

From the Quarry to the Canvas

5th Grade

Unit 2 – Renaissance Thinking

Text Connection: *The Apprentice* by Pilar Molina Llorente

Design Challenge Summary

Challenge: What will the students be required to do?

Create a series of inclined planes that allows 5 rocks (marbles) to travel from the quarry to the apprentice to the artist. The rocks must not travel in a straight line and you must include at least 3 inclined planes.

Standards:

Science:

NS.1.4.1 Communicate observations orally, in writing, and in graphic organizers
NS.1.4.2 Refine questions that guide scientific inquiry
NS.1.4.3 Conduct scientific investigations individually and in teams
NS.1.4.5 Communicate the designs, procedures, and results of scientific investigations
NS.1.4.6 Estimate and measure length, mass, temperature, capacity/volume, and elapsed time
NS.1.4.7 Collect and interpret measurable empirical evidence in teams and as individuals
NS.1.4.8 Develop a hypothesis based on prior knowledge and observations
NS.1.4.9 Identify variables that affect investigations
NS.1.4.10 Identify patterns and trends in data
NS.1.4.11 Generate conclusions based on evidence
NS.1.4.12 Evaluate the quality and feasibility of an idea or project
NS.1.4.13 Use simple equipment, age appropriate tools, technology, and mathematics in scientific investigations
PS.6.5.2 Conduct investigations using levers, pulleys, screws, inclined planes, wedges, wheel & axle

Math:

Mathematical Practice Standards

5.NF.3. Interpret a fraction as division of the numerator by the denominator ($a/b = a \div b$). Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers
5.NF.4. Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.
a. Interpret the product $(a/b) \times q$ as a parts of a partition of q into b equal parts; equivalently, as the result of a sequence of operations $a \times q \div b$.
5.MD.2. Make a line plot to display a data set of measurements in fractions of a unit ($1/2, 1/4, 1/8$). Use operations on fractions for this grade to solve problems involving information presented in line plots.

ELA:

W.5.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information.
W.5.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
W.5.3 Write narratives to develop real or imagined experiences or events using effective technique, descriptive details, and clear event sequences.
W.5.4 Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.
W.5.10 Write routinely over extended time frames and shorter time frames for a range of discipline-specific tasks, purposes, and audiences.
SL.5.1 Engage effectively in a range of collaborative discussions with diverse partners on grade 5 topics and texts, building on other's ideas and expressing their own clearly.
SL.5.3 Summarize the points a speaker makes and explain how each claim is supported by reasons and evidence.
SL.5.4 Report on a topic or text or present an opinion, sequencing ideas logically and using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace

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Result: What will students know, value, and be able to do as a result of the lesson? What's the big idea? Know and apply the engineering design loop. Value collaboration and discussion. Use knowledge of inclined planes to effectively and efficiently move objects from one location to another. Collect, record, and analyze data relating to time. (using stop watches to determine elapsed time)
Assessment: What evidence will be used to determine student learning? Did they successfully transport all 5 marbles to the painter? Did they successfully graph data using a line plot? Did they follow the design loop process? Did groups work collaboratively together?
Prior Knowledge/Experiences: What prior content knowledge and skills will the students need? Experience with the Engineering Design Loop process Connections to the Mathematical Practices Investigations/Inquiry in Science Experiences with recording data in a line plot. Experiences with simple machines, specifically inclined planes. Experiences with angles.
Summary/Connections: How will this design challenge connect with new/future learning, other content areas, real world experiences, etc.? This lesson will help students develop problem solving skills and collaboration skills that are essential in succeeding in the 21st century. It will allow students the opportunity to transfer and apply skills from various content areas within one task. Writing: Write your point of view on which group's design was most efficient and why. Be sure to provide logically ordered reasons that are supported by facts and details. Writing: Write a summary of this design challenge. When were you successful? When did you struggle? If you did this challenge again, what would you do differently? Extensions: • Students could redo the design challenge incorporating a second simple machine. i.e. inclined planes and levers, or inclined planes and pulleys • Students could redo the design challenge using 5 or more ramps minimum. • Students could redo the design challenge using a different simple machine. i.e. levers, pulleys, etc. • This lesson will provide an excellent opportunity for a conversation about the relationship between decimals and fractions. Time data gathered with a stop watch will be given as a decimal in the hundredths which could be easily written as a fraction with 100 as the denominator. This would be a good time to point out the fact that these numbers represent the same value and are read the same way. i.e. 0.27 and 27/100 are both read "27 hundredths"
Materials/Equipment/Preparation: What materials and equipment will students need to successfully complete this design challenge? Materials per Group (suggested group size 3-5): A student desk top turned on its side - landscape style Bulletin board paper strips to fit over tops of desks 3 small plastic cups Masking tape - 1 foot 3 sheets of copy paper- 8 1/2 by 11 Timer 5 marbles scissors

