REPRESENTING ENTHALPY CHANGE

- Enthalpy change is equal to heat released or absorbed by a reaction (at constant pressure).
- The symbol for enthalpy change is ΔH.
- Enthalpy change can be represented in various ways.

Example

The combustion of liquid methanol releases 638 kJ of heat for every mole of methanol consumed.

We can represent this enthalpy change in four ways.

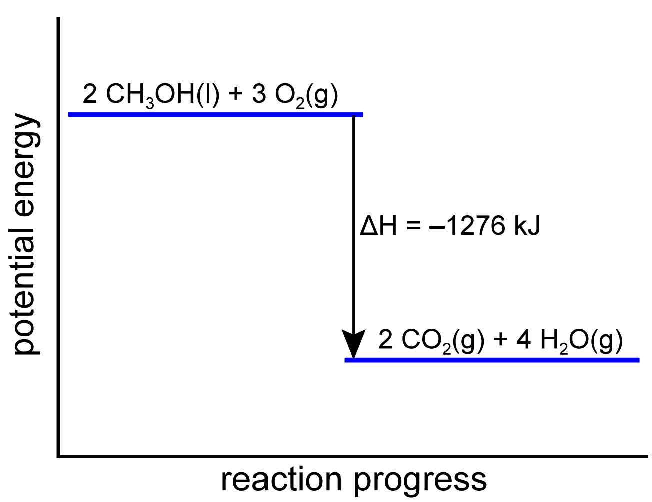
1. **Energy Term in the Chemical Equation**

$$2\ CH_3OH(l) + 3\ O_2(g) \rightarrow 2\ CO_2(g) + 4\ H_2O(g) + 1276\ kJ$$

- The energy term is on the products side because the heat is released. This is an exothermic reaction. For an endothermic reaction, the energy term would be on the reactants side.
- The energy term is 1276 kJ because the balanced chemical equation involves 2 moles of methanol (**2** CH_3OH).

$$2\ mol \times 638\ kJ/mol = 1276\ kJ$$

2. **Potential Energy Diagram**



- As the reaction progresses from reactants to products, there is a decrease in potential energy.
- The products have 1276 kJ less potential energy than the reactants.
- The energy is released as heat
- The enthalpy change, ΔH, is negative because the reaction **loses** heat (exothermic reaction).
- For an endothermic reaction, the products are higher than the reactants, and the enthalpy change is positive.

3. **Enthalpy Change with the Chemical Equation**

$$2\ CH_3OH(l) + 3\ O_2(g) \rightarrow 2\ CO_2(g) + 4\ H_2O(g) \qquad \Delta H = -1276\ kJ$$

- The enthalpy change is written to the right of the chemical reaction.
- A negative enthalpy change means that heat is released (exothermic).
- A positive enthalpy change means that heat is absorbed (endothermic).

4. **Molar Enthalpy Change**

- Molar enthalpy change is the enthalpy change per mole of substance.
- The symbol for molar enthalpy change is ΔH_x (a subscript is added).

$$\Delta H_x = \frac{\Delta H}{n}$$

(n is amount in moles)

In the case, $$\Delta H_{comb} = \frac{-1276\ kJ}{2\ mol\ CH_3OH}$$

("comb" means combustion)

(the –1276 kJ is for 2 mol CH_3OH)

$$= -638\ kJ/mol\ CH_3OH$$

- The molar enthalpy change may be written with chemical equation.

$$2\ CH_3OH(l) + 3\ O_2(g) \rightarrow 2\ CO_2(g) + 4\ H_2O(g) \qquad \Delta H_{comb} = -638\ kJ/mol\ CH_3OH$$