



Buoyancy - A STEM Lab

What I Will Be Learning In This Mastery Badge:

In this mastery badge we will learn about buoyancy. We will also use the engineering process to design and build a sailing vessel.

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:

- Density: A review
- Wind: A review
- Why do things float?
- What is buoyancy?
- How is buoyancy calculated?
- Design, build, and test a boat.

Name: _____

Date: _____



Discovering Lab

Learning Through Hands On Activities



Activity: Discovering Buoyancy

Directions: Follow the directions below to learn about buoyancy



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 buoyancy

You have been hired by a t-rex to build a sailboat. He claims he needs this boat so that he can visit his grandmother in New York City, and promised he most certainly isn't trying to escape the island where scientists created him. He also promised so very earnestly that when he arrives in New York he most certainly will NOT eat any of the people there.

And, we know he is telling the truth because he held his little tiny t-rex arm up in the air as he promised. So, go ahead and totally build that hungry-looking t-rex a boat and send him to one of the most populated cities in the world.

Supplies For This Lab

For this lab, you are only limited by your imagination. You are allowed to use any supplies that you have access to at home, or that you can talk your parents/guardians into getting for you. Keep in mind though as you plan your boat that you will actually have to build it later on, so it is best to keep your design simple and inexpensive.

Design Your Sailboat

We have not yet studied buoyancy nor have we discussed the concepts around building a good sailboat, but that is okay. Before continuing with this mastery badge, you are first going to try your best to build and test a sailboat. Later we will learn about buoyancy and then use the engineering process to improve your design.

Your Sailboat Must Carry A Passenger

Your sailboat should be able to carry a small load or weight, which will represent the t-rex. If you have an actual t-rex figurine that would be amazing. If not, that is okay, use a pencil or some other small weight to represent your passenger.

