



Newton's Second Law of Motion

What I Will Be Learning In This Mastery Badge:

In this mastery badge we will learn about Newton's Second Law of Motion.

What This Packet Includes:

It is important that you complete all aspects of this packet so that you gain the knowledge and skills that we are working on.

I. **Discovering Lab**

A discovering lab is a fun, introductory lab, where we discover the knowledge on our own.

II. **Video Instruction**

You will watch a video presented by Mr. Bertoch, and answer questions about it.

III. **Literacy Practice**

Reading and writing are critical life skills, and also very important to science. You will read the assigned article and complete a writing prompt.

IV. **Applying Lab**

An applying lab is how you pass off the Mastery Badge. It serves as the quiz. It is a hands on demonstration that you have mastered the skills and content of this badge.

Key Things We Will Learn In This Mastery Badge

Some of the most important things we will learn in this mastery badge:

- Issac Newton
- The Laws of Motion
- The Second Law of Motion
- How do you calculate acceleration?
- How do you calculate force?
- What is the formula for force?
- Mass and Force affect the rate of acceleration.

Name: _____

Date: _____



Discovering Lab

Learning Through Hands On Activities



Activity: Discovering Newton's Second Law of Motion

Directions: Follow the directions below to learn about Newton's Second Law of Motion



Video Instructions Available For This Assignment. Watch this video to learn how to do this assignment, and why it is important.

Scan This QR Code To Watch Mr. Bertoch Give You Directions For This Assignment

Goal: To learn as much as you can about Newton's Second Law

Measuring The Impact of Force

Issac Newton's second law of motion explains how force and mass affect the acceleration of an object. In this lab we will test his theory and draw our own conclusions about how force and mass affect the movement of objects.

Supplies

For this lab you will need a rubber band, and several small balls of various sizes and weights. Golf balls, ping pong balls, baseballs, and marbles work well.

Applying Equal Force

In this lab, you will be applying a force to various objects and recording how far each object travels. In order to get accurate measurements, it is important that the exact same amount of force be applied to each object. This is very difficult to do with your hands. However, we can get consistent results by using a rubber band. In order to get accurate measurements, make sure that for each trial you hold the rubber band in the exact same way, and that you pull it back the exact same distance. This will ensure that the same amount of force is exerted on each object.

Recording Accurate Data

Good scientists are careful to collect accurate and unbiased data. It is not the job of the scientist to influence the outcome. Instead, we simply want to observe what happens, and then record and interpret the data accordingly.

Applying For To Several Objects

Select five different round objects (balls) of various sizes and weights. Place each ball on a hard surface and then launch them using a rubber band. Being careful to apply the exact same amount of force on each trial. Measure and record the distance that each ball travels.

Ball Mass	Trial 1	Trial 2	Trial 3
What is the mass of this ball?	How far did the ball travel on this trial?	How far did the ball travel on this trial?	How far did the ball travel on this trial?
What is the mass of this ball?	How far did the ball travel on this trial?	How far did the ball travel on this trial?	How far did the ball travel on this trial?
What is the mass of this ball?	How far did the ball travel on this trial?	How far did the ball travel on this trial?	How far did the ball travel on this trial?
What is the mass of this ball?	How far did the ball travel on this trial?	How far did the ball travel on this trial?	How far did the ball travel on this trial?
What is the mass of this ball?	How far did the ball travel on this trial?	How far did the ball travel on this trial?	How far did the ball travel on this trial?

Graph Your Data

Raw data is important to collect. However, it can be difficult to interpret. One tool that scientists use to identify patterns in data is to create a visual graph. There are many kinds of useful graphs in science and each type tells a different story. For this lab you will create a scatter plot.

Create a scatter plot with the mass of your objects on the side, and the distance they traveled across the bottom.

