**Building a Popsicle-Stick Bridge**

**Goal:** to build the strongest bridge using wooden Popsicle sticks.

**Groups:** Students may work in pairs or individually. **Due Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Constraints:**

* The bridge must span a 55cm gap (end of one table to end of the others).
* The width of the bridge’s deck must be ***at least 5.0 cm***.
* The bridge must provide an unobstructed passage of a matchbox car.
* All types of glue may be used.
* The total mass of the bridge ***must not exceed 210 g***.
* Paper/construction paper/foam sheet may be used for the deck and ***WILL BE COUNTED*** as part of the 210 g.
* All prototypes should be documented in your design phase.
* The test load is applied to a 4.0 cm-wide section at the top of the arch.
* The test jig looks like this:



(Well-built bridges can support over 70 kg - ***the weight of an adult***)

* Your write up should include a free body diagram of all forces acting on your bridge while containing it’s maximum load, as well as calculations of all forces while containing it’s maximum load.
* The efficiency of your bridge will be calculated as follows.



* ***To receive a bonus mark complete world one of Bridge Builder on your phones or tablets!***

**Write up:**

Research the physics of bridges including explanations of five different concepts and how each concept was incorporated in your design. Include why certain materials are used for certain aspects of bridge design. Cite your source carefully and use at least three different references for this project.

Include photos or illustrations with your explanations where appropriate. Take photos throughout the design phase; use them in your report. You should be making ***multiple prototypes*** and testing them as you go! ***Explain you engineering ideas based on the concepts covered in hydrostatics.***

Include a section for qualitative data (observations) about the determination of the maximum load, as well as possible improvements you would make to your design.

**Conclusion:**

Conclude with a relative rating of your bridge compared with your expectations and what improvements need to be made to make a strong bridge. ***What would you change? How would the change make a difference?*** Remember scientists/engineers are constantly tweeting their experimental designs to maximize yield and efficiency.

Creating the Solution (Include in your write-up AND check in with teacher during the process)

|  |  |  |  |
| --- | --- | --- | --- |
| 1-2 | 3-5 | 6-8 | 9-10 |
| * **Demonstrates minimal** technical skills when making the solution
* **Creates** the solution, which functions **poorly** and is presented **in an incomplete from**
 | * **Constructs a plan** that contains some production details, resulting in peers having difficulty following the plan
* **Demonstrates satisfactory** technical skills when making the solution
* **Creates** the solution, which **partially** functions
* **Outlines** changes made to the chosen design and plan when making the solution.
 | * **Constructs a logical plan,** which considers time and resources, sufficient for peers to be able to follow to create the solution
* **Demonstrates competent** technical skills when making the solution
* **Creates** the solution, which functions **as intended**
* **Describes** changes made to the chosen design and plan when making the solution.
 | * **Constructs a detailed and logical plan,** which **describes** the efficient use of time and resources, sufficient for peers to be able to follow to create the solution.
* **Demonstrates excellent** technical skills when making the solution.
* Follows the plan to **create** the solution, which functions **as intended**
* Fully **justifies** changes made to the chosen design and plan when making the solution.
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Evaluating (Include in your write-up)

|  |  |  |  |
| --- | --- | --- | --- |
| 1-2 | 3-5 | 6-8 | 9-10 |
| * **Designs a** testing **method,** which is used to measure the success of the solution
* **States** the success of the solution
 | * **Designs a relevant** testing **method,** which generates data, to measure the success of the solution
* **Outlines** the success of the solution against the design specification based on **relevant** product testing
* **Outlines** how the solution could be improved
* **Outlines** the impact of the solution on the client/target audience.
 | * **Designs relevant** testing **methods,** which generate data, to measure the success of the solution
* **Explains** the success of the solution against the design specification based on **relevant** product testing
* **Describes** how the solution could be improved
* **Explains** the impact of the solution on the client/target audience, **with guidance.**
 | * **Designs detailed and relevant** testing **methods,** which generate data, to measure the success of the solution
* Critically **evaluates** the success of the solution against the design specification based on **authentic** product testing
* **Explains** how the solution could be improved
* **Explains** the impact of the product on the client/target audience.
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Effectiveness

|  |  |  |  |
| --- | --- | --- | --- |
| **1-2** | **3-5** | **6-8** | **9-10** |
| * Efficiency of the ***bridge*** is less than 5
 | * Efficiency of the ***bridge*** is between that 5-10
 | * Efficiency of the ***bridge*** is between that 10-15
 | * Efficiency of the ***bridge*** is greater that 15
 |

Did you complete the Bridge Builder Challenge? Yes/No (2)