

Posting ID: 429517
Course: CHE 107 2015 SU
Instructor: Lisa Blue

## CHE 107 Final Exam B Summer 2015

Exam ID: 71

Course Name: CHE 107 2015 SU

Current Date and Time: Tue, Aug 04, 2015 @ 21:36:52 EDT

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### Question #: 1

The pH of a 0.138 M hydrazoic acid solution is 2.260. What is the percent ionization of hydrazoic acid in this solution?

- A. 7.69%
  - B. 0.611%
  - C. 3.98%
  - D. 15.2%
- 

### Question #: 2

What is the **pH** of a solution that is 0.050 M in HBr and 0.200 M in HBrO ( $K_a = 2.8 \times 10^{-9}$ )? Report your answer to two decimal places.

**pH** =   1  

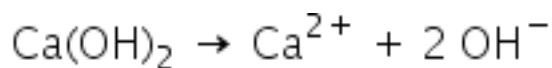
1. \_\_\_\_\_

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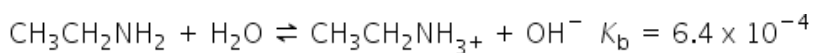
### Question #: 3

In a mixture of three bases ( $\text{Ca(OH)}_2$ ,  $\text{CH}_3\text{CH}_2\text{NH}_2$ , and  $\text{C}_6\text{H}_5\text{NH}_2$ ) in water, which reaction(s) need not be considered in calculating the pH? Choose all that apply.

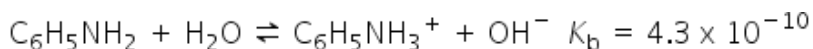
A.



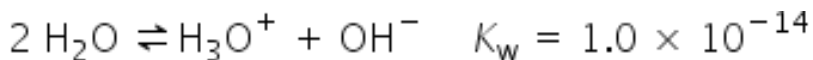
B.



C.



D.



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**Question #: 4**

Which 0.25 M aqueous salt solution has the indicated pH?

- A.  $\text{CH}_3\text{CH}_2\text{NH}_3\text{Cl}$ , pH <7
- B.  $\text{KNO}_3$ , pH >7
- C.  $\text{LiC}_2\text{H}_3\text{O}_2$  (acetate), pH = 7
- D.  $\text{NaIO}_3$ , pH <7

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**Question #: 5**

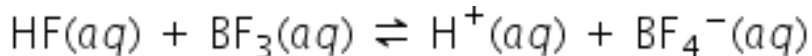
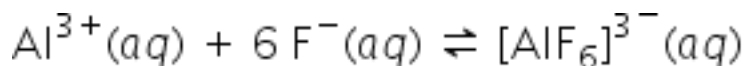
Which is the **strongest** of the acids below?

- A. HBrO
- B. HClO
- C. HIO

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**Question #: 6**

Which substances act as **Lewis acids** in the following reactions? Select **all** that apply.



- A.  $\text{Al}^{3+}(\text{aq})$
- B.  $\text{F}^{-}(\text{aq})$
- C.  $\text{HF}(\text{aq})$
- D.  $\text{BF}_3(\text{aq})$

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**Question #: 7**

A buffer prepared using formic acid ( $\text{HCHO}_2$ ,  $\text{p}K_{\text{a}} = 3.74$ ) and sodium formate ( $\text{NaCHO}_2$ ) has a pH of 4.15. What can be said about the relative concentrations of sodium formate and formic acid?

- A.  $[\text{NaCHO}_2] < [\text{HCHO}_2]$
- B.  $[\text{NaCHO}_2] = [\text{HCHO}_2]$
- C.  $[\text{NaCHO}_2] > [\text{HCHO}_2]$
- D. The relative concentrations of sodium formate and formic acid cannot be determined from the information given.

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**Question #: 8**

Which weak acid, conjugate base pair would be the best choice to prepare a pH 4.00 buffer?

