Review Sheet: Unit 13 **Name** *KEY*

I. Be able to define or apply these terms:

kinetic and potential energy
temperature
system and surroundings
specific heat capacity
phase diagram
ΔH_{fus} and ΔH_{vap}
endothermic
exothermic
activated complex
activation energy
ΔH_r

See the "Note Taking Guide: Episode 1301" (pages 13.1, 13.2, 13.3, 13.4) for these definitions.

II. Label each of the following as "endothermic" or "exothermic":

Exothermic a) Products are more stable than reactants.

Endothermic b) Kinetic energy is converted into potential energy.

Endothermic c) evaporation

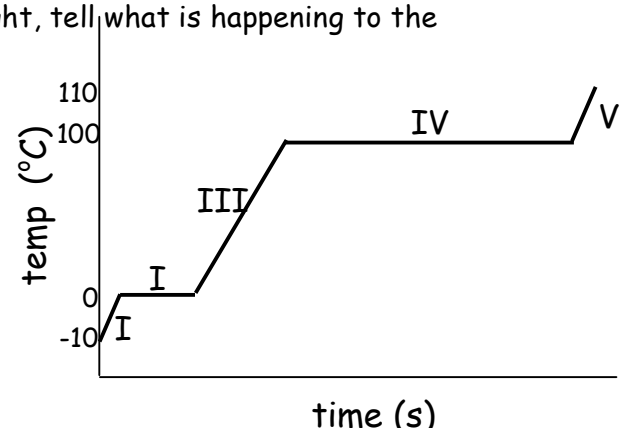
Exothermic d) combustion

Exothermic e) Water freezes.

Endothermic f) Heat seems to disappear.

III. In each section of the diagram at the right, tell what is happening to the kinetic and potential energy of the water molecules:

section	kinetic energy	potential energy
I	(**inc**, dec, same)	(**inc**, dec, same)
II	(inc, dec, **same**)	(**inc**, dec, same)
III	(**inc**, dec, same)	(**inc**, dec, same)
IV	(inc, dec, **same**)	(**inc**, dec, same)
V	(**inc**, dec, same)	(**inc**, dec, same)



IV. Discussion:

1. Three liquids of the same mass absorb the same amount of heat. Liquid A's temperature rises 20° C, liquid B's rises 10 °C, and liquid C's doesn't change. Explain.

   A has the lowest specific heat capacity of all three and therefore does not require as much heat to raise its temperature. B has the next highest and C has the highest specific heat – so high in fact, that the temperature does not increase at all. It is also possible that liquid C was changing phase (boiling).

2. Why does the air inside the shower feel warm as the water vapor condenses?

   Condensation is the changing of water vapor (gas) into liquid water. This is a decrease in PE and an exothermic reaction. The system (the water) loses energy in the form of heat and the surroundings (your skin) absorb that heat making you warmer.

3. Why does the temperature of boiling water not change, even though the water is being heated?

   During all phase changes, the temperature (average measure of kinetic energy) does not change. Instead the energy goes into changing the phase and being stored as potential energy instead of changing the temperature.

4. We know that molecules must collide in order to react. Why is energy required to make this happen? What is the energy called and how does it affect reaction rates?

   Energy is required for molecules to react because during the collision the electrons from each molecule repel each. This requires energy to overcome the repulsion. This energy is called activation energy and it determines the speed at which a reaction occurs. If the activation energy is high, then the reaction will be slow.

IV. Math:

1. a. Calculate the amount of heat released when 25.0 g of water at 25.0°C cools to 0.0°C.

   $Q = m \times C \times \Delta t$
   $Q = 25.0\ g \times 4.184\ J/g°C \times (-)25°C$
   $Q = -2620\ J$

   Δt is negative, so Q is negative as well.

   b. Calculate the amount of heat released when the same sample freezes.

   $Q = m \times \Delta H_{fus}$ $Q = 25.0\ g \times 334\ J/g = 8350\ J$

2. What is the specific heat capacity of a 35 g sample of an unknown metal that releases 6700 J of heat when it cools from 94 °C to 29 °C?

   $Q = m \times C \times \Delta t$
   $-6700\ J = 35\ g \times C \times (-)65°C$
   $C = 2.9\ J/g°C$