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Engage & Elicit The purpose for the ENGAGE stage is to pique student interest and get them personally involved in the lesson, while pre-assessing prior understanding.	-"Silent Conversations"- This portion of the lesson will be used to both *engage* my students as well as *elicit* prior understandings on forces around us. Being that my students have had a spiraled curriculum for their first two years of middle school, I need to determine their current knowledge base and possible misconceptions on forces. (LOI- Discovery Learning) -Activity: 6 cartoons (attached) are placed on large poster paper and layed on each of the student tables. Students are given approximately 1-2 minutes per table (in groups of four) to read/interpret the cartoon and then circle which force(s) (gravity, normal, frictional, tensional) listed in their Force Bank are being represented in each cartoon. A chime is used to rotate students. -Students are not allowed to talk with one another but can use markers to communicate and write comments/questions around the cartoons. As students rotate, they can respond to a classmate's comment on the paper around the cartoon with inquisitive or informative commentary.
Explore The purpose for the EXPLORE stage is to get students involved in the topic; providing them with a chance to build their own understanding.	-Students will be provided with an iPad or laptop computer and given the link below to access the Physics Classroom page defining both contact and action-at-a-distance forces. (LOI- Inquiry Lesson) -Here they will be asked to click on the links for the four forces listed on their student sheets: gravity, frictional, normal, and tensional. Prior to and while reading the links students will complete a PLAN (Predict, Locate, Add, and Note) graphic organizer. This study-reading strategy for informational text is one that will break down the reading assignment, engage my students, and aim to make clear any confusion with the four types of forces being explored. https://www.physicsclassroom.com/Class/newtlaws/U2L2b.cfm#norm
Explain The purpose for the EXPLAIN stage is to provide students with an opportunity to communicate what they have learned so far and figure out what it means.	-Students will rotate among the six cartoons once again (with a new color marker so that changes/additions to their understanding can be easily seen) but will no longer need to be silent. -Using their gained knowledge from the reading, the PLAN strategy, and class discussions with their tablemates and class discussions, students will reassess their force choice(s) for each cartoon. If they decide to eliminate a previous choice or to add an additional force, they will be required to write a brief explanation as to why the change was made. Debate can happen here too- positive debating techniques will be incorporated when needed. -After rotations are completed, student groups for each cartoon will present the happenings in the

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	picture and the force(s) leading to the movements (or no movement). Questions and discussions will ensue but now with a deeper knowledge base.
Elaborate/Extend The purpose for the EXTEND stage is to allow students to use their new knowledge and continue to explore its implications.	Day 2- **Teacher Led**: Interactive demonstrations (LOI- Interactive Demonstrations) will take place to provide students with visual representations of each of the four forces they are exploring. Students will predict what force the demonstrations are primarily exhibiting (student volunteers will be called upon to assist with the demonstrations as needed). The demonstrations will be as follows: 1. *Gravity*- Water Drop demo followed by NASA video for a deeper explanation: *https://spaceplace.nasa.gov/what-is-gravity/en/* * Additional video resource for enrichment scaffolding https://www.youtube.com/watch?v=MTY1Kje0yLg 2. *Normal Force*- Scale Demonstration and can be followed by this video (up to 1:59) if additional examples are helpful (also incorporates calculating N): https://study.com/academy/lesson/the-normal-force-definition-and-examples.html 3. *Frictional*- with rice demo and video https://study.com/academy/lesson/what-is-friction-definition-formula-forces.html and possibly block friction video with predictive component: https://www.youtube.com/watch?v=II6hP0Wxle8 4. *Tensional force*- Rope demonstration with student volunteers followed by NASA video for additional reinforcement: https://www.youtube.com/watch?v=QNIthWuoI5E *Additional video resource for enrichment scaffolding https://www.youtube.com/watch?v=RISEtSIvgo0 Day 2- **Student Led**: student groups will use class materials to come up with four short demonstrations of their own to exhibit the forces they have been studying. Groups will first, practice demonstrations with teacher/facilitator and second, record their demonstrations for classroom viewing on Day 3 or Day 4 (likely Day 4). Flipgrid can be utilized here.

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Evaluate The purpose for the EVALUATION stage is for both students and teachers to determine how much learning and understanding has taken place.	1. Completed PLAN graphic organizer from each individual student (summative) 2. Classroom participation during group rotations both through writing and discussion (formative) 3. Group presentations of each cartoon exhibiting motion (formative) 4. Group presentations of force demonstrations (formative & summative)

Background Information:

The lesson entitled, "Forces All Around Us", is one that, after I wrote it, I look forward to using at the beginning of the Physics unit on Forces and Motion that I will be teaching to my 8th grade Science students in the winter. This lesson is one that will span several days as we explore forces and work towards stronger reading and comprehension skills with science content. I currently teach one hundred and four 8th grade students who have had two years of a spiraled Science curriculum and have learned a small amount of Physics primarily as it relates to space during their 6th grade year.

