Rock Cycle Lesson 3: "The Engineer"

Student Handout

Your Challenge: You have been hired by the International Parks Conservation Association as an engineer to design a solution to prevent or mitigate weathering and erosion on our famous monuments from around the world.

Directions:

1. Choose a famous monument that is made of rock to focus on.
2. Remember how the rock cycle works and how weathering and erosion affects different kinds of rocks. Use this information to guide you to solve the Engineering problem.
3. Now you'll need to design a solution by creating a technical drawing that shows how you plan to prevent or mitigate weathering or erosion to your monument.

*Note: The word "mitigate" means to make a problem less serious or less severe. For example, if your sibling is **blasting** music, putting in earplugs would *mitigate* the problem. It doesn't fix the problem completely, just makes it easier to deal with.

Planning Organizer:

Let's Review:
Take turn quizzing the person next to you. Choose two rock types and ask your partner what forces cause the rock to change from your first rock choice to the second. When you're done, answer the questions below.

Now, choose a famous monument that is made of rock.

What kind of rock is the monument made of? How does this rock type form?

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Monument History: How did this monument form, or how was it created?

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What are the weathering and erosion factors affecting this monument?	What specific structural changes do you expect to occur if we don't do anything to protect it? *Note: Be specific as possible.*

Design your solution.	
Will your design prevent weathering and erosion or mitigate* these factors? *"Mitigate" means to make the problem less serious or less severe.	
What will your design do?	
Will you make a design that is **UNIQUE** and created by you, or will you **IMPROVE UPON AN EXISTING DESIGN?**	
How does your understanding of the rock cycle affect your design choices?	
How does your design work?	

With the above plan in mind, now it is time to design your solution
Technical Drawing illustrating a solution for how to prevent or mitigate weathering and erosion to your monument: Complete Appendix A (Create your Technical Sketch) in order to create your technical diagram on a separate piece of paper. Be sure to: ❏ Create a detailed sketch of the solution ❏ Label all parts of the drawing ❏ Include measurement labels ❏ Include annotations explaining how the design solution works

Appendix A: Create Your Technical Sketch

1. Restate the problem you are addressing in your own words.
2. How does your design solution meet the needs of this problem?
3. What **requirements** or **constraints** (limitations) would need to be considered when building your design? (cost, materials, energy use, space, effect on community, time, etc.)

<table>
<tr><td colspan="2">4. What are some tradeoffs to this solution? List the advantages and disadvantages of your solution below:</td></tr>
<tr><td>Advantages</td><td>Disadvantages</td></tr>
<tr><td colspan="2">5. Create your technical sketch of your solution on a separate sheet of paper. Make sure you following these guidelines:
Includes title on drawing for design solution
Create a detailed sketch of the solution
Use a ruler for straight lines.
Include measurements for your design (how tall/wide/long would your design be? Will your measurements be done in centimeters, meters, kilometers?)
Include labels of all parts.
Include annotations of how the design works.
Optional: Include sketches showing multiple views. What would your design look like from the front, side, and top?</td></tr>
<tr><td colspan="2">6. Create a Final Technical Sketch and Present your Solution
In your verbal presentation: Explain how your solution works and how it will prevent or mitigate weathering and erosion of your chosen monument.</td></tr>
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Optional Extension: Build a 3D prototype of your design solution

Assessment: Final Presentation

You designed a solution to the problem of weathering and erosion of a famous monument.. Next, present your proposal to an audience. Your audience may be a group of your peers, or or a group of other members of your community.

Use the checklist and Science & Engineering Practices rubric to ensure you have addressed all aspects of the "Engineer" with quality work.

Rock Cycle Engineer Checklist: Content Concepts and Practices

- ❏ Proof of planning solution (Appendix A)
- ❏ Includes title on drawing for design solution
- ❏ Create a detailed sketch of the solution
- ❏ Use a ruler for straight lines.
- ❏ Include measurements for your design (how tall/wide/long would your design be? Will your measurements be done in centimeters, meters, kilometers?)
- ❏ Include labels of all parts.
- ❏ Include annotations of how the design works.
- ❏ Optional: Include sketches showing multiple views. What would your design look like from the front, side, and top?
- ❏ In your verbal presentation: Explain how your solution works and how it will prevent or mitigate weathering and erosion of your chosen monument.
- ❏ Extension: Create a 3D model of your design solution

Science & Engineering Practices Assessed

	Emerging (1)	**Developing (2)**	**Proficient (3)**	**Advanced (4)**
Designing Solutions	Applies no scientific principles and/or data to design, construct, and/or test a design of an object, tool, process, or system.	Applies minimal scientific principles and/or data to design, construct, and/or test a design of an object, tool, process, or system.	Applies adequate scientific principles and/or data to design, construct, and/or test a design of an object, tool, process, or system.	Applies complete scientific principles and/or data to design, construct, and/or test a design of an object, tool, process, or system.
Communicating Findings/Design (Oral Presentation)	Findings/Design are incompletely and inaccurately communicated. Or no evidence of using appropriate eye contact, adequate volume, or clear pronunciation.	Findings/Design are completely communicated with some misconceptions. Or Uses minimal eye contact, inappropriate volume, or inconsistent pronunciation.	Findings/Design are completely communicated but lacking depth and complexity. Or often uses eye contact and engaging and appropriate volume and pronunciation, but is inconsistent.	Findings/Design are completely communicated with depth and complexity. Or mostly uses eye contact and engaging and appropriate volume and pronunciation.