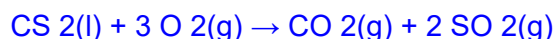


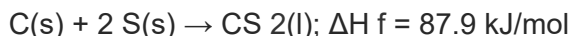
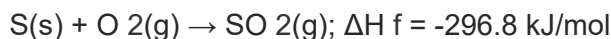
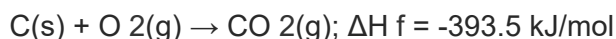
## Hess's Law

Hess's law states that the energy change in an overall chemical reaction is equal to the sum of the energy changes in the individual reactions comprising it. In other words, the enthalpy change of a chemical reaction (the heat of reaction at constant pressure) does not depend on the pathway between the initial and final states.

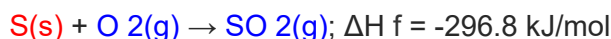
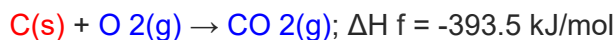
This information is extremely useful, as oftentimes a given balanced reaction may not occur spontaneously; instead Hess's law can be used to apply similar reactions that contain the same products and reactants in such a manner that the enthalpy change of the initial reaction can be deduced.



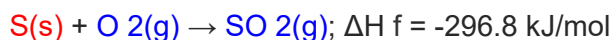
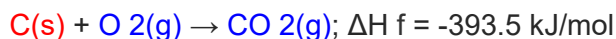
In the equation above, the enthalpy change is unknown. However, three reactions of known enthalpy change can be applied:



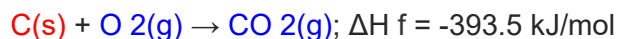
The goal is to determine how each reaction can be tweaked so that when summed together, they form a reaction identical to the initial. First, identify which species must be **kept**, and which need to be **removed**. If the species is not found in the initial equation, it must go.



The goal is to make sure that the red species are removed, which can only occur if it is found on both sides of the arrow. Simultaneously, the blue species must be found on the correct side of the arrow as the initial equation. Both tasks can be accomplished at once by switching equation 3. The  $\Delta H_f$  can be treated as a metaphorical species in this equation, so to "flip" it, the sign must be changed from + to -



Finally, you may notice that the mols of some of the reactants are not equal to the original problem. If the equations were summed now, for instance, one **S(s)** would be left over and both the  $O_2$  and  $SO_2$  species would be fewer in number. To remedy this, equation two can be multiplied by 2 in order for the molar ratios to remain constant. Remember, this also applies to the enthalpy value.



Now, it is a matter of summing all into one singular equation, then cancelling out species that are found on both sides

