

This list is a general guideline to help you study. It is NOT a definitive list. There are potentially things on here that will not show up on the test, and there are potentially things not on the list that will show up on the test. Material that appeared in Daily Practice Problems, Notes, Homework, Classwork, Labs, Study Materials, topics from Honors Chem, etc all have the potential to appear on the test.

Directions:

- Rank each of the following according to a 1 – 5 scale, where a “5” means you can teach another student and a “1” means I never learned this. **You need to be HONEST with yourself on these rankings.**
- Highlight each objective that you gave a 1 or 2.
- Circle each objective that you gave a 3
- Box each objective that is gave a 4 and 5
- Use these to help prioritize your studying. Remember – it may not be time effective to spend all your time on a “1” if you could improve several topics from a 2→3, or 3→4, etc.

0 – Honors Review

- _____ I remember the topics taught in Honors Chem and my summer assignment!
 - Chemistry basics, Atomic Structure, Electrons, Periodic Table, Bonding and Structure, Reactions, Stoichiometry, Advanced Chemical Ratios, Gas Laws, Thermochemistry, Solutions, Kinetics, Equilibrium, Acid Base, Redox

1 – Thermochemistry

- _____ Calculate kinetic energy based on mass and velocity
- _____ Define kinetic and potential energy
- _____ Describe the 1st Law of Thermodynamics
- _____ Define a state function
- _____ Be able to write thermochemical equations for endothermic and exothermic reactions
 - _____ Draw, label & interpret potential energy diagrams for both endothermic & exothermic reactions
 - Be able to Label:
 - _____ PE of reactants, products & activated complex
 - _____ Activation energy of forward & reverse reactions
 - _____ Heat of reaction
- _____ Define enthalpy
- _____ Be able to tell from the ΔH if a reaction is endothermic or exothermic
- _____ Be able to perform calorimetry problems to solve for a variety of variables
- _____ Be able to describe the difference between Specific Heat and Specific Heat Capacity, and when you would use one versus the other with regards to calorimetry problems
- _____ Define standard state conditions
- _____ Be able to explain why the standard heat of formation for an element and standard state conditions is zero
- _____ Be able to calculate the heat of reaction (ΔH) given the heats for formation for products & reactants
- _____ Be able to use Hess’s Law to calculate (ΔH) for a reaction/process, including manipulating reactions by multiplying or reversing them
- _____ Be able to calculate energy change during a reaction by using bond energy data

2 – Thermodynamics

- _____ Describe the difference between thermodynamics and kinetics
- _____ Define enthalpy
- _____ Define entropy (in a better way than “chaos”)
- _____ Define spontaneity
- _____ Define ΔG° , and ΔG
- _____ Know the Gibbs-Helmholtz equation
- _____ Know what the sign on ΔG° is when a reaction is spontaneous
- _____ Understand the 2nd Law of Thermodynamics – the connection between the entropy change of the universe and spontaneity
- _____ Know which signs on ΔH° , ΔS° are favorable
- _____ Understand the connection between reversibility of a process and the spontaneity of the process
- _____ Know under what conditions a change will always be spontaneous or never be spontaneous
- _____ Know under what temperature conditions unfavorable combinations of enthalpy and entropy may result in a reaction still being spontaneous

- _____ Understand what factors increase or decrease entropy of the system
- _____ Be able to make educated prediction on which scenarios would have more entropy than others
- _____ Given a thermochemical equation for a chemical or physical change, be able to predict the spontaneity by assessing the signs of ΔH & ΔS
- _____ Be able to calculate ΔH° , ΔS° , ΔG° mathematically in a variety of ways
 - _____ Using formation values, Hess's Law, Gibbs-Helmholtz Equation, etc
- Know how thermodynamics and equilibrium are related conceptually and mathematically
 - _____ $\Delta G = 0$ at equilibrium
 - _____ Identify equilibrium on a graph of Gibbs Free Energy
 - _____ $\Delta G = \Delta G^\circ + RT\ln(Q)$
 - _____ Know the connection between ΔG , K and Q at equilibrium and in predicting which direction a reaction will proceed when not at equilibrium
 - _____ Be able to use $\Delta G^\circ = -RT\ln(K)$ to solve for a variety of variables
 - _____ Be able to graph $\ln(K)$ versus $(1/T)$ to get a linear plot that can be used to determine ΔH° and ΔS° using the slope and the intercept
 - _____ Remember that phase changes are equilibriums and you can calculate the temperature at which they occur using Gibbs Free Energy calculations

3 – Kinetics

- _____ Use Collision Theory to describe how chemical reactions occur
- _____ Describe the difference between effective & ineffective collisions
- _____ Know the factors that influence reaction rate
- _____ Describe how changes in temp, pressure, concentration & surface area effect reaction rate
- _____ Describe how the nature of the reactants influences reaction rate
- _____ Describe how the presence of a catalyst affects reaction rate
- _____ Be able to indicate the effect of a catalyst on a PE diagram
- _____ Understand that rate laws are determined experimentally
- _____ Understand that rate orders match the coefficients for the rate determining step, not necessarily the coefficients in the overall reaction
- _____ Be able to write a rate expression in terms of any reactant or product
- _____ Be able to use a tangent line to calculate the instantaneous rate for a reaction
- _____ Be able to use a graph of concentration over time to identify reactants versus products, and determine stoichiometric ratios for each
- _____ Method of Initial Rates to determine the differential rate law
 - _____ Determine orders of each reactant
 - _____ Determine the overall order of a reaction
 - _____ Determine numerical value of rate constant
 - _____ Determine units of the rate constant
- _____ Be able to write the integrated rate law for 0^{th} , 1^{st} , 2^{nd} order reactions
- Graphical analysis for integrated rate laws
 - _____ Determining rate order by finding a linear relation based on which item is plotted versus time
 - 0^{th} order = [] vs. time, 1^{st} order = $\ln[]$ vs. time, 2^{nd} order = $1/[]$ vs. time
 - _____ Using linear plot $y = mx + b$ format to determine rate constant and other things from graphing of the integrated rate laws
- _____ Calculating Half-life based on which order reaction it is
- _____ Be able to explain how the length of the half-life does, or does not, change based on starting concentrations for 0^{th} , 1^{st} , 2^{nd} order reactions
- _____ 0^{th} , 1^{st} , 2^{nd} integrated rate laws
- _____ Identify catalysts and intermediates in a rate law
- _____ Be able to write a rate law with no intermediates present by exploiting equilibrium of fast steps in the mechanism to substitute other things for the intermediate in the rate law
- _____ Use the Arrhenius equation to solve for a variety of variables
- _____ Use rearrangements of the Arrhenius equation to find various values (remember that every temperature has a unique k value, so you can graph the k value at various temperatures)
 - _____ Linear relation with rate constant and T in Kelvin
 - _____ Use the slope of your straight line plot of $\ln(k)$ vs. $(1/T)$ to find E_a , and the intercept to find the frequency factor
 - _____ Use the "Two Point" format when you only have two data points
- _____ Relationship of kinetics with equilibrium (challenging)
- _____ Show how a change in temperature or addition of a catalyst affects a Maxwell Distribution Curve
- _____ Describe what a pseudo 1^{st} order reaction would be and how you would manipulate the experiment to do it.