1. Consider the reaction:

$$2\,NO(g) + O_2(g) \longrightarrow 2\,NO_2(g)$$

Estimate $\Delta G^\circ$ at each temperature and predict whether or not the reaction is spontaneous. (Assume that $\Delta H^\circ$ and $\Delta S^\circ$ do not change too much within the given temperature range.)

| Species | $\Delta H_f^\circ\ (kJ/mol)$ | $\Delta S_f^\circ\ (J/mol)$ |
|---|---|---|
| NO(g) | 91.3 | 210.8 |
| $O_2$(g) | 0 | 205.2 |
| $NO_2$(g) | 33.2 | 240.1 |

(a) 298 K

(b) 715 K

(c) 855 K

2. Calculate $\Delta G$ for the following reaction at 25°C under the following conditions:

$$2\,H_2S(g) + SO_2(g) \longrightarrow 3\,S(s, \text{rhombic}) + 2\,H_2O(g) \qquad \Delta G^\circ_{rxn} = -102\ kJ/mol$$

$P_{H_2S} = 2.00\ atm$, $P_{SO2} = 1.50\ atm$, $P_{H_2O} = 0.0100\ atm$

3. Calculate the equilibrium constant for the following reaction at 298 K.

$$N_2O_4(g) \rightleftharpoons 2\,NO_2(g) \qquad \Delta G^\circ_{rxn} = 2.8kJ/mol$$

4. Balance the following reaction in acidic solution.

$$Zn(s) + Sn^{2+}(aq) \longrightarrow Zn^{2+}(aq) + Sn(s)$$

5. Balance the following reaction in basic solution.

$$H_2O_2(aq) + ClO_2(aq) \longrightarrow ClO_2^-(aq) + O_2(g)$$