/ Schools Science Vision

;chools' vision of science education is to ensure that from early childhood to the end of the 12th grade, all students have heightened curiosity and an :e; possess sufficient knowledge of science and engineering to engage in discussions; are able to learn and apply scientific and technological inform ınd have the skills such as critical thinking, problem solving, and communication to enter careers of their choice, while having access to connections l technology.

Shelby County Schools has employed The Tennessee Academic Standards for Science to craft meaningful curricula that is innovative and provide a nities that extend beyond mastery of basic scientific principles.

lby County Schools Board of Education adopted a set of ambitious, yet attainable goals for school and student performance. The District is committe described in our strategic plan, Destination 2025. In order to achieve these ambitious goals, we must collectively work to provide our students with d instruction. The Tennessee Academic Standards for Science provide a common set of expectations for what students will know and be able to do be located in the Tennessee Science Standards Reference. Tennessee Academic Standards for Science are rooted in the knowledge and skills tha st-secondary study or careers. While the academic standards establish desired learning outcomes, the curriculum provides instructional planning de ıese outcomes. The curriculum maps contain components to ensure that instruction focuses students toward college and career readiness. Educat andards as a roadmap for curriculum and instruction. The sequence of learning is strategically positioned so that necessary foundational skills are s ınt mastery of the standards.

ıal is to ensure our students graduate ready for college and career. Being College and Career Ready entails, many aspects of teaching and learning / their scientific learning in the classroom and beyond. These valuable experiences include students being facilitators of their own learning through p cally. The Science and Engineering Practices are valuable tools used by students to engage in understanding how scientific knowledge develops. Tl t "processes and proficiencies" with longstanding importance in science education. The science maps contain components to ensure that instructior understanding how science and engineering can contribute to meeting many of the major challenges that confront society today. The maps are cen ınents: the Tennessee Academic Standards for Science, Science and Engineering Practices, Disciplinary Core Ideas, Crosscutting Concepts, and F

Academic Standards for Science were developed using the National Research Council's 2012 publication, A Framework for K-12 Science Educatior framework presents a new model for science instruction that is a stark contrast to what has come to be the norm in science classrooms. Thinking al morizing concepts and solving mathematical formulae. Practicing science had become prescribed lab situations with predetermined outcomes. The ı -dimensional approach to science education that capitalizes on a child's natural curiosity. The Science Framework for K-12 Science Education prov eloping the effective science practices. The *Framework* expresses a vision in science education that requires students to operate at the nexus of thr nce and Engineering Practices, Crosscutting Concepts, and Disciplinary Core Ideas. The *Framework* identified a small number of disciplinary core ic learn with increasing depth and sophistication, from Kindergarten through grade twelve. Key to the vision expressed in the *Framework* is for student ideas in the context of science and engineering practices. The importance of combining Science and Engineering Practices, Crosscutting Concepts ıted in the *Framework* as follows:

erformance expectations that are aligned to the framework must take into account that students cannot fully understand scientific and engineering ic ɔractices of inquiry and the discourses by which such ideas are developed and refined. At the same time, they cannot learn or show competence in ntext of specific content. (NRC Framework, 2012, p. 218)

kills and dispositions to use scientific and engineering practices needed to further their learning and to solve problems, students need to experience nultiple practices in developing a particular core idea and apply each practice in the context of multiple core ideas. We use the term "practices" inste ɔ emphasize that engaging in scientific investigation requires not only skill but also knowledge that is specific to each practice. Students in grades K ht practices over each grade band. Crosscutting concepts have application across all domains of science. As such, they are a way of linking the diffe utting concepts have value because they provide students with connections and intellectual tools that are related across the differing areas of discipl ɪeir application of practices and their understanding of core ideas. There are seven crosscutting concepts that bridge disciplinary boundaries, unitin elds of science and engineering. Their purpose is to help students deepen their understanding of the disciplinary core ideas and develop a coherent ed view of the world.

nt to support effective planning and instruction to rigorous standards. It is *not* meant to replace teacher planning, prescribe pacing or instructional pra merely "cover the curriculum," but rather to "uncover" it by developing students' deep understanding of the content and mastery of the standards. T ɔle about and intentionally align the learning target (standards and objectives), topic, text(s), task, and needs (and assessment) of the learners are b ɪs about how to support student learning toward such mastery. Teachers are therefore expected--with the support of their colleagues, coaches, lead s--to exercise their professional judgment aligned to our shared vision of effective instruction, the Teacher Effectiveness Measure (TEM) and related ver, while the framework allows for flexibility and encourages each teacher/teacher team to make it their own, our expectations for student learning must ensure all of our children have access to rigor—high-quality teaching and learning to grade level specific standards, including purposeful suppo arning across the content areas.

