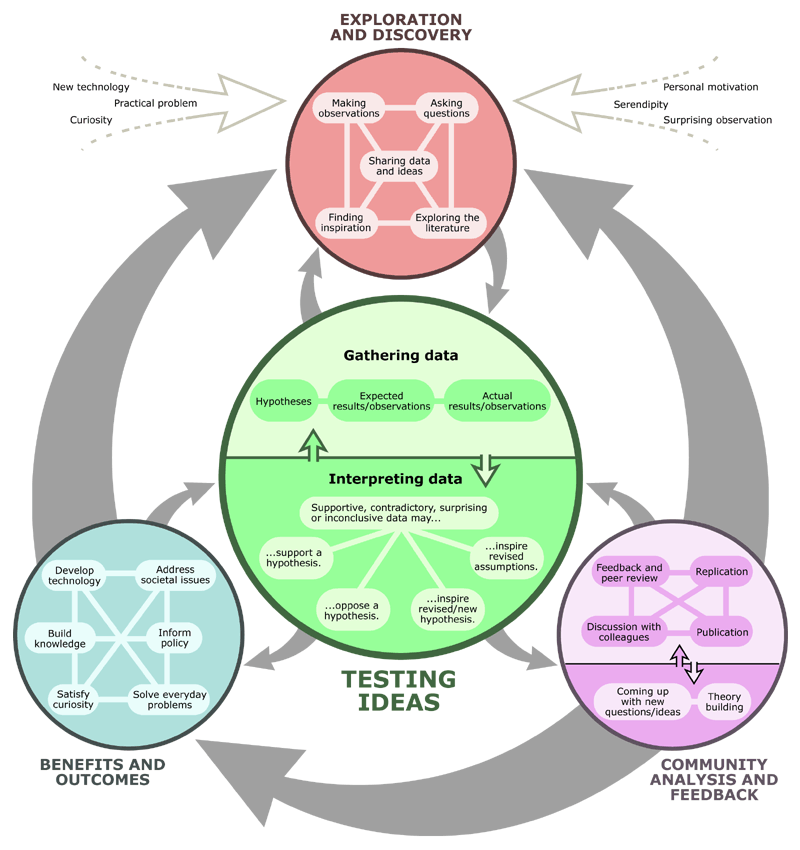
|  |
| --- |
| Chapter 6. Life Between Two Worlds  Dive!  Diving Mammal:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  A drawing of a fish  Description automatically generated |
| Seashore stewardship pledge  *I, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, do hereby solemnly pledge to be a good steward of the marine environment. This means that I will:*   1. *Listen to the instructors both in the classroom and in the field.* 2. *Walk on the shore and docks with care to avoid hurting myself, others, and the sea/river life.* 3. *Treat all life forms with care and respect.* 4. *Use only wet hands to* **touch gently (using only two fingers)** *animals that I find.* 5. *Leave creatures attached to rocks and docks because attempting to remove them can hurt them.* 6. *Not hold any marine life out of the water for more than one minute.* 7. *Leave no boulder overturned; I will carefully replace all rocks that I look under and I will only turn over rocks that are smaller than my head.* 8. *Return all organisms to their homes or where I found them.*   *Signed: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*  *Dated: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*  ORGANIZE YOUR EXPLORE TEAM  Salish Sea Explorers use teamwork to solve mysteries and save the day for sealife. Form a team and select one of these equally valuable roles, then start to explore!  Team Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   |  |  | | --- | --- | | **Chief Scientist**  Research manager  -suggests research projects  -ensures proper scientific protocol  Project manager  -ensures each team member has a job and stays on-task, motivates team with positive encouragement  -Ensures project completion  Assists all other positions as needed | **Research Associate**  Conducts background research online, in books, interviews, videos, or magazines  Methods manager  -ensures research procedures are legit.  Recorder  -records and enters data in data tables  -records summaries of team’s work  Assists all other positions as needed | | **Field/Lab Technician**  Materials manager  -gets supplies and makes sure they are in  working order  Keeps workstation organized  Infographic artist  -creates graphs from data table content  Assists all other positions as needed | **Science Communicator**  Reporter  Graphic artist  Presentation manager  -slideshow, poster, video, etc.  Translates complex science into words the general public can understand  Assists all other positions as needed | | **Cultural Liaison** (for 5 person groups)  Researches and records input and perspectives of members of the local Coast Salish Tribe (US) and/or First Nations Band (Canada). Finds Indigenous stories, songs, and/or art that teach us about keeping Salish Sea ecosystems balanced. | For long-term projects, switch roles every 4 weeks  **GO TEAM!** |   Ch. 6 life between two worlds – inspired thoughts  What did this Explore chapter bring to mind? Use this space to free-write and/or draw your thoughts, ideas, imaginings, and questions. |
