

Gibb's Free Energy Worksheet

Honors Chemistry

Calculate Gibb's Free Energy (in kJ) and tell whether the reaction is spontaneous or nonspontaneous: Show all work!

1. Calculate the ΔG for a reaction at 25°C with a heat loss of 93,000 joules and an entropy decrease of 198 J/K.

$$\begin{aligned}\Delta G &= -93,000 \text{ J} - (298 \text{ K} \times -198 \frac{\text{J}}{\text{K}}) \\ &= -93,000 \text{ J} - (-59,004 \text{ J}) \\ &= \frac{-33,996 \text{ J}}{1000 \text{ J}} \quad | \quad \frac{1 \text{ kJ}}{1000 \text{ J}}\end{aligned}$$

$$\Delta G: -34.0 \text{ kJ}$$

Spontaneous

2. Calculate the ΔG for a reaction at -24°C with a heat gain of 350,000 joules and an entropy increase of 698 J/K.

$$\begin{aligned}\Delta G &= +350,000 \text{ J} - (249 \text{ K} \times 698 \frac{\text{J}}{\text{K}}) \\ &= +350,000 \text{ J} - (173,802 \text{ J}) \\ &= \frac{+176,198 \text{ J}}{1000 \text{ J}} \quad | \quad \frac{1 \text{ kJ}}{1000 \text{ J}}\end{aligned}$$

$$\Delta G: +176.2 \text{ kJ}$$

NONSPONTANEOUS

3. Calculate the ΔG for a reaction at 23°C with a heat gain of 28,050 joules and an entropy increase of 108.7 J/K.

$$\begin{aligned}\Delta G &= +28,050 \text{ J} - (296 \text{ K} \times 108.7 \frac{\text{J}}{\text{K}}) \\ &= +28,050 \text{ J} - 32,175.2 \\ &= \frac{-4125.2 \text{ J}}{1000 \text{ J}} \quad | \quad \frac{1 \text{ kJ}}{1000 \text{ J}}\end{aligned}$$

$$\Delta G: -4.1 \text{ kJ}$$

Spontaneous

4. For a process, the enthalpy change of the system is -154.0 kJ and its entropy change is 190 J/K. Calculate the (ΔG) free energy change of the system at 305 K.

$$\begin{aligned}\Delta G &= -154.0 \text{ kJ} - (305 \text{ K} \times 190 \frac{\text{J}}{\text{K}}) \\ &= -154.0 \text{ kJ} - 57.95 \text{ kJ} \\ &= -211.95 \text{ kJ}\end{aligned}$$

$$\Delta G: -211.95 \text{ kJ}$$

Spontaneous

5. For a process, the enthalpy change of a system is 2055.0 kJ and the entropy change is 2,870.0 J/K. Calculate the (ΔG) free energy change of the system at 284 K.

$$\begin{aligned}\Delta G &= +2055 \text{ kJ} - (284 \text{ K} \times 2870 \frac{\text{J}}{\text{K}}) \\ &= +2055 \text{ kJ} - 815.1 \text{ kJ} \\ &= +1239.9 \text{ kJ}\end{aligned}$$

$$\Delta G: +1239.9$$

NONSPONTANEOUS