

Name: _____ SID: _____ Seat No.: _____ Room: _____

1.	<p>The conjugate acid–base pairs for the reaction below are:</p> $\text{HPO}_4^{2-} + \text{H}_2\text{SO}_4 \rightleftharpoons \text{HSO}_4^- + \text{H}_2\text{PO}_4^-$ <p>A. $\text{HPO}_4^{2-}/\text{H}_2\text{SO}_4$ and $\text{HSO}_4^-/\text{H}_2\text{PO}_4^-$ B. $\text{HPO}_4^{2-}/\text{HSO}_4^-$ and $\text{H}_2\text{SO}_4/\text{H}_2\text{PO}_4^-$ C. $\text{HPO}_4^{2-}/\text{H}_2\text{PO}_4^-$ and $\text{H}_2\text{SO}_4/\text{HSO}_4^-$ D. $\text{HPO}_4^{2-}/\text{H}_3\text{O}^+$ and $\text{H}_2\text{SO}_4/\text{HO}^-$</p>
2.	<p>What is the hydroxide ion concentration of an aqueous solution that has a hydronium ion concentration of 0.550 M?</p> <p>A. 1.82×10^{-14} M C. 0.260 M B. 0.00 M D. 13.7 M</p>
3.	<p>A solution is prepared by mixing 20.0 mL of 1.50 M HBr and 15.0 mL of 2.25 M HNO_3. Water is added until the final volume is 10.0 L. What is the pH of the final solution?</p> <p>A. 0.798 B. 2.196 C. 2.743 D. 4.954</p>
4.	<p>Calculate the pH of a 0.010 M $\text{Ca}(\text{OH})_2$ solution.</p> <p>A. 12.30 B. 2.00 C. 12.00 D. 1.70</p>
5.	<p>Which of the following is true, at equilibrium, for a 0.1 M solution of a <u>weak</u> base, ZH_3 ($\text{ZH}_3(\text{aq}) + \text{H}_2\text{O} \rightleftharpoons \text{ZH}_4^+(\text{aq}) + \text{OH}^-$) ? K_b for $\text{ZH}_3 = 2.6 \times 10^{-7}$.</p> <p>A. The pH is 13.00. C. $[\text{ZH}_4^+] = [\text{ZH}_3]$ B. The pH is greater than 13.00. D. $[\text{ZH}_4^+] = [\text{OH}^-]$</p>

	6. Which of the following 0.100 M solutions has the highest pH?
	<p>A. HSO_4^- $K_a = 1.3 \times 10^{-2}$</p> <p>B. HF $K_a = 7.1 \times 10^{-4}$</p> <p>C. $\text{C}_6\text{H}_5\text{NH}_3^+$ $K_a = 5.9 \times 10^{-6}$</p> <p>D. $\text{C}_6\text{H}_5\text{OH}$ $K_a = 1.3 \times 10^{-10}$</p>
	7. What is the acid ionization constant, K_a , for a 0.21 M monoprotic acid solution with pH = 4.30?
	A. 1.2×10^{-8} B. 2.5×10^{-9} C. 8.4×10^{-6} D. 5.0×10^{-5}
	8. What is the pH of a 0.10 M carbonic acid (H_2CO_3) solution? K_{a1} for carbonic acid is 4.2×10^{-7} and K_{a2} is 4.8×10^{-11} .
	A. 5.66 B. 8.34 C. 1.00 D. 3.69
	9. What is the pH of 200 mL of a 0.125 M solution of ammonia ($K_b = 1.8 \times 10^{-5}$)?
	A. 11.18 B. 13.10 C. 7.65 D. 8.91
	10. Which one of these salts dissolves in water to give a basic solution?
	A. NaClO_4 B. $\text{Al}(\text{H}_2\text{O})_6^{3+}$ C. NH_4NO_3 D. KNO_2
	11. Which one of the following 0.250 M cation solutions has the lowest pH?
	A. $\text{K}(\text{H}_2\text{O})_6^+(\text{aq})$ B. $\text{Cs}(\text{H}_2\text{O})_6^+(\text{aq})$ C. $\text{Fe}(\text{H}_2\text{O})_6^{2+}(\text{aq})$ D. $\text{Fe}(\text{H}_2\text{O})_6^{3+}(\text{aq})$
	12. K_b for aniline, $\text{C}_6\text{H}_5\text{NH}_2$, is 3.8×10^{-10} . What is K_a for the anilinium ion, $\text{C}_6\text{H}_5\text{NH}_3^+$?
	A. 2.6×10^{-5} B. 1.0×10^{-14} C. 3.8×10^4 D. 5.9×10^{-10}
	13. What is the pH of a 0.205 M $\text{CH}_3\text{NH}_3\text{Cl}$ solution? K_b for CH_3NH_2 is 4.4×10^{-4} .
	A. 2.02 B. 8.33 C. 5.67 D. 11.97

	20.	What volume of 0.155 M HCl is required to neutralize 25.0 mL of 0.0100 M Ca(OH) ₂ ?
		A. 1.61 mL B. 3.23 mL C. 25.0 mL D. 50.0 mL
	21.	Methyl red is a common acid–base indicator with $K_a = 6.3 \times 10^{-6}$. The undissociated form of the indicator is red and the anionic form is yellow. What color would a methyl red solution have at pH = 8.0?
		A. red B. orange C. yellow D. pink
	22.	In which one of the following titrations will the pH be less than 7.0 at the equivalence point? K_a for CH ₃ COOH = 1.8×10^{-5} ; K_b for NH ₃ = 1.8×10^{-5}
		A. 0.1 M HCl with 0.1 M Ca(OH) ₂ C. 0.1 M CH ₃ COOH with 0.1 M NaOH B. 0.1 M HCl with 0.1 M NH ₃ D. 0.1 M CH ₃ COOH with 0.1 M NH ₃
	23.	What is the pH of a solution obtained by mixing 217 mL of a 0.118 M sodium hydroxide solution with 94.0 mL of a 0.452 M formic acid solution? K_a for formic acid = 1.7×10^{-4} . You may assume that volumes are additive.
		A. 2.95 B. 3.77 C. 3.95 D. 6.89
	24.	What is the pH at the equivalence point when 50.0 mL of 0.250 M benzoic acid is titrated with 0.100 M sodium hydroxide? Assume volumes are additive. K_a for benzoic acid, a monoprotic acid, is 6.5×10^{-5} .
		A. 8.52 B. 3.04 C. 2.67 D. 11.33
	25.	Which statement is true concerning titrations and indicators?
		A. All indicators change color at the same pH. B. Indicators are weak acids or bases that have distinctly different colors in the ionized and non-ionized form. C. All acid–base titrations have a pH = 7.0 at the equivalence point. D. The equivalence point in all acid–base titrations occurs when there are equal volumes of acid and base solutions.