Total: 35

Homeowork 7.1

(2) **E.1** Your body temperature would decrease (ultimately, you'd get hypothermia and die)

(2) **E.4** The ball's energy will have been converted to thermal energy (the ball and the box get a bit warmer).

(2) **E.5** Foods are poor conductors of heat. The metal skewer is a good conductors and it carries heat better. With the metal skewer, the food also gets heated from the inside.

(2) **E.6** Aluminum is a much better conductor of heat than steel. Thus, the bottom of an aluminum pan heats more evenly that that of a steel pan

(2) **E.10** The red-hot heating element would heat (quickly burn) the food on one side through radiation. The aluminum foil block the radiation; thus, the food gets heated more evenly (slowly) through conduction.

(2) **E.11** Black radiators have a higher emissivity, and are, thus, very efficient at transferring heat via radiation. White or silver radiators have a lower emissivity, and radiate heat less well and aren't as effective at heating their surroundings.

(2) **E.12** Through radiation.

(2) **E.31** From the color of its light; whiter is hotter. (see table 7.3.2).

(2) **E.34** The shiny side should face outward. The shiny side has a very low emissivity and, thus, will radiate off less heat than if the black side were on the outside.

(2) **E.36** Astronomers can look at the color of the star; the whiter the color, the hotter the star (see table 7.3.2)

(2) **E.37** According to the Stefan-Boltzmann law, the emitted thermal radiation power is proportional to the fourth power of the temperature (and also to the surface area). Since the steel is about 3 times hotter than body temperature (310K) it will emit $3^4 = 81$ times more power (if it had the same surface area).

(2) **E.39** Thermal expansion. The sidewalk has a different coefficient of volume expansion than the ground and would break or buckle when the temperature changed.

(2) **E.41** The metal lid has a larger coefficient of volume expansion than the glass jar, and it pulls away from the jar when you heat them both. (The glass will also not get as hot as the lid).

P1. $P = e \cdot \sigma \cdot T^4 \cdot A$

$P = 1 \cdot 5.67 \cdot 10^{-8} \frac{J}{s \cdot m^2 \cdot K^4} \cdot (800+273)^4 K^4 \cdot 0.25 m^2$

$P = 18,800 W$

(2)

P.2 $P = 1 \cdot 5.67 \cdot 10^{-8} \frac{J}{s \cdot m^2 \cdot K^4} (900+273)^4 K^4 \cdot 0.25 m^2$

$P = 26,800 W$

(3)

Much more power emitted because of T^4-law

P.3 $P = 1 \cdot 5.67 \cdot 10^{-8} \frac{J}{s \cdot m^2 \cdot K^4} \cdot (6000 K)^4 \cdot 1 m^2$

$P = 73,500,000 W$

(2)

P.4 It will radiate $\frac{0.08}{0.4} = 0.2$ less

(or factor of 5 less)

(2)