**5th Grade Digital Learning Launch Unit - Science**

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| **Unit Topic: Balanced and Unbalanced Forces****Estimated Time: 2 Weeks** |
| **Standards** |
| **S4P3. Obtain, evaluate, and communicate information about the relationship between balanced and unbalanced forces**a. Plan and carry out an investigation on the effects of balanced and unbalanced forces on an object and communicate the results. b. Construct an argument to support the claim that gravitational force affects the motion of an object.c. Ask questions to identify and explain the uses of simple machines (lever, pulley, wedge, inclined plane, wheel and axle, and screw) and how forces are changed when simple machines are used to complete tasks. *(Clarification statement: The use of mathematical formulas is not expected.)*[Click here to see the Force and Motion Learning Progression – Appendix A](#appendixA) |
| **Science and Engineering Practices & Crosscutting Concepts:** [See Appendix B](#AppendixB) |
| **Teacher Background Knowledge** |
| *This section is included for your own background knowledge and* *is not intended for direct student instruction.** As we consider the motion of objects, we must ensure that students understand that a force is a push or a pull that causes an object to start moving, stop moving, or change direction. Students are familiar with forces in their everyday life such as pulling a wagon forward or hitting a baseball with a bat to change the direction of the ball. In a soccer game there are many examples of forces that act on the ball such as starting the ball in motion, stopping it, or changing the direction of the ball as a result of a force that is applied to the ball.
* It is also important for students to understand that more force is needed to make an object go faster. Remind students what it is like to bump into a person who is running down the hall at a fast speed versus running into someone moving at a slow speed. The force is much greater for the two people running into each other at a faster speed than a slower speed. Students who have been to the beach can think about the different types of waves in the ocean and their forces. The larger waves have a stronger force than a smaller wave.
* Gravity is the force that keeps us on earth; it pulls objects toward the center of the earth. Because of gravity objects fall to the ground and we don’t float into the air. It also keeps or moon in orbit and the sun’s gravity keeps the planets in orbit. Gravity is the force that causes a roller coaster to move along the track. As the roller coaster begins the chain pulls the cars to the top of the hill and then the roller coaster is pulled by gravity and momentum through the rest of the ride. On roller coasters the first hill is your tallest and steepest hill and then the roller coaster goes faster as it accelerates toward the ground.
* One common misconception that students and adults have about gravity is that lighter objects fall slower toward the earth while heavier objects fall faster. All objects accelerate to earth due to gravity at the same rate. A piece of paper or a feather fall slower toward the earth due to the effect of air resistance. If the objects were placed in a vacuum, they would all fall at the same rate towards earth.
* Simple machines are “simple” because they have one or no moving parts. A machine is a device that makes work easier. In order for work to occur something must move in the direction the force is being applied. A simple machine reduces the effort (force) need to move the object by moving the object a greater distance. The simplest machine is the inclined plane or ramp. It works by allowing you to lift an object to a higher level by traveling a greater distance up the ramp. A wedge is an inclined plane turned on its side. A wedge pushes two objects apart; examples are a knife, shovel, nail or an ax. A screw is also made up of an inclined plane wrapped around a cylinder. The spacing of the threads determines how hard it will be to turn the screw. Another simple machine is a lever. The point where the lever moves is called the fulcrum. When you change the position of the fulcrum you are able to do work with less effort. Examples of levers include a seesaw, rake, and hockey stick. A wheel and axle allows you to roll an object by reducing the amount of friction on the object. The larger the wheel the easier it is to move an object. The final simple machine is a pulley. It is made of a wheel and axle with a rope or chain or attached. A pulley allows you to change the direction of the motion so that you can lift an object off of the ground.
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| **Big Ideas/Enduring Understandings:** * A force is simply a push or pull (usually on an object)
* Forces can cause objects to start moving, stop moving, or change direction
* An object’s size and the amount of force exerted on an object affect its speed and motion
* Gravity is the earth’s pull on things. Things on or near the earth are pulled toward it by the earth's gravity
* Simple machines are tools that help us do work. Simple machines make work easier for us by changing the amount of force (pushing or pulling) needed to do certain kinds of work
 | **Essential Questions:*** What is the difference between a balanced and unbalanced force?
* How is the motion of an object related to the amount of force that is applied to the object?
* How can forces be used to make objects move, change direction, or stop?
* How does gravity affect the motion of an object?
* How do simple machines change forces to make work easier for people?
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| **Vocabulary:**ForceGravityFrictionBalanced forces Unbalanced forces Distance | Motion RollSlidePullRestLength  | SpeedPush LeverPulleyWedge | Inclined planeWheel and axleScrewForces |
| **Literature Connections:**Forces and Motionby Leon GrayThe Great Wonder: The Building of the Great Pyramid(Smithsonian Odyssey) by Annabelle HowardThe Lazy Bear by Brian Wildsmith |  **STEM Career Connections:**Mechanical engineer, biomechanical engineer, physicist, construction worker, carpenter, machinist |
| **Materials and Safety Considerations:**\*\*Lessons are designed with simplicity in mind. Full materials lists and safety considerations can be found if you look below for “Click here for full lesson.” |

