

## CHE 107 Exam 3 Fall 2015

Your Name: \_\_\_\_\_ Your ID: \_\_\_\_\_

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### Question #: 1

What is the pH of lemon juice if the concentration of the  $\text{H}_3\text{O}^+$  ion in the solution is 0.0098 M?

- A. 2.01
  - B. 4.11
  - C. 1.18
  - D. 8.10
- 

### Question #: 2

What is the  $\text{H}_3\text{O}^+$  concentration in a solution with pH = 8.23?

- A.  $8.2 \times 10^{-6}$  M
  - B.  $1.8 \times 10^{-8}$  M
  - C.  $5.9 \times 10^{-9}$  M
  - D.  $2.6 \times 10^{-10}$  M
- 

### Question #: 3

A 0.085 M solution of a weak monoprotic acid has a percent ionization of 0.59%. What is the acid ionization constant ( $K_a$ ) for the acid?

- A.  $3.0 \times 10^{-6}$
  - B.  $2.9 \times 10^{-2}$
  - C.  $5.1 \times 10^{-7}$
  - D.  $9.1 \times 10^{-10}$
- 

### Question #: 4

Given a mixture of 0.100 M HBr, 0.100 M HBrO ( $K_a = 2.8 \times 10^{-9}$ ), and 0.100 M  $\text{H}_3\text{BO}_3$  ( $K_{a1} = 5.4 \times 10^{-10}$ ), which acid(s) must be considered in calculating the pH?

- A. HBr only
- B. HBr and HBrO
- C. HBrO and  $\text{H}_3\text{BO}_3$
- D.  $\text{H}_3\text{BO}_3$  only

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**Question #: 5**

Which solution requires the use of the quadratic equation to calculate its  $[\text{H}_3\text{O}^+]$ ?

- A. 0.150 M benzoic acid ( $\text{HC}_7\text{H}_5\text{O}_2$ ) solution;  $K_a(\text{HC}_7\text{H}_5\text{O}_2) = 6.5 \times 10^{-5}$
  - B. 0.120 M chlorous acid ( $\text{HClO}_2$ ) solution;  $K_a(\text{HClO}_2) = 1.1 \times 10^{-2}$
  - C. 0.080 M nitrous acid ( $\text{HNO}_2$ ) solution;  $K_a(\text{HNO}_2) = 1.8 \times 10^{-4}$
  - D. 0.120 M hydrocyanic acid ( $\text{HCN}$ ) solution;  $K_a(\text{HCN}) = 4.9 \times 10^{-10}$
- 

**Question #: 6**

What is the  $\text{p}K_a$  of the anilinium ion,  $\text{C}_6\text{H}_5\text{NH}_3^+$ , given that  $K_b$  of  $\text{C}_6\text{H}_5\text{NH}_2$  is  $3.9 \times 10^{-10}$ ?

- A. 10.41
  - B. 4.59
  - C. 6.10
  - D.  $1.6 \times 10^{-4}$
- 

**Question #: 7**

Which choice describes a **basic** solution?

- A.  $\text{pH} > 7$ ,  $\text{pOH} < 7$
  - B.  $\text{pH} < 7$ ,  $\text{pOH} > 7$
  - C.  $\text{pH} = 7$ ,  $\text{pOH} = 7$
  - D.  $\text{pH} > 7$ ,  $\text{pOH} > 7$
- 

**Question #: 8**

Which aqueous solution(s) have a **basic** pH?

Select **all** that apply.

- A.  $\text{NH}_4\text{NO}_3$
- B.  $\text{KClO}$
- C.  $\text{LiC}_2\text{H}_3\text{O}_2$
- D.  $\text{CaBr}_2$

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**Question #: 9**

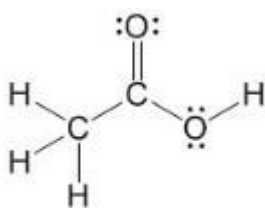
Which of the following is(are) **true** of polyprotic acids? Select **all** that apply.

- A. A polyprotic acid yields more than one hydrogen ion per molecule.
  - B. For a given polyprotic acid, the first ionization constant is much larger than the second ionization constant.
  - C. A polyprotic acid may lose of all of its hydrogen ions (that is, ionize) in a single step.
  - D. For a given polyprotic acid, the first ionization constant is much smaller than the second ionization constant.
- 

**Question #: 10**

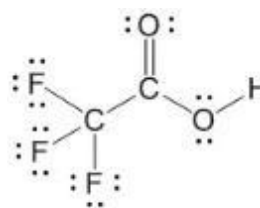
Which is the **strongest** of the acids below?

