Unit A: Experimental Design **Name:** _____

Activity 8: Diving Submarines **Period:** _____

_____/62 **PG**_____

**Purpose: To *plan* and *conduct* a controlled experiment to test a hypothesis.**

**Goal: The goal is to make a toy submarine dive as many times possible in 10 minutes.**

## ~ Part A ~

**Instructions:**

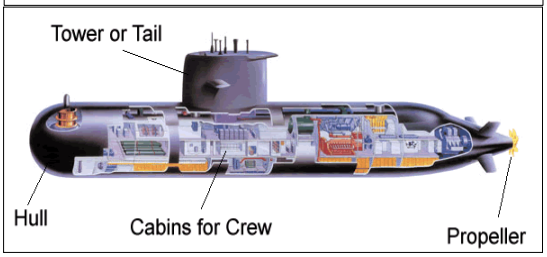
You are now Onderzeeboten Kommanders! Your goal is to make your submarine dive underwater as many times as possible in 10 minutes. Gather the list of materials & perform the procedure below.

### Materials:

1 submarine
1 small scoop
1 thermometer
baking powder
1 Red Vines container

### Procedure:

Figure 1. Submarine components




1. Fill the Red Vines container up to the first line with **cold** water.
2. Record the Temperature of the water.
3. Remove the conning tower cap of the submarine & add 10 level scoops of baking powder inside the submarine. Tap 3x to pack the powder.
4. Add 5 more scoops & tap 3x, then 5 more and tap again. Put conning tower firmly on submarine.
5. Submerge the submarine in the Red Vines container & shake the submarine under water for 4 sec.
6. Release the submarine & start a timer for 5 minutes.
7. Record the total number of dives the submarine makes in 5 minutes in Data Table 1.
8. After 5 minutes, take off the conning tower, wash out the inside of the submarine and blow dry. Dump out the Red Vines container in the sink. Return all materials to your bin.

**Data Table 1. Total Dives in Warm Water – Control Trial**

| # of Dives | Water Temperature °C | # of Scoops of Baking Powder | Time (min) | (dives/min) |
|---|---|---|---|---|
| | | 20 | 5 | |

## ~ Part B ~

**Instructions: You and your team must *plan* and *conduct* an experiment testing a hypothesis between two variables.**

a. Chose one of the two possible variables below to test:

- Temperature of water,
- Number of scoops of baking powder

*b. Complete* steps #1-6 on the next page.

**c. Get approval from your instructor.** Then *conduct* your experiment & record your data in the provided data table. Finally, *analyze* your data and communicate your conclusions.

***Step 1:*** *State* the **purpose** of your team's investigation (include YOUR TEAM's Variable).

_____

_____

_____

***Step 2:*** *Identify* the **study subject**, **manipulated variable**, and **responding variable.**

*SS* = _____

*MV* = _____

*RV* = _____

***Step 3:*** What is your scientific **question**? *("How does/What is… SS + MV affect RV?")*

_____

_____

_____

_____

_____

***Step 4:*** *Identify* the **experimental trial** & **control trial**.

ET = _____

_____

_____

_____

CT = _____

_____

_____

_____

_____

***Step 5*:** State your **hypothesis**.

**IF** (SS + MV)_____

_____

**THEN** (ET + Prediction)_____

_____

_____

**COMPARED TO** (CT)_____

**BECAUSE** (WHY = SS, MV, & RV)_____

_____

_____

**THEREFORE** _____

_____

_____

***Step 6: (6pt)*** List the **controlled & uncontrolled variables and types of error** in the experiment.
**BE SPECIFIC:** ***Be sure to go back and revise this list after your experiment is done!!***

| **Controlled Variables )** Minimum of 2 | **Uncontrolled Variables )** *List 2 or more that affect data* | **Type of Error )** *Use World of Variables HO* |
|---|---|---|
| 1. _____ | 1. _____ | 1. _____ |
| 2. _____ | 2. _____ | 2. _____ |
| 3. _____ | 3. _____ | 3. _____ |

**Step 7: Record data.**

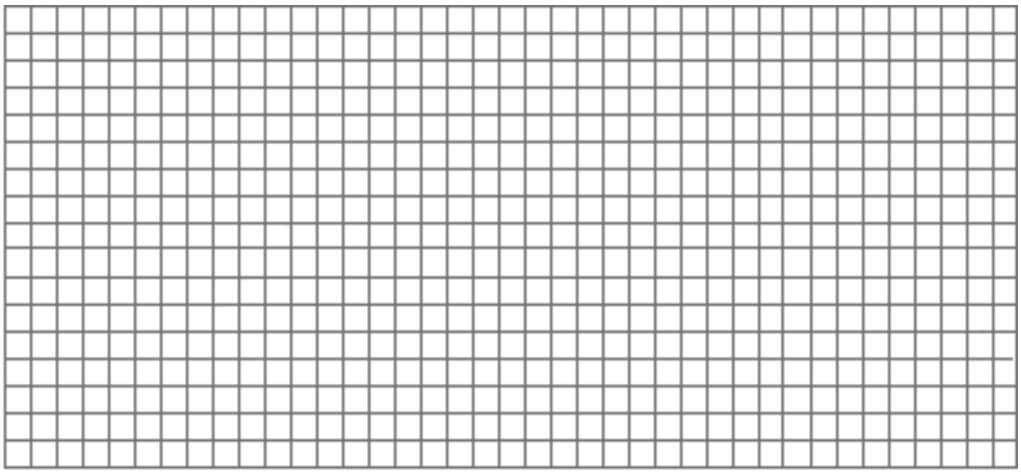
**Data Table 2. _____**

| Water Temperature °C | # of Dives | Water Temperature | # of Scoops of Baking Powder | Time (min) | (dives/min) |
|---|---|---|---|---|---|
| **Control Trial (get data from p.1)** | | | **20** | **5** | |
| **Experimental Trial 1** | | | | | |
| **Experimental Trial 2** | | | | | |
| **Mean of Exp. Trials** | | | | | |

**Step 8: Analyze data**.

**Bar Graph 1 _____**

**_____**
**Y-Axis**



**X-Axis_____**

**Be sure to properly title, label, draw a key and show the data**

**Step 9:** Conclusion. What conclusions can be drawn after analyzing the data? Use your data above and the checklist below when writing your conclusion.

___ a. Overall conclusive statement explaining what the experiment shows. ("This experiment shows..")
___ b. Evidence to support or reject your statement/claim/hypothesis. (3+ pieces of data)
___ c. Analysis of data (What do the data mean? Compare to control if present.)
___ d. Describe least one source of error that occurred (Not Recorder or Calculation errors though!)
___ e. A final statement based on your analysis that summarizes the experiment's findings. ("Therefore…")

_____

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