Fresno Unified School District

2018-19

H.S. Chemistry

Chemistry in the Earth System							
Semester 1				Semester 2			
Quarter 1		Quarter 2		Quarter 3		Quarter 4	
Instructional Segment #1: Combustion		Instructional Segment #2: Heat and Energy in the Earth System	Instructional Segment #3: Atoms, Elements and Molecules	Instructional Segment #4: Chemical Reactions	Instructional Segment #5: Chemistry of Climate Change	Instructional Segment #6: The Dynamics of Chemical Reactions and Ocean Acidification	
PS1-3$_1$* PS1-4$_5$* PS1-7$_5$* PS3-1$_4$*		PS3-1$_4$* PS3-2$_5$ PS3-4$_4$ ESS2-3$_5$ ETS1-4$_4$	PS1-1$_1$ PS1-2$_1$ PS1-7$_5$*	PS1-3$_1$* PS1-4$_5$* PS3-5$_2$ PS2-4$_1$ PS1-5$_1$* PS1-7$_5$*	ESS2-2$_7$* ESS2-4$_2$ ESS2-6$_5$* ESS3-2 ESS3-5$_7$ ESS3-6$_4$	PS1-5$_1$* PS1-6$_7$ PS1-7$_5$* ESS2-2$_7$* ESS2-6$_5$*	
** = standard is taught more than once within this course*							
EP&Cs Connections: n/a	**ELD Connections:** ELD.PI.11-12.1,5,6a-b,9,10,11a	**EP&Cs Connections:** n/a	**ELD Connections:** ELD.PI.11-12.1,5,6a-b,9,10,11a	**EP&Cs Connections:** Principles 3 & 5	**ELD Connections:** ELD.PI.11-12.1,5,6a-b,9,10,11a	**EP&Cs Connections:** Principles 3 & 4	**ELD Connections:** ELD.PI.11-12.1,5,6a-b,9,10,11a
CCSS ELA Connections: SL.11-12.5; RST.11-12.1; WHST.9-12.7,8,9	**CCSS Math Connections:** MP.4; N-Q.1-3	**CCSS ELA Connections:** SL.11-12.4,5; RST.11-12.1,2,8, WHST.9-12.7,8,9, RST.9-10.7, WHST.11-12.2,5	**CCSS Math Connections:** N-Q.1-3; MP.2; MP.4	**CCSS ELA Connections:** SL.11-12.5; RST.11-12.1, WHST.11-12. 7,8,9, SL.9-10.1c-d; WHST.9-10.4, 6, 9, 10; RST.9-10.1, 7, 9.	**CCSS Math Connections:** A-SSE.1a-b, 3a-c; N-Q.1-3; MP. 1, MP. 2, MP. 3, MP.4; LE.1b,c; S-ID.6,7	**CCSS ELA Connections:** SL.11-12.5; RST.11-12.1,2	**CCSS Math Connections:** N-Q.1-3; MP.2; MP.4

Science & Engineering Practices (SEPs)

1.) Asking questions and defining problems
2.) Developing and using models
3.) Planning and carrying out investigations
4.) Analyzing and interpreting data
5.) Using mathematics and computational thinking
6.) Constructing explanations and designing solutions
7.) Engaging in argument from evidence
8.) Obtaining, evaluating and communicating information

Crosscutting Concepts (CCCs)

1.) Patterns
2.) Cause and Effect
3.) Scale, Proportion, Quantity
4.) Systems and System Models
5.) Energy and Matter
6.) Structure and Function
7.) Stability and Change

Fresno Unified School District

2018-19

H.S. Chemistry

Guiding Questions					
Instructional Segment #1: Combustion	Instructional Segment #2: Heat and Energy in the Earth System	Instructional Segment #3: Atoms, Elements and Molecules	Instructional Segment #4: Chemical Reactions	Instructional Segment #5: Chemistry of Climate Change	Instructional Segment #6: The Dynamics of Chemical Reactions and Ocean Acidification
• What is energy, how is it measured, and how does it flow within a system? • What mechanisms allow us to utilize the energy of our foods and fuels?	• How is energy transferred and conserved? • How can energy be harnessed to perform useful tasks?	• What is inside atoms and how does this affect how they interact? • What models can we use to predict the outcomes of chemical reactions?	• What holds atoms together in molecules? • How do chemical reactions absorb and release energy?	• What regulates weather and climate? • What effects are humans having on the environment?	• How can you alter chemical equilibrium and reaction rates? • How can you predict the relative quantities of products in a chemical reaction?

