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STUDENT'S GUIDE

FOR EXPLORING THE SAILING INTO STEAM COURSE

An adventure through the STEAM Islands



**WELCOME
ABOARD, YOUNG
EXPLORERS!**



YOU'RE ABOUT TO SET SAIL ON A JOURNEY ACROSS MAGICAL STEAM ISLANDS!

Each island holds fun challenges, experiments, and discoveries waiting just for you. As we travel, you'll learn about science, technology, engineering, art, and math – all while having fun and exploring the wonders of sailing.

You are not just a student—you are a sailor, a scientist, and an inventor. **Keep your eyes open, your hands ready to build, and your mind curious!**

HOW TO USE THIS GUIDE

**EVERY ISLAND YOU VISIT HAS
EXCITING ACTIVITIES TO TRY.
FOR EACH ACTIVITY, YOU
WILL FIND:**

- A short story or introduction to the island
- Instructions for fun experiments and challenges
- Spaces where you can draw, write, or keep notes
- Questions to help you think and discover new things

You can write directly in this guide or use your own notebook to record ideas.

Ask an adult to help you when needed, but be the captain of your own adventure!

While you explore wanders of STEAM :

- S = Science (exploring how things work)
- T = Technology (using tools and inventions)
- E = Engineering (building and solving problems)
- A = Art (being creative and designing)
- M = Math (counting, measuring, shapes)

MEET YOUR GUIDE VETRA

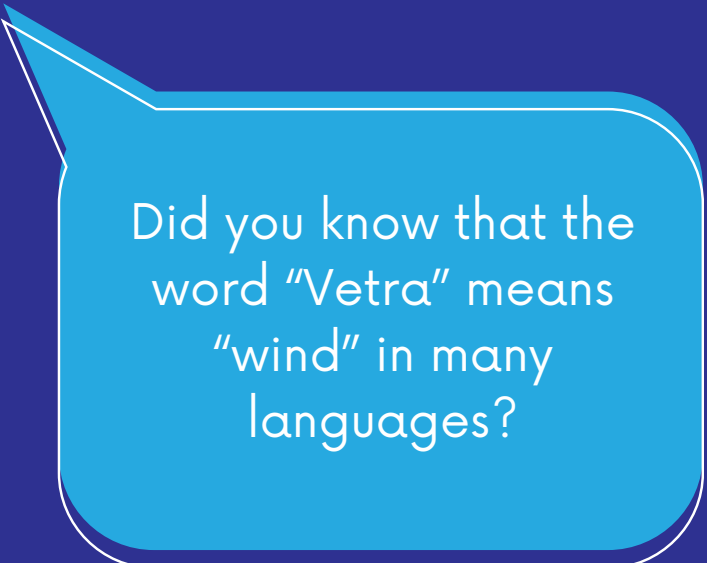


AHOY, EXPLORERS! MY NAME IS VETRA!

I am the spirit of the wind who loves to sail, discover, and solve puzzles. I've been guiding sailors of all ages across magical islands for many years, and now it's your turn to come aboard!

I know every secret of the sea and sky—from how a tiny breeze can push a big boat to how we can protect the water and nature around us. My hair is always full of wind (you'll see!), and my heart is full of curiosity. Together, we'll explore science, technology, engineering, art, and math in ways you've never seen before.

I'm here to cheer you on, give you clues when you're stuck, and share amazing facts to keep you inspired. Whether you're building, drawing, experimenting, or exploring, remember—you are a true sailor-scientist now!



Did you know that the word "Vetra" means "wind" in many languages?

YOUR STEAM ADVENTURE



BREEZY ISLAND MISSIONS:

- Where does wind come from?
- How Can Air Pressure Lift Things?
- Be a wind detective!
- Bonus: Wind Tunnel Test
- Bonus: Build a Wind Turbine



FLOATY ISLAND MISSIONS:

- Sink or Float Detective
- The Pressure Puzzle
- Archimedes' Water Trick
- Bonus: Build Your Best Boat
- Bonus: The Keel Experiment



CAPTAIN'S COVE MISSIONS:

- Design the Best Sail
- Use Wind Power to Move Your Boat
- Practice Tacking and Jibing
- Bonus: Navigate with a
- Compass and Bearings



MECHANICAL REEF MISSIONS:

- Discover Simple Machines
- Explore Pulleys and Blocks
- Steering the Boat with a Rudder
- Bonus: Build a Working Winch

NATURE MAP



BLUEWATER ISLAND MISSIONS:

- Water's Hidden Powers
- Testing Water Quality
- Cleaning Dirty Water
- Bonus: Where Are the Microplastics?
- Bonus: Explore Your Local Water



GREEN HORIZON ISLAND:

- Nature's Services
- The Hidden Dangers of Pollution
- Protecting Water Creatures
- Eco-Sailing Challenge
- Bonus: The Eco-Regatta



TECHTOPIA ISLAND MISSIONS:

- What is Coding?
- Program with Arrows and Commands
- Code with Blocks and Create Games
- Explore Programming in 3D
- Bonus: Design Your Own 3D Sailing Boat!



DEEP DIVE ISLAND MISSIONS:

- What Are Marine Robots?
- How Robots Help Sailors and Nature?
- Try Piloting a Real Underwater Drone!

BREEZY ISLAND



01



THE MYSTERY OF THE MOVING AIR

You've landed on Breezy island, the first stop on your Sailing into STEAM adventure. Here, we'll discover the secret of the invisible force that moves sailboats—the WIND! Can you feel the wind on your face? Can you see it moving leaves and flags? Today, we'll learn where wind comes from, how we can see it, and how we can use it.

"Ahh, the wind—my favorite travel companion! Ever wondered where it's born? Join me, and we'll chase the breeze and unlock its secrets together! Watch for my blue square messages—they'll guide you and reveal secret tips along the way!

Let's explore the invisible wind together!"



MISSION 1: WHERE DOES WIND COME FROM?

**Did you know the sun helps make the wind?
Let's find out why air moves!**

Watch your educator set up two containers:

- One has water.
- One has sand or rocks.
- Both are sitting under a lamp.
- There's a thermometer in each container!

"We're testing which one heats up faster!"

YOUR JOB:

☞ Check the thermometers after 5–10 minutes!

☞ Write the temperatures:

Water temperature: _____°C

Sand/Rocks temperature: _____°C

Can you explain why that happened?

When the sun shines, land heats faster than water. The air above the warm land rises, and cool air from over the water moves in. That moving air is what we call wind!"

Now for the BIG experiment!

We can't see air moving—but we CAN see water moving! Let's watch what happens when warm and cold meet!

Watch your educator set up a clear water tank:

- A warm stone on one side
- Ice cubes on the other
- Drops of red and blue color added near both sides

Predict:

- ☞ "What do you think will happen to the colored water?"
- ☞ "Which color will rise? Which one will sink?"

Draw your prediction:

cold color

warm color

Now watch the magic happen! Look closely as the colors start to move...

☞ Circle what you observe:

Warm color moves UP/DOWN.

Cold color moves UP/DOWN

"When warm air rises and cool air moves in to take its place... that invisible movement is WIND! It's air moving from heavier, cooler places (high pressure) to lighter, warmer places (low pressure). We used water and colors because air and water move similarly when heated and cooled! You just made invisible air movements visible!

MISSION 2 : HOW CAN AIR MOVE THINGS?

**Have you ever felt the wind push against you?
Did you know air can actually hold things up?**

First challenge: The Flying Paper Trick!

Take the thin strip of paper. Hold the paper under your mouth so it hangs down. Blow gently across the top of the paper (not underneath!). What happens to the paper? Does it move up or down?

✎ Write what you see. The paper moves:

✎ Draw it here:



“When air moves quickly above something, the pressure underneath gets stronger – and that can lift light things, like a piece of paper!”

Main Experiment: The Floating Ball!

Your educator shows you:

- A hairdryer
- A ping pong ball

Watch closely!

The hairdryer is turned ON and pointing up. The educator gently puts the ping pong ball in the air above the hairdryer.

What happens? Does the ball fall?

✎ Write what you see:

The ball:

Try it yourself! Take turns trying to keep the ball floating with the hairdryer.

✎ Can you tilt the hairdryer a little without making the ball fall? Did the ball stay in the air path when you tilted?

Super Challenge: Navigate the Course!

Now your educator sets up an obstacle course with hoops or rings. Try to move the floating ball through the hoops using the hairdryer. How many hoops did you pass? _____

"Thanks to the difference in pressure, air can create a special force that lifts or moves things. This force is called lift! That's how wind creates force in the sails that helps the boat move forward."

MISSION 3 : BECOME A WIND DETECTIVE!

Every sailor needs to know where the wind is blowing from and how strong it is. Today, you'll become a real wind detective by making your own tools!

You'll build:

- A Wind Vane (shows wind direction)
- An Anemometer (counts how fast the wind blows)

Step 1: Build your Wind Vane!

- Cut an arrow and tail from cardboard.
- Stick them onto a straw.
- Use a push pin to poke the straw onto a pencil eraser.
- Put the pencil into a bottle filled with sand or pebbles.
- Use a compass (or landmarks) to mark N, S, E, W on your base.
- Decorate your wind vane!

Step 2: Build your Anemometer!

- Your educator shows you how:
- Tape 4 paper cups onto the ends of 2 straws (in a cross shape).
- Pin the straws together in the middle so they spin.
- Put the pin on top of a pencil eraser (or stick in a base).
- Color your anemometer cups if you want!

