

Change of State Calculations Homework Assignment

J. Flint Baumwirt ~ Granada Hills Charter High School, CSUN Math Science and Technology Magnet ~ February 2004

$$Q = m C_D \Delta T \quad Q = \Delta H_{\text{fus}} n \quad Q = \Delta H_{\text{vap}} n \quad \text{*Remember to convert all Joules to kilojoules.}$$

1. Calculate the number of kJ it would take to convert 85.0 grams of water to steam.
2. Calculate the number of kJ it would take to convert 55.0 grams of liquid water to solid ice at 0°C.
3. Calculate the amount of heat energy that it would take to turn 15.0 grams of water into steam and raise the temperature of the steam to 180°C.
4. Calculate the amount of heat energy needed to take 35.0 grams of ice at 0°C from the freezer, put it in a saucepan over a burner on the stove and bring the resulting liquid water to a boil until all was all boiled away. *Show a heating/cooling diagram of this process with all significant temperatures and phase changes labeled.*
5. Calculate the amount of heat energy it would take to bring an old bathtub full of frozen water sitting out in a snow-covered field at (minus) -10°C to a boil at 100°C. Consider the volume of the tub to be approximately 130 cm x 70 cm x 70 cm. The density of ice is 0.931 g/cm³. *Show a heating/cooling diagram of this process with all significant temperatures and phase changes labeled.*

FOR WATER:
$\Delta H_{\text{vap}} = 40.6 \text{ kJ/mol}$
$\Delta H_{\text{fus}} = 6.02 \text{ kJ/mol}$
$C_{\text{p gas}} = 2.03 \text{ J/g}^\circ\text{C}$
$C_{\text{p liquid}} = 4.184 \text{ J/g}^\circ\text{C}$
$C_{\text{p solid}} = 2.06 \text{ J/g}^\circ\text{C}$
$H_2O = 18.0 \text{ g/mol}$

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