FRANKLIN-SIMPSON HIGH SCHOOL

Course Name: Physics **Unit Name:** **Forces and Newton's Laws**

Quality Core Objectives:

Unit 3 Newton's Laws	
A.1. Scientific Inquiry	a. Identify and clarify research questions and design experiments
	b. Design experiments with controlled variables and appropriate numbers of trials
	c. Collect, organize, and analyze data accurately and use appropriate techniques and devices
	d. Interpret results and draw conclusions, revising hypotheses as necessary and/or formulating additional questions or explanations
	e. Write and speak effectively to present and explain scientific results, using appropriate terminology and graphics
	f. Safely use laboratory equipment and techniques when conducting scientific investigations
	g. Routinely make predictions and estimations
A.2. Mathematics and Measurement in Science	a. Distinguish between precision and accuracy with respect to experimental data
	b. Use appropriate SI units for length, mass, time, temperature, area, volume, and density; describe the relationships among SI unit prefixes (e.g., centi-, milli-, kilo-) and how to convert between English units and SI units
	d. Calculate/estimate, using significant figures, the uncertainty in experimental results, and use the uncertainty to evaluate and interpret results
	f. Solve for unknown quantities by manipulating variables
	g. Use graphical, mathematical, and/or statistical models to express patterns and relationships inferred from sets of scientific data
A.3. Science in Practice	e. Explain why all scientific knowledge is subject to change as new evidence becomes available to the scientific community
B.5. Newton's Laws	a. Describe the condition under which a body under the influence of several forces will remain at rest or in a state of unaccelerated motion

	b. Contrast mass and weight
	c. Calculate, for a body initially moving in a straight line at a constant speed, the net change in the velocity of the body that will result when a constant net force is applied to the body for a given amount of time
	d. Draw a free-body diagram, and write a vector equation for a body in the form of Newton's second law
	e. Write an equation that describes the dependence of the frictional force between a body and a surface on the normal force exerted on the surface by the body, and explain the meaning of the coefficient of friction
	f. Use Newton's third law to identify action-reaction pairs; for each pair, identify the body on which the reaction force acts and determine the magnitude and direction of the reaction force

Purpose of the Unit:

In this unit students will explore forces through Newton's 3 laws. Students will understand how forces combine to provide the motion that we see every day. This unit emphasizes identifying all forces, including ones that most students are unaware of. This unit will also explore the concept of friction and its presence in our everyday lives.

Prerequisites:

Students will need to have an understanding of vectors and vector addition, which was taught in Unit 2. Students will also need to have a basic understanding of the concepts of acceleration, mass, and velocity.

Daily Lesson Guide

Day	Lesson Content and Objectives	Focus Questions	Critical Thinking (High Yield / Literacy /LTF/etc.)	Engagement	Assessment and/or Accommodations
1	**B.5.a** **Students will be able to rank objects based on their amount of inertia.**	**Why do objects move without a force?** **What factors determine how much inertia an object has?**	• Learning with others • Authenticity • Novelty • Evaluation • Analysis • Generating and Testing Hypothesis	Bellringer: Students were given a list of words and were asked to choose one that did not belong Students participated in several demonstrations including one where they tried to yank a strip of paper from under a pen and another where they hit me with a sledgehammer	• Students were asked to complete a ranking task for a number of items based on how much inertia they had Accommodations: extended time, prompting and cueing, reader, scribe, paraphrasing, use of technology as needed.
2	**B.5.a** Students will be able to describe a system of forces which result in no acceleration Calculate the force required to accelerate a given mass	**What stops objects from falling?** **How can forces be balanced if gravity is always present?**	• Learning with others • Authenticity • Novelty • Generating and Testing Hypothesis • Comparing and Contrasting • Evaluation	Students will be asked to predict which will move further, a bowling ball or ping-pong ball	Students used clickers to answer questions about balancing forces Students were given a homework assignment asking them to apply Newton's 2nd law of motion. Accommodations: extended time, prompting and cueing, reader, scribe, paraphrasing, use of technology as

