



Free elements have zero enthalpy and zero free energy. Table A-6 in the appendix of your textbook has the thermodynamic values for these state functions.

$$\Delta H_{(rxn)}^{\circ} = \sum n \Delta H_f^{\circ}(\text{products}) - \sum m \Delta H_f^{\circ}(\text{reactants})$$

$$\Delta G_{(rxn)}^{\circ} = \sum n \Delta G_f^{\circ}(\text{products}) - \sum m \Delta G_f^{\circ}(\text{reactants})$$

$$\Delta S_{(rxn)}^{\circ} = \sum n S^{\circ}(\text{products}) - \sum m S^{\circ}(\text{reactants})$$

2. What is the enthalpy change for the following reaction?  $\text{Cl}_2(\text{g}) + 2 \text{HBr}(\text{g}) \rightarrow 2 \text{HCl}(\text{g}) + \text{Br}_2(\text{l})$
3. For the reaction  $\text{Ca}(\text{cr}) + 2 \text{H}_2\text{O}(\text{l}) \rightarrow \text{Ca}(\text{OH})_2(\text{cr}) + \text{H}_2(\text{g})$ ,  $\Delta S_{rxn}^{\circ} = 25.7 \text{ J/K}$ . What is  $S^{\circ}$  for  $\text{Ca}(\text{OH})_2(\text{cr})$ ?
4. Calculate  $\Delta G_{(rxn)}^{\circ}$  for the reaction:  $2 \text{H}_2\text{O}_2(\text{l}) \rightarrow 2 \text{H}_2\text{O}(\text{l}) + \text{O}_2(\text{g})$
5. Find  $\Delta H_{(rxn)}^{\circ}$  for the reaction:  $2 \text{NaBr}(\text{cr}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{Na}_2\text{SO}_4(\text{cr}) + 2 \text{HBr}(\text{g})$
6. Find  $\Delta S_{(rxn)}^{\circ}$  for the reaction:  $\text{SO}_2(\text{g}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{H}_2\text{SO}_3(\text{aq})$

Answers to selected problems

2.  $-111.8 \text{ kJ}$

3.  $75.9 \text{ J/mol K}$

4.  $-234 \text{ kJ}$