MENDHAM TOWNSHIP SCHOOLS

SCIENCE CURRICULUM

Grade 3

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Mendham Township School District
Science Curriculum
Grade 3

Grade 3 Unit 1: *Forces and Interactions*
Kid-Friendly Title: Balance & Motion

Stage 1: Desired Results

Level Benchmarks:

Students who demonstrate understanding can:

- Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.
- Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict the future motion.
- Ask questions to determine cause and effect relationships of electric magnetic interactions between two objects not in contact with each other.
- Define a simple design problem that can be solved by applying scientific ideas about magnets.
- Define a simple design problem reflecting a need or want that includes specified criteria for success and constraints on materials, time, or cost
- 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
- 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

Enduring Understanding:

- Students will determine the effects of balanced and unbalanced forces on the motion of an object and the cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other. They will apply their understanding of magnetic interactions to define a simple design problem that can be solved with magnets.

Essential Questions:

- How can one explain and predict interactions between objects and within systems of objects?
- How can one predict an object's continued motion, changes in motion, or stability?
- What underlying forces explain the variety of interactions observed?
- Why are some physical systems more stable than others?

Skills/Knowledge:

<u>Science and Engineering Practices</u>:

Asking Questions and Defining Problems

- Ask questions that can be investigated based on patterns such as cause and effect relationships (3-PS2-3)

- Define a simple problem that can be solved through the development of a new or improved object or tool (3-PS2-4)

Planning and Carrying Out Investigations

- 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 (3-PS2-1)
- 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 (3-PS2-2)

Constructing Explanations and Designing Solutions

- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. (3-5-ETS1-2)

<u>Disciplinary Core Ideas:</u>

PS2.A: Forces and Motion

- Each force acts on one particular object and has both strength and direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative addition of forces are used at this level.) (3-PS2-1)
- The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (Boundary: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.) (3-PS2-2)

PS2.B: Types of Interactions

- Objects in contact exert forces on each other. (3-PS2-1)
- Electric, and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other. (3-PS2-3),(3-PS2-4)

ETS1.A: Defining and Delimiting Engineering Problems

- Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3-5-ETS1-1)

ETS1.B: Developing Possible Solutions

- Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5-ETS1-2)
- At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3-5-ETS1-2)
- Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-5-ETS1-3)

ETS1.C: Optimizing the Design Solution

- Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3-5-ETS1-3)

Crosscutting Concepts:

Patterns

- Patterns of change can be used to make predictions (3-PS2-2)

Cause and Effect

- Cause and effect relationships are routinely identified (3-PS2-1)
- Cause and effect relationships are routinely identified, tested, and used to explain change (3-PS2-3).

Interdependence of Science, Engineering, and Technology

- Scientific discoveries about the natural world can often lead to new and improved technologies, which are developed through the engineering design process (3-PS2-4)

Influence of Science, Engineering, and Technology on Society and the Natural World

- People's needs and wants change over time, as do their demands for new and improved technologies. (3- 5-ETS1-1)
- Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (3-5-ETS1-2)

NJSLS Unit Standards:

- 3-PS2-1: **Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object** *[Clarification Statement: Examples could include an unbalanced force on one side of a ball can make it start moving; and, balanced forces pushing on a box from both sides will not produce any motion at all.] [Assessment Boundary: Assessment is limited to one variable at a time: number, size, or direction of forces. Assessment does not include quantitative force size, only qualitative and relative. Assessment is limited to gravity being addressed as a force that pulls objects down.]*
- 3-PS2-2: **Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict the future motion** *[Clarification Statement: Examples of motion with a predictable pattern could include a child swinging in a swing, a ball rolling back and forth in a bowl, and two children on a see-saw.] [Assessment Boundary: Assessment does not include technical terms such as period and frequency.]*
- 3-PS2-3: **Ask questions to determine cause and effect relationships of electric magnetic interactions between two objects not in contact with each other.** *[Clarification Statement: Examples of an electric force could include the force on hair from an electrically charged balloon and the electrical forces between a charged rod and pieces of paper; examples of a magnetic force could include the force between two permanent magnets, the force between an electromagnet and steel paperclips, and the force exerted by one magnet versus the force exerted by two magnets. Examples of cause and effect relationships could include how the distance between objects affects strength of the force and how the orientation of magnets affects the direction of the magnetic force.] [Assessment Boundary: Assessment is limited to forces produced by objects that can be manipulated by students, and electrical interactions are limited to static electricity.]*
- 3-PS2-4: **Define a simple design problem that can be solved by applying scientific ideas about magnets** *[Clarification Statement: Examples of problems could include constructing a latch to keep a door shut and creating a device to keep two moving objects from touching each other.]*
- 3-5-ETS1-1: **Define a simple design problem reflecting a need or 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**

Interdisciplinary Connections:

