SCIENCE
RHINEBECK PRIORITIZED CURRICULUM
CHEMISTRY

Background:

(Assess students' prior knowledge of the atom, see below, to bring misconceptions to light.)

The idea that matter is made up of particles is over 2000 years old, but the idea of using properties of these particles to explain observable characteristics of matter has recent origins. Around 400 BC in ancient Greece, it was proposed that matter is composed of particles of four elements, earth, air, wind and fire, and that these particles are in continual motion. The idea that particles could explain properties of matter was not used for about 2000 years. In the late 1600's the properties of air were attributed to its particulate nature: however, these particles were not thought to be fundamental, but could change (transmutes) into other particles with different properties.

In the late 1700's, solid evidence about the nature of matter, gained through quantitative scientific experiments, accumulated. Such evidence included the finding that water and earth could not be changed into each other, and that during a chemical reaction matter was conserved. In the early 1800's a theory was proposed to explain these experimental facts. In this theory, atoms were hard, indivisible spheres of different sizes and they combined in simple whole-number ratios to form compounds. The further treatment of particles of matter as hard spheres in continual motion resulted in the 1800's in the kinetic theory of matter, which was used to explain the property of gases.

In the late 1800's evidence was discovered that particles of matter could not be considered hard spheres; instead particles were found to have an internal structure. The development of cathode ray tubes, and subsequent experiments with them in the 1860's, led to the proposal that small, negatively charged particles – electrons – are part of the internal structure of atoms. In the early 1900's, to explain the results of the "gold foil experiment", a small, dense nucleus was proposed to be at the center of the atom. Around this time, energy was proposed to exist in small, indivisible packets called quanta. This quantum theory was used to develop a model of the atom which had a central nucleus surrounded by shells of electrons. This model was successful in explaining the spectra of the hydrogen atom and was used to explain aspects of chemical bonding.

Further investigation into the nature of the electron determined that it has a wave-like property. This feature was incorporated into the wave-mechanical model of the atom, our most sophisticated model , and is necessary to explain the spectra of multi-electron atoms. **(from NYS Physical Setting/Chemistry Core curriculum)**

SCIENCE
RHINEBECK PRIORITIZED CURRICULUM
CHEMISTRY

Standard 4: Key Idea 3: Performance Indicator 3.1: Explain the properties of materials in terms of the arrangement and properties of the atoms that compose them.					
Essential Knowledge/Skills *(Major Understandings)*	***Priority Code***	***Essential Question***	***Classroom Ideas***	***Assessment Ideas***	***Time***
ATOMIC CONCEPTS 3.1a The modern model of the atom has evolved over a long period of time through the work of many scientists. 3.1b Each atom has a nucleus, with an overall positive charge, surrounded by negatively charged electrons 3.1c Subatomic particles contained in the nucleus include protons and neutrons. 3.1d The proton is positively charged and the neutron has no charge. The electron is negatively charged. 3.1e Protons and electrons have equal but opposite charges. 3.1f The mass of each proton and each neutron is approximately equal to one atomic mass unit. An electron is much less massive than a proton or a neutron. 3.1h In the wave-mechanical (electron cloud) model, the electrons are in orbitals, which are regions of most probable electron location (ground state). 3.1i Each electron in an atom has its own distinct amount of energy.	E E E E E E E E	▪ Why do scientists "make" or use models? ▪ How can we learn about things we can't see? ▪ How and why has our view of the atom changed over time? ▪ How does the current structure of the atom explain the behavior of atom? ▪ How will the concepts developed here relate to future topics i.e., periodic table, bonding?	▪ Lecture ▪ Demo ▪ Draw a picture or diagram ▪ Homework explanation ▪ Mini-lab ▪ Formal lab ▪ Brainstorm-concept map ▪ Build a model ▪ Research/literature internet ▪ Timeline ▪ Graphing, graphic organizers	▪ Quick quiz ▪ Start question ▪ Homework checks ▪ Check problem ▪ Mini-lab ▪ Rubrics for evaluating projects	2-3 weeks

Standard 4: Key Idea 3: Performance Indicator 3.1: Explain the properties of materials in terms of the arrangement and properties of the atoms that compose them.

