BOE Approved 8/18

Cliffside Park Public Schools

Science

Unit Name: Mixtures and Solutions (Physical Science)

Resource: FOSS Next Generation, Delta Education

Duration: Ten Weeks

Enduring Understandings

Separating Mixtures

- A mixture is two or more materials intermingled.
- An aqueous solution is a mixture in which a substance disappears (dissolves) in water to make a clear liquid.
- Mixtures can be separated into their constituents.
- The mass of a mixture is equal to the mass of its constituents.

Developing Models

- Models are explanations of objects, events, or systems that cannot be observed directly.
- Models are representations used for communicating and testing.
- Developing a model is an iterative process, which may involve observing, constructing, analyzing, and revising.
- Dissolving is an interaction between two (or more) substances: a solute, which dissolves, and a solvent, which does the dissolving and into which the solute disappears.
- Melting is a change in a single substance from solid to liquid caused by heat (energy transfer).
- The amount of matter is conserved when it changes form.

Concentration

- Concentration is the amount of dissolved solid material per unit volume of water.
- Solutions with a lot of solid dissolved in a volume of water are concentrated; solutions with little solid dissolved in a volume of water are dilute.
- A concentrated solution can be diluted by adding water; a dilute solution can be concentrated by adding more solid.
- When equal volumes of two salt solutions are weighed, the heavier one is the more concentrated solution.
- Density is mass per unit volume.
- More concentrated salt solutions have greater density.
- Less dense solutions form layers on more dense solutions.

Reaching Solutions

- A substance is a single, pure material.
- Solutions are composed of a solvent (liquid) and a solute (solid); the solute is dissolved in the solvent.
- Solubility is the property that indicates how readily a solute dissolves in a solvent. Solubility varies from substance to substance and is affected by kind of solvent, temperature, and other factors.
- A solution is saturated when as much solid material as possible has dissolved in the liquid.
- Substances form predictable, identifiable crystals when solutions evaporate.

Fizz Quiz

- Some mixtures of substances result in a chemical reaction.
- During reactions, starting substances (reactants) change into new substances (products).
- Formation of a gas or precipitate is evidence of a chemical reaction.
- Some products of reactions are soluble and can be identified by crystal structure after evaporation.
- Calcium carbonate reacts with acid.

Essential Questions

Separating Mixtures

- How can a mixture be separated?
- Where does the solid material go when a solution is made?
- How can you separate a mixture of dry materials?
- Are there materials outdoors that will dissolve in water?

Developing Models

- What is the process to develop a model of the black box?
- How does a draught stopper system work?
- What is the difference between dissolving and melting?

Concentration More

- Are all solutions made with soft-drink powder and water the same?
- How can you determine which salt solution is more concentrated?
- How can you determine the relative concentrations of three mystery solutions?
- What is the relationship between salt-solution concentration and density?

Reaching Saturation

- Is there a limit to the amount of salt that will dissolve in 50 mL of water?
- Does it always take the same amount of solid materials to saturate 50 mL of water?
- What is the identity of the mystery substance?
- What is in our water samples?
- What is a design to remove salt from ocean water?

Fizz Quiz

- What is the effect of mixing two substances with water?
- How can we identify the products from the baking soda and calcium chloride reaction?
- What happens when you mix substances with water in a bag?

Focus of Standards

Student Outcomes	**Skills**	**Assessments**
Separating Mixtures ● I can identify that a mixture is two or more materials intermingled. ● I can identify that an aqueous solution is a mixture in which a substance disappears (dissolves) in water to make a clear liquid. ● I can understand that mixtures can be separated into their constituents	● Asking Questions and Defining Problems ● Developing and Using Models ● Classifying Information ● Observing Investigations ● Exploring New Ideas ● Planning and Carrying Out Investigations	***Assessments:*** ● **Formative**: Notebook Entries: ○ Notebook Entries ○ Conduct an investigation to determine whether the mixing of two or more substances results in new substances ○ Measure and graph quantities to provide evidence that regardless of the type of change that occurs when

