Hess' Law

The change in enthalpy that occurs when a set of reactants changes to a set of products is the same whether the reaction takes place in one step or in a series of steps.

If a certain reaction is inconvenient to carry out, there may be a set of easier reactions whose sum is the reaction in question.

Add enthalpy changes of the series of reactions to find the heat of reaction for the original reaction.

Ex: Calculate the heat of reaction for the following:

$CH_{4(g)} + O_{2(g)} \rightarrow C_{(di)} + 2\ H_2O_{(l)}$ $\Delta H =$

$CH_{4(g)} + 2\ O_{2(g)} \rightarrow CO_{2(g)} + 2\ H_2O_{(l)}$ $\Delta H = -890$ kJ/mol

$C_{(di)} + O_{2(g)} \rightarrow CO_{2(g)}$ $\Delta H = -395$ kJ/mol

$CH_{4(g)} + 2\ O_{2(g)} \rightarrow CO_{2(g)} + 2\ H_2O_{(l)}$ $\Delta H = -890$ kJ/mol

$CO_{2(g)} \rightarrow C_{(di)} + O_{2(g)}$ $\Delta H = +395$ kJ/mol

$CH_{4(g)} + O_{2(g)} \rightarrow C_{(di)} + 2\ H_2O_{(l)}$ $\Delta H = -495$ kJ/mol