
Question #: 1

What is the **pH** of the solution formed when 20.0 mL of 0.100 M HCl is mixed with 25.0 mL of 0.200 M HNO₃? Report your answer to three decimal places.

pH = 1

1. _____

Question #: 2

The pH of a 0.224 M butanoic acid solution, HC₄H₇O₂, is 1.237. What is the **percent ionization** of butanoic acid in this solution?

- A. 25.9%
 - B. 1.24%
 - C. 38.6%
 - D. 15.2%
-

Question #: 3

What is the **pH** of a solution that is 0.100 M in HClO ($K_a = 2.9 \times 10^{-8}$) and 0.200 M in HNO₃? Report your answer to three decimal places.

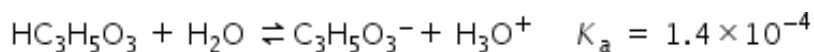
pH = 1

1. _____

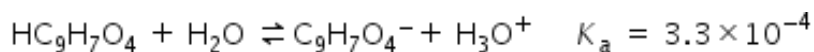
Question #: 4

In a mixture of three weak acids (HC₃H₅O₃, HC₉H₇O₄, and HC₆H₅O) in water, which reaction(s) **must** be considered in calculating the pH? Choose **all** that apply.

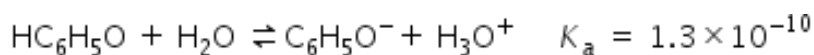
A.



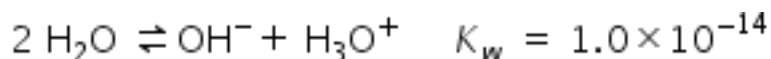
B.



C.



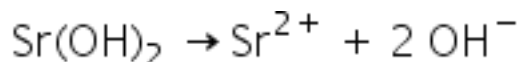
D.



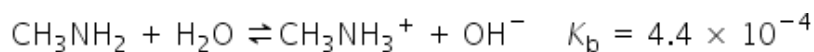
Question #: 5

In a mixture of three bases ($\text{Sr}(\text{OH})_2$, CH_3NH_2 , and $\text{C}_5\text{H}_5\text{N}$) in water, which reaction(s) **must** be considered in calculating the pH? Choose **all** that apply.

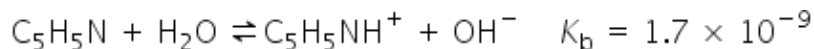
A.



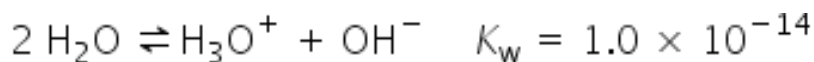
B.



C.

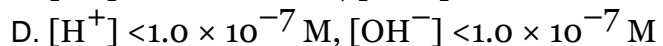
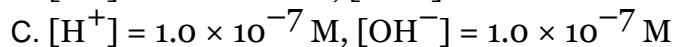
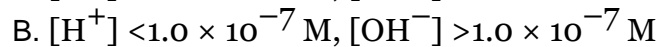


D.



Question #: 6

Which choice best describes a **weakly basic** solution?



E. $[\text{H}^+] > 1.0 \times 10^{-7} \text{ M}$, $[\text{OH}^-] > 1.0 \times 10^{-7} \text{ M}$

Question #: 7

Which aqueous salt solution (0.20 M) has the indicated pH?

- A. $\text{CH}_3\text{NH}_3\text{Cl}$, pH >7
 - B. LiNO_2 , pH >7
 - C. KF , pH = 7
 - D. NaClO_2 , pH <7
-

Question #: 8

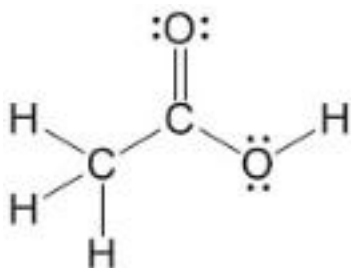
Which of the following is(are) **true** of polyprotic acids? Select **all** that apply.

