ipdae INSTITUTE FOR THE PROFESSIONAL DEVELOPMENT OF ADULT EDUCATORS

GED® Preparation Lesson Plan

Module: Science

Lesson Title: Looking for Newton

Standards: GED® Preparation (Adult General Education)

Florida GED® Science Standards	Science Practices

• Explain the relationship of work, motion, and forces (P.2)
  ○ Speed, velocity, acceleration, momentum, and collisions (e.g., inertia in a car accident, momentum transfer between two objects) (P.2.a)
  ○ Force, Newton's Laws, gravity, acceleration due to gravity (e.g., freefall, law of gravitational attraction), mass and weight (P.2.b)
	• Comprehending Scientific Presentations (SP.1)
	  ○ Understand and explain textual scientific presentations (SP.1.a)
	• Scientific Theories (SP.7)
	  ○ Understand and apply scientific models, theories, and processes (SP.7.a)

Objectives of the Lesson

Students will:

- Define Newton's Three Laws of Motion
- Understand specific scientific vocabulary
- Provide examples of each of Newton's three laws as they occur in everyday experiences

Materials

- Handout A: Applying Newton's Laws of Motion
- Handout B: Which Law of Motion Is It?
- Handout C: Which of Law of Motion Is It? (Template)
- Handout D: Answer Key Which Law of Motion Is It?
- Envelopes with sample activities of each law (Handout B divided into separate strips – one strip for each activity)
- Chart paper/board and markers
- Computer with internet access and projector

Instructional Plan

Overview

In this lesson, students will have the opportunity to gain a better understanding of Newton's Three Laws of Motion and how they apply to real-world situations.

A scripted PowerPoint presentation accompanies this lesson plan. Each of Newton's Laws of Motion should be taught separately using the PowerPoint presentation materials. The presentation provides an introduction to each of the laws, as well as activities to assist students in synthesizing the information and applying each of the laws to different real-world experiences. An introductory video by Arpan Jolly and three videos from the *Science of NFL*, a 10-part video series funded by the National Science Foundation, are included within the lesson, as well as selected online instructional and assessment materials from *The Physics Classroom*. An introduction to each of the three laws is included in the following sections of the lesson plan.

Process

You may wish to begin this lesson by dropping an apple onto the ground. Share with students the story about Sir Isaac Newton and the apple falling from the tree. Although the story is not based in fact, it is a well-known tale about Newton and the "discovery of gravity." Although the story about the discovery of gravity is not true, Newton was responsible for identifying numerous scientific laws.

Access the PowerPoint and share with students some basic information on Sir Isaac Newton. You may wish to have students research Newton and his life. Show the short video *The Best Idea Ever!* Discuss that Sir Isaac Newton worked in many areas of mathematics and physics. He developed the theories of gravitation in 1666 when he was only 23 years old. In 1686, he presented his three laws of motion. These physical principles that were discovered almost 350 years ago, explain how an aircraft flies and much, much more. They are a basic part of our physical world.

Newton's First Law of Motion

Write Newton's First Law of Motion on the board or show the appropriate PowerPoint slide.
"An object at rest stays at rest and an object in motion stays in motion with the same speed and in the same direction unless acted upon by an unbalanced force."

Share with students that this law simply means that objects keep on doing what they're doing! (Law of Inertia)

Demonstrate Newton's First Law of Motion by using a sheet of printer paper and placing a few heavier (non-breakable) objects on it. Quickly pull the paper out from under the objects.

Using the PowerPoint presentation, provide students with the basics of the First Law. The PowerPoint is designed to provide the definition of the law, basic definitions and examples, a video applying the law to NFL football, and an additional website to explore. The slides include notes to assist you in presenting the information.

Newton's Second Law of Motion

Write Newton's Second Law of Motion on the board or show the appropriate PowerPoint slide.
"The relationship between an object's mass *m*, its acceleration a, and the applied force *F* is F = ma."
Although the formula can be confusing, this law means that if a force acts on an object, it causes it to accelerate. The more force applied, the more quickly something accelerations.