A.



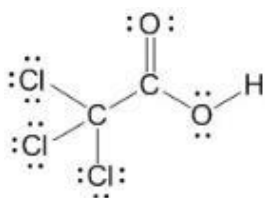
Acetic acid

C.



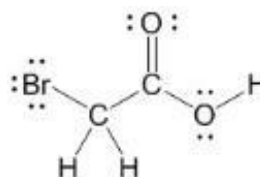
Trifluoroacetic acid

B.



Trichloroacetic acid

D.



Bromoacetic acid

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**Question #: 11**

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

- A.  $\text{HBrO}_4$
- B.  $\text{HBrO}_3$
- C.  $\text{HBrO}_2$
- D.  $\text{HBrO}$

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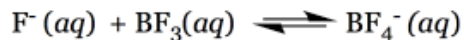
**Question #: 12**

BeCl<sub>2</sub>, BH<sub>3</sub>, and Zn<sup>2+</sup> are all examples of Lewis 1 because they can 2 an electron pair while PH<sub>3</sub>, H<sub>2</sub>S and CN<sup>-</sup> are examples of Lewis 3.

1. \_\_\_\_\_
  2. \_\_\_\_\_
  3. \_\_\_\_\_
- 

**Question #: 13**

Select the **Lewis acid(s)** from the following reactions.



Select **all that apply**.

- A. Fe<sup>3+</sup>
  - B. BF<sub>3</sub>
  - C. H<sub>2</sub>O
  - D. F<sup>-</sup>
- 

**Question #: 14**

Which of the following solutions results in a **buffer**?

- A. 10.0 mL of 0.100 M NaOH + 5.0 mL of 0.100 M HCl
  - B. 10.0 mL of 0.100 M NaOH + 20.0 mL of 0.100 M HCHO<sub>2</sub>
  - C. 20.0 mL of 0.100 M NaOH + 10.0 mL of HClO<sub>2</sub>
  - D. 10.0 mL of 0.100 M NH<sub>3</sub> + 10.0 mL of 0.100 M HCl
- 

**Question #: 15**

What is the pH of a solution that is 0.20 M in HCHO<sub>2</sub> and 0.15 M in NaCHO<sub>2</sub>? K<sub>a</sub>(HCHO<sub>2</sub>) = 1.8 × 10<sup>-4</sup>

pH = 1

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

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**Question #: 16**

If a single drop of 0.100 M NaOH is added to a 0.200 M acetic acid, 0.200 M sodium acetate buffer, how will this affect the pH? The  $pK_a$  of acetic acid is 4.74.

- A. The pH will decrease significantly below 4.74.
- B. The pH will decrease slightly below 4.74.
- C. The pH will increase slightly above 4.74.
- D. The pH will increase significantly above 4.74.

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**Question #: 17**

What is the pH after the addition of 0.030 mol of NaOH to 1.00 L of a buffer that is 0.250 M  $HC_2H_3O_2$  ( $pK_a = 4.74$ ) and 0.250 M  $NaC_2H_3O_2$ ? Ignore any volume change from the addition of NaOH. Report pH to two decimal places.

pH =   1  

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

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**Question #: 18**

Which weak acid, conjugate base pair would be the best choice to prepare a pH 5.00 buffer?

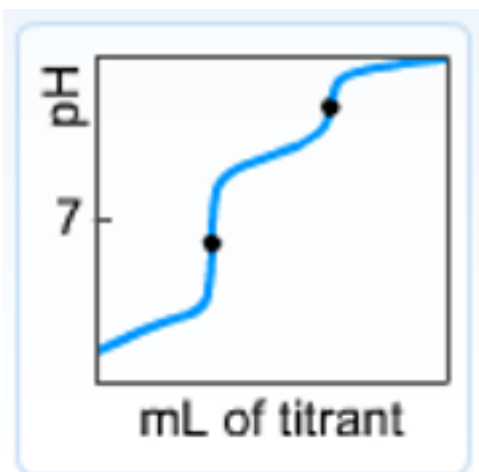
- A. pyruvic acid ( $pK_a = 2.39$ ) and sodium pyruvate
- B. hydroxylammonium ( $pK_a = 5.95$ ) and hydroxylamine
- C. nitrous acid ( $pK_a = 3.34$ ) and sodium nitrite
- D. hypochlorous acid ( $pK_a = 7.54$ ) and lithium hypochlorite

