Day 4: Continue

23. Pi bonding occurs in each of the following species except

(A) N_2F_2
(B) C_2H_2
(C) HCN
(D) C_6H_6
(E) CCl_4

24. You can prepare 0.75 molal NaCl by dissolving 15 g NaCl in what amount of water?

(A) 0.40kg
(B) 0.34kg
(C) 0.27kg
(D) 0.20kg
(E) 0.26kg

25. The formulas CH_3CH_2COOH and CH_3COCH_2OH would be expected to have the same values for which of the following? (Assume ideal behavior.)

(A) Freezing points
(B) Boiling points
(C) Specific heat capacity
(D) Percent composition
(E) Heats of combustion

Day 4

STOP. Correct your answers and note how many correct **points**

Day 4: Answers and Explanations

Answers: Quick Check

1. **A**	2. **B**	3. **A**	4. **D**	5. **A**	6. **A**	7. **C**	8. **B**	9. **D**	10. **A**
11. **A**	12. **C**	13. **E**	14. **D**	15. **D**	16. **A**	17. **C**	18. **B**	19. **E**	20. **C**
21. **B**	22. **C**	23. **E**	24. **B**	25. **D**					

Answers and Explanations

Question 1 through 4: Properties of metals, atomic structure

1. **A** *Note:* The list includes all metals. However, only K will react vigorously in cold water because K, an alkali (Group 1) metal, is the most reactive of all the metals listed.

   $K + H_2O$ -----> $H_2 + KOH +$ heat

2. **B** *Note:* Mn, Cr, Zn and Ag are all transitional metals

   Recall: Transition metals tend to form multiple oxidation numbers. Common oxidation states of the four metals are listed below.
   Mn: +2 +3 +4 +7 Cr: +3 +4 +6 Zn: +2 Ag: +1

   Note: Mn has the most oxidation states. You do need to memorize oxidation states of some common elements.

3. **A** *Recall:* Electronegativity values (a measure of atom's attraction to electrons) are lowest for elements to the left of the Periodic Table.

   K (farthest left) will have the lowest electronegative value of those listed. In general, alkali metals tends to have the the lowest electronegativity values.

4. **D** *Note:* An element with no unpaired electrons will have an even number of electrons in all of its sublevels.

   Recognize that of all elements listed, the electron configuration of Zn: [Ar] $4s^2\ 3d^{10}$, is the only one with even number of electrons in all of its sublevels.

Day 4: Answers and Explanations

Questions 5 through 8: Entropy changes in reactions

5. **A** *Note:* In this system, the number of particles is increasing from **1** F_2 molecule -----> **2 F** atoms

Recall: Increase in number of particles indicates an increase in entropy (+ΔS) Choice A.

6. **A** *Note:* In this system, pressure is decreasing from 5 atm to 1 atm. Therefore, more space for the He particles to move more freely (show more chaos).

Relate: Decrease in pressure means increase in entropy (+ΔS)

7. **C** *Note:* In this system, the number of particles is decreasing from **3** particles (**2** H_2 + **1** O_2) on the left to 2 particles (**2** H_2O) on the right.

Recall: Decrease in number of particles indicates a decrease in entropy (-ΔS) Choice C.

8. **B** *Note:* In this system, the reaction is at equilibrium (rate of forward and rate of reverse are equal)

Therefore, no one side is becoming more or less disorder than the other (No change in entropy)

Recall: Zero entropy means no change in disorder. (Choice B)

9. **D** **Solubility rules, soluble and insoluble compounds**

Recall: The solubility rules for the ions in compounds.

Note: **$Zn(OH)_2$** contains hydroxide ion (**OH-**) which forms mostly **insoluble compounds,** except when it combines with a Group 1 ion or an ammonium ion (NH_4^+)

Note: All other choices contain soluble ions (Cl-, NO_3^- and Na)

10. **A** **Enthalpy and Entropy change in a physical change**

Recall: When a solid melts, it changes from solid ----> liquid

Relate: Melting releases heat, exothermic (-ΔH or H < 0)

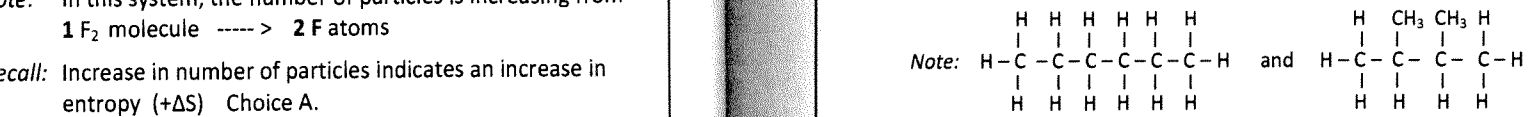
Relate: Melting results in increase in entropy (+ΔS or ΔS > 0)

Day 4: Answers and Explanations

11. **A** **Isomers, hydrocarbons, IUPAC names**

Recall: Isomers are compounds with same percent composition (same molecular formula)

Note:



n-hexane and 2,3-dimethybutane have the same molecular formula (C_6H_{14})

12. **C** **Equilibrium constant, base strength, base reactions**

Recall the equilibrium constant (*k*) equation:

$$k = \frac{[\text{product}]}{[\text{reactant}]}$$

Note: For *k* to be less than 1 (as stated in question), [reactant] must be greater than [product].

Recognize that based on the list of base strength and information in question, the correct equation must have the stronger base on the reactant (left) side.

Note: Of all the equation listed, only in Choice **e**quation is the stronger base (LiOH) appearing on the reactant side.

13. **E** **Phase diagram, critical point**

Recall: Critical point of a phase diagram is the point at which no amount of pressure can cause a substance in the gas state to change back to a liquid.

Note: The critical point (Point E) of phase diagram is always located farthest right of all the points on the diagram.

14. **D** **Phase diagram, normal boiling point**

Recall: Normal boiling point of a substance is the temperature at which vapor pressure equals the normal atmospheric pressure (1 atm).

Note: Point D is marked at 1 atm

Day 4: Answers and Explanations

15. **D** **Behavior of gases, Collision theory, rate of reaction.**

Note: Taking away molecules Y (decreasing [Y]) means fewer opportunity (decrease rate) of collision between X and Y

16. **A** **Writing reaction equation, equilibrium expression**

Step 1: Write equation for the reaction: $H_2 + I_2 <----> 2HI$

Step 2: Use x to represent moles of the substances that reacted

Let x = moles of H_2
x = moles of I_2 (because of 1 : 1 ratio in equation)

Step 3: Determine moles (concentration) of substances at equilibrium
$3 - x$ = moles of H_2
$3 - x$ = moles of I_2
$2x$ = moles HI moles H_2 reacted (x) + moles I_2 reacted (x) = 2x

Step 4: Write equilibrium expression using above equilibrium [ ]

$$K_c = \frac{[\text{products}]}{[\text{reactants}]} = \frac{[HI]^2}{[H_2] \cdot [I_2]} = \frac{\mathbf{2x^2}}{\mathbf{(3-x)^2}}$$

17. **C** **Nuclear decay, particle symbols**

Step 1: Write the symbols of emitted particles in the order given in question

beta	alpha	alpha	beta
$^{0}_{-1}e$	$^{4}_{2}He$	$^{4}_{2}He$	$^{0}_{-1}e$

Step 2: To get the top (mass) # of the stable nucleus:
Subtract the sum of top #s of particles (8) from 238. = **230**

To get the bottom (atomic) # of the stable nucleus:
Subtract the sum of bottom #s of particles (2) from 92 = **90**

$^{230}_{90}Th$

18. **B** **Half-reaction, reduction, oxidation number changes**

Recall: During reduction, there is a decrease in oxidation state of the particle being reduced.

Note: Half-equation for choice B is the only one that shows a decrease in oxidation number (Cl goes from 0 to -1)

Day 4: Answers and Explanations

19. **E** **Freezing point depression, molality, van't Hoff factor**

Recognize that based on information given, change in temperature, ΔT, must first be determined using the equation

$$\mathbf{\Delta T = i \cdot Kf \cdot m}$$

before the freezing point of the solution ($FP_{solution}$) can be determined.

Step 1: Calculate moles of solute, $AgNO_3$

$$\text{moles} = \frac{200\ g}{169.9\ g \cdot mol^{-1}} = 1.177\ mol$$

Step 2: Calculate molality (m)

$$m = \frac{\text{moles}}{\text{kg of solution}} = \frac{1.177\ mol}{1\ kg} = 1.177\ m$$

Step 2: Determine *i* (van't Hoff) factor for the solute, $AgNO_3$.

$AgNO_3$ ----> **1** Ag^+ and **1** NO_3^- = **2**

Step 3: Calculate ΔT

$\Delta T = i \cdot k_f \cdot m$

ΔT = **2** $(1.86\ ^\circ C \cdot m^{-1})(1.177\ m) = 4.38^\circ C$

Step 4: Calculate $FP_{solution}$

$FP_{solution} = FP_{water} - \Delta T$

$FP_{solution} = 0 - 4.38^\circ C = \mathbf{-4.38^\circ C}$

20. **C** **Energy, frequency, and wavelength in calculation**

Step 1: Calculate wavelength using equation below:

$$\lambda = \frac{c}{h} = \frac{3.00 \times 10^8\ m.s^{-1}}{3.00 \times 10^{14} \cdot s^{-1}} = 1.0 \times 10^{-6}\ m$$

Step 2: Calculate wavelength in nm

$$\lambda = 1.0 \times 10^{-6}\ m \times \frac{1.0 \times 10^9\ nm}{1\ m} = \mathbf{1.0 \times 10^3\ nm}$$

Day 4: Answers and Explanations

21. **B.** **Photoelectric effect, properties of elements**

Recall: Photoelectric is observed when the surface of a metal emits electrons as light shines on it.

Recall: Alkali metals, with one loosely held valance electron, most readily experience photoelectric effect

22. **C** **Solution, common-ion effect, van't Hoff factor**

Recall: If a solute containing a common-ion as a solution is placed in the solution, the solubility of the solute will be inhibited (common-ion effect)

Note: Na**Cl**, **Cu**NO_3, and Ca**Cl**$_2$ solutions each contain the same ion as $CuCl_2$ solute.

However, **Cu**Cl_2 will be least soluble in the solution with the greatest number of moles of the common-ion

Determine number of moles of the common-ion in each solution

0.02 m NaCl ------ > 0.02 moles Cl^- ion

0.02 m $CuNO_3$ ---- > 0.02 moles Cu^{+1}

0.02 m $CaCl_2$ ----- > 2(0.02 moles Cl^-) = **0.04 moles Cl-**

Note: $CaCl_2$ has the greatest moles of the common-ion.

23. **E** **Molecular structure, molecular bonding, hybridization**

Note: Pi bonding occurs in molecules where there are multiple bonding.

Note: CCl_4 is the only molecule listed with no multiple bonding

Day 4: Answers and Explanations

24. **B** **Solution, molarity , moles, and mass in calculations**

Step 1: Determine moles of NaCl

$$\text{moles} = \frac{15\ \text{g}}{58\ \text{g.mol}^{-1}} = 0.26\ \text{mol}$$

Step 2: Substitute into molarity equation and solve for Kg H_2O

$$\text{molarity} = \frac{\text{moles solute}}{\text{Kg of } H_2O}$$

$$0.75 = \frac{0.26}{X} \quad X = \mathbf{0.34\ Kg}$$

25. **D** **Hydrocarbons, molecular formulas, isomers, properties**

Note: The two formulas have the same number of atoms, therefore, are isomers.

Recall: Isomers are compounds with same molecular formula (same molar mass and same percent composition)

BUT

different structural formula (different compounds, different properties)

Day 5: Answers and Scoring Guidelines

(see important scoring guideline information on on page i)

1. **(10 points)**

Fluorine gas, $F_2(g)$, and a solid oxide, X_2O_8, are combined and heated in a 2.5 L flask to 721°C. The equilibrium reaction is shown in the balanced equation below.

$$X_3O_8(s) + 3F_2(g) \; <========> \; 3XO_2F_2(g) + O_2(g)$$

At equilibrium, the partial pressure of $F_2(g)$ is 0.83 atm and the partial pressure of $XO_2F_2(g)$ is 2.64×10^{-5} atm.

a) Calculate the partial pressure of $O_2(g)$ at 721°C,

Note: Since the partial pressure of the other product is given, use mole proportion to determine partial pressure of $O_2(g)$ (P_{O_2})

$P_{O_2} = 2.64 \times 10^{-5}$ atm $XO_2F_2 \times \frac{1 \text{ mol } O_2}{3 \text{ mol } XO_2F_2}$	**1 point** is earned for setup
$P_{O_2} = 8.80 \times 10^{-6}$ atm O_2	**1 point** for the correct P_{O_2}

b) Write the equilibrium expression, K_p, and calculate the value of the equilibrium constant for this reaction?

Recall: $K_p = \frac{(P_{products})}{(P_{reactants})}$

Write equilibrium expression from the equation $K_p = \frac{(P_{XO_2F_2})^3 (P_{O_2})}{(P_{F_2})^3}$	**1 point** is earned for writing equilibrium expression
Substitute factors into expression and solve $K_p = \frac{(2.64 \times 10^{-5})^3 (8.8 \times 10^{-6})}{(0.83)^3}$	**1 point** is earned for substitution
$K_p = \frac{1.62 \times 10^{-19}}{5.71 \times 10^{-1}}$ $K_p = 2.83 \times 10^{-19}$	**1 point** is earned for the correct K_p

c) Calculate the Gibb's Free energy change, ΔG°, for the reaction at 721°C.

Note: $\Delta G^\circ = -RT \ln Kp$ (See References Materials on Pg 340)

Note: T must be in Kelvin: 771°C + 273 = 994 K

ΔG° = R T ln Kp **$\Delta G^\circ = (-8.31\ J\ mol^{-1}\ K^{-1})(994\ K)(\ln 2.83 \times 10^{-19})$** $\Delta G^\circ = (-8.31\ J\ mol^{-1}\ K^{-1})(994\ K)(-42.7)$ **$\Delta G^\circ = 3.53 \times 10^5$ J/mol or 353 KJ/mol**	**1 point** is earned for setup **1 point** for the correct ΔG°

d) What will be the sign for the entropy change, ΔS°, for the reaction at 721°C. Explain your answer.

Recall: When entropy (disorder) increases , ΔS° is +

When entropy (disorder) decreases, ΔS° is -

ΔS° will be positive (+). According to the equation, entropy of the reaction increases because **4 moles of gaseous products are formed from 3 moles of reactants.**	**1 point** is earned for correct sign of ΔS° and explanation

e) What will be the sign for the enthalpy change, ΔH°, for the reaction at 721°C. Justify your answer.

Note: $\Delta H^\circ = \Delta G^\circ + T\Delta S^\circ$ (See References Materials on Pg 340)

ΔH° will always be positive (+) because **both ΔG° and $T\Delta S^\circ$ are positive**	**1 point** is earned for correct sign of ΔH° **1 point** is earned for correct explanation

Day 5: Answers and Scoring Guidelines

2. **(10 points)**

A pure sample of a nonvolatile compound containing only carbon, hydrogen and oxygen is analyzed. It is found to be a nonelectrolyte. Data from a combustion reaction of the compound was analyzed, and it is determined that the compound has mass percents of 31.57% C and 5.30% H.

(a) Determine the empirical formula of the compound.

Assume 100 g of the nonvolatile compound, Determine mass of each element Mass of C = 31.7 g Mass of H = 5.30 g Mass of O = 63.0 g (100 g – (31.7 g + 5.30 g) *Convert mass of each element to moles* moles = mass / molar mass moles of C = 31.7 g / 12 g.mol^{-1} = **2.639 mol C** mole of H = 5.30 g / 1.01 g.mol^{-1} = **5.2475 mol H** mole of O = 63.0 g / 16 g.mol^{-1} = **3.9375 mol O** *Determine mole ratio (subscript) of the elements by dividing each calculated mole above by the smallest of the moles (2.639 mol)* 2.639 mol C / 2.639 mol = C = 1 5.2475 mol H / 2.639 mol = H = 2 3.9375 mol O / 2.639 mol = O = 1.49 Multiply each mole by 2 to get whole number subscripts **$C_2H_4O_3$**	**1 point** is earned for calculating moles of the elements. **1 point** is earned for correctly calculating the empirical formula

(b) A 30.0 g sample of the compound is dissolved in 250.0 g of benzene C_6H_6. The freezing point of this solution is 1.46 °C. (The freezing point of benzene is 5.51 °C and K_f is 5.12 °C.kg^{-1}. mol^{-1})

(i) Determine the molecular mass of the substance.

Note: Based on information given, it is clear that moles of the nonvolatile compound must be determine in other to calculate the molecular mass (g/mol)

Determine change in freezing temperature from information given:

ΔT_f = $FP_{benzene}$ − $FP_{solution}$

ΔT_f = 5.51°C − 1.46°C = 4.05°C

Calculate molality (m) using equation below:

$\Delta T_f = i \cdot k_f \cdot m$

note: i (van't Hoff factor) is 1 because the solute is a nonelectrolyte)

$$m = \frac{T_f}{K_f} = \frac{4.05°C}{5.12\ C.m^{-1}} = 0.791\ m \text{ or } 0.791\ mol/Kg$$

Calculate moles of solute

$$m = \frac{\text{moles of solute}}{\text{Kg of solvent}}$$

moles = molality x Kg of solvent

moles = 0.791 mol/kg x .250 kg = **.198 mol solute**

1 point is earned for calculating moles of the solute

Calculate molecular mass of the substance

$$\text{Molecular mass} = \frac{\text{mass of solute}}{\text{moles of solute}}$$

$$\textbf{Molecular mass} = \frac{30\ g}{.198\ mol} = \textbf{152 g/mol}$$

1 point is earned for correctly calculating the molecular mass of the solute

Day 5: Answers and Scoring Guidelines

(ii) Determine the molecular formula for the compound.

Note: To calculate molecular formula, you need to know how many units of the empirical formula there are.

Determine mass of empirical formula (from part a)

$C_2H_4O_3$ = 2(C) + 4(H) + 3(O)

2(12) + 4(1) + 3(16) = 76 g

Find units of empirical

$$\frac{\text{Molecular mass}}{\text{Empirical mass}} = \frac{152\ g}{76\ g} = 2$$

Determine molecular formula by multiplying each subscript of the empirical formula by 2

$2(C_2H_4O_3) = C_4H_8O_6$

1 point is earned for correctly determining the molecular formula

(iii) Determine the mole fraction of the solute

Note: To determine mole fraction (X) of solute, you need to divide mole of solute ($C_4H_8O_6$) by moles of solvent (C_6H_6)

Calculate moles of solute ($C_4H_8O_6$) and of solvent (C_6H_6)

moles of $C_4H_8O_6$ = .197 mol $C_4H_8O_6$ see previous calculation for b(i)

$$\text{mole of } C_6H_6 = \frac{250.0\ g}{78\ g.\ mol^{-1}} = 3.205\ mol\ C_6H_6$$

1 point is earned for setup

Determine mole fraction (X) of solute $C_4H_8O_6$

$$X_{solute} = \frac{\text{moles of solute}}{\text{Total moles in solution}} = \frac{\mathbf{0.198}}{\mathbf{(0.198 + 3.205)}}$$

$$X_{solute} = \frac{0.198}{3.403} = \mathbf{0.058}$$

1 point is earned for correctly calculating the mole fraction of solute.

Day 5: Answers and Scoring Guidelines

(c) Determine the osmotic pressure of the solution if its density is 1.15 g/mL at 25.0 °C.

Note: Based on information known, osmotic pressure (Π), can be calculated using equation $\Pi = iMRT$ (Note i = 1)

Calculate Volume (V) from known information

$$V = \frac{\text{gram of solution}}{\text{density}} = \frac{280\text{ g}}{1.15\text{ g.mL}^{-1}} = 243\text{ mL}$$

Calculate Molarity (M)

$$M = \frac{\text{moles}}{\text{Volume}} = \frac{0.198\text{ moles}}{.243\text{ L}} = \mathbf{0.815\ M}$$

1 point is earned for calculating molarity

Calculate osmotic pressure (Π) using equation

$\Pi = MRT$

$$\Pi = \left(\frac{0.815\text{ mol}}{\text{L}}\right)\left(\frac{0.0821\text{ L. atm}}{\text{mol . K}}\right)\left(\frac{298\text{ K}}{1}\right) = \mathbf{19.9\ atm}$$

1 point is earned for correctly calculating the osmotic pressure

(d) Determine the vapor pressure (VP) of the solution at 25.0 °C. (The equilibrium vapor pressure of benzene is 95 mm Hg at 25.0 °C.)

Determine change in pressure of solvent using using Raoult's Law equation:

$\Delta P_{solvent} = (X\ solute)\ (P solvent)$

$\Delta p_{solvent} = (0.058)\ (95\ mmHg) = 5.51\ mm\ Hg$

Determine vapor pressure of the solution:

$VP_{solution} = P_{solvent} - P_{solvent}$

$\mathbf{VP_{solution}} = 95\ mmHg - 5.51\ mmHg = \mathbf{90.\ mmHg}$

1 point is earned for correctly calculating the vapor pressure

Day 5: Answers and Scoring Guidelines

(see important scoring guideline information on on page i)

1. **(15 points)**

(a) Sulfur trioxide gas is heated in the presence of solid calcium oxide.

Note: This is a combination (synthesis) reaction

(i) Balanced equation SO_3 + CaO -------> $CaSO_4$	**1 point** is earned for correct reactants **2 points are** earned for correct products **1 point** is earned for correctly balancing the equation

(ii) Draw the Lewis-dot structure for the product that forms

Ca^{2+} $\left[:\ddot{O}: \; :\ddot{O}:S:\ddot{O}: \; :\ddot{O}: \right]^{2-}$	**1 point** is earned for the correct Lewis structure

(b) Copper sulfate pentahydrate is heated over high heat.

Recall: Hydrates are ionic substances with attached water molecules.

Note: When heated, hydrates decompose to anhydrous and water.

(i) Balanced equation $CuSO_4 . 5H_2O$ ------> $CuSO_4$ + $5H_2O$	**1 point** is earned for correct reactants **2 points are** earned for correct products **1 point** is earned for correctly balancing the equation

(ii) If 5 grams of the hydrate was heated in a crucible to a constant mass, calculate the mass of the solid substance in the crucible.

Note: The solid substance in the crucible is the anhydrous, $CuSO_4$

To determine its mass in a 5-gram sample, you need to know the following: Molar mass of $CuSO_4.5H_2O$ = 250 g/mol

Mass of $CuSO_4$ in 250 g = 160 g $CuSO_4$

$5\text{ g } CuSO_4.5H_2O \times \frac{160\text{ g } CuSO_4}{250\text{ g } CuSO_4.5H_2O}$ **3.2 g $CuSO_4$**	**1 point** is earned for correctly calculating the mass

(c) Equal molar and volume of barium chloride and sodium carbonate solutions are mixed, resulting in the formation of a precipitate.

Note: This is a double replacement (ion exchange) reaction. Chlorine and sodium ions are spectator ions, therefore, are not included in the net equation.

(i) Balanced equation **Ba^{2+} + CO_3^{2-} -----> $BaCO_3$**	**1 point** is earned for correct reactants **2 points are** earned for correct products **1 point** is earned for correctly balancing the equation

(ii) Describe what will occur if the precipitate is dried and a few drops of a dilute hydrochloric acid are added. Explain.

Note: The equation for the reaction described above is as follows:

Bubbles of carbon dioxide gas (CO_2) will form. *or* **Precipitate ($BaCO_3$) will disappear.**	**1 point** is earned for the correct description.

Day 5: Answers and Scoring Guidelines

2. **(8 points)**

The reaction represented below is a reversible reaction.

$$HBr(g) + NH_3(g) <=======> NH_4Br(s)$$

(a) Predict the sign of the entropy change, ΔS, for the forward reaction. Explain your reasoning.

Entropy change will be negative. **- ΔS** Because: **Two moles of substances form one mole of substance, therefore, entropy is decreasing.** *or* **Gaseous reactants form solid product, therefore, entropy is decreasing.** *Recall:* Decreasing entropy = - ΔS	**1 point** is earned for the correct sign of entropy change. **1 point** is earned for explanation that is consistent with the sign of entropy change

(b) Predict the sign of the free energy change, ΔG, when the reaction reaches equilibrium.

ΔG = 0 **Zero** Free energy is Zero because the reaction is at equilibrium.	**1 point** is earned for the correct sign of entropy change.

(c) The forward reaction is spontaneous at low temperatures. When the temperature of the reaction is increased to a high temperature, how would the the sign of ΔG changes. Justify your answer.

Note: ΔG = ΔH - TΔS (See Reference Materials on pg 339)

Note: Since ΔS is negative (see a) and ΔH is also negative (spontaneous)

Δ G = - ΔH + TΔS (ΔG sign, therefore, depends on Temperature)

At low temperature, ΔG = - (spontaneous) because TΔS value is smaller than - ΔH value

At high temperature: **ΔG will change from negative (spontaneous) to positive (nonspontaneous)** because **At a high enough temperature, TΔS value will overcome (be greater than) - ΔH° value**	**1 point** is earned for the correct change of ΔG **1 point** is earned for correct justification

(d) Write an expression for calculating the value of the specific temperature referred to in part (c).

Note: ΔG = 0 at equilibrium $\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$ $0 = \Delta H^\circ - T\Delta S^\circ$ $T\Delta S = \Delta H$ $T = \frac{\Delta H}{\Delta S}$	**1 point** is earned for the correct expression

Day 6: Answers and Scoring Guidelines

(e) The system is allowed to reach equilibrium at the low temperature described in part (c). Additional solid $NH_4Br$is added to the reaction vessel. How will the value of the equilibrium constant be affected? Explain.

Adding more $NH_4Br(s)$ will not affect the equilibrium expression. because **a solid has constant concentration, therefore, its concentrations will not be included into equilibrium expression.**	**1 point** is earned for the correct effect **1 point** is earned for correct explanation that is consistent with the effect stated.