Step 3: Time to Test Your Tools!

Take your wind vane and anemometer outside to find some wind.
OR stay inside and use a fan to create wind!

Watch your wind vane carefully:

Which way is it pointing? Use a compass to figure out the direction (N, S, E, W)!

👉 Write the wind direction here:

The wind is coming from:

Now watch your anemometer spin:

👉 Count how many times it spins in 10 seconds!

👉 If you're inside, hold it in front of the fan always at the same distance.

👉 Write how many spins you counted: Wind Speed Data Table

Trial Number	Spins in 10 Seconds
Trial 1	
Trial 2	
Trial 3	

Average number of spins:

"To find the average, add up all your spins and then divide by 3! Scientists do this to make sure their results are fair and accurate. If you need help with dividing, ask your educator to show you how!"

BONUS MISSION: THE WIND TUNNEL TEST!

Welcome to the Wind Tunnel Lab! Today, you'll be a wind scientist! We'll discover how air moves around shapes—just like it moves around sails and boat hulls.

Think about this:

- ☞ Have you ever felt the wind push against you when you're biking or sticking your hand out of a car window?"
- ☞ Was it harder when your hand was flat or turned sideways?"

"That's **drag** (when wind pushes back) and **lift** (when wind helps you rise). Designers use wind tunnels to test what shapes move best in the air. Now we'll try it too!"

Step 1: Meet the Wind Tunnel!

- Watch your educator turn on the wind tunnel.
- See how streamers show where the air goes.
- "The tunnel helps us see invisible air moving!"

Step 2: Make Your Prediction!

Pick a shape to test:

- Cube
- Sphere

What do you think will happen when the wind hits it?
Will the air flow smoothly or get stuck?

Step 3: : Test the Shape!

Put your shape inside the wind tunnel.
Watch what happens as we turn on the wind tunnel!

☞ Draw what you see here:



"How Does Air Move?"

When air flows around a shape, it can move in two different ways:

✓ Smooth flow – when air moves straight, quietly, and without swirling. The smoke looks calm and flows around the shape like a river.

✗ Turbulence – when air gets confused, spins around, and forms little swirls. The smoke twists, breaks apart, and moves in all directions."

Step 4: What Did You Notice?

☞ Which shape had the smoothest air flow?

"Sails with the right shape help the wind create lift – so the boat can go faster! That's why shape matters!"

☞ If you were designing a sail, what shape would you choose? Why?

BONUS MISSION: USING THE POWER OF WIND!

Here you're going to use wind to make electricity and turn on a light! The Mission: You'll get a pre-built wind turbine and a tiny house model with an LED inside.

👉 Your job is to be an energy engineer and:

- Connect the wires from the turbine to the house
- Build a tiny electricity grid
- Turn on the fan in front of the turbine
- Watch if the LED lights up!

Step 1: Set Up Your Grid

Your educator gives you:

- A prebuilt wind turbine (the blades are ready!)
- A house model with an LED inside
- Wires with clips

Use the wires to connect the motor (on the turbine) to the LED inside the house. Ask for help if you're not sure which wire goes where!

"Electricity needs a complete path to flow—make sure your grid is closed!"

Step 2: Power It Up!

- Place the fan in front of the wind turbine.
- Turn the fan on.
- Watch the blades spin.

Look carefully:

- ☞ Did the LED light up?
- ☞ How fast do the blades need to spin?

☞ Write what happened:

When I turned on the fan, my LED _____

Step 3: Test and Improve!

- Try moving the fan closer or farther.
- Try tilting the fan to different angles.
- What changes helped the LED glow brighter?

“Wind energy can make electricity without burning fuel or polluting the air. It’s a clean and renewable source of energy that helps protect our planet.”

FLOATY ISLAND



02

You've landed on Floaty Island, the second stop on your SailingIntoSTEAM adventure! Here, we'll uncover the secrets of why boats float—and what makes them sink to the bottom! Have you ever wondered: Why does a huge ship float but a tiny rock sinks? What keeps a boat from tipping over? How can you build a boat that holds cargo?

"Welcome to Floaty Island—my favorite place to test boats! Did you know the shape of your boat matters as much as its weight? Let's dive into the science of floating and balancing together. And keep an eye out for my blue square messages—they'll help you master the art of buoyancy!"



MISSION 1: SINK OR FLOAT DETECTIVE!

Ahoy, explorer! It's time to solve the mystery: Why do some things float and others sink?

Your educator shows you a bowl of water and a collection of mystery objects. Together, you'll choose a few objects to test!

First, make your best guesses—will they float or sink?

👉 Write your predictions here:

Object	My Guess (Float/Sink)	What Happened?

Test each object in the water one by one. Did it float or sink? Write what happened! Why do you think some floated and others sank?

Let's learn some secrets about floating:

- **Mass** = how much "stuff" is inside an object. A rock is heavy because it has lots of mass.
- **Volume** = how much space something takes up. A big beach ball has lots of volume—even if it's not heavy!

"Do big things always weigh more? Or can a big thing be light?"

- **Density** = how packed the "stuff" is inside. We find density by this simple idea:
 $\text{Density} = \text{Mass} \div \text{Volume}$

"If an object is heavy but very small, it's dense! If it's light but big, it's less dense."

Time to make and test your shapes!

👉 Now take playdough (or modeling clay) and make a solid ball. Put it in the water. Did it float or sink? _____

👉 Next, reshape it into a boat shape. Try again! Did it float or sink this time? _____

Why do you think the shape made a difference?

How Floating Works!

When something is in water, two invisible forces act on it:

- Gravity pulls it down
- Buoyancy pushes it up

"If an object's weight (gravity pulling down) is less than the water pushing up (buoyancy), it floats! If it's heavier than the push, it sinks!"

MISSION 2 : THE PRESSURE PUZZLE (CARTESIAN DIVER)

Ahoy again, explorer! We've learned how differences in pressure can help lift something... But can pressure also make something sink?... and float again?

Your educator shows you:

- A plastic bottle filled with water
- A small solid toy diver

Today's challenge: control the diver with just a squeeze!

What do you think will happen if you squeeze the bottle?

👉 Write your guess:

Let's test it!

- Your educator places the toy diver into the water-filled bottle
- The diver just barely floats at the top
- The educator seals the bottle cap tight

Ready? Squeeze the bottle gently! Did the diver sink or float?

👉 Write what happened:

Stop squeezing.

👉 What happens now?

Why does this happen?

“When you squeeze the bottle, you increase the pressure inside the water. That pressure pushes equally in all directions—including on the little diver.”

The diver has a tiny bubble of air inside. When the pressure increases, the bubble gets smaller because air can be squeezed. The diver keeps the same mass but takes up less space—that means it becomes denser. Since it's smaller, it pushes away less water, and the buoyant force becomes weaker.

Less buoyancy → the diver sinks!

- When you let go of the bottle, the pressure goes back to normal.
- The air bubble expands again, the diver pushes away more water → buoyancy increases → and the diver floats back up.

The science behind the puzzle:

- Squeezing the bottle = more pressure
- More pressure squeezes the bubble → the diver gets smaller
- Less space = less buoyancy → the diver sinks
- Releasing = the bubble grows → more buoyancy → the diver floats again

MISSION 3 : ARCHIMEDES' WATER TRICK!

**We've reached the final challenge on Floaty Island!
Today, you'll discover Archimedes' secret: how water
pushes things up!**

Your educator shows you:

- A clear tank of water
- A plastic cup filled with rocks (or other small heavy objects)
- A kitchen scale
- A ruler or measuring tape

We're going to test what happens when we put something heavy into water. Make a prediction. What do you think will happen to the water when the cup goes in?

- Will the water stay the same?
- Will the water level rise?

👉 Write your guess:

Let's test it!

Step 1: Weigh the cup

Your educator weighs the cup with the rocks on a kitchen scale.

👉 Write down its weight. Cup weight: _____ grams

Step 2: Measure starting water

Your educator fills the tank with water and marks the starting water level.

👉 Draw or mark the water level here:

Step 3: Put the cup in!

The educator slowly lowers the cup into the water.

- Watch carefully!
- Mark how high the water rises.

👉 Draw or mark the new water level here:

What happened?

Did the water level go up or stay the same?

👉 Write your answer: _____

Why did this happen?

“When you put something in water, it pushes water out of the way (displaces it).”

The water pushes back with a force called **buoyancy**.

Archimedes said: “The water pushes up with a force equal to the weight of the water that was pushed out.”

The science behind it:

Water pushes back up (buoyancy). The more water you move (displace), the more upward force you get. If the water’s push is stronger than gravity → it floats! If gravity is stronger → it sinks.

“That’s why a boat can float even if it’s heavy—it pushes enough water away to make enough upward force!”

BONUS MISSION : BUILD YOUR BEST BOAT!

Ahoy, engineer! Now it's your turn to design a boat that can carry as much treasure (coins or marbles) as possible without sinking. You'll use recycled materials to build a small boat, then test how many coins it can carry.

Your boat-building supplies:

- Aluminum foil
- Popsicle sticks (optional)
- Corks or bottle caps (optional)
- Tape or glue
- Coins or marbles (for testing)
- A tub of water

(Ask your educator if you can add other recycled materials!)

👉 **Design your boat:** Sketch your boat idea first:



Think: Will it be wide or narrow? Will it have tall sides or flat ones? Where will you put the cargo?