Essential Knowledge/Skills (Major Understandings)	*Priority Code*	*Essential Question*	*Classroom Ideas*	*Assessment Ideas*	*Time*
3.1j After an electron in an atom gains a specific amount of energy, the electron is at a higher energy level (excited state). 3.1k When an electron returns from a higher energy state to a lower energy state, energy is emitted. This emitted energy corresponds to a specific wavelength in the electromagnetic spectrum. 3.1l Wavelengths can be used to identify a substance. Each kind of atom or molecule can gain or lose energy in discrete amounts, and thus can absorb or emit energy only at wavelengths corresponding to these amounts. 3.1m In general, the outermost electrons in an atom are called the valence electrons. The number of valence electrons determines the chemical properties of an element. The chemical reactivity of an atom is dependent on its size. 3.1n Atoms of an element that contain the same number of protons but a different number of neutrons are called isotopes of that element. 3.1o The average atomic mass of an element is the weighted average of the masses of its naturally occurring isotopes.	E E E E E E	▪ Why do scientists "make" or use models? ▪ How can we learn about things we can't see? ▪ How and why has our view of the atom changed over time? ▪ How does the current structure of the atom explain the behavior of atom? ▪ How will the concepts developed here relate to future topics i.e., periodic table, bonding?	▪ Lecture ▪ Demo ▪ Draw a picture or diagram ▪ Homework explanation ▪ Mini-lab/ activity ▪ Formal lab	▪ Homework checks ▪ Wipe board work ▪ Check problem ▪ Lab report ▪ Unit check ▪ Chapter test ▪ ▪ Rubrics for evaluating projects	2-3 weeks

Standard 4: Key Idea 3: Performance Indicator 3.1: Explain the properties of materials in terms of the arrangement and properties of the atoms that compose them.

Essential Knowledge/Skills (Major Understandings)	*Priority Code*	*Essential Question*	*Classroom Ideas*	*Assessment Ideas*	*Time*
PERIODIC TABLE 3.1y The placement or location of elements on the periodic table gives an indication of physical and chemical properties of that element. The elements on the periodic table are arranged in order of increasing atomic number. 3.1g The number of protons in an atom (atomic number) identifies the element. The sum of the protons and neutrons in an atom (mass number) identifies an isotope. Examples of common notations that represent isotopes include: $_{6}^{14}C$, ^{14}C, carbon-14, C-14. 3.1v Elements can be classified as metals, nonmetals, metalloids, and noble gases.) 3.1w Elements can be differentiated by their physical properties. Physical properties of substances, such as density, conductivity, malleability, solubility, and hardness, differ between elements. 3.1x Elements can be differentiated by chemical properties. Chemical properties describe how an element behaves during a chemical reaction. 5.2f Some elements exist as allotropes. Allotropes are two or more forms of the same element that differ in their molecular or crystalline structure, and hence in their properties. 3.1z For Groups 1,2, and 13-18, elements within the same group have the same number of valence electrons (helium is an exception) and therefore similar reactivity. 3.1aa The succession of elements within the same group demonstrates characteristic trends, e.g., differences in atomic radius, ionic radius, electronegativity, first ionization energy. These trends can be explained in terms of atomic structure (size). 3.1bb The succession of elements across the same period demonstrates characteristic trends, e.g., differences in atomic radius, ionic radius, electronegativity, first ionization energy. These trends can be explained in terms of atomic structure (nuclear charge).	E E E E E E E E E	▪ If elements are made of the same particles, how can their properties differ? ▪ How does the organization of a periodic/ reference table assist us in our study of chemistry? ▪ How is the arrangement of the periodic tale related to atomic structure? ▪ How has the organization of the elements changed over time?	▪ Lecture ▪ Demo ▪ Homework explanation ▪ Mini- lab/activity ▪ Formal lab ▪ Build a model ▪ Film (video) ▪ Research/literature Internet ▪ Timeline ▪ Internet/ computer simulations ▪ Graphing/ graphic organizers	▪ Quick quiz ▪ Start question ▪ Homework checks ▪ Wipe board work ▪ Lab report ▪ Teacher observation ▪ Student responses to teacher questions ▪ Rubrics for evaluating projects	1 week

Standard 4: Key Idea 3: Performance Indicator 3.1: Apply the principle of conservation of mass to chemical reactions.					
Essential Knowledge/Skills (Major Understandings)	*Priority Code*	*Essential Question*	*Classroom Ideas*	*Assessment Ideas*	*Time*
MOLES / STOICHIOMETRY 3.1cc compound is a substance composed of two or more different elements that are chemically combines in a fixed proportion. A chemical compound can be broken down by chemical means. A chemical compound can be represented by a specific formula and assigned a name based on the IUPAC system. 3.1dd A chemical formula can be represented as an empirical formula, a structural formula, or a molecular formula. 3.3d The empirical formula of a compound is the simplest whole-number ratio of atoms of the elements in a compound. It may be different than the molecular formula, which is the actual ratio of atoms in a molecule of that compound. 3.3e The molecular formula is a whole-number multiple of the empirical formula. 3.3a In all reactions there is a conservation of mass, energy, and charge. 3.3c A balanced chemical equation represents conservation of atoms. The coefficients in a balanced chemical equation can be used to determine mole ratios in the reaction. 3.3f The formula of a substance is the sum of the masses of its atom. The gram-formula mass of a substance equals one mole of that substance. 3.3g The percent composition by mass of each element in a compound can be calculated mathematically. 3.2b There are many types of chemical reactions, e.g., synthesis, decomposition, single replacement, and double replacement.	E E E E E E E E E	▪ How could you estimate the number of atoms in a glass of water? In your body? ▪ How do chemists determine the formulas of compounds? ▪ Compare carbon monoxide to carbon dioxide. ▪ How do scientists count atom? ▪ How are you going to convey the immense size of a mole? ▪ What does a "mole mean? ▪ How do other counting systems compare to mole? (i.e., dozen, gross, ream)? ▪ How are reactant/ product rations determined? ▪ How are formulas (such as empirical, molecular) determined? ▪ How has the organization of the elements changed over time?	▪ Lecture ▪ Demo ▪ Individual check problem ▪ Homework explanation ▪ Formal lab ▪ Investigation/ design	▪ Quick quiz ▪ Start question ▪ Homework checks ▪ Wipe board work ▪ Check problem ▪ Homework pairs ▪ Lab report ▪ Mini-test ▪ Student responses to teacher questions ▪ Rubrics for evaluating projects	4 – 5 weeks

