**Basic chemistry concepts:**

*The following subjects will be covered in the chemistry pre-examination. It is recommended to have at least a basic understanding of each, additional understanding will be built during the course. Feel free to use any additional sources (course books, internet, etc.).*

* **Molarity and concentrations, dilutions**
  + <http://abacus.bates.edu/~ganderso/biology/resources/dilutions.html>
  + <https://web.viu.ca/krogh/chem311/units%20of%20concentration.pdf>
* **Types of reactors (batch, plug flow, CSTR)**
  + Provided document reactors.pdf
  + <http://www.seas.ucla.edu/stenstro/Reactor.pdf>
* **Chemical concentrations and conversions to molarity, conversion to mg-N or mg-P**
  + Provided document Useful reminders.pdf
* **Static and dynamic processes, mass balances (with diagrams)**
  + Provided document mass balances.pdf
* **Arrhenius equation (adjusting for changes in temperature)**
  + Provided document reactors.pdf
  + [Chem libretexts website link](https://chem.libretexts.org/Textbook_Maps/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Kinetics/Modeling_Reaction_Kinetics/Temperature_Dependence_of_Reaction_Rates/Changing_Reaction_Rates_with_Temperature) , equation formatting broken in internet explorer
* **Acids and bases, concentrations, alkalinity, hardness**
  + **pH**
    - Provided document reactions.pdf
    - <https://www.chem.purdue.edu/gchelp/howtosolveit/Equilibrium/Calculating_pHandpOH.htm>
  + **Alkalinity and Hardness**
    - <https://www.researchgate.net/publication/292185663_Alkalinity_and_Hardness_Critical_but_Elusive_Concepts_in_Aquaculture> (may require student library log-in or network access)
    - Hardness only: <https://www.youtube.com/watch?v=NB-Q4GgDLgk> (video)
* **Catalysts and reactions (rates, etc)**
  + **Rate of Reaction**
    - Provided document reactions.pdf
    - <https://www.khanacademy.org/science/chemistry/chem-kinetics/reaction-rates/v/experimental-determination-of-rate-laws> ( video)
  + **Reduction Oxidation (REDOX)** 
    - <https://www.youtube.com/watch?v=lQ6FBA1HM3s> (video. covers basic concepts, not much on balancing equations – fast-paced)
    - <https://www.khanacademy.org/science/chemistry/oxidation-reduction/modal/a/oxidation-reduction-redox-reactions> (covers balancing equations better, has quick understanding test at the end)
* **Solubility products**
  + <https://www.khanacademy.org/science/chemistry/acid-base-equilibrium/copy-of-solubility-equilibria-mcat/v/solubility-product-constant-from-the-solubility> (video)
  + [Chem libretexts webiste link 2](https://chem.libretexts.org/Textbook_Maps/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Equilibria/Solubilty/Solubility_Product_Constant%2C_Ksp), equation formatting broken in internet explorer

**Extra (pH, carbonate, alkalinity, hardness, disinfection in water).** More info than necessary, but interesting: <https://dnr.wi.gov/regulations/labcert/documents/training/basics-genchem.pdf>