**Chapter 16: Aqueous Ionic Equilibria**

Be able to:
- Identify buffer solutions.
- Calculate the pH of a buffer solution (H-H equation).
- Identify the best conjugate acid/base pair to use to prepare a given buffer.
- Calculate the ratio of base to acid necessary to achieve a desired pH.
- Figure out how to prepare a buffer:
  a) by mixing solutions of the acid & base in a conjugate pair.
  b) by adding strong acid to a solution containing the anion of a weak acid.
  c) by adding strong base to a solution containing the cation of a weak base.
  d) by adding a salt to an aqueous solution of a weak acid or base.
- Calculate the predicted change in pH when a known quantity of strong acid or strong base is added to a known aliquot of buffer.
- Determine when a buffer would become exhausted.
- Identify titration curves for:
  a) strong acid titrated with strong base
  b) strong base titrated with strong acid
  c) weak acid titrated with strong base
  d) weak base titrated with strong acid.
- Calculate the pH at any point in a strong acid/base titration.
- Calculate the pH at the following points in the titration of a weak acid with a strong base:
  a) At the start of the titration
  b) in the buffer region
  c) at the equivalence point
  d) beyond the equivalence point
- Calculate the concentration of an acid or base from its titration curve.
- Understand and use the equation $N_AV_A = N_BV_B$.
- Understand the Common Ion Effect on the equilibrium of a weak acid or base.
- Understand the difference between the titration endpoint and the equivalence point.
- Write the reaction and equilibrium expression associated with a given Ksp.
- Determine Ksp from equilibrium concentrations of a saturated solution.
- Determine equilibrium concentrations in a saturated solution from Ksp.
- Determine solubility from Ksp or Ksp from solubility.
- Determine the effect on solubility from a common ion.
- Predict whether or not a precipitate will form given starting concentrations.
- Understand the effect of pH on the solubility of salts.

**Chapter 24: Transition Metals & coordination compounds**

Be able to:
- Write electronic configurations for transition metals and their cations.
- Describe the bonding in complex ions and coordination compounds.
- Identify the oxidation number of transition metals within complex ions and coordination compounds.
- Identify ligands and know their relationship to the coordination sphere.
- Identify the coordination number for a given complex and associate that to possible geometries and hybridization.
- Recognize all possible types of transition metal complex isomers including:
  - structural isomers
  - stereo isomers
  - ionization isomers
  - linkage isomers
  - coordination isomers
  - hydration isomers
  - geometric isomers (aka diastereomers) including cis/trans and fac/mer isomers
  - optical isomers (aka enantiomers) (know what makes them optically active.)
- Identify number of unpaired electrons in a transition metal complex and its magnetic character.
- Understand the spectrochemical series of ligands. (high-field vs low-field ligands).
- Predict if a complex will be high-spin or low-spin.
- Interconvert between the wavelength of maximum absorbance ($\lambda_{max}$) and the crystal field splitting energy ($\Delta^\sigma$).
- Understand chelates and chelating agents.
- Understand the dentate nature of ligands.
- Explain the splitting patterns caused by octahedral vs tetrahedral ligand fields.
- Explain the relationship between the crystal field splitting energy, the wavelength of light absorbed, and the color of the resulting solution.