ELA/Literacy:
RI.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. *(3-PS2-1)*,(3-PS2-3)
RI.3.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. (3-PS2-3)
RI.3.8 Describe the logical connection between particular sentences and paragraphs in a text (e.g., comparison, cause/effect, first/second/third in a sequence). *(3-PS2-3)*
RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (3-5-ETS-2)
RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (3-5-ETS1-2)
RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (3-5-ETS-2)
W.3.7 Conduct short research projects that build knowledge about a topic. (3-PS2-1),(3-PS2-2)
W.3.8 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories. (3-PS2-1),*(3-PS2-2)*
W.5.7 Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (3-5-ETS1-1) (3-5-ETS1-3)
W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research (3-5-ETS1-1) (3-5-ETS1-3)
SL.3.3 Ask and answer questions about information from a speaker, offering appropriate elaboration and detail. *(3-PS2-3)*

Mathematics:
MP.2 Reason abstractly and quantitatively. *(3-PS2-1)*
MP.4 Model with mathematics (3-5-ETS1-1) (3-5-ETS1-2) (3-5-ETS1-3)
MP.5 Use appropriate tools strategically. *(3-PS2-1)*
3.MD.A.2 Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem. *(3-PS2-1)*
3-5.OA Operations and Algebraic Thinking (3-5-ETS1-1) (3-5-ETS1-2)

Stage 2-Assessment

Assessment:
- Formative - observations, discussions, participation, science notebooks, performance-based tasks
- Summative Assessment - written responses, written explanations, science notebooks, inquiry-Based Activities, portfolios
- Benchmark Assessment - unit assessments

Stage 3- Learning Plan

Investigation 1: **Forces**
Summary:
Students explore the forces of magnetism and gravity using magnets. through their investigations, students find that both magnetism and gravity can pull, and magnetism can sometimes push as well. Both forces can make things move even when not in direct contact with another object. Students refine their investigations and their abilities to use science practices and collect data regarding their observations of the interaction between paper clips and magnets. they use those data to predict how far

the magnetic field extends. Building on their experience with magnetic force, students explore other pushes and pulls, considering strength and direction. Students are introduced to the effects of balanced and unbalanced forces.

Focus Questions:

What happens when magnets interact with other magnets and with paper clips?

How is the magnetic field affected when more magnets are added?

What causes change of motion?

Content Related to Disciplinary Core Ideas:

- Magnetic forces between objects does not require that the objects be in contact.
- The strength of the magnetic force between objects depends on the properties of the objects and their distance apart.
- The interaction between magnets depends on their orientation (sometimes they attract and sometimes they repel).
- Unbalanced forces (pushes or pulls) result in change of motion.
- Gravity is the force that pulls masses toward the center or Earth.

Reading/Technology:

Science Resources Book

"Magnetism and Gravity"
"What Scientists do"
"Change of Motion"

Videos

All about Motion and Balance
All about Magnets

Online Activity

"Magnetic Poles"

Embedded Assessment:

Science Notebook Entry
Performance Assessment
Response Sheet

Benchmark Assessment:

Survey
Investigation 1 I-Check

Investigation 2: **Patterns of Motion**

Summary:

Students use variety of systems to explore patterns of motion. they design wheel-and-axle systems and roll the systems down ramps to observe the pattern of motion. they extend their rolling investigations to systems with big and little wheels and use the predictable curved rolling path to meet challenges. Students make twirly birds (flying spinners) and explore the variables involved in the interaction

between twirling systems, gravity, and air. Students design tops and explore the variables that results in the best spinning top.

Focus Questions:

How can we change the motion of wheels rolling down ramps?

What rules help predict where a rolling cup will end up?

Student-created question, e.g., What happens to the motion of a twirly bird when the wing length changes?

What is the best design for a top?

Content Related to Disciplinary Core Ideas:

- The patterns of an object's motion in various situations can be observed and measured.
- When past motion exhibits a regular pattern,future motion can be predicted from it.
- A wheel-and-axle system with two sizes of wheels describes a curved path when rolled down a slope. The system curves toward the smaller wheel.
- A twirly bird is a simple winged system that spins when it interacts with air. twirler performance is affected by variables.
- Tops exhibit rotational motion (spinning) when torque is applied to the axial shaft. top performance is affected by variables.

Reading/Technology:

Science Resources Book
"Patterns of Motion"
"What Goes Around"

Online Activity
"Roller Coaster Builder"

Embedded Assessment:

Science Notebook Entry
Response Sheet
Performance Assessment

Benchmark Assessment:

Investigation 2 I-Check

Investigation 3: **Engineering**

Summary:

Students tackle an engineering design challenge in incremental steps. They first design a cart that can roll "from here to there," and then improve their designs to meet a specific distance challenge. Students continue with an investigation involving gravity and explore how start position on a ramp affects the distance the cart travels. The final challenge incorporates students' knowledge of magnetism into their cart design to meet new challenges. This investigation develops understanding of

engineering design concepts and provides opportunities for students to engage in engineering practices.

Focus Questions:

What are some important features of a cart that will roll from here to there?

How can you improve the design of your cart?

Student-created questions, e.g., How does start position affect how far a cart rolls?

