"Our mission is to prepare each student to be a successful and responsible member of society."
North Smithfield School District

Eleventh Grade Science Curriculum

North Smithfield Scope and Sequence SCIENCE Curriculum: K–12

North Smithfield District Science Curriculum Committee
Clare Arnold, District Curriculum Director
Consultants: East Bay Educational Collaborative Science Specialist Team

North Smithfield High School Course Design- Chemistry

Grade Level – Ten Text

RI Statements of Enduring Knowledge - (Established Goals):

PS 1 All living and nonliving things are composed of matter having characteristic properties that distinguish one substance from another *(independent of size or amount of substance)*

PS 2 Energy is necessary for change to occur in matter. Energy can be stored, transferred and transformed, but cannot be destroyed.

Related Rhode Island GSE's *(Understandings)*	**RI Assessment Targets** **Assessment Evidence ***High Priority**
PS1 (9-11)–2 **Students demonstrate an understanding of characteristic properties of matter by …** **2a** using given data (diagrams, charts, narratives, etc.) and advances in technology to explain how the understanding of atomic structure has changed over time. *PS1 (9-11)– 4* **Students demonstrate an understanding of the structure of matter by …** **4a** comparing the three subatomic particles of atoms (protons, electrons, neutrons) and their location within an atom, their relative mass, and their charge. *PS1 (9-11)-3* Students demonstrate an understanding of characteristic properties of matter by … **3b** predicting the relative physical and chemical properties of an element based on its location within the Periodic Table **ESS3 (9-11)–5** **Students demonstrate an understanding of the origins and evolution of galaxies and the universe by…** **5a** using appropriate prompts (diagrams, charts, narratives, etc.) students will explain how scientific knowledge regarding the structure of the universe has changed over time due to advances in technology which accumulates new evidence to redefine scientific theories and ideas. **ESS3 (9-11)–6** **Students demonstrate an understanding of the formation of the universe by…** 6a **using data (diagrams, charts, narratives, etc.) to explain how the "Big Bang" theory has developed over time citing evidence to support its occurrence (Doppler Effect/red shift).**	PS 1 (9-11) MAS + NOS-2 * *Scientific thought about atoms has changed over time. Using information (narratives or models of atoms) provided, cite evidence that has changed our understanding of the atom and the development of atomic theory.* **Activities**: • Student-generated atomic models (See department binder) PS 1 (9-11) MAS + FAF-4 * *Model and explain the structure of an atom or explain how an atom's electron configuration, particularly the outermost electron(s), determines how the atom can interact with other atoms.* **Activities**: • Atom-in-a-bag (see department binder) • Pyrotechnics lab (see department binder) ***PS1 (9-11) POC –3 **** *Explain how properties of elements and the location of elements on the periodic table are related.* **Activities**: • Element classification lab (see department binder) • Chemical periodicity graph packet (see department binder) • Periodic Table of Ordinary Things—common task (see department binder) ***PS2 (9-11) INQ+SAE -6 **** *Using information provided about chemical changes, draw*

PS2 (9-11) –6 **Students demonstrate an understanding of physical, chemical, and nuclear changes by …** **6b** identifying whether a given chemical reaction or a biological process will release or consume energy (endothermic and exothermic) based on the information provided (e.g. given a table of energy values for reactants and products or an energy diagram). *ESS1 (9-11)–3* Students demonstrate an understanding of processes and change over time within earth systems by … **3a** explaining how heat (produced by friction, radioactive decay and pressure) affects the Rock Cycle. **3b** explaining how convection circulations of the mantle initiate the movement of the crustal plates which then cause plate movement and seismic activity. *PS1 (9-11)– 4* **Students demonstrate an understanding of the structure of matter by …** **4b** writing formulae for compounds and developing basic (excluding transition elements) models using electron structure. *4c* ***explaining or modeling how the electron configuration of atoms governs how atoms interact with one another (e.g. covalent, hydrogen and ionic bonding).*** **PS2 (9-11) –6** **Students demonstrate an understanding of physical, chemical, and nuclear changes by …** **6a** writing simple balanced chemical equations to represent chemical reactions and illustrate the conservation of matter. *ESS1 (9-11)–3* Students demonstrate an understanding of processes and change over time within earth	*conclusions about and explain the energy flow in a given chemical reaction (e.g., exothermic reactions, endothermic reactions).* **Activities:** • Enthalpy lab (p. 255) • What's Hot Lab (ch. 12 Prentice Hall reference materials ***PS1 (9-11) MAS+ FAF – 4 **** *Model and explain the structure of an atom or explain how an atom's electron configuration, particularly the outermost electron(s), determines how that atom can interact with other atoms.* **Activities:** • Molecular geometry lab (see department binder) • Putting Ions in their hands (see department binder) • Compound-naming race (see department binder) • Double Displacement Lab (Textbook p459 – 460, numbers 8-11) • Visualizing Chemical Formulas and Balancing Reactions (Textbook p.266-267 Parts B & C) • Activity Series Lab (Textbook p. 641-642, numbers 1-6) • Second Semester Common Task, Singled Out (see department binder) • Acid and base lab (Textbook p. 485-488) • How Good is that Antacid ? (ch. 19 Prentice Hall reference materials) ***PS2 (9-11) INQ+SAE -6 **** *Using information provided about chemical changes, draw conclusions about and explain the energy flow in a given chemical reaction (e.g., exothermic reactions, endothermic reactions).* **Activities**:

systems by … **3c** investigating and using evidence to explain that conservation in the amount of earth materials occurs during the Rock Cycle. spreading, hydrologic cycle, weathering, element cycling). *PS1 (9-11)–1* Students demonstrate an understanding of characteristic properties of matter by … **1b** determining the degree of change in pressure of a given volume of gas when the temperature changes incrementally (doubles, triples, etc.). **3d** explaining how the physical and chemical processes of the Earth alter the crust (e.g. seafloor	• Visualizing a Mole (Flinn Chem Topics Booklet) • Moles of Chalk Lab (See department binder) • Sodium Bicarbonate and Acetic Acid Stoichiometry Lab (See department binder) ***PS1 (9-11) INQ –1**** *Use physical and chemical properties as determined through an investigation to identify a substance.* **Activities**: • Cartesian divers (Textbook, p.369-370, part A) • Graham's Law activity (Flinn binder) Boyle's Law activity (see department binder)

Unit	Focus Questions (Essential Questions)	Instructional Activities & Investigations (INQ)	Big Ideas (Understandings)
1 The Atom	• How have atomic models changed over time ? • How does the development of the modern atomic model influence our lives ? Time: 3 weeks Relevant GSE's—PS 1.2a, PS 1.4a	Text reference: Eisenkraft, pages 19-22, 39-41, 159, 302-305. Student-generated atomic models (See department binder) Flinking (Flinn Binder) and/or Obcertainer Atom-in-a-Bag (Flinn Binder) Pyrotechnics Lab (Textbook p.157-158)	• How models of the atom have changed over time. • Comparing protons, neutrons, and electrons in isotopes, ions, and neutral atoms. • Students write and recognize electron configurations for various elements and ions. • The wave-particle duality nature of light.
2 Chemical Periodicity	• How have scientific theories about the structure of the universe been advanced through the use of sophisticated technology ? • How do periodic trends help us to understand the arrangement of the periodic table ? • How can substances be classified based on their properties ?	Text reference: Eisenkraft, pages 11-12, 104-107, 196-198, 594-596. Element Classification Lab (Textbook p. 7-9) Chemical Periodicity graph packet (See department binder) First semester Common Task, Periodic Table of Ordinary Things (See department binder)	▪ Classify elements as metals, nonmetals, or metalloids. ▪ Compare characteristic properties of a material to those of its constituent elements. ▪ Determine valence electrons based on an element's location in the Periodic Table of the Elements. ▪ Demonstrate an understanding of

	Time: 4 weeks Relevant GSE's—PS 1.3b, ESS 3.5a, ESS 3.6a		characteristic properties of matter by predicting the relative physical and chemical properties of an element based on its location within the Periodic Table.
3 Energy	▪ How can one differentiate between the different types of energy? ▪ How is specific heat calculated? ▪ What is the mathematical relationship between heat and energy? Time: 4-5 weeks Relevant GSE's—PS2.6b	Text reference: Eisenkraft, pages 114-116, 259-262, 312-314, 333-335, 384, 470-473, 514-518, 535-538, 546-548, 555-556, 563-564. Heating/Cooling curve of water lab (Textbook p. 110-112) Cookware Lab (Textbook p. 560-562) Entropy lab activity (Textbook p. 329-331) Enthalpy lab (Textbook, p. 255-258) What's Hot Lab (ch. 12 Prentice Hall reference materials)	▪ . Describe the energy transformations and the roles of kinetic and potential energy as heat energy is transferred to or away from a material. ▪ Explain how energy and disorder change during physical and chemical processes. ▪ Determine if a change results in an increase or decrease in entropy. ▪ Determine if a change will be spontaneous by considering change in enthalpy and change in entropy. ▪ Determine whether energy changes are endothermic or exothermic from a particular point of reference. ▪ Distinguish between heat energy and temperature. ▪ Determine the amount of heat released from the combustion of various fuels. ▪ Explain the concept of specific heat capacity.

