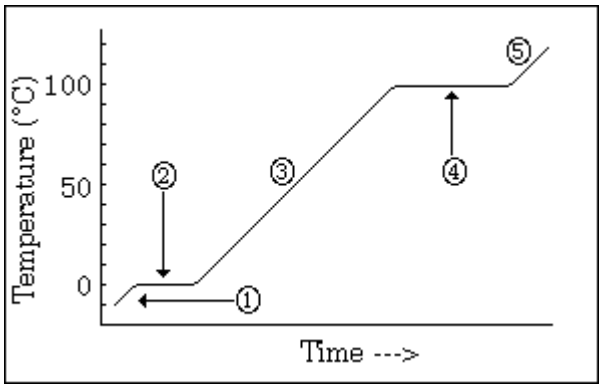
South Pasadena • AP Chemistry Name _____

Period __ Date ___/___/___

6 • Energy and Chemical Reactions

HEATING CURVE CALCULATIONS



In the heating and cooling curves tutorial we learned that energy is **absorbed** by a substance as it **warms up**, **melts** (fusion) or **boils** (vaporization) and energy is **released** from a substance as it **cools down**, **condenses**, or **freezes**.

Calorimetry ($q=mC\Delta T$) allows us to calculate the energy changes as a substance **warms or cools**. (1, 3, & 5)

The energies involved in **phase changes** (areas 2 & 4) are the **Heat of Vaporization** (liquid → gas) and the **Heat of Fusion** (solid → liquid). These energies will be used as conversion factors.

Heat of Vaporization or Heat of Condensation of water	**Heat of Fusion (melting) or Heat of Solidification of water**
$H_{vap} = \frac{2330\ J}{gram}$	$H_{fus} = \frac{335\ J}{gram}$

Joules (J) are energy units. It takes 4.184 Joules of energy to heat 1 gram of water by 1 °C.

Examples:

Calculate the energy needed to vaporize 10.0 g of water.

$$10.0\ g\ H_2O \times \frac{2330\ J}{gram} = 23{,}000\ J = 23.0\ kJ$$

Calculate the energy released when 10.0 kg of water melts.

$$10.0\ kg\ H_2O \times \frac{1000\ g}{1\ kg} \times \frac{335\ J}{gram} = 3{,}350{,}000\ J = 3{,}350\ kJ$$

Do the following calculations. Show your equation for each problem. Box your answers.

1. Calculate the energy needed to vaporize…

   a) 15.0 g of water

   b) 5.75 kg of water

   c) 3.88 moles of water

   This is represented on the Heating Curve as Section ____.

2. Calculate the mass of water (in grams) that will be vaporized by…

   a) 20.0 kJ of energy

   b) 175 kJ of energy

   c) 135 J of energy

3. Calculate the energy needed to melt…

   a) 23.0 g of water

   b) 8.75 kg of water

   c) 3.25 moles of water

   This is represented on the Heating Curve as Section ____.

4. Calculate the mass of water (in grams) that will be melted by…

   a) 30.0 kJ of energy

   b) 7.60 kJ of energy

   c) 133 J of energy

5. Calculate the energy…

   a) absorbed by 35.8 g of ice melting

   b) released as 88.5 g of water vapor condenses

   c) released as 92.2 g of water freezes

   d) absorbed as 13.6 g of water vaporizes

   e) absorbed when 2.25 moles of ice melts

   f) absorbed when 2.25 moles of water vaporizes

6. A 25.00 gram sample of ice at 0.0°C melts and then warms up to 20.0°C. How much energy is absorbed?

   This problem is represented on the Heating Curve as Sections ____ & ____.