

Change of State Calculations Homework Assignment

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

Construct a Heating/Cooling Curve for each question.

1. Calculate the number of kJ it would take to convert 85.0 grams of water to steam. The molar mass of water is 18.0 grams/mol, and the Molar Heat of Vaporization, ΔH_{vap} , is 40.6 kJ/mol.
2. Calculate the number of kJ it would take to convert 55.0 grams of liquid water to solid ice at 0°C. The Molar Heat of Fusion, ΔH_{fus} , is 6.02 kJ/mol and the molar mass of water is 18.0 g/mol.
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. The Molar Heat of Vaporization, ΔH_{vap} , is 40.6 kJ/mol and the Specific Heat of gaseous water, $C_{\text{p gas}}$, is 2.03 J/g°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.* The molar mass of water is 18.0 grams/mol, the Molar Heat of Fusion, ΔH_{fus} , is 6.02 kJ/mol, the Molar Heat of Vaporization, ΔH_{vap} , is 40.6 kJ/mol and the Specific Heat of water, $C_{\text{p liquid}}$, is 4.184 J/g °C.*
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. The molar mass of water is 18.0 grams/mol. *Show a heating/cooling diagram of this process with all significant temperatures and phase changes labeled.* The Molar Heat of Fusion, ΔH_{fus} , is 6.02 kJ/mol. The Specific Heat of ice, $C_{\text{p solid}}$, is 2.06 J/g°C and the Specific Heat of water is 4.184 J/g °C.*

*Remember to convert Joules to kilojoules.

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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