**Predicting and explaining entropy change**

**1.** Arrange the following 1 mol samples of water, all at the same pressure, in order of an increase in entropy.

H2O (s) at 0 °C

H2O (l) at 100 °C

H2O (l) at 0 °C

H2O (g) at 100 °C

H2O (l) at 25 °C

**2.** State which reactions result in an increase in entropy

Reaction 1: C2H4(g) + 3O2(g) 🡪 2CO2(g) + 2H2O(g)

Reaction 2: 2SO2(g) + O2(g) 🡪 2SO3(g)

Reaction 3: CH4(g) + H2O(g) 🡪 3H2(g) + CO2(g)

Reaction 4: CaCO3(s) 🡪 CaO(s) + CO2(g)

Reaction 5: 2Fe2O3(s) 🡪 4Fe(s) + 3O2(g)

Reaction 6: AgCl(s) 🡪 Ag+(aq) + Cl-(aq)

**3.** Describe the changes in entropy to the four reactions below and state reaction occurs with the

largest increase in entropy change and why?

Reaction A: Pb(NO3)2(s) + 2KI(s) → PbI2(s) + 2KNO3(s)

Reaction B: CaCO3(s) → CaO(s) + CO2(g)

Reaction C: 3H2(g) + N2(g) → 2NH3(g)

Reaction D: H2(g) + I2(g) → 2HI(g)

Reaction E: COCl2(g) 🡪 CO(g) + Cl2(g)

**4.** Discuss why the entropy of a gas is more than the entropy of the same substance in a solid state.

**5.** Write the equation for the dissolving of ammonium chloride in water and suggest how and why the entropy will change.

**extension**: Explain why a reaction with a negative value of Δ*H* and a negative value of Δ*S* is spontaneous only at low temperatures.

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