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| **The First 10 Days** |
| **Day 1** | **Opening** | **TOPIC 1: Plan and carry out an investigation on the effects of balanced and unbalanced forces on an object and communicate the results.****Phenomenon:** I can make a ball start moving by kicking it.**ENGAGE:**1. Have students observe a ball kicked with light and hard kicks. Students will describe what happens, noting cause and effect relationships
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| **Work Session** | 1. Students will make a t-chart listing pushes and pulls in everyday life

**EXPLORE:**Students will identify balanced and unbalanced forces in this [Tug of War Video](https://youtu.be/rP2MviNn52g) |
| **Closing** | Students will share their t-charts and video observations. |
| **Day 2** | **Opening** | Review Topic 1 and phenomenon that was covered previous day.Introduce and outline the assignment below.  |
| **Work Session** | **EXPLAIN: (Choose best activities from this list for your students)**1. HMH GA SCIENCE TEXTBOOK RESOURCES

Unit 6, Lesson 1 (pp. 303-305, p. 308-311, p. 314-315) Flip Chart p. 36 and accompanying Student Worktext pages: Unit 6, Lesson 3 (pp. 325A-326) Digital Lesson: *What Are Forces?*1. HMH DIMENSIONS ONLINE RESOURCES

**Grade 3** Unit 2 Lesson 1, pp. 68–73 Unit 2 Lesson 2, pp. 88–93Hands On Activity: *Exploring Forces*Unit Project: *Balanced Forces*Unit Performance Task: *Engineer It! Moved Without Touching* |
| **Closing** | Close this lesson using an ABC Summary- Give students a letter of the alphabet and ask them to make a statement about something they learned that begins with that letter.  |
| **Day 3** | **Opening** |  Review Topic 1 and material that was covered previous day.Introduce and outline the assignment below, address student concerns/questions.  |
| **Work Session** | **Choose activities from the list below that are appropriate for your students****EXPAND:**[Balanced Forces Unit Project](https://cobbteachingandlearningsystem.cobbk12.org/GetFile.aspx?f=7ad62c48-dca1-47ab-b3f9-9f8af8d5d819): Students will work to keep an object at rest when forces are changing around it**EVALUATE:**1. HMH Georgia Science:

 p. 319, #5; p. 350, #191. HMH Dimensions:

 3rd Grade Unit 1 Lesson 1 p. 92 #6 p. 93 #7-8 p. 105 #1 |
| **Closing** | If students complete the project, have them share with one another and note new learning. If they completed the HMH activities, lead them through the amazing, interesting, question summarizer. Students will share either something they found amazing, something they thought was interesting, or a question they still have.  |
| **Day 4** | **Opening** | **TOPIC 2: Construct an argument to support the claim that gravitational force affects the motion of an object.****Phenomenon:** 1. When you let go of an object, it falls to the ground.
2. When dropped, objects of different masses (but more or less the same shape) will hit the ground at the same time.

