

Your Name: _____ Your Country: _____
Group Members: _____

Water Wheel Challenge

Water is one of the major resources of our world that determines the fate of humanity. Civilizations throughout history have been built on water sources, such as the ancient Fertile Crescent on the Nile, Tigris, and Euphrates Rivers, Paris built along the banks of the Seine River, etc. Having water available isn't enough, though. Humans all over the world needed to discover and create engineering techniques to be able to successfully harness the power of the water available to them. Your job is to use the building materials provided to YOUR COUNTRY to construct a successful water wheel that meets these criteria:

Project Requirements:

1. Build a device to route the "water" into the water wheel
2. Using your country's available building materials, build a water wheel that can:
 - a. Generate a sustained (at least 5 second) water flow of:
 - i. 0.10 m/s
 - ii. 0.15 m/s
 - iii. 0.20 m/s
 1. This represents the water wheel's ability to function under varying rainfall conditions
3. Make a slideshow (requirements on page 7)

4 countries available:

1. **Dominican Republic:** lots of water, not many resources
 - a. Gross Domestic Product (Country's Wealth): \$94.24 billion
 - b. Budget: \$2.00
 - c. ****NO ACCESS TO HOT GLUE****
2. **Japan:** lots of resources and water
 - a. Gross Domestic Product (Country's Wealth): \$4.941 trillion
 - b. Budget: \$10.00
 - c. ****Unlimited access to hot glue****
3. **Egypt:** lots of resources, limited water
 - a. Gross Domestic Product (Country's Wealth): \$404.1 billion
 - b. Budget: \$6.50
 - c. ****Unlimited access to hot glue****
4. **Syria:** not much water or resources
 - a. Gross Domestic Product (Country's Wealth): \$11.08 billion
 - b. Budget: \$1.40
 - c. ****NO ACCESS TO HOT GLUE****



MATERIALS LIST A: JAPAN AND EGYPT

(parenthesis indicate the real world material)

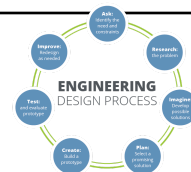
Materials	Unit Cost	Quantity	Total Cost
Styrofoam plate (metal)	\$.20 each		
Styrofoam bowl (metal)	\$.25 each		
Paper plate (plastic)	\$.05 each		
Paper bowl (plastic)	\$.10 each		
Duct tape (synthetic building adhesive)	\$.15 per foot		
Masking tape (clay)	\$.05 per foot		
Plastic spoon (plastic)	\$.04 each		
Cardboard piece (6"x 12") (cement)	\$1.50 per piece		
Popsicle Sticks (wood)	\$.07 each		
Notecards (stone)	\$.05 each		
Card Stock (stone)	\$.15 per piece		
Paper (brick)	\$.10 per piece		
Rubber Bands (bamboo)	\$.04 each		
String (palm fronds)	\$.05 per foot		
Cups	\$.05 each		
Total Cost	x	x	

MATERIALS LIST B: SYRIA AND DOMINICAN REPUBLIC

(parenthesis indicate the real world material)

Materials	Unit Cost	Quantity	Total Cost
Paper plate (plastic)	\$.05 each		
Paper bowl (plastic)	\$.10 each		
Masking tape (clay)	\$.05 per foot		
Plastic spoon (plastic)	\$.04 each		
Popsicle Sticks (wood)	\$.07 each		
Notecards (stone)	\$.05 each		
Card Stock (stone)	\$.15 per piece		
Paper (brick)	\$.10 per piece		
Cups	\$.04 each		
Rubber Bands (bamboo)	\$.05 each		
String (palm fronds)	\$.05 per foot		
Total Cost	x	x	

Waterwheel Engineering Design Planning Space



Your Design (label all materials):

Your Group's Design (label all materials *and the design must include at least 1 idea from each group member*):

Country Research for Trade Programs

1. What are things your country trades in the real world?
2. How could these things benefit other countries?
3. Does your country have a lot of access to water? If so, how might that play a role in your trade program?

If you choose to trade resources with another country, you must use your research to create a proposal in which both countries benefit. This proposal must include all of the below:

1. What materials you're giving/receiving in this class

Country #1: _____; trading _____ for _____

*list both the class material AND the real-world material

*for example: styrofoam plate/metal

We, (name our country) are trading _____ for _____
_____. This helps (name our country) because _____ and
it helps (country #1) because _____.

