Curriculum

Course Title: **Lab Chemistry**

Content Area: **Chemistry**

Grade Level(s): 9-12

Date Revised: **7/2/19**

Date Adopted:

Course Description:

Unit 1 Measurement and Periodic Table: In this unit, students will describe measurement and density, identify properties of matter and analyze characteristics of the Periodic Table. Students will solve critical thinking questions about density and describe how different matter has different density. Students will critically think how periodic table has helped scientific world.

Unit 2: Structure and property of an atom: In this unit, students will describe the Structure and property of atoms, explain how isotopes are important in everyday life. Students will investigate how radioactive decay is used in Carbon dating. Students will analyze the pros amd cons of nuclear fission and fusion. Students will identify Evolution of atomic theory and electron configuration.

Unit 3: Chemical Bonding: In this unit, In this unit, students will describe and classify materials by their observable properties. Students will **explain the formation of Ionic and Covalent bonds. Students will predict Naming of chemical compounds, make observations and design models chemical compounds and describe acid-base compounds.**

Unit 4: Chemical reactions: In this unit, students will describe formation of chemical reactions, classify

chemical reactions based on observable properties. Students will analyze and balance chemical reactions. Students will use evidence to determine the factors that affect the rate of a chemical reaction.

Total Number of Units: 4

Pacing Guide

Unit	Standard	# of days	Skill What we want students to"DO"
1. **Measurement and Periodic Table**	**HS-PS1-1** **HS-PS1-3** **HS-PS1-3**	**5** **15** **15**	**Ask questions, make observations, and gather information about safety.** **Solve numerical problems to determine various measurements and convert one unit into another.** **Analyze the periodic table to identify how it explains the properties of matter around us.**

2. **Structure and property of Atom**	**HS-PS1-8** **HS-PS2-6** **HS-PS1-3** **HS-PS1-3**	**5** **10** **7-10** **10**	**Review and Analyze the structure of an Atom and explain hydrogen spectra.** **Use mathematical formulas to calculate average atomic mass by analyzing the isotopes of an atom. Study radioactive decay and nuclear chemistry.** **Analyze the work and models of various scientists to develop a timeline for evolution of atomic theory.** **Compare the shapes of various atomic orbitals and how they affect distribution of electrons in an atom** **Analyze and predict electron**

			configuration.
3. **Chemical Bonding**	**HS-PS1-3, HS-PS2-6** **HS-PS1-3** **HS-PS2-6** **HS-PS1-3**	**10** **15** **5** **10**	**Plan and conduct experiment to describe the formation of chemical bond between two atoms.** **Analyze the type of bond formed to name various chemical compounds.** **Design a model of a chemical compound based on its bonding.** **Develop a simple sketch of various geometric shapes of covalent compounds and determine the properties.**
4. **Chemical Reactions**	**HS-PS1-3, HS-PS1-2** **HS-PS1-7** **HS-PS1-5**	**15** **10** **7-10**	**Ask questions, make observations, gather information about various types of chemical reactions** **Plan and develop reasoning to balance chemical reactions.** **Make observations to construct an evidence-based account of how concentration, temperature and surface area affect the speed of chemical reactions**

Unit 1: Measurement, Properties of Periodic table

Time Frame: 40- 45 days

Essential Questions

- **How do scientists study nature, discover new information answer questions and solve problems?**
- **Why is it important to follow proper procedures a safety measures in a laboratory setting?**
- **Does all matter exists in same form??**
- **How important is accuracy and precision in measurement?**
- **Why is metric conversion so unique?**
- **How do you differentiate between Physical and Chemical change? How is the periodic table arranged and why is it this way?**
- **What are some of the trends that can be observed in periodic table?**
- **How is Periodic Law reflected in group 7 elements?**
- **How important is accuracy and precision in measurement?**
- **What is the significance of the modern periodic table?**

Standards

Standards / CPIs (cumulative Progress Indicators) taught and assessed:

PERFORMANCE EXPECTATION

- **(HS-PS1-3)** Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.

- **(HS-PS1-1)** Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
- **(HS-PS2-6)** Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials

DISCIPLINARY CORE IDEAS

PS1.A: Structure and Properties of Matter Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. (HS-PS1-1) The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states.

SCIENCE and ENGINEERING PRACTICES

Developing and Using Models

- Develop a model based on evidence to illustrate the relationships between systems or between components of a system.
- Use a model to predict the relationships between systems or between components of a system

Planning and Carrying Out Investigations

- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.

Using Mathematics and Computational Thinking

- Use mathematical representations of phenomena to support claims

Constructing Explanations and Designing Solutions

- Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.
- Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

- Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations

CROSS CUTTING CONCEPTS

Structure and Function

- The shape and stability of structures of natural and designed objects are related to their function(s).

