

# AP Chemistry Unit 8: Equilibrium

Content Area: **Science**  
Course(s): **Sample Course, Chemistry AP**  
Time Period: **March**  
Length: **4 Weeks**  
Status: **Published**

## **Title Section**

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## **Department of Curriculum and Instruction**



**Belleville Public Schools**

Curriculum Guide

## AP Chemistry

11, 12

**Belleville Board of Education**

**102 Passaic Avenue**

**Belleville, NJ 07109**

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Board Approved:7/16/2018

## **Suggested Activities & Best Practices**

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### **Unit Overview**

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- Topics:

1. Homogeneous and heterogeneous equilibria
2. Le Chatelier's Principle
3. Partial dissociation
4. Solubility
5. Buffer solutions

### **NJSLS**

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SCI.HS-ETS1-1

Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

SCI.HS-ETS1-3

Evaluate a solution to a complex real-world problem based on prioritized criteria and

	trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
SCI.HS-ETS1-4	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
SCI.HS-PS1-3	Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
SCI.HS-PS1-6	Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.
SCI.HS-PS1-2	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
SCI.HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
SCI.HS-PS1-5	Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
SCI.HS-PS1-7	Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

## Exit Skills

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1. Apply Le Chatelier's Principle
2. Calculate the equilibrium constant
3. Calculate the equilibrium concentrations using I.C.E
4. Calculate pH and pOH of weak acids and bases
5. Prepare a buffer solution
6. Calculate pH and pOH of of a buffer solution
7. Choose the correct indicator
8. Calculate the solubility of salts

## Enduring Understanding

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1. Representations and models can be used to communicate scientific phenomena and solve scientific problems.
2. Mathematics, appropriately applied, can be used to explain phenomena.
3. Scientific questioning can be used to extend thinking or to guide investigations within the context of the AP course.
4. Planning and implementation of data collection strategies in relation to a particular scientific question, leads to supported conclusions and problem solutions
5. Proper data analysis and evaluation of evidence is imperative in scientific studies.
6. Scientific explanations and theories must be used as guiding principles for scientific investigations
7. Connections of knowledge across various scales, concepts, and representations in and across domains leads to comprehensive responses to problems in science.

## Essential Questions

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1. Why are acids that are classified as weak still very dangerous?
2. How does hydrate formation change the nature of “dry” (anhydrous) salts?
3. Why is the concept of dynamic equilibrium critical in understanding nature?
4. How do scientists quantify the concentration of acids or bases in aqueous samples?

## Learning Objectives

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1. Write the constant of homogeneous and heterogeneous equilibria
2. Predict the shift of a chemical equilibrium applying Le Chatelier's Principle
3. Calculate the concentration of all species in equilibria of gases, acids, bases, buffers, solutions, and salts

## Interdisciplinary Connections

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Please list all and any cross-curricular content standards that link to this Unit.

LA.11-12.RST.11-12.1	Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
LA.11-12.RST.11-12.2	Determine the central ideas, themes, or conclusions of a text; summarize complex concepts, process information presented in a text by paraphrasing them in simpler but still accurate terms.
LA.11-12.RST.11-12.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
LA.11-12.RH.11-12.1	Accurately cite strong and thorough textual evidence, (e.g., via discussion, written response, etc.), to support analysis of primary and secondary sources, connecting insights gained from specific details to develop an understanding of the text as a whole.
LA.11-12.RH.11-12.2	Determine the theme, central ideas, information and/or perspective(s) presented in a primary or secondary source; provide an accurate summary of how key events, ideas and/or author's perspective(s) develop over the course of the text.
LA.11-12.RH.11-12.3	Evaluate various perspectives for actions or events; determine which explanation best accords with textual evidence, acknowledging where the text leaves matters uncertain.  Decisions or predictions are often based on data—numbers in context. These decisions or predictions would be easy if the data always sent a clear message, but the message is often obscured by variability. Statistics provides tools for describing variability in data and for making informed decisions that take it into account.
LA.11-12.WHST.11-12.1	Write arguments focused on discipline-specific content.

Functions may be used to describe data; if the data suggest a linear relationship, the relationship can be modeled with a regression line, and its strength and direction can be expressed through a correlation coefficient.

LA.11-12.RH.11-12.7

Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, qualitatively, as well as in words) in order to address a question or solve a problem.

LA.11-12.RH.11-12.8

Evaluate an author's claims, reasoning, and evidence by corroborating or challenging them with other sources.

LA.11-12.RH.11-12.9

Integrate information from diverse sources, both primary and secondary, into a coherent understanding of an idea or event, noting discrepancies among sources.