Science and Engineering Practices

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

Disciplinary Core Ideas

Physical Science
PS 1: Matter & its interactions
PS 2: Motion & stability: Forces & interactions
PS 3: Energy
PS 4: Waves & their applications in technologies for information transfer

Life Sciences
LS 1: From molecules to organisms: structures & processes
LS 2: Ecosystems: Interactions, energy, & dynamics
LS 3: Heredity: Inheritance & variation of traits
LS 4: Biological evaluation: Unity & diversity

Earth & Space Sciences
ESS 1: Earth's place in the universe
ESS 2: Earth's systems
ESS 3: Earth & human activity

Engineering, Technology, & the Application of Science
ETS 1: Engineering design
ETS 2: Links among engineering, technology, science, & society

Crosscutting Concepts

1. Patterns
2. Cause & effect
3. Scale, proportion, & quantity
4. Systems & system models
5. Energy & matter
6. Structure & function
7. Stability & change

ression

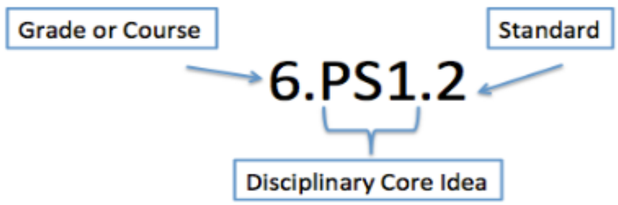
elementary science experience, students can observe and measure phenomena using appropriate tools. They are able to organize objects and ide single properties and later by multiple properties. They can create and interpret graphs and models that explain phenomena. Students can keep n l observations and identify simple patterns. They are able to design and conduct investigations, analyze results, and communicate the results to ot riosity, interest and enjoyment of the scientific world view, scientific inquiry, and the scientific enterprise into middle school.

middle school science experience, students can discover relationships by making observations and by the systematic gathering of data. They can lid arguments. Their focus has shifted from the general to the specific and from the simple to the complex. They use scientific information to make vation of the natural world. They recognize that there are both negative and positive implications to new technologies.

uate, former students should be literate in science, understand key science ideas, aware that science and technology are interdependent human ent itations, familiar with the natural world and recognizes both its diversity and unity, and able to apply scientific knowledge and ways of thinking for in

ıe Standards

: Level/Course Overview: An overview that describes that specific content and themes for each grade level or high school course.
linary Core Idea: Scientific and foundational ideas that permeate all grades and connect common themes that bridge scientific disciplines.
ard: Statements of what students can do to demonstrate knowledge of the conceptual understanding. Each performance indicator includes a specifi
ıeering practice paired with the content knowledge and skills that students should demonstrate to meet the grade level or high school course standaı



ience Curriculum Maps

ide to help teachers and their support providers (e.g., coaches, leaders) on their path to effective, college and career ready (CCR) aligned instructioı ation 2025. It is a resource for organizing instruction around the Tennessee Academic Standards for Science, which define what to teach and what grade level. The map is designed to reinforce the grade/course-specific standards and content (scope) and provides *suggested* sequencing, pacing, ırces. Our hope is that by curating and organizing a variety of standards-aligned resources, teachers will be able to spend less time wondering wha ality materials (though they may both select from and/or supplement those included here) and have more time to plan, teach, assess, and reflect witl ırove practice and best meet the needs of their students.

ıt to support effective planning and instruction to rigorous standards. It is *not* meant to replace teacher planning, prescribe pacing or instructional prı merely "cover the curriculum," but rather to "uncover" it by developing students' deep understanding of the content and mastery of the standards. T ɔle about and intentionally align the learning target (standards and objectives), topic, text(s), task, and needs (and assessment) of the learners are b ıs about how to support student learning toward such mastery. Teachers are therefore expected--with the support of their colleagues, coaches, lead s--to exercise their professional judgment aligned to our shared vision of effective instruction, the Teacher Effectiveness Measure (TEM) and related ver, while the framework allows for flexibility and encourages each teacher/teacher team to make it their own, our expectations for student learning must ensure all of our children have access to rigor—high-quality teaching and learning to grade level specific standards, including purposeful suppc arning across the content areas.

