MINNESOTA Literacy COUNCIL
Sharing the Power of Learning

Lesson 2.10: Physical Science – Review of Newton's Laws of Motion

Weekly Focus: Reading for Comprehension
Weekly Skill: Review Newton's Laws of Motion

Lesson Summary: This week students will continue the study in the areas of forces and review last week's discussion of Newton's Laws of Motion. Students will apply knowledge they have gained in the last few lessons.

Materials Needed:

- Apply Newton's Laws of Motions **Unit 2.10 Handout 1**
- Reading for comprehension: **Unit 2.10 Handout 2** (Spectrum Science, Grade 6, "On a Roll," pages 32-33)
- If teacher chooses to do experiment at the end of **Unit 2.10 Handout 2**, you will need: 2 or 3 uncooked eggs & 2 or 3 hardboiled eggs
- Extra Work/ Homework: **Unit 2.10 Handout 3** (Spectrum Science, Grade 6, "Taking to the Skies," pages 36-37)

Objectives: Students will be able to…

- Apply an understanding of Newton's Laws of Motion
- Answer comprehension questions about Newton's Laws of Motion

College and Career Readiness Standards: RI, RST, WHST, SL

ACES Skills Addressed: EC, LS, ALS, CT, SM, N

Notes: Please review and be familiar with classroom routine notes for: reading for fluency strategies (**Routine 2**), summarizing techniques (**Routine 4**), and self-management skills (**Routine 1**). The notes will help with making a smooth transition to each activity.

GED 2014 Science Test Overview – For Teachers and Students

The GED Science Test will be 90 minutes long and include approximately 34 questions with a total score value of 40. The questions will have focus on three content areas: life science (~40%), physical science (~40%), and Earth and space science (~20%). Students may be asked to read, analyze, understand, and extract information from a scientific reading, a news brief, a diagram, graph, table, or other material with scientific data and concepts or ideas.

The online test may consist of multiple choice, drop down menu, and fill-in-the-blank questions. There will also be a short answer portion (suggested 10 minutes) where students

may have to summarize, find evidence (supporting details), and reason or make a conclusion from the information (data) presented.

The work students are doing in class will help them with the GED Science Test. They are also learning skills that will help in many other areas of their lives.

Activities:

Warm-Up: Newton's Laws of Motion	**Time: 10 - 15 minutes**
Today's lesson involves a review of some aspects of Newton's Laws of Motion. Write *"What are Newton's Laws of Motion and everyday examples of each?"* on the board. Have students write in their notebooks from what they remember of the last two lessons. Circulate the room to help students with some of the previous material. If there are new students or students who missed the pervious lessons, this is a good opportunity to give them some of the reading passages from units 2.8 and 2.9 to get some background knowledge.	

Activity 1: Review and Identifying Newton's Laws of Motion (Unit 2.10 Handout 1)	**Time: 40 - 45 minutes**
1) Distribute the handout **(Unit 2.10 Handout 1)** to students. **2)** Explain to students that the purpose of this activity is for them to review and apply the knowledge they have gained over the last few units about forces and Newton's Laws of Motion. The first two pages are a review of Newton's Laws of Motion. The following pages are ways to apply the laws to real-life situations. **3)** Students are able to use their notes from previous lessons to fill in the charts. **4)** Circulate while students are working on this. Have them think about what they remember about each Law of Motion and how it can be applied to the illustrations and charts. **5)** Review answers as a whole class. Ask students to point out the evidence (proof) from the reading that led them to the answer. **6)** Students who finish early should try to think of other real-life examples for each of Newton's Laws of Motion.	

Break: 10 minutes

Activity 2: Reading Comprehension (Unit 2.10 Handout 2)	**Time: 40 – 50 minutes**
1) Distribute the handout **Unit 2.10 Handout 2** to students. **2)** Explain to students that the purpose of the reading passage is to review key vocabulary and concepts surrounding Newton's Laws of Motion. **3)** Ask students to review the title and count the number of paragraphs in the reading passage. Ask students how they know where a paragraph begins. Explain that it is important to know how to find a paragraph quickly as some test questions may ask students to refer to a certain paragraph. If you	

