Dougherty Valley HS Chemistry - AP
Thermodynamics – Spontaneity

Worksheet #1

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

1) For each system below, indicate whether ΔS and ΔH is a positive or negative value. Then indicate if the reaction is entropy driven, enthalpy driven, both or neither. Qualitative, you do not need to do calculations for this part.

a) $NaCl_{(s)} + H_2O_{(l)} + heat \rightarrow NaCl_{(aq)}$	**b)** $O_{2\,(g)} + H_2O_{(l)} \rightarrow O_{2\,(aq)} + heat$	**c)** $CO_{2\,(s)} + heat \rightarrow CO_{2\,(g)}$
ΔS =	ΔS =	ΔS =
ΔH =	ΔH =	ΔH =
Driven?	Driven?	Driven?

2) Calculate $\Delta H°_{rxn}$, $\Delta S°_{rxn}$, $\Delta G°_{rxn}$, Then, indicate whether ΔH°, ΔS°, ΔG° are positive or negative values. Then indicate if the reaction is spontaneous or not. Then indicate if the reaction is entropy driven, enthalpy driven, both, or neither.

$\Delta H° = \Sigma\Delta H_f^\circ\ prod. - \Sigma\Delta H_f^\circ\ react.$	$\Delta S° = \Sigma S^\circ\ prod. - \Sigma S^\circ\ react.$	$\Delta G° = \Sigma\Delta G\ prod. - \Sigma\Delta G^\circ\ react.$

Substance	**$\Delta H^\circ_{formation}$ (kJ/mole)**	**$S^\circ_{formation}$ (J/mole•K)**	**$\Delta G^\circ_{formation}$ (kJ/mole)**
C_3H_8 (*l*)	-103.8	269.9	-23.5
O_2 (g)	0	205.1	0
CO_2 (g)	-393.5	213.7	-394.4
H_2O (g)	-241.8	188.8	-228.6
TiO_2 (s)	-939.7	49.9	-884.5
$TiCl_4$ (*l*)	-804.2	252.3	-737.2
C (s)	0	5.7	0
Cl_2 (g)	0	223.1	0

a) C_3H_8 (*l*) + 5 O_2 (g) → 3CO_2 (g) + 4H_2O (g)

After calculations circle/highlight:

ΔH° + or -

ΔS° + or -

ΔG° + or -

Spontaneous /
"thermodynamically favorable":

Yes No

Driven:

Enthalpy Entropy
Both Neither

b) TiO_2 (s) + C (s) + 2Cl_2 (g) → $TiCl_4$ (*l*) + CO_2 (g)

After calculations circle/highlight:

ΔH° + or -

ΔS° + or -

ΔG° + or -

Spontaneous /
"thermodynamically favorable":

Yes No

Driven:

Enthalpy Entropy
Both Neither