South Pasadena • AP Chemistry

Name KEY
Period ___ Date ___/___/___

20 • Entropy and Free Energy

QUICK CHECK

☐ **Positive or Negative:**

When solid $CaCl_2$ dissolves in water, the solution gets hot. Predict the signs of ΔS, ΔH, and ΔG.

$(s) \rightarrow (aq)$

ΔS	ΔH	ΔG
+	−	−

↑ because it DOES dissolve

☐ **Spontaneity:**

Put a check next to the following situations that would lead to a spontaneous reaction.

☑	ΔS	ΔH	Temperature
	+	+	low temp
✓	+	−	high temp
	−	+	high temp
✓	−	−	low temp

any temp

☐ **Entropy Change:**

Calculate the standard entropy change for the following reaction, $Cu(s) + \frac{1}{2} O_2(g) \rightarrow CuO(s)$, given that

$S°[Cu(s)] = 33.15$ J/K·mol
$S°[O_2(g)] = 205.14$ J/K·mol
$S°[CuO(s)] = 42.63$ J/K·mol

$\Delta S_{rxn} = S_{CuO} - (S_{Cu} + \frac{1}{2} S_{O_2})$

$= 42.63 - (33.15 + \frac{1}{2}(205.14)) = -93.09$ J/K·mol

☐ **Changeover Temperature:**

At what temperature would a given reaction become spontaneous if ΔH = +119 kJ and ΔS = +263 J/K?

$\Delta G = 0$

$\Delta G = \Delta H - T\Delta S$

$0 = \Delta H - T\Delta S$

$\Delta H = T\Delta S$

$T = \frac{\Delta H}{\Delta S}$

$T = \frac{+119 \text{ kJ} \times \frac{1000 \text{ J}}{\text{kJ}}}{263 \text{ J·K}^{-1}} = 452$ K

$= 179$ °C

☐ **Entropy:**

In which one of the following reactions do you expect to have a decrease in entropy?

a) ~~$Fe(s) \rightarrow Fe(l)$~~
b) $Fe(s) + S(s) \rightarrow FeS(s)$ ~
c) $2\ Fe(s) + 3/2\ O_2(g) \rightarrow Fe_2O_3(s)$
d) ~~$HF(l) \rightarrow HF(g)$~~
e) ~~$2\ H_2O_2(l) \rightarrow 2\ H_2O(l) + O_2(g)$~~