How can you use magnets to do cart tricks?

Content Related to Disciplinary Core Ideas:

- Possible solutions to a problem are limited by available materials and resources (constraints).
- The success of a designed solution is determined by considering the desired features of a solution (criteria).
- Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions.
- The pattern of an object's or a system's motion in various situations can be observed and measured.
- When past motion exhibits a pattern, it can be used to predict future motion.

Reading/Technology:

Science Resources Book
"What Engineers Do"
"Science Practices"
"Engineering Practices"
"Soap Box Derby"
"The Metric System"
"How Engineers and Scientists Work Together"

Online Activities
"Measuring Length"
"Measurement Logic"

Embedded Assessment:

Science notebook entries
Performance assessment

Benchmark Assessment:

Investigation 3 I-Check

Investigation 4: **Mixtures**

Summary:

Students build and extend grade two experiences with matter by making mixtures of two materials. They determine the mass of the materials prior to mixing and after mixing. In one mixture, salt dissolves (disappears), resulting in a solution. Students confirm that the mass of the solution is equal to the starting masses of the water and salt. They mix vinegar and baking soda and observe a bubbling reaction. Students determine that the mass of the ending mixtures is less than the mass of the original

materials, which challenges students to infer that carbon dioxide gas, which escaped, has mass. The investigation and module ends with students designing and conducting a metric field day to creatively apply their understanding of standards of measurement.

Focus Questions:

What happens when you mix two materials?

What is the importance of accurate measurements for a metric field day?

Content Related to Disciplinary Core Ideas:

- A mixture is two or more materials distributed evenly throughout one another.
- A special class of mixture, a solution, results when a solid material dissolves (disappears) in a liquid.
- Starting materials change into new materials during chemical reactions.
- Mass is neither created nor destroyed during physical and chemical interactions Matter is conserved.

Reading/Technology:

Science Resources Book
"Mixing Solids and Liquids"
"Reactions"
"Careers You Can Count On"

Online Activities
"Measuring Mass"
"Conservation of Mass"
"Measuring Volume and Mass"
"Measuring Volume"
"Chemical Reactions"
"Measuring Length"
"Measurement Logic"
"Metric Mystery"

Embedded Assessment:

Science notebook entries
Performance assessment

Benchmark Assessment:

Post-Test

Integrated accommodations and modifications for students with IEP's 504s, ELLs, and gifted and talented students: ● Principle 1. Provide multiple means of representation. Give learners various ways to acquire information and knowledge. ● Principle 2. Provide multiple means of action and expression. Offer students alternatives for demonstrating what they know. ● Principle 3. Provide multiple means of engagement. Help learners get interested, be challenged, and stay motivated. ● Use of small group centers, partner work and 1-1 ● Questioning strategies using higher order thinking to promote critical analysis
List of Core Instructional and Supplemental Materials: FOSS Balance & Motion (NGSS Edition) United Streaming Brainpop
Integration of 21st Century Skills and Life and Career Standard CRP1, 2, 4, 6, 8, 11
Integration of the Technology Standard **NJSLS.8.1**

Grade 3 Unit 3: Weather and Climate
Kid-Friendly Title: Water, Weather & Climate

Stage 1: Desired Results

Level Benchmarks:

Students who demonstrate understanding can:

- Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.
- Obtain and combine information to describe climates in different regions of the world.
- Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.
- Define a simple design problem reflecting a need or want that includes specified criteria for success and constraints on materials, time, or cost
- 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
- 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

Enduring Understanding:

- Students will organize and use data to describe typical weather conditions expected in a season. By applying their understanding of weather-related hazards, students are able to make a claim about the merit of a design solution that reduces the impacts of such hazards.

Essential Questions:

- What regulates weather and climate?
- How do natural hazards affect individuals and societies?

Skills/Knowledge:

<u>Science and Engineering Practices</u>:

Analyzing and Interpreting Data

- Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. (3-ESS2-1)

Engaging in Argument from Evidence

- 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. (3-ESS3-1)

Obtaining, Evaluating, and Communicating Information

- Obtain and combine information from books and other reliable media to explain phenomena. (3-ESS2-2)

Asking Questions and Defining Problems

- 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. (3-5-ETS1-1)

Planning and Carrying Out Investigations

- 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. (3-5-ETS1-3)

Constructing Explanations and Designing Solutions

- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. (3-5-ETS1-2)

<u>Disciplinary Core Ideas:</u>

ESS2.D: Weather and Climate

- Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next. (3-ESS2-1)
- Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years. (3-ESS2-2)

ESS3.B: Natural Hazards

- A variety of natural hazards result from natural processes.
- Humans cannot eliminate natural hazards but can take steps to reduce their impacts. (3-ESS3-1) (Note: This Disciplinary Core Idea is also addressed by 4-ESS3-2.)

