MYP/3D Science Unit Planner

Marietta City Schools

Grade & Course: Physics	**Topic:** Newton's Laws	**Duration:** 6 weeks
Teachers: Physics PLC Teachers		

Georgia Standards and Content:

SP2. Obtain, evaluate, and communicate information about how forces affect the motion of objects. a. Construct an explanation based on evidence using Newton's Laws of how forces affect the acceleration of a body.
Explain and predict the motion of a body in absence of a force and when forces are applied using Newton's 1st Law (principle of inertia).
a. Calculate the acceleration for an object using Newton's 2nd Law, including situations where multiple forces act together.
Identify the pair of equal and opposite forces between two interacting bodies and relate their magnitudes and directions using Newton's 3rd Law.
b. Develop and use a model of a Free Body Diagram to represent the forces acting on an object (both equilibrium and non-equilibrium).
c. Use mathematical representations to calculate magnitudes and vector components for typical forces including gravitational force, normal force, friction forces, tension forces, and spring forces.
d. Plan and carry out an investigation to gather evidence to identify the force or force component responsible for causing an object to move along a circular path. Calculate the magnitude of a centripetal acceleration.
e. Develop and use a model to describe the mathematical relationship between mass, distance, and force as expressed by Newton's Universal Law of Gravitation.

Narrative / Background Information

Prior Student Knowledge: (REFLECTION – PRIOR TO TEACHING THE UNIT)

Basic knowledge of forces and acceleration
Basic F=ma calculation (using triangle method)
Basic overview of Newton's 3 laws

Year-Long Anchoring Phenomena: (LEARNING PROCESS)

The laws of physics dictate the interactions of our physical world.

Unit Phenomena (LEARNING PROCESS)

Sledding Inertia: A kid on a sled being pulled rapidly will not move with the sled (the kid will fall off) unless the force of friction is large enough.

MYP Inquiry Statement:

The relationships between interacting objects cause changes in their motion that can be used to discover their intrinsic properties.

MYP Global Context:
Scientific and Technical Innovation

Approaches to Learning Skills:
Research Skills
Thinking Skills
Collaboration Skills
Communication Skills

Disciplinary Core Ideas: (KNOWLEDGE & SKILLS)
Laws of Motion
Free Body Diagrams
Acceleration
Friction
Universal Gravitation

Crosscutting Concepts: (KNOWLEDGE & SKILLS)
Patterns (CC)
Matter & Energy (CC)
Structure & Function (CC)
Stability & Change (CC & MYP)

MYP Key and Related Concepts:
Stability & Change (CC & MYP)

Select one or more RC:

Movement & Evidence (MYP)
Patterns (CC)
Matter & Energy (CC)
Structure & Function (CC)

Possible Preconceptions/Misconceptions: (REFLECTION – PRIOR TO TEACHING THE UNIT)
Misconception: Newton's 3rd law causes forces to cancel out making objects not move.
Cannot correctly identify reaction forces.
Identifying Normal Force.
Misconception: Mass and weight are the same thing.

Key Vocabulary: (KNOWLEDGE & SKILLS)

Forces
Free Body Diagrams
Mass and Weight
Inertia
Normal Force, Force of Friction, Force of Gravity
Coefficient of Friction

Inquiry Questions:

Factual

What force attracts all masses together?

What is Inertia?
What direction does friction go?

Conceptual

What is the difference between mass and weight?
What factors affect the force of friction?

Debatable

Is Newton's First Law Redundant?

MYP Objectives	Summative assessment	
MYP A **MYP B** **MYP C** **MYP D**	Formative Friction Lab: MYP B+C Formative Collision Lab: MYP B+C Summative MYP B+C Lab Summative MYP D: Perpetual Motion Newton Summative Test: MYP A	Relationship between summative assessment task(s) and statement of inquiry: The assessments measure how well students can determine net forces that result in changes in their motion, direction, and total momentum.

Unit Objectives: Newton's Laws Need to Know - https://docs.google.com/document/d/17sCV574hizuy073Qny-eADDd7HB0926C4AqJ_cOWe10/edit?usp=sharing

Learning Activities and Experiences	Inquiry & Obtain: (LEARNING PROCESS)	Evaluate: (LEARNING PROCESS)	Communicate: (LEARNING PROCESS)

Week 1:	Station rotation examining Newton's 3 laws. Students will pull a piece of paper out from underneath a stack of blocks, launch carts of different masses, and gently push each other while sitting in a rolling chair.	Students identify which of Newton's law best applies to each scenario and calculate the acceleration of the object and identity forces involved.	Students will record their observations, calculation, and answers on a graphic organizer. They will then discuss solutions in groups of 3 before sharing as a whole class.
Week 2:	Students observe low friction carts being pulled in both directions by hanging masses. Students observe the needed force to pull an object with different masses applied on top of it and over different surfaces.	Students collect data over the motion of the carts to calculate their acceleration. Students record the force of friction resisting the motion of the objects and the normal force being applied to analyze through calculation and graphical analysis the coefficient of friction between the surfaces.	Students will show their calculations on white boards to use in a gallery walk for peer feedback. Students will show calculations and final graphical results to determine the coefficient of friction on white boards to use in a gallery walk for peer feedback.
Week 3:	Students will observe the difference between mass, weight, and normal force, by collecting data while moving up and down on an elevator.	Students will complete a series of practice problems where they compose the force equation for various scenarios and complete calculations for these scenarios as well, solving for the unknown force.	Students will communicate their knowledge through a card sort of various free body diagrams and a CER.
Week 4 & 5:	Students will observe 4 objects under conditions of high/low mass and high/low friction. Students will observe athletes dragging a heaving mass.	Students will analyze these 4 objects to determine the impact that mass and roughness have on the force of friction. Students will compare the difference in the motion of the 2 athletes' application of force on the object.	Students will take their understanding and apply it to different objects and scenarios and answer questions about these new objects' motion. Students will answer questions about the free body diagrams representing the 2 athletes.

Week 6: Remediation	Students complete a review quiz to diagnose strengths and weaknesses in the content.	Students complete review activities based upon quiz results.	Summative Assessment

Resources (hyperlink to model lessons and/or resources):

Discovery Education Science Techbook

Newton's Laws Schoology Unit: https://marietta.schoology.com/group/1606049999/materials#/group/1606049999/materials?f=63015529

Momentum and Impulse Schoology Unit:
https://marietta.schoology.com/group/1606049999/materials#/group/1606049999/materials?f=63015723

Reflection: Considering the planning, process and impact of the inquiry

Prior to teaching the unit	During teaching	After teaching the unit
PLC members planned together and shared resources to prepare for teaching the unit as well as creating CFA and CSA materials before the unit is taught.	PLC members discussed strategies that worked and did not work, discussed CFA and CSA results and the questions where students performed below the set goal (70% passing).	Collaborated on updating information From the unit and how we can Improve next year.