| VOCABULARY  Circle or highlight the words you and your classmates found important in this chapter. Come back to define with words or pictures as you learn meanings.   |  |  | | --- | --- | | Vocabulary word | Definition | | Respiration  Oxygen  Breaching  Adaptation  Anatomy  Physiology  Senses  Echolocation  Acoustics  Amplitude  Frequency  Wavelength |  |   Icon  Description automatically generated***Game time!*** Hungry Hungry Porpoise  \*Did you know: \*What to do:   |  |  | | --- | --- | | There is a harbor porpoise in the Salish Sea. It breathes air. It is hungry. Its prey is in deep water where there is no light and no air.  Image result for harbor porpoise" | Be the porpoise! Or its prey, or even an island or ship, all in a game that is kind of like tag… in the dark… without air.   1. Select a classmate to be the porpoise. 2. Place the porpoise mask on the porpoise so they can’t see. 3. Select 1-3 classmates to be its prey. Have them select the type of prey they are representing (smelt, squid, herring, …) 4. All other classmates become islands (boundaries) and form a loose circle around the hunting area. Porpoise and prey must stay within the island boundary. 5. When the game begins, the porpoise will need to locate its prey.  ***Discuss/look it up***: How do porpoises locate prey in the dark? 6. When the porpoise claps once, the prey clap twice. The porpoise must locate and catch (tag) them (without peeking!). 7. A round ends when at least one prey is caught, meaning the porpoise is full and happy, or 5 minutes goes by with no catch 8. Play a few rounds this way, then make it a little more realistic:   The porpoise has to ***hold its breath*** while hunting. When they must come up for air (breathe), another porpoise takes its place!   1. For another challenge, select several of the “islands” to turn to “ships” and make engine noise while the porpoise is trying to hunt.   What were the biggest challenges to depending on echolocation to find prey in the Salish Sea?  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  A close up of a sign  Description automatically generatedWonderAfter playing Hungry Hungry Porpoise, what do you wonder about diving animals in a noisy sea? Write or draw your thoughts below.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Ready to get to the bottom of it? Let’s explore! Write our Ch 6. Essential Question Here: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  ***Team Talk:*** How to Stay Underwater Longer  If you were a diving animal (maybe you are!), what are ways your body could make your oxygen last as long as possible? List your ideas under each category here:   |  |  |  | | --- | --- | --- | | **Behavior** | **Shape** | **Physiology** |   A close up of a logo  Description automatically generated***Activity:*** Model diving animal speed tournament  May the best hydrodynamics win!  \*Did you know: \*What to do:   |  |  | | --- | --- | | Shapes of diving mammals help them slide through the water. Here are a few (from what-when-how.com ) | * + - 1. Gather water-resistant modeling clay for each Explore Team member.       2. Make a model of a fast-diving marine animal using your clay. Name it 😊       3. Add each of your model divers to the speed tournament bracket.       4. Race your Explore Team! Time a dive from the surface to the ‘prey’ at the bottom of a tank of water.       5. Winners from each Explore Team are placed in the next level in the tournament bracket, then have a dive-off.       6. The winner leads the next Research It! experiment (see p. 11 and your teacher for guidelines) | |
| Dive Tournament reflections page |

