HW11 Solutions, Physical Science

Gladden, Fall 2006

Solutions to Chapter 15 Exercises

6. Molecules in a gram of steam have considerably more energy, as evidenced by the considerable amount of work needed to change phase from solid ice to gaseous steam.

7. The hot coffee has a higher temperature, but not a greater internal energy. Although the iceberg has less internal energy per mass, its enormously greater mass gives it a greater total energy than that in the small cup of coffee. (For a smaller volume of ice, the fewer number of more energetic molecules in the hot cup of coffee may constitute a greater total amount of internal energy~~but~~ not compared to an iceberg.)

15. Different substances have different thermal properties due to differences in the way energy is stored internally in the substances. When the same amount of heat produces different changes in temperatures in two substances of the same mass, we say they have different specific heat capacities. Each substance has its own characteristic specific heat capacity. Temperature measures the average kinetic energy of random motion, but not other kinds of energy.

17. The slowly cooling object has the greater specific heat.

25. In winter months when the water is warmer than the air, the air is warmed by the water to produce a seacoast climate warmer than inland. In summer months when the air is warmer than the water, the air is cooled by the water to produce a seacoast climate cooler than inland. This is why seacoast communities and especially islands do not experience the high and low temperature extremes that characterize inland locations.

45. The gap in the ring will become wider when the ring is heated. Try this: Draw a couple of lines on a ring where you pretend a gap to be. When you heat the ring, the lines will be farther apart~~the~~ same amount as if a real gap were there. Every part of the ring expands proportionally when heated uniformly~~thi~~ckness, length, gap and all.

Solutions to Chapter 16 Exercises

6. Energy "flows" from higher to lower temperature, from your hand to the ice. It is the energy, heat, flowing from your hand that produces the sensation of coolness. There is no flow from cold to hot; only from hot to cold.

13. The snow and ice of the igloo is a better insulator than wood. You would be warmer in the igloo than the wooden shack.

30. In winter you want warm air near the floor, so the fan should push warmer ceiling air downward. In summer you want cooler air near the floor, so the fan should pull air upward.

42. Radiation requires no medium for transfer.

51. Under open skies, the ground radiates upward but the sky radiates almost nothing back down. Under the benches, downward radiation of the benches decreases the net radiation from the ground, resulting in warmer ground and, likely, no frost.

Solutions to Chapter 17 Exercises

6. Hot coffee poured into a saucer cools because (1) the greater surface area of the coffee permits more evaporation to take place, and (2) by the conservation of energy, the internal energy that heats up the saucer comes from the coffee, cooling it.

9. In this hypothetical case evaporation would not cool the remaining liquid because the energy of exiting molecules would be no different than the energy of molecules left behind. Although internal energy of the liquid would decrease with evaporation, energy per molecule would not change. No temperature change of the liquid would occur. (The surrounding air, on the other hand, would be cooled in this hypothetical case. Molecules flying away from the liquid surface would be slowed by the attractive force of the liquid acting on them.)

23. Enormous thermal energy is released as molecular potential energy is transformed to molecular kinetic energy in condensation. (Freezing of the droplets to form ice adds even more thermal energy.)

24. You can add heat without changing temperature when the substance is undergoing a change of phase.

43. Yes, ice can be much colder than 0°C, which is the temperature at which ice will melt when it absorbs energy. The temperature of an ice-water mixture in equilibrium is 0°C. Iced tea, for example, is 0°C.