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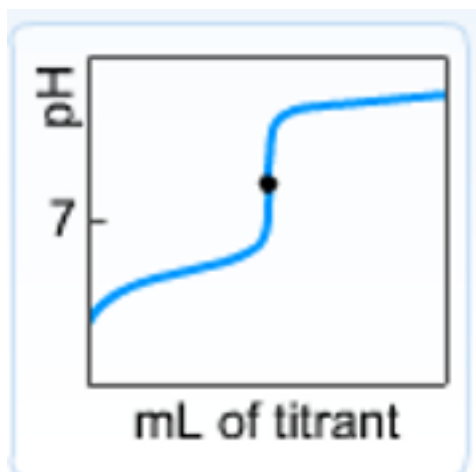
**Question #: 19**

Which of the following pH curves best represents the titration of a strong acid with strong base?

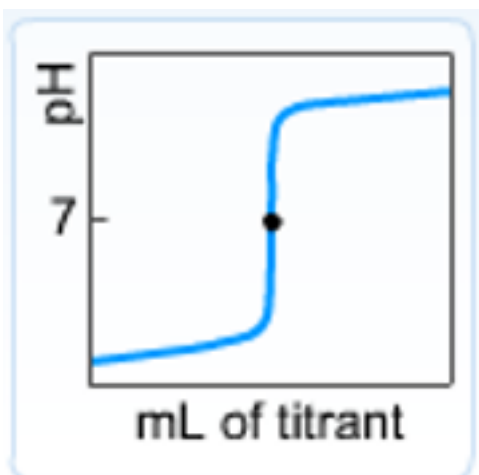
A.



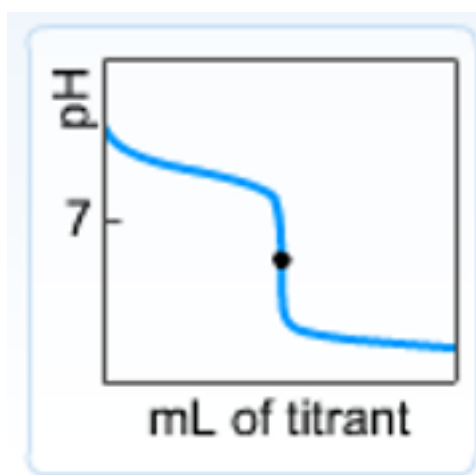
C.



B.



D.



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**Question #: 20**

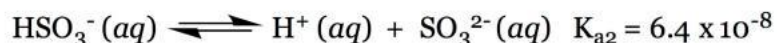
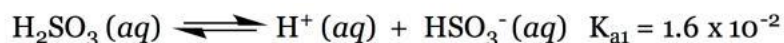
What is the pH after 15.0 mL of 0.500 M LiOH has been added to 100.0 mL of 0.225 M propanoic acid ( $\text{HC}_3\text{H}_5\text{O}_2$ ,  $K_a = 1.3 \times 10^{-5}$ )?

- A. 3.26
- B. 6.88
- C. 5.31
- D. 4.58

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**Question #: 21**

The diprotic acid  $\text{H}_2\text{SO}_3$  is titrated with 0.100 M NaOH.



Select **all the true statements** below about this titration.

- A. The pH curve has two equivalence points.
- B. The volume of NaOH required to reach the second equivalence point is identical to the volume of NaOH used to reach the first equivalence point.
- C. The pH at the two equivalence points will be less than or equal to 7.

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**Question #: 22**

Methyl red changes color from red at pH 4.2 to yellow at pH 6.2.

What is the  $\text{p}K_a$  of methyl red?   1  

What color is the solution at pH 8.0?   2  

What color is the solution at pH 5.4?   3  

- 1. \_\_\_\_\_
- 2. \_\_\_\_\_
- 3. \_\_\_\_\_

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**Question #: 23**

Which of the following compounds' solubilities can be directly compared by considering only their  $K_{sp}$  values?