A close up of a logo

Description automatically generated ***Activity:*** Team Read: What Happens During a Dive

\*Did you know? \*What to do:

|  |  |
| --- | --- |
| Diving birds, mammals, and reptiles need to breathe air to get oxygen (O2).   * The oxygen fuels the breakdown of glucose (sugar) for energy in respiration:   O2 +C6H12O6🡪CO2+H2O  (Glucose)   * The glucose comes from plants and algae, which get energy from the sun to fuel the formation of glucose from water and carbon dioxide during photosynthesis:   CO2+H2O🡪 O2 + C6H12O6 (Glucose)   * Pretty slick set-up between the producers and the consumers! * But how do diving animals conserve oxygen during a dive? * And…can *WE* do that?? | **Team Read:** *How Diving Mammals Stay Underwater So Long*  Divide the article into logical parts so each Explore Team member can read and summarize one portion.  **Draw this template** onto a poster paper:    Have each member share their summary in a different color marker, then have the *Research Associate* write a joint summary of all parts in the center, color coding its parts. |



Icon

Description automatically generated***Research it!*** Human Dive Reflex (Get your Physiologist On!)

**Research Title: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Choosing Variables:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(one **compared/changed**/**manipulated/** variable)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(one **measured/responding/dependent** variable)

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(choose three controlled variables, or things to keep identical for all trials of both treatments)

**Research Question: Do humans have a dive reflex?**

**Hypothesis/Prediction:** We predict that if \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_then\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Procedure:**

Whiteboard

Description automatically generated with medium confidenceLet your partner measure your resting heart rate for 30 seconds by placing the pads of two fingers on the inside of your wrist by the hand or on the carotid artery on your neck. Fit Bits work, too! Record in the table below.

Fill a small, paper cup with ice water and submerge your nose in the water. It is okay to let it enter your nose but be careful not to breathe it in!

Again, have your partner measure your resting heart rate, but while your nose is under water. Try to hold your breath with your nose in the water for 30 seconds, if you can. Record in the table below.

**Results:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Team Member**  **Initials** |  |  |  |  |  |
| **Heart Rate in air (BPM)** |  |  |  |  |  |
| **Heart Rate with nose submerged** |  |  |  |  |  |

**Graph your results:** Have your Research Associate add your data to the class graph, then make a graph here or in a spreadsheet on your computer.

1. Label the axes:
   1. Write what you compared on the horizontal x-axis. This is your changed or manipulated variable.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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* 1. Number your y-axis. Use > half the graph and a scale that fits your whole value range.

Heart Rate (beats per minute)

\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_

Human dive response test subjects (Initials)

Discuss your findings with your class.

*** Research it!*** Sound through a gas, liquid, and solid

Remember that: What to do:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **\****Density is the mass of an object in a given volume:*  \**Particles are squished together tight in dense materials and loose in low density materials.*  *\*So:*  *The density of steel > the density of wood*  *The density of wood > the density of water*  **You try it:**  *The density of water \_\_\_*  *the density of air.*  *(draw a greater or less than sign)* | **Team Talk:**  If sound is vibrations caused by colliding particles of matter, does sound act the same in materials with different densities?  **Try this with a partner:**  1. Blow air into a zip-top sandwich bag and seal it in.  2. Hold the bag to one ear and cover the other ear with your hand.  3. Have your partner tap on the bag of air with a pencil.  4. Fill the same bag with water and seal it.  5. Repeat steps 2-3.  6. Place a wooden block into the bag, squeeze out the air, and seal.  7. Repeat steps 2-3.  8. Color in the graph below to show the comparative sound levels.    \*Option: If you have a sound measurement app or device, repeat the steps above while holding the bag against the device and record the levels in decibels (db) in your graph.  **Sound Level**   |  |  |  | | --- | --- | --- | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |  |  |  |   **Air Water Wood** |