👉 **Build it!**

- Take 15–20 minutes to build your boat.
- Use your sketch as a guide—but feel free to adjust as you build!

👉 **Test your boat:**

- Place your boat gently in the water
- Start adding coins one at a time

👉 **Count how many coins it holds before sinking!**

Write your result: My boat held _____ coins before sinking

What did you notice?

- Where did the boat start to tip or sink?
- Did some coins make it sink faster?

👉 Write what you observed:

A boat floats because it pushes water away (displaces it). A wider boat pushes more water and gets more buoyancy to hold up weight!"

Want to make your boat stronger?

- ✓ Try folding the foil edges up like walls.
- ✓ Add popsicle sticks or bottle caps underneath for extra support.
- ✓ Put tape across the bottom so it holds its shape!"

More structure = better balance = more coins!

BONUS MISSION : THE STABILITY EXPERIMENT

Ahoy, explorer! Did you know that sailors have a special way to help boats stay upright in strong winds? It's called a keel—a long, heavy piece at the bottom of a sailboat that helps keep it from tipping over!

Today, you'll discover how adding weight below the boat makes it more stable. Let's test it!

Materials you'll need:

- A small wooden, plastic, or foam boat model
- A toothpick, craft stick, or wire (to be the keel fin)
- Small screws, nuts, washers, or playdough (to add as keel weights)
- String or thin rope
- A pulley or smooth edge (to guide the string sideways)
- A small cup or container to hold weights
- A set of small weights (like washers, coins, metal nuts)
- A tub or basin filled with water
- Towels (for spills—sailors know water goes everywhere!)

"Try to reuse old materials for your boat, weights, and strings—it's great for the planet!"

Step 1: Build Your Keel

Stick a toothpick, craft stick, or wire under the center of your boat to act as the keel fin. Attach a small nut, washer, or ball of playdough to the bottom of the keel—it's your first keel weight! Put your boat in the water. Does it float upright? Good

Step 2: Set Up Your Balance System

Tie one end of a string to the top of the boat's mast (or a toothpick "mast"). Run the string over a pulley or smooth spot on the side of the tub. Tie the other end of the string to a small container (like a paper cup).

"As we add weight into the cup, the string will pull sideways on the mast —just like the wind tries to tip a real sailboat!"

Step 3: Measure Tipping Force

- Slowly drop small weights (coins, washers) into the cup one by one.
- Watch the boat carefully!
- Stop adding when the boat tips over or stays tilted without standing back up.

✎ Write down how many weights it took to tip the boat:

"With my first keel weight, it tipped over with _____ weights."

Step 4: Add More Keel Weight

- Stick another nut, washer, or more playdough to the keel.
- Put the boat back upright in the water.
- Repeat Step 3—add weights into the cup again until the boat tips.

✎ Write your result: "With more keel weight, it tipped over with _____ weights."

Try at least three different keel weights and record how many weights it took to tip each time!

"The heavier the keel under the boat, the harder it is to tip over! The keel acts like a counterweight, pulling the boat back upright when the wind tries to push it over." But... if the keel is too heavy, the boat gets slower and harder to turn! That's why real boat designers must balance stability (so the boat doesn't tip) and speed (so the boat can move fast).

CAPTAIN'S COVE



03



THE SECRETS OF SAILS AND STEERING!

Ahoy, young explorer! You've arrived at Captain's Cove, the third island on your Sailing Into STEAM adventure. Have you ever wondered: How do sails make a boat move without an engine? Why are some sails tall and skinny, while others are wide and flat? How do sailors turn their boats and know which way to go?

"Ahoy, captain! Here at Captain's Cove, we test our sails, practice our turns, and chart our journeys. To leave this island, you'll need a clever sail, steady hands at the helm, and a navigator's brain!" "Every sailor knows: catching the wind is just the start—you also need to steer your boat and stay on course! Let's learn the secrets of sails, steering, and bearings together."



MISSION 1 : DESIGN THE BEST SAIL

Every great sailor needs a great sail! Today, you'll become a sail designer—testing shapes and materials to see which one moves your boat the fastest. You'll need to think like an engineer and an artist. Are you ready, Captain? Let's set up your sail workshop!

Your Challenge: Build different sails for your boat using recycled materials.

- Test which sail shape catches the most wind.
- Find out which one makes your boat go the furthest or fastest!

What You'll Need:

- Recycled paper, old cloth (like T-shirts or scraps), plastic bags, or old sails
- Scissors
- Lightweight sticks (like straws, twigs, or chopsticks)
- A boat base (plastic bottle, cardboard, or small piece of wood)
- Tape or eco-friendly glue
- Optional: paint to decorate your sail

Step 1: Build Your Sails

- Use your materials to build at least two different sail shapes.
- Attach each sail to your boat base with sticks or straws.
- Make sure all boats are about the same size so it's a fair test!

"A curved sail might need extra sticks or tape to hold its shape."

Step 2: Test Your Sails

- Fill a shallow tub with water—or use a smooth floor with a fan as your wind
Place your boat at the starting line
- Turn on the fan or blow gently to create wind
- Watch how far and fast the boat sails!

👉 Record your results:

Sail Shape	Distance Traveled	Notes (fast, slow, wobbly?)
_____	_____ cm	_____
_____	_____ cm	_____
_____	_____ cm	_____

Repeat each test two or three times for fairness.

Step 3: Reflect and Improve

👉 Write your discovery:

"The best sail was _____ because _____."

👉 Could you make your sail better? What would you change?

"Next time, I would _____."

"Well done, Captain! You've learned the first secret of Captain's Cove—the sail makes the journey possible! But the adventure's just beginning... Next, we'll see how to use the wind's power to steer your boat!"

MISSION 2 : USING WIND POWER TO MOVE YOUR BOAT

Now that you've built your sails, it's time to learn how to use the wind to steer and speed up your boat! Did you know the wind doesn't always blow from behind? Sailors have clever ways to move forward—even when the wind is coming from the side!

"A square sail works best when the wind blows from behind. But a triangle sail can help a boat move even when the wind comes from the side!"

Today, we'll test how sail shape and sail angle change the way your boat moves.

Your Challenge: Test both different sail shapes and different sail angles to see:

- Which combination makes your boat move the fastest?
- Which lets you sail in different directions?

What You'll Need:

- Your boat bases from Mission 1
- At least two different sail shapes: Square sail, Triangular sail
- A fan (or gentle blowing for wind)
- A shallow water tub or smooth tabletop
- Tape or markers to make a starting line and finish line
- A timer or stopwatch

"Make sure the wind (fan) blows the same each time so it's a fair test!"

Step 1: Make Predictions

- The wind is blowing from the North
- The goal is to move the boat toward the East

Which sail shape and angle do you think will help the boat move closest toward the East?

Think about these sail positions:

- Pulled tight (close to the middle)
- Halfway open (angled to the side)
- Wide open (almost sideways)

✎ **Write your prediction:**

"I think the sail at _____ angle will get closest to the target because _____."

Points of Sail

When the wind is blowing, sailors have different names for how the boat faces the wind. These are called Points of Sail:

- Close-Hauled: sailing almost into the wind (tight sail angle)
- Beam Reach: sailing with the wind hitting from the side
- Running: sailing straight with the wind from behind.

Each point of sail needs a different sail angle to work well—and not every sail shape can do them all!

MISSION 2 : USING WIND POWER TO MOVE YOUR BOAT

Step 2: Set Up Your Test

- Attach the square sail to one boat
- Attach the triangle sail to another boat
- Mark: An arrow showing wind direction (North) and A line showing the target direction (East)
- Put the fan so it blows from North toward South

“Do you think the square sail will let the boat go toward the East if the wind is coming from the North?”

Step 3: Test Each Sail Shape and Angle

Start with the square sail:

- Test with the sail wide open
- Test with the sail halfway open
- Test with the sail pulled tight

Watch: Does the boat move? Does it go toward the target or only downwind?

Now test the triangle sail:

- Wide open
- Halfway open
- Pulled tight

Watch: Does it move closer to the East? Does it drift straight, sideways, or spin?

👉 Write down what happens:

Repeat each test 2-3 times for fairness.

Sail Shape	Sail Angle	Did It Move? (Y/N)	Speed (Fast/Medium/Slow)	Direction Reached (Downwind? Sideways? No Movement)
Square	Wide open			
Square	Halfway open			
Square	Pulled tight			
Triangle	Wide open			
Triangle	Halfway open			
Triangle	Pulled tight			

Which combination helped your boat move closest toward the East?

👉 Write what you discovered: The best combination was to sail at _____ angle with sail _____ shape.

Square sails are great if the wind is pushing you straight from behind. But if you need to go sideways or a little toward the wind, triangle sails are the key! Sailors adjust the angle of triangle sails to steer their boat in different directions—even when the wind doesn't blow them straight to the treasure.

MISSION 3 : TACKING AND JIBING

Captain, now that you've learned how sails work, it's time to master the art of turning the boat! When the wind's blowing from ahead or from the side, you can't just steer straight. Sailors have special ways to turn their boats without flipping them over or losing the wind.

Today, you'll practice two special maneuvers:

- Tacking → turning the front of the boat through the wind
- Jibing → turning the back of the boat through the wind

Your Challenge:

- Practice tacking and jibing using a boat on land
- Learn how to work the tiller (steering stick) and mainsheet (sail rope) together
Understand how your weight and actions help the boat turn safely

"Every turn needs teamwork between the tiller, the sail, and your body!"

