Unit 9 – Thermal Energy! Name_____

A. Thermal energy

1. Differentiate between temperature, thermal energy and heat.
2. Why do we have different temperature scales? What are the main three and what are they based on?
3. What is equilibrium? What is averaged? Why does this occur?
4. Change the following temperatures from Celsius to Kelvin.

a. 159	b. 0	c. 27	d. 35
e. -40	f. -132	g. 289	h. 4320

5. Change the following temperatures from Kelvin to Celsius.

a. 159	b. 0	c. 27	d. 35
e. 540	f. 132	g. 289	h. 4320

6. What do the two laws of thermodynamics tell us?

B. Heat conservation - **(use chart)**

1. Why was the saying "A watched pot never boils" invented?
2. If two objects of the same mass but different specific heats are at the same temperature initially, which will cool more quickly? Why?
3. Why do we say energy is conserved? What factors could affect this?
4. If we add 3590 J of heat to a rock of mass 3.2 kg, and it heats it up 14 degrees, what is the specific heat of that rock? (80 J/kg·^{o}C)
5. How much heat does it take to heat 500 g of water from 23 to 82 degrees? (1.2×10^5 J)
6. 1.3 kg of boiling water is diluted by 230 g of milk at 13 degrees. If milk's specific heat is 4250 J/kg·^{o}C, what is the final temperature of the solution? (87^{o}C)
7. 5.3 kg of iron at 500 degrees is placed in contact with 8.2 kg of brass at -15 degrees. What is their equilibrium temperature? (210^{o}C)
8. A 250 kg car engine (iron) is cooled by water. The initial temperature of the car/water system is 35 degrees. The air temp. is 12 degrees. If 24.3 MJ of heat are given off during the cooling process, how much water was in the cooling system? (230 kg)
9. A .259 kg, 150 degree chunk of metal is placed in 1.3 kg of water at 25 degrees. The equilibrium temperature of the water is 32 degrees. What is the specific heat of the metal? (1200 J/kg·^{o}C)

Material	**Specific Heat** (J/kg.oC)
Aluminum	903
Brass	376
Ice	2060
Iron	450
Lead	130
Steam	2020
Water	4180

C. State Changes - **(use chart)**

1. What are the three ways in which heat is transferred? Give examples.
2. Why do some things conduct heat and some insulate? What types of things do each?
3. How can we prevent heat transfer into or out of a home?
4. Why does it take energy to cause a state change?
5. Name all the possible state changes, and what they are changing from and to.
6. How much heat does it take to change 350 g of ice at zero degrees to water at zero degrees? (1.2×10^5 J)
7. How much heat does it take to vaporize 158 g of mercury? (4.30×10^4 J)
8. How much heat is needed to change 450 g of ice from -25° to water at zero degrees. (1.7×10^5 J)
9. If you add 569 kJ of heat to 180 g of ice at -45 degrees, what is the final temperature, and what state is the water in? (128°C, steam)
10. How much heat is given off when 498 g of steam at 125° becomes ice at -35.8°? (1.6×10^6 J)

Material	**Hf** (J/kg)	**Hv** (J/kg)
Mercury	11 500	272 000
Copper	205 000	5 070 000
Gold	63 000	1 640 000
Iron	266 000	6 290 000
Lead	20 400	864 000
Silver	10 400	2 360 000
Water	334 000	2 260 000