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PRACTICE PROBLEMS

1. A community pool holds 1.10×10^6 kg of water. First thing in the morning, the temperature of the pool was 20.0°C. When the temperature was checked later in the day, it was 27.0°C. Calculate how much energy was required to raise the temperature of the water.

2. A scientist added 1500 J of energy to each of two 1.0 kg samples of gas kept at constant volume. One gas is CO_2 and the other is O_2. Calculate the final temperature difference between the two samples if they both started at 20°C.

3. Washing the evening dishes requires 55.5 kg of water. Tap water is at a temperature of 10.0°C and the dishwasher's preferred water temperature is 45.0°C. Find the amount of energy that is required to heat the water. Calculate the electrical cost of washing the dishes if the local utility company charges $0.120 per kilowatt-hour.

4. A covered beaker of ethanol is sitting in a window in the sun. The temperature changes from 8.00°C to 16.00°C. If this requires 2.00×10^4 J of energy, find the amount of ethanol in the beaker in kilograms.

PRACTICE PROBLEMS

5. Calculate the quantity of heat that must be removed by an ice-maker converting 4.0 kg of water to ice at 0.0°C.

6. Repeat the above calculation substituting ethyl alcohol for the water.

7. The Canadian Mint regularly produces gold coins. Calculate the amount of pure gold that the Mint could melt in one hour with a furnace capable of generating heat at a rate of 25 kJ/min.

   (Read the Technology Link on the following page before attempting problems 8 and 9.)

8. Assuming that the snow is –4°C and that the water is dumped at +4°C, calculate the amount of heat energy required to operate a Metromelt for one hour.

9. Compare the heat energy required to operate a Metromelt for one day (eight hours) to the equivalent number of hot showers the energy could supply to the citizens of Toronto. Assume that an average morning shower uses 40 kg of water that has been heated from 15°C to 70°C.

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6.1 Section Review

1. MC Why do some pots have copper bottoms?
2. K/U If you were to walk outside on a cold winter evening and touch a piece of wood, a metal fence pole, and a handful of snow, which would feel coldest? Justify your answer.
3. a) K/U Why is the specific heat capacity of the human body, although quite large, less than that of water?
   b) MC How does this large value help our survival?
4. I Extremely hot water is poured into two glasses. One glass is made of pure silver, the other of pure aluminum. Which glass will be hot to the touch first, the silver or aluminum glass? Explain.
5. K/U What happens to the work done when a bottle of lemonade is shaken?
6. K/U When wax freezes, is energy absorbed or released by the wax?
7. C A typical heating curve contains two plateaus. Describe why the plateaus exist.
8. I Why does rubbing alcohol at room temperature feel cool when a drop of it is placed on your skin?

UNIT INVESTIGATION PREP

Dramatic changes in temperature can affect the performance of athletes and sporting equipment.

- Identify the role of temperature in your investigation topic.
- How do materials used in sporting equipment compensate for changes in temperature?

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PRACTICE PROBLEMS

10. A mover pushes a 25.5 kg box with a force of 85 N down a 15 m corridor. If it takes him 8.30 s to reach the other end of the hallway, find the power generated by the mover, in watts.

11. A chair lift carries skiers uphill to the top of the ski run. If the lift is able to do 1.85×10^5 J of work in 12.0 s, what is the power of the chair lift in both watts and horsepower?

12. A 75.0 kg student runs up two flights of stairs in order to reach her next class. The total height of the stairs is 5.75 m from the ground level. If the student can generate 200 W of power and has 20.0 s to reach her classroom at the top of the stairs, will the student be on time for class?

13. A small car travelling at 100 km/h has approximately 3.6×10^5 J of kinetic energy.

(a) How much water in kg could that much energy warm from room temperature (20°C) to boiling (100°C)?

(b) What amount of power would be generated if the total mass of water was warmed in 11 min?

14. A well-insulated shed, built to house a water pump, is heated by a single 100 W light bulb.

(a) If the shed has 10.4 kg of air (assumed to be mostly nitrogen), how long, in minutes, would it take the light bulb to raise the air temperature from −8°C

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16. A portable stereo requires 265 J of energy to operate the CD player, yielding 200 J of sound energy.
    (a) How efficiently does the stereo generate sound energy?
    (b) Where does the "lost" energy go?

17. A 49.0 kg child sits on the top of a slide that is located 1.80 m above the ground. After her descent, the child reaches a velocity of 3.00 m/s at the bottom of the slide. Calculate how efficiently the potential energy is converted to kinetic energy.

18. A machine requires 580 J of energy to do 110 J of useful work. How efficient is the machine?

19. An incandescent light bulb transforms 120 J of electric energy to produce 5 J of light energy. A florescent bulb requires 60 J of electrical energy to produce the same amount of light.
    (a) Calculate the efficiency of each type of bulb.
    (b) Why is the fluorescent bulb more efficient than the incandescent bulb?

20. A microwave oven transforms 345 J of radiant energy into 301 J of thermal energy in some food. Calculate the efficiency of this energy transformation.

6.2 Section Review

1. K/U Describe the difference between work and power.

2. C Generate an energy-path diagram to show the electric energy consumed in your home.

3. I Develop an algebraic relationship for power in terms of force, F, and constant velocity, v. (Hint: Begin with the power formula and make substitutions for work, W.)

4. MC Based on the second law of thermodynamics, does an air conditioner pump "cold" in or "heat" out of a house?

5. I Consider Table 6.5. Draw an energy path diagram to suggest where energy is being consumed when travelling by (a) city bus and (b) ocean liner.

6. MC Using Table 6.5, compare cycling efficiency to driving, flying, and using a snowmobile.

Table 6.5
Transportation Energy Requirements

Mode of transportation	Energy consumption (kJ/km)
bicycle	52
walking	170
city bus	360
car	674
jumbo jet	2252
snowmobile	6743
ocean liner	8117