

Mary Lou Driskell

Physics Science in Motion

Elective 1: Unit Plan

Jeff Milbourne

2 Dec. 2020

### Newton's 3 Laws of Motion Unit Plan

#### Background Information:

This lesson is appropriate for tenth through twelfth graders, in a physics class. The objectives for this lesson are that the students will learn about Issacc Newton along with being able to describe his three laws of motion. They will be able to perform calculations based on the laws as well as use them in real life situations along with developing collaboration and communication skills.

This unit plans Depth of Knowledge content is at Level 3 and 4. The students are required to think and analyze examples along with gathering their own information, analyzing their findings and presenting what they have learned. The Level of Inquiry for this content is at a Level 4. The student's have to design, follow through with a lesson and communicate their findings and results.

#### Unit Plan Goals and State Standards:

##### Student Goals:

- Describe how the change in an object's motion depends on the sum of the forces acting on the object and the mass of the object.
- Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.
- State Newton's laws, and apply them, in qualitative terms, to explain the effect of forces acting on objects

##### Missouri State Standards:

**9-12.PS2.A.1**-Analyze data to support and verify the concepts expressed by Newton's 2nd law of motion, as it describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

**9-12.PS2.A.2-**Use mathematical representations to support and verify the concepts that the total momentum of a system of objects is conserved when there is no net force on the system.

**9-12.PS2.A.3-** Apply scientific principles of motion and momentum to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.

**9-12.PS2.B.1-** Use mathematical representations of Newton's Law of Gravitation to describe and predict the gravitational forces between objects.

**9-12.PS2.B.2-** Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.

### **PS2.A: Forces and Motion-**

Newton's second law accurately predicts changes in the motion of macroscopic objects. (A.1)

Momentum is defined for a particular frame of reference; it is the mass times the velocity of the object. (A.2)

If a system interacts with objects outside itself, the total momentum of the system can change; however, any such change is balanced by changes in the momentum of objects outside the system. (A.2),(A.3)

### **PS2.B: Types of Interactions**

Newton's law of universal gravitation and Coulomb's law provide the mathematical models to describe and predict the effects of gravitational and electrostatic forces between distant objects. (B.1)

Forces at a distance are explained by fields (gravitational, electric, and magnetic) permeating space that can transfer energy through space. Magnets or electric currents cause magnetic fields; electric charges or changing magnetic fields cause electric fields. (B.1),(B.2)

### **PS3.A: Definitions of Energy**

"Electrical energy" may mean energy stored in a battery or energy transmitted by electric currents. (secondary to B.2)

### **ETS1.A: Defining and Delimiting an Engineering Problem**

Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (secondary to A.3)

### **ETS1.C: Optimizing the Design Solution**

Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. (secondary to A.3)

### Unit Plan Assessments:

The formative assessment I plan to use during the lesson over Newton's second law, the students will write a Claim, Evidence, Reasoning paragraph. The paragraphs and how the students perform on the stimulation will help guide me in the next phase of the unit, are the students ready to move on or do they need more guidance.

The lesson I will use as my summative assessments is the Newton's Laws and the Lunar Lander activity. The objective of this lesson is for the students to gain an understanding of objects in motion, learn about the relationship between force, mass and acceleration and gain an understanding with action and reaction of forces, all dealing with the laws of motion. After completing the activity I will determine if the students have mastered the lessons learning goals and objectives.

### Unit Plan Outline:

This is an ongoing lesson that should take 6 - 8 hours to complete. The resources needed to complete this unit plan include, but not limited to, at least one device per three students, internet access, pins, styrofoam meat tray, cellophane tape, flexi-straw, scissors, drawing compass, marker pen, small party balloon, ruler, emery board and the needed handouts for each lesson. If you lab notebooks the students will also need them for data collection.

The three lesson that I will be using for this unit are:

[Elective 3: Resource Review](#)- Newton's Laws of Motion

[Elective 4: Utilizing Simulations](#)- Force interactive - Frictionless Situations

[Elective 4B: Utilizing Simulations](#)- Newton's Laws and Lunar Lander

The three lessons are all from the PSIM resources list. The Newton's Laws of Motion is from NASA. The Force interactive simulation is from The Physics Classroom site and the Newton's Laws and Lunar Lander is a Phet interactive simulation.

### Work Cited

**HIGH SCHOOL - PHYSICAL SCIENCE - MISSOURI LEARNING STANDARDS (2016)**

<https://docs.google.com/document/d/17Qym3ByAL08FQ6dglOebcpeU1EKNw4YXgbKlj>

TCb1DY/edit.

