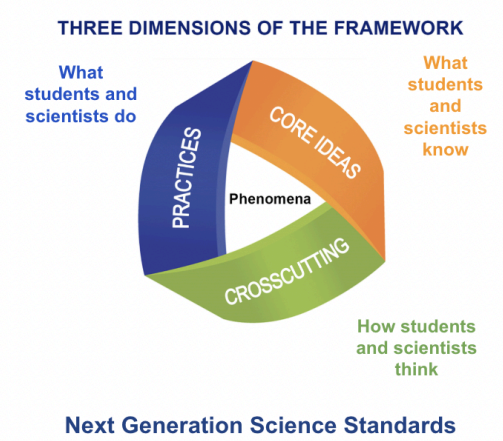
Suggested GEMS-Net Implementation Guide
Grade 3

NOTE: The following Implementation Guide is an **updated version of the recommendations provided in the Grade 3 Streamline Implementation Guide document. The goal of these two resources is to provide guidance with pacing and to identify the most critical concepts from each course. Therefore, the lessons from the FOSS Investigations that are essential to developing these critical concepts have been included in this Implementation Guide. The lessons are structured in a framework that follows a Navigate, Investigate, Sense-Make (NIS) instructional routine. These pedagogical practices move towards a more student centered approach to learning. More information about the NIS routine can be found in the document below or by viewing the following NIS Support Video. **Also, make sure you are logged into your ThinkLink account to directly access the course resources using the hyperlinks in the "Key Resources" section.***

General Resources: NIS Planning Template, Sense-Making Sentence Frames, Questioning - Crosscutting Concept

Key (NGSS Standards)		
Disciplinary Core Ideas **DCI Matrix**	**Scientific & Engineering Practices** **Practices Appendix**	**Crosscutting Concepts** **CCC Matrix**



Navigate, Investigate, Sense-Make Instructional Routine

Launch: Set your context/connect with your community
What do you notice?
What do you wonder?

Navigate: Set your purpose.
What have we figured out so far?
What do we need to know next?
What do we need to do to figure it out?

Investigate: Do the work.
Collect the data.
Engage with the text.

Sense-make: Make sense of what we've done.
What patterns have we identified?
How does this system work?
How can we explain our ideas?
What have we figured out now?
What do we need to figure out next?

Water and Climate

Launch

Week 1: Launch Activity (Self Documentation Strategy)

- Let the students know that they'll be studying water in their next science unit.
- As a class, go outdoors and develop a map of your schoolyard/community (consider planning for an observation of the schoolyard after rain).
- Encourage students to draw pictures or take photos/videos of the water in their schoolyard/community. Have students share these examples on the schoolyard map or a class.
- As a class, look for patterns in the images and sort pictures that are similar into categories. (e.g. evidence of water, bodies of water)
- Encourage students to add "I notice…" and "I wonder…?" statements to the schoolyard map or a class.
- Try to find a puddle in the schoolyard that students can focus on.
- Possible Discussion Questions:
    - What do you notice about water in our schoolyard/community?
    - What are you wondering about?
    - What do you think water does in our schoolyard/community?
    - How do you think water interacts with our schoolyard/community?
    - How might water affect our schoolyard/community?
    - Why is there water in some parts of our schoolyard but not others?
    - What do you think will happen to this puddle?
    - Why do you think so?
    - What could we do to figure out…?

Investigation 1- Water Observations

Focal NGSS Connections

Plan and carry out investigations to determine how water interacts with different materials.

Pacing/Lesson	Focus Question	Investigate: What do we need to do?	Sense-make: What did we figure out?	Key Resources
Week 2 W&C Inv. 1.1 & 1.4 Combined (**Streamlining Opportunity**)	What happens when water falls on different surfaces?	-**Investigate** what **happens** when water falls on different surfaces in the schoolyard (e.g. living and non-living plant parts, soil, pavement) -**Analyze data** to determine **patterns**. -We can **construct explanations** using **evidence** from their data to explain how water behaves on different surfaces.	-We notice that water **beads-up** or forms domes on waterproof surfaces and water soaks into or **absorbs** into some materials that are not waterproof.	5 Senses Check Frames (3-5) -Survey/posttest -Map of schoolyard -Letter to Families
Navigate: What do we need to know next? We figured out that water behaves differently on different flat surfaces (absorbs on waterproof surfaces, beads-up on water proof/resistant surfaces). We wonder what happens when we drop water on a surface that is not flat. Our next step is to observe water on different slopes.				
Week 3 W&C Inv. 1.2	Focus Question How does water move on a slope?	Investigate -We can **plan and carry out an investigation** to **observe** how water moves on a slope. -We should **analyze data** for **patterns** of motion. -We can use **evidence** from our data to support our **claims**. -**Strategic Research opportunity: ** We can obtain, evaluate, and communicate the relationship between **gravity** and water flow using *Which Way Does it Go?* In the FOSS student resource book (SRB).	Sense-Make -We identified a **cause and effect** relationship between the **size** of water drops and **speed** of **flow** and/or the **steepness** of the **slope** and **speed** of **flow.**	-FOSS Student resource book Which Way Does it Go? -Tutorial: Water on a Slope - Constructed Response Task 1 - Investigation 1 I-Check

		- **Constructed Response Opportunity**: We can apply what we have learned to an engineering/design task using evidence from our data and research to define and solve a problem.		

Streamlining Opportunity
Inv 1.3 (**Optional**) - Excellent lesson where students can engage in the practice of planning and carrying out investigations, but not essential for developing critical concepts. Complete if time allows.

Navigate: What do we need to know next? We figured out that gravity pulls water down slopes, the steeper the slope the faster the flow, and the larger the drops the faster the flow. We wonder what caused the water in the puddle to "disappear?" Our next step is to investigate how heat affects water.
Note: You may consider revisiting the puddle observed in the launch activity after it evaporates to help navigate to investigations 2.
Ask students to discuss what happened to the water?
What caused the water to disappear? (If possible point out the Sun in the sky)
What do you notice about the Sun (feel heat)
Where do you think the water goes?

Investigation 2 - Hot water, Cold water

Focal NGSS Connections

Students plan and carry out investigations to determine the effects of heating and cooling water.