Demonstrate Newton's Second Law of Motion by dropping a rock or marble and wadded-up piece of paper at the same time. Both items fall at an equal rate—their acceleration is constant due to the force of gravity acting on them. However, the rock has a much greater force of impact when it hits the ground, because of its greater mass. If you drop the two objects into a dish of sand or flour, you can see how different the force of impact for each object is, based on the crater made.

Using the PowerPoint presentation, provide students with the basics of the Second Law. The PowerPoint is designed to provide the definition of the law, basic definitions and examples, a video applying the law to NFL football, and an additional website to explore. The slides include notes to assist you in presenting the information.

Newton's Third Law of Motion - You Can't Touch Without Being Touched

Write Newton's Third Law of Motion on the board or show the appropriate PowerPoint slide.

"For every action, there is an equal and opposite reaction."

Demonstrate Newton's Third Law of Motion by sitting in a chair with wheels and your feet off the ground. With two hands, throw a basketball to someone standing a few feet away. This action should cause the chair to move backwards in the opposite direction of the throw. Ask students to describe what they saw. Then explain that this was a demonstration of Isaac Newton's Third Law of Motion – for every action there is an equal and opposite reaction.

Using the PowerPoint presentation, provide students with the basics of the Third Law. The PowerPoint is designed to provide the definition of the law, basic definitions and examples, a video applying the law to NFL football, and an additional website to explore. The slides include notes to assist you in presenting the information.

Sample Debriefing Questions

- What are Newton's Laws of Motion?
- What is inertia?
- How long will an object remain at rest, according to Newton's First Law of Motion?
- What are actions and reactions?
- What is force?
- Is speed different than acceleration? Explain.
- Why are we able to walk on the ground rather than float off into space?
- Where do Newton's Laws show up in our daily life?
- What is one example of each law that you can see in our classroom?

Modifications for Different Levels

To modify instruction, use the videos on Newton's Three Laws of Motions from StudyJams. Each video is followed by a short assessment.

- Force and Motion - Newton's First Law: Inertia; Newton's Second Law: Acceleration; Newton's Third Law: Action and Reaction. *StudyJams* http://studyjams.scholastic.com/studyjams/jams/science/index.htm

You may also wish to modify the readings for students whose reading skills are not at the GED® Preparation level. Instead of having them access *The Physics Classroom*, have them read about Newton and his Three Laws of Motion from one of the following sites:

- Newsela (select the appropriate reading level) – Inventors and Scientists: Sir Isaac Newton https://newsela.com/read/BHP-U2-4-IsaacNewton/id/15778
- Newton's Laws of Motion by Georgia Louviere, Rice University Teacher Tech Institute http://teachertech.rice.edu/Participants/louviere/Newton/

To modify the assessment tool, have students complete **Handout A: Applying Newton's Laws of Motion**.

Assessments/Extensions

Have students answer questions that you select from the various assessment tools from the *The Physics Classroom* at: http://www.physicsclassroom.com/curriculum/newtlaws/Newtons-Laws-Packet. This packet is aligned with the online resources that students read as part of the lessons on each of the Laws of Motion.

Another assessment tool is to divide the class into small groups. Give each group chart paper that is divided into three columns or provide each group with a copy of **Handout C: Which Law of Motion Is It?** Provide each group with an envelope in which you have placed strips with each of the sample activities provided in **Handout B: Which Law of Motion Is It?**.

Have students match each of the activities to the correct law. Have students share their results with the class and support their reasons for selecting a specific law, especially if there is a disagreement.