## **Alignment to 21st Century Skills & Technology**

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### **Key SUBJECTS AND 21st CENTURY THEMES**

Mastery of key subjects and 21st century themes is essential for all students in the 21st century.

Key subjects include:

- English, reading or language arts
- World languages
- Arts
- Mathematics
- Economics
- Science
- Geography
- History
- Government and Civics

## **21st Century/Interdisciplinary Themes**

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- Civic Literacy
- Environmental Literacy
- Financial, Economic, Business and Entrepreneurial Literacy
- Global Awareness
- Health Literacy

## **21st Century Skills**

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- Communication and Collaboration
- Creativity and Innovation
- Critical thinking and Problem Solving
- ICT (Information, Communications and Technology) Literacy

- Information Literacy
- Life and Career Skills
- Media Literacy

## **Technology Infusion**

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What technology can be used in this unit to enhance learning?

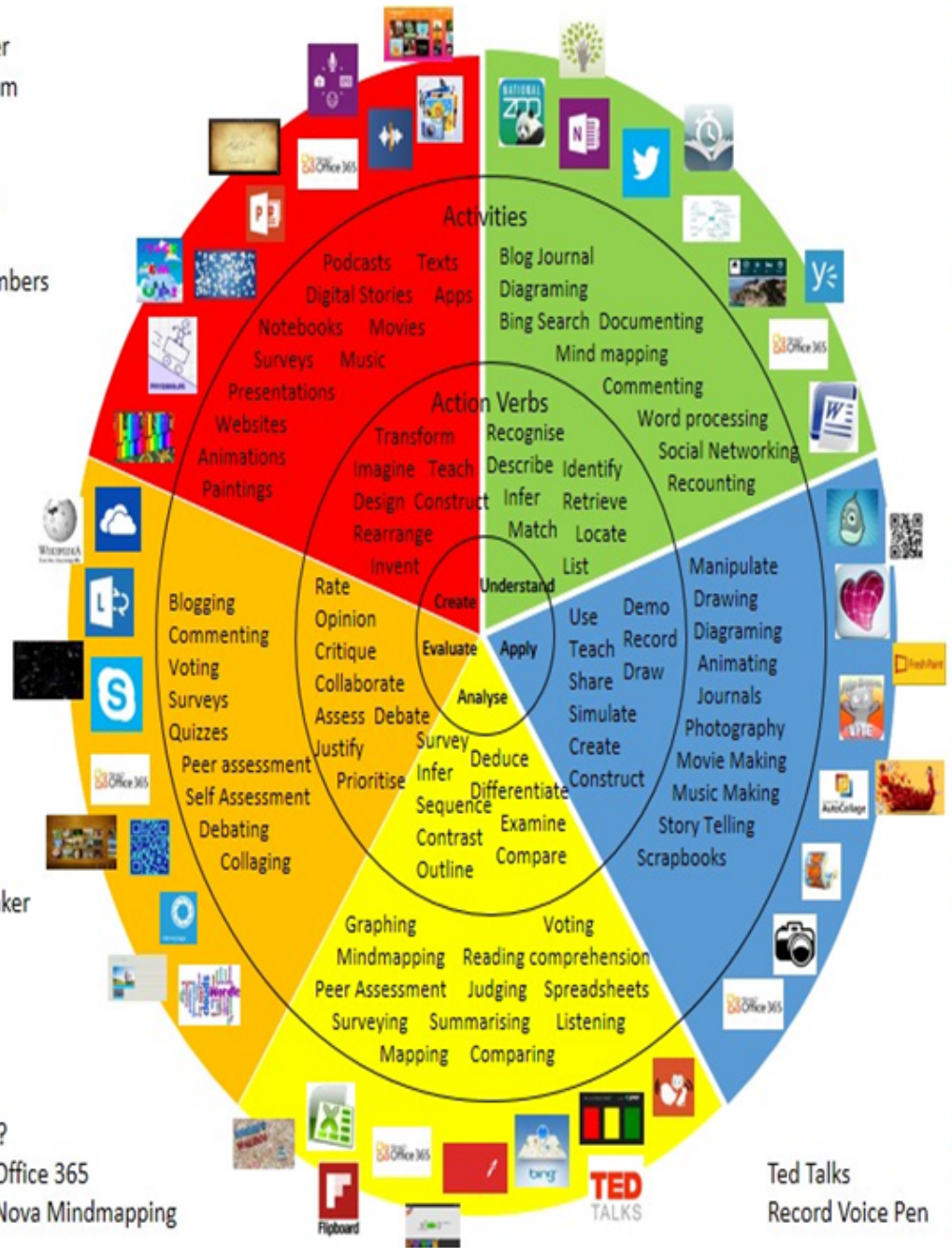
# Win 8.1 Apps/Tools Pedagogy Wheel

Podcasts  
 Photostory 3  
 Kid Story Builder  
 Music Maker Jam  
 Paint A Story  
 Office 365  
 MS PowerPoint  
 Stack 'Em Up  
 NqSquared Numbers  
 Physamajig  
 Xylophone 8