CONNECTIONS TO MATH

MP.2 Reason abstractly and quantitatively

MP.4 Model with mathematics

NJSLA for math pg 62 N-Q

https://www.state.nj.us/education/cccs/2016/math/standards.pdf

NJSLA for math pg 68 A-REI

https://www.state.nj.us/education/cccs/2016/math/standards.pdf

CONNECTIONS TO ELA

NJSLSA.R1 Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

TECHNOLOGY:

8.2.2.C.4 Identify designed products and brainstorm how to improve one used in the classroom.

8.2.2.C.6 Investigate a product that has stopped working and brainstorm ideas to correct the problem.

8.2.2.D.1 Collaborate and apply a design process to solve a simple problem from everyday experiences.

8.2.2.D.2 Discover how a product works by taking it apart, sketching how parts fit, and putting it back together.

8.2.2.D.3 Identify the strengths and weaknesses in a product or system.

HIGHLIGHTED CAREER READY PRACTICES:

- **CRP2. Apply appropriate academic and technical skills. .**
- **CRP4. Communicate clearly and effectively and with reason.**
- **CRP5. Consider the environmental, social and economic impacts of decisions.**
- **CRP6. Demonstrate creativity and innovation.**
- **CRP7. Employ valid and reliable research strategies.**
- **CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.**
- **CRP9. Model integrity, ethical leadership and effective management. .**
- **CRP11. Use technology to enhance productivity.**

SEL Practices & Competencies:

- -Management
- Social Awareness
- Responsible Decision-Making
- Relationship Skills

Overall Goal: Students will analyze the properties of matter and the relevance of periodic table.

Pre-Assessment: Teacher made Test

Please include interdisciplinary connections resources and plan in each activity

(SLO) Student Learning Objectives (with standards)	**Student Learning Strategies**	**Formative Assessment ***suggested but not limited to the following***	**Activities ***suggested but not limited to the following***	**Modifications & Reflections ***suggested but not limited to the following***
Explain the necessity of following directions and proper procedures in the laboratory. **HS-PS1-1** **NJSLSA.R1 Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence**	**Graphic Organizer** **KWL chart** **Paraphrasing**	**Do Nows** **Lab Safety Review and Quiz** **Turn and Talk**	**Lab Safety posters** **Lab safety scenario discussion.** **Effective questioning** **Lab safety worksheet** Scientific Method Bikini Bottom Experiments	**At Risk Students** ● **Less complex reading level** ● **Shortened assignments** ● **Different tiered assignments** ● **Extra time** **Students with IEP: Modifications are ususally individualized as per IEP**

when writing or speaking to support conclusions drawn from the text.			**HS-PS1-1** RST.9-10.7 **NJSLSA.R1** MP.2 NJSLA MATH page 4	● **Preferential seating** ● **Have students work in pairs** ● **Assistive technologies** ● **Reduced number of options on multiple choice exams** ● **Larger print** ● **Fewer problems on each page** ● **More time** ● **Test administered in a quieter setting** ● **Tests read orally** ● **Chunking of assignments or assessments**
Identify the fundamental units of SI and how they can be used to derive additional units	**Direct Instruction** **Think-pair-share** **Cooperative Learning** **Guided practice**	**Do Nows** **Exit Ticket** **Homework and practice**	**SI measurement units and worksheet** **HS-PS1-1** **NJSLA for math pg 62 N-Q**	
Convert units from one order of magnitude to another, as well as from metric to standard system units	**Powerpoint** **Video summary** **Small group instruction**	**Do Nows** **Practice questions and answers** **Group activity report**	**SI Units of measurement** **Mass, length practice sheet** **HS-PS1-1** **NJSLA for math pg 62 N-Q**	
Describe a measurement in	**summarizing and note-taking**	**Do Nows**	**Summarizing an arcticle**	

terms of its accuracy and its precision.	**Concept mapping**	**Homework** **exit ticket**	**Accuracy vs. Precision** **Accuracy vs. Precision Lab** **HS-PS1-1** RST.9-10.7 **NJSLSA.R1** **NJSLA for math pg 62 N-Q**	**into smaller segments** ● **Taping of lectures or providing a peer note-taker** ● **Modifications for summative and formative assessments as per IEP**
Convert measurements to and from scientific notation	**Direct instruction** **Scaffolding** **I do, We do, U do**	**Do Nows** **Group work** **Exit ticket**	**Metric Conversion WS** **HS-PS1-1** **NJSLSA.R1** MP.2 NJSLA MATH page 4	**Advanced Students:** ● **Alternative assignments with higher rigor** ● **Independent studies** ● **Mentoring of other students**
Determine the	**video**	**Do Nows**	**Racing for**	