What You'll Need:

- An Optimist dinghy (secured safely on a dolly, stand, or trailer)
- A fan (or an arrow marker) to show wind direction
- Chalk or tape to mark the ground (compass rose or 'no-go zone')
- A helper (instructor or friend) to call instructions
- Optional: a whistle or bell to signal turns

Step 1: Make Predictions

"If the wind is blowing from ahead and we want to sail across it, can we go straight into the wind?"

✎ Write or say your answer:

"I think _____."

Step 2: Practice Tacking (Turning the Bow Through the Wind)

- Sit inside the boat, holding the tiller and mainsheet
- Instructor shows where the wind is blowing from
- Instructor calls

"Ready about!" → You get ready

"Helm's a-lee!" → You push the tiller away from you to turn the front of the boat into the wind

- As the boat "turns," move the mainsheet across to the other side
- Shift your body to the new side of the boat (pretend to duck under the boom!)

"Move the tiller enough to turn, but not too much to make a big slow loop!"

- Practice this 2-3 times
- Each time, check: Did the tiller move the right amount? Did you move the sail at the right time? Did you move your body safely?

✎ Write what worked:

"When I tacked, I did _____."

✎ Write what was tricky:

"Next time I want to improve _____."

MISSION 3: TACKING AND JIBING

Step 3: Practice Jibing (Turning the Stern Through the Wind)

- Sit in the boat, facing downwind (wind behind you)
- Instructor calls: "Prepare to jibe!" – You check around "Jibe-ho!" – You pull the tiller toward you to turn the back of the boat through the wind
- Quickly control the mainsheet as the sail swings across fast
- Move your body to the new side of the boat safely

"Watch out! The sail moves faster when jibing—always hold the mainsheet!"

- Practice this 2–3 times
- Each time, check: – Did you move the tiller enough? Did you control the sail safely? Did you move your body to stay balanced?

✎ Write what worked:

"When I jibed, I did _____."

✎ Write what was tricky:

"Next time I want to improve _____."

"Which turn felt easier—tacking or jibing?"

✎ Write or say your answer:

"I thought _____ was easier because _____."

"Which turn made the sail move faster?"

✎ Write or say your answer:

"The sail moved faster during _____."

"Tacking is safer in strong winds because the sail moves slower. Jibing is faster but needs more control because the sail can swing hard!"

BONUS MISSION : NAVIGATE WITH A COMPASS AND BEARINGS

A good sailor doesn't just sail with the wind—they also navigate their way! When you're out at sea, a compass helps you know which way to go, even when there are no signs or roads." "Today, you'll learn how to use a compass and bearings to steer toward your treasure!"

Your Challenge:

- Learn how a compass works
- Follow simple bearings (directions in degrees) to reach your goal
- Practice steering a course like a real sailor or explorer!

"Every bearing is like a secret code showing how many degrees to turn from North!"

What You'll Need:

- A compass (or a compass app)
- A simple treasure map with bearings and steps
- Chalk or tape to mark a compass rose on the ground
- Cones or objects as waypoints (hidden clues or tokens)

Step 1: Learn How a Compass Works

- "The red needle always points North."
- "North is 0° , East is 90° , South is 180° , West is 270° ."
- "A bearing tells you how many degrees to turn from North to face your path."
- Practice pointing the compass to North.
- Try facing 90° (East), 180° (South), 270° (West).

✎ Write what you learned:

"North is _____. East is _____. South is _____. West is _____."

Step 2: Practice Simple Bearing

- Use chalk or tape to mark N, E, S, W on the ground in a circle.
- Stand in the middle holding the compass

Vetra gives commands:

✎ "Face 0°!" (North)

✎ "Turn to 180°!" (South)

✎ "Turn to 270°!" (West)

Try small angles too:

✎ "Face 45°!"

✎ "Face 135°!"

✎ "Face 225°!"

"Each bearing tells you a direction, like a number puzzle leading to treasure!"

Step 3: Navigate a Mini Treasure Map

Now it's time to use your compass for real. Your team will get a simple treasure map. On it, you'll see:

- A starting point
- A list of bearings and steps to follow (like secret directions!)
- Clues or hidden objects along the way

How to Play:

- Start at your marked Starting Point.
- Check your map: what's the first bearing (degrees) and how far do you need to go?

Use your compass:

- Set the bearing (point it in the right direction!)
- Face that way and get ready to move
- Walk the distance (count your steps or measure)
- Look around at the waypoint—did you find a clue or object?
- Follow the next bearing and keep going until you reach the treasure!

When you reach the final spot, celebrate your treasure-hunting skills!

"Stay focused on each bearing—like a real sailor steering across the sea. Keep your compass flat and steady, and don't let anything distract you!"

MECHANICAL REEF



04

THE ISLAND OF MACHINES AND MOVING PARTS!



As you sail away from Captain's Cove, strange shapes rise from the waves—giant wheels turning, ropes hanging from tall masts, gears spinning, and pulleys swinging in the breeze! Ahoy, Captain! Welcome to Mechanical Reef!" "This is the place where sailors, engineers, and inventors work together to build clever machines that make hard jobs easier!" "At Mechanical Reef, you'll explore how simple machines—like pulleys, levers, gears, and winches—are used on a sailboat to lift heavy sails, steer the rudder, or pull up an anchor." "You'll build, test, and discover how machines help sailors use less force to move big things. You'll even get to be an inventor yourself!"



"Ah, Mechanical Reef—my favorite island for tinkering! Gears, ropes, levers... it's like a sailor's playground! Get ready to build and test machines that make tough tasks easier. And don't forget to follow my blue square messages—they're packed with ideas to help you think like an inventor!"



MISSION 1 : DISCOVER SIMPLE MACHINES

Did you know that sailors use simple machines every day to make their work easier?

Machines like levers, pulleys, and winches help us lift heavy sails, steer big rudders, and pull up anchors without needing giant muscles!"

"Today at Mechanical Reef, you'll discover how simple machines work—and test how they make hard jobs easier!"

Your Challenge:

- Explore simple machines used on a sailboat
- Test how a lever works to lift heavy things
- Learn how machines help balance and reduce force

"Every time you see a rope, pulley, wheel, or stick on a boat—it's probably a simple machine helping the crew!"

Step 1: Learn About Simple Machines

A simple machine is something that helps you do a job with less effort. Here are some machines you might see on a sailboat:

- Lever – like a plank on a rock; you push one end to lift something on the other end
- Pulley – a wheel with a rope that helps you pull something up
- Winch – a crank with gears to wind up a rope
- Rudder – a flat piece that steers the boat by pushing water

"Even simple machines use big ideas from physics—like force, balance, and movement!"

Step 2: Test the Lever

Set up your lever:

- Place the plank over a block or rock (like a seesaw)
- Put a heavy object (like a book or stone) on one end
- Try lifting it by pushing down on the other end. "Was it easy or hard?"
- Now move the heavy object closer to the center of the lever. Try again.
- Move the heavy object farther from the center. Try again.

✎ Write what you noticed:

"It was easier to lift the object when it was _____."

Step 3: Reflect and Discuss

"Why did the lever work better when the heavy object was closer to the center?"

✎ Write or discuss:

"I think the lever helped because _____."

"Do you remember playing on a seesaw at the park? That's a lever too!" "Captain, you've discovered the first secret of Mechanical Reef: simple machines help sailors work smarter, not harder!"

MISSION N 2: EXPLORE PULLEYS AND BLOCKS

Today at Mechanical Reef, you'll test how pulleys and block systems help sailors lift and move heavy loads more easily.

Your Challenge:

- Discover how pulleys make lifting easier
- Try different pulley systems (1:1, 1:2, 1:4)
- Feel the difference in force needed with each system

"The more pulleys you use, the easier it gets—but you have to pull more rope!"

What You'll Need:

- Rope or string
- Toy pulleys or wheels
- A wooden frame (or chair or table) to hang the pulley
- Weights (like a bucket, books, or small bag)

Step 1: Learn About Pulleys and Blocks

- "A pulley is a wheel with a rope that changes the direction of the force."
- "A block is a pulley inside a frame."
- "When we use more pulleys together, we call it a block and tackle system."

There are three kinds of pulleys we use on a boat:

- **Fixed Pulley** – helps change direction, but doesn't reduce effort
- **Movable Pulley** – moves with the load, reduces effort
- **Compound Pulley** – combines both to make it even easier!

"On a sailboat, pulleys are used to raise sails, control ropes, or even pull up an anchor!"

Step 2: Try Lifting with Different Pulleys!

First, try a 1:1 system (just one pulley):

- Tie the rope to a bucket
- Run it through the pulley at the top
- Pull straight down to lift the bucket

Next, try a 1:2 system:

- Add a second pulley under the bucket
- Run the rope through both pulleys
- Pull again

Finally, try a 1:4 system if you can:

- Add more pulleys to create more loops
- Pull again

Observe how it feels each time:

- Is it easier or harder?
- Do you have to pull more rope?

Step 3: Reflect and Discuss

"Why do sailors use more than one pulley when they lift something heavy?"

✎ Write or say your answer:

"I think they use more pulleys because _____."

"The more pulleys in the system, the less force you need—but the longer the rope you have to pull. Sailors use block and tackle systems to hoist big sails, lift heavy equipment, and adjust ropes safely in strong winds."

