61. (Equilibrium) Consider the bonds that must be made or broken for the reaction

$$O_2N\text{-}NO_2\ (g) <=> 2\ NO_2\ (g)$$

The reaction will be

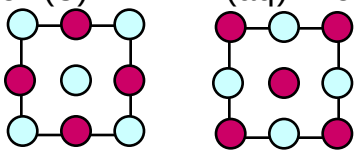
endothermic, exothermic

62. (Extended structures, discrete molecules, solubility) The reaction for dissolving gaseous HCl in water is $HCl\ (g) \rightarrow H^+\ (aq) + Cl^-\ (aq)$.

How many bonds are broken per HCl formula unit when a sample of gaseous HCl dissolves?

zero, **one**, many

The layer sequence of LiCl is shown below. The reaction for dissolving the extended solid in water is $LiCl\ (s) \rightarrow Li^+\ (aq) + Cl^-\ (aq)$.



$z = 0$ $z = 1/2$

How many bonds are broken per LiCl formula unit when a chunk of LiCl dissolves?

zero, one, **many**

66. (Enthalpy, equilibrium) $N_2(g) + 3H_2(g) <=> 2\ NH_3(g)$ + reaction energy; Which are collectively stronger bonds?

those in the reactants, **those in the products**

What effect will spraying H_2O into the system have if NH_3 is far more soluble in H_2O than N_2 and H_2?

no effect, **increase product**, increase reactants

75. (Polymers, thermodynamics) Consider the polymerization of ethylene in which, neglecting the ends of the polymer, many C=C double bonds worth ~600 kJ/mol each are converted to twice as many C-C single bonds in polyethylene worth ~350 kJ/mol each.

$$n\ H_2C{=}CH_2\ (g) \rightarrow -[-CH_2\text{-}CH_2-]_n-$$

This reaction is

exothermic, endothermic, thermoneutral

What happens to the entropy in this reaction?

increases, **decreases**, remains the same

191. When graphite is burned to yield CO_2, 394 kJ of energy are released per mole of C atoms burned. When C_{60} is burned to yield CO_2 approximately 435 kJ of energy is released per mole of carbon atoms burned. Would the buckyball-to-graphite conversion be exothermic or endothermic?

exothermic, endothermic

If heat were added to the graphite/C_{60} system, would the equilibrium shift toward graphite or C_{60}?

graphite, **C_{60}**

204. Which of the following processes will have a change in entropy less than 0?

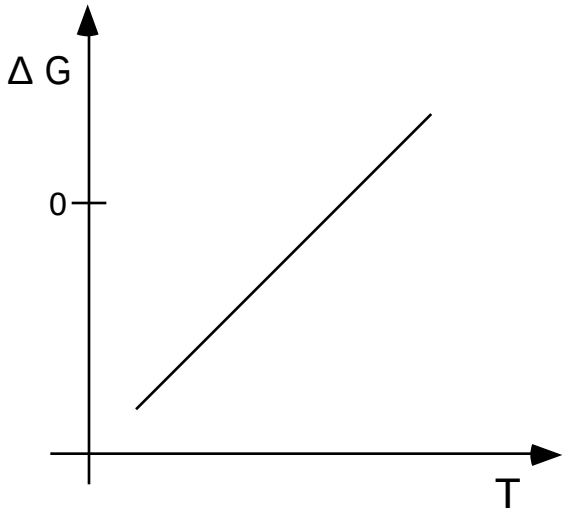
A. $CaCO_{3(s)} \leftrightarrow CaO_{(s)} + CO_{2(g)}$

B. $N_{2(g)} + 3H_{2(g)} \leftrightarrow 2NH_{3(g)}$

C. $H_2O_{(s)} \leftrightarrow H_2O_{(l)}$

A, **B**, C

205. The following graphy of the change in enthalpy versus temperature (T) corresponds to which of the following siturations?



A. ΔH > 0 ΔS < 0
B. ΔH > 0 ΔS > 0
C. ΔH < 0 ΔS < 0

A, B, **C**

210. For the reaction in which solid carbon dioxide (dry ice) sublimes to become gaseous carbon dioxide, CO2(s) --> CO2(g), which of the following is true for the reaction as written?

The reaction is endothermic ($\Delta H^o > 0$) and the entropy decreases ($\Delta S^o < 0$)
The reaction is endothermic ($\Delta H^o > 0$) and the entropy increases ($\Delta S^o > 0$)
The reaction is exothermic ($\Delta H^o < 0$) and the entropy decreases ($\Delta S^o < 0$)
The reaction is exothermic ($\Delta H^o < 0$) and the entropy increases ($\Delta S^o > 0$)

216. Many processes have a likelihood of occurring that is proportional to $\exp(-\Delta E/RT)$. In this relationship, ΔE is the energy required for the process, R is the gas constant, and T is absolute temperature. According to this expression, the process is most probable for the combination of

Large ΔE and low temperature

Large ΔE and high temperature

Small ΔE and low temperature

Small ΔE and high temperature