● I can describe that a mass of a mixture is equal to the mass of its constituents. **Developing Models** ● I can explain that models are explanations of objects, events, or systems that cannot be observed directly. ● I can demonstrate that models are representations used for communicating and testing. ● I can demonstrate that developing a model is an interactive process, which may involve observing, constructing, analyzing and revising. ● I can identify that dissolving is an interaction between two (or more) substances: a solute, which dissolves, and a solvent, which does the dissolving and into which the solute disappears. ● I can identify that melting is a change in a single substance from solid to liquid caused by heat (energy transfer). ● I can describe the amount of matter is conserved when it changes form. **Concentration** ● I can identify that concentration is the amount of dissolved solid materials per unit volume of water. ● I can identify that solutions with a lot of solid dissolved in a volume of water are concentrated; solutions with little solid dissolved in a volume of water are dilute. ● I can understand that a concentrated solution can be diluted by adding water; a dilute solution can be concentrated by	● Analyzing and Interpreting Data ● Using Mathematics and Computational Thinking ● Constructing Explanations and Designing Solutions ● Engaging in Argument from Evidence ● Obtaining, Evaluating and Communicating Information	substances are heated, cooled, or mixed, the total weight is conserved ○ Teacher Observation ○ Anecdotal Records/Notes ○ Science notebook ○ Embedded Assessment Notes ● **Summative Performance** ○ Foss Post-test on Mixtures and Solutions ○ Vocabulary check ● **Benchmark Assessments**: ○ Investigation Checks ○ Constructing models- separating mixtures ○ Constructing models- identifying solvents and solutes ○ Constructing models- chemical reactions ○ Diagraming- dilution and saturation ○ Applying- changing concentrations ● **Alternative:** ○ Conferences ○ Diagrams ○ Word Bank for vocabulary ○ Modeling ○ Illustrations of Chemical reactions and sequences ○ Storybook assembly

adding more solid. ● I can understand that equal volumes of two salt solutions are weighed, the heavier one is the more concentrated solution. ● I can identify that density is mass per unit volume. ● I can explain that more concentrated salt solutions have greater density. ● I can identify that less dense solutions form layers on more dense solutions. **Reaching Saturation** ● I can explain that a substance is a single, pure material. ● I can identify that solutions are composed of a solvent (liquid) and a solute (solid); the solute is dissolved in the solvent. ● I can identify that solubility is the property that indicates how readily a solute dissolves in a solvent. Solubility varies from substance and is affected by kind of solvent, temperature, and other factors. ● I can describe a solution is saturated when as much solid material as possible has dissolved in the liquid. ● I can explain that substances form predictable, identifiable crystals when solutions evaporate. **Fizz Quiz** ● I can identify that some mixtures of substances result in a chemical reaction. ● I can explain that during reactions, starting substances (reactants) change		

into new substances (products). ● I can identify that formation of a gas or precipitate is evidence of a chemical reaction. ● I can describe that some products of reactions are soluble and can be identified by crystal structure after evaporation. ● I can identify that calcium carbonate reacts with acid.		

NJ Student Learning Standards: Science
5-PS1 Matter and Its Interactions
Performance Expectations
5-PS1-1. Develop a model to describe that matter is made of particles too small to be seen
5-PS1-2. Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.
5-PS1-3. Make observations and measurements to identify materials based on their properties.
5-PS1-4. Conduct an investigation to determine whether the mixing of two or more substances results in new substances.
3-5 ETS1 Engineering Design
Performance Expectations
3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

ELA: RI.5.1, RI.5.3, RI.5.4, RI.5.5, RI.5.6, RI.5.8, RI.5.9
Math: 5.OA.A.1, 5.OA.A.2, 5.OA.A.3, 5.MD.A.1, 5.MD.B.2, 5.MD.C.3, 5.MD.C.4, 5.MD.C.5

Career Awareness, Exploration, And Preparation
Strand B: Career Awareness
9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
9.2.8.B.4 Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.

8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.

A. Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.

8.1.5.A.1 Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems.

8.1.5.A.3 Use a graphic organizer to organize information about problem or issue.

8.1.5.A.4 Graph data using a spreadsheet, analyze and produce a report that explains the analysis of the data.

D. Digital Citizenship: Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.

8.1.5.D.1 Understand the need for and use of copyrights.

8.1.5.D.4 Understand digital citizenship and demonstrate an understanding of the personal consequences of inappropriate use of technology and social media.

E: Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.

8.1.5.E.1 Use digital tools to research and evaluate the accuracy of, relevance to, and appropriateness of using print and non-print electronic information sources to complete a variety of tasks.

F: Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

8.1.5.F.1 Apply digital tools to collect, organize, and analyze data that support a scientific finding.

8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming

All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

A. The Nature of Technology: Creativity and Innovation Technology systems impact every aspect of the world in which we live.

8.2.5.A.1 Compare and contrast how products made in nature differ from products that are human made in how they are produced and used.

8.2.5.A.3 Investigate and present factors that influence the development and function of products and systems, e.g., resources, criteria and constraints.