Wikipedia  
 Skydrive  
 Lync  
 SkyMap  
 Skype  
 Office 365  
 Puzzle Touch  
 Easy QR  
 Memorylage  
 Life Moments  
 Word Cloud Maker

Where's Waldo?  
 MS Excel  
 Flipboard  
 Office 365  
 Nova Mindmapping

Ted Talks  
 Record Voice Pen



Originally taken from <http://www.coetail.com/vzimmer/files/2013/02/iPadagogy-Wheel.001.jpg>  
 And adapted for Windows 8.1 devices by Charlotte Beckhurst @CharBeckhurst

## Differentiation

As a Reminder:

The basis of good differentiation in a lesson lies in differentiating by content, process, and/or product.

Resources:

- NJDOE: Instructional Supports and Scaffolds for Success in Implementing the Common Core State Standards <http://www.state.nj.us/education/modelcurriculum/success/math/k2/>

## **Special Education**

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- printed copy of board work/notes provided
- additional time for skill mastery
- assistive technology
- behavior management plan
- Center-Based Instruction
- check work frequently for understanding
- computer or electronic device utilizes
- extended time on tests/ quizzes
- have student repeat directions to check for understanding
- highlighted text visual presentation
- modified assignment format
- modified test content
- modified test format
- modified test length
- multiple test sessions
- multi-sensory presentation
- preferential seating
- preview of content, concepts, and vocabulary
- reduced/shortened reading assignments
- Reduced/shortened written assignments
- secure attention before giving instruction/directions
- shortened assignments
- student working with an assigned partner
- teacher initiated weekly assignment sheet
- Use open book, study guides, test prototypes

## **ELL**

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- teaching key aspects of a topic. Eliminate nonessential information



- using videos, illustrations, pictures, and drawings to explain or clarify
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning;
- allowing students to correct errors (looking for understanding)
- allowing the use of note cards or open-book during testing
- decreasing the amount of work presented or required
- having peers take notes or providing a copy of the teacher's notes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using computer word processing spell check and grammar check features
- using true/false, matching, or fill in the blank tests in lieu of essay tests

## **Intervention Strategies**

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- allowing students to correct errors (looking for understanding)
- teaching key aspects of a topic. Eliminate nonessential information
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning
- allowing students to select from given choices
- allowing the use of note cards or open-book during testing
- collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student, eliminate sections of the test, and determine how the grade will be determined prior to giving the test.
- decreasing the amount of work presented or required
- having peers take notes or providing a copy of the teacher's notes
- marking students' correct and acceptable work, not the mistakes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using authentic assessments with real-life problem-solving
- using true/false, matching, or fill in the blank tests in lieu of essay tests
- using videos, illustrations, pictures, and drawings to explain or clarify

## **Evidence of Student Learning-CFU's**

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Please list ways educators may effectively check for understanding in this section.

- Admit Tickets
- Anticipation Guide
- Common benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- Illustration
- Journals
- KWL Chart
- Newspaper Headline
- Outline
- Question Stems
- Quickwrite
- Quizzes
- Red Light, Green Light
- Self- assessments
- Socratic Seminar
- Study Guide
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Top 10 List
- Unit tests

## **Primary Resources**

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Chemistry - The Central Science: AP Edition; 12th Edition.  
 Pearson: Brown, Lemay, Bursten, Murphy, and Woodward 2012

## **Ancillary Resources**

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Do now activities; section and chapter review questions, reinforcement worksheets, homework, problem solving, and Q&A

Lab activities and lab reports  
Video on Lab Safety  
Video on the Metric System  
PowerPoint Presentation  
[www.masteringchemistry.com](http://www.masteringchemistry.com)  
textbook  
Internet Resources  
Science Department Video Library  
United Streaming  
Demonstration (Demo a Day, Shakazeera Demo Books, Textbook Demonstrations)  
The Princeton Review, cracking the AP chemistry exam  
Laboratory manual: Hostage David, Fossett Martin, AP Chemistry

## **Sample Lesson**

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