

# Chapter 6 Continued

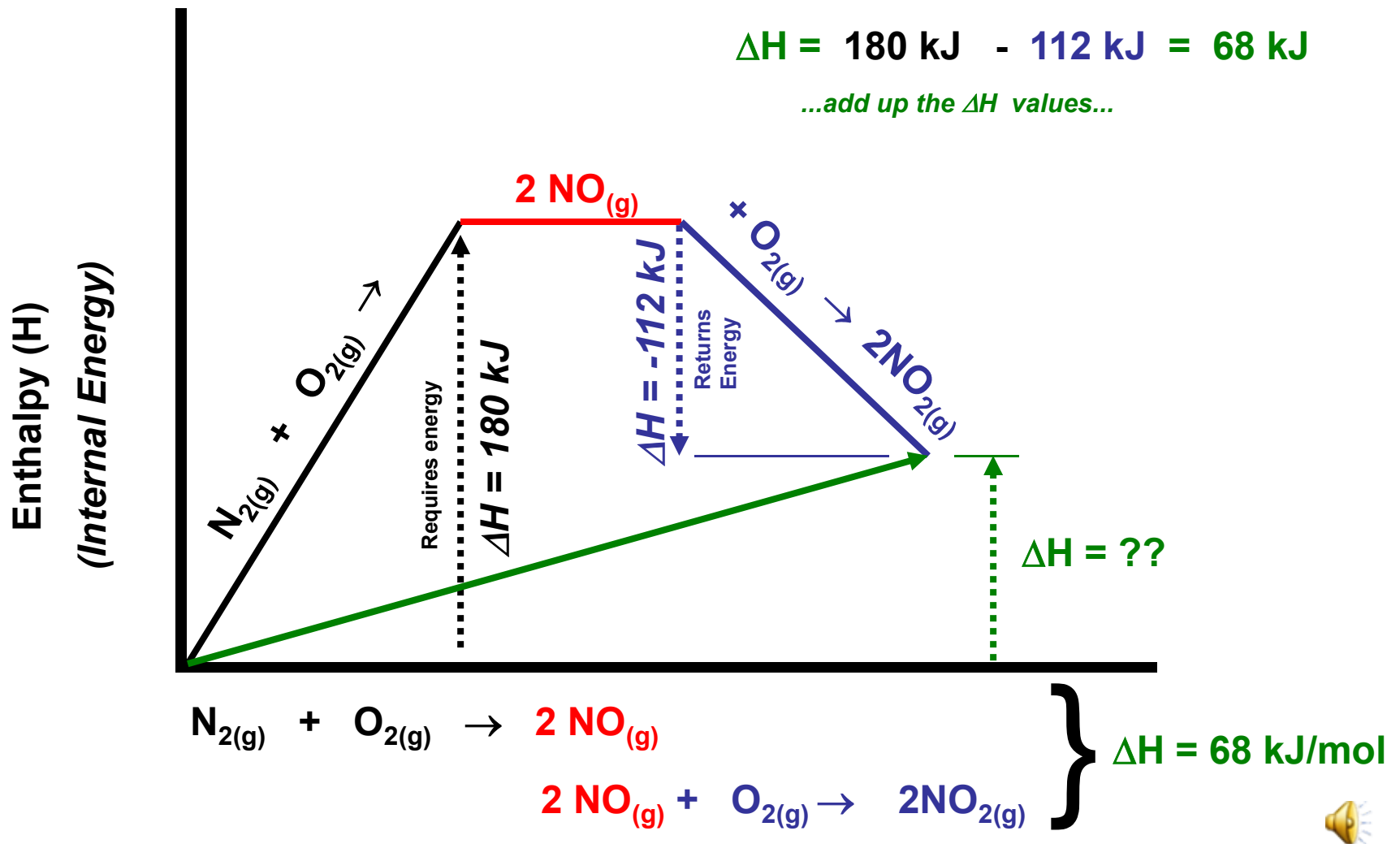
## Hess's Law



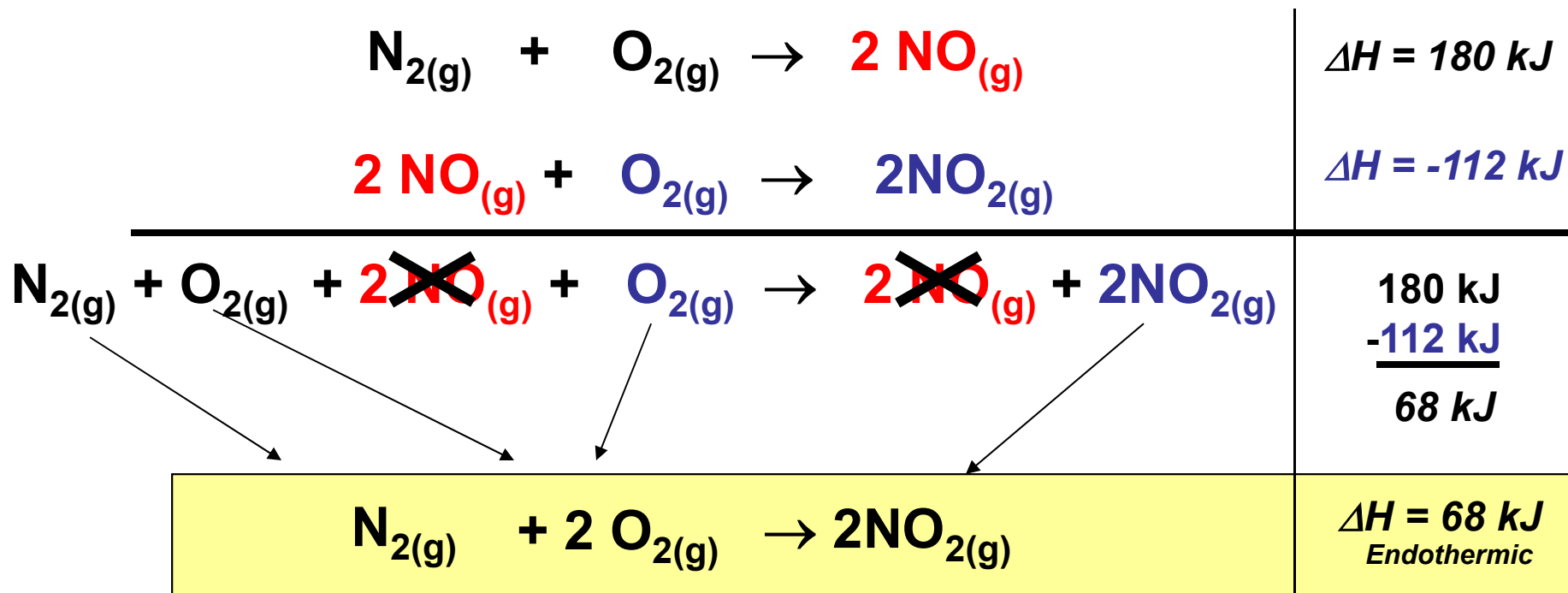
Germain Henri Hess  
(1802 - 1850)



# $\Delta H$ ...a series of reactions.



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Using chemical reactions with known  $\Delta H$  values...

we can construct new chemical reactions and ...

determine their respective enthalpy changes ( $\Delta H$ 's).