SOUND THROUGH A GAS, LIQUID, and SOLID REFLECTIONs PAGE

CONCLUSIONS

FORMATIVE ASSESSMENT

1. Does sound travel faster through water or air?

2. Does sound travel faster through wood or water?

3. Is there sound on the moon?

4. How are sound vibrations transferred to your brain?

A close up of a logo

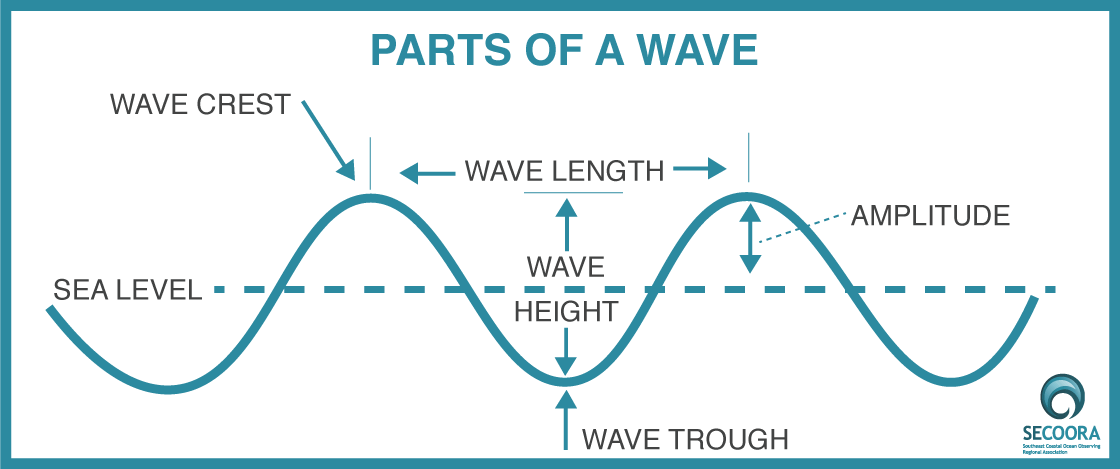
Description automatically generated***Explore Activity*** Sketching Sound

Did you know: What to do:

|  |  |
| --- | --- |
| * …that water is matter and matter is made of particles, called atoms?   +A picture containing mirror, accessory, clipart, spectacles  Description automatically generated+   * …2 atoms of hydrogen and 1 atom of oxygen bond to make a water molecule, H2O?   +  +A picture containing mirror, accessory, clipart, spectacles  Description automatically generated**-**   * …that H2O is “sticky?” One end has a **+** charge, the other has a **-** charge. Opposites attract! The + end of one H2O sticks to the – end of another.   + A picture containing mirror, accessory, clipart, spectacles  Description automatically generated+ | When your favorite diving mammal makes a sound under water, what does the sound do to the water molecules? Sketch it!  Draw dots to symbolize water molecules:  Sketch a mammal here | Sketch what its sound does to water here here  How fast does its sound travel? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ mph  Stretch the Slinky along the length of your lab table.  Make the sound of your favorite diving mammal as you send a pulse of movement through the Slinky.  Draw a picture of the Slinky in action:  Were your two pictures similar? How? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

# Label the parts of this wave diagram.

# Use words from the wave word bank.



**Wave Word Bank**

**Wave:**The repeating and periodic disturbance that travels through a medium (e.g. water) from one location to another location.

**Wave Crest:**The highest part of a wave.

**Wave Trough:**The lowest part of a wave.

**Wave Height:**The vertical distance between the wave trough and the wave crest.

**Wave Length:**The distance between two consecutive wave crests or between two consecutive wave troughs.

**Wave Frequency:**The number of waves passing a fixed point in a specified period of time.

**Wave Period:**The time it takes for two successive crests (one wavelength) to pass a specified point. The wave period is often referenced in seconds, e.g. one wave every 6 seconds.

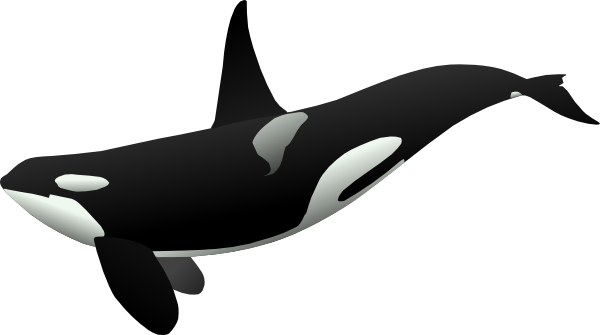
**Can you hear the orcas calling?**

# You can listen to recorded orca calls or tune in to *hydrophones* posted at three locations in the central Salish Sea at the Orca Sound website: <https://www.orcasound.net/listen/>

# An animal swimming in the water Description automatically generated

# With some additional materials and the engineering skills learned in unit 5, you can build your own hydrophone to add to your ROV or to use on its own.