- A.  $\text{Ag}_2\text{CrO}_4(s)$  and  $\text{PbBr}_2(s)$
- B.  $\text{Ag}_2\text{CrO}_4(s)$  and  $\text{BaSO}_4(s)$
- C.  $\text{Al}(\text{OH})_3(s)$  and  $\text{BaSO}_4(s)$
- D.  $\text{Ag}_2\text{CrO}_4(s)$ ,  $\text{PbBr}_2(s)$ , and  $\text{Al}(\text{OH})_3(s)$

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**Question #: 24**

What is the molar solubility of  $\text{Cr}(\text{OH})_3$  in pure water?

$$K_{sp} = 6.3 \times 10^{-31}$$

- A.  $1.2 \times 10^{-8} \text{ M}$
- B.  $3.1 \times 10^{-15} \text{ M}$
- C.  $2.3 \times 10^{-4} \text{ M}$
- D.  $6.1 \times 10^{-24} \text{ M}$

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**Question #: 25**

Which of the following compounds is less soluble in 0.100 M NaBr solution than in pure water?

Select **all** that apply.

- A.  $\text{PbBr}_2$
  - B.  $\text{KNO}_3$
  - C.  $\text{Na}_2\text{SO}_4$
  - D.  $\text{MgCl}_2$
- 

**Question #: 26**

What happens when two solutions are mixed together such that the concentration of  $\text{Ag}^+$  is  $5.00 \times 10^{-10}$  M and the concentration of  $\text{I}^-$  is  $1.00 \times 10^{-5}$  M in the resulting solution?

$$K_{\text{sp}}(\text{AgI}) = 5.00 \times 10^{-10}$$

- A.  $Q_{\text{sp}} < K_{\text{sp}}$  and the solution remains unsaturated.
  - B.  $Q_{\text{sp}} = K_{\text{sp}}$  and the solution is saturated, resulting in the precipitation of  $\text{AgI}(s)$ .
  - C.  $Q_{\text{sp}} > K_{\text{sp}}$ , resulting in precipitation of  $\text{AgI}(s)$ , leaving behind an unsaturated solution.
  - D.  $Q_{\text{sp}} > K_{\text{sp}}$ , resulting in precipitation of  $\text{AgI}(s)$ , leaving behind a saturated solution.
- 

**Question #: 27**

Calculate the minimum concentration of  $\text{Na}_2\text{SO}_4$  required to selectively precipitate  $\text{BaSO}_4(s)$  from a solution of 0.010 M  $\text{Ba}^{2+}$  and 0.020 M  $\text{Ca}^{2+}$ .

$$K_{\text{sp}}(\text{BaSO}_4) = 1.07 \times 10^{-10}$$

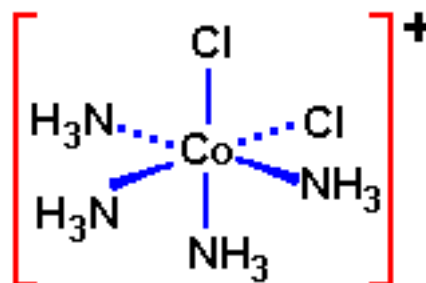
$$K_{\text{sp}}(\text{CaSO}_4) = 7.10 \times 10^{-5}$$

- A.  $1.1 \times 10^{-8}$  M
  - B.  $1.0 \times 10^{-5}$  M
  - C.  $3.7 \times 10^{-3}$  M
  - D.  $4.6 \times 10^{-2}$  M
- 

**Question #: 28**

What is the oxidation state of cobalt and how many  $d$ -electrons does cobalt have in the complex at right?

- A. +1,  $d^8$
- B. +3,  $d^6$
- C. +1,  $d^7$
- D. +3,  $d^4$





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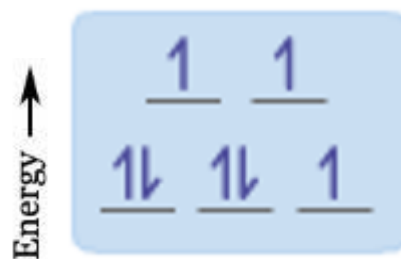
**Question #: 29**

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

A.



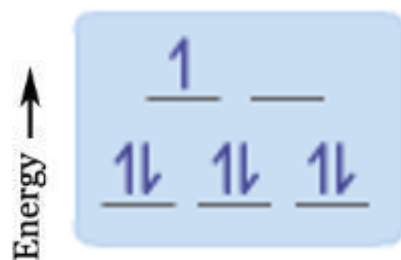
C.



B.



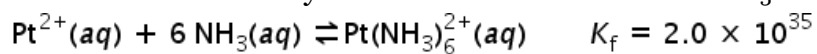
D.