MISSION 3 : STEERING THE BOAT WITH A RUDDER

Today at Mechanical Reef, you'll discover how the rudder works and why turning it changes the boat's direction

Your Challenge:

- Explore how the rudder steers a boat
- Test how the rudder's angle changes the boat's path
- Understand how the water pushes against the rudder to turn the boat

"The rudder doesn't push the boat—it pushes the water! And the water pushes back to turn the boat."

What You'll Need:

- A small plastic container or toy boat
- A piece of cardboard or ruler to use as the rudder
- A water tub or basin
- Tape or glue

Step 1: Learn About the Rudder

- "A rudder is a flat piece that turns left or right to steer the boat."
- "When you turn the rudder, it pushes water to the side."
- "And when water gets pushed one way, it pushes the boat the other way."

"The farther the rudder is from the middle of the boat, the bigger the turning force—it's called torque!"

Step 2: Build Your Rudder Boat

- Tape or glue a small ruler or flat cardboard onto the back of your plastic boat to be the rudder
- Fill your tub or basin with water
- Put your boat in the water
- Try turning the rudder left (30° , 45° , 60° , 90°) and right
- Gently push the boat forward or use your hand/fan to make “water flow”

Watch which way the boat turns!

✎ Write or say your answer:

“When I turned the rudder left, the boat went _____.”

“When I turned the rudder right, the boat went _____.”

“The more I turned the rudder, the _____ the boat turned.”

“The rudder doesn’t pull the boat—it redirects the water! When you push water one way, the water pushes the boat the other way—just like paddling a canoe on one side.”

BONUS MISSION : BUILD A WORKING WINCH

Welcome back to Mechanical Reef, sailor-in-training! Today you'll become an engineer and build a real winch—just like the ones sailors use to hoist sails, lift anchors, or tighten ropes in wild winds!

Your Challenge:

- Discover how winches help sailors do heavy work
- Build your own working winch system
- Try out different gear setups and test your design!

"Every time you turn a handle to move a rope, you're using a winch! The secret is in the gears—small turns can move big things!"

What You'll Need:

- Gears, shafts, cranks (Lego Technic pieces, wooden gears, or similar)
- String or rope
- Plastic base with holes (or use a box/cardboard to mount the winch)
- Optional: Two syringes (10ml and 5ml) + clear plastic tubing for a hydraulic winch experiment

Step 1: Learn How a Compass Works

- "A winch is a machine that winds rope to lift or pull heavy things."
- "It uses gears to increase power and a crank to turn the drum."
- "The secret? A big gear turns slower—but with more strength!"

"Try different gear sizes and feel how the effort changes. That's the gear ratio in action!"

Step 2: Build Your Winch!

1. Choose two gears (one big, one small)
2. Place them on shafts and mount the shafts onto a sturdy base
3. Attach a crank handle to one shaft
4. On the second shaft, add a drum and wrap a rope around it

☛ Turn the crank and watch the drum spin and pull the rope!

Step 3: Test It Out!

- Attach a small weight to the end of the rope
- Try turning the crank and lifting the weight
- Was it easy or hard?

Now change the setup:

- Swap the big and small gears
- Try again—what changed?

☛ Write or say what you noticed:

"When the big gear was first, it felt _____. When I reversed it, it felt _____."

Step 4: Reflect and Discuss

- "Why do you think some gear combinations made it easier or harder?"
- "When would sailors need a strong winch the most?"
- "How does a winch make sailing safer?"

☛ "I think winches help because _____."

BONUS MISSION : BUILD A WORKING WINCH

Bonus Mission: Try a Hydraulic Winch! Ready to level up your engineering skills? In this Bonus Mission, you'll use water power to control your winch—just like real machines that use hydraulic systems!

What You'll Need:

- 2 plastic syringes (one 10ml, one 5ml or both 10ml)
- 1 clear plastic tube (fits tightly over syringe tips)
- A small crank and drum setup (Lego, cardboard, or wood)
- Rope or string
- Water

Step-by-Step: Build Your Hydraulic Winch

1. **Fill the system:** Fill both syringes and the tube with water. No air bubbles allowed—it works best with only water!
2. **Connect the system:** Push the plastic tube tightly onto the tip of each syringe. One syringe is your “pump,” and the other is your “motor.”
3. **Build your winch setup:** Attach a simple winch (drum + string) to the second syringe's plunger using tape, glue, or Lego parts. 🏗️ When this syringe moves, it should turn the winch and lift something small!
4. **Control the winch with water power:** Gently push the plunger on the first syringe. Watch how the second syringe moves by itself—and powers the winch!

“This is how hydraulics work: You push water through a tube, and it sends force to another part of the machine—no electricity needed!”

Explore Further:

Try different sizes of syringes.

- What happens when the pump is bigger than the motor?
- Can you lift more weight or move faster?
- How could sailors use hydraulic systems on big ships?

BLUEWATER ISLAND



05

The sea glistens deep blue as your boat approaches a quiet island surrounded by sparkling waves. Water splashes gently against the rocks, and tall grasses sway in the breeze. "Welcome to Bluewater Island! This is where we explore the mysteries of water— what it's made of, how it behaves, and how we can protect it." "Every sailor depends on water—not just for sailing, but for life itself. At Bluewater Island, we'll become water scientists, testing, observing, and learning how to care for the waters we sail on."

"Ahh, the wind—my favorite travel companion! Ever wondered where it's born? Join me, and we'll chase the breeze and unlock its secrets together! Watch for my blue square messages—they'll guide you and reveal secret tips along the way!

Let's explore the invisible wind together!"



MISSION 1 : WATER'S HIDDEN POWERS

Water may look clear and calm, but it holds powerful secrets! It can float things, mix with other stuff, and even change shape when it gets hot or cold. Today, we'll unlock the mysteries hiding inside every drop! Let's explore how water behaves in different conditions—and how that helps us sail, swim, and stay safe in it.

Your Challenge:

- Become a Water Detective
- Investigate how water reacts to salt, temperature, and ice
- Discover why some things float, why some dissolve, and how temperature makes water move!

"Understanding water helps every sailor! When you know how it behaves, you'll be ready for oceans, rivers, or even ice-covered seas."

What You'll Need:

- 4 glass or metal containers (no plastic!)
- Water (cold, warm, and room temperature)
- Salt
- Reusable ice cubes or regular ice
- Natural dye (like red cabbage water)
- Spoons
- Thermometer (optional)
- Notebook or observation sheet

 *Sustainability Note: Use reusable containers and natural materials like vegetable dye. Don't pour salty or dyed water into nature—dispose of it safely!*

Step 1: Solubility Test – Where Did the Salt Go?

- Fill a cup with room-temperature water.
- Add a spoonful of salt and stir.
- Watch closely: does it disappear?

 Write what you saw:

"When I stirred salt into the water, I noticed _____." 62

"If something disappears into water, we say it's soluble—it becomes part of the liquid!"

Step 2: Temperature Test – Where Does Color Go?

- Fill one container with cold water and one with warm water.
- Add a few drops of natural dye to each. Watch carefully!

👉 Describe what happened:

"In warm water, the dye moved _____. In cold water, it moved _____."

"In warm water, the molecules move faster—that's why the dye spreads more quickly!"

Step 3: Ice Cube Test – Will It Float?

- Drop an ice cube into a glass of room temperature water.
- Does it float or sink? Now try the same with salty water.

👉 Write what you saw:

"In plain water, the ice cube _____. In salty water, it _____."

Step 4: Salt and Ice – Melting Mystery

In a clean container, mix cold water and lots of salt. Add an ice cube and observe how fast it melts compared to plain water.

👉 What did you notice?

"The ice melted faster/slower in salt water. I think this happened because _____."

"Salt lowers the freezing point of water. That's why icy roads are salted— and why salty seas melt ice differently!"

Step 5: Reflect and Discuss

"Captain, you've seen water change when it's warm, cold, salty, or still. These invisible changes shape the world sailors live in."

Ask yourself: Which water was the densest? Where did the color move fastest? What floated? What didn't?

"You've completed your first mission on Bluewater Island! You now know how water behaves—and why it matters for sailing and science."

MISSION 2: TESTING WATER QUALITY

The educator places four jars of water on a table—some are clear, some are cloudy, and one smells a little funny. They smile and point to the jars. “Captain,” the educator says, “can you tell which of these waters is clean just by looking? Sometimes we can guess—but to be sure, sailors and scientists test water to keep people, animals, and boats safe.” “Today, you’ll test different water samples and become a true Water Quality Detective!”

Your Challenge:

- Test different water samples
- Check their pH, clarity, and smell
- Discover which water is clean and which needs help!

“Good sailors care about clean water—it keeps nature healthy and boats in top shape!”

What You’ll Need:

- 3–4 water samples (from tap, rain, river, lake, etc.)
- Clear jars or cups
- pH test strips or a pH meter
- Magnifying glass
- Notebook or Water Detective sheet
- Optional: flashlight for extra clarity test
- Optional: conductivity meter

 *Sustainability Note: Use refillable jars and avoid plastic waste. Collect samples safely—never drink untested water!*

Step 1: Collect and Observe

Pour each water sample into a clear jar.
Look closely. Use your eyes and a magnifying glass.

- Is the water clear or cloudy?
- Are there any bits floating?
- What color is it?
- Does it smell clean, musty, or strange?

 Record your first clues:

"Sample 1 looks _____ and smells
_____."

Step 2: Test the pH

Dip your pH strip (or use your meter) into each sample.
Wait and check the number or color change.
Remember: Safe drinking water = pH 6.5–8.5

 Record: "Sample 1 pH: _____ (safe / too acidic / too basic)"

"Water that's too acidic or too basic can harm fish, boats, and people."