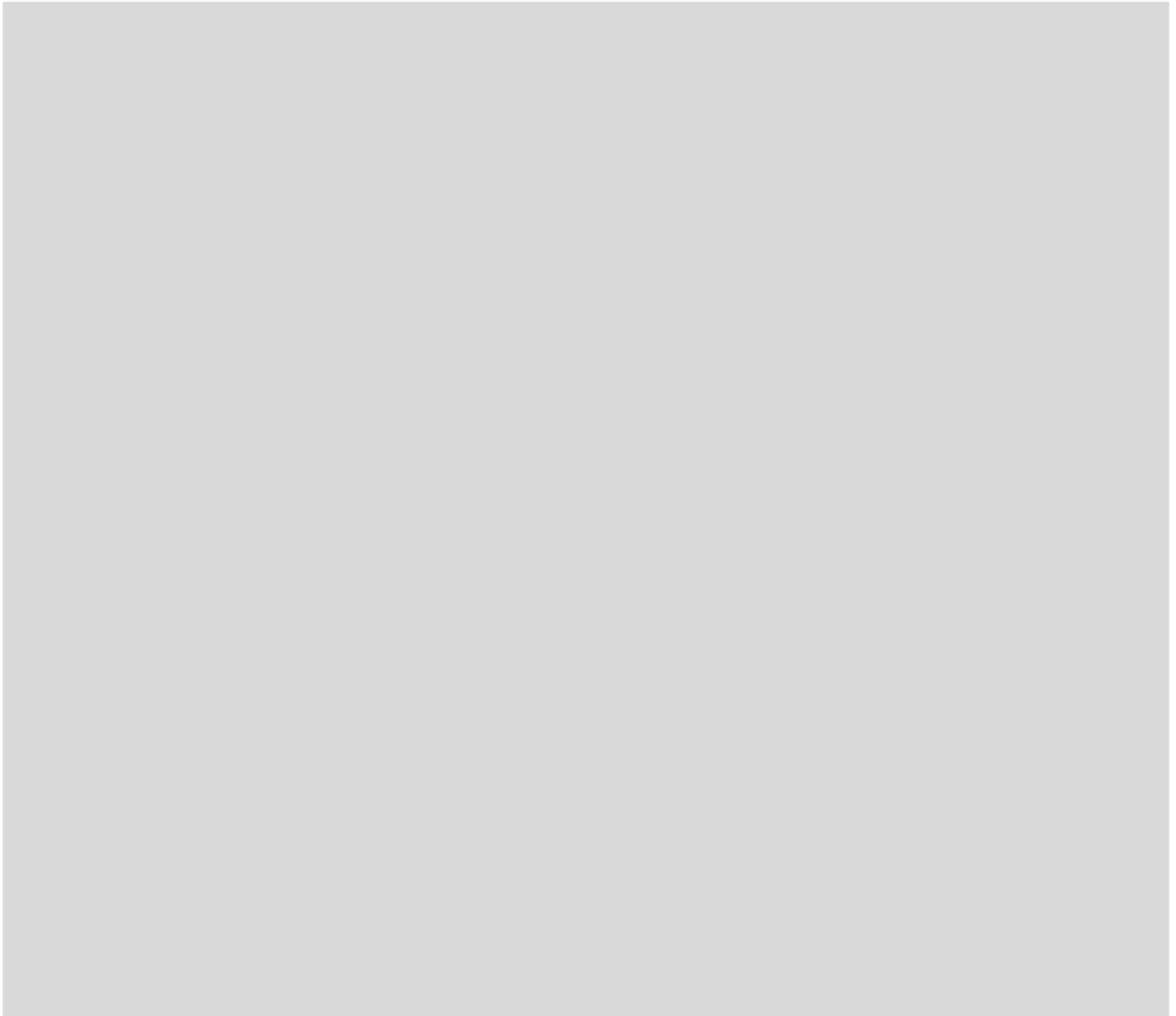
Plan Your Design

Engineers are a special kind of scientist that create ideas and inventions to solve problems. When solving a new problem they always start by first planning. They often use computer programs for this, such as Autocad. Before computers, though they did this planning using paper and pencil, which is what we will be doing.

Before building your sailboat, you need to first design it. Draw a diagram showing how you will build your sailboat. Label each part of your diagram showing the materials that you intend to use. Remember that you will actually be building this, so it is best to keep your design simple.

Important: This is a sailboat so don't forget to include a sail in your design.

Diagram and label your boat in the space provided.



Put Your Design Into Action

Now that your design is completed, it's time to build it. Using the supplies you specified in your design build your sailboat. If you find that you want to alter your design, change the diagram first, and then continue building. Make sure that when you finish, your boat and your diagram match.

Test Your Design

Take your boat somewhere safe where you can test it. Ideal locations would be a small stream, a pond, or a swimming pool. Alternatively, you can also test your design in a bathtub. Be very careful and be safe around water. Make sure you have an adult with you.

How well does your boat float? Did it continue to float until you removed it from the water, or did it begin to sink? Was your boat waterproof?

Was your boat balanced? Did it stand upright or tip toward the side?

Apply wind to your sail and observe the results. A fan, leaf blower, or hair dryer are good solutions for creating wind, but be very careful. Water and electricity do not mix!

MAKE SURE AN ADULT IS WITH YOU AT ALL TIMES!

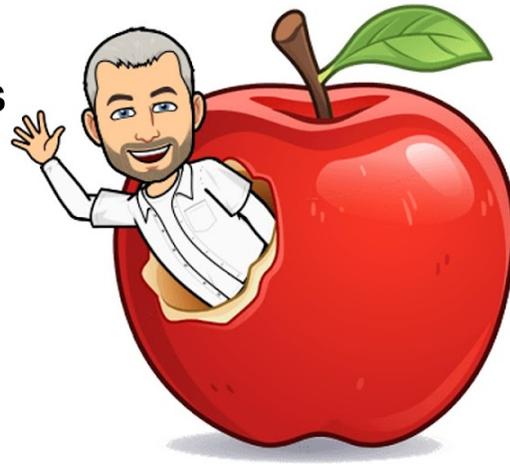
Describe what happened when you applied wind to your boat. How well did it sail? Did it remain upright or did it tip over?

The Engineering Process

Engineers are always improving their designs. No matter how good an idea or technology is, there is always room for improvement. What could you do to improve the design of your sailboat?

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.

