# Molar Enthalpy Worksheet

A change in enthalpy ($\Delta H$) is a measurement of energy transfer in the form of heat. **Molar enthalpy** is the enthalpy change per mole of a substance involved in a transformation. Examples of transformations are phase changes, dissolving and chemical reactions.

The units are generally expressed as kJ/mole. Thus, the molar enthalpy of **fusion** for water is the energy in kilojoules required to **melt** one mole of ice at its melting point. Positive molar enthalpies ($+\Delta H$) indicate that energy is being gained by the substance, whereas negative molar enthalpies ($-\Delta H$) indicate that energy is lost.

Complete the problems below on a separate piece of paper. Show all work, and express answers with significant figures and proper labels (units and substance).

1) Calculate the molar enthalpy of solidification ($\Delta H_{solidification}$) when 10.00kJ of energy are lost as 30.00g of water are frozen at $0^{\circ}C$. Remember that this value will be negative, because energy is lost when water freezes. (Hint: start by finding out how many moles of water that are freezing)

2) Compare your answer in question #1 to the value given for $\Delta H_{fusion}$ in problem 19b on p.353 of your textbook. What do you notice? Explain the coincidence, thinking about the difference between solidification and fusion.

3) Calculate the molar enthalpy of condensation ($\Delta H_{condensation}$) for ammonia when 50.0g of $NH_3$ gas turn into a liquid at its boiling point. 68 500J of energy are released in the process.

4) Calculate the energy released when $2.0 \times 10^3$g of dry ice ($CO_2$) sublimate at the normal sublimation point. The molar enthalpy of sublimation is -8.647kJ/mol.

5) Methane ($CH_4$) has a normal boiling point of $-161.6^{\circ}C$. At this temperature, the $\Delta H_{condensation} = -8.17$kJ/mol. If 16.5g of liquid methane vaporize, how much energy is absorbed?

6) How much energy is required to melt a 20.lb bag of ice at $0^{\circ}C$? A pound (lb.) of ice is equivalent to 0.4536 kg. The $\Delta H_{fusion}$ of ice is +6.009kJ/mol.

7) When water vaporizes at its normal boiling point, its $\Delta H_{vaporization} = +40.79$kJ/mol. Calculate the number of moles of water that condense if 3456kJ of energy are released.

8) What mass of aluminum metal would absorb 250.kJ when it melted at its melting point? The molar enthalpy of fusion for aluminum is +10.71kJ/mol.