Step 3: Clarity Check

Hold the jar up to the light or shine a flashlight through it.
Rate the clarity using this scale:

- 1 = Crystal clear
- 2 = A little cloudy
- 3 = Cloudy
- 4 = Very murky
- 5 = Can't see through at all

 Write: "Sample 1 clarity: _____ (1–5)"

MISSION 2: TESTING WATER QUALITY

Optional Step 4: Conductivity Test

- Use your conductivity meter to measure minerals and salts
- Higher numbers mean more dissolved stuff inside

👉 Note: "Sample 1 conductivity: _____"

Step 5: Make Your Water Detective Report

Fill in your table:

Sample	pH Level	Clarity (1-5)	Smell	Safe to Sail?
1				
2				
3				
4				

👉 Write your thoughts:

"The cleanest water was _____ because _____. "The most polluted water was _____ because _____."

Reflect and Discuss:

"What surprised you most?"

"Which sample would you feel safe swimming or sailing in?"

"Why is testing water important for sailors and nature?"

👉 What Did You Learn About Water?

Finish this sentence:

"I learned that water can..._____"

Example: "I learned that water can look clean but still be dirty."

MISSION 3: CLEANING DIRTY WATER

Today, you'll build your own filter and discover how layers of natural materials help clean water!

Your Challenge:

- Build a simple water filter
- Test how dirty water becomes cleaner
- Learn how nature's filters work—and why they matter for sailors and the sea!

"Sailors use filters too—on boats, we need clean water for drinking and washing!"

What You'll Need:

- A clean, reused plastic or carton cup (with a small hole at the bottom)
- Cotton pads or sponge
- Activated charcoal (optional)
- Sand
- Small gravel
- Big gravel or stones
- Dirty water (tap water + soil, leaves, or sand)
- A clear container to catch the filtered water
- Spoon

 *Sustainability Note: Use reused materials and natural fillers. Don't dump dirty water into nature—dispose of it safely!*

Step 1: Build Your Filter

- Put your cup on top of a clear container (so you can catch the clean water).
- Layer your filter like this (from bottom to top): Cotton pad or sponge (at the very bottom)
- Optional: Activated charcoal, Sand, Small gravel, Big gravel or stones (on top)

"The biggest pieces catch big dirt. The smaller layers catch tiny bits. Each one has a job!"

Step 2: Test Your Filter

- Pour your dirty water slowly into the top of your filter.
- Watch as it drips through the layers and comes out the bottom.

✎ Write what you notice:

"Before filtering, the water was _____."

"After filtering, the water looked _____."

Step 3: Try Again (Optional)

- Pour the same water through the filter a second time.
- Does it look even clearer?

✎ Write:

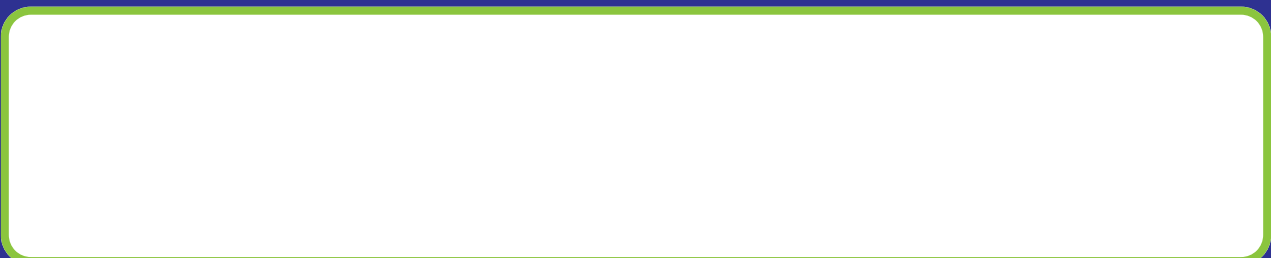
"After filtering twice, the water looked _____."

Step 4: Reflect and Discuss

- "What did each layer of your filter do?"
- "Which part do you think caught the most dirt?"

✎ Draw your filter and show:

- Each layer (label them!)
- Dirty water going in
- Clean water coming out



BONUS MISSION : WHERE ARE THE MICROPLASTICS?

Even clear water can hide tiny pieces of plastic—too small to see without help. These are called microplastics, and they’re a big problem for fish, birds... and even boats.” “Today, you’ll become a Pollution Detective—filtering water to find hidden microplastics and learning how to keep our seas clean!”

Your Challenge:

- Test water samples to find hidden microplastics
- Use simple tools to filter and observe
- Learn where microplastics come from—and how to stop them!

Microplastics may be tiny, but they cause BIG problems for nature and sailors alike.”

What You’ll Need:

- Water samples (from tap, rain, or pretend samples with plastic bits)
- Coffee filters or fabric cloth
- Clear jars or plastic containers
- Magnifying glass or USB microscope (optional)
- Wooden sticks or spoons
- Tray or paper towel
- Observation sheet or notebook

 *Sustainability Note: Only pretend to test dirty water—don’t put real plastic or soap in rivers or lakes. Try using old jars or paper filters again instead of throwing them away!*

Step 1: Prepare Your Samples

- Get your water sample ready.
- If you don't have real polluted water, mix clean water with tiny bits of plastic—like chopped straws, glitter, or thread.
- Label each sample.

"Microplastics come from things like old clothes, broken toys, and packaging."

Step 2: Filter the Water

- Place a coffee filter or cloth over a jar.
- Slowly pour your water through the filter.
- Wait until all the water passes through.

✎ Write:

""We filtered _____ sample(s)."

Step 3: Dry and Examine

- Place the filter on a tray or paper towel to dry a little.
- Use your eyes, magnifying glass, or microscope to look closely.
- What can you spot?

✎ Look for:

✨ Shiny bits

🧵 Tiny threads

🌈 Colored specks

✎ Draw what you find.

BONUS MISSION : WHERE ARE THE MICROPLASTICS?

Step 4: Record Your Results

Sample Name	Number of Plastic Pieces	Type (fiber, flake, glitter...)	Where It Might Come From
Sample 1			
Sample 2			

Step 5: Reflect and Discuss

- "Were you surprised by what you found?"
- "Where do you think these plastics came from?"
- "What do you think happens when fish or birds eat these pieces?"

✎ Write your thoughts:

"I was surprised by _____."

"I think the plastics came from _____."

Step 6: Take Action!

- Make a Plastic-Free Promise with your class!
- Here are some easy ways to help:

- Say “no” to plastic straws and glitter
- Bring a reusable water bottle and lunchbox
- Help clean up your school or park
- Teach your family and friends about plastic in the water

“Even the smallest choices—like picking up a piece of litter—can protect rivers and oceans.” “How would clean water help animals and sailors?” “What will you do differently after today?”

BONUS MISSION : EXPLORE YOUR LOCAL WATER

Water is everywhere—but do you know where your nearest lake, river, or stream is? And what does it look like? Let's go exploring!" Today, you'll investigate the water near your school, home, or sailing club. You'll look, listen, and sketch like a real Environmental Explorer!

Your Challenge:

- Find a local water source (real or on a map)
- Observe what you see, hear, and smell
- Sketch it, rate it, and reflect on how it's being used—and protected!

"Sailors don't just love the water—they care for it too. Knowing what's around you is the first step in keeping it clean."

What You'll Need:

- A map (digital or paper)
- Notebook or worksheet
- Colored pencils or markers
- Optional: camera or mobile device
- Optional: weather-appropriate clothes (if going outdoors)
- Clipboard (for outside sketching)

 *Sustainability Note: When you visit the water, walk or bike if you can. Take your things with you and leave only footprints behind—just like a kind explorer!*

Step 1: Find Your Water

- Look on a map, or visit in person:
 - River – Pond – Lake – Sea or bay – Stream

👉 Ask:

- What is it called?
- Is it natural or man-made?
- What is it used for? (Sailing, fishing, swimming, drinking?)

Step 2: Observe and Explore

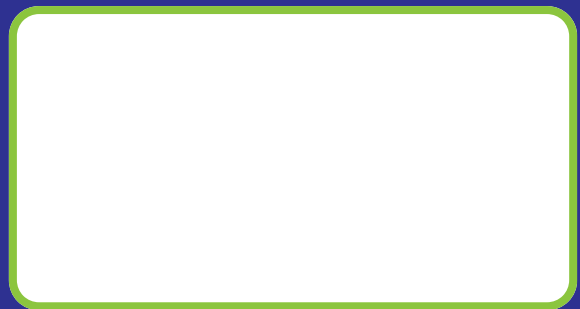
- Visit the water (if possible) or look at pictures/videos.
- Notice:
 - What color is the water? Is it moving or still?
 - Are there plants, fish, birds, or bugs? Are there boats, docks, or people?
 - Do you see any trash or pollution?

👉 Write or draw:

"The water looks _____ and I saw _____ around it."

Step 3: Make a Simple Map or Sketch

- Draw your water source and show:
 - The shape of the water (river, lake, etc.)
 - Trees, grass, or buildings nearby
 - Any boats, docks, or signs
 - Trash or pollution spots (if any)



Step 4: Reflect and Protect

Ask yourself:

- Does the water look clean and healthy?
- Would you want to sail or swim there?
- How do people use this water—fishing, sailing, drinking?
- What could hurt this water—littering, oil spills, too many boats?