Pacing/Lesson	Focus Question	Investigate: What do we need to do?	Sense-make: What did we figure out?	Key Resources
Streamlining Opportunity Inv 2.1 (**Optional**) - Background knowledge lesson in standards of measure using a thermometer to measure temperature, but not critical for concept development.				
Week 4 W&C Inv. 2.2	What happens to water when it gets hot or cold?	- We can **plan and carry out an investigation** to **observe** how water reacts to heat and cold. - **Strategic Research Opportunity:** Students ask questions based on their observations. Students may ask "Why does water expand when it is heated and contract when it cools?"	-We observed the **cause and effect** relationship when **water** is **heated** and **cooled**. When water is heated (cause), it **expands** to take up more space (effect). When water is cooled (cause), it **contracts** to take up less space (effect).	-FOSS Student Resource Book "Water: Hot and Cold"

		-Students can **obtain, evaluate, and communicate information** by reading "Water: Hot and Cold" (First page only) to investigate these questions.		
Navigate: What do we need to know next? We figured out that water expands when heated and contracts when cooled. We wonder what might happen if hot and cold water mix. Our next step is to investigate hot and cold water mixing together.				
Week 5 W&C Inv. 2.3	Focus Question What happens when hot or cold water is put into room temperature water?	Investigate - (**Teaching Note**) Introduce density: Objects that are less dense than water float, objects that are less dense than water sink. - We can **plan and carry out an investigation** to **observe** how temperature **affects** the density of water.	Sense-Make - We observed that **hot water** is **less dense** than room temperature water because it **floats**. **Cold water** is **more dense** than room temperature water because it **sinks**. - We can **create a model** of these **systems** to explain **why** this happens.	-Tutorial: Density of Hot and Cold water - Virtual Investigation: Hot and Cold Water Density
Navigate: What do we need to know next? We figured out that hot water is less dense than room temperature water (particles have more energy, more space between them, water expands volume) and cold water is more dense than room temperature water because it sinks (particles have less energy, less space between them, water contracts volume). We wonder why ice floats? (Problematizing) Our next step is to observe water when it gets really cold (freezes).				
Week 6 W&C Inv. 2.4	Focus Question How does water change when it gets really cold?	Investigate - We can **plan and carry out an investigation** to **observe** what **happens** when water gets really cold using the materials provided. - (**Teaching Note**) Suggest using units of measure with the 50mL syringes to collect **quantitative data**. - We can engage in an **argument using evidence** using our collected data. -**Strategic Research Opportunity:** We can **obtain, evaluate, and communicate information** from researching how water changes when it gets really cold and the effect it has on our daily life through research in "Ice is Everywhere"; *Why Pipes Burst* section only. Students can **create a model** using the information from their data and the text to explain.	Sense-Make - We observed that **water expands** when it gets really cold (**freezes**).	-"Ice is Everywhere"; Why Pipes Burst section only. -Tutorial: Expansion and Contraction of water -Response Sheet Investigation 2 -Math Extension- Problem of the week - Investigation 2 I-Check

Streamlining Opportunity
Inv 2.5 (**Optional**) - Great connection to living things and environment, but not conceptually critical.

Navigate: What do we need to know next? We figured out that water expands (increases volume) when it gets really cold. We wonder what causes the water in the puddle to disappear. Our next step is to investigate water over time.
Note: You may consider revisiting the schoolyard map from the launch activity and allow students to make revisions based on what they have learned.
What have we learned about how heat affects the water?
What are we still wondering about? (Have students discuss parts of the system still unknown, focus on the evaporation, this will lead you into investigation 3)

Investigation 3 - Weather and Water

Focal NGSS Connections

Plan and carry out investigations to determine how water moves through Earth's systems.

Pacing/Lesson	Focus Question	Investigate: What do we need to do?	Sense-make: What did we figure out?	Key Resources
Streamlining Opportunity Inv 3.1 (**Optional**) - Will address weather in Inv. 4.1.				
Week 7 W&C Inv. 3.2	What happens to wet paper towels overnight? (or student generated question related to evaporation)	- **Plan and carry out an investigation** to **observe** what **happens** to water overnight (**Note**: consider how we may collect **quantitative data** using measurements, mass?)	-We explored the **cause and effect** relationship between **energy** and **water**. We noticed if a wet paper towel is exposed to open air (cause), then it will **dry** out (effect). -Introduce the concept of **evaporation** and have students **create a model** to show the process. -Introduce **water particles** and prompt students to think about how water particles may be moving in the **system**. -Students may include water particles moving from the wet paper towel into the air in their **model**.	-FOSS Student Resource Book "Drying up"

Navigate: What do we need to know next? We figured out when water is exposed to air it evaporates (changes from a liquid to a gas; water vapor). We wonder what could cause water to evaporate faster/slower. Our next step is to investigate the effects of other variables on the rate of evaporation (e.g. surface area, heat).				
Week 8 W&C Inv. 3.3	Focus Question How does surface area affect evaporation?	Investigate - We can **plan and carry out an investigation** to determine how surface area **affects** evaporation using the materials provided (**Note:** This will take time, suggested set up on Monday and review Friday) - Suggest keeping all variables the same except for surface area, same amount of water, same location, and measure accurately. **Record quantitative data** (Starting and ending volume). - **Record and analyze data** to determine the amount of water that evaporated from each container. - We can engage in **arguments from evidence** to defend their procedures and conclusions.	Sense-Make - We can draw conclusions about how **surface area** affects evaporation through **cause and effect** relationships. - We noticed the **larger** the **surface area** the **greater** the amount of **evaporation**.	-Evaporation Place Mat - Notebook Sheet #14-Surface Area Table - Math Connection-Estimating Surface Area -FOSS Student Resource Book "Surface Area-Experiment"
Navigate: What do we need to know next? We figured out that the larger the surface area the faster water evaporates (more water exposed to the air). We wonder what else affects the rate of water evaporation. Our next step is to investigate other variables that may affect the rate of evaporation (e.g. temperature).				
Week 9 W&C Inv. 3.4	Focus Question What else affects how fast water evaporates? (or student generated question about temperature and evaporation)	Investigate - **Plan and carry out an investigation** using the materials provided to determine how temperature **affects** evaporation. (**Note:** This investigation will take several days. Suggested set up on Monday and review results Friday with daily checkers of temperature at each location) -Suggest keeping all variables the same except for location (different locations with different temperatures, same amount of water, and measure accurately).	Sense-Make - We noticed a cause and effect relationship based on the pattern. The higher the **temperature** the faster water evaporates.	