have an overhead, point to it and/or label the indents.
4) Explain to students they should read all of the paragraphs silently in order to answer the questions that follow. To help students find the main idea of the reading passage, remind them to think *"What are all of the paragraphs about?"* and *"What is the point that the author is trying to make?"*
5) While students are reading, circulate and discuss with students that when reading for comprehension, there are many strategies to use: read the title to predict what the reading is about; look at images, look at words in bold with their definitions on the left, while reading remember to ask "What is this all about?".
6) Review answers as a whole class. Ask students to point out the evidence (proof) from the reading that led them to the answer.
7) When students have finished reviewing their answers, take out the uncooked and hard-boiled eggs to try the "What's Next" section of the reading. It's a fun way to engage students in thinking about physical science with every day objects.
8) If there is extra time, have students read the passage in pairs to promote reading fluency. If there is extra time or to challenge students, they can write a 3 – 5 sentence summary of all of the material presented. Use Routine 4 Summarizing Techniques Handout.

Wrap-Up: Summarize	**Time: 5 minutes**
Have students turn to a partner (or write in their journals) about what they have learned today about energy. They may want to discuss some of the areas that they would like to do further study on in the future. Their summary may include any wonderings they have about the subject. *Note: Use Routine 4 Handout*	

Extra Work/Homework: Unit 2.10 Handout 3	**Time: 15 minutes outside of class**
Students can read and answer questions from the **Unit 2.10 handout 3** (2 pages total.) This is an excellent opportunity for students to review today's material in a different format.	

Differentiated Instruction/ELL Accommodation Suggestions	**Activity**
If some student groups finish early, they can turn their paper over and summarize the three Newton's Laws of Motion.	**Activity 1 Handout 1**
There may be a lot of new vocabulary and ideas for some students, be prepared to assist by circulating while they are reading.	**Activity 1 & 2**

Online Resources:

Online Quiz of Newton's Laws of Motion

If students are able to have access to the Internet, there are some online quizzes for them to check on their knowledge of Newton's Laws of Motion. The online component may help with digital literacy skills needed for GED 2014.

http://www.softschools.com/quizzes/science/newtons_laws/quiz384.html

http://www.proprofs.com/quiz-school/story.php?title=laws-motion-quiz

Suggested Teacher Readings:

- GED Testing Service – GED Science Item Sample (to get an idea of what the test *may* be like)

  http://www.gedtestingservice.com/itemsamplerscience/

- Assessment Guide for Educators: A guide to the 2014 assessment content from GED Testing Service:

  http://www.riaepdc.org/Documents/ALALBAASSESSMENT%20GUIDE%20CHAPTER%203.pdf

- Minnesota is getting ready for the 2014 GED test! – website with updated information on the professional development in Minnesota regarding the 2014 GED.

  http://abe.mpls.k12.mn.us/ged_2014_2

Unit 2.10 Handout 1 (6 pages total)

Force and Motion

Brief #5: Newton's Laws of Motion

Focus

Sir Isaac Newton's laws explain the relationship between forces and motion.

Sir Isaac Newton was a scientist who lived in the 17th century in England. In 1686 he published a book called *Principia.* In this book, he describes how motion and force are connected. He outlined three basic laws of motion.

He did not discover these things, but he was the first scientist to fully explain the behavior of forces and motion. Sir Isaac Newton is considered one of the most important scientists who ever lived.

Sir Isaac Newton

First Law of Motion

An object will stay at rest or in motion at a constant speed unless acted upon by an unbalanced force.

You can easily demonstrate the first part to this law right at your desk. Place a pencil in front of you. You can see that it is just resting there on your desk. And if no force acts on it, it will continue to rest there forever. But if you push the pencil off of the desk, it will fall to the ground. Your hand pushing the pencil is the unbalanced force that has acted on the pencil.

But what about the second part of Newton's first law? Imagine throwing a baseball. You can predict with 100% accuracy what will eventually happen to the ball. It will fall to the ground because of the force of gravity. But what if we threw that ball out in space where there is no gravity? Newton's first law states that the ball would keep going and going at a constant speed unless another force came along and acted upon it.

Vocabulary

1. inertia
2. momentum

This law of motion is often called the law of inertia. **Inertia means that an object tends to resist a change in its motion.** In other words, an object at rest will tend to stay at rest, and an object in motion will tend to stay that way too unless some force comes along to change it. The more mass an object has, the greater its inertia.