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**Question #: 30**

What is  $[\text{Pt}^{2+}]$  in a solution that is initially 0.010 M  $\text{Pt}^{2+}$  and 0.200 M  $\text{NH}_3$ ?



- A.  $2.0 \times 10^{36}$  M
- B.  $6.0 \times 10^{-35}$  M
- C.  $1.2 \times 10^{-30}$  M
- D.  $6.6 \times 10^{-33}$  M

## CHE 107 Exam 3 Fall 2015

Your Name: \_\_\_\_\_ Your ID: \_\_\_\_\_

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### Question #: 1

What is the pH of lemon juice if the concentration of the  $\text{H}_3\text{O}^+$  ion in the solution is 0.0098 M?

- A. 2.01
  - B. 4.11
  - C. 1.18
  - D. 8.10
- 

### Question #: 2

What is the  $\text{H}_3\text{O}^+$  concentration in a solution with pH = 8.23?

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  - B.  $1.8 \times 10^{-8}$  M
  - C.  $5.9 \times 10^{-9}$  M
  - D.  $2.6 \times 10^{-10}$  M
- 

### Question #: 3

A 0.085 M solution of a weak monoprotic acid has a percent ionization of 0.59%. What is the acid ionization constant ( $K_a$ ) for the acid?

- A.  $3.0 \times 10^{-6}$
  - B.  $2.9 \times 10^{-2}$
  - C.  $5.1 \times 10^{-7}$
  - D.  $9.1 \times 10^{-10}$
- 

### Question #: 4

Given a mixture of 0.100 M HBr, 0.100 M HBrO ( $K_a = 2.8 \times 10^{-9}$ ), and 0.100 M  $\text{H}_3\text{BO}_3$  ( $K_{a1} = 5.4 \times 10^{-10}$ ), which acid(s) must be considered in calculating the pH?

- A. HBr only
  - B. HBr and HBrO
  - C. HBrO and  $\text{H}_3\text{BO}_3$
  - D.  $\text{H}_3\text{BO}_3$  only
- 

### Question #: 5

Which solution requires the use of the quadratic equation to calculate its  $[\text{H}_3\text{O}^+]$ ?

- A. 0.150 M benzoic acid ( $\text{HC}_7\text{H}_5\text{O}_2$ ) solution;  $K_a(\text{HC}_7\text{H}_5\text{O}_2) = 6.5 \times 10^{-5}$
- B. 0.120 M chlorous acid ( $\text{HClO}_2$ ) solution;  $K_a(\text{HClO}_2) = 1.1 \times 10^{-2}$
- C. 0.080 M nitrous acid ( $\text{HNO}_2$ ) solution;  $K_a(\text{HNO}_2) = 1.8 \times 10^{-4}$
- D. 0.120 M hydrocyanic acid (HCN) solution;  $K_a(\text{HCN}) = 4.9 \times 10^{-10}$

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**Question #: 6**

What is the  $pK_a$  of the anilinium ion,  $C_6H_5NH_3^+$ , given that  $K_b$  of  $C_6H_5NH_2$  is  $3.9 \times 10^{-10}$ ?

- A. 10.41
  - ✓ B. 4.59
  - C. 6.10
  - D.  $1.6 \times 10^{-4}$
- 

**Question #: 7**

Which choice describes a **basic** solution?

- ✓ A.  $pH > 7$ ,  $pOH < 7$
  - B.  $pH < 7$ ,  $pOH > 7$
  - C.  $pH = 7$ ,  $pOH = 7$
  - D.  $pH > 7$ ,  $pOH > 7$
- 

**Question #: 8**

Which aqueous solution(s) have a **basic** pH?

Select **all** that apply.

- A.  $NH_4NO_3$
  - ✓ B.  $KClO$
  - ✓ C.  $LiC_2H_3O_2$
  - D.  $CaBr_2$
- 

**Question #: 9**

Which of the following is(are) **true** of polyprotic acids? Select **all** that apply.

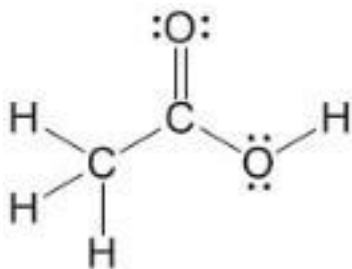
- ✓ A. A polyprotic acid yields more than one hydrogen ion per molecule.
- ✓ B. For a given polyprotic acid, the first ionization constant is much larger than the second ionization constant.
- C. A polyprotic acid may lose of all of its hydrogen ions (that is, ionize) in a single step.
- D. For a given polyprotic acid, the first ionization constant is much smaller than the second ionization constant.

