## Chapter 14

### Problems & Exercises

1.

$5.02 \times 10^8$ J

3.

$3.07 \times 10^3$ J

5.

0.171°C

7.

10.8

9.

617 W

11.

35.9 kcal

13.

(a) 591 kcal

(b) $4.94 \times 10^3$ s

15.

13.5 W

17.

(a) 148 kcal

(b) 0.418 s, 3.34 s, 4.19 s, 22.6 s, 0.456 s

19.

33.0 g

20.

(a) 9.67 L

(b) Crude oil is less dense than water, so it floats on top of the water, thereby exposing it to the oxygen in the air, which it uses to burn. Also, if the water is under the oil, it is less efficient in absorbing the heat generated by the oil.

22.

a) 319 kcal

b) 2.00°C

24.

20.6°C

26.

4.38 kg

28.

(a) $1.57 \times 10^4$ kcal

(b) 18.3 kW · h

(c) $1.29 \times 10^4$ kcal

30.

(a) $1.01 \times 10^3$ W

(b) One

32.

84.0 W

34.

2.59 kg

36.

(a) 39.7 W

(b) 820 kcal

38.

35 to 1, window to wall

40.

$1.05 \times 10^3$ K

42.

(a) 83 W

(b) 24 times that of a double pane window.

44.

20.0 W, 17.2% of 2400 kcal per day

45.

10 m/s

47.

85.7C

49.

1.48 kg

51.

$2 \times 10^4$ MW

53.

(a) 97.2 J

(b) 29.2 W

(c) 9.49 W

(d) The total rate of heat loss would be 29.2 $W$ + 9.49 $W$ = 38.7 $W$. While sleeping, our body consumes 83 W of power, while sitting it consumes 120 to 210 W. Therefore, the total rate of heat loss from breathing will not be a major form of heat loss for this person.

55.

−21.7 kW
Note that the negative answer implies heat loss to the surroundings.

57.

−266 kW

59.

−36.0 W

61.

(a) 1.31%

(b) 20.5%

63.

(a) −15.0 kW

(b) 4.2 cm

65.

(a) 48.5C

(b) A pure white object reflects more of the radiant energy that hits it, so a white tent would prevent more of the sunlight from heating up the inside of the tent, and the white tunic would prevent that heat which entered the tent from heating the rider. Therefore, with a white tent, the temperature would be lower

than 48.5C, and the rate of radiant heat transferred to the rider would be less than 20.0 W.

67.

(a) $3 \times 10^{17}$ J

(b) $1 \times 10^{13}$ kg

(c) When a large meteor hits the ocean, it causes great tidal waves, dissipating large amount of its energy in the form of kinetic energy of the water.

69.

(a) $3.44 \times 10^{5}$ $m^3/s$

(b) This is equivalent to 12 million cubic feet of air per second. That is tremendous. This is too large to be dissipated by heating the air by only 5C. Many of these cooling towers use the circulation of cooler air over warmer water to increase the rate of evaporation. This would allow much smaller amounts of air necessary to remove such a large amount of heat because evaporation removes larger quantities of heat than was considered in part (a).

71.

20.9 min

73.

(a) $3.96 \times 10^{-2}$ g

(b) 96.2 J

(c) 16.0 W

75.

(a) 1.102

(b) $2.79 \times 10^{4}$ J

(c) 12.6 J. This will not cause a significant cooling of the air because it is much less than the energy found in part (b), which is the energy required to warm the air from 20.0C to 50.0C.

76.

(a) 36ºC

(b) Any temperature increase greater than about 3C would be unreasonably large. In this case the final temperature of the person would rise to 73C (163ºF).

(c) The assumption of 95% heat retention is unreasonable.

78.

(a) 1.46 kW

(b) Very high power loss through a window. An electric heater of this power can keep an entire room warm.

(c) The surface temperatures of the window do not differ by as great an amount as assumed. The inner surface will be warmer, and the outer surface will be cooler.