Analyze And Interpret Your Data

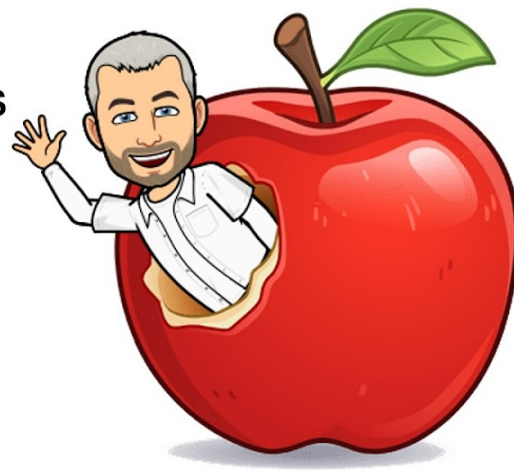
With your scatter plot completed you now have a tool that you can use to more easily identify patterns.

What patterns do you notice in your data?

Look over your data and identify any apparent patterns. There are no right or wrong answers. What matters is only that your answer is supported by your data. Is there any relationship between the mass and the distance that objects travel? Explain your answer.

Video Instruction

Reviewing The Teacher's Instruction At My Own Pace



Handsome Science Teacher One Take Videos

Now that you have completed the Discovering Lab let's watch the video that goes with it. In this video Mr. Bertoch will help connect the discoveries that you made during the lab to the broader concepts covered under this badge, and will also introduce the vocabulary that goes with these concept.

Take Your Time, Pause And Rewind As needed

You are not in a hurry! It is more important that you understand the concepts in this video than that you finish it quickly. Take your time. If you don't understand something, pause the video and use the Internet or other resources to look up the concept that has you confused.

When you finish this video, you should have a good understanding of the concepts that have been taught. If you find yourself confused, rewind, and rewatch.

The Video For This Mastery Badge Can Be Opened Using This QR Code

This Mastery Badge includes one video:



Watch The Assigned Science Video

Scan This QR Code To Open And Watch The Assigned Video For This Mastery Badge

Check Point

Let's make sure that you really did take your time and watch the video carefully! Remember that it is important to hold yourself accountable to a high standard and to take pride in your own success as a learner.

I watched the video carefully, and paused to look up anything I didn't understand.

Recording Your Learning

On the next page, you will record your learning and connect it to things you already know.

Ten Things I Learned From This Video

A powerful tool to help you retain what you learn is to take notes. Notes give you something that you can look back at later, to quickly remind your brain reinforcing the memories for the concepts you have learned. Record ten things that you learned or that you perhaps already knew that were discussed in this video.

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

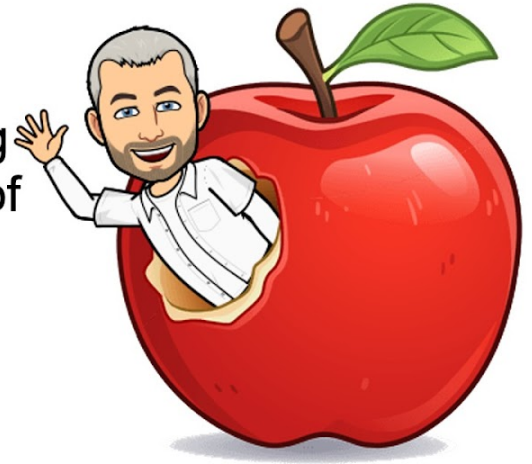
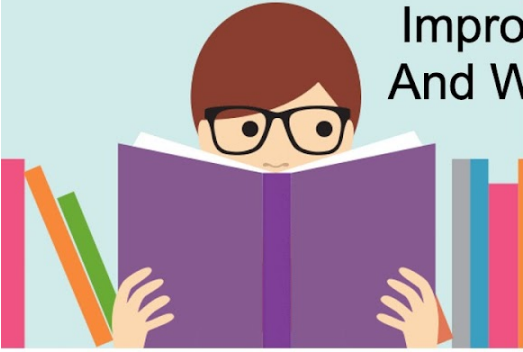
Now, Let's Connect These New Concepts To Things You Already Knew

Another great way to help your brain retain new things is to connect these new concepts to other things that you already know. This gives your mind a place to store the new knowledge. Imagine that you are placing the new knowledge on a shelf in your brain next to facts that are already in there.

Write a paragraph explaining how the concepts taught in this video relate to things you already knew. There are no wrong answers. What are some things that you already knew that this video reminded you of?

