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Physics – Bridge Quarter Project

Every year over 100 million cars cross the George Washington Bridge in New York alone. If you drive for more than 10 minutes, there's a very good chance that you'll cross several bridges without even realizing it. Bridges are an important part of our lives that often go unnoticed. This project is designed to challenge both your mechanical and creative abilities as you build a small, lightweight bridge that can hold many times its own weight. Hopefully you'll also gain appreciation for one of the great engineering marvels of our modern world.

Rules

1. **NO LATE PROJECTS WILL BE ACCEPTED**.
2. A team may consist of 1, 2 or 3 students – all from the same class.
3. The bridge cannot be made from a pre-fabricated kit. It must be homemade. The students, not the students' parents or siblings should complete the project.
4. The bridge will be made of **SPAGHETTI**. Please do not attempt to use fettuccini, linguini, or any other type of pasta. Everyone knows what regular spaghetti looks like, so there will be no excuses. Bridges made of other materials will be <u>disqualified</u>.
5. You are allowed to use any type of glue. However, glue may be used to join spaghetti pieces together only. You may NOT coat spaghetti pieces with glue. Excess glue will lead to <u>disqualification</u>. Glue should be found in the joints of your bridge only. Nowhere else.
6. The spaghetti may be cooked, uncooked, or any combination of the two.
7. Your bridge must be **at least 35 cm long (i.e. the tables will have a 30 cm gap between them so the bridge length must exceed 30 cm or the bridge will fall through the gap)**. This is a bit over 1 foot long. Your bridge must be **between 5 cm and 7.5 cm wide**. That's about 2 – 3 inches. Make sure that your bridge is not too narrow, or too wide. Your bridge must be **at least 5 cm tall**, or about 2 inches minimum. Finally, your bridge <u>cannot have a mass greater than **1.5 Kilograms**</u>. That's roughly 52.9 ounces or 3.3 pounds! Look at your pack of spaghetti to get an idea of about how much you should use. It is important that your bridge adheres to the allowed dimensions.
8. **<u>Mrs. Ruiz-Houston's Class</u>** ~
    - You will be using straps and adding the weights to your bridge directly in 1 kg increments. Leave locations to place the straps and spread the weight out throughout the bridge.
    - The project has **<u>two</u>** parts:
        - The physical Bridge is due on **Friday, December 7th.**
        - The Poster is due on **Monday, December 10, 2018.**
    - **NO LATE PROJECTS! NO EXCEPTIONS!**

9. Bridges will be tested on **Monday, December 10th.**
10. Your bridge will be measured to determine whether it meets the dimensional criteria. Any bridges that do not meet the standards listed above will be disqualified. Your bridge must also be capable of accommodating the wooden block and bolt. If you have any doubt, bring your bridge in early, before the due date, to be judged. If there is a problem, and it is before the due date, you can still fix it. Once the due date arrives, it will be too late for alterations.

11. The goal of your bridge is to support a heavy load before it breaks. Your bridge will span an opening 30 cm wide. You will attach 1-3 straps at locations of your choosing around your bridge. You will then hang sand bags from the straps until the bridge breaks. Any bridge that cannot support the straps and S-hooks will score zero for this part of the grade.
12. Once the straps are hanging from the bridge, each team will have **120 seconds** to add sand to the bucket. The competition is over once one of three things happen: the bridge breaks, the bridge sags more than 5 cm, or the 2 minute time limit is reached.
13. The weight that the bridge can hold will be used to determine the bridge grade.
14. Teachers will disqualify bridges that attempt to circumvent the spirit of these rules, or whose owners display unsportsmanlike or boorish behavior. This is supposed to be fun!

The **Bridge**:

- will have no unsafe components
- will use only the materials allowed by the instructions
- will be "home-made", not from a kit, and built by student(s) in the group
- will be due at the beginning of class on **Friday, December 7, 2018**
- Testing will be on **Monday, December 10, 2018**

Your Points	Possible Points	Requirements
	/60	Bridge Meets Specifications, is On Time and is Safe • Glue should be found in the joints of your bridge only. • Your bridge must be **at least 35 cm long**. • The spaghetti may be cooked, uncooked, or any combination. • Your bridge must be **between 5 cm and 7.5 cm wide**. • Your bridge must be **at least 5 cm tall**. • Finally, your bridge **cannot have a mass greater than 1.5 Kilograms.**
	/1	For every Newton the Bridge Supports, Rounded to the Nearest Whole Number (40 N max – approximately 9 pounds) _____ $Bags \cdot \left(\frac{1\ Pound}{1\ Bag}\right)\left(\frac{4.448\ N}{1 Pound}\right)\left(\frac{1\ point}{1\ N}\right) =$ _____ $Points$ _____ $Bags \cdot \left(\frac{1\ Pound}{1\ Bag}\right)\left(\frac{1\ N}{0.225 Pound}\right)\left(\frac{1\ point}{1\ N}\right) =$ _____ $Points$
	/100	**TOTAL POINTS**

The **Poster**:

- will be traditional poster size (approx 50 cm by 70 cm)
- will predominantly feature at least two scale illustrations or diagrams of the bridge
- will have diagrams labeled with dimensions in **metric units**
- will explain your research on 3 different bridge designs.
    - You will discuss what features you have incorporated into your bridge from this research.
    - You may use pictures &/or diagrams to assist in clearly and concisely discussing your reasoning.
- will have appropriate spelling & grammar
- will be aesthetically pleasing to the eye
- will be due at the beginning of class on **Monday, December 10, 2018.**

IB Objective	1 – 2	3 – 4	5 – 6	7 – 8
Objective A i Explain scientific knowledge	The student states scientific knowledge	The student outlines scientific knowledge	The student describes scientific knowledge	The student explains scientific knowledge
Objective A ii Apply scientific knowledge and understanding to solve problems set in familiar	The student applies scientific knowledge and understanding to suggest solutions to problems set in familiar situations	The student applies scientific knowledge and understanding to solve problems set in familiar situations	The student applies scientific knowledge and understanding to solve problems set in familiar situations and suggest solutions to problems set in unfamiliar situations	The student applies scientific knowledge and understanding to solve problems set in familiar and unfamiliar situations
Objective A iii Analyze and evaluate information to make scientifically supported judgments	The student interprets information to make judgments.	The student interprets information to make scientifically supported judgments.	The student analyzes information to make scientifically supported judgments.	The student analyzes and evaluates information to make scientifically supported judgments.
Objective D i Explain the ways in which science is applied and used to address a specific problems	The student is able to, with limited success, state the ways in which science is used to address a specific problem or issue	The student summarizes the ways in which science is applied and used to address a specific problem or issue	The student describes the ways in which science is applied and used to address a specific problem or issue	The student explains the ways in which science is applied and used to address a specific problem or issue
Objective D ii Discuss and evaluate the various implications of the use of science and its applications	The student is able to, with limited success, state the implications of using science to solve a specific problem or issue, interacting with a factor	The student describes the implications of using science and its application to solve a specific problem or issue, interacting with a factor	The student discusses the implications of using science and its application to solve a specific problem or issue, interacting with a factor	The student discusses and evaluates the implications of using science and its application to solve a specific problem or issue, interacting with a factor
Objective D iii Apply scientific language effectively	The student is able to, with limited success, apply scientific language to communicate understanding	The student sometimes applies scientific language to communicate understanding	The student usually applies scientific language to communicate understanding clearly and precisely	The student consistently applies scientific language to communicate understanding clearly and precisely
Objective D iv Document the work of others and sources of information used	The student is able to, with limited success, document sources.	The student sometimes documents sources correctly.	The student usually documents sources correctly.	The student documents sources completely.