Water, Water, Everywhere?
Engineering Portfolio

This portfolio belongs to:

Anticipation Guide: Global Access to Clean Water

Read the statements below and indicate whether you agree or disagree. First complete the columns under “You.” After whole class results are shared, or after class discussion, record where the majority of your classmates responded under “Your class.”

You			Your Class	
Agree	**Disagree**	**Statement**	**Agree**	**Disagree**
		The number of people worldwide without access to clean water is about three times the population of the United States.		
		More people die from war and conflict violence than from lack of access to clean water.		
		We have enough water in the world for our world's population.		
		The water I drink is safe and uncontaminated.		
		Overall, more water is used for cooking, washing and drinking than for farming.		
		I worry that we will run out of clean water in the future.		
		Illness caused by unsafe drinking water and poor sanitation and hygiene kills millions of people every year.		
		I waste more water than I should.		
		An increasing number of future conflicts will be fought over access to water.		
		There is a water crisis in the United States.		
		There is a water crisis in Africa.		
		There is a water crisis in China.		

Global Water Issues

The chart below is designed to help you organize the information you uncover as you investigate global water issues. This is not the only way to organize the information, but it can be used as a starting point as you begin your exploration. Feel free to add any additional information that you find.

Take notes as you watch the video clips and explore the links provided on the website.

Questions	Facts and Comments	Source of Information
How much of the world's water is drinkable?		
What are the issues with water that is not drinkable?		
How many people in the world do not have access to clean water?		
What are some of the hardships faced by people with limited access to clean water?		
What are some of the health implications of limited access to clean water?		

Global Water Issues (continued)

Questions	Facts and Comments	Source of Information
What regions of the world have the most pressing issues with limited access to clean water?		
What political conflicts arise from water access issues?		
How do these political conflicts affect the people living in these areas?		

Additional Information:

Your Challenge

Are you ready to embark on your engineering challenge? Use the engineering design process outlined below as your team works on this project.

1. Define the Problem:

Develop a concise statement that clearly states the real-world problem. The problem statement should be framed in a way that allows for multiple solutions to the problem. In developing your problem statement, consider the following questions:

A. What is the problem you plan to address? Include the area of the world on which you will focus.
B. Why is it important to address this problem? What significance will a solution bring to the people who live in the area?

2/3. Brainstorm and research possible solutions: Work with your STEM team to explore the suggested links and brainstorm answers to the following questions:

A. What water issues are present in your chosen region?

Your Challenge

B. What contaminants/issues with access are present in the water supply of your chosen region?

C. What are the cultural, religious or economic issues that need to be considered?

D. What, if any, are the conflicts over water access that need to be considered?

E. What are some current and past solutions to this problem?

Your Challenge

4. Identify Criteria and Constraints: Write criteria and constraints below.

5. Explore Possibilities:

Sketch or write out some ideas for possible water purification systems that are cost efficient. As you explore different ideas, ask yourself:

- Is this approach capable of removing physical contaminants like sand and dirt?
- Is this approach capable of removing chemical contaminants?
- Is this approach inexpensive and easy to use?
- Is this approach able to be scaled up?

Write a list of the ideas for which you are able to answer "yes" to all of the questions.

As you brainstorm, it may help to consider the materials you have available to you:

Supply List:

plastic or glass containers	$8.00
fabric	$2.00
ice	$1.00
coffee filters	$.50
activated charcoal	$1.00
alum	$.50
plastic wrap	$.50
paper towels	$.50
gravel	$1.00
cotton balls	$.50
sand	$.50
flexible tubing	$2.00
cooking pot with lid	$10.00
rubber bands	$.50
small heatproof container	$1.00

Your Challenge

Explore Possibilities (continued)

Use this page to take notes as you explore different possibilities. You may review resources that you have explored previously, and you may also conduct any additional research you need to come up with ideas.

Your Challenge

Explore Possibilities: Technical Drawing

As a team, come to a consensus on a potential solution and create a technical drawing of your design solution. A technical drawing must be drawn to scale and is based on research. It must identify all components of the design solution.