ETS1.A: Defining and Delimiting Engineering Problems

- Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3-5-ETS1-1)

ETS1.B: Developing Possible Solutions

- Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5-ETS1-2)
- At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3-5-ETS1-2)
- Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-5-ETS1-3)

ETS1.C: Optimizing the Design Solution

- Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3-5-ETS1-3)

<u>Crosscutting Concepts</u>:

Patterns

- Patterns of change can be used to make predictions. (3-ESS2-1),(3-ESS2-2)

Cause and Effect

- Cause and effect relationships are routinely identified, tested, and used to explain change. (3-ESS3-1)

Influence of Engineering, Technology, and Science on Society and the Natural World

- Engineers improve existing technologies or develop new ones to increase their benefits (e.g., better artificial limbs), decrease known risks (e.g., seatbelts in cars), and meet societal demands (e.g., cell phones). (3-ESS3-1)
- People's needs and wants change over time, as do their demands for new and improved technologies. (3- 5-ETS1-1)

Science is a Human Endeavor

- Science affects everyday life. (3-ESS3-1)

NJSLS Unit Standards:

- 3-ESS2-1: **Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.** *[Clarification Statement: Examples of data could include average temperature, precipitation, and wind direction.] [Assessment Boundary: Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.]*
- 3-ESS2-2: **Obtain and combine information to describe climates in different regions of the world.**
- 3-ESS3-1: **Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.** *[Clarification Statement: Examples of design solutions to weather-related hazards could include barriers to prevent flooding, wind resistant roofs, and lightning rods.]*
- 3-5-ETS1-1: **Define a simple design problem reflecting a need or 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**

Interdisciplinary Connections:

ELA/Literacy:
RI.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-ESS2-2)
RI.3.9 Compare and contrast the most important points and key details presented in two texts on the same topic. (3-ESS2-2)
W.3.1 Write opinion pieces on topics or texts, supporting a point of view with reasons. (3-ESS3-1)
W.3.9 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories. (3- ESS2-2)
RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (3-5-ETS-2)
RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (3-5-ETS1-2)
RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (3-5-ETS-2)
W.3.7 Conduct short research projects that build knowledge about a topic. (3-PS2-1),(3-PS2-2)
W.3.8 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories. (3-PS2-1),*(3-PS2-2)*
W.5.7 Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (3-5-ETS1-1) (3-5-ETS1-3)

W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research (3-5-ETS1-1) (3-5-ETS1-3)
SL.3.3 Ask and answer questions about information from a speaker, offering appropriate elaboration and detail. *(3-PS2-3)*

Mathematics:
MP.2 Reason abstractly and quantitatively. (3-ESS2-1),(3-ESS2-2),(3-ESS3-1)
MP.4 Model with mathematics (3-5-ETS1-1) (3-5-ETS1-2) (3-5-ETS1-3)
MP.5 Use appropriate tools strategically. (3-ESS2-1)
3.MD.A.2 Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem. (3-ESS2-1)
3.MD.B.3 Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in bar graphs. (3-ESS2-1)
3-5.OA Operations and Algebraic Thinking (3-5-ETS1-1) (3-5-ETS1-2)

Stage 2-Assessment

Assessment:

- Formative - observations, discussions, participation, science notebooks, performance-based tasks
- Summative Assessment - written responses, written explanations, science notebooks, inquiry-Based Activities, portfolios
- Benchmark Assessment - unit assessments

Stage 3- Learning Plan

Investigation 1: Water Observations

Summary:
Students investigate properties of water. They compare the way water interacts with four different surfaces. They compare the rates of different amounts of water flowing downhill. They explore how sponges interact with water to soak up spills. Students go outdoors to explore how water interacts with natural materials.

Focus Questions:

What happens when water falls on different surfaces?

How does water move on a slope?

How much water can a dry sponge soak up?

What happens outdoors when rain falls on natural materials?

Content Related to Disciplinary Core Ideas:

- Water forms beads on waterproof materials and soaks into absorbent materials.
- Water moves downhill. The angle of the slope and the amount of water affect flow.

Reading/Technology:

Science Resources Book

"A Report from the Blue Planet"
"Surface Tension"
"Which Way Does It Go?"
"Opinion and Evidence"
"Water Everywhere"

Videos

Aquatic Surface Dwellers
Aquatic Insect Adaptations

Online Activities

"Measuring Volume"
"Measuring Mass"
"Metric Mystery"

Embedded Assessment:

Science notebook entries
Performance assessment

Benchmark Assessment:

Survey
Investigation 1 I-Check

Investigation 2: Hot Water, Cold Water

Summary:

Students are introduced to temperature as a measure of how hot matter is and to standard metric units to measure temperature (degrees Celsius). Students observe the properties of water as it is heated, cooled, and frozen. They make a water thermometer and find that water expands as it is heated. Students compare the density of water at different temperatures and find that warm water is less dense than cool water, and that ice is less dense than liquid water. They go outdoors to compare melting of ice in different conditions (above ground and underground).

Focus Questions:

How can you measure temperature accurately?

What happens to water when it gets hot? cold?

What happens when hot or cold water is put into room-temperature water?

How does water change when it gets really cold?

Where should an animal go to stay warm or to stay cool?

