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AP Chemistry – Entropy and Free Energy – 33

Name _____Per ___

1. Look up the standard entropies at 25°C for each substance in the following pairs. Explain the difference in the entropy values for each pair.

(a) $CuO_{(s)}$ and $Cu_2O_{(s)}$

(b) 1 mole $N_2O_{4(g)}$ and 2 moles $NO_{2(g)}$

(c) $CH_3OH_{(g)}$ and $CH_3OH_{(l)}$

(d) 1 mole $PbO_{(s)}$ combined with 1 mole $CO_{2(g)}$ and 1 mole $PbCO_{3(s)}$

2. Calculate the $\Delta S°$ values for the following reactions.

(a) $N_2H_{4(g)} + H_{2(g)} \rightarrow 2NH_{3(g)}$

(b) $Al_{(s)} + 3Cl_{2(g)} \rightarrow 2AlCl_{3(s)}$

(c) $Mg(OH)_{2(s)} + 2HCl_{(g)} \rightarrow MgCl_{2(s)} + 2H_2O_{(l)}$

(d) $2CH_{4(g)} \rightarrow C_2H_{6(g)} + H_{2(g)}$

3. What is the meaning of the standard free-energy change, $\Delta G°$, as compared with ΔG?

4. For any process that occurs at constant temperature and pressure, what is the significance of $\Delta G = 0$?

5. For a certain process, ΔG is large and negative. Does this mean that the process necessarily occurs rapidly? Explain.

6. A certain reaction has $\Delta H° = -19.5$ kJ/mole and $\Delta S° = 42.7$ J/moleK.

(a) Is the reaction exothermic or endothermic?

(b) Does the reaction lead to an increase or decrease in the disorder of the system?

(c) Calculate $\Delta G°$ for the reaction at 298 K.

(d) Is the reaction spontaneous at 298 K?

7. Calculate $\Delta H°$, $\Delta S°$ and $\Delta G°$ at 298 K for each of the following reactions. As a fourth calculation in each case, show that $\Delta H° - T\,\Delta S° = \Delta G°$.

(a) $Ni_{(s)} + Cl_{2(g)} \rightarrow NiCl_{2(s)}$

(b) $P_4O_{10(s)} + 6H_2O_{(l)} \rightarrow 4H_3PO_{4(aq)}$

(c) $2CH_3OH_{(l)} + 3O_{2(g)} \rightarrow 2CO_{2(g)} + 4H_2O_{(l)}$