# The Sacred in Science

## Session 2 – *Heat*

http://www.bickart.org/

1. ***FIRE:***
   Oxygen in relation to earth, air, water, and fire. Organic chemistry (C, H, O, N). The Geology of metals: "The Earth is on fire!"

   - Take Away Mindfulness Demonstrations:
     - Carbon Test [goggles & aprons, propane tank with nozzle, dried leaf, food, rock, bone, fingernail, meat, fish, eggshell, egg, milk, plastic, leather]
     - Oxygen Test [collecting jar apparatus, splint, oxygen tank]
     - Oxidizing Carbon [candle, glass tube]
     - Oxidizing Wood [wood branch]
     - Oxidizing Iron {O/A}, Magnesium [iron powder, magnesium ribbon]
     - Oxidizing Bone & Rock [bone, rock]
     - Slaking Dust [bone, rock, cement, CaO]

2. ***EXTREME HEAT:*** **Temperature, Kinetic Energy, Calories**

   - Take Away Mindfulness Demonstrations:
     - Trusting Your Senses {O/A} [3 Bowls of hot, cold, and lukewarm water]
     - Stress Friction [hangar]
     - Red Hot Steel [steel ball, stand with mesh]
     - Extreme Expansion of propane + $O_2$ [balloons, long rod, propane tank, oxygen tank]

3. ***COLD:*** **CO2 Five Ways**

   This is great fun for the demonstration person and for the audience! You start showing **$CO_2$** in its pure form as a gas, then make it chemically, and then with dry ice.

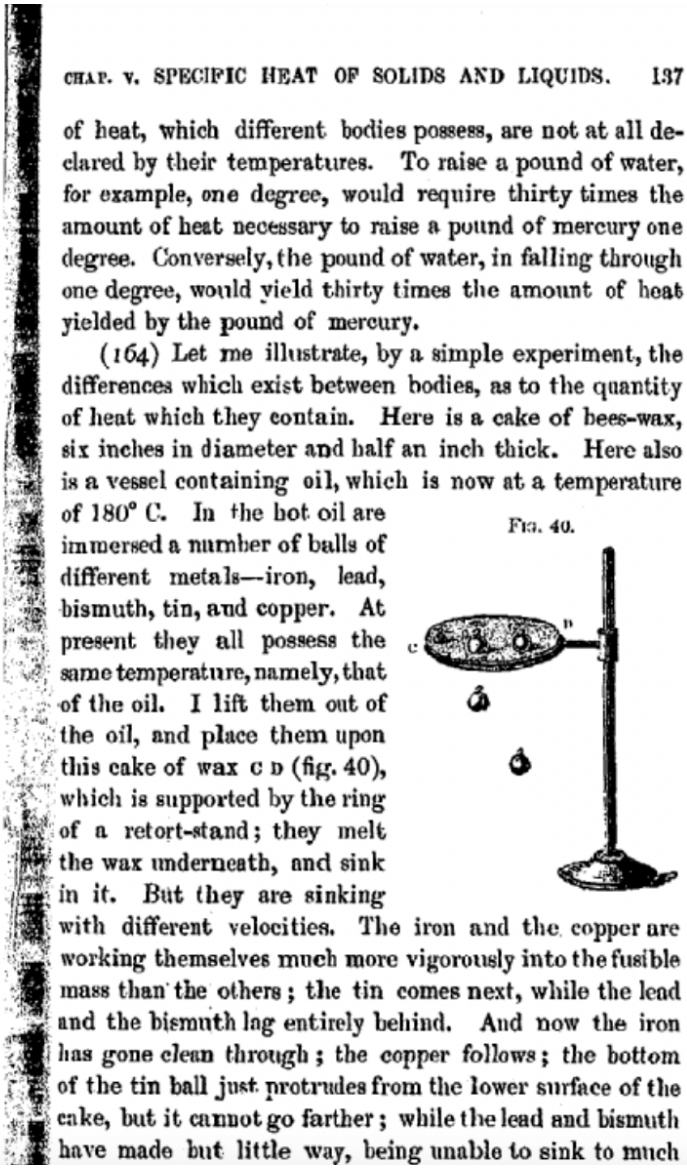
   - Take Away Mindfulness Demonstrations:
     1) Direct from Tank [$CO_2$ tank, collecting jar apparatus, candle, fire extinguisher]
        - Tongue
        - In Test Tube, Extinguish Flame
     2) Chemicals [Vinegar + Baking Soda, collecting jar apparatus]
        - Little: Pour onto candle
        - Big: Floating Bubbles
     3) Invisible [candle, glass tube, propane tank with nozzle]
        - Where did the candle go?
        - Carbon Soot on Glass with propane flame
     4) Dry Ice [bubbles, quarters, pan, hot & cold water, soap solution]
        - Blowing Bubbles