number of significant digits used in an experiment.	**summarizing and note taking**	**Test on Measurement** **exit ticket**	**significant numbers activity** **HS-PS1-1** **RST.9-10.2.** MP.2 page 4	
Determine and compare the density of 10 different solid objects.	**video** **Hands on learning** **Cooperative learning**	**prelab questions** **Lab report**	**Flinn Density Lab** **Practice sheet** **Teacher made worksheet** **HS-PS1-1** **HSN-Q.A.1 NJSLA MATH pg 5**	
Compare and contrast physical and chemical change	**Cooperative learning** **Graphic Organizer** **Lab**	**Do Nows** **Quick write** **Lab report**	**Read article, watch video and summarize physical change vs chemical change** **Evidence of Chemical change lab**	

			Write a lab report **HS-PS1-1** **RST.9-10.2.** WHST.9-12.2	
Classify mixtures as homogeneous and heterogeneous. **HS-PS1-1** **NJSLSA.R2. Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.**	**cooperative learning** **Hands on learning** **Lab**	**Lab report** **Do Nows** **summary question**	**Homogeneous mixture/Heterogeneous mixture review questions** **Homegeneous vs. Heterogeneous Mixture lab** **Lab report** **HS-PS1-3** **RST.9-10.2.** WHST.9-12.2	
Describe how the elements are	**Powerpoint**	**Do Nows**	**Periodic table**	

arranged in the periodic table.	**Video** **summarizing and note taking**	**Quiz on Periodic Table** **One sentence summary** **3-2-1 response**	**Activity** **Coloring periodic table activity** **-Lab Acitivity: The Mendeleev lab of 1869** **HS-PS1-3** MP.2 page 4 W.9-10.2	
Describe the names and properties of group 1A through 8A in the periodic table.	**Powerpoint** **video** **Direct instruction** **http://www.chemheritage.org/discover/online-resources/chemistry-in-history/activities/path-to-the-periodic-table.aspx**	**Do Nows** **Think-pair-share** **oral questioning** **Test on Periodic table** **exit ticket**	**-Element Bingo** **Prepare Element Brochure** **-Adopt an element project** **-Summarize the**	

Describe the properties of transition and inner transition elements.			**video Meet the element song** **Meet the element Worksheet based on the video** **-Path to the periodic table Activity** **HS-PS1-3** MP.2 page 4 W.9-10.2	
Electronegativity and bond polarity	**Powerpoint** **Video** **summarizing and note taking**	**Do Nows** **Exit Ticket** **quick write**	**-Electronegativity and Bond polarity activity** **HS-PS1-3** HSN-Q.A.1 pg 62	

Describe the periodic properties like atomic radius, ionic radius and ionization energy. Describe the periodic trend among the properties of periodic table State periodic Law **HS-PS1-3**	**Powerpoint** **video** **Direct instruction** **Think -pair-share**	**Do Nows** **Summarizing** **Teacher created Test on Characteristics of Periodic Table**	**Teacher made hand out on periodic trends.** **Plot a graph by using various periodic properties.** **Element Jeopardy review game** **NJSLA for math pg 68 A-CED** **HS-PS1-3** **NJSLSA.R1**	

21st Century Theme Targeted – Global Awareness, Financial, Economic, Business and Entrepreneurial Literacy, Civic Literacy Health Literacy) **Global Awareness**					
21st Century Skills Targeted					
Creativity &	**Information**	**Media Literacy**	**Critical Thinking &**	**Communication &**	**Life &**

Innovation	Literacy		Problem Solving	Collaboration	Careers
Design Periodic Table poster Design Safety poster	Autobiography of Mendeleev	Video on Mendeleev	Adopt an Element project		Take it Further: Careers in Science and Engineering Mechanical Engineer

Summative Assessments: (include rubrics & exemplars)

Pre Unit Test

Post Unit Test

Unit 2: Atomic Structure, Atomic Orbitals and Electron Configuration

Time Frame: 40- 45 days

Essential Questions

- How unique is the structure of an atom?
- Where does the mass of an atom come from?
- How has the current theory of atom evolved?

- **In the modern atomic model where are the electrons located?**
- **How is isotope relevant to us?**
- **How can we describe atomic orbitals?**
- **How does atomic orbitals allow us to predict molecular geometry?**
- **How are valence electrons of elements important for characteristics of an element?**
- **What is the significance of electronic configuration in chemical bonding?**
- **Why is an understanding of intermolecular forces important?**

Standards

Standards / CPIs (cumulative Progress Indicators) taught and assessed:

PERFORMANCE EXPECTATIONS

- **(HS-PS1-3)** Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
- **(HS-PS1-1)** Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
- **(HS-PS1-8)** Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.
- **(HS-PS2-6)** Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials

DISCIPLINARY CORE IDEAS

- **PS1.A: Structure and Properties of Matter** Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. (HS-PS1-1) The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states.
- **PS1.C: Nuclear Processes** Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or

absorption of energy. The total number of neutrons plus protons does not change in any nuclear process.

