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Scope & Sequence

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Fire & Ice Preliminary Outline, CBauer, UNH, 2014

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.

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| Day | CONCEPT(S) | APPLICATIONS | ACTIVITIES | ONLINE RESOURCES | HOMEWORK |
|-----|--|---|---|--|--|
| 1 | Hotness and coldness are same | | Feeling hot/cold water | | Split-up content, everyone does a topic |
| 2 | Physiology of heat sensation | <ul style="list-style-type: none"> Thermoregulation Homeostasis in humans, warm-blooded vs. cold-blooded animals Hot/cold medical treatments <ul style="list-style-type: none"> cold for bruising, burns (constrict vessels); hot for pains, increasing circulation (dilate vessel, increase fluid flow) Hot-stone massage, hot-yoga, saunas | Jigsaw <ul style="list-style-type: none"> Discuss in expert groups Rearrange to tackle a problem Poster (?) | https://www.youtube.com/watch?v=NJEBfl_LKno (Thermoregulation in penguins and elephants) http://www.passbiology.com/z/biology-level-3/homeostasis (Thermoregulation and body temp) | Get familiar with Odyssey |
| 3,4 | Particulate Model of Gases/ Temperature related to motions | | <ul style="list-style-type: none"> Liquid Nitrogen play, compressibility test KMT simulator (Boltzmann, Odyssey) Phase diagram simulation Creating a temp scale | http://www.acs.org/content/dam/acsorg/education/resources/highschool/chemmatters/archive/december-2006.pdf (Thermometers, p 14 Chem Matters) | Readings on BP and altitude (1779) |
| 5,6 | -Construct model for how heat relates to phase change, molecular motion, and temperature | <ul style="list-style-type: none"> Alcohol wipes (L-> G) Electronic dust sprays (L->G) Connection: <i>absorption of heat</i> <ul style="list-style-type: none"> Thermochromic material as evaporation surface | Activities that show reversibility of L<->G, S<->L <ul style="list-style-type: none"> Ice melting calorimetry experiments Steam condensation experiments (?) | | Readings about activities <ul style="list-style-type: none"> hypothermia, sweating, transpiration in plants, swamp cooling (L->G) clouds (G->L) Play around with PhET phase diagram Making ice in the East |

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|--------|---|--|--|---|--|
| | -Latent heat related to phase change | | | | Indies (1775) (evaporative cooling) |
| 7 | SLACK DAY! | | | | |
| 8,9 | Thermal Equim and relationship of heat to change in molecular motion | <ul style="list-style-type: none"> Heat exchange through a barrier (thermal conductivity, heat dissipation) | <ul style="list-style-type: none"> Mixing hot and cold water Activity to show different materials as better conductors (contrast metals vs. diff substances) Jigsaw of self-readings | | <ul style="list-style-type: none"> “March of the Penguins (biological application) Self-readings of: <ul style="list-style-type: none"> -Insulation -Window design -thermal blankets -other animal adaptations (animal ears) -energy conservation A -social adaptation to climate |
| 10, 11 | -Mechanical Equivalence of Heat and Caloric Model of Heat vs. Motion model -Heat is not a substance. Heat is related to mass, change in T, and heat capacity | | -Joules’ experiment (test with honey or molasses) answering question “Where is the heat coming from?” -Find activities | https://www.youtube.com/watch?v=PThq8fJpCLw (Model of Joule’s apparatus for the mechanical equivalent of heat) - No explanation, just person doing the expt | <ul style="list-style-type: none"> Rumford’s article (invite Dr. Greenberg?) Chem Matters article (Cary?) |
| 12, | -How else | <ul style="list-style-type: none"> Car radiator | -activity to show in a | -burning of a candle (to show | <ul style="list-style-type: none"> |

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|----------------|--|---|---|--|---|
| 13 | does heat move? -conduction, radiation, convection | <ul style="list-style-type: none"> • Fireplace design (Rumford's fireplace) • Microwave ovens • Incandescent light • Evidence for light being energy (black clothes) <p><i>Cooking vs. Baking (assessment?)</i></p> | <p>vacuum, no heat is transferred (no matter)</p> <p>-consumer challenge (Magic Thaw)</p> <p>-magnify glass activity (newsprint vs. none)</p> <p>-heat radiation reflection (IR sensor)</p> <p>-Jigsaw activity for different applications</p> | radiation and convection) | |
| 14 | Global Warming | • | | | • |
| 15 | SLACK DAY! | | | | |
| 16, 17, 18, 19 | Chemical Energy | <ul style="list-style-type: none"> • Fossil fuels • Using Bondo • UV-gel nails | <ul style="list-style-type: none"> • Salt dissolution experiment (exo vs. endo rxns) (NaCl, NH₄Cl, CaCl₂) (<i>show amount of heat generated is proportional to amount of material</i>) • Nutrition connection (gummy bear calorimetry) • Chem 403 expt (bond breaking vs. forming) | <ul style="list-style-type: none"> • YouTube /readings on nutrition • http://www.canwestesthetics.com/uv-light-cured-gel-how-it-works/ (UV-gel nails) | <p><i>Historical connections</i></p> <ul style="list-style-type: none"> • LaVoisier and combustion readings "heat as a substance belief" • Nobel and dynamite (why things explode?) • Celluloid • Move theatre films and nitrocellulose |
| 20 | SLACK DAY! (Assessment- Thermochromic paper and sweaty hands?) | | | | |
| 21 | Quality of Energy (Entropy) | • | | | <ul style="list-style-type: none"> • Isaac Asimov reading • Steam engine (Carnot cycle) (?) • |