WAMC Lab Template

Math Concept(s): Force Vectors

Source / Text:

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Attach the following documents:

- Lab Instructions
- Student Handout(s)
- Rubric and/or Assessment Tool

Short Description (Be sure to include where in your instruction this lab takes place):

Lab Plan

Lab Title: Worlds Tallest Golf Tee

Prerequisite skills: Understand how to brain storm with a team and go through the design process.

Lab objective: To gain an understanding of vectors, improve teamwork/collaboration skills. Gain an understanding of the design process by using critical thinking and problem solving.

Standards: *(Note SPECIFIC relationship to Science, Technology, and/or Engineering)*

Mathematics K–12 Learning Standards:

- Mathematics K–12 Learning Standards: NV-M.4a. Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of the sum of two vectors is typically not the sum of the magnitudes.
- NV-M.2. Find the components of a vector by subtracting the coordinates of a terminal point.

Standards for Mathematical Practice:

- Use appropriate tools strategically
- Attend to precision
- Use appropriate angles
- Achieve static equilibrium

K-12 Learning Standards-ELA (Reading, Writing, Speaking & Listening):

- RST.9-10.3 Follow precisely a complex multistep procedure when carrying experiments, taking measurements, or performing technical tasks, attending to special cases or expectations defined in the text
- RST.9-10.4 Determine meaning of symbols, key terms, or other domain specific words and phrases as they are used in specific technical context.
- RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form and translate information expressed verbally or mathematically into words.

K-12 Science Standards

- PSI-3 Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles

Technology

- 1.2.1 Communicate and Collaborate to learn with others
- 2.2.1 Develop skills to use technology effectively
- 2.4.1 Formulate and synthesize new knowledge

Engineering

- HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Leadership/21st Century Skills:

21st Century Interdisciplinary themes (Check those that apply to the above activity.)

☐ Global Awareness ☐ Financial/Economic/Business/Entrepreneurial Literacy ☐ Civic Literacy
☐ Health/Safety Literacy ☐ Environmental Literacy

21st Century Skills (Check those that students will demonstrate in the above activity.)

LEARNING AND INNOVATION
Creativity and Innovation
X Think Creatively
X Work Creatively with Others
X Implement Innovations
Critical Thinking and Problem Solving
X Reason Effectively
X Use Systems Thinking
X Make Judgments and Decisions
X Solve Problems
Communication and Collaboration
X Communicate Clearly
X Collaborate with Others

INFORMATION, MEDIA & TECHNOLOGY SKILLS
Information Literacy
☐ Access and Evaluate Information
☐ Use and manage Information
Media Literacy
☐ Analyze Media
☐ Create Media Products
Information, Communications and Technology (ICT Literacy)
☐ Apply Technology Effectively

LIFE & CAREER SKILLS
Flexibility and Adaptability
☐ Adapt to Change
☐ Be Flexible
Initiative and Self-Direction
☐ Manage Goals and Time
☐ Work Independently
☐ Be Self-Directed Learners
Social and Cross-Cultural
☐ Interact Effectively with Others
☐ Work Effectively in Diverse Teams

Productivity and Accountability
☐ Manage Projects
☐ Produce Results
Leadership and Responsibility
☐ Guide and Lead Others
☐ Be Responsible to Others

TXacher Preparation: (What materials and set-up are required for this lab?)

Materials

- 10 pieces of printer paper
- 6' of string
- 3 feet of tape
- Scissors
- Golf ball

Set-Up Required:

- Lay out Material for students

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected):

Cooperative Learning:

- Students work in groups of 2-3 to build a structure using limited resources.

Expectations:

- Students should display go through the design process from brain storming to a final project and test and record their results.

