

HW #4 14: 1, 2, 3, 7, 18, 27, 30, 31, 35, 36, 38, 39, 40, 43, 44, 46
 15: 1, 2, 3, 5, 10, 11, 14, 16, 24, 25, 27, 28, 33

14.1 spontaneous processes can happen, able to proceed without any external driving force. It doesn't mean that it will happen in a ~~see~~ human time frame.

14.2 A transformation is spontaneous if it contributes to the increase of entropy in the universe. To make a nonspontaneous process occur, another spontaneous reaction must drive it.

14.3 (a), (d), (e)

14.7 (a) Because entropy is negative, ΔH must be negative, too, so exothermic

(b) Because ΔH is negative & rxn is exothermic, increased heat to surroundings means increased entropy

(c) higher

14.19 (a) endothermic

(b) position change in entropy (c) spontaneous at high temp.

$$14.27 (a) \Delta G^\circ = \Delta G_f^\circ[\text{H}_2\text{O}(s)] - \Delta G_f^\circ[\text{H}_2\text{O}(l)] = -228.6 \text{ kJ/mol} - (-237.2 \text{ kJ/mol}) = 8.6 \text{ kJ/mol}$$

this is a (+) ΔG° so nonspontaneous so H_2O is a liquid at room temp.

(b) ~~see~~ $\Delta G^\circ = -8.6 \text{ kJ/mol}$ so the condensation of water is spontaneous at room temp.

$$(c) \Delta G^\circ = (-60.6 \text{ kJ/mol}) - (-65.3 \text{ kJ/mol}) = 4.7 \text{ kJ/mol}$$

so vaporization is not spontaneous & CCl_4 is a liquid.

(d) $\Delta G^\circ = -4.7 \text{ kJ/mol}$ so the condensation is spontaneous.

(e) $\Delta G^\circ = 4.4 \text{ kJ/mol}$ Methanol is a liquid @ 25°C

(f) $\Delta G^\circ = -4.4 \text{ kJ/mol}$ Methanol spontaneously condenses @ 25°C