

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

1.	K _a of phenol, C ₆ H ₅ OH, is 1.3 x 10 ⁻¹⁰ . Which statement is true about a 0.10 M aqueous solution of phenol? [C ₆ H ₅ OH(aq) ⇌ H ⁺ (aq) + C ₆ H ₅ O ⁻ (aq)]
	A. pH = 1.00 B. pH < 1.00
	C. [H ⁺] = [C ₆ H ₅ O ⁻] D. [H ⁺] >> [C ₆ H ₅ O ⁻]

2.	What is the pH of a solution that was made by dissolving 1.90 g of pyridine, C ₅ H ₅ N, and diluting to a final volume of 250 mL? K _b (pyridine) = 1.7 x 10 ⁻⁹ ; molar mass of pyridine = 79 g.
	A. 4.89 B. 10.06 C. 3.94 D. 9.11

3.	K _a of hydrofluoric acid, HF (aq), is 7.1 x 10 ⁻⁴ . K _b of the benzoate anion, C ₆ H ₅ CO ⁻ (aq), is 1.5 x 10 ⁻¹⁰ . Which of the following species is the strongest acid in aqueous solution?
	A. HF B. C ₆ H ₅ CO ₂ H C. F ⁻ D. C ₆ H ₅ CO

4.	What is the pH of a 0.450 M CH ₃ NH ₃ Br solution? K _b for CH ₃ NH ₂ is 4.4 x 10 ⁻⁴ .
	A. 5.50 B. 8.50 C. 2.35 D. 11.65

5.	Which of these salts will not dissolve to give a solution with the indicated pH?
	A. KHSO ₄ , pH < 7; K _a (HSO) = 1.3 x 10 ⁻²
	B. NaClO ₄ , pH = 7
	C. NH ₄ Cl, pH > 7
	D. KF, pH > 7

6.	Which of the following result in a buffered solution when equal volumes of the two aqueous solutions are mixed?
	A. 0.400 M CH ₃ COOH (acetic acid) and 0.400 M NaOH
	B. 0.400 M CH ₃ COOH and 0.800 M NaOH
	C. 0.400 M CH ₃ COOH and 0.20 M NaOH
	D. 0.400 M CH ₃ COOH and 0.400 M NH ₃

7.	<p>What is the pH of the solution obtained by mixing 0.15 moles of ascorbic acid, $C_6H_8O_6$, with 0.40 moles of sodium ascorbate, $C_6H_7O_6Na$ and diluting to a volume of 500 mL with H_2O? K_a for $C_6H_8O_6$ is 8.0×10^{-5}; molar masses: ascorbic acid = 176 g, sodium ascorbate = 198 g</p> <p>A. 2.46 B. 3.67 C. 9.48 D. 4.52</p>
8.	<p>The addition of 80.0 mL of 0.25 M KOH solution to 50.0 mL of 0.50 M HCl solution gives a solution with which pH? Assume volumes are additive.</p> <p>A. 0.038 B. 1.00 C. 13.00 D. 1.41</p>
9.	<p>What is the pH of the solution that results when 100. mL of 0.125 M HCl is added to 250. mL of 0.200 M NH_3? Assume volumes are additive. K_b for NH_3 is 1.8×10^{-5})</p> <p>A. 4.27 B. 0.90 C. 9.73 D. 11.28</p>
10.	<p>What is the pH at the equivalence point when 150. mL of 0.250 M acetic acid, CH_3COOH, is titrated with 0.150 M NaOH? K_a for CH_3COOH is 1.8×10^{-5}. Assume volumes are additive.</p> <p>A. 8.86 B. 5.14 C. 7.00 D. 9.57</p>
11.	<p>Which of the following statements is true when 10.0 mL of 0.010 M $AgNO_3$ is mixed with 100. mL of 0.10 M Na_2SO_4? K_{sp} for Ag_2SO_4 is 1.4×10^{-5}. Assume volumes are additive.</p> <p>A. $Q = 1.4 \times 10^{-5}$; the solution is a saturated solution. B. $Q = 1.0 \times 10^{-5}$; Ag_2SO_4 will precipitate. C. $Q = 8.26 \times 10^{-5}$; Ag_2SO_4 will precipitate. D. $Q = 7.51 \times 10^{-8}$; Ag_2SO_4 will not precipitate.</p>
12.	<p>What is the equilibrium HPO_4^- concentration in a 1.0 M H_3PO_4 solution? For H_3PO_4: $K_{a1} = 7.5 \times 10^{-3}$ $K_{a2} = 6.2 \times 10^{-8}$ $K_{a3} = 4.8 \times 10^{-13}$</p> <p>A. 3.3×10^{-2} M C. 6.2×10^{-8} M B. 4.6×10^{-5} M D. 1.8×10^{-10} M</p>
13.	<p>What is the molar solubility of lanthanum iodate, $La(IO_3)_3$? K_{sp} for $La(IO_3)_3$ is 6.2×10^{-12}.</p> <p>A. 5.8×10^{-5} M C. 4.0×10^{-44} M B. 1.6×10^{-3} M D. 6.9×10^{-4} M</p>

