Instructions: Answer all questions below in a font color other than black. You must show all calculations and answers!

In 2019, the plastic bottles market was estimated at $159.68 billion. In 2018, it is estimated that 481.6 billion plastic bottles were used worldwide. The plastic bottles market has become a lucrative industry even though it has faced much backlash from environmentalists and consumers. In this project, you will investigate which plastic bottle is the best and design a water bottle that is consumer friendly and environmentally conscious.

Part 1: Pre Planning

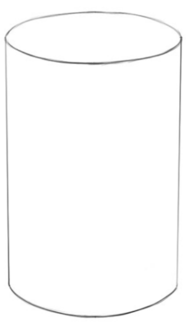
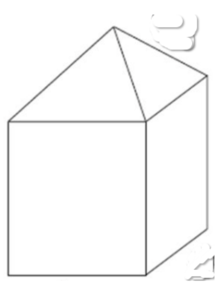
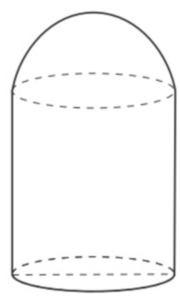
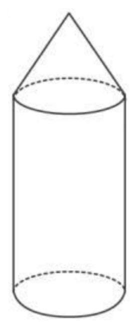
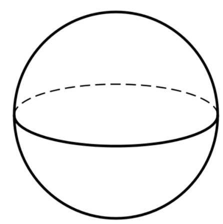

Hypothesis: Based on the pictures above, which water bottle do you think holds the most amount of water **AND** uses the least amount of plastic? **Justify your answer in 2-3 sentences.**

Type your answer in this box

The Why: What features of a water bottle do you think are important? (This should include functionality and visual appeal!)

Type your answer in this box

Part 2: The Math - The table below will help organize your thinking and make decisions about the best shape for a water bottle. The diagrams are a rough estimate of the shape of each water bottle.

	Voss	Fiji	SmartWater	Dasani	Ogo
Diagram and Dimensions **All dimensions are in cm**	 Height: 20.3 Diameter: 5.1	 Height of base: 15.1 Height of top: 3.0 Base dimensions: 6.75 by 6.65	 Height of base: 23 Diameter: 7	 Height of base: 17.2 Height of top: 3.1 Radius: 3.2	 Diameter: 8.57
What shape or shapes do you see?					
Formula(s) you will use (Highlight the one(s) you will use)	$V = \pi \cdot r^2 \cdot h$ $V = base\ area \cdot h$ $V = \frac{1}{3} \cdot base\ area \cdot h$ $V = \frac{4}{3} \cdot \pi \cdot r^3$ $V = \frac{1}{3} \cdot \pi \cdot r^2 \cdot h$	$V = \pi \cdot r^2 \cdot h$ $V = base\ area \cdot h$ $V = \frac{1}{3} \cdot base\ area \cdot h$ $V = \frac{4}{3} \cdot \pi \cdot r^3$ $V = \frac{1}{3} \cdot \pi \cdot r^2 \cdot h$	$V = \pi \cdot r^2 \cdot h$ $V = base\ area \cdot h$ $V = \frac{1}{3} \cdot base\ area \cdot h$ $V = \frac{4}{3} \cdot \pi \cdot r^3$ $V = \frac{1}{3} \cdot \pi \cdot r^2 \cdot h$	$V = \pi \cdot r^2 \cdot h$ $V = base\ area \cdot h$ $V = \frac{1}{3} \cdot base\ area \cdot h$ $V = \frac{4}{3} \cdot \pi \cdot r^3$ $V = \frac{1}{3} \cdot \pi \cdot r^2 \cdot h$	$V = \pi \cdot r^2 \cdot h$ $V = base\ area \cdot h$ $V = \frac{1}{3} \cdot base\ area \cdot h$ $V = \frac{4}{3} \cdot \pi \cdot r^3$ $V = \frac{1}{3} \cdot \pi \cdot r^2 \cdot h$

Volume of the bottle (All volume measurements are in mL)					
Benefits of the Design (2 bullets) *Think about functionality, volume, etc.)*					
Challenges of Design (2 bullets) *Think about functionality, volume, etc.)*					

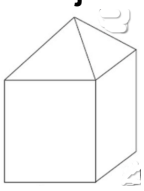
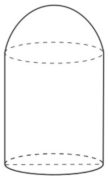
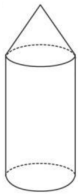
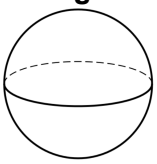
Which water bottle can hold the most water?

Type your answer in this box

A person is supposed to drink 2000 mL of water a day. How many of each water bottle would a person need to drink in order to reach this recommendation?

	Voss	Fiji	SmartWater	Dasani	Ogo
Bottle Number					

Surface Area Information: Below are the surface areas for each shape.

Diagram and Dimensions **All dimensions are in cm**	**Voss**	**Fiji**	**Smartwater**	**Dasani**	**Ogo**
	 Surface Area: 366.11 cm^2	 Surface Area: 509.83 cm^2	 Surface Area: 582.77 cm^2	 Surface Area: 422.89 cm^2	 Diameter: 8.57 Surface Area: 230.73 cm^2

Based on the information from the 2 tables, which water bottle would you consider the best? Which is the worst? Justify your answer using information from both volume and surface area tables and mathematical reasoning. Your answer should be at least 5 sentences long.

Type your answer in this box

Part 3: The Design

It is time for you to create your own water bottle. You will need to create a **realistic** water bottle that will satisfy a couple of requirements:

1. Your water bottle must include **at least** 2 of the shapes we have talked about in class
2. The water bottle must hold **at least** 500 mL
3. The water bottle should be functional (realistic for the real world)
4. You must name your water product

Use one of the 2 websites below to design you product:

a. Beginner Level: Google drawing
b. Advanced Level: Tinkercad
    i. If you choose to use Tinkercad, I would watch this video on how to use it!

Include a picture of your water bottle here. Type the name of the water bottle in the first box

Name	
Model with measurements	

After you create your water bottle, you must decide on the dimensions for your water bottle. **In the space below, show your calculations for the volume of your water bottle.** If you use a pyramid or cone, let me know.

Volume and Surface Area
Work:
Answer:
Use this website to find the surface area of your bottle. **Make sure you switch the measurements to cms AND only look at the lateral surface area! You will need to add your composite shapes together AND include the bottom shape as well!**

Part 4: Reflection

Answer all questions below in complete sentences. Each response requires a **minimum** of 2 sentences (more is expected for the majority of questions).

1. Why did you choose the design that you did? Explain your decision making process.

   Type your answer in this box

2. Why does the design of a plastic bottle matter?

   Type your answer in this box

Choose one of the following questions: Your answers to either question should be a 5 sentence paragraph. You SHOULD use outside research to make an argument for your team.

3. Imagine that you are a part of the marketing team for a plastic water bottle company. Knowing that plastic bottles have environmental repercussions, how would you market your product?

   Type your answer in this box

4. Imagine that you are part of an environmental team. Knowing that plastic water bottles are a cost effective and convenient option for many people, create an argument for eliminating them from the market.

   Type your answer in this box