SCS Chemistry Curriculum Map

t 1 tructure	Unit 2 Interactions of Matter Part I	Unit 3 Interactions of Matter Part II	Unit 4 Interactions of Matter Part III	Unit 5 Matter and Energy	U Acid & B Nuclear
eks	4 weeks	9 weeks	3 weeks	6 weeks	9 weeks

Unit 1 Atomic Structure

ing Question(s)

ncept of the atom change over time?

ard, Explanations, conceptions gth [5 days]	**Essential Questions, Learning Outcomes, Phenomena**	**3-Dimensional Instructional Approach (SEPs and CCCs) **Suggestions***	**Vocabulary and Cu Materials**
latter and Its **1** Develop and ical models of the atom us to quantum model) arguments to show how edge evolves over experimental ue, and alternative *should be taught in* *h and to support other* *in this unit.*	**<u>Essential Questions</u>** What role does chemistry play in the world around us? How does qualitative data differ from quantitative data? What models of the atom have led to the development of our current understanding of atomic structure? How do various atomic models compare with current scientific evidence? How do models in science change over time?	**<u>Science and Engineering Practice</u>** **Engaging in argument from evidence** Students critically evaluate evidence supporting an argument and create written or oral arguments which invoke empirical evidence, scientific reasoning and scientific explanations. **<u>Cross Cutting Concepts</u>** **Systems and System Models** Students create and manipulate a variety of different models: physical, mathematical, and computational. **<u>Textbook</u>** Modern Chemistry Chap. 3 & 4	<u>Vocabulary</u> Chemistry, substance, ma model, scientific method, c data, quantitative data, hy experiment, independent v dependent variable, contro conclusion, theory, scienti research, applied research atomic theory, atom, catho electron, nucleus, proton, **<u>Textbook</u>** Modern Chemistry Chap. Interactive Video Modern Chemistry W Resources: http://www.visionlearning.cor ule_viewer.php?mid=49&l **<u>Laboratory</u>**

ıdards reference tn.gov/content/dam ı/standards/sci/sci_ ɘference.pdf ve developed an of physical science ng to chemistry, they ıted a number of these er, the names have not olicit. One approach aken to this standard e the ideas when other standards. For ıson's model is ond classifications and vhen differentiating and molecular **ıs** ıd solid sphere smaller particles.	**Learning Outcomes** Familiarity with use and importance of the scientific method, including hypothesis, independent/dependent variables Differentiation between a theory and a scientific law Compare and contrast the major models of the atom (i.e. Bohr, and the quantum mechanical model). Identify the contributions of major atomic theorists: Bohr, Chadwick, Dalton, Planck, Rutherford, and Thomson. Compare the Bohr model and the quantum mechanical electron-cloud models of the atom. **Phenomenon** Use of the scientific method in research and development for all scientific research such as drug development. Introduce students to the steps of scientific research used from the beginning to the end of drug development. Have students consider a familiar example of a weighted average. For example, a students' grade where each category is counted a different percentage. Discuss the process of		**Activities/Investigations** Modern Chemistry p. 73 C Phet labs to accompa simulations https://colorado.edu/en/sir tegory/new **Simulations** Modern Chemistry Web R History of Atom and Hydrc Helium: http://www.visionlearning.cor ule_viewer.php?mid=50 Ions, atoms, molecule simulation: http://www.visionlearning.cor ule_viewer.php?mid=51 https://phet.colorado.e mulation/rutherford-sc **Articles** **https://www.ck12.org/c/c** **istory-of-chemistry/less** **in-Chemistry-History-** **CHEM/?referrer=concep** Modern Chemistry p. Nanotechnologist **Performance Tasks** Modern Chemistry We Resources: Tutorial http://www.teachersdomain.c 07_int_theatom/ Model Building Intera http://phet.colorado.edu/en/s d-an-atom Build an atomic theory tim textbook resources and or

	calculating their grade. Take this same concept and apply it to the calculation of average atomic mass as seen on the periodic table.		resources. Students will u of copy paper and marker pencils to develop a timeli Democritus to the Quantu theory. Students should be given elements and their atomic atomic number. Students calculate the number of pr neutrons, and electrons. S should also identify and ca atomic number and atomi when given the number of neutrons, and electrons.

ing Question(s)

erior structure of the atom and how was it experimentally determined?

