**Dougherty Valley HS AP Chemistry**

**Review**

**Thermodynamics Review**

**Name: Date: Period: Seat #:**

STATION 1: ENTROPY CHANGE

For each of the following examples, decide whether the entropy is increasing or decreasing. Is ΔS + or ?

ΔS is \_\_\_\_\_ The electrolytic decomposition of water. 2H2O(*l*) → 2 H2(g) + O2(g)

ΔS is \_\_\_\_\_ The freezing of water. H2O(*l*) → H2O(s)

ΔS is \_\_\_\_\_ The reaction of sodium metal with water. 2Na(s) + 2H2O(*l*) → H2(g) + 2Na+(aq) + 2 OH-(aq)

ΔS is \_\_\_\_\_ The boiling of water. H2O(*l*) → H2O(g)

ΔS is \_\_\_\_\_ The reaction of OF2 and water. OF2(g) + H2O(g) → O2(g) + 2HF(g)

Entropy and Free Energy

STATION 2: ΔH, ΔS, ΔG, GIBB’S FREE ENERGY

C2H2*(g)* + 2 H2*(g)*  C2H6*(g)*

|  |  |  |
| --- | --- | --- |
| Substance | *S* (J/mol⋅K) | *H**f* (kJ/mol) |
| C2H2*(g)* | 200.9 | 226.7 |
| H2*(g)* | 130.7 | 0 |
| C2H6*(g)* | 229.6 | -84.7 |

Calculate ΔS, ΔH, and ΔG for this reaction at 298 K.

Entropy and Free Energy

STATION 3: EQUILIBRIUM

Consider the boiling of liquid bromine: Br2*(l)* ⮀ Br2*(g)*

At 25°C, *H* = 30.84kJ/mol and ΔS° = 92.9 J/mol·K for this reaction.

Calculate the value of ΔG°.

Assuming that ΔH and ΔS do not change at different temperatures, calculate the normal boiling point of liquid bromine.

Entropy and Free Energy

STATION 4: PREDICTING SPONTANEITY

Consider the reaction: MgO(s) + SO2(g) → MgSO3(s)

What is the sign of ΔH for this reaction? \_\_\_\_\_\_ Justify your answer.

What is the sign of ΔS for this reaction? \_\_\_\_\_ Justify your answer.

This reaction will be:

a) spontaneous at all temperatures

b) spontaneous at high temperatures

c) spontaneous at low temperatures

d) non-spontaneous at all temperatures

Entropy and Free Energy

STATION 5: Keq & ΔG

Consider the reaction: C2H5Cl*(g)* + Cl2*(g)*  C2H4Cl2*(g)* + HCl*(g)*

**Standard Free Energies of Formation at 298 K**

|  |  |
| --- | --- |
| **Substance** | ***G**f* kJ·mol-1** |
| C2H4Cl2*(g)* | -80.3 |
| C2H5Cl*(g)* | -60.5 |
| HCl*(g)* | -95.3 |
| Cl2*(g)* | 0 |

Calculate the value of ΔG° for this reaction.

Calculate the value of Keq for the reaction at 298 K. [ΔG° = -RT *ln*K; R = 8.31 J·mol-1·K-1]

From the AP Exam:

