NAMES: _____ _____

_____ _____

FLASH FLOOD EXPERIMENT
5TH GRADE:

Section A: Design

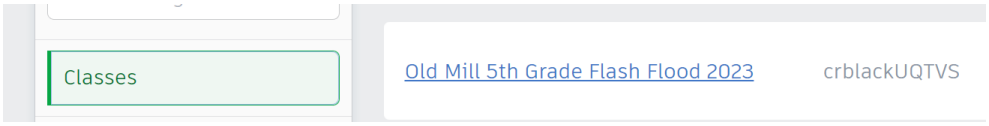
You are a group of engineers trying to protect an area from occasional, but devastating, flash floods. There are some **constraints**. You only have so much money, time, and materials to build your barrier. You better start by experimenting with a small model first.

Take a look at the experimental setup. What do you notice? What will you need to protect the town and the beach? Where do you think it needs the most protection? Write some notes and draw some ideas for designs in the box below as you brainstorm with your group. You may use more scratch paper if you'd like. Once your teacher has given you the okay, get on TinkerCad and create your design!

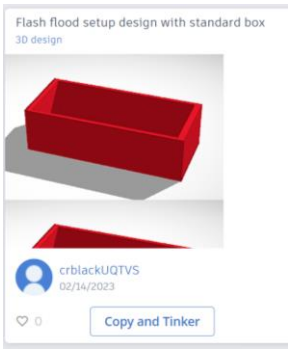
TINKERCAD INSTRUCTIONS

1. Choose ***1*** **Chromebook,** and go to https://www.tinkercad.com/
2. Scroll down slightly, and click on "Join Class"

3. Your class code is: _____
4. Click on "Join with nickname"
5. Your group nickname is: _____
6. On the left-hand side of the screen is a link for Classes
7. Click on Classes, and then _____



8. Click on Flash Flood Barrier Design, and then "Copy and Tinker"



9. When you open the design you will see two things. The first is the layout of your experimental model. The second is a small open box. **YOUR DESIGN MUST FIT INSIDE THAT BOX!! IT CANNOT BE LONGER, WIDER, or TALLER!** Your design does not all have to be in one piece (it can be broken up) but all together it cannot be larger, or we will not have enough time to print everyone's designs.

10. Get to tinkering! Work together to build your barrier! It should save automatically, and the teacher can get your design right off TinkerCAD. No need to send it anywhere.

Section B: Research

Watch the following 3 videos with your group. Answer the questions for each video.

1. https://youtu.be/wDwgxHqX03U

Think about the natural disasters that occur in different parts of the world: tsunami's, landslides, flash floods, hurricanes, etc. What would be the most difficult to predict or plan for? How could you design early warnings for these types of natural disasters? Choose one and describe your design idea.

_____
_____
_____
_____
_____
_____

2.
https://www.ted.com/talks/peter_haas_when_bad_engineering_makes_a_natural_disaster_even_worse?utm_campaign=tedspread&utm_medium=referral&utm_source=tedcomshare

Why is it important to maintain strict building codes and techniques when building both private and community structures? What might you look for when purchasing a home? Why would it be important to understand the threat of natural disasters where you live?

_____
_____
_____
_____
_____
_____

3. https://youtu.be/wmsxUyTuEBw

What tools were the researchers using to design infrastructure that is more resilient to natural disasters?

_____
_____
_____

Can we eliminate the impact of natural hazards altogether? Why or why not?

_____
_____
_____
_____

Section C: Assign Jobs

Everyone in your group will need a job for this experiment. **EVERY** job is VERY IMPORTANT!

The Boss: The site boss makes sure all instructions are being followed and that the experiment is being setup the exact same way every time. Have others in your group help with the setup but give them jobs and instruct them on what to do. You are the boss! You will run the experiment 6 times. 3 times with no barrier in place, and 3 times with the barrier in place. It will be tempting to change your setup in-between runs, especially if the barrier doesn't work the first time. Keep it consistent!

Observation Attendant: The Observation Attendant takes a mental note of things that happen during the experiment. For example, how swiftly did the water seem to be running? What was picked up by the water, and how destructive was the flood? What did the water look like? Was it murky or clear? How high did the water seem to go? Report your observations to the *Documentation Expert.* Give them specific details!

Measurement Expert: The measurement expert uses the ruler to measure the amount of sand washed away by the flash flood, as well as measure the water and debris added to the experiment. They need to be patient and precise!

Scribe: The scribe oversees writing and drawing the results of the experiment. They must have good penmanship and be willing to help the Observation Attendant and Measurement Expert get the proper information for your report.

