**Quiz 7**

# Directions: Answer each of the following questions. Be sure to use complete sentences where appropriate. For full credit be sure to show all of your work. Where appropriate answers should be boxed for clarity, written to the correct number of significant figures, and, include the proper units.

1. Without doing any calculations, determine the signs of ΔSsys and ΔSsurr for each of chemical reaction. In addition, predict under what temperatures (all temperatures, low temperature, or high temperatures, if any, the reaction is spontaneous (4 points).
   1. 2 N2 (g) + O2 (g) → 2 N2O (g) ΔH°rxn = +163.2 kJ
   2. 4 NH3 (g) + 5 O2 (g) → 4 NO (g) + 6 H2O (g) ΔH°rxn = -906 kJ
2. For each pair of substances, choose the one that you expect to have the higher standard molar entropy (S°) at 25 °C. Explain your choices (6 points).
   1. Ar (g) or CO2 (g)

* 1. CH3OH (l) or CH3OH (g)
  2. NaBr (s) or NaBr (aq)

|  |  |
| --- | --- |
| Substance | ∆G° f (kJ/mol) |
| I2 (s) | 0 |
| IO3- (aq) | -128.0 |
| I- (aq) | -51.57 |
| H2O (l) | -237.1 |
| OH- (aq) | -157.3 |

1. Consider the balanced equation (10 points):
2. OH- (aq) + 3 I2 (s) 🡪 IO3- (aq) + 3 H2O (l) + 5 I- (aq)
   1. Calculate ∆G° for the reaction at 25 °C.
   2. Is the reaction spontaneous or nonspontaneous under standard-state conditions?

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# Directions: Answer each of the following questions. Be sure to use complete sentences where appropriate. For full credit be sure to show all of your work. Where appropriate answers should be boxed for clarity, written to the correct number of significant figures, and, include the proper units.

1. Without doing any calculations, determine the signs of ΔSsys and ΔSsurr for each of chemical reaction. In addition, predict under what temperatures (all temperatures, low temperature, or high temperatures, if any, the reaction is spontaneous (4 points).
   1. 2 N2 (g) + O2 (g) → 2 N2O (g) ΔH°rxn = +163.2 kJ

ΔSsys < 0, and ΔSsurr > 0, nonspontaneous at all temperatures

* 1. 4 NH3 (g) + 5 O2 (g) → 4 NO (g) + 6 H2O (g) ΔH°rxn = -906 kJ

ΔSsys > 0, and ΔSsurr > 0, spontaneous at all temperatures

1. For each pair of substances, choose the one that you expect to have the higher standard molar entropy (S°) at 25 °C. Explain your choices (6 points).
   1. Ar (g) or CO2 (g) \_\_\_\_CO2 (g), greater molar mass and complexity
   2. CH3OH (l) or CH3OH (g) \_\_\_\_ CH3OH (g), gas phase
   3. NaBr (s) or NaBr (aq) \_\_\_\_ NaBr (aq), aqueous
2. Consider the balanced equation (10 points):
3. OH- (aq) + 3 I2 (s) 🡪 IO3- (aq) + 3 H2O (l) + 5 I- (aq)
   1. Calculate ∆G° for the reaction at 25 °C.

|  |  |
| --- | --- |
| Substance | ∆G° f (kJ/mol) |
| I2 (s) | 0 |
| IO3- (aq) | -128.0 |
| I- (aq) | -51.57 |
| H2O (l) | -237.1 |
| OH- (aq) | -157.3 |

ΔG°f = Σ n­products ΔG°f products - Σ nreactants ΔG°f reactants

ΔG°f = [(1 mol)(ΔG° IO3- (aq)) + (3 mol)(ΔG° H2O (l)) + (5 mol)(ΔG° I- (aq))] – [(6 mol)(ΔG° OH- (aq) + (3 mol)(ΔG° I2 (s))]

ΔG°f = [(1 mol)(-128.0 kJ/mol) + (3 mol)(-237.1 kJ/mol) + (5 mol)(-51.57 kJ/mol)] – [(6 mol)(-157.3 kJ/mol) + (3 mol)(0 kJ/mol)]

ΔG°f = -128.0 kJ + -711.3 kJ + -257.85 kJ – (-943.8 kJ)

ΔG°f = -153.4 kJ

* 1. Is the reaction spontaneous or nonspontaneous under standard-state conditions? Spontaneous