

# Submarine Density Project

## **Project Description:**

A submarine is a vehicle designed to function deep below the ocean's surface. Inside every submarine is a set of hollow chambers called ballast tanks that can be filled with pressurized air or water. As the tanks fill with water, the density of the submarine increases and moves underwater. When the tanks are filled with air, the density of the submarine decreases and the submarine rises. Propellers help drive the submarine forward and hydroplanes steer the vehicle.

## **Your Mission:**

Either with a partner or own your own, design, construct, and demonstrate a submarine device that will float, sink, then float again OR sink, float, then sink again in a tank of water 30 cm deep. This mission also includes calculating the changing density of your submarine and writing a "Captain's Log" of your design process.

## **Procedure:**

1. Research information as to how submarines submerge under water by reading Internet resources and Discovery Education videos.
2. Draw sketches of your device and determine what materials are needed to construct your submarine.
3. Build a prototype of your device and run trials to determine what design changes need to be made to have a successful dive.
4. Keep a Captain's Log – written report using the scientific method.
5. Present your final device to class on Dive Day – testing the device in the tank and a multi-media presentation of your choice.

## **Restrictions:**

- Device must be more than 5 cm long and not larger than an average shoebox.
- You will have 5 minutes to get your submarine to complete its mission. After 5 minutes, the mission will be considered unsuccessful.
- The density of the water in the tank must remain unchanged after your sub has completed its mission. Things that dissolve in water are not allowed. Kleenex and paper dissolve in water and can contaminate the tank.
- If working with a partner, the partnership will earn the same grade for the device and presentation, but each person will earn an individual grade for Captain's Log.

## **Resources:**

Listed on the Buoyancy Board in Discovery Techbook

- Must watch at least 2 videos and take notes and visit at least 2 websites and take notes. All notes kept in Captain's Log.
- Must cite sources in Captain's Log.

**Materials:**

Students may bring any materials to school to create their submarine as long as they are safe. No chemicals and only minor cutting/tooling may be completed at school. If students do not have their own materials from home the following will be provided:

- 1 plastic water bottle or pop bottle
- clay
- kite string
- 1 drinking straw

**Multi-Media Presentation:**

- 5 minutes maximum for testing device.
- 3-5 minute multimedia presentation explaining your design process (follow your Captain's Log)
- Tools you could use: PowerPoint, Weebly web page, Discovery Board Builder, Glogster, Prezi, Educreations screencast, etc...

**Due Dates:**

Check Point	Date	When
Background information in Captain's Log	Monday, November 18	End of class
Design Sketch #1 in Captain's Log	Tuesday, November 19	End of class
Materials needed in Captain's Log	Tuesday, November 19	End of class
Prototype built and 3 trials run in class tank	Thursday, November 21	End of class
Design Sketch #2 in Captain's Log	Friday, November 22	Beginning of class
Final sub built and 3 trials run in class tank	Monday, November 25	End of class
Captain's Log complete	Tuesday, November 26	End of class
Final workday at school	Wednesday, Nov. 27	Class time
Dive Day – final presentations	Monday, December 2	Class time

Check points will be entered as formative assessments in the gradebook. No credit will be given for check points not completed on the due date.

Any student not prepared to present on Dive Day will receive an INCOMPLETE (0%) for their summative presentation grade. Students will have to arrange a time after school that fits Mrs. Haygood's schedule to present.

## Scale Scores

### Submarine - Summative

4.0	Design goes above and beyond level 3. Deeper understanding of buoyancy is evident in the sophistication of the design.
3.0	Submarine completed the mission successfully within 5 minutes (float, sink, float OR sink, float, sink). Submarine is at least 5 cm long but not larger than an average shoebox. No residue was left behind in the tank.
2.0	Submarine's mission was successful, but had a design violation.
1.0	Submarine's mission was unsuccessful.
0	No submarine was built.

### Captain's Log - Summative

4.0	Log goes above and beyond level 3. Deeper understanding of buoyancy is evident. Connections go beyond the scope of this project.
3.0	All parts of the log are complete. Explanations are thorough and evidence is provided for reasoning. Grammar and spelling errors are minimal.
2.0	Log is complete but with basic explanations/evidence for reasoning. Grammar and spelling errors are abundant.
1.0	Captain's log is not complete.
0	Captain's Log is missing

## Background Information

Paragraph explaining how submarines dive and resurface:

Paragraph explaining ways to change the density of an object:

## Problem

How does the design of a submarine affect how it floats or submerges in water?

**Hypothesis** (Answer the problem using *If, then, because* statement)

**Sketch #1** (Draw initial design and label parts. Explain how parts move/work)

**Materials** (list All materials needed to build initial design)

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**Data** (qualitative and quantitative results from first dive attempt – what worked, what didn't?)

Trial 1	Trial 2	Trial 3

**Sketch #2** (Draw revised design and label parts. Explain how parts move/work)

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**Materials** (list All materials needed to build revised design)

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**Calculations**

Mass of sub:	Volume of sub:
Density of sinking sub :	Density of floating sub:

**Conclusion**

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# Research

Internet Site #1:  
Notes:

Citation:

Internet Site #2:  
Notes:

Citation:

# Captain's Log

## Research

Video #1 Title: \_\_\_\_\_

Notes:

Citation:

Video #2 Title: \_\_\_\_\_

Notes:

Citation: