
4. Choose the **false** statement concerning a solution with $[\text{H}_3\text{O}^+] = 3.4 \times 10^{-9}$.

A. $\text{pOH} = 5.53$

C. $[\text{OH}^-] = 2.9 \times 10^{-6}$

B. $\text{pH} = 14.00 - \text{pOH}$

D. The solution is acidic

5. What is $[\text{OH}^-]$ of an aqueous solution at 25 °C if $[\text{H}_3\text{O}^+] = 2.1 \times 10^{-5}$ M?

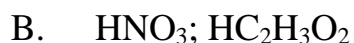
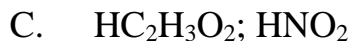
A. 4.8×10^{-10} M

C. 2.1×10^{-9} M

B. 2.1×10^{-19} M

D. 1.0×10^{-7} M

6. _____ is a **weak** acid; _____ is a **strong** acid.



7. The pH of a 0.010 M $\text{HCl}(aq)$ solution is _____. The pH of a 0.010 M $\text{CH}_3\text{COOH}(aq)$ solution is _____.

A. $\text{pH} = 2.00$, $\text{pH} < 2.00$

C. $\text{pH} = 2.00$, $\text{pH} > 2.00$

B. $\text{pH} = 2.00$, $\text{pH} = 2.00$

D. $\text{pH} < 2.00$, $\text{pH} > 2.00$

8. Calculate the pH of a 0.18 M HNO_2 solution. $K_a(\text{HNO}_2) = 4.5 \times 10^{-4}$.

A. 4.54

C. 0.74

B. 2.05

D. 3.29

9. What is the **percent ionization** of a 0.250 M solution of benzoic acid (monoprotic)?
 K_a of benzoic acid = 6.5×10^{-5}

A. 0.0065%

C. 1.6%

B. 0.026%

D. 3.2%

10. Calculate the pH of a solution containing 0.0125 M HBr and 0.0100 M $\text{HC}_7\text{H}_5\text{O}_2$ (benzoic acid). K_a (benzoic acid) = 6.5×10^{-5} .

A. 1.61

C. 3.07

B. 5.89

D. 1.90

11. Select the solution with the **highest** pH.

A. 0.10 M HCl

C. 0.10 M HBr

B. 0.10 M HF

D. A and C are equally the highest.

12. What is the K_b value for CHO_2^- given that the K_a of HCHO_2 is 1.8×10^{-4} ?

A. 5.6×10^{-11}

C. 5.6×10^{-18}

B. 1.8×10^{-10}

D. 1.8×10^{-4}

13. For methylamine (CH_3NH_2), K_b is 4.4×10^{-4} . Select the correct values.

A. $\text{p}K_b(\text{CH}_3\text{NH}_2) = 3.36$, $\text{p}K_a(\text{CH}_3\text{NH}_3^+) = 10.64$

B. $\text{p}K_b(\text{CH}_3\text{NH}_2) = 4.44$, $\text{p}K_a(\text{CH}_3\text{NH}_3^+) = 4.44$

C. $\text{p}K_b(\text{CH}_3\text{NH}_2) = 3.36$, $\text{p}K_a(\text{CH}_3\text{NH}_3^+) = 3.36$

D. $\text{p}K_b(\text{CH}_3\text{NH}_2) = 4.44$, $\text{p}K_a(\text{CH}_3\text{NH}_3^+) = 9.56$

14. The pH of a 0.10 M solution is given for each of the following bases. Select the base with the **largest** K_b value.

A. aniline, $\text{pH} = 8.79$

B. pyridine, $\text{pH} = 9.12$

C. ethylamine, $\text{pH} = 11.87$

D. The formula of the base must be known to determine the answer.

15. What is the pH of a 0.500 M NaF solution? K_a of HF = 3.5×10^{-4}

A. 5.42

C. 8.58

B. 3.46

D. 12.12

16. Which 0.100 M salt solution will result in the **lowest** pH?

A. $\text{CH}_3\text{NH}_3\text{I}$

C. $\text{KC}_2\text{H}_3\text{O}_2$

B. NaNO_3

D. RbClO_4

17. The autoionization constant of water (K_w) depends on temperature. At 0 °C, the pH of neutral water is 7.46. What is K_w of water at 0 °C?