SCIENCE
RHINEBECK PRIORITIZED CURRICULUM
CHEMISTRY

Standard 4: Key Idea 3: Performance Indicator 3.1: Explain chemical bonding in terms of the behavior of electrons.

Essential Knowledge/Skills *(Major Understandings)*	*Priority Code*	*Essential Question*	*Classroom Ideas*	*Assessment Ideas*	*Time*
CHEMICAL BONDING 5.2g Compounds differ in composition as well as chemical and physical properties. Two major categories of compounds are ionic compounds and molecular (covalent) compounds. 5.2a Chemical bonds are formed when valence electrons are: - Transferred from one atom to another (ionic) - Shared between atoms (covalent) - Mobile within a metal (metallic) 5.2e In a multiple covalent bond, more than one pair of electrons is shared between two atoms. Unsaturated organic compounds contain at least one double or triple band. 5.2l Molecular polarity can be determined by the shape and the distribution of charge. Examples of symmetrical (nonpolar) molecules include CO_2, CH_4 and diatomic elements. Examples of asymmetric (polar) molecules include HC1, NH3, and H_2O. 5.2c When an atom gains one or more electrons, it becomes a negative ion and its radius increases. When an atom loses one or more electrons, it becomes a positive ion and its radius decreases.	 E E I E E	▪ If industry can mine silver, why can't we "find" metallic (elemental) sodium? ▪ If sodium is so reactive, how can it exist in the ocean? ▪ Why are some small molecules in the liquid state under ordinary conditions? ▪ Why are some elements stable? ▪ Are all bonds the same? ▪ How do the bonds within a molecule contribute to the overall polarity/ shape of the molecule?	▪ Lecture ▪ Demo ▪ Draw a picture or diagram ▪ Individual check problem ▪ Homework explanation ▪ Mini-lab/ activity ▪ Formal lab ▪ Build a model ▪ Research/ literature Internet ▪ Internet/ computer simulations	▪ Quick quiz ▪ Start question ▪ Homework checks ▪ Wipe board work ▪ Check problem ▪ Homework pairs ▪ Mini-lab ▪ Lab report ▪ Mini-test ▪ Teacher observations ▪ Student responses to teacher questions ▪ Rubrics for evaluating projects	3 weeks

SCIENCE
RHINEBECK PRIORITIZED CURRICULUM
CHEMISTRY

Standard 4: Key Idea 3: Performance Indicator 3.1: Explain the properties of materials in terms of the arrangement and properties of the atoms that compose them.

Essential Knowledge/Skills *(Major Understandings)*	***Priority Code***	***Essential Question***	***Classroom Ideas***	***Assessment Ideas***	***Time***
5.2h When a bond is broken, energy is absorbed. When a bond is formed, energy is released. 5.2b Atoms tend to bond so that a stable valence electron configuration, like that of a noble gas, is achieved. 5.2d Electron-dot diagrams (Lewis structures) can represent the valence electron arrangement in elements and compounds. 5.2f Electronegativity indicates how strongly an atom of an element attracts electrons in a chemical bond. 5.2i Electronegativity values are assigned according to arbitrary scales. 5.2k The electronegativity difference between two bonded atoms is used to assess the degree of polarity in the bond.	E E E I I E	▪ If industry can mine silver, why can't we "find" metallic (elemental) sodium? ▪ If sodium is so reactive, how can it exist in the ocean? ▪ Why are some small molecules in the liquid state under ordinary conditions? ▪ Why are some elements stable? ▪ Are all bonds the same? ▪ How do the bonds within a molecule contribute to the overall polarity/ shape of the molecule?	▪ Lecture ▪ Demo ▪ Homework explanation	▪ Quick quiz ▪ Start question ▪ Homework checks ▪ Wipe board work ▪ Check problem ▪ Homework pairs ▪ Mini-lab ▪ Lab report ▪ Unit tests ▪ Test revisions ▪ Chapter tests ▪ Teacher observations ▪ Student responses to teacher questions ▪ Rubrics for evaluating projects	3 weeks

SCIENCE
RHINEBECK PRIORITIZED CURRICULUM
CHEMISTRY

Standard 4: Key Idea 3: Performance Indicator 3.1: Observe and describe transmission of various forms of energy, and explain heat in terms of kinetic molecular theory.

