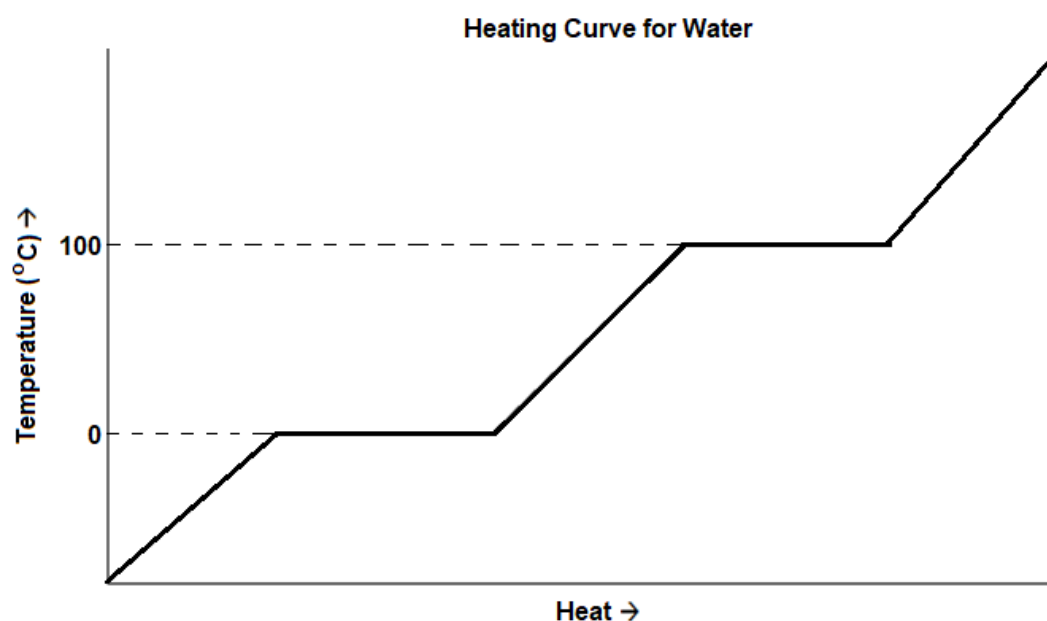


Heat of Phase Changes

Use the data table below, the heating curve, dimensional analysis, and $q = m \times \text{specific heat} \times \Delta T$ to solve the following problems.

Substance	Specific Heat (J/g·K)	MP (°C)	ΔH_{fus} (kJ/mol)	BP (°C)	ΔH_{vap} (kJ/mol)
H ₂ O(s), ice	2.09	0.00	6.02	***	***
H ₂ O(l), water	4.18	***	***	100.00	40.7
H ₂ O(g), steam	1.84	***	***	***	***

*** indicates data not available or not applicable



SHOW YOUR WORK. WRITE YOUR ANSWERS IN JOULES.

All processes occur at a constant pressure of 1 atm.

1. Calculate the amount of heat required to change 80.0 g of ice at $-12.0\text{ }^{\circ}\text{C}$ to steam at $114\text{ }^{\circ}\text{C}$.
2. How much heat is transferred in the process of completely melting a 1.6-kg block of ice starting at $-15.0\text{ }^{\circ}\text{C}$? Is this process endothermic or exothermic?
3. How much heat is exchanged with the environment when a sample of steam with a temperature of $109\text{ }^{\circ}\text{C}$ condenses to 3.6 mL of liquid water with a density of 0.997 g/mL at $25.0\text{ }^{\circ}\text{C}$? Is this process endothermic or exothermic?
4. Calculate the amount of heat transferred when 2.0 L of water at $25.0\text{ }^{\circ}\text{C}$ (density = 0.997 g/cm^3) is frozen to $-10.0\text{ }^{\circ}\text{C}$. Is this process exothermic or endothermic?