ard, Explanations, conceptions gth [10 days]	Essential Questions, Learning Outcomes, Phenomena	3-Dimensional Instructional Approach (SEPs and CCCs)	Vocabulary and Cu Materials
Waves and Their Technologies for ansfer Using a model, explain emit characteristic light and how this used ing of the behavior of en developed first by operties of waves in	**Essential Questions** How are calculations impacted by the accuracy of measuring devices and the precision of the measurements? How do scientist's express quantities and convert them into different units? **Learning Outcomes** Use SI system during measurement and problem solving. Use a variety of appropriate notations (e.g., exponential, functional, square	**Science and Engineering Practice** **Developing and using models** Students can test the predictive abilities of their models in a real-world setting and make comparisons of two models of the same process or system. **Cross Cutting Concepts** **Cause and Effect** Students use cause and effect models at one scale to make	**Vocabulary** Base unit, second, meter, atomic emission spectrum photoelectric effect, photo constant, quantum, wavel **Textbook** Modern Chemistry Chap. **Laboratory Activities/Investigations** Flame test lab or dem Modern Chemistry Teache Resources PhET labs based on simu found at https://colorado.edu/en/sir

ıd more recently in hen students etween mechanical ȷnetic waves. This is at students investigate or the emission of ıasis should be placed ı of characteristic ɛmitted when electrons ic movements and of each element that s should explore the these ideas on arification may be rentiate this particulate ıt from previous its wave properties; ssions of Quantum ɛntiating wave-particle ond the scope of this **ıs** / emit light if they the emission of light do with gaining energy ɜ source.	root). Accuracy, precision, and error in a series of measurements. Read/interpret graphs: (pie, bar, and line) Interpret a Bohr model of an electron moving between its ground and excited states in terms of the absorption or emission of energy. **Phenomenon** Why does glow in the dark paint glow? Why do fireworks explode in various colors? Help students understand the process of paint particles gaining energy from light and glowing as the excited electrons move from the excited state to the ground state. Use a flame test lab to help students see the colors emitted from different metallic ions as they gain energy from the flame and remit it as the electrons move from the ground state to the excited state and them back to the ground state. Link this lab activity to the different colors we see as fireworks explode.	predictions about the behavior of systems at different scales. **Textbook** Modern Chemistry Chap. 4	tegory/new **Simulations** Modern Chemistry Teache Resources https://phet.colorado.edu/e n/wave-on-a-string https://phet.colorado.edu/e n/legacy/photoelectric https://phet.colorado.edu/e n/legacy/discharge-lamps https://phet.colorado.edu/e n/molecules-and-light https://phet.colorado.edu/e n//legacy/hydrogen-atom Modern Chemistry Teache Resources: Energy Level Atom (Animation) **Videos** **Modern Chemistry Web** http://winter.group.shef.ac.uk (shapes of orbitals) **Articles** Modern Chemistry p.114 ˉ Decade **https://www.ck12.org/c/c hotoelectric- effect/lesson/Photoelect CHEM/?referrer=concep** **Performance Tasks:** Have two students hold a spring or slinky along the t tabletop. Ask one of the s begin moving the spring b forth so that a wave patter forms. Students should de the wavelength changes a frequency of the movemen increased and then

			decreased. Students shou wave model and identify tl crest, wavelength, amplitu frequency. This can then b the wavelength of light and electrons in the atomic mo Students will observe gas flame test colors of metals compounds using diffractio or a simulation. Students why different metal compo different colors. Students s relate and discuss the rela the excitement of electron of energy as the atoms ret the ground state which rel energy that relates to a sp wavelength of light in the v spectrum. Paint a piece of poster boa glow in the dark paint. Tu lights in the classroom if it made dark by doing so. Ex board to a camera flash w student holds their hand in board. The students shou the paint glows where the board but does not where was held during the flash. lead the students to a disc electrons moving from the state to the excited state a back to the ground state. students to use the terms state, excited state, and e levels. Use this to lead int

			photoelectric effect. Students will write orbital r various elements from the table. Students will apply to the organization of the p table.

