

IWS 2 (10 points)

Easy Level (0.1 points each * 15 problems = 1.5 points total)

1. Identify the ligands in the complex compounds: $[Cr(OH)_4]^-$; $[CuCl_4]^{2-}$; $[Cr(NH_3)(H_2O)_4]^{2+}$; $[Fe(CN)_6]^{4-}$.
2. Find the coordination number of the central metal ion in $[Cr(H_2O)_6]^{3+}$; $[CoCl_4(NH_3)_2]^-$; $[Zn(OH)_4]^{2-}$; $[Ni(CO)_4]$.
3. Calculate the molar mass of the complex compound: $[Co(NH_3)_6]Cl_3$; $H_2[PtCl_6]$; $(NH_4)_2[Ce(NO_3)_6]$; $[NpO_2Cl_4]^{2-}$.
4. Determine the oxidation state of the metal in the complex: $[Ag(NH_3)_2]^+$; $[SbF_6]^-$; $[Fe(CO)_5]$; $[CdI_4]^{2-}$.
5. Provide the IUPAC name for the complex compound: $[Ni(CO)_4]$; $[Fe(CO)_3(NO)]$; $[Fe(C_2O_4)_3]^{3-}$.
6. Identify whether $[Pt(NH_3)_2Cl_2]$ exhibits cis-trans isomerism.
7. How many grams of NaCl are needed to prepare 500 mL of a 0.5 M NaCl solution?
8. How much water should be added to 100 mL of a 2 M HCl solution to dilute it to 0.5 M?
9. What is the final concentration when 200 mL of 0.5 M NaOH is mixed with 300 mL of 0.2 M NaOH?
10. Calculate the weight/volume percentage concentration of a solution prepared by dissolving 10 g of NaOH in 250 mL of water.
11. Calculate the volume required to prepare 1 L of 0.2 M KOH from a 1 M KOH solution.
12. What is the pH of a 0.01 M HCl solution?
13. Calculate the molarity of a solution prepared by dissolving 10 g of NaOH in 500 mL of water.
14. Identify the type of complex formed when excess ammonia is added to a solution of copper sulfate.
15. If 100 mL of 0.1 M HCl is mixed with 100 mL of water, what is the final concentration of HCl?

Medium Level (0.3 points each * 15 problems = 4.5 points total)

16. Explain the crystal field splitting in octahedral and tetrahedral complexes.
17. How many grams of KNO_3 are required to prepare 250 mL of 0.5 M KNO_3 solution?
18. Calculate the dilution factor when 50 mL of a 6 M solution is diluted to 300 mL.
19. What is the final concentration of NaCl when 100 mL of 1 M NaCl is mixed with 200 mL of 0.5 M NaCl?
20. How would you prepare 1 L of a buffer solution with a pH of 7.4 using NaH_2PO_4 and Na_2HPO_4 ?
21. Determine the oxidation state of iron in $[Fe(C_2O_4)_3]^{3-}$.
22. Write the IUPAC name for $[Cr(NH_3)_5Cl]Cl_2$; $[Ni(CO)_4]$; $[Eu(EDTA)]^-$; $[SnCl_6]^{2-}$.
23. Predict the geometry of $[Zn(NH_3)_4]^{2+}$.
24. If you have a 10 M stock solution of H_2SO_4 , how would you prepare 1 L of a 0.5 M solution?
25. Provide examples of ionization isomers for the complex $[Co(NH_3)_5Br]SO_4$.
26. Calculate the concentration of Cl^- ions in a solution of $[Cr(H_2O)_4Cl_2]Cl$.

27. Calculate the mass/volume percentage of a solution prepared by dissolving 25 g of sugar in 500 mL of water.
 28. How would you prepare 250 mL of 0.1 M Na_2CO_3 solution from solid Na_2CO_3 ?
 29. Arrange the following ligands in order of increasing field strength: H_2O , NH_3 , CN^- , Cl^- .
 30. Calculate the pH of a solution prepared by diluting 25 mL of 0.2 M HCl to 250 mL.
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Hard Level (0.4 points each * 10 problems = 4.0 points total)

31. Explain how chelation therapy works using EDTA to treat metal poisoning.
32. Discuss the factors affecting the stability of metal complexes.
33. You have 100 mL of a 2 M NaOH solution. How would you prepare 250 mL of 0.5 M NaOH solution?
34. When 50 mL of 1 M HCl is mixed with 150 mL of 0.5 M NaOH , what is the pH of the resulting solution?
35. Describe the steps to prepare potassium hexacyanoferrate(III) from iron(III) chloride and potassium cyanide.
36. Calculate the pH of a buffer solution made by mixing 50 mL of 0.1 M acetic acid and 50 mL of 0.1 M sodium acetate.
37. Given the equilibrium constant for the formation of $[\text{Cu}(\text{NH}_3)_4]^{2+}$ is $K_f = 1.7 \cdot 10^{13}$, calculate the concentration of $[\text{Cu}(\text{NH}_3)_4]^{2+}$ in a solution containing 0.1 M Cu^{2+} and 1 M NH_3 .
38. Explain how UV-Vis spectroscopy can be used to determine the concentration of a metal-ligand complex.
39. Describe Job's method and how it can be used to determine the stoichiometry of a metal-ligand complex.
40. How would you prepare 500 mL of 0.01 M HNO_3 from a 16 M concentrated stock solution? Describe the safety precautions you would take.