		-**Record quantitative data** (Starting and ending volume, daily temperature at each location). - **Analyze the data** and may **observe patterns**.		
Navigate: What do we need to know next? We figured out that higher temperatures cause water to evaporate faster (more energy, faster evaporation). We wonder what causes water to form on some surfaces (e.g. condensation) Our next step is to investigate water forming on surfaces.				
Week 10 W&C Inv. 3.5	Focus Question What causes moisture to form on the side of a cup? (or student generated question related to condensation)	Investigate - Introduce the concept of condensation, water vapor in the air condenses (changes from gas to liquid) forming drops of liquid water on the outside of the cup. - We can **create models** of the **system**, suggesting students think about tiny particles of water vapor contacting the cup and clumping together into liquid drops of water. - Use condensation chambers to **create** an initial **model** of the **Water Cycle**. -**Observe results** and **analyze** the **cause and effect** relationship. - **Constructed Response Opportunity**: We can use several resources, data from our investigations, "Condensation" article (Water and Climate SRB), The Water Cycle - Video (Chapter 3 only), or The Water Cycle article (Water & Climate SRB) to respond to the prompt. (**Note**: Relate this back to the puddle of water in the schoolyard. Consider having students revise their model of this system using this new information)	Sense-Make - **Water vapor** contacts a **cold surface** and **condenses** (Changes from **gas to liquid**) forming liquid water drops on the surface. - Our **model** shows **water evaporating** from the small pool of water at the bottom of the condensation chamber in the heat of the Sun, then **condensed** on the cool surface of the cup above.	-FOSS Student Resource Book (SRB) "Condensation"/"The Water Cycle" articles -The Water Cycle Video (Chapters 2-3) -Constructed Response Task 2 - Investigation 3 I-Check (Omit items 2-3 related to weather data)
Navigate: What do we need to know next? We figured out that heat causes water to evaporate (change from liquid to gas/water vapor) and cold causes water to condense (change from gas/water vapor to liquid) and gravity causes water to fall back down to Earth's surface collecting in streams, rivers, lakes, and the Ocean. We wonder how the water cycle relates to the weather in our area. Our next step is to investigate/research weather in our location. **Note: This may be a good time to revisit the class schoolyard map and see if students can now answer some of their initial questions or add new notices/wonderings!*				

Investigation 4 - Seasons and Climate

Focal NGSS Performance Expectations

Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. (3-ESS2-1)

Obtain and combine information to describe climates in different regions of the world. (3-ESS2-2)

Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard. (3-ESS3-1)

Pacing/Lesson	Focus Question	Investigate: What do we need to do?	Sense-make: What did we figure out?	Key Resources
Week 11 W&C Inv. 4.1	What are the typical weather conditions in our area? (Or students generated questions related to weather)	- **Obtain and evaluate information** on typical weather conditions in our region using **data** from weather websites (e.g. weather underground). -Use **mathematics and computational thinking** to **create graphs** of their weather data. **Analyze the data** in graphs. - **Communicate information** on typical weather conditions during 1 month out of the year to our peers.	- We noticed **weather patterns** such as more rain in the spring, coldest temperatures in the winter, and warmest temperatures in the summer months. -We can define **weather** as the condition of the **air** in an area which is always **changing**.	-FOSS SRB "Studying Weather" article - Weather Graph
Navigate: What do we need to know next? We figured out there are different patterns of weather at different times of the year in our location. We wonder what the weather is like in other locations at different times of the year. Our next step is to research weather in different climates.				
Week 12 W&C Inv. 4.2	Focus Question How do we describe different climates? (or student generated question about climate)	Investigate - **Strategic Research Opportunity**- View the video All About Climate and Seasons, read Climate Regions in FOSS SRB, and/or use data from the Climate Maps online resource. - **Obtain, evaluate, and communicate information** from our research. - Provide different examples of different kinds of climate.	Sense-Make - Scientists use **average temperature** and **precipitation** to describe **climate** regions. - We noticed **patterns** in the **climate data** (e.g. the climate is warmer closer to the equator and colder father from the equator)	-Teacher Master #11- World Map - All About Climate and Seasons video -FOSS SRB Climate Regions article -Climate Maps online Resource

Navigate: What do we need to know next? We figured out that climate is the typical weather conditions in a region and can be determined using average temperature and precipitation in a location. We wonder how people deal with extreme weather in different climates (e.g. tropical locations like South East Asia have a flooding season). Our next step is to research extreme weather in different climates.				
Week 12 (continued) W&C Inv. 4.3	Focus Question How do people deal with natural hazards such as floods? (Or student generated question about floods)	Investigate - **Strategic Research Opportunity**- View Floods video and Wetlands for Flood Control article in the FOSS SRB. - **Obtain, evaluate, and communicate information** about dealing with floods from our research. - **Writing Response Opportunity**- Students can write a response using evidence from multiple sources.	Sense-Make - Provide examples of **flood** control using changes in **building designs** to **minimize damage** from floods or to make clean up easier. - Describe how **wetlands** or **floodplains** can be used as **protection** from floods as long as the land is protected and not used for buildings or roads.	-Come a Tide video -Floods video -FOSS SRB Wetlands for Flood control video - Investigation 4 I-Check
Navigate: What do we need to know next? We figured out people can deal with natural hazards such as flood using scientific knowledge of how water interacts with surfaces and on slopes. We wonder how water interacts with soil in our schoolyard. Our next step is to investigate how water interacts with the soil schoolyard. **Note: This may be a good time to revisit the class schoolyard map and see if students can now answer some of their initial questions or add new notices/wonderings!*				

Investigation 5 - Water Works

Focal NGSS Connections

Plan and carry out investigations to determine how water interacts with earth materials?

Pacing/Lesson	Focus Question	Investigate: What do we need to do?	Sense-make: What did we figure out?	Key Resources
Week 13 W&C **Start with Inv. 5.2**	Do soils in our schoolyard drain water at the same rate? (Or student generated question)	- Discuss observations, ask questions, plan and carry out investigations to answer their questions. - Analyze data and make a claim about how water drains differently or the same in different soils in the schoolyard. - Support claims with data from their investigation.	- We noticed different **properties** of the **soils** and ask how that might contribute to how fast water drains (**Navigation:**This could lead back to Inv. 5.1)	

Week 13 (continued) W&C Inv 5.1				
	Focus Question What happens when water is mixed with other Earth materials? (or student generated questions from Inv. 5.2)	Investigate - **Plan and carry out an investigation** using the materials provided to test how water drains through these Earth materials. - Write a step-by-step procedure starting with equal amounts (masses) of Earth materials to be **tested**. (Note: students can use sand from outdoors as well.) - Add equal amounts of water to each sample. - **Measure** the amount of water drained and collected from each sample. - **Strategic Research Opportunity**- Read Natural Resources in SRB (First 3 pages only) to learn more about the ingredients of soil and how they affect water retention.	Sense-Make - We **analyzed and interpreted the data** to find a **pattern/cause and effect** relationship between the **Earth material** properties and amount of water drainage. (e.g. water **drains** through rocks/pebbles and absorbs in **humus**)	- FOSS SRB Natural Resources (first 3 pages only) - Survey/Posttest (Omit items related to optional lessons)
Streamlining Opportunity Inv 5.3 (**Optional**) - Excellent engineering/design activity but not critical for concept development.				