Country #2: _____; trading _____ for _____

*list both the class material AND the real-world material

*for example: styrofoam plate/metal

We, (name our country) are trading _____ for _____
_____. This helps (name our country) because _____ and
it helps (country #2) because _____.

2. What materials the other country involved in the trade is giving/receiving in this class
3. What these materials represent for “your country” (for example, if your country has a lot of gold mines, perhaps what you’re giving the other country is gold)
4. What these materials represent for the other “country” (for example, if your country has a lot of gold mines, perhaps what you’re giving the other country is gold)
5. Signatures from a representative for each country involved in the trade, as well as your teacher (the UN representative)

Create a UN proposal below:

(Country 1 representative signature)

(Country 2 representative signature)

(UN Representative Signature)

SLIDESHOW REQUIREMENTS

Directions: Create a Google Presentation with your group to address the following. Practice your presentation so you are ready to stand up in front of the class and explain your project. Your project must include slides for letters a-i below. Each of the bullet points below should be its own slide. **Each group member must present at least one slide individually.**

- a. A title slide with your team name and members, **presented by the group.**
- b. Information about your country
 - country flag
 - GDP
 - limitations in country's building materials/water
- c. How has your Country's resource list & budget impacted your design?
- d. What are the main features of your design? Why do these features ensure your design's success?
 - What is the cost of your project and what materials did you use?
- e. After testing your machine, what did you change about your design to **optimize** it and **why**?
- f. How much energy does your country produce per year?
 - How much of that is renewable energy and how much is nonrenewable?
- g. Are waterwheels a good renewable energy source for your country? Why or why not?
- h. What's one environmental disaster your country has faced in the last 5 years?
 - How has climate change impacted this disaster (if at all)?
- i. Explore the [UN Sustainable Development Goals](#). Explain how one or more of these goals relates to your design, UN proposal, and/or this project as a whole
- j. How did trade affect your water wheel design? Include all UN proposals on this slide!
- k. Resources Slide for all websites and pictures used from the internet

Presentation Feedback

Group #: _____ Country Represented: _____

One interesting aspect of their construction was: _____

One thing I learned about their country was: _____

One thing I liked about their presentation was: _____

Group #: _____ Country Represented: _____

One interesting aspect of their construction was: _____

One thing I learned about their country was: _____

One thing I liked about their presentation was: _____

Group #: _____ Country Represented: _____

One interesting aspect of their construction was: _____

One thing I learned about their country was: _____

One thing I liked about their presentation was: _____

Group #: _____ Country Represented: _____

One interesting aspect of their construction was: _____

_____.

One thing I learned about their country was: _____

_____.

One thing I liked about their presentation was: _____

_____.

Reflection

1. What's one thing you learned from doing this project?
2. If you could do it again, what would you change (if anything)?
3. What are you most proud of?
4. How does this change your idea of the world?

NGSS Science Standards

MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

MS-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

MS-PS2-1. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.

MS-PS2-2. Plan and conduct an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

MS Engineering Design Standards

MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

MS English Language Arts Standards

Key Ideas and Details:

8R1: Cite textual evidence to support an analysis of what the text says explicitly/implicitly and make logical inferences. (RI&RL)

Text Types and Purposes:

8W2: Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

8W2a: Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information, using strategies such as definition, classification, comparison/contrast and cause/effect.

8W2b: Develop a topic with relevant facts, definitions, concrete details, quotations, or other information and examples; include formatting, graphics, and multimedia when useful to aid comprehension.

8W2c: Use precise language and content-specific vocabulary to explain a topic.

8W2d: Use appropriate transitions to create cohesion and clarify the relationships among ideas and concepts.

8W2e: Provide a concluding statement or section that explains the significance of the information presented.

8W2f: Establish and maintain a style appropriate to the writing task.

8W5: Draw evidence from literary or informational texts to support analysis, reflection, and research. Apply the grade

8 Reading Standards to both literary and informational text, where applicable.

Research to Build and Present Knowledge:

8W6: Conduct research to answer questions, including self-generated questions, drawing on multiple sources and refocusing the inquiry when appropriate. Generate additional related questions for further research and investigation.

8W7: Gather relevant information from multiple sources; assess the credibility and accuracy of each source; quote or paraphrase the data and conclusions of others; avoid plagiarism and follow a standard format for citation.