Essential Knowledge/Skills (Major Understandings)	*Priority Code*	*Essential Question*	*Classroom Ideas*	*Assessment Ideas*	*Time*
PHYSICAL BEHAVIOR OF MATTER		▪ What is a "pure" substance? ▪ How can mixtures be separated? ▪ Why do gases behave differently than liquids and solids? ▪ Why are some materials soluble in water?	▪ Lecture ▪ Demo ▪ Draw a picture ▪ Mini-lab/ activity ▪ Formal lab ▪ Brainstorm- concept map ▪ Word splash	▪ Quick quiz ▪ Start question ▪ Homework checks ▪ Wipe board work ▪ Mini-lab ▪ Lab report ▪ Teacher observations ▪ Student responses to teacher questions ▪ Rubrics for evaluating projects	5-6 weeks
3.1r Matter is classified as a substance or a mixture of substances.	E				
3.1jj The three phases of matter, i.e., solids, liquids, and gases, have different properties	E				
3.1s A substance (element or compound) has a constant composition and constant properties throughout a given sample, and from sample to sample	E				
3.1u Elements are substances that are composed of atoms that have the same atomic number. Elements cannot be broken down by chemical change.	E				
3.1t A mixture is not a substance because it is made up of two or more different elements and/or compounds. The proportions of components in a mixture can be varied. Each component in a mixture retains its original properties.	I				
3.1mm When different substances are mixed together, a homogeneous or heterogeneous mixture is formed. Mixtures are composed of two or more different substances that can be separated by physical means.	I				

Standard 4: Key Idea 3: Performance Indicator 3.1: Explain the properties of materials in terms of the arrangement and properties of the atoms that compose them.

Essential Knowledge/Skills (Major Understandings)	*Priority Code*	*Essential Question*	*Classroom Ideas*	*Assessment Ideas*	*Time*
3.1nn Differences in physical properties such as mass, particle size, molecular polarity, boiling point and freezing point, and solubility permit physical separation of the components of the mixture	E	▪ How can we produce or transfer energy? ▪ What is the relationship/ difference between matter and energy? ▪ How is matter classified? ▪ What are the different forms of matter? ▪ What are the different forms of energy?	▪ Lecture ▪ Demo ▪ Draw a picture or diagram ▪ Homework explanation ▪ Mini-lab/ activity ▪ Formal lab ▪ Investigation/design ▪ Write a problem ▪ Graphing, graphic organizers	▪ Quick quiz ▪ Start questions ▪ Homework checks ▪ Wipe board work ▪ Mini-lab ▪ Lab report ▪ Teacher observations ▪ Student responses to teacher questions ▪ Rubrics for evaluating projects	
3.1oo A solution is a homogeneous mixture of a solute dissolved in a solvent. The solubility of a solute in a given amount is dependent on the temperature, pressure, and the chemical natures of the solute and solvent. The concentration of a solution is expressed in molarity (M), percent by volume, percent by mass, or parts per million (ppm).	E				
3.1pp The addition of a nonvolatile solute to a solvent causes the boiling point of the solvent to increase and the freezing point of the solvent to decrease. The greater the concentration of particles, the greater the effect.	I				
4.1a Energy can exist in different forms, e.g., chemical, light, heat, nuclear.	E				
4.2a Heat is a transfer of energy (usually thermal energy) from a body of higher temperature to a body of lower temperature. Thermal energy is the energy associated with the random motion of atoms and molecules.	E				

Standard 4: Key Idea 3: Performance Indicator 3.4, 4.2: Use kinetic molecular theory to explain rates of reactions and the relationship among temperature, pressure and volume. Explain heat in terms of kinetic molecular theory.