- A. pyruvic acid ( $\text{p}K_{\text{a}} = 2.39$ ) and sodium pyruvate
- B. hydroxylammonium ( $\text{p}K_{\text{a}} = 5.95$ ) and hydroxylamine
- C. nitrous acid ( $\text{p}K_{\text{a}} = 3.34$ ) and sodium nitrite
- D. hypochlorous acid ( $\text{p}K_{\text{a}} = 7.54$ ) and lithium hypochlorite

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**Question #: 9**

A 20.0 mL portion of 0.250 M  $\text{CH}_3\text{NH}_2$  ( $K_{\text{b}} = 4.4 \times 10^{-4}$ ) is titrated with 1.00 M HCl. What is the pH at the equivalence point?

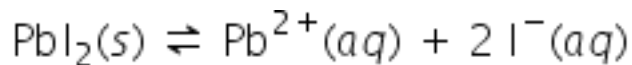
- A. 3.64

- B. 5.67
- C. 6.82
- D. 8.10

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**Question #: 10**

What is the molar solubility of lead(II) iodide in water?  $K_{sp} = 8.5 \times 10^{-9}$



- A.  $7.2 \times 10^{-17} \text{ M}$
- B.  $4.1 \times 10^{-5} \text{ M}$
- C.  $8.5 \times 10^{-9} \text{ M}$
- D.  $1.3 \times 10^{-3} \text{ M}$

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**Question #: 11**

Suppose you have a solution that contains 0.010 M each of  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ , and  $\text{Zn}^{2+}$ .

If solid  $\text{Na}_2\text{C}_2\text{O}_4$  is slowly added, which of the following oxalate species will precipitate out of solution first?

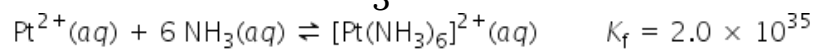
$$K_{sp}(\text{NiC}_2\text{O}_4) = 1.0 \times 10^{-7}$$
$$K_{sp}(\text{PbC}_2\text{O}_4) = 4.8 \times 10^{-12}$$
$$K_{sp}(\text{ZnC}_2\text{O}_4) = 1.4 \times 10^{-9}$$

- A.  $\text{NiC}_2\text{O}_4$
- B.  $\text{PbC}_2\text{O}_4$
- C.  $\text{ZnC}_2\text{O}_4$
- D.  $\text{Na}_2\text{C}_2\text{O}_4$

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**Question #: 12**

What concentration of  $\text{Pt}^{2+}$  will remain when 100.0 mL of 0.010 M  $\text{Pt}(\text{NO}_3)_2$  is combined with 100.0 mL of 0.200 M  $\text{NH}_3$ ?

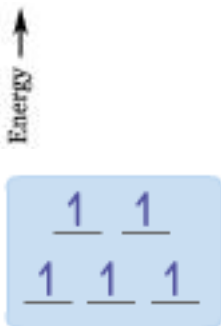


- A.  $4.1 \times 10^{-37}$  M
- B.  $2.0 \times 10^{-35}$  M
- C.  $2.1 \times 10^{-31}$  M
- D.  $1.7 \times 10^{-3}$  M

**Question #: 13**

Which octahedral crystal-field splitting diagram matches a low-spin  $\text{Fe}^{3+}$  ion?

A.

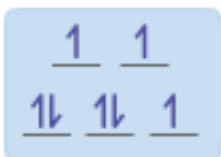


B.



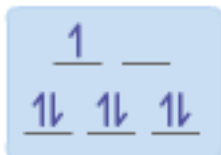
C.





D.

↑  
Energy



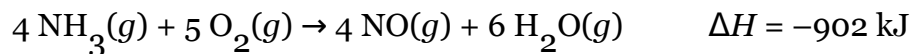
**Question #:** 14

Which of the following statements is **true**?