**Introduce the new topic and begin the activity below by demonstrating one of the tests. Allow students to complete other tests during their work time.** |
| **Work Session** | **ENGAGE & EXPLORE:**Use the [Leaning Tower of Pisa Recording Sheet](https://cobbteachingandlearningsystem.cobbk12.org/GetFile.aspx?f=10f85673-0c97-45dd-a550-91514de96c18) to guide this activity where you drop a ball, a flat piece of paper, a crumpled piece of paper, and a larger ball to compare gravity’s effect on each object. (This is an Engage and Explore activity) |
| **Closing** | Have students complete a 6-word summary of what they’ve learned and share them with the class.Organizer here: <https://cobb.discoveryeducation.com/learn/player/6a99e3f9-426e-4563-ba5c-4f10789908ce>  |
| **Day 5** | **Opening** | Review Topic 2 and phenomenon that was covered previous day.Introduce and outline the assignment below.  |
| **Work Session** | **EXPLAIN: (Choose best activities from this list for your students)**1. HMH GA SCIENCE TEXTBOOK RESOURCES

 Unit 6, Lesson 1 (p. 306)1. HMH DIMENSIONS ONLINE RESOURCES

 Grade 3 Unit 2 Lesson 2, pp. 96-98 Grade 5Unit 5 Lesson 1, pp. 282-286 Grade 5 Unit 5 Lesson 1, Extra Hands-On Activity: Falling to Earth, p. 272B (TE) |
| **Closing** | Pose several true/false questions to students based on the work you assign above. Students will answer with a thumbs up or thumbs down. |
| **Day 6** | **Opening** | Present the problem solved by the STEM challenge below. Try dropping a small toy or stuffed animal on camera and asking students why we may want things to fall slowly- brainstorm a list (examples: supplies dropped to military, dropping rockets slowly so that they don’t break, skydiving recreation, etc.) |
| **Work Session** | **EXPAND:**Mini-STEM Challenge: [Engineer a parachute](https://cobbteachingandlearningsystem.cobbk12.org/GetFile.aspx?f=5c45f0f2-a194-4027-9236-8895342e1606). Students will design a parachute that a plastic skydiver can use to jump from 3 meters high and float to the ground |
| **Closing** | Test student designs together on camera. Discuss ideas and common design elements that were successful.  |
| **Day 7** | **Opening** | Review topics learned from previous day’s mini STEM challenge.  |
| **Work Session** | **EVALUATE:**1. Students will construct an argument using the [CER Framework](https://cobbteachingandlearningsystem.cobbk12.org/GetFile.aspx?f=41059482-c954-4489-8625-999d9df09672) to support the claim “Gravity affects the motion of an object.”
2. HMH Georgia Science

 p. 319, #6; p. 350, #20 |
| **Closing** | Ask students to create a new hashtag that would represent what they have learned today. It must be less than 6 words and convey the meaning of something they learned.  |
| **Day 8** | **Opening** | **TOPIC 3: Ask questions to identify and explain the uses of simple machines (lever, pulley, wedge, inclined plane, wheel and axle, and screw) and how forces are changed when simple machines are used to complete tasks.****Phenomenon:** The Great Pyramids of Giza were built in 2500 B.C. Each block that makes of the pyramids weighs 2.5 tons (about how much a car weighs). No one is really sure how they were built.**ENGAGE:**Push a brick across the table with your finger. Ask students to come up with easier ways to get the brick to the other side of your table. Record ideas.  |
| **Work Session** | Continue activity above by tying a string around the brick and pull it, then use the same string, but put the brick on a row of round pencils. Students will ask questions and observe each step of the task to introduce simple machines. |
| **Closing** | Ask students to design hand signals that could represent each simple machine to help them remember what each one does. For example, they could twist one pointed finger in the air to represent a screw.  |
| **Day 9** | **Opening** | Review the hand signals created the day before and each simple machine. Share the instructions and demonstrate how to play Inventioneers for students.  |
| **Work Session** | **EXPLORE:**Students can use simple machines to design digital Rube Goldberg machines using a free app called [Inventioneers](https://www.filimundus.com/inventioneers/). Students will then identify the simple machines that they used. **EXPLAIN:**1. HMH GA SCIENCE TEXTBOOK RESOURCES