Essential Knowledge/Skills (Major Understandings)	*Priority Code*	*Essential Question*	*Classroom Ideas*	*Assessment Ideas*	*Time*
4.2b Temperature is a measurement of the average kinetic energy of the particles in a sample of material. Temperature is not a form of energy. 3.4b Kinetic molecular theory (KMT) for an ideal gas states: - All particles are in random, constant, straight-line motion. - Gas molecules are separated by great distances relative to their size; the volume of the gas molecules is considered negligible. - The molecules have no attractive forces between them. - Collisions between gas particles may result in the transfer of energy between gas particles 3.4d Particles are in constant motion except at absolute zero (zero kelvin). 3.4c Kinetic molecular theory describes the relationship of pressure, volume, temperature, velocity, and frequency and force of collisions.	E E E E	▪ How can we produce or transfer energy? ▪ What is the relationship/ difference between matter and energy? ▪ How is matter classified? ▪ What are the different forms of matter? ▪ What are the different forms of energy?	▪ Lecture ▪ Demo ▪ Draw a picture or diagram ▪ Individual check problem ▪ Homework explanation ▪ Mini-lab/ activity ▪ Formal lab	▪ Quick quiz ▪ Start questions ▪ Homework checks ▪ Wipe board work ▪ Check problem ▪ Homework pairs ▪ Lab report ▪ Problem writing ▪ Mini test ▪ Teacher observations ▪ Student responses to teacher questions ▪ Rubrics for evaluating projects	

Standard 4: Key Idea 3,4,5: Performance Indicator 3.1, 3.2, 4.1, 4.2, 5.2: Explain the properties of materials in terms of the arrangement and properties of the atoms that compose them. Use atomic and molecular models to explain common chemical reactions. Observe and describe transmission of various forms of energy. Explain heat in terms of kinetic molecular theory. Explain chemical bonding in terms of the behavior of electrons.

Essential Knowledge/Skills (Major Understandings)	*Priority Code*	*Essential Question*	*Classroom Ideas*	*Assessment Ideas*	*Time*
4.2c The concepts of kinetic and potential energy can be used to explain physical processes that include: fusion (melting), solidification (freezing), vaporization (boiling, evaporation), condensation, sublimation, and deposition. 3.2a A physical change results in the rearrangement of existing particles in a substance. A chemical change results in the formation of different particles with changed properties.) 4.1b Chemical and physical changes can be exothermic or endothermic. 3.1ii The structure and arrangement of particles and their interactions determine the physical state of a substance at a given temperature and pressure. 5.2m Intermolecular forces created by the unequal distribution of electrons result in varying degrees of attraction between molecules. Hydrogen bonding is an example of a strong intermolecular force.	E E E E E	▪ What is the relationship/ difference between matter and energy? ▪ How is matter classified? ▪ What are the different forms of matter? ▪ What are the different forms of energy?	▪ Lecture ▪ Demo ▪ Draw a picture or diagram ▪ Homework explanation ▪ Mini-lab/ activity ▪ Formal lab ▪ Investigation/design	▪ Quick quiz ▪ Start questions ▪ Homework checks ▪ Wipe board work ▪ Check problem ▪ Homework pairs ▪ Mini labs ▪ Lab report ▪ Unit checks ▪ Test revisions ▪ Chapter test ▪ Teacher observations ▪ Student responses to teacher questions ▪ Rubrics for evaluating projects	

Standard 4: Key Idea 3: Performance Indicator 3.4, 4.1: Use kinetic molecular theory to explain rates of reactions and the relationships among temperature, pressure, and volume of a substance. Observe and describe transmission of various forms of energy.

Essential Knowledge/Skills (Major Understandings)	*Priority Code*	*Essential Question*	*Classroom Ideas*	*Assessment Ideas*	*Time*
KINETICS & EQUILIBRIUM 4.1e The stability of a compound is dependent on the amount of energy absorbed or released during the formation of the compound from its elements. 3.4f Collision theory states that a reaction is most likely to occur if reactant particles collide with the proper energy and 3.4f The rate of a chemical reaction is the change in concentration of a reactant or product per unit time. 3.4g The rate of chemical reaction depends on several factors: temperature, concentration, and nature of reactants, surface area, and the presence of a catalyst. 3.4i Some chemical and physical changes can reach equilibrium. 3.4j At equilibrium the rate of the forward reaction equal the rate of the reverse reaction while the measurable quantities of reactants and products remain constant.	I E E E E E	▪ Why are some reactions dangerous or explosive? ▪ Can chemists control or influence the rate of chemical change? ▪ What factors affect the rate of a chemical reaction? ▪ What is it that is equal in equilibrium? ▪ What factors affect equilibrium?	▪ Lecture ▪ Demo ▪ Draw a picture or diagram ▪ Individual check problem ▪ Mini-lab/ activity ▪ Formal lab ▪ Investigation/ design ▪ Graphing, graphic organizers	▪ Quick quiz ▪ Start question ▪ Homework checks ▪ Wipe board work ▪ Mini- lab ▪ Lab report ▪ Mini-test ▪ Teacher observations ▪ Student responses to teacher questions ▪ Rubrics for evaluating projects	3 weeks

Standard 4: Key Idea 3: Performance Indicator 3.4, 4.1: Use kinetic molecular theory to explain rates of reactions and the relationships among temperature, pressure, and volume of a substance. Observe and describe transmission of various forms of energy.