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**Question #: 10**

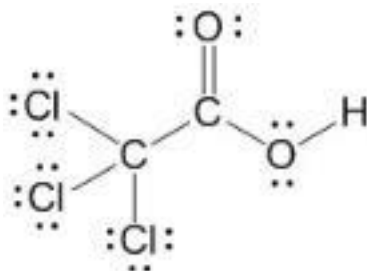
Which is the **strongest** of the acids below?

A.



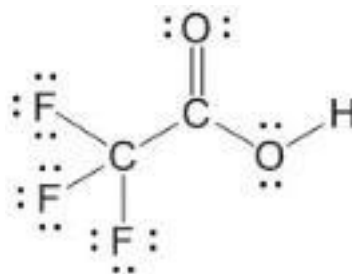
Acetic acid

B.



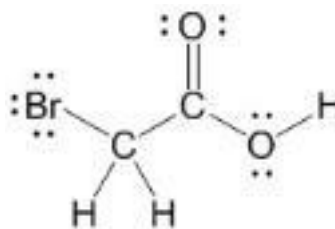
Trichloroacetic acid

✓C.



Trifluoroacetic acid

D.



Bromoacetic acid

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**Question #: 11**

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

- ✓ A. HBrO<sub>4</sub>
- B. HBrO<sub>3</sub>
- C. HBrO<sub>2</sub>
- D. HBrO

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**Question #: 12**

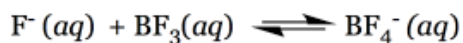
BeCl<sub>2</sub>, BH<sub>3</sub>, and Zn<sup>2+</sup> are all examples of Lewis 1 because they can 2 an electron pair while PH<sub>3</sub>, H<sub>2</sub>S and CN<sup>-</sup> are examples of Lewis 3.

1. acid|acids|
2. accept|except|add|take|
3. bases|base|

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**Question #: 13**

Select the **Lewis acid(s)** from the following reactions.



Select **all that apply**.

- A.  $\text{Fe}^{3+}$
- B.  $\text{BF}_3$
- C.  $\text{H}_2\text{O}$
- D.  $\text{F}^{-}$

---

**Question #: 14**

Which of the following solutions results in a **buffer**?

- A. 10.0 mL of 0.100 M NaOH + 5.0 mL of 0.100 M HCl
- B. 10.0 mL of 0.100 M NaOH + 20.0 mL of 0.100 M  $\text{HCHO}_2$
- C. 20.0 mL of 0.100 M NaOH + 10.0 mL of  $\text{HClO}_2$
- D. 10.0 mL of 0.100 M  $\text{NH}_3$  + 10.0 mL of 0.100 M HCl

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**Question #: 15**

What is the pH of a solution that is 0.20 M in  $\text{HCHO}_2$  and 0.15 M in  $\text{NaCHO}_2$ ?  $K_a(\text{HCHO}_2) = 1.8 \times 10^{-4}$

pH = 1

1. 3.62

---

**Question #: 16**

If a single drop of 0.100 M NaOH is added to a 0.200 M acetic acid, 0.200 M sodium acetate buffer, how will this affect the pH? The  $pK_a$  of acetic acid is 4.74.

- A. The pH will decrease significantly below 4.74.
- B. The pH will decrease slightly below 4.74.
- C. The pH will increase slightly above 4.74.
- D. The pH will increase significantly above 4.74.

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**Question #: 17**

What is the pH after the addition of 0.030 mol of NaOH to 1.00 L of a buffer that is 0.250 M  $\text{HC}_2\text{H}_3\text{O}_2$  ( $pK_a = 4.74$ ) and 0.250 M  $\text{NaC}_2\text{H}_3\text{O}_2$ ? Ignore any volume change from the addition of NaOH. Report pH to two decimal places.

pH = 1

1. 4.84|4.83|4.85|

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**Question #: 18**

Which weak acid, conjugate base pair would be the best choice to prepare a pH 5.00 buffer?