SCIENCE and ENGINEERING PRACTICES

Developing and Using Models

- Develop a model based on evidence to illustrate the relationships between systems or between components of a system.
- Use a model to predict the relationships between systems or between components of a system

Planning and Carrying Out Investigations

- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.

Using Mathematics and Computational Thinking

- Use mathematical representations of phenomena to support claims

Constructing Explanations and Designing Solutions

- Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.
- Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
- Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations

CROSS CUTTING CONCEPTS

Structure and Function

- The shape and stability of structures of natural and designed objects are related to their function(s).

CONNECTIONS TO MATH

MP.2 Reason abstractly and quantitatively. (HS-PS1-5),(HS-PS1-7)

MP.4 Model with mathematics.

HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.

CONNECTIONS TO ELA

RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate

information expressed visually or mathematically (e.g., in an equation) into words

RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account

NJSLSA.W7 Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject

NJSLSA.R1 Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

TECHNOLOGY:

8.2.2.C.4 Identify designed products and brainstorm how to improve one used in the classroom.

8.2.2.C.6 Investigate a product that has stopped working and brainstorm ideas to correct the problem.

8.2.2.D.1 Collaborate and apply a design process to solve a simple problem from everyday experiences.

8.2.2.D.2 Discover how a product works by taking it apart, sketching how parts fit, and putting it back together.

8.2.2.D.3 Identify the strengths and weaknesses in a product or system.

Highligted career Ready practices:

- **CRP2. Apply appropriate academic and technical skills. .**
- **CRP4. Communicate clearly and effectively and with reason.**
- **CRP5. Consider the environmental, social and economic impacts of decisions.**
- **CRP6. Demonstrate creativity and innovation.**
- **CRP7. Employ valid and reliable research strategies.**
- **CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.**
- **CRP9. Model integrity, ethical leadership and effective management. .**
- **CRP11. Use technology to enhance productivity.**

SEL Practices & Competencies:

- Self-Management
- Social Awareness
- Responsible Decision-Making
- Relationship Skills

Overall Goal: Structure and properties of an atom.
Pre-Assessment: Teacher made Test

Please include interdisciplinary connections resources and plan in each activity

(SLO) Student Learning Objectives (with standards)	**Student Learning Strategies**	**Formative Assessment ***suggested but not limited to the following***	**Activities ***suggested but not limited to the following***	**Modifications & Reflections ***suggested but not limited to the following***
Describe and compare the three subatomic particles. **Contrast and compare continuous electromagnetic spectra and atomic emission spectra**	**Graphic Organizer** **Turn and Talk** **Think-pair-Share**	**Do Nows** **Exit ticket** **Video summary** **T-chart** **3-2-1 countdown**	**-Interactive activity: Build an atom activity** **Electromagnetic spectrum worksheet** **-Periodic table pop quiz** **HS-PS1-1** **HS-PS1- 3** **NJSLSA.W7**	**At Risk Students** ● **Less complex reading level** ● **Shortened assignments** ● **Different tiered assignments** ● **Extra time**

Classify and compare the different types of radioactive decay. Dangers of radioactive decay Describe Half Life	Scaffolding Instruction Shoulder buddy Cooperative learnning	Do Nows Exit Ticket Higher order Strategic questioning Lab	Use Venn diagram to compare nuclear fussion and fission Lab Radioactive decay using pennies Video summary: Write an essay on Chenobyl Disaster HS-PS1-8 RST.9-10.9 MP.2 page 4	Students with IEP: Modifications are uusally individualized as per IEP ● Preferential seating ● Have students work in pairs ● Assistive technologies ● Reduced number of options on multiple choice exams ● Larger print ● Fewer problems on each page ● More time ● Test administered in a quieter setting
Identify the number of electrons, protons and neutrons in an atom that is expressed in isotope notation. Calculate the average atomic masses of various elements using known values of their isotopes.	summarizing and note-taking Student practice opportunity: I do, we do, you do	Do Nows Exit Ticket Paraphrasing summarizing and note-taking	Lab: Beanium isotope lab Isotope and Atomic Mass interactive game -Teacher made Calculate Atomic mass practice sheet HS-PS1-1 HS-PS1-8 HSN-Q.A.1 pg 62	
Describe the evolution of atomic models over periodic of time. Describe the characteristics and	Direct Instruction Concept mapping video Identifying similarities and differences	Do Nows Homework exit ticket metacognition	-Use 4 square activity to describe the atomic models -Jigsaw Activity: History of the atomic model: -Lab Flame test	