Force and Motion

Brief #5: Newton's Laws of Motion *(cont.)*

Second Law of Motion

> The acceleration of an object depends on the mass of the object and the strength of the force applied to it.

To understand Newton's second law, let's pretend that you are grocery shopping with a friend in preparation for a large party. You both are pushing shopping carts. In your cart you have all of the paper and plastic goods: the plates, napkins, forks, knives, and spoons. In your friend's cart are 10 cases of canned soda. Who has to push harder to get the cart to move forward? If you guessed your friend, then you are correct.

Newton's second law can be described as an equation: **acceleration = force ÷ mass.** When the force on an object increases, its acceleration will increase. When the force on an object decreases, its acceleration will decrease.

Third Law of Motion

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

This is probably Newton's most famous law of motion. It means that forces are found in pairs.

Let's imagine that you are playing basketball. You are accelerating toward the hoop, dribbling the ball as you go. When you get about one foot away from the basket, you prepare to jump and shoot. Your feet push down against the ground. This is called the action force. But the ground is also exerting an upward force. This is called the reaction force. The action and the reaction force are of equal strength.

Momentum

Momentum is related to Newton's third law. **Momentum can be described as the motion of mass.** All matter has mass. If that mass is moving, it also has momentum. Momentum depends upon the object's mass and velocity. Momentum can be described as an equation: **momentum = mass x velocity**. If an object has a large mass and velocity, it has large momentum.

Newton's third law tells us that if we wanted to stop an object with a lot of momentum, then we would need a force that was equal to or greater than the momentum of the object.

Name _____ Date _____

First Law of Motion

Newton's first law of motion states that an object at rest tends to stay at rest and an object in motion tends to stay in motion with the same speed and in the same direction unless acted upon by an unbalanced force. This is also known as **inertia**. Read each description. Then answer the questions.

1 Jonathon wants to put ketchup on his hamburger. He turns the ketchup bottle at an angle toward his plate and smacks the bottom of the bottle until the ketchup comes

What is the unbalanced force? _____

How does inertia affect the ketchup in the bottle? _____

2 The Jacksons are driving to the lake when a car in front of theirs slams on its brakes. Mrs. Jackson slams on her brakes, too. Everyone is wearing their seatbelts which stop them from being thrown forward in the car.

What is the unbalanced force? _____

How does inertia affect the each person in the Jackson car? _____

3 Terry is riding her skateboard. Suddenly one of the wheels hits a small rock and the skateboard stops. Terry stumbles forward off the skateboard, and catches her balance at the last moment before she falls to the ground.

What is the unbalanced force? _____

How does inertia affect Terry and her skateboard? _____

4 Jack is carrying a cup of water. He doesn't see a wrinkle in the floor rug and he trips. Jack manages not to fall or drop the cup, but the water sloshes over the side of the cup and onto the floor.

What is the unbalanced force? _____

What keeps moving? _____

Name _____ Date _____

Second Law of Motion

Newton's second law of motion states that acceleration is produced when a force acts on a mass. The greater the mass of the object to be accelerated the greater the amount of force needed to accelerate the object. Each of the following situations demonstrates Newton's second law. Describe how the difference in mass will affect the force needed to change the acceleration..

1. Amy weighs 78 pounds and her dad weighs 187 pounds. They are rollerskating. Amy challenges her dad to a race. They are equally strong. They stand poised at a starting line. Explain who will win?

2. Tony and Jose play on the football team. Tony weighs more than Jose. During practice, Tony and Jose practice blocking on a tackle dummy. Both boys start from the same place and position. Each tackle dummy has the same mass. At the same speed, the boys run forward into the dummy. What is their affect on the dummy?

3. Two vehicles are broken down on the side of the road. One is a small sports car. The other is a delivery truck. The drivers need to push the vehicles forward and onto the shoulder of the road. Both drivers can push with the same amount of force. Who will get their car off the road first?

Name _____ Date _____

Third Law of Motion

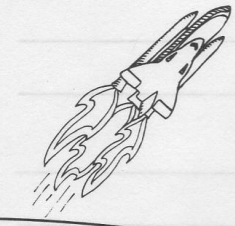
Newton's third law states that for every action, there is an equal and opposite reaction. For each situation, describe the action and the reaction.