Content Related to Disciplinary Core Ideas:

- Temperature is a measure of how hot matter is.
- Water expands when heated and contracts when cooled.
- A material that floats in water is less dense than the water; a material that sinks is more dense.
- Cold water is more dense than warm water.
- Water expands when it freezes; ice is less dense than liquid water.
- Ice melts when heated; water freezes when cooled

Reading/Technology:

Science Resources Book
"Vacation Aggravation"
"Celsius and Fahrenheit"
"Water: Hot and Cold"
"Ice Is Everywhere"
Online Activities
"Measuring Temperature"
"Reading a Thermometer"
"Bottle Thermometer"
"Density of Hot/Cold Water"
"Expansion and Contraction of Water"

Embedded Assessment:

Science notebook entries
Performance assessment
Response sheet

Benchmark Assessment:

Investigation 2 I-Check

Investigation 3: Weather and Water

Summary:

Students compare weather data that they observe and collect to meteorologists' forecasts and historical weather data. Students are introduced to water vapor and evaporation. They explore the effects of environmental conditions and surface area on rates of evaporation. They set up condensation chambers and consider how evaporation and condensation contribute to the water cycle.

Focus Questions:

What does the weather forecast tell us?
What happens to wet paper towels overnight?
How does surface area affect evaporation?
What else affects how fast water evaporates?
What causes moisture to form on the side of a cup?

Content Related to Disciplinary Core Ideas:

- Weather is measured using observations and tools such as thermometers, wind vanes, and rain gauges.
- Evaporation is the process by which liquid (water) changes into gas (water vapor).
- High temperatures, greater surface area, and moving air (wind) increase the rate of evaporation.

- Condensation is the process by which gas (water vapor) changes into liquid water; it occurs on a cool surface.
- Evaporation and condensation contribute to the movement of water through the water cycle.

Reading/Technology:

Science Resources Book

"Studying Weather"
"Drying Up"
"Surface-Area Experiment"
"Condensation"
"The Water Cycle"

Videos

All about Meteorology
Water Cycle

Online Activities

"Weather Grapher"
"Evaporation Experiment"
"Water Cycle"

Embedded Assessment:

Science notebook entries
Performance assessment
Response sheet

Benchmark Assessment:
Survey
Investigation 3 I-Check

Investigation 4: Water Observations

Summary:
Students investigate properties of water. They compare the way water interacts with four different surfaces. They compare the rates of different amounts of water flowing downhill. They explore how sponges interact with water to soak up spills. Students go outdoors to explore how water interacts with natural materials.

Focus Questions:

What happens when water falls on different surfaces?

How does water move on a slope?

How much water can a dry sponge soak up?

What happens outdoors when rain falls on natural materials?

Content Related to Disciplinary Core Ideas:

- Water forms beads on waterproof materials and soaks into absorbent materials.
- Water moves downhill. The angle of the slope and the amount of water affect flow.

Reading/Technology:

Science Resources Book
"A Report from the Blue Planet"
"Surface Tension"
"Which Way Does It Go?"
"Opinion and Evidence"
"Water Everywhere"

Videos
Aquatic Surface Dwellers
Aquatic Insect Adaptations

Online Activities
"Measuring Volume"
"Measuring Mass"
"Metric Mystery"

Embedded Assessment:

Science notebook entries
Performance assessment

Benchmark Assessment:

Survey
Investigation 1 I-Check

Investigation 5: Seasons and Climate

Summary:
Students work in groups to organize and analyze local daily weather data for 4 months of the previous year (January, April, July, and October). This leads students to understand the difference between weather (condition of the atmosphere now) and climate (typical weather that can be expected to occur in a region). Through media, students are introduced to ways that people manage the problems associated with floods. They discuss engineering methods to deal with these weather-related hazards.

Focus Questions:
What are typical weather conditions in our region?
How do we describe different climates?
How do people deal with natural hazards such as floods?

Content Related to Disciplinary Core Ideas:

- Typical weather in a region often varies with seasons. High and low temperatures and amount of precipitation are the main ways to describe seasonal weather changes.
- The Sun's energy drives weather.
- Weather data in tables and in graphic displays, may show patterns over time.
- Climate is the average or typical weather that can be expected to occur in a region, based on longterm observation and data analysis.
- Weather-related natural hazards include tornadoes, hailstorms, blizzards, lightning, floods, and drought.
- People often modify their homes and their way of life to deal with floods.
- Wetland protection and restoration is one way to prevent floods.

Reading/Technology:

Science Resources Book

"Climate Regions"
"Wetlands for Flood Control"
"Conserving Water during Droughts"

Videos

All about Climate and Seasons
Come a Tide
Floods

Online Activity

"Climate Regions Map"

Embedded Assessment:

Science notebook entries

Benchmark Assessment:

Investigation 4 I-Check

Investigation 6: Waterworks

Summary:
Students compare what happens when water is poured through two different earth materials, soil and gravel. Students test soil in a number of locations on the schoolyard to compare the drainage rates. They construct a waterwheel and use it to lift objects, learning about the power of water. Students are introduced to renewable natural resources and ways to conserve them.