Literacy Practice

Improving Our Reading
And Writing In Search of
Knowledge



Activity: Reading And Writing About Lunar Phases

Directions: Reading and writing are very important life skills. Good scientists must be able to learn through reading and communicate their own discoveries through writing.



Video Instructions Available For This Assignment. Watch this video to learn how to do this assignment, and why it is important.

Scan This QR Code To Watch Mr. Bertoch Give You Directions For This Assignment

1. Practice Reading For Understanding

Read the article below **for understanding**. Reading for understanding means that you take your time and monitor your own learning. If you get to the end of a sentence and you do not remember or understand what you read, **re-read it**.

2. Practice Writing To Communicate

Complete the writing prompt below. Do your very best to write clearly so that others will understand what you are saying. This means using correct spelling, grammar, and writing, taking your time to think about the best ways to clearly communicate to others the main ideas that you are trying to get across to them.

Article:



Read The Assigned Article Carefully For Understanding.

<https://handsomescienceteacher.com/Online-science-classes-kids/newtons-second-law-of-motion/>

Scan This QR Code To Open And Read The Article That Goes With This Mastery Badge

Check Point

Let's make sure that you really did read for understanding! Remember that it is important to hold yourself accountable to a high standard and to take pride in your own success as a learner.

I Read For Understanding. I did not skim the article. I understood the material that the article discussed.

Quiz Time

Complete the quiz at the end of the article and post your score in the box below. Your goal is to get at least 75% on the quiz. Did you accomplish this goal?

%

Now Let's Write To Communicate

Remember that when you write to communicate you are taking your time, and explaining the topic in a detailed and concise way. Don't rush! You are not in a hurry. Think about what you are going to say, and plan how you will say it. So that someone else who reads your paragraphs will understand them easily.

Writing Prompt: Write two paragraphs in your own words explaining Issac Newton's Second Law of Motion.

Blank area for writing the response to the writing prompt.

Name: _____

Date: _____



Applying Lab

Proving That We Can Do It Ourselves



Directions: Answer each question below carefully.



Video Instructions Available For This Assignment. Watch this video to learn how to do this assignment, and why it is important.

Scan This QR Code To Watch Mr. Bertoch Give You Directions For This Assignment

Goal: To demonstrate your understanding of Newton's Second Law

Using Mathematics And Computational Thinking

Scientists use math to better understand and explain the things they observe in the natural world. Math is a very important part of science. In this lab you will be using the formula $F=ma$ to solve a variety of math problems.

$F=ma$ is an algebraic math equation and requires an understanding of algebra to solve. If you are confused about how to do this, it is okay to seek an adult's help in solving each problem.

Solve each of the following problems using Isaac Newton's Second Law of Motion.

$F=ma$ (f=force, m=mass, a=acceleration)

Show your work

If an object has a mass of 12 grams, and if it accelerates at a rate of 10 meters per second squared, how much force must have been applied to it?

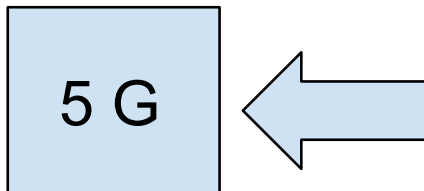
If an object has a mass of 6 g, and if it accelerates at a rate of 3 m/s^2 , how much force must have been applied to it?

If a force of 40 newtons is applied to an object that has a mass of 8 grams, how fast will that object accelerate?

If a force of 88 n is applied to an object that has a mass of 11 g, how fast will that object accelerate?

If a force of 24 newtons is applied to an object, and if that object then accelerates at a rate of 6 meters per second squared, then how much mass must the object have had?

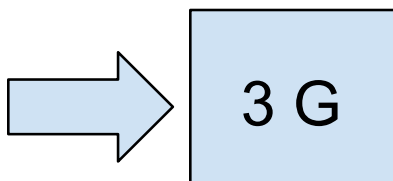
If a force of 16 n is applied to an object, and if that object then accelerates at a rate of 2 m/s^2 , then how much mass must the object have had?