14.	What is the molar solubility of CuBr in 0.10 M aqueous KBr? K_{sp} (CuBr) = 4.2×10^{-8} ; KBr completely ionizes in solution; ignore the possibility of complex formation between CuBr and Br^- .
	A. 4.2×10^{-7} M B. 2.0×10^{-4} M C. 2.2×10^{-3} M D. 4.2×10^{-9} M
15.	What is the molar solubility of magnesium hydroxide in an aqueous solution buffered at pH = 9.00? $K_{sp} = 8.9 \times 10^{-12}$ for $\text{Mg}(\text{OH})_2$
	A. 1.0×10^{-5} M B. 8.9×10^{-2} M C. 8.9×10^{-7} M D. 8.9×10^{-12} M
16.	CuSO_4 is very soluble in water. Gradual addition of aqueous NH_3 to a 0.25 M blue, aqueous solution of CuSO_4 causes first the precipitation of a pale blue solid, followed by redissolution to give an intensely blue solution. Which statement is correct?
	A. The initial blue solution contains principally $[\text{Cu}(\text{OH})_4]^{2-}$ ions. B. The pale blue precipitate is $\text{Cu}(\text{NH}_2)_2$. C. The pale blue precipitate redissolves because the continued addition of aqueous NH_3 lowers the pH of the solution. D. The principal copper species in the final, intensely blue solution is the $[\text{Cu}(\text{NH}_3)_4]^{2+}$ ion.
17.	What is K_{sp} for SrF_2 if the solubility of SrF_2 is 0.129 g/L? Molar mass of SrF_2 is 125.6 g.
	A. 6.9×10^{-8} B. 4.3×10^{-9} C. 8.6×10^{-3} D. 6.3×10^{-2}
18.	Which metal is correctly matched with its maximum oxidation state?
	A. Sc, 5+ B. Cr, 6+ C. Mn, 5+ D. Co, 8+
19.	What is the valence electron configuration of a Rh^{3+} ion?
	A. $4d^3$ B. $3d^3$ C. $4d^6$ D. $5s^2 4d^4$
20.	What are the coordination number and oxidation state of cobalt in the complex compound <i>trans</i> - $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{NO}_3$?
	A. 5, +6 B. 6, +3 C. 5, +3 D. 6, +2

21.	Name the compound $K_4[Co(CN)_6]$.
	A. Potassium cobalt cyanide (IV) B. Potassium hexacyanocobaltate (II) C. Tetrapotassium hexacyanocobaltate (IV) D. Potassium cobalt (II) hexa(nitrocarbide)

22.	Which complex can exhibit geometric (<i>cis-trans</i>) isomerism?
	A. $[Pt(NH_3)_3Cl]^+$, square planar B. $[Cr(NH_3)_5Cl]^{2+}$, octahedral C. $[Pt(en)_2]^{2+}$, square planar, en = $H_2NCH_2CH_2NH_2$ D. $[Co(NH_3)_4Cl_2]^+$, octahedral

23.	Which of these metal complexes has no unpaired electrons in the complex ion?
	A. $[V(H_2O)_6]^{3+}$ B. $[Fe(CN)_6]^{4-}$ C. $[CoF_6]^{3-}$ D. $[Cu(H_2O)_4]^{2+}$

24.	Which of these ions forms a colorless aqueous solution?
	A. Sc^{3+} B. Cr^{3+} C. Fe^{2+} D. Cu^{2+}

A	25.	$Fe(NO_3)_3$ dissolves in water to give an acidic solution because
		A. the water ligands in $[Fe(H_2O)_6]^{3+}$ are more acidic than free water molecules. B. the NO ions form HNO_3 (<i>aq</i>). C. the hydroxy ligands in $[Fe(OH)_4]^-$ are very acidic. D. the Fe^{3+} ion catalyzes the autoionization of H_2O into H^+ (<i>aq</i>) and OH^- (<i>aq</i>), lowering the pH of the water solvent.