# Hess's Law of Heat Summation:

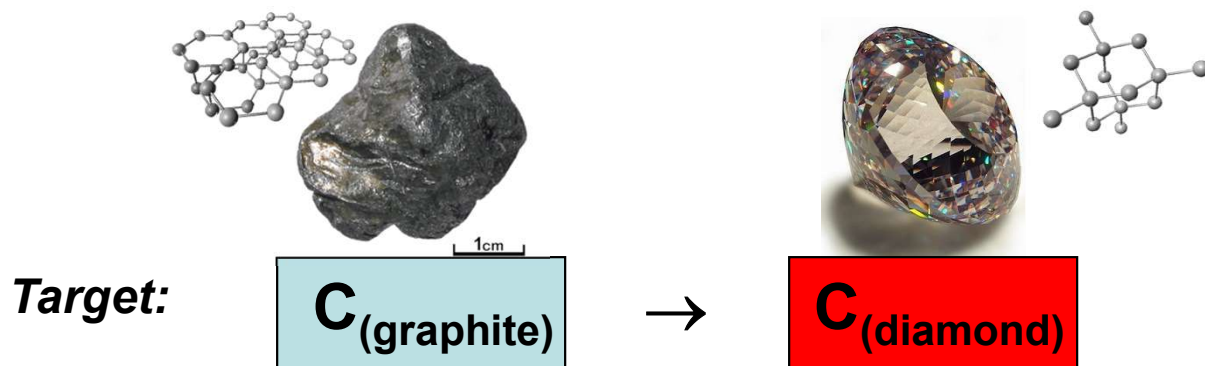
*If the reaction is carried out in a sequence of steps, the  $\Delta H$  of the reaction equals the sum of the  $\Delta H$  values of each of the steps.*

$$\Delta H_{\text{rxn}} = \sum \Delta H_{\text{step}} = \Delta H_{\text{step 1}} + \Delta H_{\text{step 2}} + \Delta H_{\text{step 3}} + \dots$$