Timeline:

- 1-2 class periods

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab

- Team work
- The Design Process
- Buildings and structures

Career Applications

- Structural engineering

Optional or Extension Activities

- Same lab done horizontally
- Balsa wood bridges
- Balsa wood towers

World's Tallest Golf Tee

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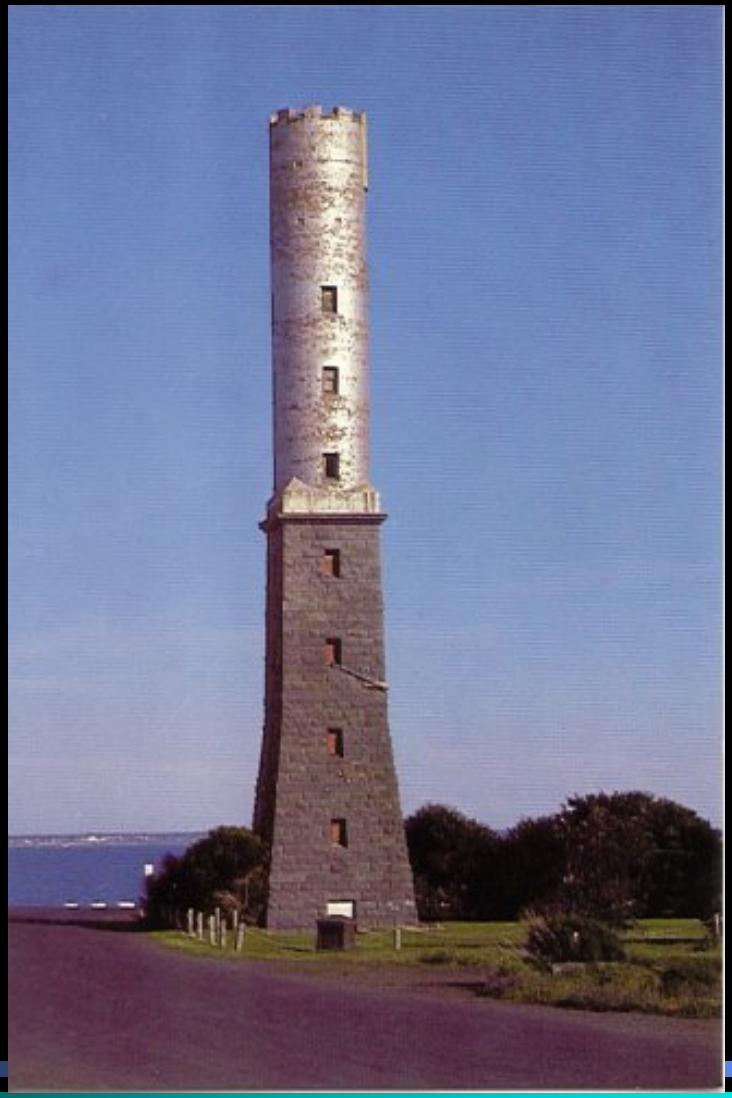

The World's Tallest Golf Tee

1. People:

- Do you feel that everybody in your group do their fair share of the work when planning, decision making, and building?
- What are some reasons why?

The World's Tallest Golf Tee

2. Information:

- What types of knowledge did you use when choosing your final design?

The World's Tallest Golf Tee

3. Materials:

- If you could have had an unlimited amount of paper, string, or tape, would the results have been any different?
- Explain why or why not.

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4. Tools & Machines:

- Explain at least one type of tool or machine that could have helped improve your final solution.

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5. Energy:

- What type of energy would the tool or machine listed in your previous answer require.

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6. Capital:

- How does money play an important role in "real world" construction?
- What needs to be purchased when a "real" structure is constructed?

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7. Time:

- Do you think it would have been helpful to have more time to complete this activity?
- What part of the construction process would you have liked to spend more time on?
- Why could this have changed the results?

WEAU
Channel 13
Tower

- *Looking Up*

WEAU
Channel 13
Tower

- *Close Up*

WEAU
Channel 13
Tower

- *Suspension Cables*

WEAU
Channel 13
Tower

- *Cables*
Looking Up

Water Tower

Team 1

Team 2

Team 3

Team 4

Team 5

Team 6

Team 7

Team 8

Team 9

Team 1

Team 2

Team 3

Team 4

Team 6

Team 8

Team 9

The End

_____ / 10 points

Name: _____
Date: _____
Hour: _____
Teammates: _____
_____

The World's Tallest Golf Tee

Overview:
Your team has been challenged to create a structure that will hold a golf ball a minimum of 36" off of a table.

