

## AP Worksheet 6c (Hess's Law)

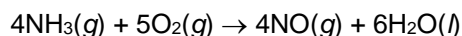
1. Calculate the enthalpy change in the reaction below given the data below (in  $\text{kJ mol}^{-1}$ ).

$$\Delta H^\circ_f \text{NH}_3(g) = -45.5$$

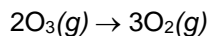
$$\Delta H^\circ_f \text{NO}(g) = +91.0$$

$$\Delta H^\circ_f \text{H}_2\text{O}(l) = -286$$

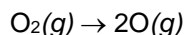
$$\Delta H^\circ_f \text{O}_2 = 0.00$$



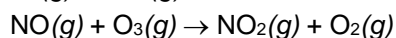
2. Given the following thermochemical equations:



$$\Delta H^\circ = -427 \text{ kJ}$$

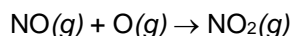


$$\Delta H^\circ = 495 \text{ kJ}$$

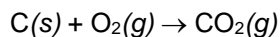


$$\Delta H^\circ = -199 \text{ kJ}$$

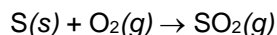
Calculate  $\Delta H^\circ$  for:



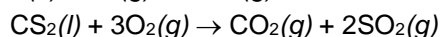
3. Use Hess's Law to calculate the standard enthalpy of formation of one mole of liquid carbon disulfide ( $\text{CS}_2$ ) from its elements, given that



$$\Delta H^\circ_f = -393.5 \text{ kJ}$$



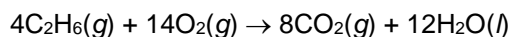
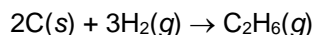
$$\Delta H^\circ_f = -296.1 \text{ kJ}$$



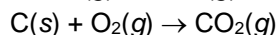
$$\Delta H^\circ_c = -1072.0 \text{ kJ}$$

4. Consider the formation of ethane,  $\text{C}_2\text{H}_6$ .

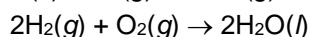
- a. Given the following data, calculate  $\Delta H^\circ$  for the reaction:



$$\Delta H = -6240 \text{ kJ}$$



$$\Delta H = -394 \text{ kJ}$$



$$\Delta H = -572 \text{ kJ}$$

- b. Consider the enthalpy change calculated in (a). Does this represent the standard enthalpy of formation of ethane? Explain your answer.
5. Calculate the standard enthalpy of formation of benzene ( $\text{C}_6\text{H}_6$ ), given the following standard enthalpies of combustion (in  $\text{kJ mol}^{-1}$ ):

$$\text{C}_6\text{H}_6(l) = -3273; \text{C}(s) = -393.5; \text{H}_2(g) = -285.5$$

6. Calculate the standard enthalpy of formation of cyclohexanol ( $\text{C}_6\text{H}_{11}\text{OH}$ ), given the following standard enthalpies of combustion (in  $\text{kJ mol}^{-1}$ ):

$$\text{C}_6\text{H}_{11}\text{OH}(l) = -3727; \text{C}(s) = -393.5; \text{H}_2(g) = -285.5$$

7. The standard enthalpy of formation of buta-1,3-diene ( $C_4H_6$ ) =  $112.0 \text{ kJ mol}^{-1}$ . Calculate the standard enthalpy of combustion of this compound, given the data below.



8. Calculate the standard enthalpy of formation of butane ( $C_4H_{10}$ ) from the data below.