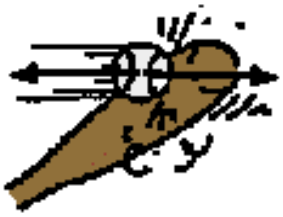
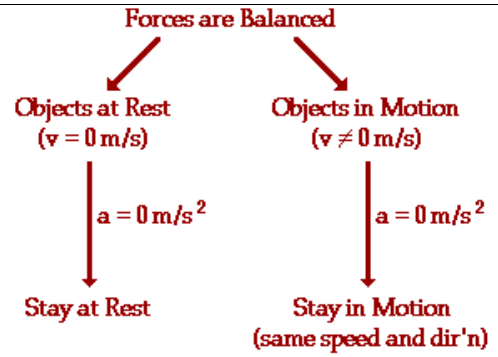
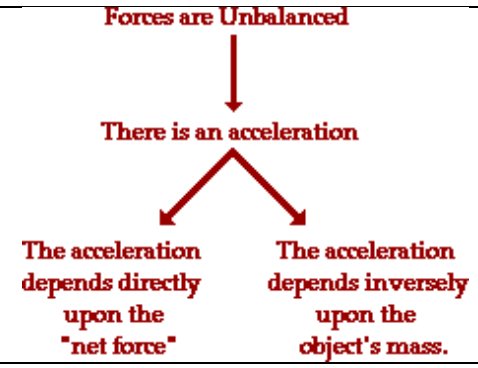
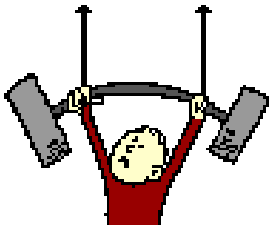
Applying Newton's Laws of Motion

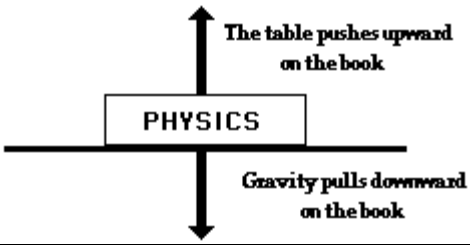
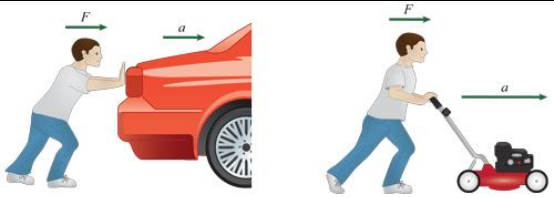
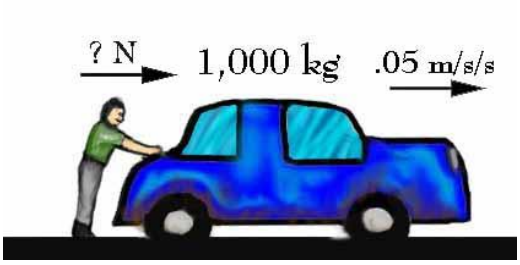
Newton's Laws of Motion	Write the law here in your own words	Provide a real-world example of the law
First Law		
Second Law		
Third Law		

Sample Answer Key - Applying Newton's Laws of Motion

Newton's Laws of Motion	Write the law here in your own words	Provide a real-world example of the law
First Law	Law of inertia, which means something stays the way it is unless there is a force that makes it change.	When driving to work, a purse is sitting on the passenger seat falls .
Second Law	F = ma, which means that if force is applied to something it moves. How quickly it moves, depends on much force is applied.	It's easier to push an empty shopping cart than one which is full of groceries.
Third Law	For every action there is an equal and opposite reaction.	When you push on a door and it pushes back.

Which Law of Motion Is It?

	To dislodge ketchup from the bottom of a ketchup bottle, the bottle is often turned upside down, thrust downward at a high seed and then abruptly halted.
F = ma	Balls of different sizes and weights travel different distances when thrown.
	
The force of gravity on an individual walking down a steep hill.	Newton's law that supports the wearing of a seatbelt.
	