drawback of the following models: **Democritus's theory** **Dalton's theory** **Bohr's model** **Rutherfords experiment and** **model** **Thompson's model**			-Study electron spectra summary activity **HS-PS1-3** NJSLSA.W2 MP.4 page 4	● **Tests read orally** ● **Chunking of assignments or assessments into smaller segments** ● **Taping of lectures or providing a peer note-taker** ● **Modifications for summative and formative assessments as per IEP** **Advanced Students:** ● **Alternative assignments with higher rigor** ● **Independent**
Describe the behavior of electrons as wave rather than particle **Heisenberg's uncertainity principle**	**Direct instruction** **I do, We do, U do** **Comparison Matrix** **video** https://www.youtube.com/watch?v=NYZOKCzhljo	**Do Nows** **Group work** **Exit ticket** **Higher order questions**	-Unlocking the atom Create Powerpoint presentation - Teacher generated Tic-tac-toe project on Atomic structure **HS-PS1-3** WHST.9-12.9 RH.9-10.2	
Represent arrangement of electrons outside the nucleus using Bohr diagram.	**video** **summarizing and note taking** **Scaffolding**	**Do Nows** **exit ticket** **online simulation results**	Bohr Diagram Interactive game: **Using Clay students design Bohr model for given elements**	

	Instruction	**Teacher made practice sheet from www. Sciencespot.net**	**Teacher created activity and handout.** **HS-PS1-3** MP.4 page 4	**studies** ● **Mentoring of other students**
Determine the number of valence electrons in a given element.	**video** **Hands on learning** **Cooperative learning**	**prelab questions** **Lab report** **Exit Slip** **Homework- independent study**	-Modelling Valence electron activity Teacher made handout **HS-PS1-3** MP.2 page 4	
Compare and contrast the shapes of s,p,d and f orbitals.. **Describe the properties of various atomic orbitals.** **Determine the number of electrons that each type of orbital can hold.** **Locate and describe the s, p d, f blocks in the periodic table.**	**Graphic Organizer** **Scaffolding instruction** **Individualized instruction**	**Do Nows** **Quick write** **3-2-1 response** **Exit ticket**	**Video summary** *-Teacher demonstration of atomic orbitals using balloons* *https://www.youtube.com/watch?v=Kb0mxAMHnfE* *-Atomic model hands on activity using Atomic orbital model set by Flinn* http://www.flinnsci.com/store/Scripts/prodView.asp?idproduct=15605 -Atomic model worksheet	

			-Quiz **HS-PS1-3** NJSLSA.R2	
Predict the placement of electrons in various orbits and orbitals. **Hund's rule** **Pauli's exclusion principle** **Aufbau principle**	**cooperative learning** **Hands on learning**	**Lab report** **Do Nows** **summary question**	Hog Hilton Electron Configuration activity **Electron Configuration simulation** **HS-PS1-3** MP.2 page 4	

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21st Century Skills Targeted					
Creativity & Innovation	**Information Literacy**	**Media Literacy**	**Critical Thinking & Problem Solving**	**Communication & Collaboration**	**Life & Careers**
Black box activity	**Use of isotopes in Medical science**	**Video on Chernobyl disaster and its impact**	**Isotope questions**	**lab**	**Nuclear chemistry**

Summative Assessments: (include rubrics & exemplars)

Pre Unit Test

Post Unit Test

Unit 3: Chemical bonding and Chemical compounds

Time Frame: 40- 45 days

Essential Questions

- **What is the significance of an ion in chemical bonding?**
- **Why is an understanding of intermolecular forces important?**
- **How does an atom change from neutral atom to ion?**
- **How does the chemical bonding determine behavior of a substance?**
- **How does two atoms share electrons to form covalent compounds?**
- **Why is a consistent system of naming compounds necessary?**
- **How does polarity affect the property of the molecule?**
- **Under what circumstances a compound becomes polar or nonpolar?**
- **Why ozone has a bent shape instead of a linear shape?**
- **How is human activity affecting the balance of acids and bases in the environment?**
- **How do acids and bases influence peoples' lives?**

Standards

Standards / CPIs (cumulative Progress Indicators) taught and assessed:

PERFORMANCE EXPECTATIONS

- **(HS-PS1-3)** Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
- **(HS-PS1-1)** Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
- **(HS-PS2-6)** Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials

DISCIPLINARY CORE IDEAS

- **PS1.A: Structure and Properties of Matter** Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states.
- **PS2.B: Types of Interactions** Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects.

SCIENCE and ENGINEERING PRACTICES

Developing and Using Models

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Planning and Carrying Out Investigations

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CROSS CUTTING CONCEPTS

Structure and Function

- The shape and stability of structures of natural and designed objects are related to their function(s).

