Unit 08: Chemical Equilibrium

Content Area: **Science**
Course(s):
Time Period: **Marking Period 4**
Length: **1-2 Weeks**
Status: **Published**

Brief Summary of Unit

In this unit, the basic concepts of equilibrium will be examined. Specific properties of equilibrium of gases, solutions, and acids/bases will be presented as well as LeChatelier's Principle. ICE charts will be introduced to aid in the organization and solving of equilibrium problems. Weak acid/base equilibria will strengthen the comprehension of equilibrium calculations as well as incorporate pH and its relationships. The effect of climate change on ocean acidification will be addressed.

Revised June 2022

Standards

	With a growth mindset, failure is an important part of success.
LA.K-12.NJSLSA.R1	Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
	Career planning requires purposeful planning based on research, self-knowledge, and informed choices.
	Collaboration with individuals with diverse experiences can aid in the problem-solving process, particularly for global issues where diverse solutions are needed.
MA.N-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
MA.N-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
LA.K-12.NJSLSA.R8	Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.
MA.N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
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.
LA.K-12.NJSLSA.W1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
PS1.B	Chemical Reactions
LA.K-12.NJSLSA.W4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
LA.K-12.NJSLSA.W6	Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
LA.K-12.NJSLSA.W8	Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.

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.
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.
PS3.D	Energy in Chemical Processes

Essential Questions

Essential Questions

What are characteristics of equilibrium?

What are the consequences of these characteristics?

Enduring Understandings

Equilibrium reactions can be both qualitatively and quantitatively analyzed.

Students Will Know/Students Will be Skilled At

Students will know the characteristics of chemical equilibrium.

Students will know the consequences of the state of equilibrium.

Students will know how the equilibrium constant and concentrations are expressed.

Students will know how the magnitude of the equilibrium constant indicates if the reaction is reactant or product favored at equilibrium.

Students will know how the reaction quotient is used.

Students will be skilled at applying LeChatlier's Principle.

Students will be skilled at using an ICE chart to solve equilibrium problems.

Students will know what the acid/base dissociation constants represent.

Students will be skilled at calculating the pH of a weak acid or weak base.

Learning Plan

Preview the essential questions and connect them to learning throughout the unit.

Explain the nature of the state of equilibrium.

Relate the concentration of coefficients of reactants and products to the equilibrium constant.

Distinguish between reactant favored and product favored.

Related the reaction quotient to the equilibrium constant and the direction of the equilibrium shift.

Predict the effect of stress on chemical equilibrium.

Model how to use an ICE chart to solve equilibrium problems.

Discuss the general equilibrium expressions for weak acids and weak bases.

Model how to calculate the pH of a weak acid.

Review how the pH of a weak acid is different from the pH of a strong acid.

Introduce the effect of climate change on ocean acidification through a published article. Students may then complete the Gizmo STEM case study or a worksheet on ocean carbon equilibrium.

Labs/Activities:

The following PhET simulations can be utilized: Reversible Reactions, Strong vs Weak Acids.

LeChatlier's Lab

Gizmo STEM case study on Ocean Carbon Equilibrium

Evidence/Performance Tasks

Formative

Describing key characteristics of a reaction in equilibrium.

Using Lechatlier's Principle to predict the shift in the reaction to re-establish equilibrium.

Quantitatively analyzing a reaction in equilibrium.

Self Assessment problems during class.

Completed problems in CHEMFILE: MINI GUIDE TO PROBLEM SOLVING HOLT 1999

Assigned homework problems in CHEMISTRY 11 ED. CHANG MCGRAW HILL 2013

Summative

Unit Quiz and Test

Gizmo STEM case study, "Ocean Carbon Equilibrium."

Benchmark

Final Exam

Alternative

Lab Report for LeChatlier's Lab

Gizmo STEM case study, "Ocean Carbon Equilibrium."

Materials

CHEMISTRY 11 ED. CHANG MCGRAW HILL 2013

CHEMFILE: MINI GUIDE TO PROBLEM SOLVING HOLT 1999

Approved Textbook Link

In addition to general lab and safety equipment as noted in lab handouts:

cobalt(II) chloride

calcium chloride

silver nitrate

hydrochloric acid

ethanol

Suggestions Strategies for Modifications

FOR SPECIAL EDUCATION STUDENTS , ELL, AT RISK AND STUDENTS GIFTED STUDENTS

https://docs.google.com/spreadsheets/d/1pQwsQoD_QLot65BTdHFEHN5dXIiqS54iQ5iDL8C4q6o/edit?usp=sharing