

# FRANKLIN-SIMPSON HIGH SCHOOL

Course Name: Chemistry

Unit Name: Chemical Equilibrium

Days: 8

## Quality Core Objectives:

Unit 15 Chemical Equilibrium	
I.A.1. Scientific Inquiry	b. Design experiments so that variables are controlled and appropriate numbers of trials are used
	c. Collect, organize, and analyze data accurately and use techniques and equipment appropriately
	d. Interpret results and draw conclusions, revising hypotheses as necessary and/or formulating additional questions or explanations
	e. Write and speak effectively to present and explain scientific results, using appropriate terminology and graphics
	f. Safely use laboratory equipment and techniques when conducting scientific investigations
	g. Routinely make predictions and estimations
	I.A.2. Mathematics and Measurement in Science
c. Use the correct number of significant figures in reporting measurements and the results of calculations	
e. Express numbers in scientific notation when appropriate	
f. Solve for unknown quantities by manipulating variables	
g. Use graphical, mathematical, and/or statistical models to express patterns and relationships inferred from sets of scientific data	
I.A.3. Science in Practice	e. Use a variety of appropriate sources (e.g., Internet, scientific journals) to retrieve relevant information; cite references properly
V.B.1. Chemical Equilibrium and Factors Affecting Reaction Rates; Le Châtelier's Principle	a. Explain the collision theory of reactions
	b. Analyze factors (e.g., temperature, nature of reactants) affecting reaction rates in relation to the kinetic theory
	e. Describe the conditions that define equilibrium systems on a dynamic molecular level and on a static macroscopic scale
	f. Apply Le Châtelier's principle to explain a variety of changes in physical and chemical equilibria
	g. Define $K_{sp}$ and manipulate $K_{sp}$ to predict solubility

	h. Explain the law of concentration (mass) action and write equilibrium law expressions for chemical equilibria
	i. Determine solubility product constants from solubilities (and vice versa) for a given solubility equilibrium system
V.B.4. Enthalpy and Entropy	d. Define entropy and explain the role of entropy in chemical and physical changes, and explain the changes that favor increases in entropy

**Purpose of the Unit:** Students will be able to use the collision theory to explain chemical reactions. They will also be able to discuss the different factors and the impact that they have on establishing and maintaining chemical equilibrium. Students will be able to discuss and calculate  $K_{sp}$  for solubility equilibrium systems.

**Prerequisites:** Students should be able to:

- identify insoluble compounds
- identify phase changes on the basis of requiring and releasing energy
- identify the difference between endothermic and exothermic reactions
- calculate solution concentrations

### Daily Lesson Guide

Day	Lesson Content and Objectives	Focus Questions	Critical Thinking (High Yield / Literacy /LTF/etc.)	Engagement	Assessment and/or Accommodations
1	* Collision theory * Factors affection reaction rates * Defining equilibrium on micro- and macroscopic scales V.B.1.a, b, c	* What factors determine if and how fast a reaction reaches equilibrium?	* Summarizing/ note taking * Nonlinguistic representation * Identifying similarities and differences * Analysis/ Application	* Pre – test * ACT bell ringer * demo on MoLEs website** * Model notes * 3-2-1 exit slip (formative)	* Evaluate pre-test * Evaluate math notes and sample problems for understanding <b>Accommodations: prompting/ cueing, paraphrasing, reader, scribe, reduced assignment, extended time (as needed)</b>

