KEY
2/8/11
PER XX
CH 22 #1

CH 22 1-20, 33, 39, 40-45

1. They transfer energy through the conducting material.

2. Metal is a better conductor so the is heat flow from your skin.

3. A conducter moves heat quickly. An insulator moves heat slowley sp?

4. These materials have lots of air spaces. Air is a good insulator.

5. Cold is just the absence of high temp or thermal energy.

6. Warmed air is less dense and is buoyed upward.

7. During the day, the air warms the land. Warm air rizes, pulling in coastal air.

At night land cools, air drops, sea air is warmer and reverses the flow.

★8. When compressed, gas temp increases. when expanded, temp decreases. (If adiabatic)

9. Conduction

10. The energy of electromagnetic waves.

11. Higher temp = higher f (blue, white)

12. Good absorbers are also good emitters.

13. Assuming same materials; the black pot. It is a better emitter.

14. It appears black as it is absorbing light (vs. reflecting).

☆ 15. Pupils are black because entering light is absorbed (not reflected)

16. Red-hot poker in a cold room will cool faster (larger ΔT).

17. Yes, the law applies to any ΔT.

18. Radiant energy emitted by the earth.

19. Earth's temp is lower, so longer waves (lower f).

20. a. Only short wavelengths pass back out.

b. Earth

☆ 33. Coal dust is black an absorbs radiant energy melting the snow.

39. If more radiation escapes, the earth would cool.

☆

If more radiation is trapped, the earth will warm.

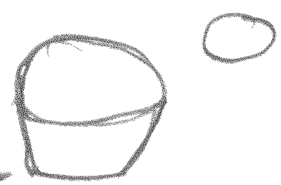
☆ 40. 12 ℓ of H_2O
20°C to 70°C

$$Q = mc\Delta T$$

$$= (12\ kg)\left(\frac{1000\,g}{1\,kg}\right)\left(\frac{1\ cal}{g\,°C}\right)(50°C)$$

$$\boxed{= 6.0 \times 10^5\ cal}$$

41. ☆A



$T_{o_w} = 20°C$

$T_{f_w} = 37°C \qquad T_{f_{Al}} = 37°C$

Find $T_{o_{Al}}$

$Q = mc\Delta T$

so $Q_{lost\ Al} = Q_{gain\ H_2O}$

$m_{Al} c_{Al} \Delta T_{Al} = m_{H_2O} c_{H_2O} \Delta T_{H_2O}$

$\Delta T_{H_2O} = 37°C - 20°C \qquad c_{H_2O} = 1.0 \frac{cal}{g°C}$

$\Delta T_{H_2O} = \underline{17°C} \qquad c_{Al} = .215 \frac{cal}{g°C}$

$\Delta T_{Al} = \underline{T_{o_{Al}} - 37°C}$

Rearranged →

$$\Delta T_{Al} = \frac{m_{H_2O} c_{H_2O} \Delta T_{H_2O}}{m_{Al} c_{Al}}$$

Plug #s

$$T_{o_{Al}} - 37°C = \frac{(75g)\left(\frac{1\ cal}{g°C}\right) 17°C}{(50g)\left(.215 \frac{cal}{g°C}\right)}$$

$T_{o_{Al}} - 37°C = 119°C$

$T_{o_{Al}} = 119°C + 37°C$

$\boxed{T_{o_{Al}} = 156°C}$

He's right!

★ 42. $0.03 \frac{J}{kg\,yr}$ of energy release

$C = 800 \frac{J}{kg\,°C}$

How many years to increase 500°C?

$Q = mc\Delta T$ (but no time?)

so divide both sides by time

rate $\left\{ \frac{Q}{t} = \frac{mc\Delta T}{t} \right\}$ rate

Units still funny. Need $\frac{J}{kg \cdot yr}$

so divide both sides by m

(matches rate) $\left\{ \frac{Q}{mt} = \frac{c\Delta T}{t} \right.$ ← need to find this

$t = \frac{c\Delta T}{Q/mt}$ NOW CAN SOLVE?

$$t = \frac{\left(800 \frac{J}{kg\,°C}\right)(500°C)}{0.03 \frac{J}{kg\,yr}}$$

$t = 1.33 * 10^7 \, yr$ UNITS CHECK

$t = 13.3 * 10^6 \, yr$

43. burn 0.6g peanut
beneath 50g of H_2O

A

$\Delta T = 50°C - 22°C$

$\Delta T = 28°C$

a. Assume 40% efficancy
find # cal

$Q = mc\Delta T$

$Q_{lost} = Q_{gain}$

$Q_{gain} = (50g)\left(\frac{1 cal}{g°C}\right)(28°C)$

$= 1.4 \times 10^3 cal$ (1400 cal)

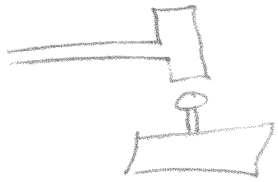
$(.4)(Q_{peanut}) = 1400 cal$

$Q_{peanut} = \frac{1400 cal}{.4}$

$Q_{peanut} = 3500 cal$

b. $\frac{3.5 Cal}{0.6 g} = 5.8 C/g$ ← Big C

44.



$F = 500\ N$

Nail = 6 cm

$m = 5g$

$c = 450 \frac{J}{kg\ °C}$

Find ΔT

Find Work

$W = F * d$

$= (500N)(6cm)\left(\frac{1m}{100cm}\right)$

$= \underline{30J}$

Find ΔT

All energy into ΔT so:

$Q = mc\Delta T$

$\Delta T = \frac{Q}{mc}$

$\Delta T = \frac{30J}{\left(5g \cdot \frac{1kg}{1000g}\right)\left(450\frac{J}{kg\ °C}\right)}$

$= \frac{30J}{2.25\frac{J}{°C}}$

$\boxed{\Delta T = 13.3\ °C}$

A 45. $200 \frac{W}{m^2}$ from sun

3 kW req'd

25% Efficiency

Find req'd size

How to solve?

Use units!

Efficiency

$$\text{Area} * \frac{200\ W}{m^2} * .25 = 3*10^3\ W$$

$$\text{Area} = \frac{3*10^3\ W}{\left(200 \frac{W}{m^2}\right)(.25)}$$

Area = 60 m^2