👉 Write:

"I think this water is _____ because _____. "One thing people could do to protect it is _____."

GREEN HORIZON ISLAND



06



CARING FOR WATER AND ALL WHO LIVE IN IT

The wind is soft, the sky is wide, and your sailboat gently glides toward a green and peaceful shore. You've arrived at Green Horizon Island—a special place where sailors learn how nature helps us... and how we can help it back. Have you ever wondered how the Earth gives us clean water, fresh air, and food? Or why it's important to keep rivers, lakes, and oceans safe and healthy? That's what we'll explore here. We'll discover what ecosystem services are (that's just a fancy way of saying how nature helps us), and how we can be sustainable sailors who protect the water, animals, and plants around us. From learning what pollutes the water to finding out how to care for sea creatures, this island will turn you into a real eco-explorer!

"Welcome back, sailor! Did you know your sailboat glides through more than just water? You're floating on ecosystems, wildlife, and nature's gifts. Today, we learn how to enjoy sailing—sustainably." "Let's learn how nature helps us—and how we can help nature!"



MISSION 1 :NATURE'S SERVICES – WHAT WATER GIVES US

“Nature helps us more than we realize. When you sail, hike, or just breathe fresh air, you're using something called ecosystem services.”

Your Challenge:

- Discover the 4 types of ecosystem services
- Play the Water Life Web to see how everything is connected
- Reflect on how sailing depends on nature

“Every fish, plant, and wave works together to keep water healthy. That’s teamwork—nature style!”

The 4 Gifts of Nature (Ecosystem Services):

Supporting Services – Water cycles, sunlight for plants, homes for animals

Provisioning Services – Food, wood, and medicine from nature

Regulating Services – Clean air, cool temperatures, flood protection

Cultural Services – Fun, peace, beauty... like sailing!

Activity: The Water Life Web

Stand in a circle, become creatures like fish, crabs, and plankton. Toss a string to someone who eats or depends on you. Build a web of life!

👉 Reflect: “What happens if one part disappears?”

What You Need:

- A picture of a water food web
- String, paper, scissors
- Optional: plastic cups and picture cards about how nature helps us

Let's Play: The Water Life Web

Goal: Show how all life in the water is connected—and why keeping it healthy helps us too!

What You'll Do:

1. Everyone stands in a big circle. Each person picks a role—like a fish, algae, crab, bird, or plankton.
2. One person starts: "I'm algae. I make food from the sun!" Then they toss a ball of string to someone who eats them.
3. That person says, "I'm a shrimp, and I eat algae!" and holds part of the string.
4. The game keeps going, with each person connecting to another—until you've made a big web!

This shows how all water creatures depend on each other. That's called a **food web**.

When part of the web breaks (like if one animal disappears), the whole system can get messed up. That means less clean water, fewer flowers, fewer animals—and less fun things like sailing!

MISSION 2: THE HIDDEN DANGERS OF POLLUTION

Water can get polluted in different ways — not just by garbage! There's physical pollution (like trash or heat), chemical pollution (like oil or soap), and biological pollution (like harmful plants or tiny animals). This hurts fish, birds, and all life in the water.

Your Challenge:

- Identify different types of pollution
- Investigate how sailing can cause or prevent pollution
- Try a mini pollution experiment

Even clean-looking water can be sick. A smart sailor always watches out!

Pollution Experiment:

Use 3 jars of water:

- Add leaves or trash (physical pollution)
- Add food coloring or oil (chemical)
- Add dirty water or plant bits (biological)

👉 Observe and discuss:

"What changed in the water?"

"How might that hurt fish or birds?"

Go outside and document the pollution! Look for signs of pollution near a river, lake, or beach. Can you guess how it got there? Talk about how sailing might add to it — and how to stop it.

MISSION 3: PROTECTING WATER CREATURES

Sailing brings us close to animals like otters, dolphins, and nesting birds. But we must respect their space.

Your Challenge:

- Spot animals during a nature walk
- Create a poster to protect them
- Be a quiet, respectful sailor

"The quieter the sailor, the closer the wildlife will come. That's how you become part of the sea, not just a visitor."

Classroom Activity:

Find photos of local river and sea animals.

Create a poster: "Protect the _____!"

Add: threats they face + how sailors can help

Outdoor Activity:

Listen for birds, watch for wildlife, and pick up trash along the way!

Write or draw what you saw.

Outside!

- Go on a wildlife walk.
- Can you see birds or animals?
- Take photos or draw them.
- Pick up trash if you see any!
- Listen for bird songs — how many can you count?

MISSION 4: BE A SUSTAINABLE SAILOR

Every sailor leaves a footprint, but we can choose to make it green!

Your Challenge:

- Pack an eco-sailing kit
- Share sustainable habits
- Check off your Eco Sailor List

Eco Sailor Checklist:

- ☒ Reusable water bottle
- ☒ Snacks without plastic
- ☒ Sail and Paddle, not motor
- ☒ No soap in nature
- ☒ Trash bag always packed
- ☒ Teach others

"A clean boat = a clean planet. Be the sailor nature is proud of!"

Outdoor Activity:

Build and compare eco-sailing bags!

👉 "My eco-choice was

_____ because

_____."

BONUS MISSION: THE ECO-REGATTA

**Sailing can protect nature when done right—
this is called ecotourism.**

Your Challenge:

- Create an eco-tourism poster or mini info booth
- Plan your own Eco-Regatta (green sailing race!)
- Share a “green story” at your club

Eco-Regatta Rules:

- No motors
- Bring reusable water & food
- Pick up trash during the race
- Take photos, not souvenirs

“You don’t need to be a grown-up to make a difference. You just need heart, wind—and a little sail!”

Ask yourself and your crew:

- What’s one thing you can do differently the next time you sail?
- How did learning about nature change the way you think about boats and water?

✍ Write:

“One way I will protect nature while sailing is
_____.”

“Nature and sailing belong together because
_____.”

TECHTOPIA ISLAND



07



FROM PLAYERS TO CREATORS!

As you sail past the reef, you spot something glowing on the horizon. Strange shapes rise— giant screens, floating keyboards, blinking lights, and 3D printers stacked like sails! Welcome to TechTopia Island—where sailors don't just ride the waves... They code them!



"Here on TechTopia, we don't just use technology —we create it! You'll explore how computers, robots, and 3D printers follow instructions, and then write some of your own!"



MISSION 1 : WHAT IS CODING?

Did you know every game, robot, or smart device is just following instructions someone gave it? That someone is called a programmer, and today—it's you!

Your Challenge:

- Understand what coding is
- Pretend to be a computer (or a boat!)
- Write clear instructions to complete a task

"Computers don't guess. If the code isn't clear, it won't work!"

Try This:

1. Play Code a Boat

- One person is the captain, the other is a boat
- Captain gives step-by-step directions like:
 - ➡ "Take 3 steps forward"
 - ↺ "Turn left"
 - ➡ "Go 2 steps"
- Boat follows the instructions exactly.
- Did the boat end up in the right spot? If not—there's a bug in your code!

2. Play Regatta Race: The Treasure Hunt Game

- Hide a "treasure" and create a map with clear instructions.
- Another team follows the map.
- If they don't find the treasure, improve your code!

👉 Write what you learned:

"I learned that computers need _____ instructions to work."
finding it is part of the fun!"

"Even a small mistake in code is called a bug—and finding it is part of the fun!"

MISSION 2: PROGRAM WITH ARROWS AND COMMANDS

Let's move from the real world to the screen! Code.org lets you tell characters what to do using simple arrow blocks

Your Challenge:

- Use arrow blocks to move a character
- Help BB-8 clean the beach
- Fix bugs and try again!

"Computers don't guess. If the code isn't clear, it won't work!"

Try This:

- Type **code.org** into your browser
- If it's your first visit:
- Accept cookies or close the cookie window
- Set your language and click "Submit"
- Scroll down and click the purple "Elementary School" block (with the bee)
- Scroll again and click "Start Pre-Reader Course" (with the dog and unicorn)
- In the third row, select **Lesson 4: Programming with Rey and BB-8**, then click on **circle 2**
- Close the video that pops up, and click anywhere to remove the shadow
- Drag the blue-green arrow blocks to guide BB-8 to:
 - Collect all the trash
 - Reach the recycling bin
- Click Run to test your program
- If you complete the puzzle, click **Continue**
- If not, click **Reset** and try again

After solving all 10 puzzles, use the back arrow (top left of the page) and choose another course, e.g. **Lesson 3: Programming with Angry Birds and repeat steps.**

"Just like sailing, coding takes practice and precision. Keep testing and improving!"

👉 Reflect:

"When I used more commands in the right order, the robot
-----." "If something didn't work, I
-----."

🌟 More Games to Explore:

- **Lightbot**: Solve logic puzzles (requires Flash on desktop or mobile [app/game for mobile devices](#)).
- **Kodable – Beach Cleanup**: Clean up the beach using arrows

MISSION 3: CODE WITH BLOCKS AND CREATE GAMES

Now that you've mastered arrows, it's time to try block coding—where you control the game characters with full commands!

Your Challenge:

- Use drag-and-drop blocks to write programs
- Make characters jump, spin, or respond
- Try loops and conditions

Try This:

- Go to hourofcode.com
- Click on Activities in the top menu
- Choose your preferred language (right side of the screen)
- Filter results: **Grades:** Choose your age range, **Programming Language:** Select Blocks
- Click a game (e.g. Minecraft, Angry Birds) and hit Start
- Follow the instructions to drag and snap together code blocks to complete each challenge

"Block coding lets you build smart, repeatable instructions—and it's fun too!"

👉 Reflect:

"My favorite block was _____ because it made the character _____."

"The trickiest part was _____ but I solved it by _____."

✨ Another fun option: Return to Code.org and explore Minecraft Adventurer!

- For the first 3 steps see above Activity 2: Coding with simple commands > Hands-On Learning. Then:
- Scroll down and click **Try the Hour of Code** (blue-green block with Minecraft characters)
- Click **Explore Minecraft** (purple button, right column)
- Click **Minecraft Adventurer > Get Started**
- Close the video that pops up
- Choose your character and follow the coding steps
- Use blocks to solve the puzzles by clicking **Run, Reset, and Continue** as needed

MISSION 4: EXPLORE PROGRAMMING IN 3D

TechTopia is not flat! Let's build our own world—and code what happens inside it! With Kodu, you can design terrain, add characters, and make them react to what happens.

Your Challenge:

- Create a 3D game world
- Program your character to move, collect, or score
- Discover how to code interactions!

Try This:

- Go to kodugamelab.com/downloads
- Click the link [KoduSetup.EXE](#) and install the program (Windows only)
- Open Kodu Game Lab and start a New World
- Use the terrain editor to raise land or add water
- Use visual "tiles" to program your character:
- Example: WHEN see apple DO collect

"In Kodu, you're the creator of the world and the rules. Your characters can think, move, or react—it's all up to your code!"

Reflect:

"In my Kodu world, I made _____ when _____."

"One fun rule I added was: _____."

✨ Helpful Video Tutorials:

Getting Started:

- [Kodu Game Lab: Tutorial \(11:49\)](#)

Features:

- [Kodu Game Lab - Beginner - 01 Creating a New World \(5:24\)](#)
- [Kodu Raising Terrain & Water \(6:04\)](#)
- [Kodu Game Lab - Beginner - 02 Saving/Importing/Exporting Worlds \(2:01\)](#)
- [Kodu Game Lab - Beginner - 03 Player Movement \(1:44\)](#)
- [Kodu Game Lab - Beginner - 04 Spawning \(2:55\)](#)
- [Kodu Game Lab - Beginner - 05 Score Points \(2:38\)](#)
- [Teleporting in Kodu \(7:20\)](#)

Sample Projects:

- [Coding for kids | Create a game with KODU game lab | Age 5+ \(4:10\)](#)
- [How to collect an object in Kodu games lab \(4:19\)](#)
- [How to create a target game in Kodu Game Lab \(4:15\)](#)
- [How to Create a Racing Game in Kodu Game Lab \(4:15\)](#)
- [How to Create a World for Your Games in Kodu Game Lab \(4:33\)](#)

BONUS MISSION: DESIGN A 3D SAILING BOAT!

Time to build a real object with code—something you can even print!

Your Challenge:

- Design a 3D object using CAD
- Create your own sailboat
- Save and share your model!

Try This:

- Open your browser and go to <https://www.tinkercad.com>
- Click Sign Up (top-right corner) to create a free account.
- Why? Signing up lets you save your work and access built-in tutorials from Autodesk.
- Once logged in, click Create New Design to start your project.
- Use drag-and-drop shapes to create your boat. Try combining boxes, wedges, and cylinders for the hull, mast, and sails.

"Design is coding too! Each shape, size, and rotation follows math and logic—and your imagination."

Reflect:

"My 3D boat has _____. "I would add _____ to make it even better."

✨ Learn by Watching – General Tutorials:

- [TinkerCAD - Tutorial for Beginners in 10 MINS! \(10:44\)](#)
- [TINKERCAD for Beginners – Simple Basic Tutorial \(7:17\)](#)

📺 Build a Boat – Step-by-Step Examples:

- [TinkerCAD - Sailboat \(8:49\)](#)
- [How to Make a SAILBOAT 🚢 \(10:23, no voice-over\)](#)
- [\[1DAY_1CAD\] SAILING SHIP – Tinkercad Style \(10:33\)](#)

📖 Learn by Reading:

- [Boise State University Tinkercad Guide \(Text & Image\) \(or search for “Boise State Tinkercad tutorial”\)](#)

📺 Remix Ideas – Ready-Made Designs to Explore: (Search for these in the Tinkercad gallery once logged in)

- [Sailing boat](#)
- [Sailing Yacht](#)
- [Small Sailboat](#)
- [Triple hull sail boat](#)

DEEP DIVE ISLAND



08



DIVE INTO MARINE ROBOTICS!

As your ship approaches the mysterious reef of Deep dive Island, something glimmers under the surface—tiny propellers, blinking cameras, and underwater explorers! Welcome to Deep dive Island Island: Marine Robotics, where sailors learn how robots explore the sea, protect nature, and support sailing adventures.



"Marine robots are like underwater explorers— they dive where we can't, see what we miss, and help us care for our waters. Ready to pilot one yourself?"



MISSION 1: WHAT ARE MARINE ROBOTS?

Let's dive into the fascinating world of marine technology! Before we can build or pilot anything, we need to understand what marine robots are, why they're useful, and how they help both scientists and sailors every day.

Your Challenge:

- Learn what marine robots are
- Discover the types of marine robots
- Understand how they're used in science, sailing, and more

Try This: Talk in pairs or small groups about these questions:

- Why do we need robots in the ocean?
- Where do you think marine robots go that people can't?
- What do you think they look like?

Learn:

Marine robots are machines that go underwater to explore, monitor, or fix things. Some are like submarines, others like marine drones. Some drive themselves (autonomous), and others are controlled by a person using a remote (ROV = Remotely Operated Vehicle). They help scientists learn about the ocean, check for pollution, protect coral reefs, and even help sailors by checking boat hulls or sea conditions.

"A robot doesn't get tired, seasick, or scared of the deep! But it still needs a smart human to tell it what to do."

MISSION 2: HOW ROBOTS HELP SAILORS AND NATURE

Now that you know what marine robots are, let's discover what they can actually do! These high-tech helpers are not just cool—they're also incredibly useful for protecting nature and making sailing safer and smart.

Your Challenge:

- Discover how marine robots protect the environment
- Explore their roles in sailing

Try This: Look at photos or videos of marine robots in action. Talk or write about:

- How can marine robots help sailors?
- How can they find pollution or trash in the sea?

Learn: Marine robots can:

- Check under boats without lifting them out of the water
- Explore dangerous places like oil spills or deep sea vents
- Watch fish and coral without disturbing them
- Collect samples of water or sand

"Sailors use them to check anchors, inspect hulls, or scout harbors. Scientists use them to protect marine life. Some marine robots are even solar-powered—clean energy for a clean sea!

MISSION 3: TRY PILOTING A REAL UNDERWATER DRONE!

Time to go hands-on! Today you will use your phone to pilot a real underwater drone called an ROV (Remotely Operated Vehicle).

Your Challenge:

- Connect your phone to the ROV system
- Use the Blueye app to pilot the drone underwater
- Complete a simple task (explore a pool, find an object, follow a line)

Setup Steps:

1. Install the WireGuard App (Android or iOS)

- Android: [WireGuard on Google Play](#)
- iOS: [WireGuard on App Store](#)
- Open the app after installing it.

2. Add the VPN Tunnel

- Tap the '+' or 'Add tunnel' button
- Choose 'Create from QR code'
- Scan the code provided by your teacher
- Name it something like "BlueyeWG"
- Tap the switch to activate the tunnel

3. Install the Blueye App

- Android: [Blueye on Google Play](#)
- iOS: [Blueye on App Store](#)

4. Connect the Drone

Your teacher will:

- Power on the surface unit (the drone's hub),
- Plug in the ethernet cable into a port near the pool,
- Activate the ROV with a magnet (watch the LED light blink!)

5. Start Piloting!

- Activate the WireGuard VPN
- Open the Blueye app
- Tap on the ROV name when it appears
- Tap "Start Dive" to begin
- Use the screen interface to steer, dive, turn, and turn on the lights

👁️ What to Observe:

- What do you see underwater?
- Was it easy or hard to steer?
- How deep did you go?
- Did you notice anything unexpected?

🧑‍🔧 Features to Try:

- Live video view Depth hold (hover at one depth)
- Tilt lock Light control Video recording

📖 Extra Resources:

- [WireGuard official site](#)
- [Blueye Support](#)

"ROV pilots need steady hands, sharp eyes, and a plan! What would you explore if you could dive anywhere in the sea?"

👉 Reflect:

"I used the ROV to _____."

"The hardest part of piloting was _____."

"I think marine robots are important because

_____."

YOU DID IT, EXPLORER!



You've sailed across all the STEAM Islands—solving mysteries, building inventions, and discovering how science, nature, and sailing work together.



"I'm so proud of you, sailor! You explored, tested, built, and protected the water around you. Wherever the wind takes you next—stay curious, kind, and full of ideas. The world needs explorers like you!"





Co-funded by
the European Union



CERTIFICATE

OF COMPLETION

This is to celebrate and recognize that

has successfully completed the Sailing Into STEAM
adventure!

They have sailed across magical islands, explored the wonders of science, technology, engineering, art, and math, and shown curiosity, creativity, and courage along the way. From building boats and testing sails to solving water mysteries and protecting nature - you have proven yourself to be **a true Sailor-Scientist and a STEAM Explorer.**

(Educator / Instructor)

(Date)