CONNECTIONS TO MATH

MP.2 Reason abstractly and quantitatively. (HS-PS1-5),(HS-PS1-7)

MP.4 Model with mathematics.

HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.

NJSLA.G-GMD

page 82 - Geometric Measurement and Dimension

https://www.state.nj.us/education/cccs/2016/math/standards.pdf

CONNECTIONS TO ELA

RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words

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connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

NJSLSA.R2. Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.

NJSLSA.W9 Draw evidence from literary texts to support analysis, reflection, and research. WHST.9-12.9

TECHNOLOGY:

8.2.2.C.4 Identify designed products and brainstorm how to improve one used in the classroom.

8.2.2.C.6 Investigate a product that has stopped working and brainstorm ideas to correct the problem.

8.2.2.D.1 Collaborate and apply a design process to solve a simple problem from everyday experiences.

8.2.2.D.2 Discover how a product works by taking it apart, sketching how parts fit, and putting it back together.

8.2.2.D.3 Identify the strengths and weaknesses in a product or system.

Highlighted career Ready practices:

- **CRP2. Apply appropriate academic and technical skills. .**
- **CRP4. Communicate clearly and effectively and with reason.**
- **CRP5. Consider the environmental, social and economic impacts of decisions.**
- **CRP6. Demonstrate creativity and innovation.**
- **CRP7. Employ valid and reliable research strategies.**
- **CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.**
- **CRP9. Model integrity, ethical leadership and effective management. .**
- **CRP11. Use technology to enhance productivity.**

SEL Practices & Competencies:

- -Management
- Social Awareness
- Responsible Decision-Making
- Relationship Skills

Overall Goal: Chemical Bonds and Naming chemical compounds
Pre-Assessment: Teacher made Test

Please include interdisciplinary connections resources and plan in each activity

(SLO) Student Learning Objectives (with standards)	**Student Learning Strategies**	**Formative Assessment ***suggested but not limited to the following***	**Activities ***suggested but not limited to the following***	**Modifications & Reflections ***suggested but not limited to the following***
Determine the atom's valence electron and the type of ion formed. **Describe the formation of ionic bonds.** **Draw Lewis dot diagram for atoms to show transfer of electron.** **Describe the properties of ionic compounds.**	**Direct Instruction** **Think-pair-Share** **Scaffolding instruction**	**Do Nows** **Exit ticket** **Video summary** **T-chart** **Strategic questioning**	-Ionic bond practice sheet -Formation of Ionic bond puzzle -Lewis dot structures ionic bonds activity Quiz HS-PS1-1 HS-PS1- 3 HS-PS2-6 NJSLSA.R2 MP.2 page 4	**At Risk Students** ● **Less complex reading level** ● **Shortened assignments** ● **Different tiered assignments** ● **Extra time** **Students with IEP: Modifications are usually individualized as**

				per IEP ● **Preferential seating** ● **Have students work in pairs** ● **Assistive technologies** ● **Reduced number of options on multiple choice exams** ● **Larger print** ● **Fewer problems on each page** ● **More time** ● **Test administered in a quieter setting** ● **Tests read orally** ● **Chunking of assignments or**
Explain how the Octet rule applies to atoms of metallic and nonmetallic elements. **Explain how transition elements have multiple charges.** **Determine names of ionic compounds formed with cations of single charges.** **Determine names of ionic compounds formed with multiple charges.** **Differentiate between stock and classical method to name ionic compounds**	**Concept mapping** **Cooperative learning** **video** **https://www.youtube.com/watch?v=-a5iZKhg1e8**	**Do Nows** **Exit Ticket** **Higher order Strategic questioning** **Lab**	-Naming ionic compound activity with ionic cards -Go Fish for Ions activity -Lab on Properties of Ionic and Covalent Compounds" **Lab report** -teacher made practice sheet for naming ionic compound using stock method and classical method based on the video. **Naming ionic compound practice activity** HS-PS1-1 HS-PS1- 3 HS-PS2-6 NJSLSA.W9	
Describe the formation	**Think -pair- Share**	**Do Nows**	Create Covalent	