1 ucture	Unit 2 Interactions of Matter Part I	Unit 3 Interactions of Matter Part II	Unit 4 Interactions of Matter Part III	Unit 5 Matter and Energy	Acid & Nuclea
ks	4 weeks	9 weeks	3 weeks	6 weeks	9 week

Questions:

ms of one element different from atoms of another element?

e periodic table developed and how does it relate to the physical and chemical properties of elements?

ard, Explanations, conceptions gth [7 days]	Essential Questions, Learning Outcomes, Phenomena	3-Dimensional Instructional Approach (SEPs and CCCs)	Vocabulary and Cu Materials
Matter and Its **2** Explain the origin on of the Periodic chemical and physical ain group elements iber of subatomic harge, ionization radius, and ty) based on location of ble. Construct an	**Essential Questions** How is the position and energy of a specific electron assigned for an atom? How is the charge on anions and cations determined by electron configurations? How does the structure of matter determine its chemical and physical properties? How does the structure of the periodic	**Science and Engineering Practice** **Constructing explanations and designing solutions** Students form explanations that incorporate sources (including models, peer reviewed publications, their own investigations), invoke scientific theories, and can evaluate the degree to which data and evidence support a given conclusion. **Cross Cutting Concepts**	**Vocabulary** Periodic law, periodic tabl lanthanide, actinide, alkali alkaline earth metals, peri Mendeleev, Moseley, tran elements, main-group ele halogens, atomic radius, i ionization, ionization ener affinity, cation, anion, vale electron, electronegativity **Textbook** Modern Chemistry Chap. **Laboratory Activities/Investigations**

·scribe how the anical model of the terns of valence and) defines periodic the periodic ewis dot structures and nding of orbital gh drawing and iphical representations resenting electrons in ıddressed in this ar as patterns leading nent of the periodic tterns in the behavior of n be explained by the periodic table. d engage in activities portunities to uncover For example, an cussion of orbital d relate back to the the periodic table, rely following a chart aufbau principle. activity can be ugh investigation. **ns** tern to the organization periodic table.	table allow us to predict the chemical and physical properties of an element? How is the periodic table a template of organization for the material world? **Learning Outcomes** Interpret the periodic table to describe an element's atomic makeup. Apply the periodic table to determine the number of protons and electrons in a neutral atom. Distinguish between the subatomic particles in terms of relative charge and mass. Describe the structure of the atom, including the locations of the subatomic particles. Calculate the number of electrons, protons, and neutrons in an atom, given its mass number and atomic number. Draw Bohr models of the first 18 elements. Identify the *s*, *p*, *d*, and *f* blocks based on their electron configuration and location on the periodic table. Represent an electron's location in the quantum mechanical model of an atom in terms of the shape of electron	**Patterns** Students recognize, classify, and record patterns in quantitative data from empirical research and mathematical representations. **Textbook** Modern Chemistry Chap. 5	Modern Chemistry Quick l Designing Your Own Peric Labs accompanying PhET simulations https://phet.colorado.edu/ ns/category/chemistry **Simulations** Modern Chemistry Chap. Resources: Animated Che Periodic Trends https://phet.colorado.edu/ n/build-an-atom https://phet.colorado.edu/ n/isotopes-and-atomic-ma http://phet.colorado.edu/en/s rogen-atom **Video** Modern Chemistry: Why It Video: Periodic Law **Articles** **https://www.ck12.org/c/c arly-history-of-the-perio table/rwa/Finding-Patter Elemental-Behavior/?referrer=conc** Modern Chemistry Chap. Material Scientists Modern Chemistry Chap. Pieces Everything is Made for Putting Small Pieces ir **Performance Tasks** Modern Chemistry Web R http://phet.colorado.edu/en/s opes-and-atomic-mass Electron Configuration Ba Divide into pairs, each stu laminated Periodic Table (sheet protector) and dry e marker. They mark out the

	clouds (s and p orbitals in particular), relative energies of orbitals, and the number of electrons possible in the s, p, d, and f orbitals. (Heisenberg Uncertainty Principle) Use the periodic table to identify an element as a metal, nonmetal, or metalloid Apply the periodic table to determine the number of protons and electrons in a neutral atom Define and calculate an isotope. Determine the number of protons and neutrons for a particular isotope of an atom Determine the Lewis electron dot structure or number of valence electron from an atom of any main-group element from its atomic number or position in the periodic table. **Phenomenon** Relate the trends of the periodic table to trends in fashion and trends among teenagers. Students understand trends in fashion as things that everyone is doing. Relate the ideas of trends in society to the repetition of characteristics within groups and periods in the periodic table.		on the table (3, 4, or 5 ele row) with a dry erase marl looking at their partner's b students guess the locatio ships by using the electroi configuration for the corre element location.

g Question(s)

ms interact with other atoms?

st atoms form chemical bonds?

