Name ____________________________________

Date ________________ Pd ___

Unit 3 Worksheet 3 – Quantitative Energy Problems

Show all work on a *separate* sheet of paper so that you may use as much space as you need for each problem.

- Model the problem: for each question sketch a warming/cooling curve to help you decide which constant(s) to use in your analysis. Draw energy bar (LOL) charts to help your analysis as needed.
- Find the desired quantity, showing all work and canceling units.
- Keep a reasonable number of sig figs and **box** in your answers.
- Skip Lines between problems.

Refer to your Energy Constants handout for specific heat capacities and heats of fusion or vaporization.

1. A cup of coffee (140 g) cools from 75˚C down to comfortable room temperature 20.˚C. How much energy does it release to the surroundings?

2. Suppose during volleyball practice, you lost 2.0 lbs of water due to sweating. If all of this water evaporated, how much energy did the water absorb from your body? Express your answer in kJ. 2.2 lbs = 1.0 kg

3. Suppose that during the Icy Hot lab that 65 kJ of energy were transferred to 450. g of water at 20.˚C. What would have been the final temperature of the water?

4. If the same quantity of energy as in #3 were transferred to a 450. g chunk of iron at 20.˚C, what would be the final temperature? (see your reference sheet for iron's energy constants)

5. Suppose a bag full of ice (450. g) at 0.0 ˚C sits on the counter and begins to melt to liquid water. How much energy, in kJ, must be absorbed by the ice if 2/3 of it melted?

6. A serving of Cheez-Its releases 130. kcal (1 kcal = 4.18 kJ) when digested by your body. If this same amount of energy were transferred to 2.5 kg of water at 27˚C, what would the final temperature be?

7. If the same quantity of energy (from #6) were transferred to 2.5 kg of water at its boiling pt, what fraction of the water would be vaporized?

8. Most engine blocks are currently made from aluminum. In testing, a sample aluminum engine block is heated from room temperature (20. ^{o}C) up to 312 ^{o}C by absorbing 4.47 x 10^{3} kJ of energy. What is the mass of the engine block?

Energy Constants for Water:

2.1 J/g˚C	Heat capacity (c) of solid water
4.18 J/g˚C	Heat capacity (c) of liquid water
334 J/g	Heat of fusion H_f
2260 J/g	Heat of vaporization H_v

Energy Constants of Some Other Common Substances:

Substance (state @ room temp)	Melting Point (°C)	Boiling Point (°C)	Specific Heat Capacity for state (J/g °C)	Heat of Fusion for solid (J/g)	Heat of Vaporization for liquid (J/g)
Aluminum (s)	660.	2520	0.897	397	
Iron (s)	1538	2862	0.449	247	
Mercury (l)	-38.8	357	0.140	11.4	
Carbon (s)	3974**	---	0.710	104.6**	
Silver (s)	962	2163	0.235	102	
Gold (s)	1064	2857	0.129	64.3	
Methanol (l)	-97.9	64.6	5.07	99	2.20×10^3
Ethanol (l)	-114.5	78.4	2.44	109	838
Acetone (l)	-94.8	56.1	2.18	98	502

**in the presence of air, carbon combusts before melting. In the absence of air, carbon sublimes at normal atmospheric pressure before melting.

The symbols (s), (l), and (g) indicate the solid, liquid and gaseous states, respectively

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