Focus Questions:

What happens when water is mixed with other earth materials?

Do soils in the schoolyard drain water at the same rate?

What is needed to make a waterwheel system function well?

Content Related to Disciplinary Core Ideas:

- Soil is rock particles mixed with organic material called humus.
- Soils retain more water than rock particles alone.
- Water drains more easily through some earth materials than through others.
- The energy of flowing water can be used to do work; waterwheels are machines powered by flowing water.

Reading/Technology:

Science Resources Book
"Water: A Vital Resource"
"Natural Resources"
"Ellen Swallow Richards: An Early Ecologist"
"Making Drinking Water Safe"
"Using the Energy of Water"

Embedded Assessment:

Science notebook entries
Performance assessment
Response sheet

Benchmark Assessment:

Post-Test

Integrated accommodations and modifications for students with IEP's 504s, ELLs, and gifted and talented students:

- Principle 1. Provide multiple means of representation. Give learners various ways to acquire information and knowledge.
- Principle 2. Provide multiple means of action and expression. Offer students alternatives for demonstrating what they know.
- Principle 3. Provide multiple means of engagement. Help learners get interested, be challenged, and stay motivated.
- Use of small group centers, partner work and 1-1
- Questioning strategies using higher order thinking to promote critical analysis

List of Core Instructional and Supplemental Materials:

FOSS Water and Climate
United Streaming
Brainpop

Integration of 21st Century Skills and Life and Career Standard

CRP1, 2, 4, 6, 8, 11

Integration of the Technology Standard

NJSLS.8.1

Grade 3 Unit 3: Interdependent Relationships in Ecosystems, Life Cycles & Traits
Kid Friendly Title: Ecosystems

Stage 1: Desired Results

Level Benchmarks:

Students who demonstrate understanding can:

- Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.
- Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.
- Construct an argument that some animals form groups that help members survive.
- Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.
- Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.
- Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.
- Use evidence to support the explanation that traits can be influenced by the environment.
- Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.
- Define a simple design problem reflecting a need or want that includes specified criteria for success and constraints on materials, time, or cost
- 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
- 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

Enduring Understanding:

- Students will explore the field of environmental engineering as they design a process to clean an oil spill in a model river. They learn how pollution can negatively impact the organisms in the ecosystem and how engineers must consider both short and long-term effects of pollutants on the organisms in a given ecosystem.

Essential Questions:

- How do some animals form groups that help members survive?
- How do fossils provide evidence of the organisms and the environments in which they lived long ago?
- How do some organisms survive well, less well, and not well?
- How do plants and animals change when the environment changes?
- How do organisms grow and develop?
- How does genetic variation among organisms affect survival and reproduction

Skills/Knowledge:

<u>Science and Engineering Practices</u>:

Analyzing and Interpreting Data
- Analyze and interpret data to make sense of phenomena using logical reasoning (3-LS4-1)

Engaging in Argument from Evidence
- Construct an argument with evidence, data, and/or a model (3-LS2-1)
- Construct an argument with evidence (3-LS4-3)
- 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 (3-LS4-4)

Developing and Using Models
- Develop models to describe phenomena. (3-LS1-1)

Constructing Explanations and Designing Solutions
- Use evidence (e.g., observations, patterns) to support an explanation. (3-LS3-2) Use evidence (e.g., observations, patterns) to construct an explanation. (3-LS4-2)

Scientific Knowledge is Based on Empirical Evidence
- Science findings are based on recognizing patterns. (3-LS1-1)

<u>Disciplinary Core Ideas:</u>

LS1.B: Growth and Development of Organisms
- Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles. (3-LS1-1)

LS2.C: Ecosystem Dynamics, Functioning, and Resilience
- When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die. (secondary to 3-LS4-4)

LS2.D: Social Interactions and Group Behavior
- Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size. (Note: Moved from K–2) (3-LS2-1)

LS3.A: Inheritance of Traits
- Many characteristics of organisms are inherited from their parents. (3-LS3-1)
- Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment. (3- LS3-2)

LS3.B: Variation of Traits
- Different organisms vary in how they look and function because they have different inherited information. (3-LS3-1)
- The environment also affects the traits that an organism develops. (3-LS3-2)

LS4.A: Evidence of Common Ancestry and Diversity
- Some kinds of plants and animals that once lived on Earth are no longer found anywhere. (Note: Moved from K–2) (3-LS4-1)
- Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environments. (3-LS4-1)

LS4.B: Natural Selection

- Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing. (3-LS4-2)

LS4.C: Adaptation

- For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. (3-LS4-3)

LS4.D: Biodiversity and Humans

- Populations live in a variety of habitats, and change in those habitats affects the organisms living there. (3-LS4-4)

Crosscutting Concepts:

Patterns

- Similarities and differences in patterns can be used to sort and classify natural phenomena. (3-LS3-1)
- Patterns of change can be used to make predictions. (3-LS1-1)