ard, Explanations, **conceptions** **gth [5 days]**	**Essential Questions, Learning Outcomes, Phenomena**	**3-Dimensional Instructional Approach** **(SEPs and CCCs)**	**Vocabulary and Cu** **Materials**
Matter and Its **3** Use the periodic ronegativity differences predict the types of formed between atoms al reactions and write hemical compounds, tomic ions using l that the determination classifications based on ty can differ from one he next. While specific ange from one ne next, attention to the underlying idea epresent some form of c (electrostatic differences between n then be related back e electrostatic ther or not atoms are hey interact. **<u>ns</u>** negativity difference	**<u>Essential Questions</u>** How does a study of valence electrons help to explain most chemical phenomena? How does chemical naming exhibit organizational patterns**?** **<u>Learning Outcomes</u>** Analyze ionic and covalent compounds in terms of their formation, names, chemical formulas, percent composition, and molar masses. Determine the types of chemical bond that occurs in a chemical compound. **<u>Phenomenon</u>** Relate the melting point and boiling point of different ionic and covalent compounds to the bond type. This could be done using an inquiry lab where student test the melting point and boiling point and electrical conductivity of various compounds and classify the compound as ionic or covalent based on both the chemical formula, electronegativity, conductivity and the melting and boiling point.	**<u>Science and Engineering Practice</u>** **Constructing explanations and designing** **solutions** Students form explanations that incorporate sources (including models, peer reviewed publications, their own investigations), invoke scientific theories, and can evaluate the degree to which data and evidence support a given conclusion **<u>Cross Cutting Concepts</u>** **Cause and Effect** Students use cause and effect models at one scale to make predictions about the behavior of systems at different scales. **<u>Textbook</u>** Modern Chemistry Chap. 6 & 7	**Vocabulary** chemical bond, cation, ani bond, ionic compound, co covalent compound, cryst electrolyte, lattice energy, unit, monatomic ion, oxida number, polyatomic ion, s formula, resonance, coorc covalent bond **<u>Textbook</u>** Modern Chemistry Chap. **<u>Laboratory Activities/Investigations</u>** Modern Chemistry Lab: C as an Indicator of Bond Ty Determining the percentag in copper sulfate pentahyc Modern Chemistry Teache Resource: Determining th Formula of MgO. Inquiry labs accompanying simulations https://phet.colorado.edu/e ns/category/chemistry **<u>Simulations</u>** Modern Chemistry Teache Resources: Why It Matter Chemical Bonding Modern Chemistry Teache

vays be used to iine the type of For example, the negativity difference en boron and fluorine is et scientist know n experimentation that trifluoride is a ntly bonded compound.	Relate chemical bonds to people in a crowded elevator. As people squeeze into the confined space, they come in contact with each other. Many people will experience a sense of being too close together and wanting to push others away from them. Likewise, when atoms get close enough, their outer electrons repel each other. But in contrast to the people in the elevator the electrons of one atom are attracted to the nucleus of the other atom. The degree of attracting determines the type of chemical bond.		Resources: Animated Che Types of Bonds Modern Chemistry Teache Resources: Why It Matters and Compounds Modern Chemistry Teache Resources: Formula Mass Mass (Animation) Video http://www.visionlearning.cor ule_viewer.php?mid=55# https://phet.colorado.edu/e n/build-a-molecule https://phet.colorado.edu/e n/legacy/conductivity **Articles** **Modern Chemistry** p. 17(Energy **https://www.ck12.org/c/c hemical-bond/rwa/Bond- Bond/?referrer=concept** Modern Chemistry Teache Resources **Performance Tasks** ● Students will take of ionic compounc samples of covale compounds and u lid and candle will samples for their r point. All samples place on the can l same time. Stude use a ring stand a support the can lic

			will then light a ca place under the ca lid. Students will t the compounds by melting. Students their knowledge o properties of ionic covalent compour classify the compo either ionic or cov ● Students will be g several compounc will then classify tl compounds as ior covalent. Student use the appropria naming the compo ● Students carry ou Determining the E Formula of MgO a the process and s determining the er formula from lab c

