Whitehall-Coplay School District Syllabus

Course Title: COLLEGE PREP CHEMISTRY Grade: 10-12

DESCRIPTION OF COURSE: This course is designed for the college-bound student who may or may not major in the sciences. Students will learn the basic structure of atoms, ions, and molecules and how they determine properties of matter. They will also learn chemical bonding, reactions, the periodic table, the mole concept, gas laws, writing chemical formulas, and dimensional analysis methods to solve problems. Students will understand and use the scientific method of inquiry by solving problems in the laboratory. Working individually and in small groups, students will analyze and interpret data. Achievement will be demonstrated through tests, quizzes, laboratory investigations, homework, and projects.

Unit	Anchoring Phenomena	SUGGESTED INSTRUCTIONAL TIME	STANDARDS/ ELIGIBLE CONTENT
Unit 0: Lab safety, Observation, Modeling, Scientific Discourse.	We look at a candle burning and wonder, how does that work?	4.0 weeks	
Unit 1: The Search for Life	We look at an image of the night sky and wonder if there is life out there.	14 lessons: 8-9 weeks	• **HS-PS1-1:** Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. • **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. • **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. • **HS-PS2-6:** Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. Partially developed Earth science PEs • **HS-ESS2-5:** Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. • **HS-ESS1-2:** Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.
Unit 2: Fuels	Anchoring Phenomenon: We learn that carbon emissions are a huge problem, and that rocket fuel could mitigate carbon emissions; but we don't use it. Why?	15 lessons- 8-9 weeks	• **HS-PS1-4:** 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. • **HS-PS3-5:** 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 interaction. • **HS-PS3-1:** Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. • **HS-PS1-7:** Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. [Clarification Statement:

			Emphasis is on using mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem-solving techniques.] [*Assessment Boundary: Assessment does not include complex chemical reactions.*] • **HS-ESS3-2:** Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.* [Clarification Statement: Emphasis is on the conservation, recycling, and reuse of resources (such as minerals and metals) where possible, and on minimizing impacts where it is not. Examples include developing best practices for agricultural soil use, mining (for coal, tar sands, and oil shales), and pumping (for petroleum and natural gas). Science knowledge indicates what can happen in natural systems—not what should happen.]
Unit 3: OystersUnit	Anchoring Phenomenon: We see a video of oyster farmers in the Northwest US and hear that the oysters are impacted by more acidic water. Why is that happening?	11 lessons - 5-7 weeks	• ***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. [Clarification Statement: Emphasis is on student reasoning that focuses on the number and energy of collisions between molecules.] [Assessment Boundary: Assessment is limited to simple reactions in which there are only two reactants; evidence from temperature, concentration, and rate data; and qualitative relationships between rate and temperature.] • **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.* [Clarification Statement: Emphasis is on the application of Le Chatelier's Principle and on refining designs of chemical reaction systems, including descriptions of the connection between changes made at the macroscopic level and what happens at the molecular level. Examples of designs could include different ways to increase product formation including adding reactants or removing products.] [Assessment Boundary: Assessment is limited to specifying the change in only one variable at a time. Assessment does not include calculating equilibrium constants and concentrations.] • **HS-PS1-7.** Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. [Clarification Statement: Emphasis is on using mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem-solving techniques.] [Assessment Boundary: Assessment does not include complex chemical reactions.] • **HS-ESS3-4.** Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.* [Clarification Statement: Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or areal changes in land surface use (such as for urban development, agriculture and livestock, or surface mining). Examples for limiting future impacts could range from local efforts (such as reducing, reusing, and recycling resources) to large-scale geoengineering design solutions (such as altering global temperatures by making large changes to the atmosphere or ocean).] • **HS-ESS3-6.** Use a computational representation to illustrate the relationships among Earth systems and how

			those relationships are being modified due to human activity. [Clarification Statement: Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere. An example of the far-reaching impacts from human activity is how an increase in atmospheric carbon dioxide results in an increase in photosynthetic biomass on land and an increase in ocean acidification, with resulting impacts on sea organism health and marine populations.] [Assessment Boundary: Assessment does not include running computational representations but is limited to using the published results of scientific computational models.]
Unit 4:Nuclear Unit	Anchoring Phenomenon: We wonder how an amount of nuclear material the size of a milk jug could ruin a city and if that power could be used for good. We read that Einstein, who brought the possibility of nuclear energy to the US, changed his mind about cooperating with the US government when he saw the damage of the bomb.	12 lessons- 5-7 weeks	• **HS-PS1-8:** Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay. • **HS-ESS3-2:** Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
Unit 5: Polar Ice	Anchoring Phenomenon: We see how people are having to move away from coastal areas all around the world and we worry about where they can go. We wonder if there's anything that we can do to make the sea stop rising, and we worry about what is causing the sea level rise and how much it will rise.	11 lessons- 5-7 weeks	• **HS-PS3-1:** Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. • **HS-PS3-4:** 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 system results in a more uniform energy distribution among the components in the system (second law of thermodynamics). • **HS-ESS2-2:** Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems. • **HS-ESS3-4:** Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.* • **HS-ESS3-5:** 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. • **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. • * The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

RESOURCES: inquiryHub Chemistry (Northwestern University and University of Colorado Boulder), Textbook: Chemistry, by Wilbraham, Pearson Publisher, 2017,
Rev.: 9/29/25