CH 21 #2
1-20, 23, 27, 35,
37, 41, 54, 55,
59, 63, 65

KEY
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PER XX
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★ = SCORED PROBS

1. Temperature is a measure of AVERAGE Kinetic Energy of molecules.

2. ICE → BOIL = 100°C

ICE → BOIL = 180°F

3. Temperature is the same as average KE is the same.

4. Matter contains internal thermal energy. Heat is the flow of energy due to ΔT.

5. Heat allways flows from Hot (High) to Cold (LOW) Temp.

6. The thermometer temp reaches equilibrium with its surroundings.

7. Thermal equilibrium is the state when all temperatures are equal.

8. Internal Energy is the sum of the energy in a substance (Thermal, Chemical, Nuclear ....)

9. 1 Calorie = 1000 calories (kcal)

10. 1 calorie = 4.186 J
Both are units of energy.

11. Specific Heat Capacity represents the material's ability to store internal energy. High specific Heat capacity means little change in T for large change in Q.

★ 12. Substances that heat up quickly have low specific heat capacity.

13. Water has the highest specific heat capacity of common substances

14. Both coasts are "buffered" by their oceans. This has more to do with weather patterns than specific heat.

Book answer is poor

15. Bimetal strips bend due to different thermal expansion rates for the metals

16. Gases expand the most with T.

☆ 17. Water is <u>most</u> <u>dense</u> at 4°C.

18. At 0°C you have "microscopic slush".

19. Ice Water and Ice are less dense and float. So, it "freezes" at the top.

20. All of the water must reach < 4°C before the lake can freeze. This is rare in a deep lake.

23. 500g 50°C

$Q = mc\Delta T$

☆ $= (500g)\left(\frac{1 cal}{g°C}\right) 50°C$

$= 25{,}000$ cal

or 2.5×10^4 cal

or 25 kcal

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33. More energy Iceberg or Coffee?

oops

ICEBERG ~ −15°C
or 258 K

COFFEE ~ 83°C
or 356 K

NOT REALLY JOULES ↓

ICEBERG	258 K * 1.9×10^5 kg	∝	4.9×10^7 kg K
COFFEE	356 K * .45 kg	∝	1.6×10^2 kg K

32. SUN ~ 10^7 degrees °C or K

10,000,000 ± 273 has no difference

so does not matter °C or K.

35. Which to bring 10 kg Brick or 10 kg Water?

Ans: Water because of higher specific heat capacity. More Joules of energy will flow to the bed for $\Delta 1°C$ in water.

$(Q = mc\Delta T)$

37. Sand has low specific heat capacity. It "gives off a lot of heat" at end of day.

A

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41. Freezing water expands and can break the pipes (and it does)

54. Heat 100 kg H_2O 15°C

$Q = mc\Delta T$

CAL

$= (100\,kg)\left(\frac{1000\,g}{kg}\right)\left(\frac{1\,cal}{g\,°C}\right)(15\,°C)$

$= 1.5 \times 10^6\ cal$ (1500 kcal)

1 cal = 4.186 J

$1.5 \times 10^6\ cal \times \frac{4.186\ J}{cal} = 6.28 \times 10^6\ J$

6280 kJ

6.28 MJ

OMIT 55. 500 mL H_2O @ 28°C

Δ to 4°C in Fridge

$Q = mc\Delta T$

$\underbrace{500\,mL \times \frac{1000\,g}{1\,L}}_{m} \times \frac{1\,cal}{g\,°C} \times \frac{4.186\,J}{1000\,c} \times (28-4)°C =$

$= 5.02 \times 10^4\ J$

$\cong 50{,}000\ J$

59. MIX 1 L 40°C w/ 2 L 20°C

$mc\Delta T_1 = mc\Delta T_2$

$(1\,kg)\left(\frac{1\,cal}{g\,°C}\right)(40°C - T_f) = (2\,kg)\left(\frac{1\,cal}{g\,°C}\right)(T_f - 20°C)$

(CONT)

59. (CONT)

$$(1\,kg)\left(\frac{1\,cal}{g^\circ C}\right)(40^\circ C - T_f) = (2\,kg)\left(\frac{1\,cal}{g^\circ C}\right)(T_f - 20^\circ C)$$

$$40^\circ C - T_f = \left(\frac{2\,kg}{1\,kg}\right)(T_f - 20^\circ C)$$

$$40^\circ C - T_f = 2T_f - 40^\circ C$$

$$80^\circ C = 2T_f + T_f$$

$$\frac{80^\circ C}{3} = T_f$$

$$\boxed{T_f = 26.7^\circ C}$$

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65. Steel expands 1 part in 100,000/°C

$$1.5\,km * \frac{1\,part}{100{,}000\,part\ °C} * 20°C = 3*10^{-4}\,km$$

or .3 m

or 30 cm

63. FE (IRON) ↑ 10°C = Q

PB (LEAD) ↑ 35°C = ? (SAME?)

$$Q = mc\Delta T$$

$$m_{FE} c_{FE} \Delta T_{FE} = m_{PB} c_{PB} \Delta T_{PB}$$

$$m_{FE} = m_{PB}$$

$$c_{FE} \Delta T_{FE} = c_{PB} \Delta T_{PB}$$

$$\left(.107\,\frac{cal}{g°C}\right)(10°C) = \left(.031\,\frac{cal}{g°C}\right) \Delta T_{PB}$$

$$\Delta T_{PB} = \frac{\left(.107\,\frac{cal}{g°C}\right) 10°C}{\left(.031\,\frac{cal}{g°C}\right)}$$

$$= 34.5\,°C$$

$$\cong 35°C$$