2	<ul style="list-style-type: none"> <li>* Using LeChatlier's principal and entropy to predict shifts in equilibrium</li> <li>V.B.1.f</li> <li>V.B.4.d</li> </ul>	<ul style="list-style-type: none"> <li>* How can you predict the direction of change to reestablish equilibrium in a reaction?</li> </ul>	<ul style="list-style-type: none"> <li>* Summarizing/ note taking</li> <li>* Analysis/ Application</li> <li>* I Do – We Do – You Do</li> <li>* Identifying similarities and differences</li> <li>* Nonlinguistic representation</li> </ul>	<ul style="list-style-type: none"> <li>* ACT bell ringer</li> <li>* demo on MoLEs website**</li> <li>* Model notes and examples together, alone (formative)</li> </ul>	<ul style="list-style-type: none"> <li>* Evaluate sample problems for understanding</li> <li>Accommodations: prompting/ cueing, paraphrasing, reader, scribe, reduced assignment, extended time (as needed)</li> </ul>
3-4	<ul style="list-style-type: none"> <li>* Ksp and predicting solubility</li> <li>* Law of mass action and equilibrium law expressions</li> <li>* Calculating solubility product constant from solubilities (vice-versa) for eqm systems</li> <li>V.B.1.g, h, i</li> </ul>	<ul style="list-style-type: none"> <li>* How can "insoluble salts" really be soluble?</li> <li>* How much of an "insoluble salt" will dissolve in a solution?</li> </ul>	<ul style="list-style-type: none"> <li>* Summarizing/ note taking</li> <li>* Analysis/ Application</li> <li>* I Do – We Do – You Do</li> <li>* Generating and testing hypotheses</li> <li>* Advanced organizers</li> </ul>	<ul style="list-style-type: none"> <li>* ACT bell ringer</li> <li>* math notes</li> <li>* Model notes and sample problems together, alone (formative)</li> <li>* Article about trace metals in our water supply</li> </ul>	<ul style="list-style-type: none"> <li>* Evaluate sample problems and math notes for understanding</li> <li>* Evaluate comprehension of article</li> <li>Accommodations: prompting/ cueing, paraphrasing, reader, scribe, reduced assignment, extended time (as needed)</li> </ul>
5-6	<ul style="list-style-type: none"> <li>* Laboratory: Modeling equilibrium with "bean reactions"</li> <li>I.A.1.b, c, d, e, f, g</li> <li>I.A.2.b, c, e, f, g</li> <li>I.A.3.e</li> <li>V.B.1.a, b, e, f, g, h, i</li> <li>V.B.4.d</li> </ul>	<ul style="list-style-type: none"> <li>* How can I apply what I know from this unit to model a chemical reaction and determine when equilibrium has been established?</li> </ul>	<ul style="list-style-type: none"> <li>* Synthesis/ Application/ Analysis</li> <li>* Identifying similarities and differences</li> <li>* Learning with others</li> <li>* Authenticity</li> <li>* Novelty and Variety</li> <li>* Generating and testing hypotheses</li> </ul>	<ul style="list-style-type: none"> <li>* ACT bell ringer</li> <li>* Conduct lab according to procedures provided (summative)</li> </ul>	<ul style="list-style-type: none"> <li>* Evaluate lab report</li> <li>Accommodations: Partner students based on skill level, prompting/ cueing, extended time (as needed)</li> </ul>

7	<ul style="list-style-type: none"> <li>* Review</li> <li>I.A.1.b, c, d, e, f, g</li> <li>I.A.2.b, c, e, f, g</li> <li>I.A.3.e</li> <li>V.B.1.a, b, e, f, g, h, i</li> <li>V.B.4.d</li> </ul>	<ul style="list-style-type: none"> <li>* What can I do to be better prepared for the exam?</li> </ul>	<ul style="list-style-type: none"> <li>* Use clickers to test students' knowledge and clarify and misconceptions before the exam with immediate feedback.</li> </ul>	<ul style="list-style-type: none"> <li>* ACT bell ringer</li> <li>* Use clickers to review with exam like questions (summative)</li> </ul>	<ul style="list-style-type: none"> <li>* Students participate in review</li> <li>Accommodations: prompting/ cueing, extended time, paraphrasing, reader, use of formula sheet (as needed)</li> </ul>
8	<ul style="list-style-type: none"> <li>* Exam</li> <li>I.A.1.b, c, d, e, f, g</li> <li>I.A.2.b, c, e, f, g</li> <li>I.A.3.e</li> <li>V.B.1.a, b, e, f, g, h, i</li> <li>V.B.4.d</li> </ul>	<ul style="list-style-type: none"> <li>* Can I demonstrate my knowledge on the exam?</li> </ul>	<ul style="list-style-type: none"> <li>* Evaluation</li> <li>* Analysis</li> <li>* Application</li> <li>* Synthesis</li> </ul>	<ul style="list-style-type: none"> <li>* ACT bell ringer</li> <li>* Students take exam (summative)</li> </ul>	<ul style="list-style-type: none"> <li>* Evaluate exam</li> <li>Accommodations: prompting and cueing, extended time, paraphrasing, reader, limited choices, use of formula sheet (as needed)</li> </ul>

\*\* MoLEs website: <http://genchem1.chem.okstate.edu/CCLI/CCLIDefault.html>