of covalent compounds. Describe the properties of covalent compounds. Draw Lewis dot diagram for covalent compounds Determine the names of covalent compounds using proper prefixes.	video http://webcache.googleusercontent.com/search?q=cache:R6viELhb3b0J:www.nclark.net/CovalentCompoundsWorksheet.doc+&cd=1&hl=en&ct=clnk&gl=us summarizing and note-taking	Exit Ticket Paraphrasing Strategic questioning Homework	compounds with Lewis Dot diagram Properties of covalent compound practice sheet Naming of covalent compound HS-PS1-1 HS-PS1- 3 HS-PS2-6 NJSLSA.W9	assessments into smaller segments ● Taping of lectures or providing a peer note-taker ● Modifications for summative and formative assessments as per IEP
Describe the formation of single bond. Differentiate between single, double and triple bond. Differenciate between polar and nonpolar	I do, we do, you do Cooperative learning video Identifying similarities and differences	Do Nows Homework exit ticket student designed flashcards	-Build covalent compounds using Flinn Molecular model set -Stick and Ball model of covalent compounds -Polar Bears and penguins covalent bond activity HS-PS1-1 HS-PS1- 3 HS-PS2-6 NJSLSA.R21	Advanced Students: ● Alternative assignments with higher rigor ● Independent studies ● Mentoring of other students
Differentiate between the properties of ionic	Scaffolding instruction	Do Nows 3-2-1 countown	*Ionic vs covalent compound lab*	

and covalent compounds. **HS-PS1-1** **HS-PS1- 3** **HS-PS2-6** **(MP.4**) Model with mathematics. (HS-ETS1-3), (HS-ETS1-4) **NJSLSA.W9** Draw evidence from literary texts to support analysis, reflection, and research. (HS-PS1-3), (HS-ETS1-3)	**graphic organizer** **Similarities and dissimilarities**	**Homework** **response notebook**	***Lab report*** **HS-PS1-1** **HS-PS1- 3** **HS-PS2-6** **NJSLSA.W9** **WHST.9-12.9**	
Describe the shapes and molecular geometry of covalent compounds. **Construct VSEPR model of common compounds.**	**video** **summarizing and note taking** **Scaffolding Instruction** **Online simulation**	**Do Nows** **exit ticket** **online simulation results** **Project based learning**	**VSEPR model reading lab activity** **Teacher designed Build a molecule project** **HS-PS1-1** **HS-PS1- 3** **HS-PS2-6** **NJSLSA.R1** **NJSLA.G-GMD** **page 82**	
Compare and contrast the properties of acids	**Guided practice** **Cooperative**	**Lab report**	**Acids and Bases Matching activity online**	

and bases. Describe pH and pOH. Describe the usefulness of buffers in everyday chemistry	learning Lab investigations	Exit Slip Homework- independent study	Acid-Base lab activity Summarizing activity on uses of buffers after reading an article HS-PS1-1 HS-PS1- 3 HS-PS2-6 NJSLSA.R1	

21st Century Theme Targeted – Global Awareness, Financial, Economic, Business and Entrepreneurial Literacy, Civic Literacy Health Literacy) Global Awareness					
21st Century Skills Targeted					
Creativity & Innovation	Information Literacy	Media Literacy	Critical Thinking & Problem Solving	Communication & Collaboration	Life & Careers
Build an atom project	Use of drugs among young adults and its impact on brain.	Video on use of common chemical compounds in everyday life	Electron Configuration chart	Chemical compounds lab	Pharmaceuticals, medicine, nursing
Summative Assessments: (include rubrics & exemplars)					

Pre Unit Test

Post Unit Test

Unit 4: Chemical Reactions

Time Frame: 40- 45 days

Essential Questions

- How do I classify and balance the 5 main types of chemical reactions?
- How do I identify oxidation and reduction in a chemical equation?
- What happens at the molecular level when substances react with each other?
- What situations affect the rates of chemical reactions?
- What is the format for representing a chemical reaction with a chemical equation?
- When does a chemical reaction attain equilibrium?
- What signs indicate that a chemical reaction has occurred when leaves change color?
- Is it possible to predict the products of a chemical reaction by analyzing the type of reaction?
- How is Law of Conservation obeyed during a chemical reaction?
- How does intermolecular force affect a chemical reaction?

Standards

Standards / CPIs (cumulative Progress Indicators) taught and assessed:

- **(HS-PS1-3)** Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
- **(HS-PS1-1)** Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms**.**
- **(HS-PS2-6)** Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials
- **(HS-PS1- 2) -** Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
- **(HS-PS1-7)-** Use mathematical. representations to support the claim that atoms and therefore, mass are conserved during chemical reaction.
- **(HS-PS1-5)-** Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs

DISCIPLINARY CORE IDEAS

- **PS1.A: Structure and Properties of Matter** Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states.
- **PS2.B: Types of Interactions** Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects.
- **PS1.B: Chemical Reactions** Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy.
- In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present.

SCIENCE and ENGINEERING PRACTICES

Developing and Using Models

- Develop a model based on evidence to illustrate the relationships between systems or between components of a system.

- Use a model to predict the relationships between systems or between components of a system

Planning and Carrying Out Investigations

- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.

