Lesson Title: How does understanding actions and reactions help youi explain patterns of movement?

Author: Mary Webster *Please also name your file with LastName_FirstName when submitting in the dropbox/discussion forum.*

Topic: For every reaction there is an equal and opposite reaction. Motion depends on the observer's point of view and can be described in terms of position, direction and speed.

Targeted Grade Level: 8th Grade Lesson

Time Needed: *List the time needed for the lesson.*

Subject Integration:

Science:

Math:

Social studies- history of flight through the decades worldwide*For the purposes of this assignment, choose at least **TWO** of the following subject areas- Science, Technology, Engineering, or Math to address. Along with those subjects, please choose **at least one** other subject to integrate (any of the S- T- E -M- subjects, Art, Literacy, Social Studies, P.E., Music, etc.), for a total of **at least** three different subject areas. Please list them here.*

Justification:

Science:

Social Studies:

Math:

Clearly explain how each subject is integrated and how integration enhances students' understanding in each subject. Substantiate how practices will be developed within subjects. Why is the integration logical?

Standards: *NGSS, Common Core, or related State standards. Write out (or copy and paste) standards completely. Please identify the point when each standard is addressed in the 5E template below. Each standard should be explicitly*

addressed within the lesson if it is to be included. Example: Reading aloud a non-fiction text does not solely qualify for ELA integration. Making a graph does not solely qualify for math integration. What concept is explicitly being taught?

NGSS Performance Expectations:

MS-PS2-1 Evidence Statements June 2015 asterisks.pdf

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts:
Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. • Apply scientific ideas or principles to design an object, tool, process or system.	PS2.A: Forces and Motion • 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).	Cause and effect relationships that can be explained through a mechanism Systems and System Models • Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems.

Common Core State Standards:

Science: MS-PS2-1. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.

Tennessee State Standard 8.PS2.6 Evaluate and interpret that for every force exerted on and object there is an equal

force exerted in the opposite direction.

Math:

- **MP.2** - Reason abstractly and quantitatively.

ELA:

- **RST.6-8.1** - Cite specific textual evidence to support analysis of science and technical texts.
- **RST.6-8.3** - Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
- **WHST.6-8.7** - Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

Measurable Student Learning Objectives: *Write the learning objectives as "students will be able to" statements. Be sure that your objectives are measurable and connect to the standards listed above.*

You are encouraged to use Webb's Depth of Knowledge to create action oriented objectives.

Nature of STEM: *Summarize how your lesson addresses the "nature of" science, technology, engineering, math, etc. as discussed in the Methods of STEM course.*

Engaging Context/Phenomena: Students will watch a video of a skateboarder using arm braces to propel themself across an open area to learn about what causes position and motion to change and how that may look different from various points of view. *What are your engaging phenomena or your "hook" for the lesson? Be sure whatever you choose is appropriate for the subject area and grade level you are addressing.* Several example phenomena are shared in course. Consider how observations of the natural world serve as phenomena to engage students in the content. *You must utilize a NASA resource in your lesson (please discuss with your instructors if you need assistance).*

Data Integration: *What data is being used in this lesson? Are students analyzing or collecting data? What are they doing with the data? This would be a great place to include all the different NASA data made available to you. If NASA data is not appropriate for your lesson, speak to your course instructor to identify another source of data that is appropriate. It may be publicly available, collected by students, or accessible to you with permission through other projects.*

Differentiation of Instruction: *How can you adjust this lesson to meet the unique needs of students in your classes? What needs should be addressed? Think about and make these modifications PRIOR to the lesson so all students have the greatest ability to participate.*

Real-life Connection: *Is there a real-life connection to this lesson? If so, what is it? How have you considered culturally responsive teaching practices? How will students connect to the lesson in their everyday lives?*

Possible Misconceptions: *Are there any previous ideas or thoughts you anticipate students having about this concept? List them here as it will help you consider ideas to include in your lesson.*

Lesson Procedure: *This is where you include each phase of the 5E. They should be extremely clear, well organized, and ready to be used by another educator. Be sure that each learning experience meets the guidelines for each "E". The template below will help you.*

5E Model	5E Objectives

Engage *Introduce the lesson with an anchoring phenomenon. Facilitate student questions, discussion, etc. as appropriate. Learn about what students already know and want to know.*	**Procedure:** *(What happens during this phase? What is the teacher doing? What is the student doing?)* **Modifications** *(What student needs must be addressed? How can you make each experience accessible for ALL learners?)* **Standards Addressed** *(Which standards are being explicitly taught in this section?)* **Formative/Summative Assessments** *(How will you assess in each phase?)* **Resources** *(List all resources and materials used in this part of the lesson.)*
Explore *Plan for students to engage in hands-on activities that are designed to facilitate conceptual change.*	**NASA activity Rubber Band Powered Helicopter Engineering Challenge** **Procedure: During this phase,** **Modifications** *(What student needs must be addressed? How can you make each experience accessible for ALL learners?)* **Standards Addressed** *(Which standards are being explicitly taught in this section?)* **Formative/Summative Assessments** *(How will you assess in each phase?)* **Resources** *(List all resources and materials used in this part of the lesson.)*
Explain *Facilitate opportunities for students to explain their understanding of concepts and processes*	**Procedure:** *(What happens during this phase? What is the teacher doing? What is the student doing?)* **Modifications** *(What student needs must be addressed? How can you make each experience accessible for ALL learners?)* **Standards Addressed** *(Which standards are being explicitly taught in this section?)*

and make sense of new concepts.	**Formative/Summative Assessments** *(How will you assess in each phase?)* **Resources** *(List all resources and materials used in this part of the lesson.)*
Elaborate *Provide applications of concepts and opportunities to challenge and deep ideas; build on or extend understanding and skills.*	**Procedure:** *(What happens during this phase? What is the teacher doing? What is the student doing?)* **Modifications** *(What student needs must be addressed? How can you make each experience accessible for ALL learners?)* **Standards Addressed** *(Which standards are being explicitly taught in this section?)* **Formative/Summative Assessments** *(How will you assess in each phase?)* **Resources** *(List all resources and materials used in this part of the lesson.)*
Evaluate *Assess students knowledge, skills and abilities.*	**Procedure:** *(What happens during this phase? What is the teacher doing? What is the student doing?)* **Modifications** *(What student needs must be addressed? How can you make each experience accessible for ALL learners?)* **Standards Addressed** *(Which standards are being explicitly taught in this section?)* **Formative/Summative Assessments** *(How will you assess in each phase?)* **Resources** *(List all resources and materials used in this part of the lesson.)*

Teacher Background: *What background information does the teacher need to effectively teach this lesson? If you can provide links to resources, please do so.*