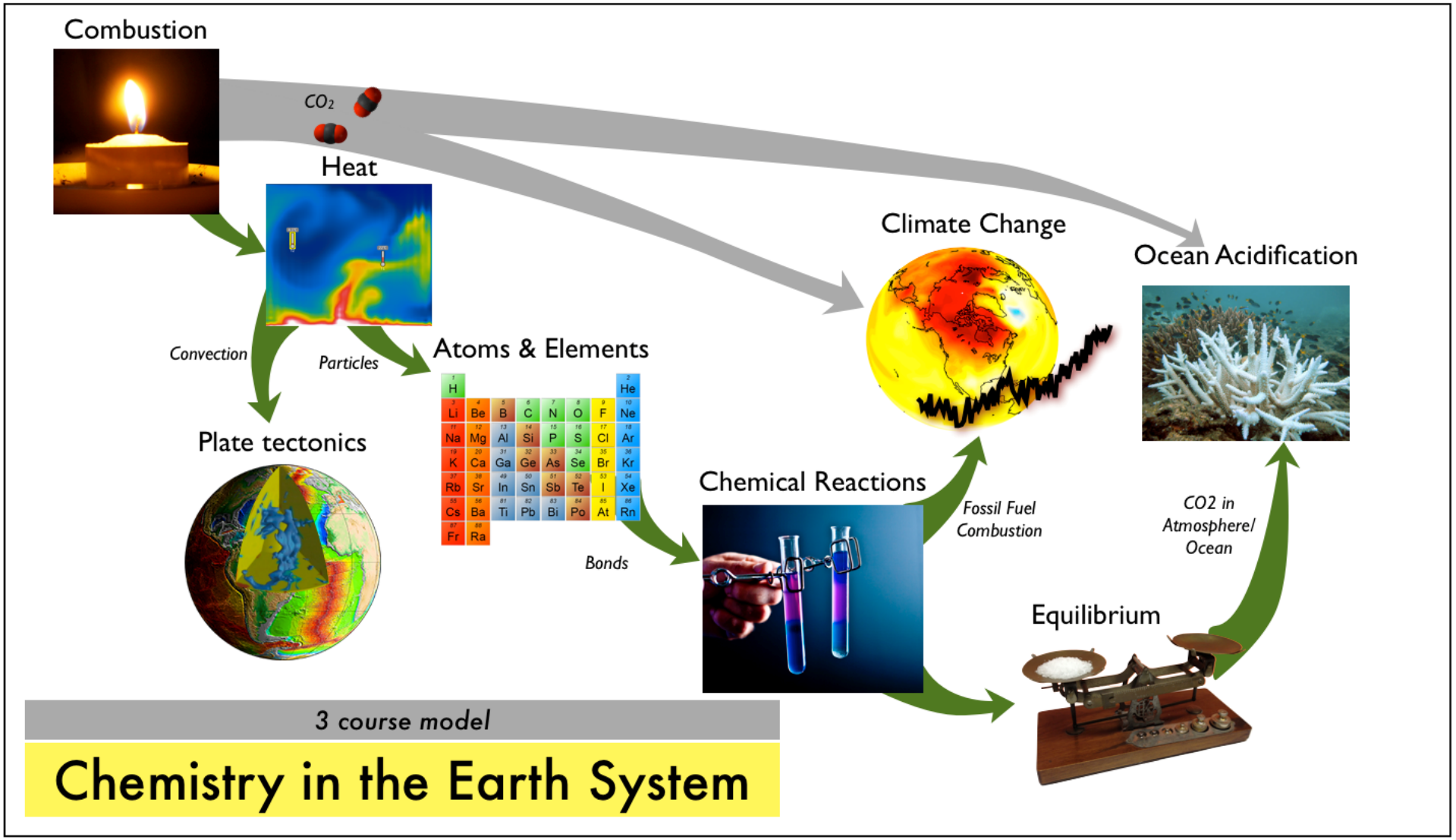
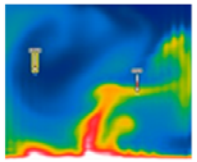
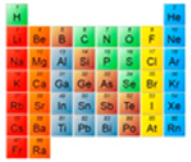
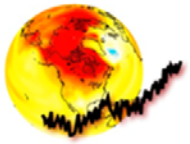
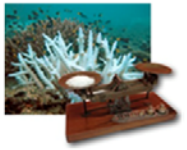

