1-1-2016

15.0.C Hands-on Heat Transfer Challenges

Christopher F. Bauer
University of New Hampshire, chris.bauer@unh.edu

Follow this and additional works at: https://scholars.unh.edu/day15

Recommended Citation
https://scholars.unh.edu/day15/38

This Report is brought to you for free and open access by the Fire and Ice at University of New Hampshire Scholars' Repository. It has been accepted for inclusion in Day 15 by an authorized administrator of University of New Hampshire Scholars' Repository. For more information, please contact nicole.hentz@unh.edu.
Keep the same role structure today as you had last class (manager, recorder, spokesperson, encourager – if you are in 5-person group, let the encourager be the person who did not have a role last time)

Task 1:
Complete the graphs of your data, and post it up on the wall. If you have completed that, proceed to Task 2. Please get this done as efficiently as you can.

In review, it seems that all experimental conditions have been tested, so we are ready for a conference after the graphs are posted.

Task 2:
Once you have prepared your graph, start considering these questions. Use a new recorder report form.

1) Look at the shape of the graphs from the second set of experiments. Describe the shape of the graphs so that someone who can’t see the graphs can image what they look like (and could reproduce the shape).

2) The shape you see illustrates an important principle of all matter. See if you can state it by starting a sentence with “When two materials at different temperatures are ……” Ask CB to listen to your statement, and he’ll tell you the formal name (s).

3) Is the hypothesis of hot-stays-hot-and-cold-stays-cold supported by the data?

4) Are the results of this second set of experiments consistent with the results of the direct mixing experiments? Cite specific data.

5) Does the hot water give caloric corpuscles to the cold water?
Does the cold water give frigorific corpuscles to the hot water?
Is there a better way to explain the process?

6) Do our experiments support the notion of conservation of energy? How so?
7) Assuming you like the energy idea, how can you use the graph to tell you something about the quantities of energy involved?

8) Try to write a little mathematical equation that expresses this energy idea in terms of the information on the graph. [It may be easier to figure this out by using the direct mixing experimental data. And to look at the equal-volume condition first. Then consider the non-equal volume condition.] Your equation should make sense in terms of your model that you described in #5.

9) We may have a general conference at this point, or we may proceed to more experiments.

Task 3: Extensions of the ideas

Choose one of the research questions below.
I will also entertain alternative suggestions from your group.

Design an experiment that will help you investigate the question. I will have materials available that may spark your thinking. Clear your intended procedure with an instructor. Gather the data, review, perform additional confirmatory experiments if necessary, and assemble information for presentation (e.g. graph of data).

Research Questions

1) Can the movement of heat be controlled?

2) Do cold things have heat?

3) Do different substances have the same ability to provide heat?

4) Develop proof that latent heat of phase change actually involves heat transfer.
Temperature v Time of Very Cold Can in Cold Mug

Jake S, Heather P, Jon T, Emily D
Do cold things have heat?

- Water
- Methanol
- Water (empty can)

Temperature (°C) vs. Time (sec)

Christopher F. Bauer, Principal Investigator.
This material is based upon work supported by the National Science Foundation under Grant No. 1245730.
Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.
Licensed: http://creativecommons.org/licenses/by-nc-sa/3.0/
Christopher F. Bauer, Principal Investigator.
This material is based upon work supported by the National Science Foundation under Grant No. 1245730.
Any opinions, finding and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.
Licensed: http://creativecommons.org/licenses/by-nc-sa/3.0/
Thermal Equilibrium rate for different number of nested cups

- 4 nested cups inside cup
- 4 nested cups outside
- 1 cup inner
- 1 cup outer

Christopher F. Bauer, Principal Investigator.
This material is based upon work supported by the National Science Foundation under Grant No. 1245730.
Any opinions, finding and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.
Licensed: http://creativecommons.org/licenses/by-nc-sa/3.0/
Temperature vs. Time of Heat Transfer

- bulb: --- = 80 mL cold
  --- = 120 mL cold
- mug: --- = 80 mL hot
  --- = 120 mL hot

*The cold samples were actually smaller granites.
Illustration of input of heat to a phase change (40 mL water; 5 mL ice)

Christopher F. Bauer, Principal Investigator.
This material is based upon work supported by the National Science Foundation under Grant No. 1245730.
Any opinions, finding and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.
Licensed: http://creativecommons.org/licenses/by-nc-sa/3.0/
Temperature vs. Time for different metals

<table>
<thead>
<tr>
<th>Metal</th>
<th>Weight</th>
<th>Initial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brass</td>
<td>135.0g</td>
<td>46.0°C</td>
</tr>
<tr>
<td>Copper</td>
<td>142.7g</td>
<td>48.0°C</td>
</tr>
</tbody>
</table>

(placed in 80mL of water)

**KEY**
- Blue: Water
- Orange: Brass
- Green: Copper