*$\Delta H$  is a state function that only depends on the initial and final states of the reaction and not on the exact pathway that transforms reactants into products.*



# Example

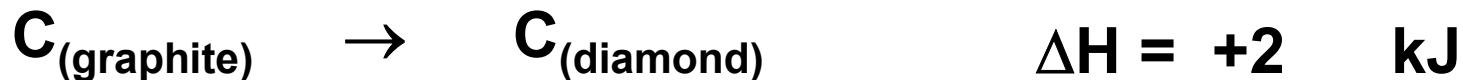
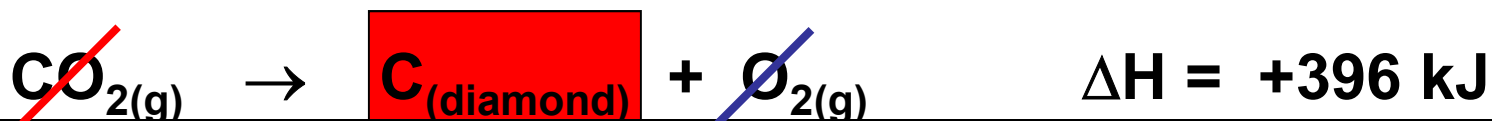


Reaction doesn't  
require much  
energy to occur....

...but goes too  
slowly to be  
practical!

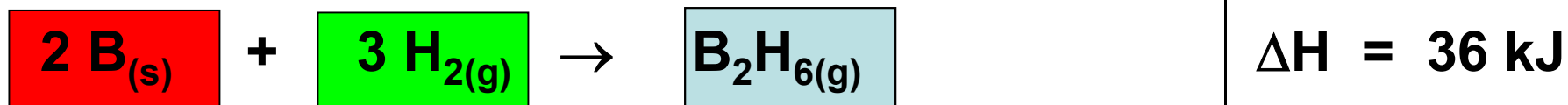
**Reactions:**

No Change

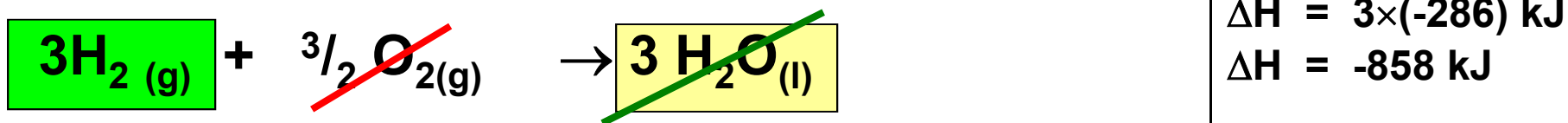
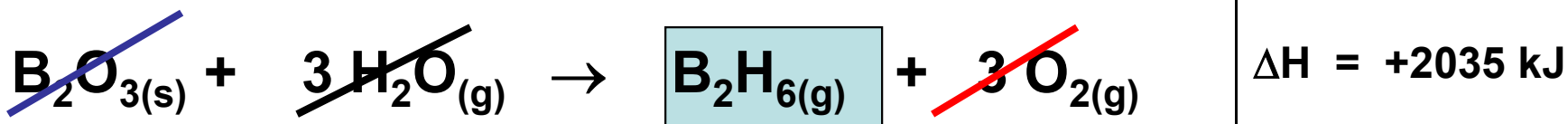
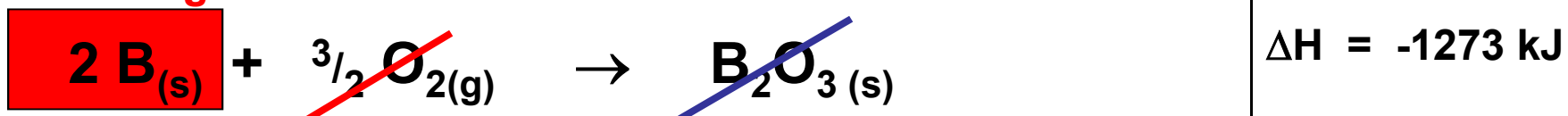


# Example

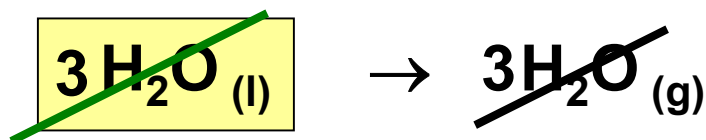
Target Reaction:



No change



$$\Delta H = -858 \text{ kJ}$$



$$\Delta H = 44 \text{ kJ}$$

$$\Delta H = 132 \text{ kJ}$$

$$\Delta H = 36 \text{ kJ}$$