- A. Polyprotic acids release their acidic protons one at a time in successive ionization steps.
 - B. $K_{a1} < K_{a2} < K_{a3}$
 - C. A 0.0100 M H_2SO_4 solution has pH <2.00.
-

Question #: 9

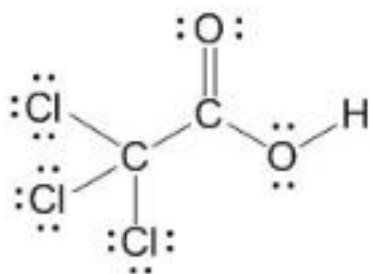
Which is the **strongest** of the acids below?

A.



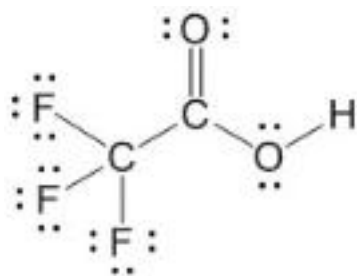
Acetic acid

B.



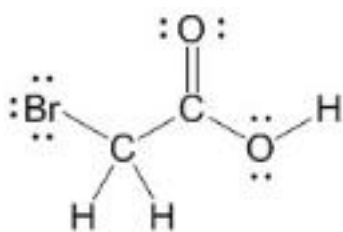
Trichloroacetic acid

C.



Trifluoroacetic acid

D.



Bromoacetic acid

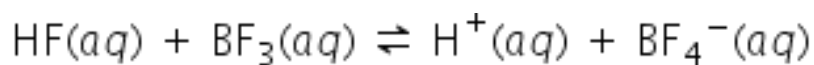
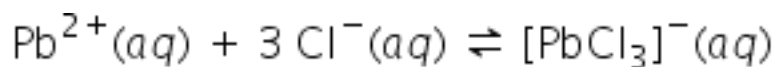
Question #: 10

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

- A. HIO_4
- B. HIO_3
- C. HIO_2
- D. HIO

Question #: 11

Select all of the Lewis bases from the following reactions.



- A. Pb^{2+}
- B. BF_3
- C. HF
- D. Cl^{-}

Question #: 12

Which pair of compounds forms a buffer in aqueous solution?

- A. HCN and HCl
- B. HCN and NaCN
- C. NaCN and KCN
- D. HCl and NaOH
- E. HCl and NaCl

Question #: 13

What is the pH after the addition of 0.020 mol of NaOH to 1.0 L of a buffer that is 0.220 M HF ($\text{p}K_a = 3.46$) and 0.110 M NaF? Ignore any volume change from the addition of NaOH. Report pH to two decimal places.

pH = 1

1.

Question #: 14

Calculate the base-to-acid ratio needed to prepare a pH 4.45 lactic acid, sodium lactate buffer.

$$K_a(\text{lactic acid}) = 1.4 \times 10^{-4}$$

- A. 0.151
- B. 2.85
- C. 3.98
- D. 5.06

Question #: 15

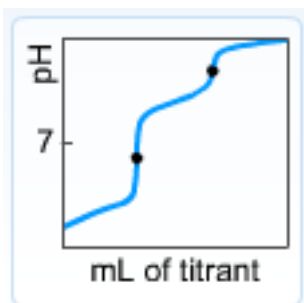
Which choice is the most effective buffer?

- A. 0.020 M nitrous acid and 0.020 M sodium nitrite
- B. 0.200 M formic acid and 0.020 M sodium formate
- C. 0.200 M hypochlorous acid and 0.200 M sodium hypochlorite
- D. 0.020 M benzoic acid and 0.200 M sodium benzoate

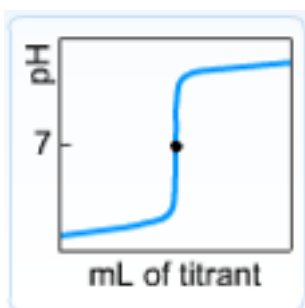
Question #: 16

Which curve best matches a weak acid titrated with a strong base?

A.



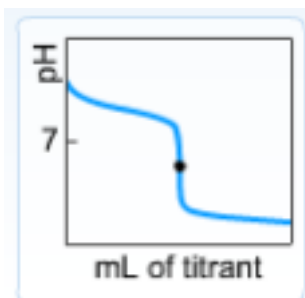
B.