8.2.5.A.5 Identify how improvement in the understanding of materials science impacts technologies.

B. Technology and Society: Knowledge and understanding of human, cultural and societal values are fundamental when designing technology systems and products in the global society.

8.2.5.B.2 Examine systems used for recycling and recommend simplification of the systems and share with product developers.

C. Design:The design process is a systematic approach to solving problems.

8.2.5.C.4 Collaborate and brainstorm with peers to solve a problem evaluating all solutions to provide the best results with supporting sketches or models.

D. Abilities for a Technological World: The designed world is the product of a design process that provides the means to convert resources into products and systems.

8.2.5.D.1 Identify and collect information about a problem that can be solved by technology, generate ideas to solve the problem, and identify constraints and trade-offs to be considered.

8.2.5.D.2 Evaluate and test alternative solutions to a problem using the constraints and trade-offs identified in the design process to evaluate potential solutions.

8.2.5.D.3 Follow step by step directions to assemble a product or solve a problem.

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.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP11. Use technology to enhance productivity.
CRP12. Work productively in teams while using cultural global competence.

NJSLS: Science and Engineering Practices
Practice 1. Asking questions (for science) and defining problems (for engineering)
Asking questions and defining problems in 3–5 builds on K–2 experiences and progresses to specifying qualitative relationships.

- Ask questions about what would happen if a variable is changed.
- Identify scientific (testable) and non-scientific (non-testable) questions.
- Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.
- Use prior knowledge to describe problems that can be solved.
- Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost.

Practice 2. Developing and using models
Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.

- Identify limitations of models.
- Collaboratively develop and/or revise a model based on evidence that shows the relationships among variables for frequent and regular occurring events.
- Develop a model using an analogy, example, or abstract representation to describe a scientific principle or design solution.
- Develop and/or use models to describe and/or predict phenomena.
- Develop a diagram or simple physical prototype to convey a proposed object, tool, or process.
- Use a model to test cause and effect relationships or interactions concerning the functioning of a natural or designed system.

Practice 3. Planning and carrying out investigations
Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.
- Evaluate appropriate methods and/or tools for collecting data.
- Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.
- Make predictions about what would happen if a variable changes.

- Test two different models of the same proposed object, tool, or process to determine which better meets criteria for success.

Practice 4. Analyzing and interpreting data

Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used.

- Represent data in tables and/or various graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships.
- Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation.
- Compare and contrast data collected by different groups in order to discuss similarities and differences in their findings.
- Analyze data to refine a problem statement or the design of a proposed object, tool, or process.
- Use data to evaluate and refine design solutions.

Practice 5. Using mathematics and computational thinking

Mathematical and computational thinking in 3–5 builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions.

- Decide if qualitative or quantitative data are best to determine whether a proposed object or tool meets criteria for success.
- Organize simple data sets to reveal patterns that suggest relationships.
- Describe, measure, estimate, and/or graph quantities (e.g., area, volume, weight, time) to address scientific and engineering questions and problems.
- Create and/or use graphs and/or charts generated from simple algorithms to compare alternative solutions to an engineering problem.

Practice 6. Constructing explanations (for science) and designing solutions (for engineering)

Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.

- Construct an explanation of observed relationships (e.g., the distribution of plants in the backyard).
- Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem.
- Identify the evidence that supports particular points in an explanation.
- Apply scientific ideas to solve design problems.
- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.

Practice 7. Engaging in argument from evidence

Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).

- Compare and refine arguments based on an evaluation of the evidence presented.
- Distinguish among facts, reasoned judgment based on research findings, and speculation in an explanation.
- Respectfully provide and receive criticism from peers about a proposed procedure, explanation, or model by citing relevant evidence and posing specific questions.
- Construct and/or support an argument with evidence, data, and/or a model.
- Use data to evaluate claims about cause and effect.
- Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem.

Practice 8. Obtaining, evaluating, and communicating information

Obtaining, evaluating, and communicating information in 3–5 builds on K–2 experiences and progresses to evaluating the merit and accuracy of ideas and methods.

- Read and comprehend grade-appropriate complex texts and/or other reliable media to summarize and obtain scientific and technical ideas and describe how they are supported by evidence.
- Compare and/or combine across complex texts and/or other reliable media to support the engagement in other scientific and/or engineering practices.
- Combine information in written text with that contained in corresponding tables, diagrams, and/or charts to support the engagement in other scientific and/or engineering practices.
- Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem.
- Communicate scientific and/or technical information orally and/or in written formats, including various forms of media and may include tables, diagrams, and charts.

