

Heat of Formation Review Problems

1. Given the equation $3 \text{O}_2(\text{g}) \rightarrow 2 \text{O}_3(\text{g}) \quad \Delta H = +285.4 \text{ kJ}$, calculate for the reaction $\text{O}_3(\text{g}) \rightarrow 3/2 \text{O}_2(\text{g})$.

$$\Delta H = -285.4 \div 2 = \boxed{-142.7 \text{ kJ}}$$

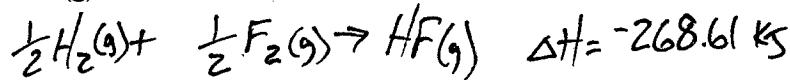
2. What is the enthalpy change when 12.8 grams of $\text{H}_2(\text{g})$ react with excess $\text{Cl}_2(\text{g})$ to form $\text{HCl}(\text{g})$?



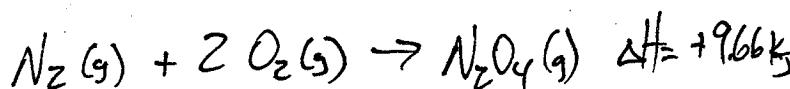
$$\frac{12.8 \text{ g H}_2}{1} \times \frac{1 \text{ mol H}_2}{2.016 \text{ g}} \times \frac{-184.6 \text{ kJ}}{1 \text{ mol H}_2} = \boxed{-1170 \text{ kJ}}$$

3. Write the heat of formation reaction for each of the following compounds. Include the heat of formation value as shown in the example, $\text{C}(\text{s}) + \frac{1}{2} \text{O}_2(\text{g}) \rightarrow \text{CO}(\text{g}) \quad \Delta H = -110.5 \text{ kJ}$

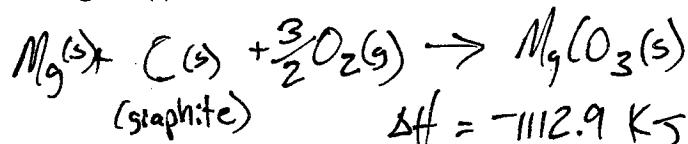
- a. $\text{HF}(\text{g})$



- b. $\text{N}_2\text{O}_4(\text{g})$

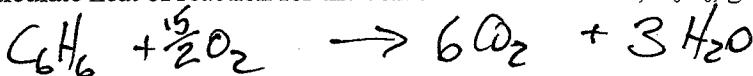


- c. $\text{MgCO}_3(\text{s})$



Standard Enthalpies of Formation of Some Inorganic Substances at 25°C			
SUBSTANCE	ΔH_f° (kJ/mol)	SUBSTANCE	ΔH_f° (kJ/mol)
$\text{Ag}(\text{s})$	0	$\text{H}_2\text{O}_2(\text{l})$	-187.6
$\text{AgCl}(\text{s})$	-127.04	$\text{Hg}(\text{l})$	0
$\text{Al}(\text{s})$	0	$\text{I}_2(\text{s})$	0
$\text{Al}_2\text{O}_3(\text{s})$	-1669.8	$\text{Hf}(\text{g})$	25.94
$\text{Br}_2(\text{l})$	0	$\text{Mg}(\text{s})$	0
$\text{HBr}(\text{g})$	-36.2	$\text{MgO}(\text{s})$	-601.8
$\text{C}(\text{graphite})$	0	$\text{MgCO}_3(\text{s})$	-1112.9
$\text{C}(\text{diamond})$	1.90	$\text{N}_2(\text{g})$	0
$\text{CO}(\text{g})$	-110.5	$\text{NH}_3(\text{g})$	-46.3
$\text{CO}_2(\text{g})$	-393.5	$\text{NO}(\text{g})$	90.4
$\text{Ca}(\text{s})$	0	$\text{NO}_2(\text{g})$	33.85
$\text{CaO}(\text{s})$	-635.6	$\text{N}_2\text{O}_4(\text{g})$	9.66
$\text{CaCO}_3(\text{s})$	-1206.9	$\text{N}_2\text{O}(\text{g})$	81.56
$\text{Cl}_2(\text{g})$	0	$\text{O}(\text{g})$	249.4
$\text{HCl}(\text{g})$	-92.3	$\text{O}_2(\text{g})$	0
$\text{Cu}(\text{s})$	0	$\text{O}_3(\text{g})$	142.2
$\text{CuO}(\text{s})$	-155.2	$\text{S}(\text{rhombic})$	0
$\text{F}_2(\text{g})$	0	$\text{S}(\text{monoclinic})$	0.30
$\text{HF}(\text{g})$	-268.61	$\text{SO}_2(\text{g})$	-296.1
$\text{H}_2(\text{g})$	218.2	$\text{SO}_3(\text{g})$	-395.2
$\text{H}_2(\text{g})$	0	$\text{H}_2\text{S}(\text{g})$	-20.15
$\text{H}_2\text{O}(\text{g})$	-241.8	$\text{ZnO}(\text{s})$	-347.98
$\text{H}_2\text{O}(\text{l})$	-285.8		

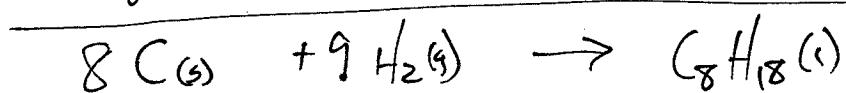
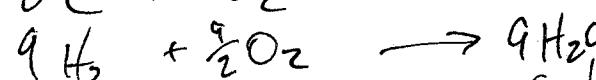
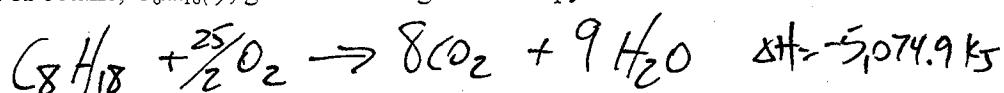
4. Calculate heat of reaction for the combustion of benzene, C_6H_6 , given the ΔH_f of $\text{C}_6\text{H}_6(\text{l})$ is +49.0 kJ.



$$\Delta H_{rxn} = [6(-393.5 \text{ kJ}) + 3(-285.8 \text{ kJ})] - [49.0 \text{ kJ} + 0] = \boxed{-3,270 \text{ kJ}}$$

$\sum \Delta H_f \text{ Products} - \sum \Delta H_f \text{ Reactants}$

5. Calculate the heat of formation of octane, $\text{C}_8\text{H}_{18}(\text{l})$, given the change in enthalpy for the combustion reaction is -5,074.9 kJ/mol.



$8(-393.5)$

$9(-285.8)$

$+5,074.9$