1. Calculate the **molar heat capacity** of the following:

   aluminum  (specific heat capacity = 0.900 J/g°C)

   carbon tetrachloride  (specific heat capacity = 0.861 J/g°C)

2. Calculate the **specific heat capacity** of the following:

   C₂H₂ – acetylene  (molar heat capacity = 43.93 J/mol·K)

   CF₃CCl₃ – a chlorofluorocarbon  (molar heat capacity = 120.5 J/mol·K)

3. Energy is stored in the body in the form of adenosine triphosphate, ATP. It forms on reaction between adenosine diphosphate, ADP, and phosphoric acid:

   \[ \text{ADP} + \text{H}_3\text{PO}_4 + 38 \text{ kJ} \rightarrow \text{ATP} + \text{H}_2\text{O} \]

   Is this reaction endothermic or exothermic?

4. Ethyl alcohol has been suggested as an additive to gasoline. It burns to give CO₂ and H₂O, the usual products of combustion:

   \[ \text{C}_2\text{H}_5\text{OH}(g) + 3\text{O}_2(g) \rightarrow 2\text{CO}_2(g) + 3\text{H}_2\text{O}(l) + 1409 \text{ kJ} \]

   Is this reaction endothermic or exothermic?

5. “Gasohol,” a mixture of gasoline and ethyl alcohol, C₂H₅OH, is a possible automobile fuel. The alcohol produces energy in a combustion reaction with O₂:

   \[ \text{C}_2\text{H}_5\text{OH}(g) + 3\text{O}_2(g) \rightarrow 2\text{CO}_2(g) + 3\text{H}_2\text{O}(l) \]

   If 0.115 g of alcohol evolves 3.45 kJ when burned at constant pressure, what is the molar enthalpy (or heat) of combustion for ethyl alcohol in kJ/mol?
6. White phosphorus, P₄, ignites in air to produce heat, light, and P₄O₁₀:

   \[ \text{P}_4(s) + 5\text{O}_2(g) \rightarrow \text{P}_4\text{O}_{10}(s) \]

If you burn 3.56 g of P₄, you find that 86.5 kJ of heat are evolved at constant pressure. What is the molar enthalpy of combustion of P₄ in kJ/mol?

7. A laboratory “volcano” can be made from ammonium dichromate. When ignited, the compound decomposes in a fiery display:

   \[(\text{NH}_4)_2\text{Cr}_2\text{O}_7(g) \rightarrow \text{N}_2(g) + 4\text{H}_2\text{O}(g) + \text{Cr}_2\text{O}_3(s)\]

If the decomposition produces 315 kJ per mole of ammonium dichromate at constant pressure, how much heat energy would be produced by 1 ounce (28.3 g) of the solid?

8. The thermite reaction, the reaction between aluminum and iron(III) oxide, produces a tremendous amount of heat:

   \[2\text{Al}(s) + \text{Fe}_2\text{O}_3(s) \rightarrow \text{Al}_2\text{O}_3(s) + 2\text{Fe}(s) + 852 \text{ kJ}\]

If you begin with 10.0 g of Al and excess Fe₂O₃, how many kilojoules of heat are evolved at constant pressure?

9. \[\text{Al}_2\text{O}_3(s) + \text{heat} \rightarrow 2\text{Al}(s) + \frac{1}{2}\text{O}_2(g)\]

   This reaction is (endothermic/exothermic).

   a) In the above reaction, the enthalpy (increases/decreases).

   b) Which is greater: \(\Delta H_{\text{reactants}}\) \(\Delta H_{\text{products}}\) (Circle one)

   c) In the above reaction, \(\Delta H\) is (positive/negative).

   Sketch the potential energy diagram:

10. \[\text{Sn}(s) + \text{Cl}_2(g) \rightarrow \text{SnCl}_2(s) + \text{heat}\]

   This reaction is (endothermic/exothermic).

   a) In the above reaction, the enthalpy (increases/decreases).

   b) Which is greater: \(\Delta H_{\text{reactants}}\) \(\Delta H_{\text{products}}\) (Circle one)

   c) In the above reaction, \(\Delta H\) is (positive/negative).

   Sketch the potential energy diagram: