

CH 123

General Chemistry

Exam 3

July 29, 2002

KEY

Name: _____
(please print)

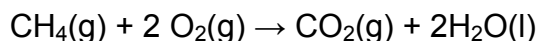
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(last 4 digits)

Each question is worth 1 point.

Circle your answer clearly, otherwise no credit will be given.

Circle only one answer. If you circle two or more, you will receive no credit.

- The disorder of a system is represented by the
 - entropy.
- Which of the following represents an increase in entropy?
 - boiling of water
- Calculate the standard entropy change for the following reaction,



given that $S^\circ[\text{CO}_2(\text{g})] = 213.74 \text{ J/K}\cdot\text{mol}$, $S^\circ[\text{O}_2(\text{g})] = 205.14 \text{ J/K}\cdot\text{mol}$,
 $S^\circ[\text{H}_2\text{O}(\text{l})] = 69.91 \text{ J/K}\cdot\text{mol}$, and $S^\circ[\text{CH}_4(\text{g})] = 186.26 \text{ J/K}\cdot\text{mol}$.

- 242.98 J/K
- Calculate the standard molar entropy of urea ($\text{CO}(\text{NH}_2)_2(\text{s})$) if the standard entropy change for the formation is $-456.3 \text{ J/K}\cdot\text{mol}$ and given $S^\circ[\text{C}(\text{s})] = 5.74 \text{ J/K}\cdot\text{mol}$, $S^\circ[\text{O}_2(\text{g})] = 205.1 \text{ J/K}\cdot\text{mol}$, $S^\circ[\text{N}_2(\text{g})] = 191.6 \text{ J/K}\cdot\text{mol}$, and $S^\circ[\text{H}_2(\text{g})] = 130.7 \text{ J/K}\cdot\text{mol}$.
 - +105.0 J/K•mol
 - For the reaction

$$\text{MgO}(\text{s}) + \text{CO}_2(\text{g}) \rightarrow \text{MgCO}_3(\text{s})$$

$$\Delta H^\circ_{\text{rxn}} = -178 \text{ kJ} \text{ and } \Delta S^\circ_{\text{rxn}} = -161 \text{ J/mol}\cdot\text{K}.$$

Will the reaction be spontaneous at 900 °C?

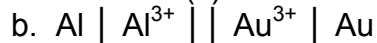
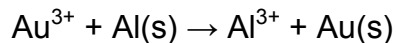
 - No, because ΔG is positive.
 - If a process is exothermic and not spontaneous, then what must be true?
 - $\Delta S < 0$
 - Which of the following is true about vaporization?
 - ΔS and ΔH are both positive.
 - Which of the following does not have a free energy of zero?
 - $\text{N}(\text{g})$ and d. $\text{Na}(\text{g})$
 - Ammonium nitrate spontaneously dissolves in water at room temperature and the process causes the solution to become quite cold. Which of the following is **TRUE** about the dissolution of ammonium nitrate?
 - Its solubility will be greater in warmer water.
 - The following general reaction is not spontaneous at room temperature.

$$\text{A} + \text{B} \rightarrow \text{C} + \text{D} \quad \Delta H^\circ = +50.0 \text{ kJ} \text{ and } \Delta S^\circ = +100. \text{ J/K}$$

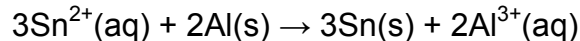
At what temperature will the reaction become spontaneous?

 - 500 K

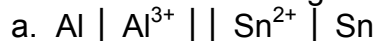
11. Which of the following is the correct cell notation for the reaction



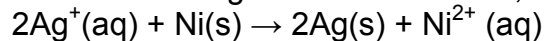
12. Consider an electrochemical cell where the following reaction takes place:



Which of the following is the correct cell notation for this cell?

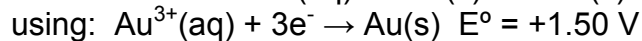
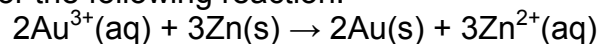


13. If ΔG of the following reaction is -203 kJ, what is E° ?



e. +1.05 V

14. Calculate ΔG for the following reaction:



d. -1310 kJ

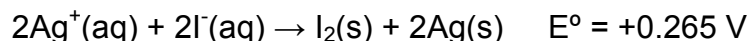
15. How many kwh of electrical energy are required to produce 1 kg of aluminum from a molten mixture of Al^{3+} using 2.5 V? (1 joule = 1 volt•coulomb and 1 kwh = $3.60 \times 10^6 \text{ J}$)

a. 7.5 kwh

16. How is aluminum currently produced in industry?

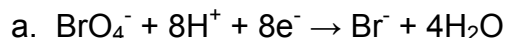
d. electrolysis of a mixture of Al_2O_3 and Na_3AlF_6 to give Al and O_2

17. What is the equilibrium constant for the following reaction at 298 K?

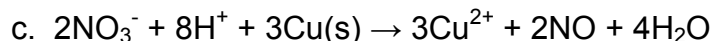
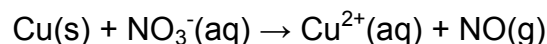


b. 9.04×10^8

18. Under acidic conditions the bromate ion is reduced to the bromide ion. Write the balanced half-reaction for this process.



19. Balance the following redox equation which occurs in acidic solution.



20. What is the balanced reduction half-reaction under acidic conditions in the equation below?

