

● Thermodynamics

A gas sample is heated in a cylinder, using 586 kJ of heat. A piston compresses the gas, using 611 kJ of work. What is the change in internal energy of the gas during this process?

Determine the Standard entropy of reaction:

$2 \text{CO(g)} + \text{O}_2\text{(g)} \rightarrow 2\text{CO}_2\text{(g)}$. Absolute entropies are as follows: carbon monoxide gas, 197.5 J/molK; oxygen gas, 205.0 J/molK; carbon dioxide gas, 213.7 J/molK.

Predict whether entropy should increase or decrease for the following:

Cooling of water from 50°C to 4°C.

Sublimation of dry ice, $\text{CO}_2\text{(s)} \rightarrow \text{CO}_2\text{(g)}$.

Oxidation of nitrogen, $\text{N}_2\text{(g)} + 2\text{O}_2\text{(g)} \rightarrow 2\text{NO}_2\text{(g)}$.

The standard enthalpy of formation of liquid acetone, CH_3COCH_3 (solvent used in nail polish remover), at 25°C is -247.6 kJ/mol. The standard enthalpy of formation of gaseous acetone at 25°C is -216.6 kJ/mol. What is the entropy change when 1.00 mol liquid acetone vaporizes at 25°C?

Determine the standard free energy change for the following reaction:

$4\text{HCN(l)} + 5\text{O}_2\text{(g)} \rightarrow 2\text{H}_2\text{O(g)} + 4\text{CO}_2\text{(g)} + 2\text{N}_2\text{(g)}$. The ΔG_f° values (in kJ/mol) are as follows: $\text{HCN(l)} = 121$; $\text{H}_2\text{O(g)} = -228.6$; $\text{CO}_2\text{(g)} = -394.4$.

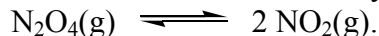
Consider the following:

$\text{Ba(OH)}_2 \cdot 8\text{H}_2\text{O(s)} + 2\text{NH}_4\text{NO}_3\text{(s)} \rightarrow 2\text{NH}_3\text{(g)} + 10\text{H}_2\text{O(l)} + \text{Ba(NO}_3)_2\text{(aq)}$

Predict the sign of the standard entropy change.

The standard enthalpy change at 25°C is 170.4 kJ; the standard entropy change at 25°C is 657 J/K. What is the standard free energy change at 25°C? Interpret the values of these thermodynamic quantities.

Determine the value of the thermodynamic equilibrium constant at 25°C for the reaction



The standard free energy of formation values (in kJ/mol) at 25°C are $\text{N}_2\text{O}_4\text{(g)}$, 97.82; $\text{NO}_2\text{(g)}$, 51.30.

The equilibrium constant (K_p) for the reaction

$\text{H}_2\text{(g)} + \text{CO}_2\text{(g)} \rightleftharpoons \text{H}_2\text{O(g)} + \text{CO(g)}$ is 4.40 at 2000K. Calculate ΔG° for the reaction. Calculate ΔG for the reaction when the partial pressures are $P_{\text{H}_2} = 0.25$ atm, $P_{\text{CO}_2} = 0.78$, $P_{\text{H}_2\text{O}} = 0.66$ atm, and $P_{\text{CO}} = 1.20$ atm.

Calculate the standard free energy change for the following process at 75°C and at 110°C.