Your Challenge

6. Select an Approach:

Which of the possibilities that you have explored seems like the best solution? As you decide, think about:

- How does your system work to remove contaminants? Does it remove both chemical and physical contaminants?
- Can this system be produced inexpensively?
- Can this system be scaled up if necessary? What modifications would you need to make?

Briefly describe your approach below:

7. Develop a Design Proposal:

Now that you have selected an approach, your team will need to write up a design proposal that explains your choice. Include each of the following components in your proposal. Write your design proposal on the next three pages.

- Introduction: Briefly introduce the problem your water purification system will address and summarize your solution.
- Objective: Outline the goal and scope of your proposed solution, including constraints and limitations.
- Design Strategy: Describe how your proposed solution will achieve the objectives that you have listed. Explain the science behind your proposed solution, and provide detail on why your proposed solution is the best one.
- Plan of Action: Describe the steps you will take to implement your solution.
- Verification Plan: Create a plan for ensuring that your proposed solution is working to purify contaminated water.
- Predicted Cost and Schedule: Estimate the cost of implementing your solution and include an estimate of how long it would take to create.
- Statement of Contribution of Each Team Member: Describe how each team member contributed to the development and selection of your system and the creation of the design proposal.

Your Challenge

Design Proposal

Introduction:

Objective:

Design Strategy:

Your Challenge

Design Proposal (continued)

Plan of Action:

Verification Plan:

Your Challenge

Design Proposal (continued)

Predicted Cost and Schedule:

Statement of Contribution of Each Team Member:

Your Challenge

8. Make a Prototype: Build your prototype according to the design proposal and technical drawing your team has developed.

9. Test and Evaluate

Are you ready to test? Make a hypothesis and record it below.

Now test your design and record your observations in the chart below. You may wish to complete several trials.

Trial	Observations (before): Describe the appearance and odor of your untreated water sample.	Observations (during): Describe what you see as your water sample is processed.	Observation (after): Describe the appearance and odor of your water sample after it has been treated.	Apparatus Observations: Describe any changes or problems you see with your water purification system.
1.				
2.				
3.				

Your Challenge

What is your conclusion? Think about the following questions:

- Did your apparatus successfully improve the appearance and/or odor of the water sample?
- Did your observation of the treatment process give you any insight on the process of purifying water?
- Did your system perform in an acceptable way? Is the treated water acceptable for drinking?

Write your responses below.

10. Refine Your Design: Engineering solutions rarely work perfectly the first time. Think of some ways you could refine your water purification system and write them below.

If there is time, refine and rebuild your system to create your final product. Record your results below.

Trial	Observations (before): Describe the appearance and odor of your untreated water sample.	Observations (during): Describe what you see as your water sample is processed.	Observation (after): Describe the appearance and odor of your water sample after it has been treated.	Apparatus Observations: Describe any changes or problems you see with your water purification system.
4				

Your Challenge

11. Communicate Results:
Now that you have a system that could help improve water quality in your area, how will you spread the word about your design? Your final assignment is to create a short video or multimedia presentation describing water quality issues in your chosen region, how water quality affects people's lives, and how large-scale implementation of the water purification process you have developed (or a similar approach) can help.

Begin by viewing the suggested videos. Think about the following questions and write your answers below.

- What makes these videos effective?
- What style of video is used, and what information is shared?
- How do the producers appeal to the viewers' reason or emotion?

Your Challenge

Communicate Results (continued)

Now it is time to think about ideas for producing your own campaign. Write your ideas below.

Questions to Consider	Ideas	Additional Notes
Who is the audience you are trying to reach?		
What is the key message?		
Are you appealing to reason, emotion or a sense of fairness or outrage?		
What is the call to action?		
Which secondary points would you like to include, if possible?		
What kinds of images will have the most impact?		
What information, statistics or connections will have the most impact?		
What is the best way to share this information?		
What should be included in the audio track? Music? Narration? What else?		

Notes

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