Unit 6, Lesson 4 (pp. 329A-346)Flip Chart page 37- *Machines and Forces*1. HMH DIMENSIONS ONLINE RESOURCES

Grade 3 SE/TE: Unit 2 Lesson 1, pp. 83–84 Science and Engineering Leveled Readers: On Level/Extra Support Readers: *How Do We Use Machines?* Enrichment Reader: *Building with Machines* |
| **Closing** | Share the function of each simple machine and ask students to show you the hand signal for the matching simple machine.  |
| **Day 10** | **Opening** | **EXPAND:**Choose one Rube Goldberg machine featured on [this site](http://coolmaterial.com/roundup/rube-goldberg-machines/) and have students help you describe all the simple machines that were used. |
| **Work Session** | **EVALUATE:**1. HMH Georgia Science

p. 344, #3; p. 345, #6Share with students the line attributed to Archimedes, “If I had a place to stand and a lever big enough, I could move the world.” Have students write a letter to Archimedes agreeing or disagreeing with him while **explaining how forces are changed when simple machines are used.** |
| **Closing** | Have students ask questions to the class where the answer is ONE simple machine. Students will answer with their hand signals.  |

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| [Click here to download the unabridged version of the Topic 1 Lesson](https://cobbteachingandlearningsystem.cobbk12.org/GetFile.aspx?f=1ba1f103-5500-4a30-8df4-8dffcd1d7519) | [Click here to download the unabridged version of the Topic 2 Lesson](https://cobbteachingandlearningsystem.cobbk12.org/GetFile.aspx?f=1ba1f103-5500-4a30-8df4-8dffcd1d7519) | [Click here to download the](https://cobbteachingandlearningsystem.cobbk12.org/GetFile.aspx?f=fbba68fa-af46-41be-8ab3-14664581f3b4) [unabridged version of the Topic 3 Lesson](https://cobbteachingandlearningsystem.cobbk12.org/GetFile.aspx?f=fbba68fa-af46-41be-8ab3-14664581f3b4) |
| **ADDITIONAL RESOURCES** |
| **STEM Challenges*** [Roller Coaster Rally](https://drive.google.com/file/d/15RbW1bEvgI4YSEmtZB9SfGfozeOoNZ97/view?usp=sharing)
* [Ancient Machines](https://cobbteachingandlearningsystem.cobbk12.org/GetFile.aspx?f=4dfa1122-7e6f-4544-b198-32bd34f19745&t=v)
 | **Science Probes*** [Apple on a Desk](https://www.dropbox.com/sh/msgq2lnc423z0bk/AADX_F_dit5H_BEgAUN2oz4Ia/4th%20Grade%20Science%20Probes?dl=0&preview=AppleOnTheDeskV3-ch8.pdf&subfolder_nav_tracking=1&t=v)
* [Rolling Marbles](https://www.dropbox.com/sh/msgq2lnc423z0bk/AADX_F_dit5H_BEgAUN2oz4Ia/4th%20Grade%20Science%20Probes?dl=0&preview=RollingMarblesV3-ch9.pdf&subfolder_nav_tracking=1&t=v)
* [Dropping Balls](https://www.dropbox.com/sh/msgq2lnc423z0bk/AADX_F_dit5H_BEgAUN2oz4Ia/4th%20Grade%20Science%20Probes?dl=0&preview=DroppingBallsV3-ch10.pdf&subfolder_nav_tracking=1&t=v)
* [Talking about Gravity](https://www.dropbox.com/sh/msgq2lnc423z0bk/AADX_F_dit5H_BEgAUN2oz4Ia/4th%20Grade%20Science%20Probes?dl=0&preview=TalkingAboutGravityV1-ch13.pdf&subfolder_nav_tracking=1&t=v)
 | **Picture Perfect Sci*** Sheep in a Jeep
 |  **Mystery Science*** How could you win a tug-of-war against a bunch of adults?
* What makes bridges so strong?
* How can you go faster down a slide?
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| **Differentiation:** \*\*Click on full versions of lessons listed above for specific suggestions for differentiation |