Essential Knowledge/Skills (Major Understandings)	*Priority Code*	*Essential Question*	*Classroom Ideas*	*Assessment Ideas*	*Time*
3.4k LeChatelier's principle can be used to predict the effect of stress (change in pressure, volume, concentration, and temperature) on a system at equilibrium.	E	▪ Why are some reactions dangerous or explosive? ▪ Can chemists control or influence the rate of chemical change? ▪ What factors affect the rate of a chemical reaction? ▪ What is it that is equal in equilibrium? ▪ What factors affect equilibrium?	▪ Lecture ▪ Demo ▪ Draw a picture or diagram ▪ Mini-lab/ activity ▪ Formal lab ▪ Analogies	▪ Quick quiz ▪ Start question ▪ Homework checks ▪ Wipe board work ▪ Check problem ▪ Lab report ▪ Unit checks ▪ Test revisions ▪ Chapter test ▪ Teacher observations ▪ Student responses to teacher questions ▪ Rubrics for evaluating projects	3 weeks
4.1c Energy released or absorbed by a chemical reaction can be represented by a potential energy diagram.	E				
4.1d Energy released or absorbed during a chemical reaction is equal to the difference between the potential energy of the products and the potential energy of the reactants.	E				
3.4h A catalyst provides an alternate reaction mechanism, which has a lower activation energy than an uncatalyzed reaction.	E				
3.1kk Entropy is a measure of the randomness or disorder of a system. A system with greater disorder has greater entropy.	E				
3.1ll Systems in nature tend to undergo changes in energy and entropy.	E				

SCIENCE
RHINEBECK PRIORITIZED CURRICULUM
CHEMISTRY

Standard 4: Key Idea 3,5: Performance Indicator 3.1, 3.2, 5.2: Explain the properties of materials in terms of the arrangement and properties of the atoms that compose them. Use atomic and molecular models to explain common chemical reactions. Explain chemical bonding in terms of the behavior of electrons.

Essential Knowledge/Skills (Major Understandings)	*Priority Code*	*Essential Question*	*Classroom Ideas*	*Assessment Ideas*	*Time*
ORGANIC CHEMISTRY 3.1ee Organic compounds contain carbon atoms which bond to one another in chains, rings, and networks to form a variety of structures (polymers, oils, and other large molecules). (3.1ee) 3.1gg Functional groups impart distinctive physical and chemical properties to organic compounds. 3.1ff Hydrocarbons, organic acids, alcohols, esters, amines, amides, and amino acids are categories of organic molecules that differ in their structural formulae as a result of different functional groups. 3.1hh Hydrocarbons, organic acids, alcohols, and esters are named using the IUPAC system. The IUPAC system. The IUPAC system provides a method of distinguishing among isomers of organic compounds. 3.1ii Unsaturated organic compounds contain at least one 3.2c Addition, hydrogenation, substitution, polymerization, esterification, fermentation, saponification, oxidation, and combustion are examples of organic reactions.	E E E E E E	▪ How can we synthesize important molecules found in nature? ▪ How are the key molecules made in your body? ▪ Why is carbon the most important element in your life? ▪ Why is carbon unique? Why can carbon form some many different types of compounds? ▪ How do we name different types of carbon compounds? ▪ What kinds of reactions can carbon containing compounds undergo? ▪ What are isomers? ▪ What is saturated and unsaturated?	▪ Lecture ▪ Demo ▪ Wipe board example ▪ Draw a picture or diagram ▪ Individual check problem ▪ Homework explanation ▪ Mini-lab/ activity ▪ Formal lab	▪ Quick quiz ▪ Start question ▪ Homework checks ▪ Wipe board work ▪ Homework pairs ▪ Mini- lab ▪ Lab report ▪ Teacher observations ▪ Student responses to teacher questions ▪ Rubrics for evaluating projects	2 weeks

Standard 4: Key Idea 3: Performance Indicator 3.2, 3.3: Use atomic and molecular models to explain common chemical reactions. Apply the principle of conservation of mass to chemical reactions.