Combustion
CO_2
Heat
Climate Change
Ocean Acidification
Convection
Particles
Atoms & Elements
Plate tectonics
Chemical Reactions
Fossil Fuel Combustion
CO2 in Atmosphere/ Ocean
Bonds
Equilibrium
3 course model
Chemistry in the Earth System

Table 7.4. Overview of Instructional Segments for High School Chemistry in the Earth System

	***1 Combustion***	In this brief introductory unit, students investigate the amount of stored chemical potential energy in food. They make observations of material properties at the bulk scale that they will later explain in the atomic scale. The themes of combustion and CO2 tie together several of the Instructional Segments.
	**2** Heat and Energy in the Earth System	Students develop models of energy conservation within systems and the mechanisms of heat flow. They relate macroscopic heat transport to atomic scale interactions of particles, which they will apply in later units to construct models of interactions between atoms. They use evidence from Earth's surface to infer the heat transport processes at work in the planet's interior.
	**3** Atoms, Elements, and Molecules	Students recognize patterns in the properties and behavior of elements, as illustrated on the periodic table. They use these patterns to develop a model of the interior structure of atoms and to predict how different atoms will interact based on their electron configurations. They use chemical equations to represent these interactions and begin to make simple stoichiometric calculations.
	**4** Chemical Reactions	Students refine their models of chemical bonds and chemical reactions. They compare the strength of different types of bonds and attractions and develop models of how energy is stored and released in chemical reactions.
	**5** Chemistry of Climate Change	Students develop models of energy flow in Earth's climate. They revisit combustion reactions from IS1 to focus on emissions from fossil fuel energy sources. They apply models of the structures of molecules to explain how different molecules trap heat in the atmosphere. Students evaluate different chemical engineering solutions that can reduce the impacts of climate change.
	**6** Dynamics of Chemical Reactions and Ocean Acidification	Students investigate the effects of fossil fuel combustion on ocean chemistry. They develop models of equilibrium in chemical reactions and design systems that can shift the equilibrium. Students conduct original research on the interaction between ocean water and shell-building organisms.

Resource from: CA Science Framework, Ch. 7, pg. 126-127

Chemistry- Quarter 1 Overview			
Quarter Topic Focus: Combustion			
Science & Engineering Practice (SEP)	**Disciplinary Core Idea (DCI)**	**Crosscutting Concept (CCC)**	**Performance Expectation (PE)**
How students will demonstrate their understanding…	**What** students will understand…	How students will connect their understanding across units and courses… (**Why** they should know it)	A complete standard **(SEP + DCI + CCC = PE)** *colors are associated with SEP (see page 1 for key)
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.	(Patterns)	PS1-3
Develop a model to illustrate	that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.	(Energy and Matter)	PS1-4
Use mathematical representations to support	the claim that atoms, and therefore mass, are conserved during a chemical reaction.	(Energy and Matter)	PS1-7
Create a computational model to calculate the change	in energy of one component of a system when the change in energy of the other component(s) and energy flows in and out of the system are know.	(Systems and System Models)	PS3-1