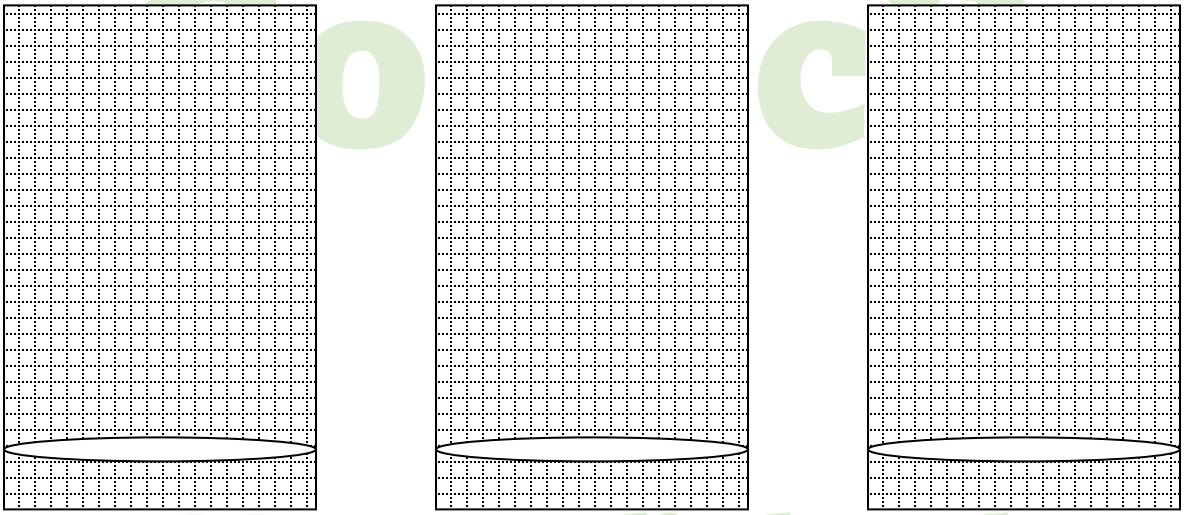
- Your structure must hold the golf ball still for a minimum of 10 seconds for the test to be recorded.
- Your structure can only be made from the materials shown on the ***materials list***.
- Your team may attach your structure to the table top but the structure cannot be attached to any other object.
- Your team may use a ruler and a scissors to help build the structure but they cannot to be used as a part of the structure.
- Your team will be given 5 minutes to plan, 10 minutes to build, and 5 minutes to test and modify your structure.

Materials List:

- 10 sheets of 8.5" x 11" paper
- 36" of ¾" masking tape
- 72" string

The *Technological Problem Solving Process*

1. Define the problem (see above).
2. Describe the results you want (set goals).
3. Gather information (What do you know about these types of structures?).
4. Create alternative solutions (brainstorm).



label your materials label your materials label your materials

5. Choose the best solution (circle the idea your team has chosen).
6. Implement your solution (build it).
7. Evaluate your solution and make necessary changes (test and repair on your own).

Directions: Complete the following questions using complete sentences.

Lab Questions: (3 points each)

1. Your team was led through the ***Technological Problem Solving Process.*** What are some advantages of using this technique over simply trying your first idea you think of?

   _____
   _____

2. Why is it important to know the constraints (rules) of a project before starting?

   _____
   _____

3. How can we use our knowledge from other subject areas (e.g. math, science, art, etc.) to help build a better structure?

   _____
   _____

4. How did your team change the physical characteristics of your paper to make it more useful?

   _____
   _____

5. What are the consequences of wasted resources?
   The consequence of wasting some of the **tape** is

   _____
   _____

   The consequence of wasting **paper** is

   _____
   _____

   The consequence of wasting the **string** is

   _____
   _____

   The consequence of wasting the **time** is

   _____
   _____

6. Why did some of the structures in the classroom fail to hold a golf ball at 36”?

   _____
   _____

7. How does team work aid in the development of a new structure?

   _____
   _____

Worlds Tallest Golf Tee Final Assessment

1. Is the structure free standing 25 point _____
2. Is