4 Chemical Formulas & Bonding	▪ Why are chemical formulas important? ▪ What is the importance of understanding chemical bonding? ▪ How is polarity determined? ▪ How are molecular geometry and polarity related ? Time: 4-5 weeks Relevant GSE's—PS 1.4b, PS 1.4c	Text reference: Eisenkraft, pages 451-453. Chemical Names and Formulas Lab (Textbook p. 450-451, numbers 6-9) Putting Ions in Their Hands (Flinn Binder) Compound-naming race (see department binder) Molecular geometry lab (See department binder)	▪ Predict the charges of ions of various elements. ▪ Determine the formulas of ionic and covalent compounds. ▪ Write the conventional names of ionic and covalent compounds. ▪ Write correct Lewis Dot Structures for various elements and compounds.
5 Chemical Reactions & Equations	▪ How are chemical reactions classified? ▪ How is the Law of Conservation of Matter supported by balanced chemical equations? Time: 4-5 weeks Relevant GSE's—PS 2.6a	Text reference: Eisenkraft, pages 461-463, 270, 279-282, 393-397, 525-528, 489-492. Double Displacement Lab (Textbook p459 – 460, numbers 8-11) Visualizing Chemical Formulas and Balancing Reactions (Textbook p.266-267 Parts B & C) Activity Series Lab (Textbook p. 641-642, numbers 1-6) Second Semester Common Task, Singled Out (see department binder) Acid and base lab (Textbook p. 485-488) How Good is that Antacid ? (ch. 19 Prentice Hall reference materials)	▪ Distinguish between different classes of chemical reactions. ▪ Predict the possible products of single-replacement and double-replacement reactions. Use the Law of Conservation of Matter to balance chemical reactions.
6 The Mole & Stoichiometry	▪ What types of numerical relationships exist in chemical reactions? ▪ How can one determine the amount of product or reactant used or produced in a chemical reaction? Time: 4-5 weeks	Text reference: Eisenkraft, pages 215-217. Visualizing a Mole (Flinn Chem Topics Booklet) Moles of Chalk Lab (See department binder) Sodium Bicarbonate and Acetic Acid Stoichiometry Lab (See department binder)	▪ Determine the percent composition for various compounds. ▪ Determine the empirical formula from the percent composition of various compounds. ▪ Use stoichiometry to determine the amount, mass, or volume of a substance produced or required in a chemical reaction.

	Relevant GSE's—PS 2.6a		Predict quantities of gas produced in chemical reactions.
7 Gas Laws	▪ How can one predict the change in characteristic properties of a gas when pressure and volume are altered? ▪ How can one predict the change in characteristic properties of a gas when temperature and volume are altered? ▪ How can one predict the change in characteristic properties of a gas when temperature, pressure, and volume are altered? Time: 3-4 weeks Relevant GSE's—PS 1.1b	Text reference: Eisenkraft, pages 372-375, 383-385, 393-397, 404-405, 410-413. Cartesian Divers (Textbook p.369-370 Part A) Graham's Law Activity (Flinn Binder) Boyle's Law Activity (See department binder)	▪ Investigate the relationship between the volume and pressure of gases at constant temperature. ▪ Quantify changes in volume or pressure with changes in the other. ▪ Interpret data concerning gas volume and pressure. ▪ Investigate the relationship between temperature and volume of a gas. ▪ Determine the volume of one mole of a gas. Determine the effect of molecular size on molecular motion.

Formative Assessment in the High School Classroom

Science Notebooks and Claims & Evidence

In light of the newly released and adopted National Common Core Standards for Literacy in Science, the use of science notebooks is critical every day. Science notebooks or journals can be used to help students develop, practice, and refine their science understanding, while also enhancing reading, writing, mathematics and communications, to meet these standards. As teachers involve students in inquiry-based science investigations, the need to communicate science learning in new ways has become evident. If students are encouraged to communicate their understanding of concepts through science notebook writings, these notebooks can be an effective strategy to help students learn science. Research has shown that science notebook writing may also be a way for students to strengthen their language skills as they develop an understanding of the world around them. Science notebooks allow teachers to formatively assess students' understanding and provide the timely feedback students need for improving their performance.

Science notebooks contain a record of information about the students' classroom inquiry experiences and are encouraged to use them as scientists would, before, during, and after all investigations. They are a place where students formulate and record their questions, make predictions, record data, procedures, and results, compose reflections, and communicate findings. Most importantly, notebooks provide a place for students to record new concepts they have learned.