

# Chemistry Tip Sheet: Approaching & Diagnosing Problems

## Stoichiometry & Thermodynamics



- Read** the question and **circle** any key words.  
ex. (bomb) calorimeter, heat of formation, closed system, energy, exothermic, fusion, temperature change, work
- Write** a *balanced* chemical equation where necessary  
(Include diagrams if applicable).
- Remove** significant values given by the question. Assign them each a variable.\*

*\*Tip: Be as specific and organized as possible when there are multiple elements or energy transfers in question.*

- Convert** the given values to appropriate units of measurement.
- Define** the unknown variable and choose potential formula(s) that could be helpful.
- Evaluate** the selected formula(s) in relation to the key words and type of problem.
- Determine** any supplementary values that may be required for the formula.
- Apply** the formula to solve for the unknown variable.\*

*\*Tip: Try to avoid substituting values for variables until the final step for greater precision*

- Evaluate** the calculated answer. Does it make logical sense based on the situation?

## Quick Reference for Thermodynamic Question Diagnostic

Keyword	Ask yourself...	Ask yourself...	Suggested Formula
Initial/final temperature/specific heat capacity	Is the system is closed?	Is there one element in question?	$q = mc\Delta T$ $\Delta T = T_{\text{final}} - T_{\text{initial}}$
		Are there two elements in question?	$mc\Delta T + mc\Delta T = 0$
Fusion/fission/state change/total energy	Is there one element in question?	Is the system is open?	$q_{\text{total}} = q_1 + q_2 + q_3 \dots$
	Are there two elements in question?	Is the system is closed?	$q_1 + q_2 + \dots = 0$
Work/Transfer of energy	Is the reaction occurring under constant pressure?	Does it reference volume?	$W = -P \times \Delta V$
	Are there internal energy changes in system?	Does it reference heat?	$\Delta U = q + w$
Calorimetry/Enthalpy change	Does it mention constant pressure?	Is the reaction occurring in a coffee cup calorimeter?	$q_r + q_{\text{solution}} = 0$
	Does it mention constant volume?	Is the reaction occurring in a bomb calorimeter?	$q_r + q_{\text{bomb}} + q_{\text{water}} = 0$ $q_r + C_{\text{water}}\Delta T + mc\Delta T = 0$
Enthalpy changes/ ( $\Delta_r H^\circ$ )/ ( $\Delta_f H^\circ$ )	Does it mention the enthalpy change for the reaction ( $\Delta_r H^\circ$ )?	Is ( $\Delta_r H^\circ$ ) given?	Multiply $\Delta_r H^\circ$ by mols OR Apply Hess' Law
		Does it reference enthalpies of formation ( $\Delta_f H^\circ$ )?	$\Delta_r H^\circ = \sum n \Delta_f H^\circ(\text{products}) - \sum n \Delta_f H^\circ(\text{reactants})$