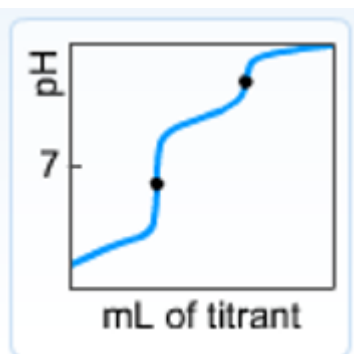
- A. pyruvic acid ( $pK_a = 2.39$ ) and sodium pyruvate
- ✓ B. hydroxylammonium ( $pK_a = 5.95$ ) and hydroxylamine
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- D. hypochlorous acid ( $pK_a = 7.54$ ) and lithium hypochlorite

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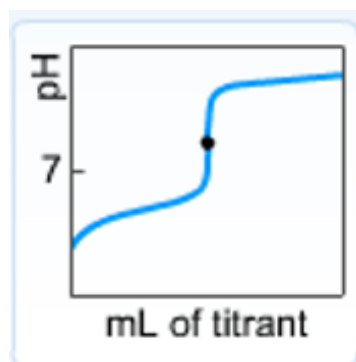
**Question #: 19**

Which of the following pH curves best represents the titration of a strong acid with strong base?

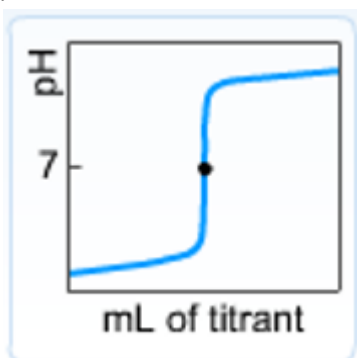
A.



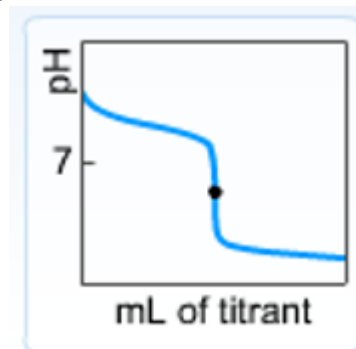
C.



✓ B.



D.



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**Question #: 20**

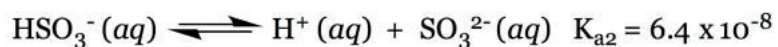
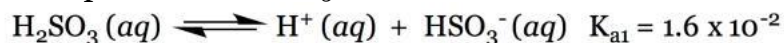
What is the pH after 15.0 mL of 0.500 M LiOH has been added to 100.0 mL of 0.225 M propanoic acid ( $HC_3H_5O_2$ ,  $K_a = 1.3 \times 10^{-5}$ )?

- A. 3.26
- B. 6.88
- C. 5.31
- ✓ D. 4.58

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**Question #: 21**

The diprotic acid  $\text{H}_2\text{SO}_3$  is titrated with 0.100 M NaOH.



Select **all the true statements** below about this titration.

- ✓ A. The pH curve has two equivalence points.
- ✓ B. The volume of NaOH required to reach the second equivalence point is identical to the volume of NaOH used to reach the first equivalence point.
- C. The pH at the two equivalence points will be less than or equal to 7.

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**Question #: 22**

Methyl red changes color from red at pH 4.2 to yellow at pH 6.2.

What is the  $\text{p}K_a$  of methyl red? 1

What color is the solution at pH 8.0? 2

What color is the solution at pH 5.4? 3

1. 5.2
2. yellow
3. orange

---

**Question #: 23**

Which of the following compounds' solubilities can be directly compared by considering only their  $K_{sp}$  values?

- ✓ A.  $\text{Ag}_2\text{CrO}_4(s)$  and  $\text{PbBr}_2(s)$
- B.  $\text{Ag}_2\text{CrO}_4(s)$  and  $\text{BaSO}_4(s)$
- C.  $\text{Al}(\text{OH})_3(s)$  and  $\text{BaSO}_4(s)$
- D.  $\text{Ag}_2\text{CrO}_4(s)$ ,  $\text{PbBr}_2(s)$ , and  $\text{Al}(\text{OH})_3(s)$

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**Question #: 24**

What is the molar solubility of  $\text{Cr}(\text{OH})_3$  in pure water?

$$K_{sp} = 6.3 \times 10^{-31}$$

- ✓ A.  $1.2 \times 10^{-8} \text{ M}$
- B.  $3.1 \times 10^{-15} \text{ M}$
- C.  $2.3 \times 10^{-4} \text{ M}$
- D.  $6.1 \times 10^{-24} \text{ M}$

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**Question #: 25**

Which of the following compounds is less soluble in 0.100 M NaBr solution than in pure water? Select **all** that apply.