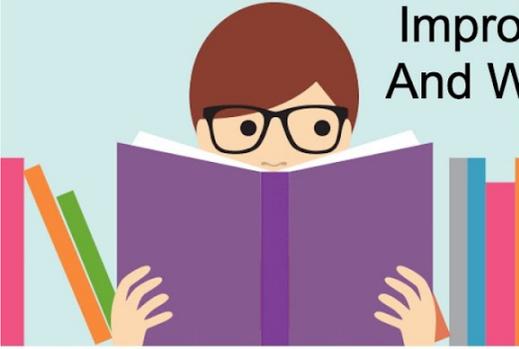
Now, Let's Connect These New Concepts To Things You Already Knew

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/buoyancy-the-archimedes-principle/>

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 articleI 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 three paragraphs in your own words explaining what buoyancy is and what causes things to float.

Name: _____

Date: _____



Applying Lab

Proving That We Can Do It Ourselves



Directions: Follow the steps outlined below to create an improved sailboat design.



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 use the engineering process in order to create an improved sailboat.

Remember that hungry-looking t-rex that you sent to New York City? Well, after he arrived he picked up a phone and called some of his buddies back on the island. Which you have to admit is pretty impressive considering that his little arms don't reach up to his face. He probably used speakerphone.

While on the phone he told his three t-rex friends about the delicious peop, err I mean he told them that all of their grandmas are also sick and that they definitely need to also visit New York City.

Thus, you have been hired to build a new and improved sailboat that can carry three times as much weight as your first design.

Supplies For This Lab

For this lab, you are only limited by your imagination. You are allowed any supplies you have access to at home, or that you can talk your parents/guardians into getting for you. Keep in mind though as you plan your boat that you will actually have to build it, so it is best to keep your design simple and inexpensive.

Design Your Sailboat

Now that we have studied buoyancy you are better equipped to build an improved design. More importantly, you now have experience building boats. You have already built and tested an earlier version of your sailboat.

Your goal is to improve your design.

Your Sailboat Must Carry three Passengers

Your sailboat should be able to carry a small load or weight, which will represent the three t-rexes. If you have three actual t-rex figurines that would be amazing. If not, that is okay, use pencils or other small weights to represent your passengers. Make sure that your weight is three times heavier than it was when you tested your first boat.

Plan Your Design

Engineers are a special kind of scientist that create ideas and inventions to solve problems. They do this by using the engineering process. You have already built one design. How can you improve it? How can you make your design better?

Diagram and label your improved boat design in the space provided.



Build Your Design

Now that your design is complete, it's time to build it. Using the supplies you specified in your design build your sailboat. If you want to alter your design, change the diagram first, and then continue building. Make sure that when you finish, your boat and your diagram match.

Test Your Design

Take your boat somewhere safe where you can test it. Ideal locations include a small stream, a pond, or a swimming pool. Alternatively, you can also test your design in a bathtub. Be very careful and be safe around water. **Make sure you have an adult with you.**

How well does your boat float? Did it continue to float until you removed it from the water, or did it begin to sink? Was your boat waterproof?

Was your boat balanced? Did it stand upright or tip towards the side?

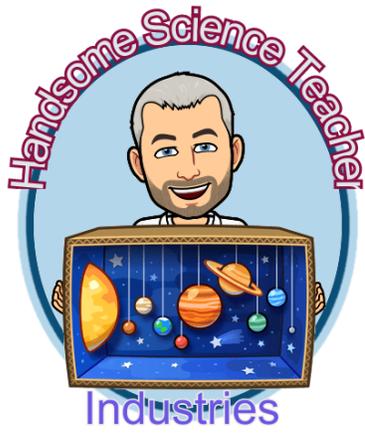
Apply wind to your sail and observe the results. A fan, leaf blower, or hair dryer are good solutions for creating wind, but be very careful. Water and electricity do not mix!

MAKE SURE AN ADULT IS WITH YOU AT ALL TIMES!

Describe what happened when you applied wind to your boat. How well did it sail? Did it remain upright or did it tip over?

The Engineering Process Is Ongoing

Engineers are always improving their designs. This is a cycle that never ends. Which is why companies are constantly releasing new and improved versions of their products. No matter how good an idea or technology is, there is always room for improvement. What might you do to improve the design of your sailboat even further?



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.