Essential Knowledge/Skills *(Major Understandings)*	*Priority Code*	*Essential Question*	*Classroom Ideas*	*Assessment Ideas*	*Time*
OXIDATION/ REDUCTION		▪ How does your body produce energy?	▪ Lecture	▪ Quick quiz	2 weeks
3.2d An oxidation-reduction (redox) reaction involves the transfer of electrons (e^-).	E	▪ What particles move during chemical changes?	▪ Demo ▪ Wipe board example	▪ Start question ▪ Homework checks	
3.2e Reduction is the gain of electrons.	E	▪ Why do bridges need frequent repairs?	▪ Draw a picture or diagram	▪ Wipe board work	
3.2f A half-reaction can be written to represent reduction.	E		▪ Individual check problem	▪ Check problem	
3.2g Oxidation is the loss of electrons. Historically, oxidation was explained as the chemical combination with oxygen.	E	▪ What is conserved during chemical change? ▪ How does a car rust?	▪ Homework explanation ▪ Mini-lab/ activity ▪ Formal lab	▪ Homework pairs ▪ Lab report ▪ Unit checks	
3.2h A half-reaction can be written to represent oxidation.	E	▪ How does a battery work?	▪ Investigation/ design	▪ Mini tests	
3.3b In a redox reaction there is a conservation of charge and mass. The number of electrons lost is equal to the number of electrons gained.	E	▪ How do we "plate" things?	▪ Lecture ▪ Demo ▪ Wipe board example	▪ Test revisions ▪ Chapter test ▪ Teacher observation	
3.2i Oxidation numbers can be assigned to atoms and ions. Changes in oxidation numbers indicate oxidation and reduction.	E		▪ Draw a picture or diagram ▪ Mini-lab/ activity ▪ Formal lab	▪ Student responses to teacher questions ▪ Rubrics for evaluating projects	
3.2j Corrosion of metals, combustion of fuels, and spoilage of foods are examples of redox reactions.	I		▪ Analogies		
3.2k In an electrochemical cell, oxidation occurs at the anode and reduction at the cathode.	I				
3.2l A voltaic cell can operate without an outside energy source.	E				
3.2m Batteries are practical applications of voltaic cells.	I				
3.2n An electrolytic cell requires an outside energy source.	E				
3.2a Refining of metals and electroplating are practical applications of voltaic cells	I				

SCIENCE
RHINEBECK PRIORITIZED CURRICULUM
CHEMISTRY

Standard 4: Key Idea 3: Performance Indicator 3.1: Explain the properties of materials in terms of the arrangement and properties of the atoms that compose them.

Essential Knowledge/Skills *(Major Understandings)*	*Priority Code*	*Essential Question*	*Classroom Ideas*	*Assessment Ideas*	*Time*
ACIDS, BASES, AND SALTS		▪ What is the difference between acidic, basic, and neutral solutions?	▪ Lecture	▪ Quick quiz	3 weeks
3.1uu Behavior of many acids and bases can be explained by the Arrhenius theory. Arrhenius acids and bases are electrolytes.	E	▪ Why do acids neutralize bases?	▪ Demo	▪ Start question	
3.1qq An electrolyte is a substance which, when dissolved in water, forms a solution capable of conducting an electric current. The ability of a solution to conduct an electric current depends on the number of ions.	E	▪ What are some everyday acids and bases?	▪ Wipe board example	▪ Homework checks	
3.1vv Arrhenius acids yield H_3O^+ (hydronium ion) as the only positive ion in an aqueous solution	E	▪ Why are some acids and bases harmful?	▪ Draw a picture or diagram	▪ Wipe board work	
3.1ww Arrhenius acids react with active metals to produce hydrogen gas.	E	▪ Why do some solutions conduct?	▪ Individual check problem	▪ Check problem	
3.1xx Arrhenius bases yield OH^- (hydroxide ion) as the only negative ion in an aqueous solution.	E	▪ What happens when an acid and base are mixed?	▪ Mini-lab/ activity	▪ Homework pairs	
3.1yy In the process of neutralization, an Arrhenius acid and an Arrhenius base react to form a salt and water.	E	▪ Where in your body are acids important?	▪ Formal lab	▪ Mini lab	
		▪ Why are acids important in general?	▪ Investigation/ design	▪ Lab report	
			▪ Graphing, graphic organizers	▪ Teacher observation	
				▪ Student responses to teacher questions	
				▪ Rubrics for evaluating projects	

Standard 4: Key Idea 3: Performance Indicator 3.1: Explain the properties of materials in terms of the arrangement and properties of the atoms that compose them.

Essential Knowledge/Skills (Major Understandings)	*Priority Code*	*Essential Question*	*Classroom Ideas*	*Assessment Ideas*	*Time*
3.1zz Titration is a laboratory process in which a volume of solution of known concentration is used to determine the concentration of another solution. 3.1rr An aqueous solution of a salt conducts electricity. The solution can have a pH greater than, equal to, or less than 7. 3.1ss The acidity or alkalinity of a solution can be measured by its pH value. The relative level o f acidity or alkalinity of a solution can be shown by using indicators. 3.1tt The mathematical definition of pH is: pH=-log [H_3O^+]. On the pH scale, each decrease of one unit of pH represents a ten-fold increase in hydronium ion concentration.	E E E E	▪ What is the difference between acidic, basic, and neutral solutions? ▪ Why do acids neutralize bases? ▪ What are some everyday acids and bases? ▪ Why are some acids and bases harmful? ▪ Why do some solutions conduct? ▪ What happens when an acid and base are mixed? ▪ Where in your body are acids important? ▪ Why are acids important in general?	▪ Lecture ▪ Demo ▪ Wipe board example ▪ Draw a picture or diagram ▪ Individual check problem ▪ Homework explanation ▪ Mini-lab/ activity ▪ Formal lab ▪ Graphing, graphic organizers ▪ analogies	▪ Quick quiz ▪ Start question ▪ Homework checks ▪ Wipe board work ▪ Check problem ▪ Homework pairs ▪ Lab report ▪ Problem writing ▪ Unit checks ▪ Mini tests ▪ Test revisions ▪ Teacher observation ▪ Student responses to teacher questions	