Motion and Matter

Launch

Week 14: Launch Activity (Self Documentation Strategy)

- Take your students outdoors! Use guiding questions: **What *do we notice and wonder about motion in our schoolyard?***
- Have them observe and discuss the motion outdoors.
- If possible, explore playground equipment (swings, see-saw, slides)
- If possible, consider using balls (soccer, kickball, basketball etc.) Observe motion down hills, no motion at top of hill etc.
- Create a schoolyard map with questions or driving questions board that can be utilized throughout the unit.
- Revisit the schoolyard at a later date to discuss and record new parts of the system students notice.

Investigation 1- Forces

Focal NGSS Performance Expectations

Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. (3-PS2-1)

Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other. (3-PS2-3)

Pacing/Lesson	Focus Question	Investigate: What do we need to do?	Sense-make: What did we figure out?	Key Resources
Week 15 M&M	What causes change of motion?	-**Strategic Research Opportunity**- **obtain, evaluate, and communicate information** from All about Motion and Balance video,Chapter 2. Then students	- Discuss how all **forces** are acting on an object equally, the forces are **balanced** and there is **no motion**. - Discuss when forces are unequal,	- Survey/Posttest - Family Letter - All About Balance and Motion video (Chapter 2)

Inv. 1.3 (*NOTE: Consider starting with this lesson as it relates to the outdoor launch activity.)		read *Change of Motion* in SRB. - **Constructed Response Opportunity**- Students draw on what they learned from investigations and research to respond.	forces are not balanced (**unbalanced**) then an object will **move**. - Discuss how when more force is applied to an object in one direction the object moves in the direction of that greater force. - Introduce **gravity** as a force that **pushes** down on all objects.	- *Change of Motion* in SRB - Constructed Response Task 3
Navigate: What do we need to know next? We figured out that objects move when unequal forces are applied to them. When objects are not in motion all forces acting on the object are equal/balanced. Gravity is a force pushing down on all objects. We wonder what causes objects to move when they are not in contact? Our next step is to investigate motion of objects that are not in contact.				
Week 16 M&M Inv. 1.1	Focus Question What happens when magnets interact with other magnets and with paper clips?	Investigate - Make **observations, collect data, and ask questions** based on the magnet activities. - **Create a model** of the floating paper clip. - **Compare models, discuss patterns**, "What do we all agree on? What are some differences?" - **Strategic Research Opportunity**- Create models of systems through research on *Magnetism and Gravity* in SRB to explain magnetic force.	Sense-Make - Students may include **multiple forces interacting** in their **model** such as the force of the **magnet pulling** on the paper clip, the force of the **string pulling** in the opposite direction of the magnet, and the force of **gravity pulling** down.	Notebook Sheet No. 1: Magnetic-Force Checklist - Teacher Masters 2-6: Magnetic-Force Activities - Magnetic Poles Online Activity - *Magnetism and Gravity* in SRB
Navigate: What do we need to know next? We figured out that magnets can **push** and **pull** each other and magnetic objects like paper clips without making contact because they are surrounded by an invisible **magnetic field**. We wonder how far the magnetic field extends from the magnet? What affects the strength of the magnetic field (e.g. does the size of the magnet affect the strength of the magnetic field)? Our next step is to measure the strength of the magnetic field when changing the size of the magnet?				
Week 17 M&M Inv. 1.2	Focus Question How is the magnetic field affected when more magnets are added? (Or student generated question about magnetic field)	Investigate - **Plan and carry out an investigation** to determine how the magnetic field is **affected** by adding magnets together. - **Notice patterns** in their **data**. - **Analyze and interpret data** to come up with a **claim** supported with **evidence**.	Sense-Make -Students may notice that the **size/strength** of the **magnetic field increases** as more **magnets** are **added**.	- Teacher Master 7: Recording Data: Magnetic Force Investigation - Investigation 1 I-Check

Navigate: What do we need to know next? We figured out that the size/strength of the magnetic field increases as more magnets are added. We wonder what else affects the strength of the magnetic field? Does the magnetic field go on forever but just get weaker as it extends out?
Note: If time allows you can provide opportunities for students to investigate other variables of magnetism.

**Note: This may be a good time to revisit the class schoolyard map and see if students can now answer some of their initial questions or add new notices/wonderings!*

Investigation 2 - Patterns of Motion

Focal NGSS Performance Expectations

Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion. (3-PS2-2)

Launch: Consider revisiting the schoolyard to observe motion and discuss patterns students notice.
- What kinds of motion do you notice in our schoolyard?
- What would happen if..? (you push the swings)
- What patterns of motion do you notice?

Navigate:
- What more can we learn about patterns of motion using a wheel-and-axle system?

Pacing/Lesson	Focus Question	Investigate: What do we need to do?	Sense-make: What did we figure out?	Key Resources
Week 18 M&M Inv. 2.1	What patterns of motion do you notice in a wheel-and-axle system? How can we change the motion of wheel-and-axle systems rolling down ramps?	-**Draw models** of **wheel**-and-**axle systems** explored. - Describe **patterns** of motion in the **systems** and connect to structures of the system with the **motions observed**. - Share several different systems and discuss the **structures and functions** in connection to the motion. - Students **ask questions** based on their **observations** to explore in future investigations and research.	Possible patterns described… - **If** a wheel and axle system has a large wheel on one side and a small wheel on the other side of the axle, **then** it will turn. - **When** a wheel and axle system has two same size wheels, it rolls straight.	

Navigate: What do we need to know next? We figured out that different configurations of wheels produce predictable patterns of motion (e.g. A wheel and axle system with a large wheel on one side and a small wheel on the other side of the axle will turn). We wonder why this information is important and helpful? How