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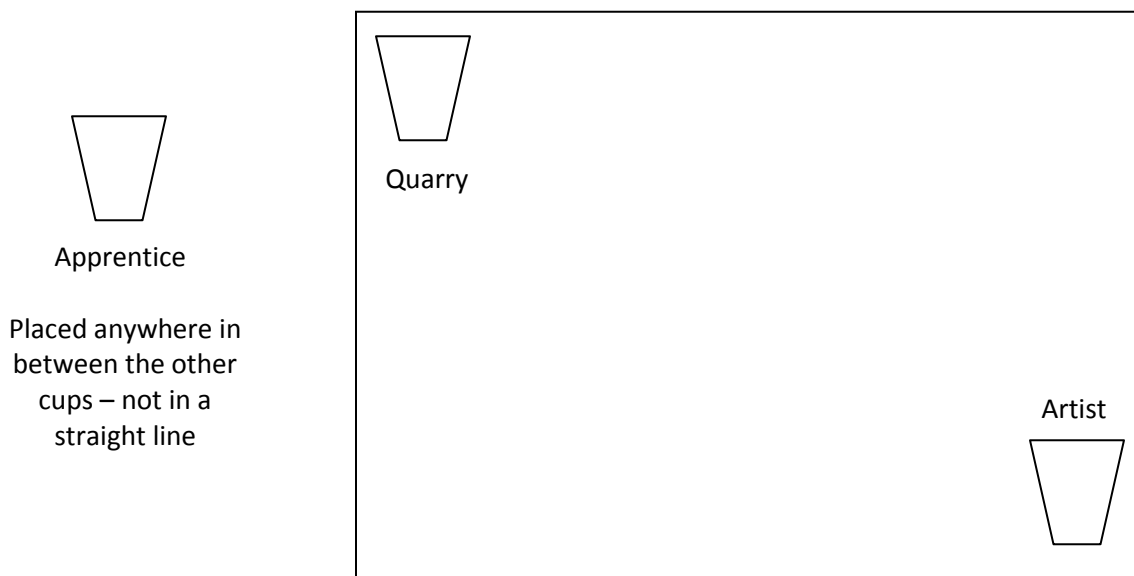
ADDITIONAL INFORMATION

The bulletin board paper becomes the workspace for the design. They can lay it flat while crafting the course and then tape it to the desk as they are ready to test it. Or, if they prefer, they can begin with it taped to the desk and work off of it.

3 cups represent the 3 locations the rocks must travel. The quarry's cup needs to be at the top left corner of the desk. The artist's cup needs to be in the bottom right corner of the desk. The apprentice's cup can be anywhere in between – as long as it doesn't create a straight line/path.

Students will need to craft a hole in the cups, cut bottom of the cups off, etc., for proper passage of the rock (marble) through the course. You can share this information with them, or allow them to discover that as they work through the challenge.

Student Desk – turned on its side – landscape view



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Your job is to move 5 rocks to the Maestro's studio to grind for paint.

Create a series of inclined planes that allow 5 rocks (marbles) to travel from the quarry to the apprentice to the artist. The rocks must not travel in a straight line and you must include at least 3 inclined planes.



Group Supplies:

A student desk top turned on its side

3 small plastic cups

Masking tape 1 foot

8 ½ by 11 paper-3 sheets

Timer

5 Marbles

scissors

The entire project should be accomplished on the space provided by the surface of the student desk. The desk needs to be placed in landscape position.

Date: _____

Evaluate:

- [illegible]

-
- This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slightly textured appearance and is set against a dark background.

CGI Problem with STEM Connection Unit 2 Design Challenge: Quarry to Canvas

The Apprentice has to get the paint pigment to the painter. She stops to drink water every ____ miles. If her water bottle holds 7 cups of water, how many miles can she hike?

(1/10)

(2/10)

(5/10)

(7/10)

There is a new slide, “The Intimidator”, at the Splash Zone Water Park. A person can slide down the slide in ____ seconds! If there are ____ people in line, how long will it take all of them to go down the slide?

(7½, 6)

(7 ½, 12)

(3¾, 12)

Arduino can transport 5 rocks in 10 minutes. How many minutes will it take him to transport ____ rocks?

(1)

(3)

(3000)

(5675)

Each rock Arduino grinds can make ____ ounces of paint pigment. If he grinds ____ rocks, how many ounces of paint pigment can he give to the painter?

(14, 3)

(14, 3½)

(14, 6½)

(7, 6½)