Who will be…

The Boss? _____

Observation Attendant? _____

Measurement Expert? _____

Scribe? _____

Section D: Test Your Design

Materials:

Flash Flood Setup	Cup of Cheerios
Container to catch water	Cup of sand
Your 3D printed barrier	Metric Ruler
Small amount of modeling clay	Full cup of water

Round 1: No Barrier

1. Place your experimental setup on an inclined plane as instructed by your teacher. The setup should have the "drain" hanging about two inches off of the edge of the desk.
2. Pour a layer of sand on the area of the flash flood setup labeled "beach". It will not be perfect, just do your best.
3. In your cup of water, add 10 Cheerios.
4. Place someone holding the container to catch the water that flows through the setup.
5. Pour out the entire contents of your cup (including Cheerios) directly on the setup in the location shown. You have 10 seconds to completely empty the cup. Someone should be counting.
6. Observe what happens. What area of the setup was hit the worst? Measure how much sand was washed away. Record your measurements and observations.
7. Repeat steps (1-6)2 more times, cleaning out the setup between each run.

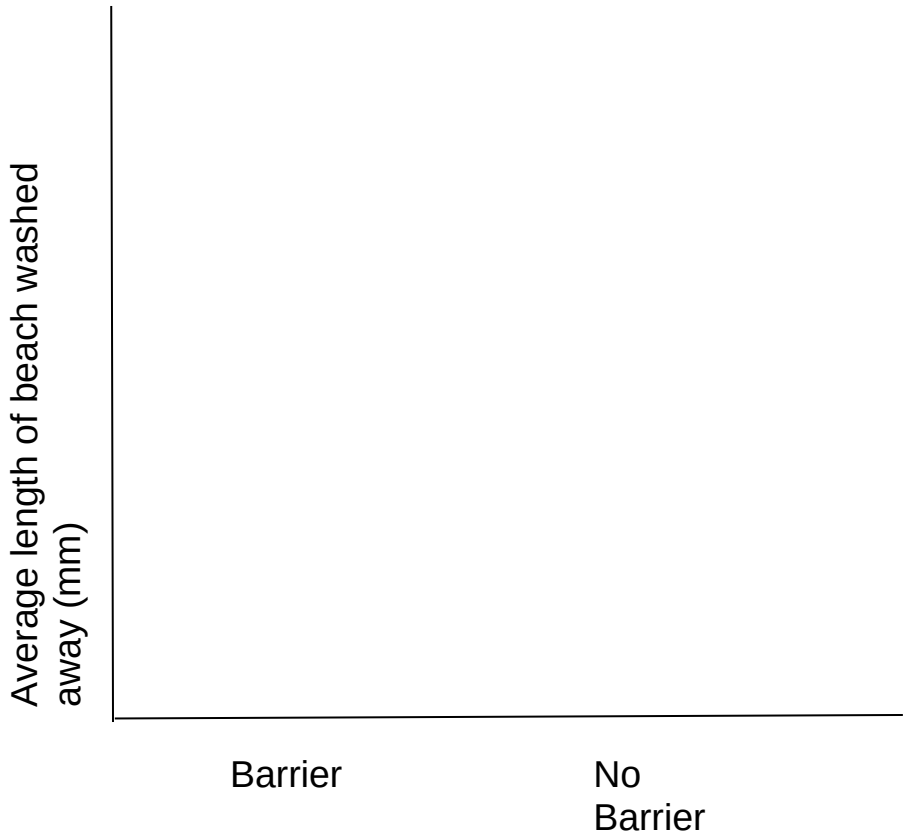
Round 2: With Barrier

1. Decide where to place your barrier using your observations from Round 1 to guide your decision.
2. Use a very small amount of modeling clay to anchor your barrier, and run the experiment again 3 times with the barrier. Record your observations and measurements on the following page.

	mm Sand Washed Away	Observations
No Barrier Test 1		
No Barrier Test 2		
No Barrier Test 3		
With Barrier Test 1		
With Barrier Test 2		
With Barrier Test 3		

Section E: Results and Conclusions

Create a bar graph of your results by taking the average of your measurements. Take a look at your data. Does it vary a lot? Did your barrier perform as expected? Write a summary of your observations below the graph. Using the data and observations together, how did your barrier perform?



OBSERVATIONS SUMMARY

_____

_____

_____

_____

_____

_____

_____

Write your conclusions below by answering these questions. How did your barrier perform? What would you do differently if you were redesigning your barrier? Do you think this a reasonable solution to a real-life flash-flooding situation? Why or why not?

Conclusions

_____

_____

_____

_____

_____

_____

_____