Concepts and calculations related to the final exam

Chapters 0-6 (0 point). But the contents are important for some calculations and explanations involved in the following chapters.

Chapter 8.

1. The effect of ionic strength on acid dissociation, pH of water, and solubility of a precipitate.
2. Ionic atmosphere and ionic strength.
3. Activity and activity coefficient
4. The relationship between activity coefficient and ionic strength (Extended Debye-Hückle equation will be provided).
5. Charge and mass balance equations
6. Setting up enough equations using charge and mass balance equations and equilibrium constants for a solution containing several species.

Chapters 7 and 9.

1. Means to detect the end point of a titration.
2. Systematic treatments of weak acid and base equilibria
3. Calculating the pH values of weak acid and base in relatively high and low acid/base concentrations.
4. Buffer solutions and components of a buffer solution.
5. Henderson-Hasselbalch equation (provided) and the calculations involved (dilution, addition of an acid, preparation of a buffer solution and some special cases).
6. Fraction of dissociation α. The relationship between α and the solution pH.

Chapter 11.

1. Strong acid-base titration curve. Calculating the pH values in the three regions: (a) before, (b) at, and (c) after equivalence point
2. Strong acid-monoprotic weak base (or vice versa) titration curve. Calculating the pH values in the four regions: (a) before titrant is added, (b) before, (c) at, and (d) after the equivalence point.
3. How indicator works and the choice of an indicator for a particular titration.

Chapter 12. EDTA Titrations

1. The chelating effect and multidentate ligands.
2. Conditional formation constant of a metal-EDTA complex. The use of it to calculate free metal concentration in a metal-EDTA solution of known concentration.
3. Calculate pM^{n+} at different stages of an EDTA titration: before, at and after the equivalence point.

Chapters 14-16. Electrochemistry, Electrodes and Poteniometry, and Redox Titration

1. Cell notation. Draw a cell from a given notation or write the notation for a cell drawing.
2. Standard reduction potential. Identifying (strong) oxidants and reductants. Nernst equation.
3. Developing the Nernst equation (will be provided) based on a given cell notation. Write Nernst equations for half cell reactions and the complete cell reaction. Calculate half cell potentials and cell voltage as well.
4. A typical setup for a potentiometric titration. Write a cell notation for such a device.
5. Types of reference electrodes and their pertinent half cell reactions.
6. The principle behind ion-selective detection. Junction potential. The mechanism involved in the ion transport in glass electrode and in crystalline membrane electrode. The component of a typical liquid membrane electrode.
7. Balancing redox reactions. A typical setup for a redox titration.

Chapter 17. Electroanalytical Techniques

Setup for a voltammetric experiment. The basic concept of a biosensor and the principle behind stripping analysis.

Chapter 18. Spectrophotometry and spectrophotometer

1. Beer's law for a single component system. To be able to perform calculations using Beer's law (Beer’s law will be provided).
2. What happens when a molecule absorbs light (processes of absorption, emission, and fluorescence)

Chapter 27. Gravimetric Analysis

Weight percent. Gravimetric factor. To be able to perform calculations dealing with two unknowns in a mixture.