Comprehension and Collaboration:

8SL1: Engage effectively in a range of collaborative discussions with diverse partners; express ideas clearly and persuasively, and build on those of others.

8SL1a: Come to discussions prepared, having read or researched material under study; draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.

8SL2: Analyze the central ideas and supporting details presented in diverse formats (e.g., including visual, quantitative, and oral) and explain how the ideas clarify and/or contribute to a topic, text, or issue under study

Presentation of Ideas and Knowledge:

8SL4: Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear enunciation.

8SL5: Include digital media and/or visual displays in presentations to clarify claims and findings and emphasize salient points.

8SL6: Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate.

Vocabulary Acquisition and Use:

8L6: Acquire and accurately use general academic and content-specific words and phrases; apply vocabulary knowledge when considering a word or phrase important to comprehension or expression.

MS Social Studies Standards & Practices

Standards:

5.1 EARLY PEOPLES OF THE AMERICAS: The first humans in the Western Hemisphere modified their physical environment as well as adapted to their environment. Their interactions with their environment led to various innovations and to the development of unique cultures.

- 5.1b Human populations that settled along rivers, in rainforests, along oceans, in deserts, on plains, in mountains, and in cold climates adapted to and made use of the resources and environment around them in developing distinct ways of life

5.2 COMPLEX SOCIETIES AND CIVILIZATIONS: Between 1100 B.C.E. and 1500 C.E., complex societies and civilizations developed in the Western Hemisphere. Although these complex societies and civilizations have certain defining characteristics in common, each is also known for unique cultural achievements and contributions.

- 5.2b Complex societies and civilizations adapted to and modified their environment to meet the needs of their people.

5.4 GEOGRAPHY IN THE WESTERN HEMISPHERE: The diverse geography of the Western Hemisphere has influenced human culture and settlement in distinct ways. Human communities in the Western Hemisphere have modified the physical environment.

- 5.4a Physical maps reflect the varied climate zones, landforms, bodies of water, and natural resources of the Western Hemisphere.

8.3 EXPANSION AND IMPERIALISM: Beginning in the second half of the 19th century, economic, political, and cultural factors contributed to a push for westward expansion and more aggressive United States foreign policy.

- 8.3d The Roosevelt Corollary expanded the Monroe Doctrine and increased United States involvement in

the affairs of Latin America. This led to resentment of the United States among many in Latin America.

- Students will evaluate the United States actions taken under the Roosevelt Corollary and their effects on relationships between the United States and Latin American nations, including the building of the Panama Canal.

8.8 DEMOGRAPHIC CHANGE: After World War II, the population of the United States rose sharply as a result of both natural increases and immigration. Population movements have resulted in changes to the American landscape and shifting political power. An aging population is affecting the economy and straining public resources.

- 8.8c Pollution, population growth, the consumption of natural resources, clearing of land for human sustenance, and large-scale industrialization have put added stress on the global environment.
 - Students will explore the effects of pollution, industrialization, and population growth on the environment, including urban areas, plant and animal life and energy sources.

Practices:

A. Gathering, Interpreting and Using Evidence

2. Identify, select, and evaluate evidence about events from diverse sources (including written documents, works of art, photographs, charts and graphs, artifacts, oral traditions, and other primary and secondary sources).
3. Analyze evidence in terms of historical context, content, authorship, point of view, purpose, and format; identify bias; explain the role of bias and audience in presenting arguments or evidence.
4. Describe and analyze arguments of others, considering historical context.
5. Make inferences and draw general conclusions from evidence.

B. Chronological Reasoning

1. Identify causes and effects, using examples from current events, grade-level content, and historical events.
2. Identify and analyze the relationship between multiple causes and multiple effects.
3. Distinguish between long-term and immediate causes and effects of an event from current events or history.

D. Geographic Reasoning

1. Distinguish human activities and human-made features from “environments” (natural events or physical features—land, air, and water—that are not directly made by humans) and describe the relationship between human activities and the environment.
2. Characterize and analyze changing interconnections between places and regions.

E. Civic Participation

1. Participate in activities that focus on a classroom, school, community, state, or national issue or problem.
2. Participate in negotiating and compromising in the resolution of differences and conflict; introduce and examine the role of conflict resolution.
3. Identify situations in which social actions are required and determine an appropriate course of action.
4. Develop the connections of an interdependent global community by engaging in the political process as it relates to a global context.