Standard 4: Key Idea 3,4,5: Performance Indicator 3.1, 4.4, 5.3: Explain the properties of materials in terms of the arrangement and properties of the atoms that compose them. Explain the benefits and risks of radioactivity. Compare energy relationships within an atom's nucleus to those outside the nucleus.

Essential Knowledge/Skills (Major Understandings)	*Priority Code*	*Essential Question*	*Classroom Ideas*	*Assessment Ideas*	*Time*
NUCLEAR CHEMISTRY 3.1p Isotopes of atoms can be stable or unstable. Stability of isotopes is based on the number of protons and neutrons in its nucleus. Some nuclei are unstable and spontaneously decay, emitting radiation. 4.4a Each radioactive isotope has a specific mode and rate of decay (half-life). 3.1q Spontaneous decay can involve the release of alpha particles, beta particles, or gamma radiation from the nucleus of an unstable isotope. These emissions differ in mass, charge, and penetrating and ionizing power. 5.3a Any change in the nucleus of an atom that converts it from one element to another is called transmutation. This can occur naturally or can be induced by the bombardment of the nucleus by high-energy particles.	E E E E	▪ Why are some isotopes radioactive, and what happens to them? ▪ What is conserved during nuclear changes? ▪ How can man "cause" nuclear change? ▪ How can we produce electricity from the atom? ▪ What are the risks/ benefits associated with the use of radioactivity? ▪ Can nearby nuclear reactors explode like an atomic bomb? What is an atomic bomb? ▪ Are there different types of radiation? Are they all bad? ▪ Why are such large amounts of nuclear energy released during a nuclear reaction?	▪ Lecture ▪ Demo ▪ Draw a picture or diagram ▪ Individual check problem ▪ Homework explanation ▪ Mini-lab/activity ▪ Research/ literature Internet ▪ Graphing, graphic organizers ▪ Discussions	▪ Quick quiz ▪ Start question ▪ Homework checks ▪ Wipe board work ▪ Homework pairs ▪ Mini-lab ▪ Mini-test ▪ Teacher observation ▪ Student responses to teacher questions ▪ Rubrics for evaluating projects	1-2 weeks

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Standard 4: Key Idea 3,4,5: Performance Indicator 3.1, 4.4, 5.3: Explain the properties of materials in terms of the arrangement and properties of the atoms that compose them. Explain the benefits and risks of radioactivity. Compare energy relationships within an atom's nucleus to those outside the nucleus.

Essential Knowledge/Skills *(Major Understandings)*	***Priority Code***	***Essential Question***	***Classroom Ideas***	***Assessment Ideas***	***Time***
4.4b Nuclear reactions can be represented by equations that include symbols which represent atomic nuclei (with the mass number and atomic number), subatomic particles (with mass number and charge), and/or emissions such as gamma radiation. 5.3b Energy released in a nuclear reaction (fission/fusion) comes from the fractional amount of mass converted into energy. Nuclear changes convert matter into energy according to $E=mc^2$. 5.3c Energy released during nuclear reactions is much greater then the energy released during chemical reactions. 4.4d There are inherent risks associated with radioactivity and its uses, such as long-term storage and disposal of radioactive isotopes, and nuclear accidents. 4.4c Radioactive isotopes have many beneficial uses. Radioactive isotopes are used in medicine and industrial chemistry, e.g., radioactive dating, tracing chemical and biological processes, industrial measurement, detection and treatment of diseases.	E I E I I	▪ Why are some isotopes radioactive, and what happens to them? ▪ What is conserved during nuclear changes? ▪ How can man "cause" nuclear change? ▪ How can we produce electricity from the atom? ▪ What are the risks/ benefits associated with the use of radioactivity? ▪ Can nearby nuclear reactors explode like an atomic bomb? What is an atomic bomb? ▪ Are there different types of radiation? Are they all bad? ▪ Why are such large amounts of nuclear energy released during a nuclear reaction?	▪ Lecture ▪ Newsprint summary ▪ Homework explanation ▪ Film (video) ▪ Research/ literature Internet ▪ Discussion	▪ Quick quiz ▪ Start question ▪ Homework checks ▪ Wipe board work ▪ Check problem ▪ Unit checks ▪ Test revisions ▪ Chapter test ▪ Teacher observation ▪ Student responses to teacher questions ▪ Rubrics for evaluating projects	1-2 weeks