C.



D.



Question #: 17

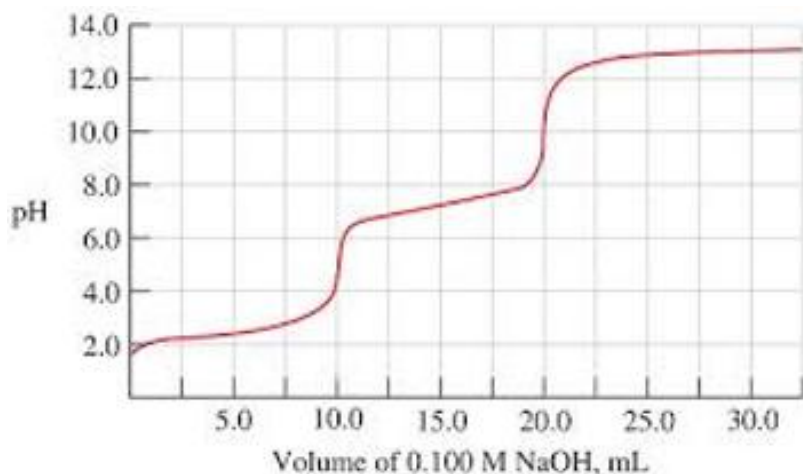
A 25.0 mL portion of 0.200 M CH_3NH_2 ($K_b = 4.4 \times 10^{-4}$) is titrated with 0.250 M HCl. What is the pH after 5.00 mL of HCl has been added? Report your answer to two decimal places.

pH = 1

1.

Question #: 18

Given the titration curve for a 20.0 mL sample of an unknown diprotic acid, H_2A , with 0.100 M NaOH, what is the molarity of the acid?



- A. 0.200 M
- B. 0.100 M
- C. 0.0500 M
- D. 0.0250 M

Question #: 19

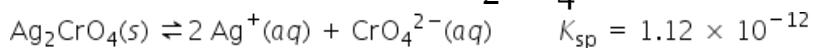
A 25.0 mL portion of 0.200 M CH_3NH_2 ($K_b = 4.4 \times 10^{-4}$) is titrated with 0.250 M HCl. What is the pH at the equivalence point? Report your answer to two decimal places.

pH = 1

1. _____

Question #: 20

What is the molar solubility of Ag_2CrO_4 ?



- A. $6.54 \times 10^{-5} \text{ M}$
- B. $1.20 \times 10^{-10} \text{ M}$
- C. $5.41 \times 10^{-3} \text{ M}$

D. $2.06 \times 10^{-7} \text{ M}$

Question #: 21

The solubility/ies of which compound(s) will be strongly affected by changes in pH? Select **all** that apply.

- A. CoCO_3
 - B. KBr
 - C. MgF_2
 - D. AgCl
-

Question #: 22

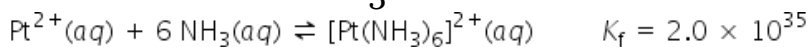
Suppose you have a solution that contains 0.010 M each of Ca^{2+} , Mg^{2+} , and Zn^{2+} . If solid $\text{Na}_2\text{C}_2\text{O}_4$ is slowly added, which of the following oxalate species will precipitate out of solution first?

$$K_{\text{sp}}(\text{CaC}_2\text{O}_4) = 2.32 \times 10^{-9}$$
$$K_{\text{sp}}(\text{MgC}_2\text{O}_4) = 4.83 \times 10^{-6}$$
$$K_{\text{sp}}(\text{ZnC}_2\text{O}_4) = 2.70 \times 10^{-8}$$

- A. CaC_2O_4
 - B. MgC_2O_4
 - C. ZnC_2O_4
 - D. $\text{Na}_2\text{C}_2\text{O}_4$
-

Question #: 23

What concentration of Pt^{2+} will remain when 100.0 mL of 0.020 M $\text{Pt}(\text{NO}_3)_2$ is combined with 100.0 mL of 0.400 M NH_3 ?