does this apply to real world examples (e.g. cars, wagons, carts etc.) What would happen if… Our next step is to use our knowledge of predicting patterns of motion to complete a task.				
Week 19 M&M Inv. 2.2	Focus Question What rules help predict where a rolling cup will end up? (Or student generated question)	Investigate -Use **observations of patterns** of motion from the wheel-and-axle systems from part 1 to **predict the motion** of the rolling cups. - **Strategic Research Opportunity**- **obtain, evaluate, and communicate information** in researching *Patterns of Motion* in SRB to provide reasoning for patterns of motion observed. - **Constructed Response Opportunity**- use **evidence** from part 1 and 2 to support **claims** and provide **reasoning** when responding.	Sense-Make -Students may notice that they can **predict** which way a wheel-and-axle **system** will roll depending on the **size** and **orientation** of the **wheels** on the **axle**.	- *Patterns of Motion* in SRB - Constructed Response Task 4 - Grade 3 Dr. Stegagno Lab Video - Grade 3 Dr. Stegagno Robotics Transfer Task (Student) - Grade 3 Dr. Stegagno Robotics Transfer Task (Teacher)
Navigate: What do we need to know next? We figured out that we can predict the motion of systems based on past patterns of motion. We wonder what other systems of motion we can investigate? How can we apply this knowledge to another system? How do engineers use scientific knowledge of motion to design systems? (Dr. Stegagno Lab Video & Transfer Task Activities) Our next step is to investigate other systems of motion.				
Week 20 M&M Inv. 2.3	Focus Question What happens to the motion of a twirly bird when the design changes?	Investigate - **Plan and carry out investigations** and choose **variables** to **test**. - Make **observation**s of the standard twirly bird design and ask **testable questions**. - Choose **one variable** at a time to **change** and **test**, compared to the standard twirly bird design.	Sense-Make - Communicate findings and describe the **forces** at work while the **twirly bird** is in **motion**. - Describe **cause-and-effect** relationships observed. For example, if the **wings** are cut **short** (cause), then the twirly birds spin and descend **faster** (effect).	- Notebook Sheet No. 8: Twirly Bird Investigation - Teacher Master 10: Twirly Bird Templates
Navigate: What do we need to know next? We figured out changing different variables in a system will affect the motion of that system. We wonder what other systems of motion we can explore and/or what other variables may affect this twirly bird system? Are there other systems of motion we can explore? Our next step is to explore other systems of motion to investigate the effects of other variables?				
Week 21 M&M Inv. 2.4	Focus Question What is the best design for a top?	Investigate - Engage in the **engineering/design process**. - **Observe patterns** of motion in **rotation** of the **top** on its **axis**. - **Create designs, test, and redesign** tops until they have the best design.	Sense-Make - **Communicate** findings from **investigations** and **research**. - Students may explain that the **best design** for a spinning **top** is to have a fairly heavy **mass** near the **bottom** of the **shaft** and a way of getting the	- *What Goes Around* in SRB - Teacher Master 11: Spinning Designs - Motion Review Image Gallery - Investigation 2 I-Check

		- **Strategic Research Opportunity**- obtain, evaluate, and communicate information from research in *What Goes Around* in SRB.	**system** to **rotate** really **fast**.	

Streamlining Opportunity:
Consider using Inv. 2.3–2.4 as open exploration stations in your classroom that students can go to when time allows and share results with classmates.

Navigate: What do we need to know next? We figured out that the best design for a spinning top system is to include a heavy mass near the bottom and a way of getting the top to rotate very fast. We wonder what other systems of motion we can design using this science knowledge? and/or what other variables may affect the spinning top? Our next step is to design another system of motion using spinning, wheels, and rotational force.
**Note: This may be a good time to revisit the class schoolyard map and see if students can now answer some of their initial questions or add new notices/wonderings!*
Note: Consider launching Investigation 3 using the 2023 Williamsport Soap Box Derby race. Have students share what they notice and wonder about the Soap Box carts.

Investigation 3 - Engineering

Focal NGSS Performance Expectations

Define a simple design problem that can be solved by applying scientific ideas about magnets. (3-PS2-4)

Pacing/Lesson	Focus Question	Investigate: What do we need to do?	Sense-make: What did we figure out?	Key Resources
Week 22 M&M Inv. 3.1	What are some important features of a cart that will roll from here to there?	-Students **create models** of their **cart designs** and discuss **problems and solution** ideas. - Introduce **wheel bearing** design when students come across this problem in their designs. - Students **illustrate the solution** to the wheel bearing problem in their **models.** - **Strategic Research Opportunity**- Students **obtain, evaluate, and communicate information** about the engineering process through research in *What Engineers Do* in SRB.	- When engaging in the **design process** it helps to create a model first, create a design based on the model, test, determine problems and consider solutions to the design. - Students may share **solutions** to the **bearing** issue.	- Notebook Sheet No. 9: Elements of the Engineering Design Process - Notebook Sheet No. 10: Engineering Practices A - Notebook Sheet No. 11: Engineering Practices B

Navigate: What do we need to know next? We figured out that the design process includes brainstorming, creating a model, design, test, finding problems and determining solutions to improve our design. We wonder if we can get our carts to roll further/faster? Our next step is to improve on our cart designs to get our carts to roll further/faster.				
Week 23 M&M Inv. 3.2	Focus Question How can you improve the design of your cart?	Investigate - Continue the e**ngineering design process** started in part 1 to **improve the design** of their cart to travel 50cm farther. - **Create models** of new cart designs. - **Identify one problem and solution** to improve design. - Include **data** on **how far** the cart traveled (cm) **before** and **after** the new design. - **Strategic Research Opportunity**- **obtain, evaluate, and communicate information** on how scientists and engineers work together in *Soap Box Derby* in SRB.	Sense-Make - Students may share **problems** such as **friction**, **weight/mass**, **stability** of **axle**, **wheel bearing system** etc. - **Solutions** may include using **bearings** to cut down on friction, discs/clips/straws used as bearings, **adding weight**, using discs to **stabilize** axle movement etc.	- *Soap Box Derby* in SRB - Tutorial: Measuring Logic - Tutorial: Measuring Length
Navigate: What do we need to know next? We figured out we can improve our designs by identifying problems, implementing solutions, re-testing, and continuing this process until our goals/criteria are achieved. We wonder if there are other factors/variables that may affect the speed of our carts? (Notes: bring students attention to the Soap Box Derby video and focus on inclines/hills/slope/gravity) Our next step is to investigate other variables affecting the speed of our carts.				
Week 24 M&M Inv. 3.3	Focus Question How does the start position on a ramp affect how far a cart rolls? (Or student created question)	Investigate - Write an **investigable question** related to the **start position** of carts on ramps and distance traveled (can use sentence frame *"How does _____ affect _____?*) - **Control variables** making sure the ramp remains in one position, consistently starting and measuring final positions, and conducting multiple trials (at least 3). - **Organize and analyze data** looking for **patterns**. - **Writing Response Opportunity**- explain the **cause-and-effect** relationship from the data. - **Strategic Research Opportunity**-	Sense-Make - The **higher** the **start position** of the cart, the **farther** it travels.	- *How Scientists and Engineers Work Together* in SRB - Teacher Master 15: Start Position - Investigation 3 I-Check

		obtain, evaluate, and communicate information on how scientists and engineers work together through research in *How Scientists and Engineers work Together* in SRB.		

Navigate: What do we need to know next? We figured out that the start position affects the speed of our carts. For example, the higher the start position, the further the cart will travel. My evidence is… We wonder what other variables might affect the motion of the cart?
**Note: This may be a good time to revisit the class schoolyard map and see if students can now answer some of their initial questions or add new notices/wonderings!*

M&M Investigation 3.4 (**Optional**)- Extension engineering design challenge that relates to what students learned about magnetism if you have time.