# The University of Connecticut provides instructions. Search for COSEE TEK Simple Hydrophone Design online.

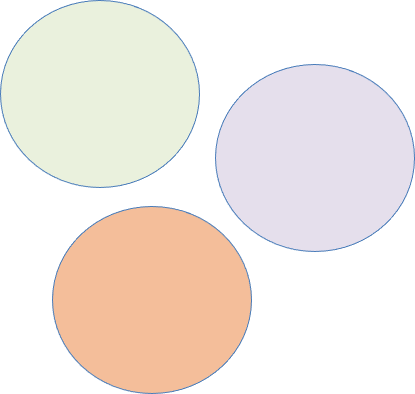
***Icon

Description automatically generatedEngineer it!* Lowering Sound in the Sound**

Have you heard the orcas sing? Let’s help them hear one another and their prey! Gather your materials then design, build, and test your prototype, aiming for the quietest ship hull in the class.

Write and sketch mini diagrams in the circles below to record your engineering process steps.

IDENTIFY THE PROBLEM



DESIGN

EXPLORE

**CREATE**

**TRY IT OUT**

**MAKE IT BETTER**

Repeat any steps!

A picture containing linedrawing

Description automatically generated

Quieter Ship Design Log Date\_\_\_\_\_\_\_\_\_\_

What did you accomplish today with your Explore Team’s ship design? List positive things under the plus and things that could be changed under the triangle\*

\*a triangle is a Greek symbol for a delta, where a river enters the sea and forms a triangle shape of sand. A delta is a site of constant change!

+ Δ\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Notes - additional thoughts and ideas

Use this page to track your prototype progress. Return to describe the benefits (+) and changes you’d make to each of your designs.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Design 1  Design 2  Design 3 | | | Notes  +  Δ  Notes  +  Δ  Notes  +  Δ | | | |
| Engineer Name: | NO | | SOMEWHAT | YES |
| I and my team designed and built 3 ship hulls |  | |  |  |
| Our team designed and built a functioning propeller |  | |  |  |
| Our final prototype floated balanced on the water |  | |  |  |
| Our final ship prototype produced less noise compared to our initial prototype |  | |  |  |

 ***Put Science to Work*** ACOUSTICAL ENGINEERING RESEARCH

Research Title: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Research Question:** *What features make a ship quiet?* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Choosing Variables:**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

one **changed/ manipulated/independent** variable (what you will compare) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

one **measured/responding/dependent** variable (what you will count/measure)

1\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Hypothesis/Prediction** (not all research is hypothesis-driven, so this step may be skipped, if yours is a survey or collection of interviews with elders:

We predict that if \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ then\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Diagram:** Draw a ***labeled*** illustration of the experiment. Show all materials in action.

**Procedure:** Number step- by-step directions for how to do the experiment.

1. Tell how you will set up the experiment.
2. Tell how you will change the manipulated variable.
3. Tell how you will measure the responding variable.
4. Tell how often you will take and record measurements.
5. Tell how many times you will repeat each test/observation.

**Results: Tables, graphs, and brief description of outcome**

1. Label columns and rows including units (in parentheses)
2. Include a space for the calculated average (mean)

**Data table:** Sound Levels in ship prototypes

|  |  |  |
| --- | --- | --- |
| **Explore Team** | **Prototype 1 Sound Level (db)** | **Prototype 2 Sound Level (db)** |
| **1** |  |  |
| **2** |  |  |
| **3** |  |  |
| **4** |  |  |
| **5** |  |  |
| **6** |  |  |

**Graph your results:** Add your data to the class graph then make a graph here or in a spreadsheet on your computer

1. Label the axes: Write the items you compared on the horizontal x-axis. This is your manipulated or input variable. Write what you measured on the vertical y-axis. This is your responding or output variable.
2. Number your y-axis. Use > half the graph and a scale that fits your whole value range.
3. Choose the best graph type to most easily compare between orca types.

y-axis title \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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x-axis labels \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_

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Brief and Concise description of results

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| --- | --- |
| Claim | Evidence  • What does the graph show? |
| Evidence  • Do the math, what are the numerical differences between the two responding/output variables? How much quieter was the quietest ship than the average? | Reasoning  • explain why you think the results turned out that way and any possible errors |
| Implications  How might this research affect the world? | Applications  • What could/should be done? |

These stamps certify achievement of the following:

Sensory Savvy

Diving Adept

Wave Wiz

Research Scientist Superstar

Forensic Fortitude

A close - up of a robot

Description automatically generated with medium confidenceA picture containing text

Description automatically generatedA picture containing text

Description automatically generated