Cause and Effect

- Cause and effect relationships are routinely identified and used to explain change. (3-LS2-1),(3-LS4-3)

Scale, Proportion, and Quantity

- Observable phenomena exist from very short to very long time periods. (3-LS4-1)

Systems and System Models

- A system can be described in terms of its components and their interactions. (3-LS4-4)

Interdependence of Science, Engineering, and Technology

- Knowledge of relevant scientific concepts and research findings is important in engineering. (3-LS4-4)

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

- Science assumes consistent patterns in natural systems. (3-LS4-1)

NJSLS Unit Standards:

- 3-LS1-1: **Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.** *[Clarification Statement: Changes organisms go through during their life form a pattern.] [Assessment Boundary: Assessment of plant life cycles is limited to those of flowering plants. Assessment does not include details of human reproduction.]*
- 3-LS3-1: **Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.** *[Clarification Statement: Patterns are the similarities and differences in traits shared between offspring and their parents, or among siblings. Emphasis is on organisms other than humans.] [Assessment Boundary: Assessment does not include genetic mechanisms of inheritance and prediction of traits. Assessment is limited to non-human examples.]*
- 3-LS2-1: **Construct an argument that some animals form groups that help members survive.**
- 3-LS4-1: **Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.** *[Clarification Statement: Examples of data could include type, size, and distributions of fossil organisms. Examples of fossils and environments could include marine fossils found on dry land, tropical plant fossils found in Arctic areas, and fossils of extinct organisms.] [Assessment Boundary: Assessment does not include identification of specific fossils or present plants and animals. Assessment is limited to major fossil types and relative ages.]*
- 3-LS4-3: **Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.** *[Clarification Statement: Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other.]*

- 3-LS4-4: **Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.** *[Clarification Statement: Examples of environmental changes could include changes in land characteristics, water distribution, temperature, food, and other organisms.] [Assessment Boundary: Assessment is limited to a single environmental change. Assessment does not include the greenhouse effect or climate change.]*
- 3-LS3-2: **Use evidence to support the explanation that traits can be influenced by the environment.** *[Clarification Statement: Examples of the environment affecting a trait could include normally tall plants grown with insufficient water are stunted; and, a pet dog that is given too much food and little exercise may become overweight.]*
- 3-LS4-2: **Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.** *[Clarification Statement: Examples of cause and effect relationships could be plants that have larger thorns than other plants may be less likely to be eaten by predators; and, animals that have better camouflage coloration than other animals may be more likely to survive and therefore more likely to leave offspring.]*
- 3-5-ETS1-1: **Define a simple design problem reflecting a need or 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**

Interdisciplinary Connections:

ELA/Literacy:

RI.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-LS2-1),(3-LS4-1),(3-LS4-3),(3-LS4-4)
RI.3.2 Determine the main idea of a text; recount the key details and explain how they support the main idea. (3-LS4-1),(3-LS4-3),(3LS4-4)
RI.3.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. (3-LS2-1),(3-LS4-1),(3-LS4-3),(3-LS4-4)
RI.3.7 Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur). (3-LS1-1)
W.3.1 Write opinion pieces on topics or texts, supporting a point of view with reasons. (3-LS2-1),(3-LS4-1),(3-LS4-3),(3-LS4-4)
W.3.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (3-LS4-1),(3-LS4-3),(3-LS4-4)
W.3.8 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories. (3-LS4-1)
SL.3.4 Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace. (3-LS4- 3),(3-LS4-4)
SL.3.5 Create engaging audio recordings of stories or poems that demonstrate fluid reading at an understandable pace; add visual displays when appropriate to emphasize or enhance certain facts or details. (3-LS1-1)
RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (3-5-ETS-2)
RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (3-5-ETS1-2)

RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (3-5-ETS-2)
W.3.7 Conduct short research projects that build knowledge about a topic. (3-PS2-1),(3-PS2-2)
W.3.8 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories. (3-PS2-1),*(3-PS2-2)*
W.5.7 Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (3-5-ETS1-1) (3-5-ETS1-3)
W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research (3-5-ETS1-1) (3-5-ETS1-3)
SL.3.3 Ask and answer questions about information from a speaker, offering appropriate elaboration and detail. *(3-PS2-3)*

Mathematics:

MP.2 Reason abstractly and quantitatively. (3-LS4-1),(3-LS4-3),(3-LS4-4)
MP.4 Model with mathematics (3-5-ETS1-1) (3-5-ETS1-2) (3-5-ETS1-3)
MP.5 Use appropriate tools strategically. (3-LS4-1) 3.NBT Number and Operations in Base Ten (3-LS2-1)
3.NBT Number and Operations in Base Ten (3-LS1-1)
3.NF Number and Operations—Fractions (3-LS1-1)
3.MD.B.3 Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs. (3-LS4-3)
3.MD.B.4 Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters. (3-LS4-1)
3-5.OA Operations and Algebraic Thinking (3-5-ETS1-1) (3-5-ETS1-2)

Stage 2-Assessment

Assessment:

- Formative - observations, discussions, participation, science notebooks, performance-based tasks
- Summative Assessment - written responses, written explanations, science notebooks, inquiry-Based Activities, portfolios
- Benchmark Assessment - unit assessments

Stage 3- Learning Plan

Preparatory Lesson

Summary:
This lesson will introduce students to the broad concepts of engineering and technology. This is helpful to frame student's experiences in the rest of the this unit.