M&M Investigations 4.1-4.3 (**Optional**)- great for students to begin to learn about matter and interactions but is a 5th grade standard.

Structures of Life

Launch

Week 25: Launch Activity (Self Documentation Strategy)

- Let the students know that they'll be studying plants and animals in their next science unit.
- As a class, go outdoors and develop a map of your schoolyard/community.
- Encourage students to draw pictures or take photos/videos of the plants and animals (insects may be the only animals they can find) in their schoolyard/community. Have students share these examples on the schoolyard map or a class Padlet.
- As a class, look for patterns in the images and sort pictures that are similar into categories. (Animals, Plants, Schoolyard and Community Habitats)
- Encourage students to add "I notice…" and "I wonder…?" statements to the schoolyard map or a class Padlet.
- Possible Discussion Questions:
  - What do you notice about the plants and animals in our schoolyard/community?
  - What are you wondering about?
  - What parts of the plants and animals do you notice?
  - What do you think those parts are for?
  - How do you think the plants and animals interact in our schoolyard/community habitats?
  - How might plants and animals grow and survive?
  - Where/what do plants come from? (**Note:** focusing on "seeds" will help navigate students to investigation 1)

***NOTE: These next investigations require making observations over a period of time. You will help students set up a variety of habitats in the classroom. Some Life Science observation periods will overlap or be switched based on the growth of your living things. Be**

flexible. Plan for classroom space and helpers, as well as organization of how this will be documented, for example folders of work vs. notebooks with sections having tabs.

Investigation 1- Origin of Seeds

Focal NGSS Connections

Construct an argument that plants have internal and external structures that function to support survival, growth, behavior, and reproduction.

Pacing/Lesson	Focus Question	Investigate: What do we need to do?	Sense-make: What did we figure out?	Key Resources
Week 26 Inv. 1.1	How are seeds alike and different? (Or What do you notice and wonder about fruits/seeds?)	-**Observe** and **compare** seeds of different fruits. -Name the fruits and **record** the number of seeds in each. -**Draw** and **describe characteristics** of each fruit seed. -Recognize **patterns** in fruit seeds **comparing similarities and differences**. -**Strategic Research Opportunity**: **obtain, evaluate, and communicate information** on the **structures and functions** of seeds and fruits in The Reason for Fruits SRB.	- Different **fruits** have a different number of **seeds** (1-many). - Some **seeds** are **similar** in size, **shape**, **color**, **texture**. - Some seeds are hard, soft, tiny, large, brown, tan, oval, circular shaped. - A **fruit** is the **structure** of a **plant** that contains the **seeds**. - Fruits **protect** seeds and **attract animals** to **carry seeds away** from parent plants. - A seed is the **dormant** stage of a **plant's life cycle**. - Seeds grow up to be new plants. -Seeds are the **structures** of plants that allow them to **reproduce**.	- Survey/Posttest - Letter to Families - The Reason for Fruits SRB
Inv. 1.2	What effect does water have on seeds?	- **Note:** Set up seeds in mini-sprouters and class sprouters. Students will observe for 10-15 minutes daily for 6 days. - Students **plan and carry out an investigation** to determine the **effect** of water on seeds.	**Note:** Sense-making will come at end of week long observation	- Teacher Master No. 2: Mini-Sprouter placemats

Navigate: What do we need to know next? We figured out that different fruits have different numbers of seeds. Some fruit seeds have similar characteristics and some different characteristics. Fruit structure of the plant protects and contains the seeds, seeds are dormant part of plant life cycle, seeds grow to be new plants… We wonder what happens when seeds get wet? What causes seeds to start growing/"Wake up" out of dormant state? Our next step is to continue to observe seeds in water.
- **Note:** Once students notice seeds in sprouters swell up/get larger go into Inv. 1.3.

Week 27 SOL Inv. 1.3/1.2	Focus Question How much water does a seed soak up? (or student generated question)	Investigate -**Plan and carry out an investigation** to determine how much water a seed can soak up using balances appropriately. - **Organize and analyze data** focusing on **cause-and-effect**. - Writing/Communication Opportunity: provide **evidence** from data to support **claims**.	Sense-Make - If you **soak** lima beans in water (cause), then they **soak up water** and **weigh more** (effect). -Introduce **structures** of seed (**seed coat**, **cotyledon**, **embryo**) and students begin to identify **functions**.	
	Inv. 1.2 (Review Results) What effect does water have on seeds?	Investigate - **Compare data**, notice **patterns**, and identify **cause-and-effect** relationships. -**Strategic Research Opportunity**: **obtain, evaluate, and communicate information** on plant seed germination through Tutorial-Basic Plant Needs multimedia	Sense-Make - Seeds **change size, shape, texture, and color,** "skin" seed coat is coming off (effect) after **watering** (cause). - Introduce plant **structures** (**root**, **stem**, **leaves**) and students begin to identify **functions**.	Tutorial-Basic Plant Needs multimedia

Navigate: What do we need to know next? We figured out seeds are structures of plants that allow them to reproduce. Seeds soak up water and swell. Seeds have several structures that function to help the growing plant survive (e.g. seed coat/protects, cotyledon/provides food, embryo/grows into new plant) We wonder what other structures help a growing plant survive? What will happen to the seeds next? Our next step is to continue observing the plant seeds and research plant growth.
**Note: This may be a good time to revisit the class schoolyard map and see if students can now answer some of their initial questions or add new notices/wonderings!*
- **Note:** Once bean seeds have grown roots, stem, and leaves transfer them to the hydroponics to continue growing for 6 weeks.

Investigation 2 - Growing Further

Focal NGSS Performance Expectations

Construct an argument that plants have internal and external structures that function to support survival, growth, behavior, and reproduction.

Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death. (3-LS1-1)

Use evidence to support the explanation that traits can be influenced by the environment. (3-LS3-2)

Pacing/Lesson	Focus Question	Investigate: What do we need to do?	Sense-make: What did we figure out?	Key Resources
Week 28 SOL Inv. 2.1	What structures does a seedling have to help it grow and survive?	- **Compare sprouting** seeds and **notice patterns**. - **Identify** the **structures and functions** of the plant.	- **Stem** supports leaves. - **Roots** take up water. - **Leaves** provide food? Take in **sunlight**?	- Teacher Master No. 7: Comparing Germinated Seeds - Growing Further: Seedling Sort Multimedia - Teacher Master No. 8: Class Chart- Bean Plant Growth
	Inv. 2.1 (Continued)	- **Constructed Response Opportunity**: **obtain, evaluate and communicate information** from multiple texts in response to the prompt. - Students **record week 1 observation** of bean plants	- Explain roots growing first (not a stem). **Roots** usually grow first, not the stem. Roots take in water and **nutrients**. Green leaves provide food for the plant. - Cite **evidence** that the **seed** is **living** because it **grows** after adding **water**-no longer **dormant**.	- Constructed Response Task 5 - "Germination" article (SRB) - Tutorial: Structures and Functions of Plants multimedia
Navigate: What do we need to know next? We figured out seeds germinate and begin to grow important structures that function to help them survive (e.g. roots to take up water, stem to support leaves, leaves to get food/sunlight? We wonder what seeds need to continue growing? Our next step is to research how seeds get the resources they need to grow?				
Week 29 SOL Inv. 1.4	Focus Question How do seeds disperse away from the parent plant?	Investigate - **Strategic Research Opportunity**: **obtain, evaluate, and communicate information** on **adaptations** of seeds for **dispersal** through How Seeds Get Here…and There video. - Engage in the **engineering design process** to **develop model** seeds that	Sense-Make - Only a **few seeds** will be able to **grow** (not all). - **Seeds move** to places with **more space**, **light**, and other **resources** needed to grow. - **Seeds** will need time to **disperse** and will be **affected** by different	- How Seeds Get Here…and There video - Teacher Master No. 3: Seed-Dispersal Action Cards - Teacher Master No. 4: Seed-Go Card - Investigation 1 I-Check

		will disperse based on information from **research**. - **Test and modify** their **designs** to **improve results**. - Students **record week 2 observation** of bean plants.	**weather conditions** (e.g. wind, rain etc.) - **Humans** and other **animals** may help **disperse seeds** that stick to clothes, fur, and hair getting moved from place to place. - Humans may plant young seeds in gardens.	
Navigate: What do we need to know next? We figured out that seeds need resources like sunlight, space, water, soil to continue growing. Seeds must move away from parent plants to get these resources. Seeds have adaptations/structures to help them travel away from parent plants (e.g. wings to be carried by wind, spikes to stick to fur etc.) We wonder what other structures plants need to help them grow and survive? Our next step is to continue to observe plant growth and record data. - **Note:** Consider drawing students' attention to plant roots in hydroponics here. This will lead into the next part of investigation 1. Ask students "What do you notice and wonder about the roots of our bean plants? What can we do to learn more about plant roots?"				
Week 30 SOL Inv. 2.3	Focus Question How do the roots of schoolyard plants compare to the roots of bean plants?	Investigate - Introduce **roots** and **shoots** (the part of the plant above ground). -Students **compare** root **systems** of schoolyard plants and look for **patterns**. - Students **record week 3 observation** of bean plants.	Sense-Make - Students may notice that some plants have **fibrous roots** and some plants have **taproots**. -Discuss the **functions** of different root **structures**. -Introduce inherit, students discuss roots as an **inherent trait** from **parent plants**.	
Navigate: What do we need to know next? We figured out that plants have structures that function to help them survive. We wonder what structures do animals have to help them survive? Our next step is to observe animals to see how their structures help them survive. **Note:** Consider revisiting the schoolyard map and reviewing questions "What did we learn? What questions do we still have?" Focus on animals in the schoolyard.				

Investigation 3 - Meet the Crayfish

Focal NGSS Performance Expectations

Construct an argument that animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

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. (3-LS4-3)

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. (3-LS4-4)

Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death. (3-LS1-1)

Use evidence to support the explanation that traits can be influenced by the environment. (3-LS3-2)

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. (3-LS4-2)

Pacing/Lesson	Focus Question	Investigate: What do we need to do?	Sense-make: What did we figure out?	Key Resources
Week 31 SOL Inv. 3.1	What are the structures of a crayfish?	- **Create diagrams/models** of crayfish with **structures labeled**. - Describe the **functions** of crayfish **structures**. - Students **record week 4 observation** of bean plants.	Students may notice… - **carapace** provides protection. - **pincers** provide protection and allow the crayfish to catch food. - **antennae** help to locate objects, such as food.	
Navigate: What do we need to know next? We figured out animals like crayfish have certain structures that function to help them survive. We wonder what other structures crayfish have to survive? What else do crayfish do to grow and survive? What structures do other animals have to help them survive? Do animal structures change? Our next step is to continue to observe crayfish and research other animals.				
Week 32 SOL Inv. 3.2	Focus Question How do crayfish structures and behaviors help crayfish survive?	Investigate - Introduce **behaviors** as things that animals do. - **Observe** crayfish behaviors and **describe** their **functions**. - Students **record week 5 observation** of bean plants.	Sense-Make - Students may notice… - **crayfish swim** backwards fast to **avoid predators**. - **crayfish** put **pincers** up for **protection**. - **crayfish walk** forwards, backwards, and side-to-side to **avoid predators** and **find food**.	- Notebook Sheet 14: Crayfish behavior
	Focus Question How does variation in	Investigate - **Strategic Research Opportunity**:	Sense-Make - **Variation** in **traits** (such as color)	All About Animal Adaptations video

	traits among individuals of a species affect survival?	**obtain, evaluate, and communicate information** about animal adaptations from All About Animal Adaptation video and "Adaptations" article in SRB. - **Identify** and **describe characteristics** that are adaptations. - **Sort** and **categorize characteristics** that are adaptations (movement, getting food, protection, and carrying young). - **Constructed Response Opportunity**: **use models** to explain **variations** in **traits** of walking sticks in Walking Stick online simulation.	allow **some individuals** in a species to **survive** more easily than others in certain environments. - These **traits** are then passed down to future **generations** of the species. - Animal **behaviors** and **adaptations** help them to **survive** in their environment. - **Adaptations** happen over time (several **generations**) within a species.	(Chapters 1-8 only) - "Adaptations" article in SRB -Notebook Sheet No. 16 - Constructed Response Task 6 - Notebook Sheet No. 17 - Notebook Sheet No. 18 -Notebook Sheet No. 19
Inv. 3.3 **Optional** (In this investigation students observe crayfish in their natural habitat to notice their territorial behavior) This can be done as a quick 5-10 minutes observation daily for 1 week.				
Navigate: What do we need to know next? We figured out animals have behaviors and adaptations to help them survive in their environment. Adaptations take time (several generations) to happen in an organism. We wonder how our crayfish compare to animals in our schoolyard? Our next step is to investigate other animals in our schoolyard and continue to observe our bean plants.				
Week 33 SOL Inv. 3.4/2.2	Focus Question How are the characteristics of crayfish and other animals alike and different?	Investigate - **Compare** crayfish to other organisms in the schoolyard and notice **patterns** (similarities). - **Identify structures** of other organisms and **describe** their **functions**. - Students **record week 6 observation** of bean plants.	Sense-Make - **Insects** in our schoolyard have **similar structures** as the **crayfish**… - **walking legs** for movement -**pincers** for protection and grasping food -**head**, **abdomen** (Carapace), **thorax** -**antenna** for feeling -hard shell/**exoskeleton** for protection - body **segments** for flexibility	- Investigation 3 I-Check (Omit item #7 related to food chains)
	Inv. 2.2 (revisited) What is the sequence of a bean plant's life cycle?	Investigate - After students **observe** the bean plant's growth for 6 weeks, revisit inv. 2.2. - **Analyze** their **data** and **create a model** of the bean plant's **life cycle** including **patterns**, **structure and function**. - **Strategic Research Opportunity: obtain, evaluate, and communicate information** about **photosynthesis** in	The **Bean Plants life cycle** is… 1. **Seed**: contains the new plant 2. **Root** begins to grow 3. First **leaves** have grown. **Cotyledon** dries up. 4. Plant has grown and has many leaves. 5. **Flowers** have appeared 6. **Fruit** or **bean pods** have appeared 7. **Pods** are fully grown and contain **seeds**.	- Notebook Sheet No. 8: Bean Life-Cycle Pictures - Notebook Sheet No. 9: Bean Life Cycle - How Plants get Food Video - "Life Cycles" article SRB - Investigation 2 I-Check