					needed.
3	**B.5.b** Students will be find the weight of a mass given its position Students will be able to differentiate between weight and mass	**Are weight and mass the same thing?** **How can we change an object's weight?** **Can we change an object's mass?**	• Learning with others • Authenticity • Novelty • Evaluation • Analysis • Generating and Testing Hypothesis	Students will participate in a "agree or disagree" activity where they will either agree or disagree with three statements about weight and mass. After deciding, students will go to a side of the room and will explain their reasoning behind their decisions	Students will complete a ranking task where they are asked to rank various object's weights which are located in various places in the solar system. Accommodations: extended time, prompting and cueing, reader, scribe, paraphrasing, use of technology as needed.
4	**B.5.d** Students will be able to draw a free body diagram Students will be able to use a free body diagram to determine the net force on an object.	**How do we determine a net force?** **How do forces add together?**	• Non-linguistic representation • Novelty • Analysis • Generating and testing hypothesis	Students will be asked to draw humorous scenarios.	Students will answer an ACT-like multiple choice question Accommodations: extended time, prompting and cueing, reader, scribe, paraphrasing, use of technology as needed.
	B.5.d Students will be able	**How do we determine a net force?**	• Non-linguistic representation • Novelty • Analysis • Authenticity	Students will design a car and define basic properties of	Students will submit their drawings of their car in along with their resulting net force.

5	to draw free body diagram with at least 3 forces acting on it Students will be able to determine the net force of a system with at least 3 forces	**How do forces add together**	• Creativity	the car. Students will then hand their car to another group and that group will smash it with at least 3 forces.	Accommodations: extended time, prompting and cueing, reader, scribe, paraphrasing, use of technology as needed.
6	**B.5.e** Students will be able to compare various surfaces and determine which sufarce will provide the most friction.	**What causes objects to stop moving?** **How does an object's surface affect its friction?**	• Learning with others • Authenticity • Evaluation • Analysis • Generating and Testing Hypothesis	Students will design and conduct an experiment to determine which of three materials will have the most friction.	Students will submit a lab report which will include a hypothesis, data, and a conclusion. Students will answer a clicker question predicting which of four surfaces would have the most friction. Accommodations: extended time, prompting and cueing, reader, scribe, paraphrasing, use of technology as needed.
7	**B.5.e** Students will be able to calculate kinetic frictional forces when given a coefficient of kinetic friction between two surfaces.	**What causes objects to stop moving?** **How does an object's surface affect its friction?**	• Learning with others • Authenticity • Evaluation • Novelty • Generating and Testing Hypothesis	Students will observe demonstrations on frictional forces. Students will apply coefficients of friction to road safety.	Students will complete a ranking task where they rank a number of objects based on the amount of frictional force that they feel as an exit slip Accommodations: extended time, prompting and cueing, reader, scribe, paraphrasing, use of technology as needed.

8	**B.5.e** Students will be able to calculate static frictional forces when given a coefficient of static friction between two surfaces.	**What causes objects to stop moving?** **How does an object's surface affect its friction?**	• Learning with others • Authenticity • Evaluation • Novelty • Generating and Testing Hypothesis	Students will watch a clip of Mythbusters, where they attempt to pull two phone books apart using a car, but can't	Students will complete a ranking task where they rank a number of objects based on the amount of static frictional force that they feel as an exit slip. Accommodations: extended time, prompting and cueing, reader, scribe, paraphrasing, use of technology as needed.
9	**B.5.f** Students will be able to identify action-reaction pairs using Newton's 3rd Law Students will be able to apply Newton's 3rd law in the explanation of the mechanism of propulsion behind a rocket.	**How do objects "Push back"?** **How do rockets work?**	• Learning with others • Authenticity • Novelty • Generating and Testing Hypothesis	Students will watch a clip of a rocket blasting off and hypothesize what makes it move? Students will compare a balloon to a rocket	Students will identify action-reaction pairs through the use of 2 clicker questions as an exit slip. Accommodations: extended time, prompting and cueing, reader, scribe, paraphrasing, use of technology as needed.
10	**B.5.f** Students will design a device which will help diminish the force felt on an egg	**What kind of design would protect an egg?** **How can we optimize our**	• Learning with others • Authenticity • Novelty • Evaluation • Creativity and Design • Generating and Testing Hypothesis	Students will build a device for an egg drop.	Students will be assessed on their ability to prevent the egg from breaking when it is dropped from the top of the football stadium.

	which is dropped.	**design, with our limited materials?**			
11	**B.5.f** Students will design a device which will help diminish the force felt on an egg which is dropped.	**What kind of design would protect an egg?** **How can we optimize our design, with our limited materials?**	• Learning with others • Authenticity • Novelty • Evaluation • Creativity and Design • Generating and Testing Hypothesis	Students will build a device for an egg drop.	Students will be assessed on their ability to prevent the egg from breaking when it is dropped from the top of the football stadium.