- A. $4.6 \times 10^{-37} \text{ M}$
- B. $2.0 \times 10^{-35} \text{ M}$

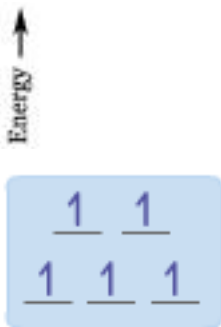
C. $6.6 \times 10^{-33} \text{ M}$

D. $8.1 \times 10^{-30} \text{ M}$

Question #: 24

Which octahedral crystal-field splitting diagram matches a low-spin Mn^{2+} ion?

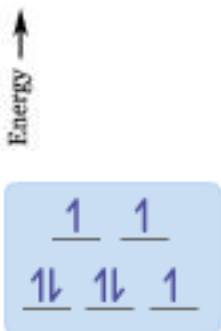
A.



B.

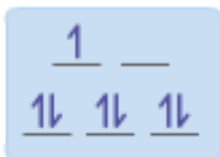


C.



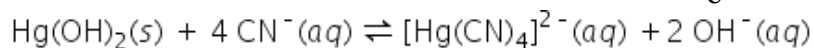
D.





Question #: 25

Calculate the value of the equilibrium constant, K_c , for the following reaction.



The solubility product constant, K_{sp} , for $\text{Hg}(\text{OH})_2$ is 3.1×10^{-26} , and the formation constant, K_f , for $[\text{Hg}(\text{CN})_4]^{2-}$ is 1.8×10^{41} . Report your answer to two significant figures, using the format 1.2E10 to indicate 1.2×10^{10} .

$$K_c = \underline{\quad 1 \quad}$$

Addition of CN^- results in 2 [more, less, the same amount of] $\text{Hg}(\text{OH})_2(\text{s})$ dissolving.

1. _____
2. _____

Question #: 1

What is the **pH** of the solution formed when 20.0 mL of 0.100 M HCl is mixed with 25.0 mL of 0.200 M HNO₃? Report your answer to three decimal places.

pH = 1

1. 0.808

Question #: 2

The pH of a 0.224 M butanoic acid solution, HC₄H₇O₂, is 1.237. What is the **percent ionization** of butanoic acid in this solution?

- ✓A. 25.9%
 - B. 1.24%
 - C. 38.6%
 - D. 15.2%
-

Question #: 3

What is the **pH** of a solution that is 0.100 M in HClO ($K_a = 2.9 \times 10^{-8}$) and 0.200 M in HNO₃? Report your answer to three decimal places.

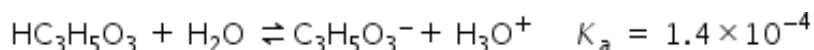
pH = 1

1. 0.699

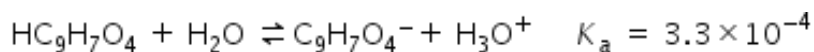
Question #: 4

In a mixture of three weak acids (HC₃H₅O₃, HC₉H₇O₄, and HC₆H₅O) in water, which reaction(s) **must** be considered in calculating the pH? Choose **all** that apply.

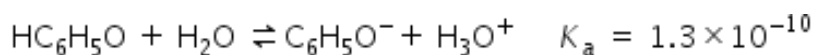
✓A.



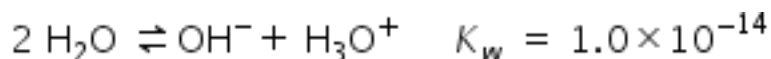
✓B.



C.



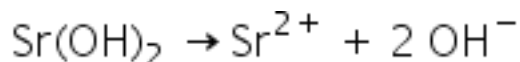
D.



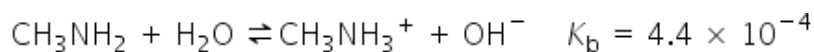
Question #: 5

In a mixture of three bases ($\text{Sr}(\text{OH})_2$, CH_3NH_2 , and $\text{C}_5\text{H}_5\text{N}$) in water, which reaction(s) **must** be considered in calculating the pH? Choose **all** that apply.

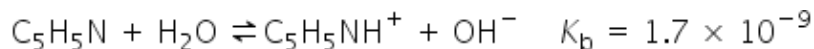
✓A.



