TOOTHPICK BRIDGE PERFORMANCE TASK

Standards: S8P4: Investigate the relationship between force, mass, and the motion of objects: S8P5: recognize characteristics of gravity as a major kind of force acting in nature: S8CS1. Explore the importance of curiosity, honesty, openness, and skepticism in science and will exhibit these traits in their own efforts to understand how the world works; S8CS3. Have the computation and estimation skills necessary for analyzing data and following scientific explanation: S8CS5. Use the ideas of systems, model, change, and scale in exploring scientific and technological matters: S8CS6 communicate scientific ideas and activities clearly; S8CS7 question scientific claims and arguments effectively: & understand the features of the process of scientific inquiry

Objective: To design, sketch and build a bridge which can be tested for structural strength and then analyzed for the forces involved: 1) Design and sketch a possible bridge, 2) Build the bridge from flat toothpicks and glue, 3) Identify the type of bridge constructed and the strengths and weaknesses of your bridge, and 4) Write about the experience (bridge design & building and physical science this year – this part may be done at home.

Instructions and Materials: Each student will design, sketch and build a bridge using **flat wooden toothpicks**, **Elmer's white glue, and a piece of wax/parchment paper**.

Summary: The goal of this lesson is to not only educate students about the types of bridges that exist and how they hold weight but also to have the students think critically about how they can construct a bridge using a very limited set of materials. In this case the limits are not budget or amount of each material but simply the type of materials that can be used. They can use an unlimited amount of those materials but absolutely nothing supplemental.

Engineering Connection: Bridges are an important civil engineering device. Without bridges we would not be able to span water of any variety. In order to understand how bridges work and hold weight students will attempt to construct their own bridge. This gives students a basic understanding of some physics and allows them to employee physics they know to solve a problem.

Only the materials listed may be used to build the bridge.

Excessive amounts of glue may not be used as part of the structure, i.e. the bridge may not be completely covered with glue. **Only the points of contact should contain glue**.

Toothpick Bridge Building Specifications

PLEASE read all bridge specifications prior to starting construction of your bridge.

Materials: You must use only **flat wooden toothpicks**, **Elmer's white glue**, and a **piece of wax paper** to build your bridge.

Mass: The mass of the bridge should not exceed 43 grams or is less than 35 grams (**possible 30 points**).

Overall Dimensions:

Maximum allowed length – 40 cm - **possible points - 15**
Minimum allowed length - 30 cm
Maximum allowed width, including road bed - 10cm
Road bed must be at least - 5 cm -not more than 10 cm – **possible points -15**
Maximum allowed height - 30.5 cm (including the piers (legs) of the bridge)
-**possible points -15**

Span: The Bridge must span a gap or opening of 6 to 10 cm off the ground.

Type of Bridge: You may not build a hanging bridge or suspension bridge. The bridge must be **free standing**. This may limit you to building a truss bridge or beam bridge.

LOAD: A gradually increasing force (weight) will be applied to the bridge from above. For maximum points, the bridge should hold a minimum mass of 2268 grams or 5 pounds – **possible points 25.** If bridge holds less than 2268 grams point value decreases.

PROCEDURE

To test each bridge's strength we will place the bridge onto and between two flat-topped tables spaced 10 inches apart.

Two Bricks - 2268 grams (2.5 pounds each) will be added to the middle of the roadbed one at a time. The bridge should hold the weight of both bricks.

The lightest bridge that withstands the most weight will be declared the best of the competition.

GOOD LUCK

TOOTHPICK BRIDGE RUBRIC

Categories	Possible points	Points earned
Bridge Mass		
35 grams – 43 grams	30	
30 grams – 34 grams	20	
24 grams – 29 grams	10	
Below 24 grams and higher than 55 g	05	
Bridge Length		
30cm – 40 cm	15	
19 cm – 29 cm	07	
Bridge Road Bed Width		
5 cm – 10 cm	15	
Less than 5cm or more than 10 cm	8	
Bridge Height		
7cm – 30.5 cm	15	
31 cm – 33 cm	10	
Below 7 cm or above 34 cm	05	
Bridge Strength		
Holds a mass of		
2268 grams or more than 5 pounds	25	
2267 -1179 grams(2.5-4.99 pounds)	20	
1134 grams (2.5 pounds or less)	10	
TOTAL POINTS	**100**	

Student Name _____ Class Period _____

Please keep up with the Rubric, it must be presented with the bridge.
Bridge construction must be completed in class.
Due Date: May 17, 2016