- ✓ A.  $\text{PbBr}_2$
- B.  $\text{KNO}_3$
- C.  $\text{Na}_2\text{SO}_4$
- D.  $\text{MgCl}_2$

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**Question #: 26**

What happens when two solutions are mixed together such that the concentration of  $\text{Ag}^+$  is  $5.00 \times 10^{-10}$  M and the concentration of  $\text{I}^-$  is  $1.00 \times 10^{-5}$  M in the resulting solution?

$$K_{\text{sp}}(\text{AgI}) = 5.00 \times 10^{-10}$$

- A.  $Q_{\text{sp}} < K_{\text{sp}}$  and the solution remains unsaturated.
- B.  $Q_{\text{sp}} = K_{\text{sp}}$  and the solution is saturated, resulting in the precipitation of  $\text{AgI}(s)$ .
- C.  $Q_{\text{sp}} > K_{\text{sp}}$ , resulting in precipitation of  $\text{AgI}(s)$ , leaving behind an unsaturated solution.
- ✓ D.  $Q_{\text{sp}} > K_{\text{sp}}$ , resulting in precipitation of  $\text{AgI}(s)$ , leaving behind a saturated solution.

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**Question #: 27**

Calculate the minimum concentration of  $\text{Na}_2\text{SO}_4$  required to selectively precipitate  $\text{BaSO}_4(s)$  from a solution of 0.010 M  $\text{Ba}^{2+}$  and 0.020 M  $\text{Ca}^{2+}$ .

$$K_{\text{sp}}(\text{BaSO}_4) = 1.07 \times 10^{-10}$$

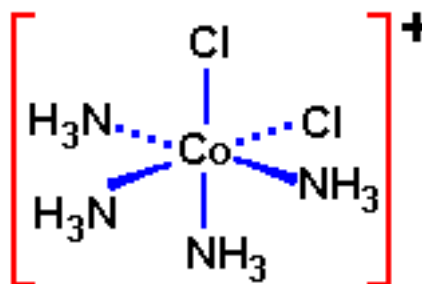
$$K_{\text{sp}}(\text{CaSO}_4) = 7.10 \times 10^{-5}$$

- ✓ A.  $1.1 \times 10^{-8}$  M
- B.  $1.0 \times 10^{-5}$  M
- C.  $3.7 \times 10^{-3}$  M
- D.  $4.6 \times 10^{-2}$  M

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**Question #: 28**

What is the oxidation state of cobalt and how many  $d$ -electrons does cobalt have in the complex at right?



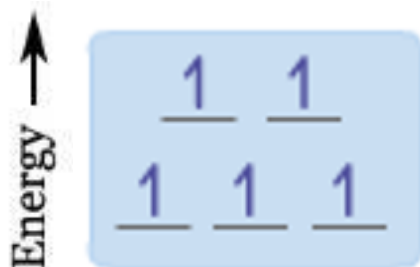
- A. +1,  $d^8$
- ✓ B. +3,  $d^6$
- C. +1,  $d^7$
- D. +3,  $d^4$



**Question #: 29**

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

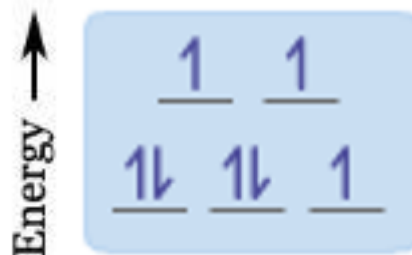
✓ A.



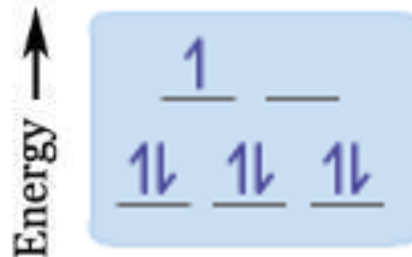
B.



C.

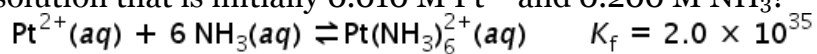


D.



**Question #: 30**

What is  $[\text{Pt}^{2+}]$  in a solution that is initially 0.010 M  $\text{Pt}^{2+}$  and 0.200 M  $\text{NH}_3$ ?



- A.  $2.0 \times 10^{36}$  M
- B.  $6.0 \times 10^{-35}$  M
- C.  $1.2 \times 10^{-30}$  M
- ✓ D.  $6.6 \times 10^{-33}$  M