5 m/s^2

Which direction will this object go? Hint: The arrow shows the direction it is being pushed.

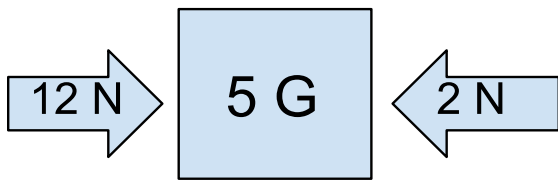
Calculate the force that was used to push this object. Notice that it is accelerating at a rate of 5 m/s^2 and it has a mass of 5 grams.



10 m/s^2

Which direction will the object go?

Calculate the force that was used to push this object. Notice that it is accelerating at a rate of 10 m/s^2 and it has a mass of 3 grams.



Which direction will this object go?

Calculate how fast it will accelerate.

Hint: If I push on one side of a box with 12N of force, and someone else pushes back with 2N of force in the other direction, what will the total net force be?

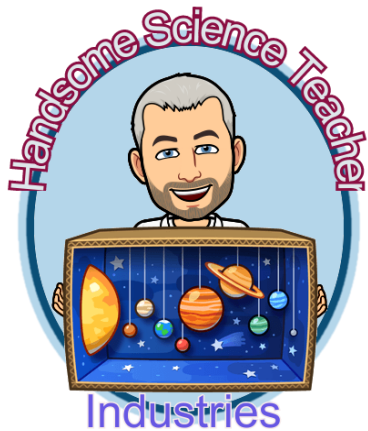
Final Questions:

Answer each question using complete sentences.

1. If we increase the mass of an object, how will that affect its acceleration? Explain your answer in detail, including why this is the case.

2. If we increase the force applied to an object how will this affect its acceleration? Explain your answer in detail, including why this is the case.

3. Draw a picture showing Newton's Second Law in action.



Congratulations! You Have Completed The Entire Mastery Badge

You have worked really hard to earn this mastery badge. More importantly, you have worked hard to earn your knowledge!

Time To Evaluate Your Work

Check each of the following to evaluate your work:

1. Did you do every assignment?
2. Did you read the assigned article?
3. Did you watch the assigned video?
4. Did you answer all the questions using complete sentences?
5. Are your answers accurate?

My Self-Evaluation:

Based on the criteria listed above, I believe I have passed off this Mastery Badge because...
(Be detailed and specific)

Mastery Badge Counselor Evaluation:

I have reviewed this student's work. Based on the criteria listed above I hereby certify that they have passed off the Mastery Badge because... (Be detailed and specific) Note: Any adult may serve as a Mastery Badge Counselor, so long as they are committed to ensuring the highest standards of excellence.

Student's Signature

Date

**Signature of Mastery
Badge Counselor**

Date

Certificate For Your Homeschool Records

The following certificate which has been awarded through self-evaluation by the student, and also certified by a mastery badge counselor proves that the student listed thereon has completed all the work and has mastered all the concepts for the specified topic.

Keep this on file as evidence of your successful completion of this topic.

If audited by the State, these certificates stand as evidence that you have worked on and successfully completed a rigorous science curriculum.



The certificate features a decorative border with a repeating floral pattern. In the top-left corner, there is a circular logo with a cartoon man's face and the text "Handsome Science Teacher Industries". The main title "Mastery Badge Certificate" is centered in a large, bold, black font. Below the title, the topic "Topic: Newton's Second Law of Motion" is written in a purple font. A line for the student's name is provided below the topic. The central text reads: "This certificate certifies that the person named above has completed all of the requirements to earn this Mastery Badge." At the bottom, there are two horizontal lines for signatures, labeled "MASTERY BADGE COUNSELOR SIGNATURE" and "DATE AWARDED". A small version of the "Handsome Science Teacher Industries" logo is in the bottom-right corner.

Mastery Badge Certificate

Topic: Newton's Second Law of Motion

Student Name: _____

This certificate certifies that the person named above has completed all of the requirements to earn this Mastery Badge.

MASTERY BADGE COUNSELOR SIGNATURE

DATE AWARDED