Core Instructional Materials:

- FOSS Next Generation: Mixtures and Solutions(2016)

Supplemental Materials: (videos, leveled readers, Readworks, recommended books etc.)
Videos: https://www.fossweb.com/moduledetail?dDocName=G3842595&classId=
Recommended books: https://www.fossweb.com/additional-resources-books-xslt?dDocName=G4292315#non-fiction-books

21st Century Themes

Learning about the properties and behaviors of substances and systems of substances gives knowledge about how things go together and how they can be taken apart and gives an opportunity to use and develop models that explain phenomena too small to see directly. Learning about changes in substances can lead to the development of new materials and new ways to produce energy and resources such as clean drinking water.

- Global Awareness
- Civic Literacy
- Health Literacy
- Environmental Literacy
- Financial/Economic/Business/Entrepreneurial Literacy

21st Century Skills
Creativity and Innovation

- Critical Thinking and Problem Solving
- Communication and Collaboration
- Collaborative teamwork
- Critical thinking
- Problem solving

Interdisciplinary Connections
ELA

- Read and comprehend complex science texts related to their prior experience and knowledge.
- Write informational/explanatory texts, arguments to support claims, and narratives about experience in science.
- Engage in collaborative discussions about science.
- Learn new vocabulary and language structures in context.

Mathematical Practices

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Use appropriate tools strategically.
- Attend to precision.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning.

Differentiation/Accommodations/Modifications ***(Alternate Modes of Instruction and Support)***		
Modifications to Support Gifted and Talented Students	**Modifications to Support English Language Learners**	**Modifications to Support Our Learners (Students with IEPs/504s and At-Risk Learners)**
Newsela article: *10 interesting things about air* Lexile: 930 Recommended non fiction books https://www.fossweb.com/additional-resources-books-xslt?dDocName=G4292315#non-fiction-books	Newsela article: *10 interesting things about air* (Spanish version) Equipment photo cards (spanish and english) Modeling chemical reaction- in words Visual cues- image gallery https://www.fossweb.com/additional-res	Newsela article: *10 interesting things about air* Lexile: 630 Storyboard- Making a drink- A mixture? Equipment photo cards Modeling Particles of Matter Chemical Cafe

Independent research- make slime! Build Crystals. Debate / Compare and contrast- changing substance back after a reaction- is it possible? Participate in inquiry and project-based learning units of study Assigning roles within partnerships Differentiated supports: content, process, product, environment	ources-image-galleries-xslt?dDocName=G4292315#image-galleries Researching Solutions we drink Vocabulary log- Pronunciation/translation assistance https://dictionary.cambridge.org/us/ Vocabulary builder Thesaurus- https://www.thesaurus.com/ Native Language Translation (peer, online assistive technology, translation device, bilingual dictionary) Pair visual prompts with verbal presentations Front Load and immerse students in literacy and language experiences related to content Provide students with visual models, sentence stems, concrete objects, and hands-on materials. Model procedures for life skills. Collaboration between ELL and general education teacher to maximize learning	Air, A Gas Chemical Reaction Vehicles Teaching Grade 5 Structure and Properties of Matter Visual cues- image gallery https://www.fossweb.com/additional-resources-image-galleries-xslt?dDocName=G4292315#image-galleries Word walls Review student individual educational plan and/or 504 plan. Establish procedures for accommodations and modifications for assessments as per IEP/504. Establish procedures for modification of classwork and homework as per IEP/504. Modify classroom environment to support academic and physical needs of the students as per IEP/504. Provide appropriate accommodations, instructional adaptations, and/or modifications as determined by the IEP or 504 team. Differentiation through content, process, product, environment Provide Title I services to students not meeting academic standards in ELA and/or Math. Provide instructional adaptations and interventions in the general education classroom. Modify classroom environment to support student needs. Differentiated instruction Basic Skills Intensive individual intervention

Sources:
NJSLS Science Standards (2016): http://www.nj.gov/education/cccs/2016/science/
NJ: 2014 SLS: Technology: http://www.state.nj.us/education/cccs/2014/tech/8.pdf
NJSLS-S: Science and Engineering Practices: http://www.nj.gov/education/cccs/2016/science/3-5-ETS1.pdf
21st Century Life and Careers: http://www.state.nj.us/education/cccs/2014/career/9.pdf
Career Ready Practices: http://www.state.nj.us/education/cccs/2014/career/9.pdf
2015 FOSS Next Generation: www.FOSSweb.com
NSTA: https://ngss.nsta.org/