1 A boy and girl on roller skates stand facing each other. The girl puts her arms out and pushes away from the boy.	Action: _____ _____ _____ Reaction: _____ _____ _____
2 A golfer swings her club down to hit a golf ball on a tee.	Action: _____ _____ _____ Reaction: _____ _____ _____
3 A frog sits on a lily pad in the middle of a pond. Suddenly it makes a leap pushing off the lily pad.	Action: _____ _____ _____ Reaction: _____ _____ _____

Name _____ Date _____

Identifying Newton's Laws

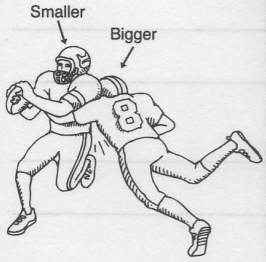
For each illustration, describe how the given laws affect the object's motion.



Earth

1. First Law of Motion: _____

2. Third Law of Motion: _____



3. Second Law of Motion: _____

4. Third Law of Motion: _____

5. First Law of Motion: _____

6. Third Law of Motion: _____

Unit 2.10 Handout 1

ANSWER KEY (two pages)

1. Newton's First Law of Motion

1. The force of smacking or hitting the bottle is greater than the force holding the ketchup inside. The ketchup keeps moving.

2. The force of the bodies travelling forward is greater than the force holding them in their seats. The bodies keep moving.

3. The force of the rock against the skateboard is greater than the force of the skateboard. The skateboarder keeps moving.

4. The force of tripping on the wrinkle is greater than the forward movement of his feet. Jack and water keep moving.

2. Newton's Second Law of Motion

1. Amy uses less mass so using the same amount of force, she will accelerate faster than her dad.

2. If they run at same speed, Tony (more mass) will hit the dummy with more force and cause it o accelerate faster.

3. Smaller car will accelerate faster than truck because smaller mass accelerates faster and requires less force to move the same acceleration.

3. Newton's Third Law of Motion

1. Action: Girl pushes boy. Reaction: Boy pushes back on her hands with equal force causing both kids to roll away.

2. Action: Golf club hits ball. Reaction: Ball hits back on the club (that's why clubs have cushions and shock absorbers to absorb the reaction force of impact.

3. Action: Frog legs push down on lily pad. Reaction: Lily pad pushes back on frog's legs allowing it to go forwards.

Unit 2.10 Handout 1

ANSWER KEY (two pages)

4. Identifying Newton's Laws

1. First Law of Motion: Rocket in motion will stay in motion unless gravity becomes greater than thrust.

2. Third Law of Motion: thrust of engines push down on Earth, Earth pushes back which allows shuttle to go upward.

3. Second Law of Motion: More massive player will hit with greater force

4. Third Law of Motion: Action – big player hits smaller player. Reaction – smaller player hits big player with equal force in opposite direction.

5. First Law of Motion: A boat in motion will stay in motion unless friction/gravity become greater.

6. Third Law of Motion: Action force – paddles push on water. Reaction force – water pushes back on paddles allowing boat to move.

Unit 2.10 Handout 2

On a Roll

TEACHER ANSWER KEY

1. **Answers may vary, suggested answer:**

Newton's law says that an object in motion will continue moving at the same speed unless it is acted upon by an outside force. In ta car accident, the impact would stop the car, but if you weren't buckled in, your body would fly through the air at a high speed.

2. **Answers may vary, suggested answer:**

If you kick a soccer ball, it will keep moving until friction with the ground and air molecules make it come to a stop.

3. **Answers may vary, suggested answer:**

A cup has rounded sides, so it rolls. Caleb needed to be able to mark the exact spot where the cup landed, so the boys needed to use an object that wouldn't roll.

4. **Answers may vary, suggested answer:**

When the skateboard hits the brick after gaining speed from rolling down the ramp, the skateboard will stop, but the box on top of it will continue moving.

Unit 2.10 Handout 3

Taking to the Skies

ANSWER KEY

1. lift, thrust
2. air pressure
3. thermals
4. food, muscles
5. feather
6. they are hollow
7. When a bird soars, it doesn't have to flap its wings, an action that uses up energy.
8. Lift causes a bird to rise in the air, and thrust causes it to move forward.
9. Possible answer: The down stroke of a bird's wings pushes it forward. The upstroke is angled so the bird doesn't just hover in place.