**APPENDIX A**

**Disciplinary Core Idea: Physical Science Learning Progression**

**Force & Motion**

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| Kindergarten | 2nd Grade | 4th  | 8th | High School Physical Science |
| SKP2. Obtain, evaluate, and communicate information to compare and describe different types of motion.a. Plan and carry out an investigation to determine the relationship between an object’s physical attributes and its resulting motion (straight, circular, back and forth, fast and slow, and motionless) when a force is applied. (Examples could include toss, drop, push, and pull.) b. Construct an argument as to the best way to move an object based on its physical attributes.  | **S2P2. Obtain, evaluate, and communicate information to explain the effect of a force** **(a push or a pull) in the movement of an object (changes in speed and direction).** a. Plan and carry out an investigation to demonstrate how pushing and pulling on an object affects the motion of the object. b. Design a device to change the speed or direction of an object. c. Record and analyze data to decide if a design solution works as intended to change the speed or direction of an object with a force (a push or a pull) | **S4P3. Obtain, evaluate, and communicate information about the relationship between balanced and unbalanced forces**a. Plan and carry out an investigation on the effects of balanced and unbalanced forces on an object and communicate the results.  b. Construct an argument to support the claim that gravitational force affects the motion of an object.c. Ask questions to identify and explain the uses of simple machines (lever, pulley, wedge, inclined plane, wheel and axle, and screw) and how forces are changed when simple machines are used to complete tasks. *(Clarification statement: The use of mathematical formulas is not expected.)* | **S8P3. Obtain, evaluate, and communicate information about cause and effect relationships between force, mass, and the motion of objects.** a. Analyze and interpret data to identify patterns in the relationships between speed and distance, and velocity and acceleration. (*Clarification statement: Students should be able to analyze motion graphs, but students should not be expected to calculate velocity or acceleration.)* b. Construct an explanation using Newton’s Laws of Motion to describe the effects of balanced and unbalanced forces on the motion of an object. c. Construct an argument from evidence to support the claim that the amount of force needed to accelerate an object is proportional to its mass (inertia) | **SPS8. Obtain, evaluate, and communicate information to explain the relationships among force, mass, and motion** a. Plan and carry out an investigation and analyze the motion of an object using mathematical and graphical models. *(Clarification statement: Mathematical and graphical models could include distance, displacement, speed, velocity, time and acceleration.)* b. Construct an explanation based on experimental evidence to support the claims presented in Newton’s three laws of motion. *(Clarification statement: Evidence could demonstrate relationships among force, mass, velocity, and acceleration.)* c. Analyze and interpret data to identify the relationship between mass and gravitational force for falling objects. d. Use mathematics and computational thinking to identify the relationships between work, mechanical advantage, and simple machines. |

**APPENDIX B**

**Science and Engineering Practices:** Based on the fourth quarter standards, there may be a gap in the understanding of the following Science and Engineering Practices:

# Obtaining, Evaluating, and Communicating Information: Scientists and engineers must be able to communicate clearly and persuasively the ideas and methods they generate. Critiquing and communicating ideas individually and in groups is a critical professional activity. Communicating information and ideas can be done in multiple ways: using tables, diagrams, graphs, models, and equations as well as orally, in writing, and through extended discussions. Scientists and engineers employ multiple sources to obtain information that is used to evaluate the merit and validity of claims, methods, and designs.



**Cross-Cutting Concepts:**