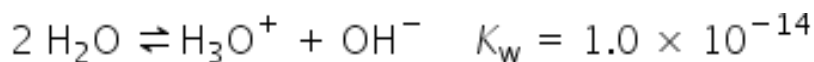
B.



C.

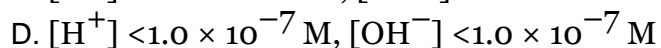
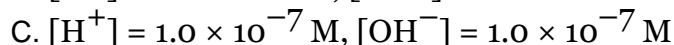
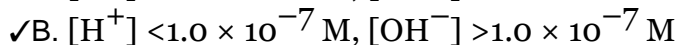


D.



Question #: 6

Which choice best describes a **weakly basic** solution?



$$E. [H^+] > 1.0 \times 10^{-7} \text{ M}, [OH^-] > 1.0 \times 10^{-7} \text{ M}$$

Question #: 7

Which aqueous salt solution (0.20 M) has the indicated pH?

- A. $\text{CH}_3\text{NH}_3\text{Cl}$, pH > 7
- ✓ B. LiNO_2 , pH > 7
- C. KF , pH = 7
- D. NaClO_2 , pH < 7

Question #: 8

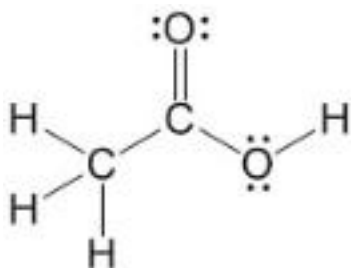
Which of the following is(are) **true** of polyprotic acids? Select **all** that apply.

- ✓ A. Polyprotic acids release their acidic protons one at a time in successive ionization steps.
- B. $K_{a1} < K_{a2} < K_{a3}$
- ✓ C. A 0.0100 M H_2SO_4 solution has pH < 2.00.

Question #: 9

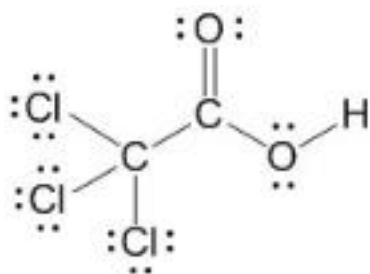
Which is the **strongest** of the acids below?

A.



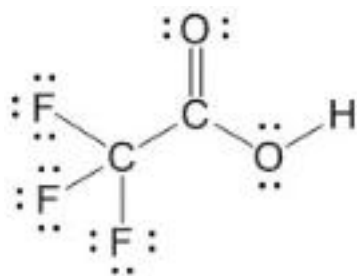
Acetic acid

B.



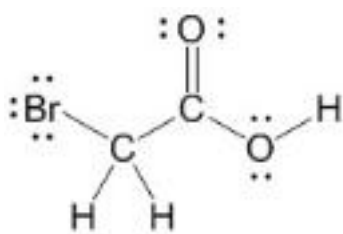
Trichloroacetic acid

✓C.



Trifluoroacetic acid

D.



Bromoacetic acid

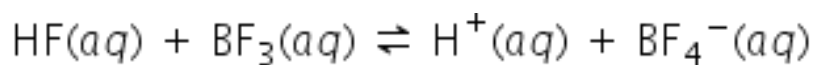
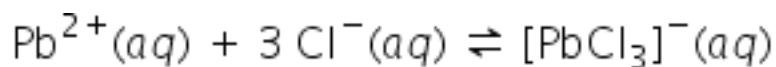
Question #: 10

Which is the weakest of the acids below?

- A. HIO_4
- B. HIO_3
- C. HIO_2
- ✓D. HIO

Question #: 11

Select all of the Lewis bases from the following reactions.



- A. Pb^{2+}
- B. BF_3
- ✓C. HF
- ✓D. Cl^{-}

Question #: 12

Which pair of compounds forms a buffer in aqueous solution?

