Chemistry Unit 11: Kinetics and Equilibrium

Unit #:	APSDO-00019436	Duration:	2.5 Week(s)	Date(s):	

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Grades:
12
Subjects:
Science

Unit Focus

In this unit, students will explore the dynamic and reversible nature of chemical equilibria. Because the behavior of equilibria is based on reaction kinetics, they will also explore factors that determine the direction of the chemical reaction and the rate of chemical reactions. Instructional materials include a traditional textbook, numerous teacher-generated readings and handouts, guided inquiry learning activities, and online tutorials/simulations/problem sets. Summative assessments may include: written quizzes and tests that include application problems demonstrating the role concentration plays in determining reaction rate and how changing concentrations can effect chemical equilibria; and models as well as lab reports that include experimental design, data analysis, and laboratory practice.

Stage 1: Desired Results - Key Understandings

Established Goals

Next Generation Science Standards (DCI)
Science: 12

- Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. *PS1.9.B1*
- In many situations, a dynamic and condition-dependent balance between a

Transfer

T1

Integrate knowledge from a variety of disciplines and apply it to new situations to make sense of information, formulate insightful questions, and/or solve problems

T2

Design an investigation or model using appropriate scientific tools, resources, and methods

T3

Collect, analyze and evaluate the quality of evidence in relation to a question

T4

reaction and the reverse reaction determines the numbers of all types of molecules present. *PS1.9.B2*

Develop a valid scientific conclusion, assess its validity and limitations, and determine future course of actions to inspire further questions

T5

Communicate scientific information clearly, thoroughly, and accurately.

T6

Use mathematics to represent physical variables and their relationships, to make quantitative predictions, and to solve problems.

Meaning

Understandings	Essential Questions
U1 The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. [PS1.B] **U2** Chemical processes, their rates, and corresponding energy changes can be understood in terms of the collisions of molecules and the rearrangements of atoms as bonds break and form to create new molecules. [PS1.AB] **U3** (U413) In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present.	**Q1** (8-12) What factors affect the rate of a reaction? **Q2** (Q411) How do we predict and explain why specific substances react, what they will form, and how much product will result? **Q3** (Q414) How could you change the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium?

Acquisition of Knowledge and Skill

Knowledge	Skills

	K1 Concentration, temperature, surface area and catalysts affect the rate of reaction according to collision theory **K2** Reaction rates are determined experimentally **K3** Reaction rates can be defined in terms of their order **K4** An equation that relates reaction rates and reactants is called the rate law for the reaction **K5** Rate laws enable the prediction of reaction rates given the concentration of a reactant(s) and visa versa **K6** A system is at equilibrium when the forward and reverse reaction rates are equal **K7** Le Chatlier's principle states that when a stress is applied to an equilibrium system, the system responds to reestablish equilibrium **K8** The equilibrium constant, K. is determined from a balanced equation. Its magnitude indicates if the reaction is product or reactant favored	**S1** Students will be able to interpret rate laws **S2** Students will predict and explain the reaction shift which results from a stress applied to the equilibrium system **S3** Students will interpret the value of K for a given equilibrium expression **S4** Students will solve problems using equilibrium expressions to calculate K or equilibrium concentrations of reactants or products **S5** Students will explore factors that affect reaction rate **S6** Students will use a balanced equation to write an equilibrium expression