To write this lesson plan, I utilized two of our PSIM resources: "Levels of Inquiry" (Wenning and Wenning, 2005) and "Teaching Reading in Science"(Barton & Jordan, 2001). Each year, I aim to have my students leave my class having enjoyed learning Science, having added to their scientific knowledge base, and having gained more confidence in their ability to read and understand scientific literature around them such as the New York Times Science Times articles (every Tuesday!), National Geographic magazines and other current publications such as Scientific American, as well as Science textbooks.

"Forces All Around Us" incorporates several Levels of Inquiry, the first being ***Discovery Learning***. By asking my students about the phenomena of forces through the cartoons, I am able to guide students to using the four force terms and relating them to the scenarios happening in the cartoons they are seeing as well as real-life situations. This will then lead to further questioning and discussions within their table groups and as a class. ***Interactive Demonstrations*** will also be utilized to provide students with a more hands-on and visual understanding of the four forces. These will be done after students complete the textual reading in the Physics Classroom and have completed the PLAN reading strategy graphic organizer. Finally, a ***Guided Inquiry Activity*** will be assigned. Students will be asked to create a 2-minute video with

demonstrations and clear definitions of the four forces. Students are able to use their Physics Classroom reading, PLAN graphic organizer, websites for research purposes, classroom materials, and their texts.

Learning Outcomes:

Learning Goals for Science: Students will be able to know, use, and interpret scientific explanations of four forces as they relate to motion; generate and evaluate scientific evidence and explanations; explore and understand the relationships among the ideas in text; and implement a study-reading strategy for informational text to read strategically.

The following CCSS and NGSS will be met with this lesson plan:

CCSS.ELA-Literacy.RST.6-8.1
Cite specific textual evidence to support analysis of science and technical texts.

CCSS.ELA-Literacy.RST.6-8.3
Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

CCSS.ELA-Literacy.RST.6-8.4
Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6-8 texts and topics*.

CCSS.ELA-Literacy.RST.6-8.7
Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table)

CCSS.ELA-Literacy.RST.6-8.9
Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

CCSS.ELA-Literacy.RST.6-8.10
By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently.

MS- PS2-1: Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.* [Clarification Statement: Examples of practical problems could include the impact of collisions between two cars, between a car and stationary objects, and between a meteor and a space vehicle.] [*Assessment Boundary: Assessment is limited to vertical or horizontal interactions in one dimension.*]

PS2.A:

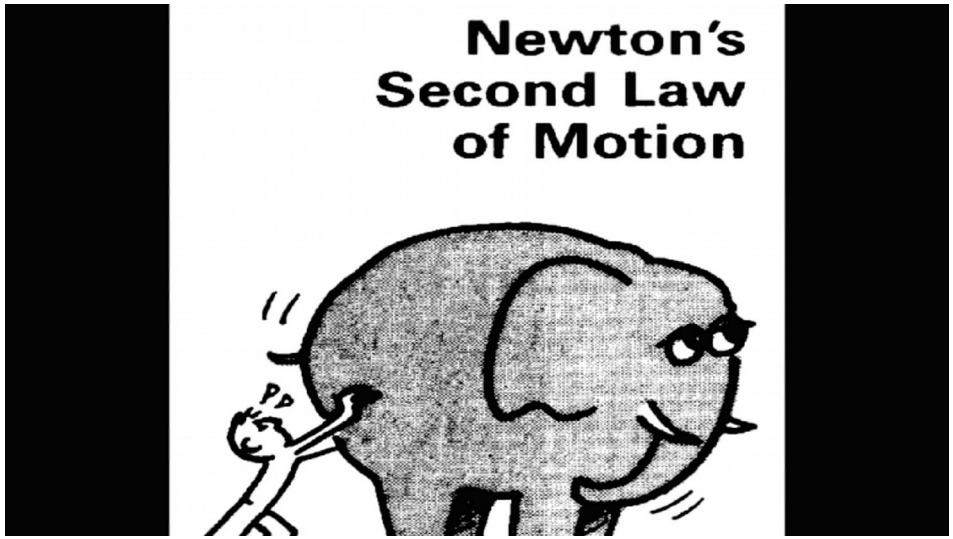
For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's Third Law).

The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion.