Students will…

1. examine everyday examples of technology.
2. discuss how these objects were designed to solve problems.
3. discuss the materials that objects are made of.

Investigation 1: **Tehya's Pollution Solution**

Summary:
Students will read the storybook, *Tehya's Pollution Solution*, which introduces them to the field of environmental engineering, the connectedness of ecosystems and food webs, and how pollution, such as an oil spill, can have a profound impact on the environment.

Students will…

1. read the story *Tehya's Pollution Solution.*
2. discuss the field of environmental engineering.
3. discuss some parts of an ecosystem.
4. examine and discuss some connections between parts of an ecosystem.
5. trace Tehya's use of the Engineering Design Process.

Investigation 2: **An Enviro-Mystery**

Summary:
Students work in environmental engineering teams to investigate possible sources of air and soil pollution in the fictional Greentown. They conduct pH tests of soil and water at different sites (tests often performed by environmental engineers) and compare their results to historical data from the same sites in order to draw conclusions about pollution sources.

Students will…

1. learn about some of the problems plaguing the plants and animals of the fictional Greentown
2. test the pH of soil and water in certain areas of the town
3. compare the current pH data from select sites with historical pH data to locate possible sources of pollution
4. view a demonstration of how water moves through soil and discuss connections between parts of the environment
5. present their findings concerning possible pollution sources to the mayor and citizens of Greentown

Investigation 3: **A Slick Idea**

Summary:
Students first examine the ecosystem in which this model oil spill takes place: a river ecosystem in the Pacific Northwest Unites States. The class acts out a kinesthetic food web to identify the predator/prey connections between different organisms in the ecosystem. Students then stretch their knowledge to think about how the organisms that live in the ecosystem are dependent on the river for some of the their basic needs. Finally, the class examines how the ecosystem might be impacted by an oil spill in the river. Students come to realize that, over time, everything in the ecosystem can be harmed by the oil.

Students will…

1. create a model to represent the connections between the different components of a river ecosystem
2. brainstorm ways that the ecosystem might be affected by an oil spill and use the model they create to study how the ecosystem might be impacted

3. use a controlled experiment to examine different materials and methods used to clean oil spills and discuss the advantages and disadvantages of each

Investigation 4: **Cleaning an Oil Spill**

Summary:

Students undertake their design challenge in this lesson. They design a process to clean an oil spill in a model river so that the oil has the least impact on the surrounding ecosystem. Using what they have learned in the previous lessons and the storybook, team select which materials they will use in their process and in what order they will use them. They also face budgetary constraints. Groups them implement, test, and analyze their designs to see how much oil remains in the river and how that remaining oil might impact the river ecosystem.

Students will…

1. use the Engineering Design Process to design, implement, evaluate and improve a process for cleaning the oil spill so that the oil has the least impact on the surrounding ecosystem
2. "Ask" questions about the problem, "Imagine" possible processes for cleaning the oil spill, "Plan," "Create" and test one oil spill cleaning process, and "Improve" their designs based on testing results

Integrated accommodations and modifications for students with IEP's 504s, ELLs, and gifted and talented students:

- Principle 1. Provide multiple means of representation. Give learners various ways to acquire information and knowledge.
- Principle 2. Provide multiple means of action and expression. Offer students alternatives for demonstrating what they know.
- Principle 3. Provide multiple means of engagement. Help learners get interested, be challenged, and stay motivated.
- Use of small group centers, partner work and 1-1
- Questioning strategies using higher order thinking to promote critical analysis

List of Core Instructional and Supplemental Materials:

STEM Project: A Slick Solution: Cleaning an Oil Spill
Discovery United Streaming
Brainpop
Ultimate Fossil Kit
Book: Fossils Tell of Long Ago by Aliki

Integration of 21st Century Skills and Life and Career Standard

CRP1, 2, 4, 6, 8, 11

Integration of the Technology Standard

NJSLS.8.1

Science Gr. 3 Pacing Guide

Unit Topic	NJSLS	Marking Period	Duration (Weeks)
1	3-PS2-1 3-PS2-2 3-PS2-3 3-PS2-4 3-5 ETS1-1 3-5 ETS1-2 3-5 ETS1-3	1-2	10-13
2	3-ESS2-1 3-ESS2-2 3-ESS3-1 3-5 ETS1-1 3-5 ETS1-2 3-5 ETS1-3	2-3	11-13
3	3-LS1-1 3-LS2-1 3-LS3-1 3-LS3-2 3-LS4-1 3-LS4-2 3-LS4-3 3-5-ETS1-1	3-4	12-13