- A. When ice is added to water, heat flows from the ice to the water in a spontaneous process.
- B. Water evaporates spontaneously, increasing the entropy of the system.
- C. All endothermic reactions are nonspontaneous.
- D. NaCl dissolving in water is nonspontaneous because the process increases entropy for the system.

**Question #:** 15

What is the change in the entropy of the surroundings for the following reaction conducted at 55.0 °C?



- A. 2.75 kJ/K
- B. -4.95 kJ/K
- C. 17.9 kJ/K
- D. -18.4 kJ/K

**Question #:** 16

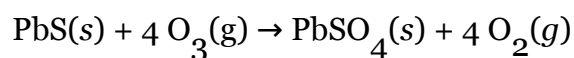
Which set of conditions results in a reaction that is nonspontaneous at all temperatures?

- A.  $\Delta H > 0, \Delta S > 0$
- B.  $\Delta H < 0, \Delta S > 0$
- C.  $\Delta H > 0, \Delta S < 0$
- D.  $\Delta H < 0, \Delta S < 0$

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**Question #: 17**

What is  $\Delta G^\circ$  for the ozonolysis of lead(II) sulfide under standard conditions, given the information below?



Substance	$\Delta G_f^\circ$ (kJ/mol)
PbS(s)	-98.7
PbSO <sub>4</sub> (s)	-813.0
O <sub>3</sub> (g)	163.2

- A. -1367.1 kJ
- B. -978.2 kJ
- C. -568.4 kJ
- D. -221.0 kJ

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**Question #: 18**

Calculate  $\Delta G_{\text{rxn}}$  at 298 K for the reaction



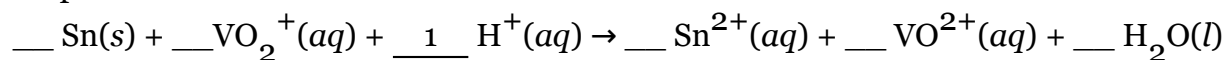
when  $P(\text{H}_2) = 0.460 \text{ atm}$ ,  $P(\text{I}_2) = 0.320 \text{ atm}$ , and  $P(\text{HI}) = 0.020 \text{ atm}$ .

- A. 10.27 kJ
- B. -9.80 kJ
- C. -15.64 kJ
- D. -12.03 kJ

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**Question #: 19**

What is the coefficient of  $\text{H}^+(aq)$  when the redox reaction below is balanced in acid with the smallest possible whole numbers?

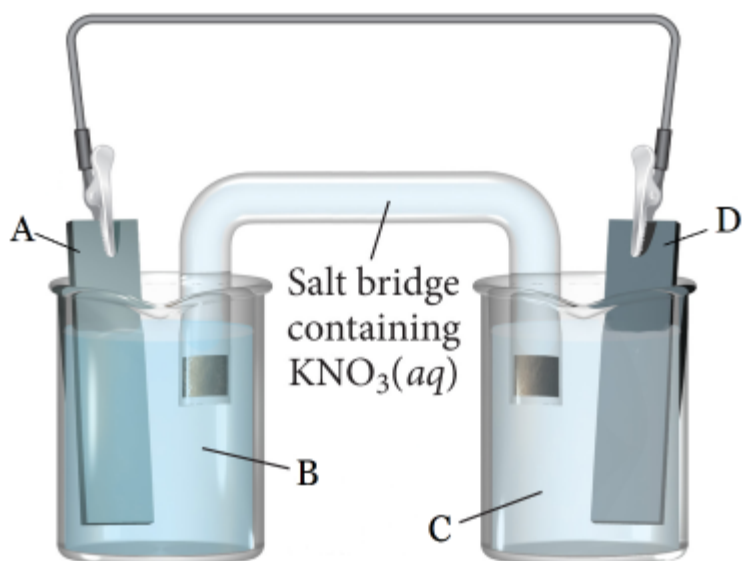


1. \_\_\_\_\_

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**Question #: 20**

Label the voltaic cell using information given in the electrochemical cell notation below.