Chemistry- Quarter 2 Overview			
Quarter Topic Focus: Heat and Energy in the Earth System & Atoms, Elements and Molecules			
Science & Engineering Practice (SEP)	**Disciplinary Core Idea (DCI)**	**Crosscutting Concept (CCC)**	**Performance Expectation (PE)**
How students will demonstrate their understanding…	**What** students will understand…	How students will connect their understanding across units and courses… (**Why** they should know it)	A complete standard **(SEP + DCI + CCC = PE)** *colors are associated with SEP (see page 1 for key)
Create a computational model to calculate the change	in energy of one component of a system when the change in energy of the other component(s) and energy flows in and out of the system are know.	(Systems and System Models)	PS3-1
Develop and use models to illustrate that	energy at the macroscopic scale can be accounted for as a combination of energy associated with the motion of particles (objects) and energy associated with the relative positions of particles (objects).	(Energy and Matter)	PS3-2
Plan and conduct an investigation to provide evidence that	the transfer of thermal energy when two components of different temperatures are combined within a closed systems results in a more uniform energy distribution among the components in the system (second law of thermodynamics).	(Systems and System Models)	PS3-4
Develop a model based on evidence	of Earth's interior to describe the cycling of matter by thermal convection.	(Energy and Matter)	ESS2-3
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.	(Systems and System Models)	ETS1-4

Use the periodic table as a model	to predict the relative properties of elements based on the patterns of electrons in the outmost energy level of atoms.	(Patterns)	PS1-1
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.	(Patterns)	PS1-2
Use mathematical representations to support the	claim that atoms, and therefore mass, are conserved during a chemical reaction.	(Energy and Matter)	PS1-7

Chemistry- Quarter 3 Overview			
Quarter Topic Focus: Chemical Reactions & Chemistry of Climate Change			
Science & Engineering Practice (SEP)	**Disciplinary Core Idea (DCI)**	**Crosscutting Concept (CCC)**	**Performance Expectation (PE)**
How students will demonstrate their understanding…	**What** students will understand…	How students will connect their understanding across units and courses… (**Why** they should know it)	A complete standard **(SEP + DCI + CCC = PE)** *colors are associated with SEP (see page 1 for key)
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.	(Patterns)	PS1-3
Develop a model to illustrate that	the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.	(Energy and Matter)	PS1-4
Develop and use a model of	two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interactions.	(Cause and Effect)	PS3-5
Use mathematical representations of	Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.	(Patterns)	PS2-4
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.	(Patterns)	PS1-5
Use mathematical representations to support the	claim that atoms, and therefore mass, are conserved during a chemical reaction.	(Energy and Matter)	PS1-7

Analyze geoscience data to make the claim that	one change to Earth's surface can create feedbacks that cause changes to other Earth systems.	(Stability and Change)	ESS2-2
Use a model to describe how	variations in the flow of energy into and out of Earth's systems result in changes in climate.	(Cause and Effect)	ESS2-4
Develop a quantitative model to describe	the cycling of carbon among the hydrosphere, atmosphere, biosphere, and geosphere.	(Energy and Matter)	ESS2-6
Evaluate competing design solutions for	developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.	(Engineering CCC connection)	ESS3-2
Analyze geoscience data	and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth's systems.	(Stability and Change)	ESS3-5
Use a computational representation to illustrate	the relationships among Earth systems and how those relationships are being modified due to human activity.	(Systems and System Models)	ESS3-6

Chemistry- Quarter 4 Overview			
Quarter Topic Focus: The Dynamics of Chemical Reactions and Ocean Acidification			
Science & Engineering Practice (SEP)	**Disciplinary Core Idea (DCI)**	**Crosscutting Concept (CCC)**	**Performance Expectation (PE)**
How students will demonstrate their understanding…	**What** students will understand…	How students will connect their understanding across units and courses… (**Why** they should know it)	A complete standard **(SEP + DCI + CCC = PE)** *colors are associated with SEP (see page 1 for key)
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.	(Patterns)	PS1-5
Refine the design of a chemical system	by specifying a change in conditions that would produce increased amounts of products at equilibrium.	(Stability and Change)	PS1-6
Use mathematical representations to support the claim that	atoms, and therefore mass, are conserved during a chemical reaction.	(Energy and Matter)	PS1-7
Analyze geoscience data to make the claim that	one change to Earth's surface can create feedbacks that cause changes to other Earth systems.	(Stability and Change)	ESS2-2
Develop a quantitative model to describe	the cycling of carbon among the hydrosphere, atmosphere, biosphere, and geosphere.	(Energy and Matter)	ESS2-6