		How Plants Get Food video and life cycles of the bean plant and other organisms in Life Cycles article SRB.		
Inv 3.5 **Optional** (Engaging outdoor simulation, but concepts will be addressed in 4th and 5th grade).				

Investigation 4 - Human Body

Focal NGSS Performance Expectations

Construct an argument that animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago. (3-LS4-1)

Week 34: Investigation 4 Launch Activity (Self Documentation Strategy)
**Note: This may be a good time to revisit the class schoolyard map and see if students can now answer some of their initial questions or add new notices/wonderings!*

- Consider using the first part of Investigation 4.1 as a launch where students observe each other jump roping and come up with observations and questions about the human skeletal system.
- What do you notice and wonder about the human skeleton?
- What can we do to learn more? (Suggest using a model of the skeletal system)

Pacing/Lesson	Focus Question	Investigate: What do we need to do?	Sense-make: What did we figure out?	Key Resources
Week 34 SOL Inv. 4.1	What are the functions of the skeletal system?	- **Use mathematics and computational** thinking to estimate the number of **bones** in the human **skeletal system**. - **Create a model** of the human **skeletal system** and begin to **identify** its **structures and functions**. - **Use model**s in response to Notebook Sheet No. 26: Response Sheet-Investigation 4. - Engage in **argument citing evidence** from data. - **Strategic Research Opportunity**: **obtain, evaluate, and communicate**	- The human skeleton is made of about 206 bones. - There are **joints** that connect bones mankind the skeleton **flexible** - Some **bones** provide **protection** for vital **organs** like the **skull** protects the **brain** and the **rib cage** protects the **lungs** and **heart**. - In response to the notebook sheet students may notice… - the large **vertebrae** need to be removed from the **neck** and placed between the **ribs** and **pelvis**. - the lower right arm should have two	- Notebook Sheet No. 24: Counting bones - Notebook Sheet No. 25: Bone Names - Notebook Sheet No. 26: Response Sheet-Investigation 4 - Teacher Master No. 16-17: Mr. Bones Puzzle pieces - Mr. Bones multimedia activity

		information about the **functions** of the **skeletal system** through research in "The Human Skeleton" article in SRB.	bones rather than the upper arm. - the rib cage is upside down.	
Navigate: What do we need to know next? We figured out that the human skeletal system is made up of many bones. The bones provide structure, flexibility, and protection. We wonder how the human skeleton compares to other animals? Our next step is to investigate the skeleton of other animals.				
Week 35 SOL Inv. 4.2	Focus Question In what ways are the skeletons of a rodent and a human similar?	Investigate - **Plan and carry out an investigation** using **owl pellets** to reconstruct the skeleton of a **rodent**. - Organize their **observations** and use **data** in **discussions**. - Notice **patterns** and **construct explanations** regarding the **structure and function** as well as the variations of the bones found in the owl pellets. - **Strategic Research Opportunities**: **obtain, evaluate, and communicate information** about **fossils** in "Fossils" article in SRB and All About Fossils video. Also, **engage in argument using evidence** from "Skeletons on the Outside" article in SRB. In addition, students **compare crayfish** and **humans** in the "Crayfish, Snails and Humans" article in SRB.	Sense-Make - **Rodents** have some **similar skeletal structures** as **humans** (e.g. skull, spine, rib cage etc.) - Rodents have **more vertebrae** in their **spine** which may **cause** them to be more **flexible** and squeeze into tight spaces. -Rodents have a **tail** for **balance**. - **Crayfish** have an "**exoskeleton**" or skeleton on the outside along with some other animals (insects). - Both exoskeletons and internal skeletons have **similar functions (e.g. structures, protection, flexibility**). - We can learn about the skeletal structures of animals from the past through **fossils.**	- Notebook Sheet No. 28: Rodent Bone Identification - "Fossils" article in SRB - All About Fossils video - "Skeletons on the Outside" article in SRB - Crayfish, Snails, and Humans" article in SRB
Navigate: What do we need to know next? We figured out that the skeletal system of animals all function to provide structure, protection, and flexibility. We wonder why joints make the skeletons of humans flexible? How does our skeletal system allow us to move (e.g. walk, run, jump, grasp etc.) Our next step is to research the human skeletal system and use the information to develop a model that can be used to test flexibility.				
Week 36 SOL Inv. 4.3	Focus Question What makes our skeletal system flexible?	Investigate - **Strategic Research Opportunities**: **obtain, evaluate, and communicate information** through **research** in "Joints and Muscles" article in SRB. - Use what they learned about **joints**, **muscles**, and **tendons** to **construct a model** of a working **leg system**. - Use the **engineering and design process** to create, test, redesign, and	Sense-Make Students may notice… - that **joints** and **muscles** allow us to **move** and make our skeletal system **flexible**. - observe that **joints** are places where two bones meet and learn that there are three different kinds (**hing**, **gliding**, **ball-and-socket**). - determine that **muscles** go across	- Notebook Sheet No. 29: Thumb Joints - Notebook Sheet No. 30: Picture and Maze - Teacher Master no. 18: Leg Muscle - Survey/Posttest (Omit item 10 related to food chains)

		retest models.	joints and **connect bones**. When muscles **contract** (shorten), they pull on bones, causing them to move. - research that muscles attach to bones with tissue called **tendons**.	
Inv. 4.4. **Optional** (reinforces variation of traits for humans).				