ard, Explanations, conceptions gth [5 days]	Essential Questions, Learning Outcomes, Phenomena	3-Dimensional Instructional Approach (SEPs and CCCs)	Vocabulary and Cu Materials
Matter and Its 4 Use Lewis dot lectronegativity predict the polarities of es (linear, bent, trigonal pyramidal,	**Essential Questions** How do the charges of electrons affect bond geometry? **Learning Outcomes** Analyze compounds according to elements and their valence electrons. Determine number of bonding and non-bonding electrons and how they	**Science and Engineering Practice** **Obtaining, evaluating, and communicating information** Students can provide written and oral explanations for phenomena and multi- part systems using models, graphs, data tables, and diagrams. **Cross Cutting Concepts**	**Vocabulary** linear, bent, trigonal plana pyramidal, tetrahedral, pol VSEPR, valence electrons **Textbook** Modern Chemistry Chap. (**Laboratory** Modern Chemistry Lab: F Convulsion: determining t unshared electrons on mo

onstruct an argument electronegativity arity of chemical is standard is on polarity of molecules that influence that are two separate erstanding associated pt. The first strand use of electronegativity polarity. This level of can be applied at a binary compounds, but fficient to explain the complex compounds. and of this standard es the shape of xplain polarities. be able to consider a ucture and determine e molecule as well as king the distribution of y into account when ape. *(Only molecules ctet rule will be h molecules such as night be used during ustrate the effect of the of electrons on the olecule, as compared de which lacks this The additional one pair to disrupt not actual bond angles l.)*	affect the molecular shape. (VSEPR) Determine how the molecular shape of a compound affects its polarity. **Phenomenon** How can molecular geometry affect how substances interact; example why oil does not mix with water or why ionic compounds do mix with water? Have students observe the mixing of oil and water and then of alcohol and water. Show students the molecular structure of alcohol, water and oil. Help the student analyze the structure for similarities and differences. Lead the students to see how water is more like alcohol than oil and then to an understanding of why oil and water do not mix and why alcohol and water will mix. How does soap remove stains from your clothing? Students try to clean different stains from a fabric with or without soap and using different solvents. This simulation works well for both middle school and high school students depending on how it is used. For younger students, focus on the concept of 'like dissolves like' and mixtures. For older students the focus can shift to polarity, colloids, and micelles. This simulation can also be used when discussing cell membranes in biology.	**Structure and Function** Students infer the function of a component of a system based on its shape and interactions with other components. **Textbook** Modern Chemistry Chap. 6 Sec 5	shape **Virtual Lab** http://phet.colorado.edu/en/s d-a-molecule **Activities/Investigations** Modern Chemistry Teache Resources: Science Explo Labs accompanying PhET simulations Video Modern Chemistry W Resource: Lewis Dot http://library.thinkquest.org/1 ding/bonding.htm **Simulations** Modern Chemistry Teache Resources: Molecular Ge Video http://library.thinkquest.org/1 metry/geobody.htm **Articles** **https://www.ck12.org/c/ ewis-electron-dot-struct Simple- Code/?referrer=concept** **Performance Tasks** Students will be given bin compound names and will classify the bonds based differences in electronega either polar or nonpolar. Modern Chemistry Teache Resources

ns :hink that atoms within arranged in a flat reality they have a 3-D			
ard, Explanations, conceptions gth [5 days]	**Essential Questions, Learning Outcomes, Phenomena**	**3-Dimensional Instructional Approach (SEPs and CCCs)**	**Vocabulary and Cu Materials**
Aotion and Stability: eractions Draw, identify, and cal representations of s (ionic, covalent, and l on chemical formulas. communicate show that atoms nsferring or sharing resumes discussions of tween atoms from nth grade, students rns within the periodic ed the physical and erties of substances to the constituent e periodic table. eral trends is likely to however a focus should he transfer of electrons erences in properties. It show that electrostatic cur even between two	**Learning Outcomes** Differentiate between ionic and covalent bond models. **Phenomenon** Have students compare the brittleness of ionic crystals to that of covalent crystals and metallic substance by hitting them with a hammer. Students can then look at the structure of each and analyze the attraction between particles to use guided inquiry to analyze why the ionic compounds are brittle and fall apart when hit with a hammer and why metals simply are hammered into a thin sheet. Students could also test the melting point of various ionic and covalent compounds noting that ionic compounds melt at high temperatures than do covalent compounds.	**Constructing explanations and designing solutions** Students form explanations that incorporate sources (including models, peer reviewed publications, their own investigations), invoke scientific theories, and can evaluate the degree to which data and evidence support a given conclusion. **Cross Cutting Concepts** **Structure and Function** Students apply patterns in structure and function to unfamiliar phenomena. **Textbook** Modern Chemistry Chap. 6	**Vocabulary** Ionic, covalent, electron tr electron sharing, metallic l delocalized electrons (sea electrons) **Textbook** Modern Chemistry Chap. **Video** Modern Chemistry: Why l Chemical Bonds **Laboratory Activities/Investigations** Modern Chemistry Teache Resources: 1) Chemical E (Virtual Lab) 2) Chemical Bonds: Test v substances in the lab and the bond type base on cha **Simulations** Modern Chemistry Teache Resources https://phet.colorado.edu/e n/build-a-molecule https://phet.colorado.edu/e n/legacy/sugar-and-salt-so Modern Chemistry Web R Ionic Bond Interactive: http://www.learner.org/interac c/groups_interactive.html

