickly than materials like silica (or glass). Suggest an explanation for why metals conduct heat more quickly. [This question requires extending the idea in Part A and connecting that idea to an idea that we talked about early in the semester.]

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Sara Edquist, Intern Assignments Biology

Pre-class assignment

Based on what you know about heat, chemical properties, and physiology, what do you think are some of the consequences or effects of heat (or the lack thereof) for living organisms?

Post-class assignment

1. For the animal adaptation you investigated, does it aid in temperature regulation in cold or warm climate, or both? Could this adaptation serve as an alternative function?
2. Please describe two other animal adaptations (behavioral or physiological) to regulate body temperature. Explain how this adaptation works (include if heat transfer occurs by conduction, convection, radiation, and/or evaporative cooling).
3. Do you have any questions from Thursday's class (about mechanisms, other animals, etc.)? If so, please include and I will try to respond to them.

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Chemical Reactions

Ben Stewart, Intern Assignment

Post-class reflection

At the molecular level, where is the heat going when the system cools down? Where is the heat coming from when the system releases heat/ How does this contribute to your understanding of heat in new ways?

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Refractories

Patrick Kessler, Intern Assignment

Post-class

Suppose you were an engineer at a plant that performs the process you have been discussing. If you were instructed to design and plan out the construction of this heater, refractory, kiln or furnace layout, what are key points that you would make to the plant manager to approve the funding of refractory for the system? (some cost analysis information: refractory costs ~$150-500 (depends on type of refractory used) / metric ton, cost of steel ~$800-850 / metric ton; life span of refractory varies from 1 to 10 years depending on the type of refractory, with average lifespan of 5 years, life span of a well-kept kiln or furnace ~30 years). These numbers are just some crude reference numbers, but use sound scientific reasoning to help explain why the purchase of refractory would be important for your process.

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