IWS 3 (10 points)

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

1. If 25.0 mL of a 0.02 M EDTA solution is required to titrate 50.0 mL of a Mg^{2+} solution, what is the molarity of the Mg^{2+} solution?
2. In a titration of 0.1 M Fe^{2+} with 0.1 M Ce^{4+}, what is the equivalence point in terms of Fe^{2+} moles?
3. If 30.0 mL of 0.1 M EDTA solution is used to titrate 0.5 g of $CaCO_3$, what is the purity of $CaCO_3$ in the sample?
4. How many moles of MnO_4^- are required to reach the endpoint in the titration of 0.1 M Fe^{2+} solution (25 mL)?
5. Calculate the concentration of Zn^{2+} in a solution if 40 mL of 0.05 M EDTA is required to reach the endpoint.
6. How much 0.01 M EDTA is needed to titrate 100 mL of 0.02 M Pb^{2+} solution?
7. If 25.0 mL of 0.02 M $Na_2S_2O_3$ is needed to titrate I_2 in a redox titration, calculate the molar mass of $Na_2S_2O_3$.
8. If 50 mL of 0.1 M Cr^{3+} is titrated with 0.1 M EDTA, how many moles of Cr^{3+} are present at the equivalence point?
9. What is the molarity of the Ca^{2+} ion in a solution if 25 mL of 0.01 M EDTA is needed to titrate 50 mL of the solution?
10. What indicator would you use in a redox titration involving Fe^{2+} and Ce^{4+}, and why?
11. How many moles of $KMnO_4$ are needed to reach the endpoint in a titration of 0.1 M Fe^{2+} (25 mL)?
12. Calculate the concentration of a Pb^{2+} solution if 50 mL of 0.1 M EDTA is required for titration.
13. How many grams of $Na_2S_2O_3$ are required to titrate 25 mL of a 0.05 M I_2 solution?
14. What volume of 0.01 M EDTA is needed to titrate 100 mL of 0.02 M Ni^{2+} solution?
15. How many moles of MnO_4^- are required to titrate 25 mL of a 0.1 M Fe^{2+} solution?

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

16. In a titration between Fe^{2+} and Ce^{4+}, calculate the number of electrons transferred at the equivalence point.
17. If 25 mL of 0.1 M EDTA is used to titrate 50 mL of Zn^{2+} solution, calculate the stoichiometry of the reaction.
18. Draw and analyze the titration curve of a titration between 0.1 M Fe^{2+} and 0.1 M MnO_4^-.
19. A solution of Zn^{2+} is titrated with EDTA using a back titration method. If 25 mL of 0.1 M EDTA is required to reach the endpoint, calculate the concentration of Zn^{2+}.
20. Determine the molarity of a Cr^{3+} solution if 50 mL of 0.02 M EDTA is required to titrate 100 mL of the solution.
21. Given the formation constant K_f for $[Cu(EDTA)]^{2-}$ is 1.0×10^{18}, calculate the concentration of free Cu^{2+} in a solution after titration with EDTA.

22. Explain how you would detect the endpoint in a redox titration between Fe^{2+} and $KMnO_4$.

23. A 100 mL sample of water requires 35 mL of 0.01 M EDTA for titration. Calculate the hardness of the water in ppm $CaCO_3$.

24. How would you prepare a buffer solution to maintain a pH of 10 for the titration of Zn^{2+} with EDTA?

25. Determine the change in oxidation number for Mn in the titration of Fe^{2+} with $KMnO_4$.

26. Calculate the equilibrium constant for the redox reaction between Ce^{4+} and Fe^{2+}, given their standard electrode potentials.

27. Which indicator would you choose for a titration between Zn^{2+} and EDTA, and why?

28. Calculate the mass of Fe^{2+} in a solution if 25 mL of 0.1 M $KMnO_4$ is required for titration.

29. In the redox titration of Fe^{2+} with MnO_4^-, calculate the moles of MnO_4^- needed to oxidize 1 mole of Fe^{2+}.

30. Calculate the concentration of Fe^{2+} in a solution if 50 mL of 0.1 M Ce^{4+} is required for titration.

Hard Level (0.4 points each * 10 problems = 4.0 points total)

31. In a titration involving Fe^{2+} and EDTA, calculate the concentration of Fe^{2+} in a 100 mL solution if 50 mL of 0.1 M EDTA is required.

32. Given the equilibrium constant for the formation of $[Fe(EDTA)]^{2-}$ is 1.0×10^{25}, calculate the concentration of free Fe^{2+} in a solution after titration.

33. A solution contains both Zn^{2+} and Mg^{2+} ions. Calculate the concentration of each ion after titration with 0.1 M EDTA.

34. In the titration of Fe^{2+} with $KMnO_4$, analyze the redox reaction in terms of electron transfer and balancing the equation.

35. Calculate the pH of a buffer solution used in the titration of Fe^{2+} with Ce^{4+}, given the pKa of the buffer components.

36. Discuss the kinetic factors affecting the rate of the redox titration between Fe^{2+} and MnO_4^-.

37. Calculate the stability constant of a complex formed between Co^{2+} and EDTA during a titration.

38. Given the redox potentials of MnO_4^- and Fe^{2+}, calculate the cell potential during the titration process.

39. Calculate the concentration of Cr^{3+} in a solution after titration with 0.05 M EDTA, considering the complexation constant.

40. Interpret the titration curve for the titration of Cr^{3+} with EDTA, focusing on the different regions and the equivalence point.