- A. HCN and HCl
- ✓B. HCN and NaCN
- C. NaCN and KCN
- D. HCl and NaOH
- E. HCl and NaCl

Question #: 13

What is the pH after the addition of 0.020 mol of NaOH to 1.0 L of a buffer that is 0.220 M HF ($\text{p}K_a = 3.46$) and 0.110 M NaF? Ignore any volume change from the addition of NaOH. Report pH to two decimal places.

pH = 1

1. 3.27

Question #: 14

Calculate the base-to-acid ratio needed to prepare a pH 4.45 lactic acid, sodium lactate buffer.

$$K_a(\text{lactic acid}) = 1.4 \times 10^{-4}$$

- A. 0.151
- B. 2.85
- ✓C. 3.98
- D. 5.06

Question #: 15

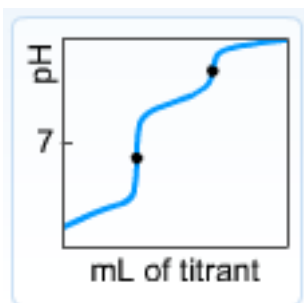
Which choice is the most effective buffer?

- A. 0.020 M nitrous acid and 0.020 M sodium nitrite
- B. 0.200 M formic acid and 0.020 M sodium formate
- ✓C. 0.200 M hypochlorous acid and 0.200 M sodium hypochlorite
- D. 0.020 M benzoic acid and 0.200 M sodium benzoate

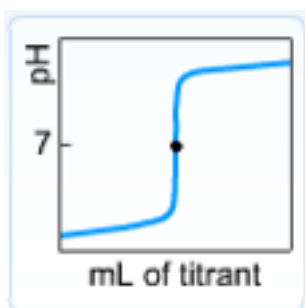
Question #: 16

Which curve best matches a weak acid titrated with a strong base?

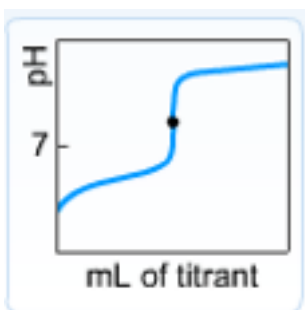
A.



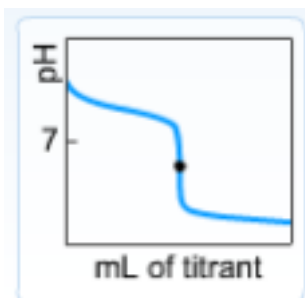
B.



✓C.



D.



Question #: 17

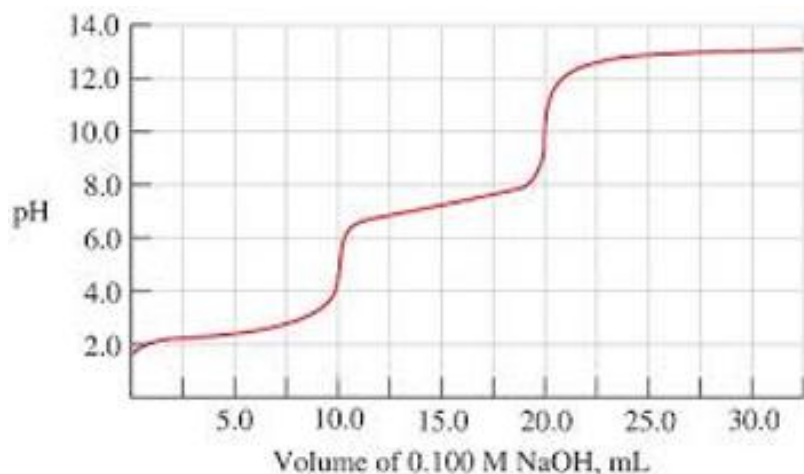
A 25.0 mL portion of 0.200 M CH_3NH_2 ($K_b = 4.4 \times 10^{-4}$) is titrated with 0.250 M HCl. What is the pH after 5.00 mL of HCl has been added? Report your answer to two decimal places.

pH = 1

1. 11.12|11.11|11.13|

Question #: 18

Given the titration curve for a 20.0 mL sample of an unknown diprotic acid, H_2A , with 0.100 M NaOH, what is the molarity of the acid?