- Vibrating Quarter
- Screaming Pan
- Skating Puck
- Small Pieces in a Balloon will blow it up

5) Homemade Soda [cups, sugar water, pitcher, food coloring]

4. ***THERMODYNAMICS:*** **Specific Heat, Expansion, Water: Earth's Savior**

- Take Away Mindfulness Demonstrations:
  - Regelation [regelation apparatus]
  - Burning Money [Soak a dollar bill in water and alcohol, then burn off alcohol]
  - Ping Pong Ball in boiling water [camp stove, pot, ping pong balls]
  - Expansion/Contraction [Bimetallic Strip, Ball/Ring]
  - Hot Marble in cold water [propane tank with nozzle, marbles, pot]
  - Homemade Thermometer [glass tubes]
  - Expanding Pendulum [stand with brackets, wire, plumb bob]
  - Tyndall's Specific Heat Apparatus [camp stove, wax discs, metal balls, specific heat weights, tongs]



CHAP. V. SPECIFIC HEAT OF SOLIDS AND LIQUIDS. 137

of heat, which different bodies possess, are not at all declared by their temperatures. To raise a pound of water, for example, one degree, would require thirty times the amount of heat necessary to raise a pound of mercury one degree. Conversely, the pound of water, in falling through one degree, would yield thirty times the amount of heat yielded by the pound of mercury.

(164) Let me illustrate, by a simple experiment, the differences which exist between bodies, as to the quantity of heat which they contain. Here is a cake of bees-wax, six inches in diameter and half an inch thick. Here also is a vessel containing oil, which is now at a temperature of 180° C. In the hot oil are immersed a number of balls of different metals—iron, lead, bismuth, tin, and copper. At present they all possess the same temperature, namely, that of the oil. I lift them out of the oil, and place them upon this cake of wax C D (fig. 40), which is supported by the ring of a retort-stand; they melt the wax underneath, and sink in it. But they are sinking with different velocities. The iron and the copper are working themselves much more vigorously into the fusible mass than the others; the tin comes next, while the lead and the bismuth lag entirely behind. And now the iron has gone clean through; the copper follows; the bottom of the tin ball just protrudes from the lower surface of the cake, but it cannot go farther; while the lead and bismuth have made but little way, being unable to sink to much

FIG. 40.

*Tyndall's Original Experiment*

5. ***EXTREME COLD:* What if the Sun ceased to give light and heat?**
   Properties of liquid nitrogen, Absolute Zero!


   - Take Away Mindfulness Demonstrations:
     - Liquid Nitrogen
       - Brittle Lettuce
       - Instant Ice
       - Banana Hammer
       - Shrinking Balloon
       - Freeze Small Marshmallows
       - Potato Chips
       - Nitro Cream with cups & spoons & whisk & bowl
       - … then Eat, Pour on Floor

6. ***THERMODYNAMICS (again)***

   - Take Away Mindfulness Demonstrations:
     - Ice Bomb
     - Homemade Blinker from Bimetallic Strip
     - Weights of hot and cold air on homemade balance
     - Weights of hot and cold water on laboratory balance

7. ***CHEMISTRY***

   - Take Away Mindfulness Demonstrations:
     - Grand Cycle: Burning
     - Grand Cycle: Growing
     - Grand Cycle: Eating
     - Calcium Cycle: Our Bones
     - Calcium Cycle: Earth's Bones
     - Calcium Cycle: Lime Cycle
     - Other Cycles: Hydrolysis
     - Other Cycles: Fermentation
     - Other Cycles: Saponification
     - Other Cycles: Action of an Acid
     - Other Cycles: Action of a Base
     - Other Cycles: Action of an Acid + a Base

For a reference to *current writers on the hoped for, next version of humankind*, go to "Good Reading" on http://www.bickart.org/.

**References**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