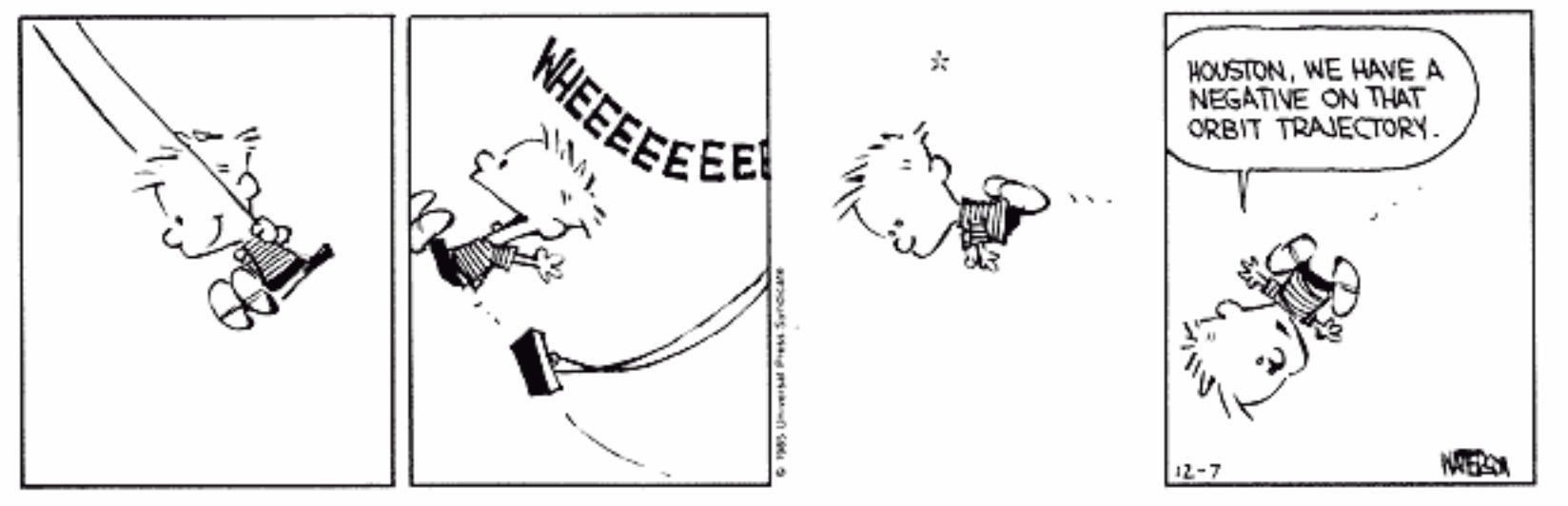
MS-PS2.2: Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. [Clarification Statement: Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.] [*Assessment Boundary: Assessment is limited to forces and changes in motion in one-dimension in an inertial reference frame and to change in one variable at a time. Assessment does not include the use of trigonometry.*]

Silent Conversation- Picture #1

Silent Conversation- Picture #2

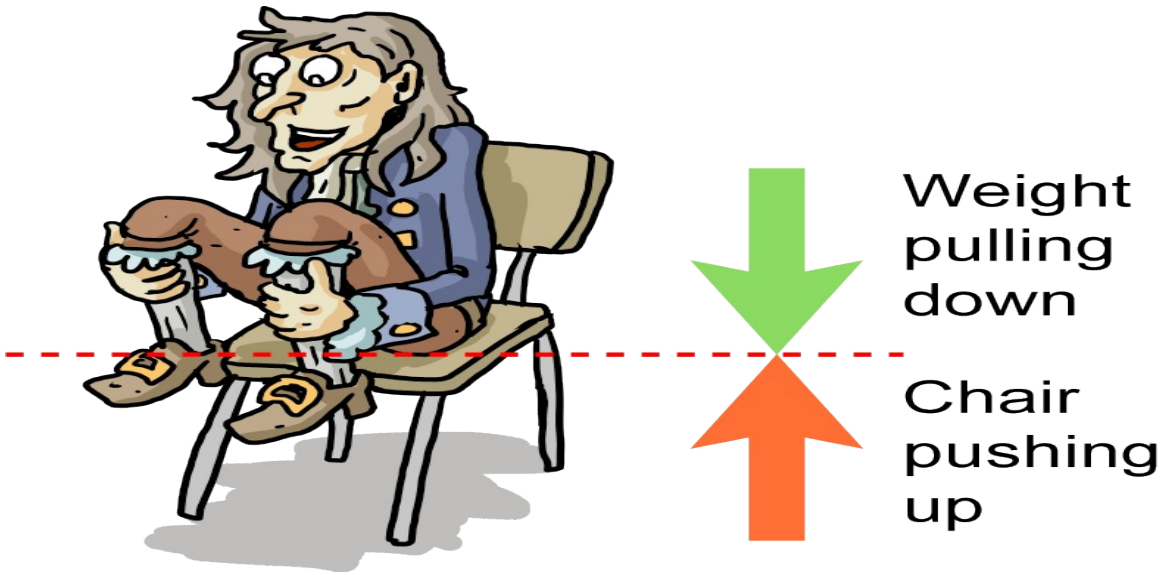


Silent Conversation- Picture 3



Silent Conversation- Picture 4

Silent Conversation- Picture 5



Silent Conversation- Picture 6