A. 2.65×10^{-7}

B. 1.00×10^{-14}

C. 1.20×10^{-15}

D. 4.73×10^{-15}

18. Which pair has the **stronger** acid listed first?

- A. H_2Te , H_2S C. H_2O , H_2Se
B. H_2O , HF D. H_2S , HCl

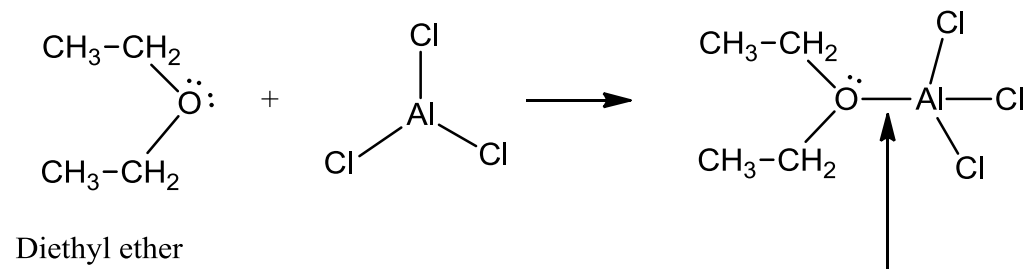
19. Which oxyacid has the **smallest** K_a ?

- A. HNO_3 C. HBrO_3
B. HClO_3 D. HIO_3

20. Which substance can act as a Lewis acid?

- A. NH_3 C. O_2^-
B. Pt^{4+} D. Br^-

21. Consider the bond, designated by an arrow, on the product side of the reaction.



Select the **true** statement.

- A. The bond is formed as aluminum trichloride (the Lewis base) donates electrons to diethyl ether (the Lewis acid).
B. The bond is formed as aluminum trichloride (the Lewis acid) donates electrons to diethyl ether (the Lewis base).
C. The bond is formed as diethyl ether (the Lewis base) donates electrons to aluminum trichloride (the Lewis acid).
D. The bond is formed as diethyl ether (the Lewis acid) donates electrons to aluminum trichloride (the Lewis base).
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22. Which statement about buffers is **false**?

- A. A solution containing significant amounts of a weak acid and its conjugate base is a buffer.
- B. A solution containing significant amounts of a weak base and its conjugate acid is a buffer.
- C. A buffer resists pH changes when the weak acid in the buffer neutralizes an added base.
- D. A buffer resists pH changes when the weak acid in the buffer neutralizes an added acid.

23. Which pair acts as a **buffer** when an equimolar amount of each compound is mixed together in an aqueous solution?

- A. HCl and NaCl
- B. NH₃ and NH₄⁺
- C. H₂SO₄ and SO₄²⁻
- D. H₂O and HF

24. Calculate the pH of a buffer containing 0.18 M CH₃NH₂ and 0.12 M CH₃NH₃Br.
 $K_b(\text{CH}_3\text{NH}_2) = 4.4 \times 10^{-4}$

- A. 4.02
 - B. 3.39
 - C. 10.59
 - D. 10.82
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28. Which solution makes the **least effective** formic acid (HCHO_2) buffer?

- A. 0.200 M HCHO_2 , 0.0200 M KCHO_2
- B. 0.00200 M HCHO_2 , 0.00200 M KCHO_2
- C. 0.0200 M HCHO_2 , 0.200 M KCHO_2
- D. 0.200 M HCHO_2 , 0.200 M KCHO_2

29. Which buffer solution is the **least effective** against the addition of 0.250 moles of HCl ?

- A. 0.500 moles HA , 0.500 moles of A^-
- B. 0.400 moles HA , 0.300 moles of A^-
- C. 0.400 moles HA , 0.200 moles of A^-
- D. 0.200 moles HA , 0.400 moles of A^-

30. 0.10 mol of NaCN is added to 10.0 L of a solution containing 0.10 M NaNO_2 and 0.12 M HNO_2 . Which statement is correct?

- A. Because CN^- reacts with and is neutralized by the HNO_2 of the buffer, the pH changes only minimally.
 - B. Because Na^+ reacts with and is neutralized by the NO_2^- of the buffer, the pH changes only minimally.
 - C. Because buffers cannot neutralize salts, the addition of NaCN causes the pH to decrease substantially.
 - D. Because the solution is not a buffer, the addition of NaCN causes the pH to increase substantially.
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Answer Key:

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