Using Mathematics and Computational Thinking

- Use mathematical representations of phenomena to support claims

Constructing Explanations and Designing Solutions

- Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.
- Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
- Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations

CROSS CUTTING CONCEPTS

Structure and Function

- The shape and stability of structures of natural and designed objects are related to their function(s).

CONNECTIONS TO MATH

MP.2 Reason abstractly and quantitatively. (HS-PS1-5),(HS-PS1-7)

MP.4 Model with mathematics.

HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.

CONNECTIONS TO ELA

RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words

RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account

NJSLSA.W7 Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject

NJSLSA.R1 Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

NJSLSA.R2. Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.

NJSLSA.W9 Draw evidence from literary texts to support analysis, reflection, and research. WHST.9-12.9

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8.2.2.C.4 Identify designed products and brainstorm how to improve one used in the classroom.

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- Self-Management
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Overall Goal: Chemical Reactions
Pre-Assessment: Teacher made Test

Please include interdisciplinary connections resources and plan in each activity

(SLO) Student Learning Objectives (with standards)	**Student Learning Strategies**	**Formative Assessment ***suggested but not limited to the following***	**Activities ***suggested but not limited to the following***	**Modifications & Reflections ***suggested but not limited to the following***
Describe the formation of simple composition and decomposition reaction. **Describe the formation of replacement reactions.** **Describe the formation of acid-base neutralization reaction.** **Describe the double replacement reactions.**	**Direct Instruction** **Cooperative Learning** **Scaffolding instruction** **video** **https://www.youtube.com/watch?v=g-biRwAVTV8**	**Do Nows** **Exit ticket** **Station activity report** **Poster** **Strategic questioning**	**Shall we Dance Pogil activity for Classifying chemical reactions** **-Types of Chemical reaction cards activity** **- lab on types of chemical reactions** **Lab on replacement reactions by flinn** **HS-PS1-2** **HS-PS1-3** **HS-PS1-6** **NJSLSA.R1** **WHST.9-12.2** **Everyday chemical reactions poster**	**At Risk Students** ● **Less complex reading level** ● **Shortened assignments** ● **Different tiered assignments** ● **Extra time** **Students with IEP: Modifications are usually individualized as per IEP**

Oxidation and reduction reactions	**Guided practice** **video** **https://www.youtube.com/watch?v=5rtJdjas-mY** **Summarizing and note-taking** **Lab**	**Do Nows** **Exit Ticket** **Homework** **Lab report**	**Redox reaction activity** **Online simulation redox activity** **HS-PS1-2** **HS-PS1-3** **HS-PS1-7** **NJSLA W.9-10.2**	● **Preferential seating** ● **Have students work in pairs** ● **Assistive technologies** ● **Reduced number of options on multiple choice exams** ● **Larger print** ● **Fewer problems on each page** ● **More time** ● **Test administered in a quieter setting** ● **Tests read orally** ● **Chunking of assignments or assessments**
Describe how matter changes during a chemical reaction system in terms of rearrangement of atoms. **Use mathematical representations of chemical reactions to support the claim that atoms, and therefore mass, are conserved during chemical reactions.** **Use Law of Conservation of mass to predict the outcome of a chemical**	**Think -pair- Share** **video** **summarizing and note-taking**	**Do Nows** **Exit Ticket** **Paraphrasing** **Strategic questioning** **Homework**	**Snowman Challenge** **Balancing chemical equations simulation activity** ***Role play balancing chemical equations.*** ***Balancing Act*** *Computer simulation activity# 1* Computer simulation activity #2 **HS-PS1-2** **HS-PS1-3** **HS-PS1-7** MP.2 page 4	

reaction.				into smaller segments ● Taping of lectures or providing a peer note-taker ● Modifications for summative and formative assessments as per IEP Advanced Students: ● Alternative assignments with higher rigor ● Independent studies ● Mentoring of other students
Rates of chemical .	I do, we do, you do Cooperative learning video Lab	Do Nows Homework exit ticket lab report	lab rates of chemical reaction flinn scientific rates of chemical reaction simulation lab Simulation lab report HS-PS1-5 HS-PS1-6 HS-PS1-7 NJSLA W.9-10.2	

21st Century Theme Targeted – Global Awareness, Financial, Economic, Business and Entrepreneurial

Literacy, Civic Literacy Health Literacy)

Global Awareness

21st Century Skills Targeted

Creativity & Innovation	Information Literacy	Media Literacy	Critical Thinking & Problem Solving	Communication & Collaboration	Life & Careers
Role Play chemical reaction activity	Redox reaction activity	Everyday chemical reactions poster	Simulation activity	Rates of reaction lab	

Summative Assessments: (include rubrics & exemplars)

Pre Unit Test

Post Unit Test