- A. 0.200 M
- B. 0.100 M
- ✓C. 0.0500 M
- D. 0.0250 M

Question #: 19

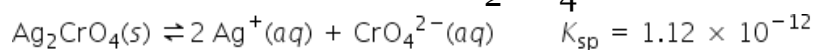
A 25.0 mL portion of 0.200 M CH_3NH_2 ($K_b = 4.4 \times 10^{-4}$) is titrated with 0.250 M HCl. What is the pH at the equivalence point? Report your answer to two decimal places.

pH = 1

1. 5.80|5.799|5.8|

Question #: 20

What is the molar solubility of Ag_2CrO_4 ?



- ✓A. $6.54 \times 10^{-5} \text{ M}$
- B. $1.20 \times 10^{-10} \text{ M}$
- C. $5.41 \times 10^{-3} \text{ M}$

D. $2.06 \times 10^{-7} \text{ M}$

Question #: 21

The solubility/ies of which compound(s) will be strongly affected by changes in pH? Select **all** that apply.

- A. CoCO_3
 - B. KBr
 - C. MgF_2
 - D. AgCl
-

Question #: 22

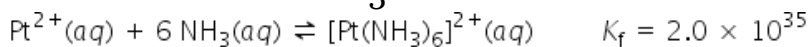
Suppose you have a solution that contains 0.010 M each of Ca^{2+} , Mg^{2+} , and Zn^{2+} . If solid $\text{Na}_2\text{C}_2\text{O}_4$ is slowly added, which of the following oxalate species will precipitate out of solution first?

$$K_{\text{sp}}(\text{CaC}_2\text{O}_4) = 2.32 \times 10^{-9}$$
$$K_{\text{sp}}(\text{MgC}_2\text{O}_4) = 4.83 \times 10^{-6}$$
$$K_{\text{sp}}(\text{ZnC}_2\text{O}_4) = 2.70 \times 10^{-8}$$

- A. CaC_2O_4
 - B. MgC_2O_4
 - C. ZnC_2O_4
 - D. $\text{Na}_2\text{C}_2\text{O}_4$
-

Question #: 23

What concentration of Pt^{2+} will remain when 100.0 mL of 0.020 M $\text{Pt}(\text{NO}_3)_2$ is combined with 100.0 mL of 0.400 M NH_3 ?



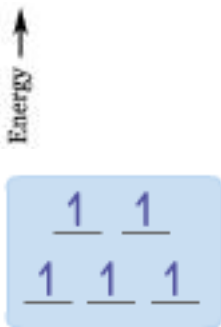
- A. $4.6 \times 10^{-37} \text{ M}$
- B. $2.0 \times 10^{-35} \text{ M}$

- ✓C. $6.6 \times 10^{-33} \text{ M}$
- D. $8.1 \times 10^{-30} \text{ M}$

Question #: 24

Which octahedral crystal-field splitting diagram matches a low-spin Mn^{2+} ion?

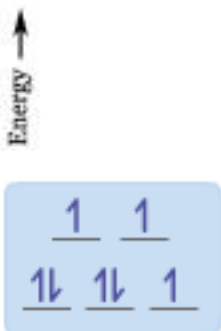
A.



✓B.

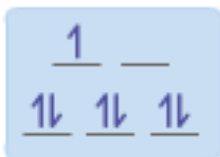


C.



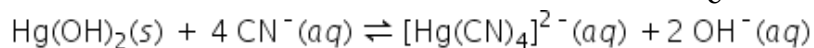
D.





Question #: 25

Calculate the value of the equilibrium constant, K_c , for the following reaction.



The solubility product constant, K_{sp} , for $\text{Hg}(\text{OH})_2$ is 3.1×10^{-26} , and the formation constant, K_f , for $[\text{Hg}(\text{CN})_4]^{2-}$ is 1.8×10^{41} . Report your answer to two significant figures, using the format 1.2E10 to indicate 1.2×10^{10} .

$$K_c = \underline{\quad 1 \quad}$$

Addition of CN^- results in 2 [more, less, the same amount of] $\text{Hg}(\text{OH})_2(\text{s})$ dissolving.

1. 5.6E15|5.6e15|5.58E15|5.58e15|5.6E+15|5.6e+15|5.58E+15|5.58e+15|

2. more|MORE|More|