**Anode A** is composed of   1  .

**Solution B** is   2  .

**Solution C** is   3  .

**Cathode D** is composed of   4  .

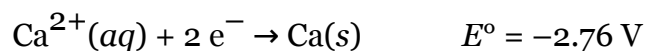
1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_



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**Question #: 21**

Which of the following is the strongest reducing agent?

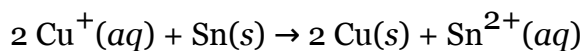


- A.  $\text{Au}^{3+}(\text{aq})$
- B.  $\text{Au}(\text{s})$
- C.  $\text{Ca}^{2+}(\text{aq})$
- D.  $\text{Ca}(\text{s})$

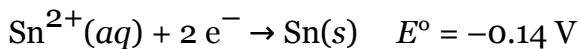
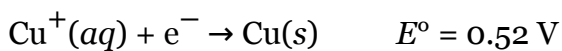
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**Question #: 22**

Calculate  $\Delta G^{\circ}$  for the reaction



given

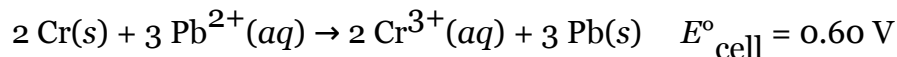


- A.  $-54 \text{ kJ}$
- B.  $-160 \text{ kJ}$
- C.  $-77 \text{ kJ}$
- D.  $-130 \text{ kJ}$

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**Question #: 23**

Calculate  $E_{\text{cell}}$  at 298 K when  $[\text{Pb}^{2+}] = 1.2 \text{ M}$  and  $[\text{Cr}^{3+}] = 0.10 \text{ M}$  for the electrochemical reaction below.

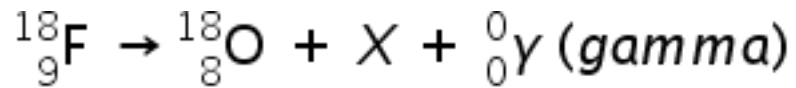


- A. 0.52 V
- B. 0.56 V
- C. 0.62 V
- D. 0.64 V

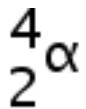
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Question #: 24

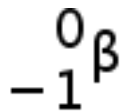
What is X in the nuclear equation below?



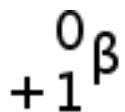
A.



B.



C.

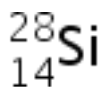


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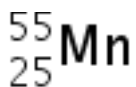
Question #: 25

Which one of the following isotopes is most likely to undergo radioactive decay?

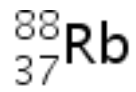
A.



B.



C.



D.



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**Question #:** 26

A patient is injected with 10.0  $\mu\text{Ci}$  of iodine-131 with  $t_{1/2} = 8.02$  days. Assuming 90.0% of the iodine-131 makes it to the thyroid, what is the activity in the thyroid 20 days post-injection?

- A. 1.46 mCi
- B. 1.60 mCi
- C. 1.92 mCi
- D. 2.27 mCi

**Answer Key:**

1. C
2. "1.30"
3. B, C, D
4. A
5. B
6. A, D
7. C
8. C
9. B
10. D
11. B
12. C
13. B
14. B
15. A
16. C
17. A
18. D
19. "4"
20.
  1.  $\text{Al(s)}|\text{Al}|$
  2.  $\text{Al}^{3+}|\text{Al}^{3+}|\text{Al}^{3+}(\text{aq})|\text{Al}^{3+}(\text{aq})|$
  3.  $\text{Cu}^{2+}|\text{Cu}^{2+}|\text{Cu}^{2+}(\text{aq})|\text{Cu}^{2+}(\text{aq})|$
  4.  $\text{Cu(s)}|\text{Cu}|$
21. D
22. D
23. C
24. C
25. C
26. B