s. Demonstrations can by using static charge on against a wall or oppositely charged ble tape are attracted h other but also to tors and non- ch as foil strips or **ns** t understand that the ula for ionic compounds implest formula of the opposed to the olecules that are each p of atoms.			Modern Chemistry WebResource: Molec Bonding Interactive Q http://www.teachersdomain.c sps07.sci.phys.matter.molecu **Articles** **https://www.ck12.org/c/c onic-bond/rwa/Give-Me-a Smile/?referrer=concept** Modern Chemistry Teache Resources **Performance Tasks** Students will be given sev covalent compound name students will draw Lewis s these compounds. Studen use either molecule kits or and toothpicks or marshm build the molecule. Studen label the bonds as polar o and then use molecule str symmetry to classify the b either polar or nonpolar.

ard, Explanations, conceptions gth [3 days]	Essential Questions, Learning Outcomes, Phenomena	3-Dimensional Instructional Approach (SEPs and CCCs)	Vocabulary and Cu Materials
Motion and Stability: eractions Understand that forces created by the ution of charges result ees of attraction cules. Compare and ermolecular forces	**Essential Questions** How does the kinetic-molecular theory explain the properties of solids, liquids, and gases in terms of particle energy and the forces between particles? **Learning Outcomes** Contrast the arrangement of particles	**Science and Engineering Practice** **Developing and using models** Students can test the predictive abilities of their models in a real-world setting and make comparisons of two models of the same process or system.	**Vocabulary** Dipole-dipole forces, dipol bonding, London dispersio unshared electron pairs, in dipole **Textbook** Modern Chemistry Chap. **Laboratory Activities/Investigations** **https://www.ck12.org/c/c**

ding, dipole-dipole ondon dispersion lifferent types of simple ily those following the predict and explain chemical and physical ose substances using hical representations. esumes where f in 7.PS1. Students' o all three phases of hird grade, by fifth were investigating s in matter. These ve not included a explain why states of endent on temperature Students should andard in conjunction S2.1 to explore ntermolecular in molecular and ionic d the behavior of ng to these differences. **ns** think of hydrogen eparate type of force. In fact, it is a ong dipole-dipole force.	in solids, liquids, and gases. Explain how the addition and removal of energy can cause a phase change. Interpret a phase diagram **Phenomenon** Discuss and have the students explain the difference between the boiling point of water and a substance such as alcohol. Students could measure the boiling point of both alcohol and water. Have students then explain phenomenon like why it hurts to dive off of the diving board and land on your back or why you can pour water over the top of a cup and it will form a convex surface but alcohol will not. This should involve student analysis of molecular structure, shape and polarity to develop an understanding of attraction between molecules that lead to the properties of molecules.	**Cross Cutting Concepts** **Stability and** **Change** Students provide examples and explanations for sudden and gradual changes. **Textbook** Modern Chemistry Chap. 6 Sec 5	**olar-molecules/rwa/The-Effect/?referrer=concept** Modern Chemistry Teache Resources **Simulations** **https://interactives.ck12 tions/chemistry/intermol forces/app/index.html?h 49a742e131936d1039b5f urce=ck12&artifactID=29 errer=concept_details&b ps%3A//www.ck12.org/c polar-molecules/%23sim** **Modern Chemistry Web** Practice Quiz: http://www.pbs.org/wgbh/nov cal-bonds-quiz.html http://phet.colorado.edu/en/s ecule-polarity Modern Chemistry We Resource: Intermolecular Forces http://www.chem.arizona.edu /hbond.html **Articles** **https://www.ck12.org/c/c olar-molecules/rwa/The-Effect/?referrer=concept** Modern Chemistry Teache Resources **Performance Tasks** Modern Chemistry Teache Resources Students will use the follo perform the simulation inv intermolecular forces. **https://www.ck12.org/c/c**

			olar-molecules/rwa/The-Effect/?referrer=concept