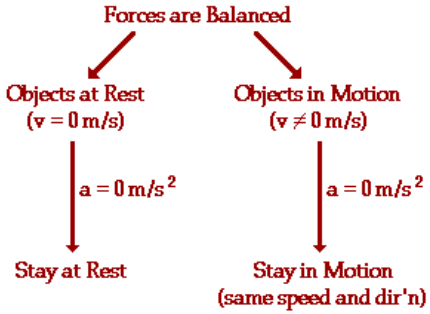
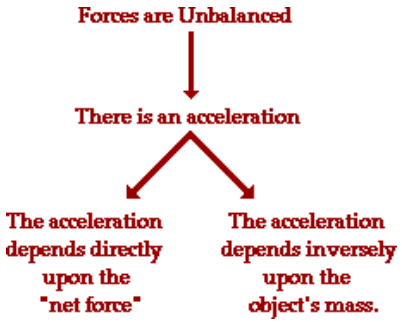
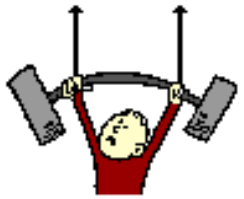
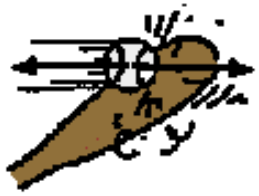
	
	
A large roller coaster is rapidly accelerating while it is going through curves, turns, and twists and yet it stays on the track.	Bonnie is holding a cup full of coffee as she walks around the room talking. Not a drop is spilled.
A car accelerates faster than a truck.	A fish that is swimming in the lake or a bird that is flying in the air.
A rocket accelerates in space.	While driving, you notice a bug striking the windshield of the car.
A car comes to a sudden stop, but all of the passengers continue to move forward.	A magician pulls the tablecloth out from under a table full of dishes.

Handout C

Which Law of Motion Is It?

Newton's First Law of Motion	Newton's Second Law of Motion	Newton's Third Law of Motion

Answer Key: Which Law of Motion Is It?

Newton's First Law of Motion	Newton's Second Law of Motion	Newton's Third Law of Motion
		
A car comes to a sudden stop, but all of the passengers continue to move forward.	**F = ma**	
A magician pulls the tablecloth out from under a table full of dishes	Balls of different sizes and weights travel different distances when thrown.	
Newton's law that supports the wearing of a seatbelt.		
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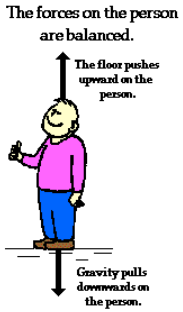
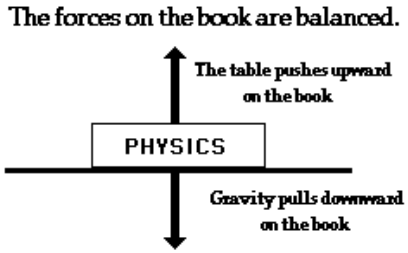
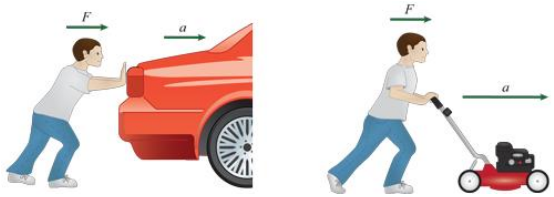
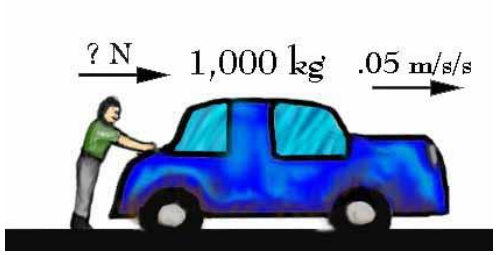
Bonnie is holding a cup full of coffee as she walks around the room talking. Not a drop is spilled.   	The force of gravity on an individual walking down a steep hill. A car accelerates faster than a truck.   	A fish that is swimming in the lake or a bird that is flying in the air. While driving, you notice a bug striking the windshield of the car. A rocket accelerates in space.