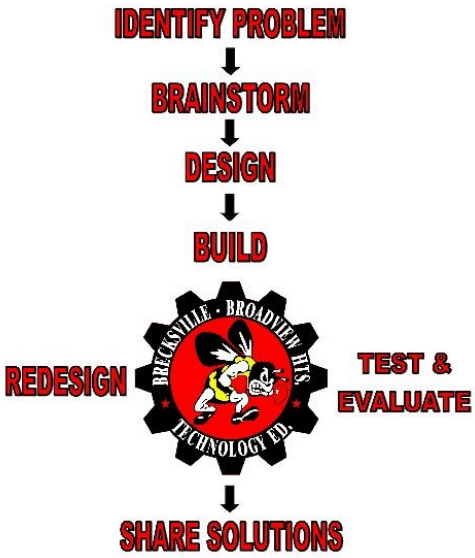
NAME: _____

PERIOD: _____

Have you ever seen a bridge, ever driven on one? I hope so! Bridges are everywhere around us and they are not going anywhere anytime fast. According to the U.S. Bureau of Transportation Statistics, there are approximately 600,000 bridges in the United States. These bridges are often over looked by the average U.S. citizen because they do exactly what they are designed to do, make our lifes easier. Although bridges are more complicated and important than most give them credit for. In this lesson we are going to find out how/why bridges work, the different types and we might even have a greater appreciation for them as well as see bridges as an art form.

THE DESIGN PROCESS



IDENTIFY PROBLEM (Problem Statement)

In this unit we are studying the bridges that are all around you. Your job is to use the design process to help you learn about, design, and build your very own scaled down balsa wood bridge that a Hotwheels car can drive on to compete in a class competition. The competetion will take place on thre bridge tester in class. For this competition their will be two winners: 1) the student who's bridge holds the most weight, 2) the stundent who's bridge is the most efficient. Students will be given time to build, test and evalute their designs, then redesign and change them as nessesary.

BRAINSTORMING

First, research and consider all possible ideas and configureations of the bridge design. Then the next step is to create sketches of 4 different designs. Fold your paper into 4 equal sections and draw one good size sketch in each section. At least 1 of the 4 sketches needs to be an isometric representation of the idea. The other 3 sketches can be any view of your choice (top, front, side).

Considerations:

- Weight distribution
- Balance
- Overall weight
- Overall length
- Compression, tension, & torsion
- Car must go down bridge deck
- Bridge deck must rest on the abutments of the tester

DESIGN

In this step a multiview drawing (using AutoCAD) of the bridge is produced. This is a formal and professional method of communicating the design to peers and making the design repticalble (capible of being produced by anyone).

The multiview drawinging must:

- Full scale
- Include all parts
- Include proper views (top, front, side)
- Use construction lines to project geometry
- Fully dimensioned (anyone should be able to build your exact bridge)
- 1 inch spacing between views
- Proper dimensions

BUILD

The building process first starts by taking inventory of the provided building materials.
Everyone should receive:

- 1 balsa bridge deck (3” x 12” x ¼”)
- 12 balsa strips (1/8” x 1/8” x 24”)

Other materials that may be used later:

- Hot or wood glue

Once all materials are accounted for the first step is to refer to the CAD drawing created ealier and use it as a set of plans. If you want your CAD drawing can be printed for you to use as a template. When gluing always have wax paper down so that your bridge is not glued to the table. Also bridges that have “exessive” amounts of glue will loose points or be disqualified based on the severity of the situation.

The visual above represents our bridge tester. There is 10” between abutments in the bridge tester and the piston that pulls on the bridge deck is centered between the abutments.

Considerations:

- **Use CAD drawing**
- **Wax paper**
- **No “exessive” glue**
- **May attention to joints**
- **Make sure car can pass through bridge**
- **Bridge deck must sit on abutments**
- **Abutments are 10” apart, hole in center of deck for tester.**

TEST & EVALUATE

After the bridge is fully constructed it is time to test it. This is a good time to make sure all parts of the bridge are connected. Apply gentle preasure to different areas of the bridge, look for exessive flexing or twisting.

Things to look for:

- **Solid joints**
- **Flexing**
- **Twisting**

REDESIGN

Use information observed durring testing & evaluation to change the design for the better. The first thing that you change may not fix the problem, it may even make the problem worse. A helpful hint is to only change one variable at a time so that it is clear if and which adjustments you are making are working or not. For this project it may be difficult to change anything once the bridge is constructed since everything is held together with glue.

SHARE SOLUTIONS

This is thought of as the “final” step in the design process. Now the design is finalized and it is time find out how well you have done. For this project this is where we have our class competition (bridge tester).

Competition rules/info:

- **Each students has 1 attempt**
- **You have 30 secconds to place your bridge in the tester after your name is called**
- **Two winners!**
    - **Holds most wieght**
    - **Most efficient**

GRADING

For this project the grade will be detrminded by both formative and sumative assessments. The larger (summative assessment) part will be comprised of everything done within the design process to design, build, test & evaluate, and redsign the project. The smaller (formative assessment) part is determined by the performance of the bridge constructed compered to the performance of the others in the class.

SUMMATIVE

Category	50% - 69%	70% - 84%	85% - 100%
Sketches (10)	5-6.9	7-8.4	8.5-10
Brainstroming sketches	2 complete sketches.	3 complete sketches. 1 ISO.	All four sketches complete. 1 ISO with labels.
Multiview CAD (30)	15-20	21-25	26-30
Top, front, side of design in AutoCAD	One side represented, missing dimensions or drawings misplaced.	Only two sides represented, missing dimensions or drawings misplaced.	All 3 sides represented (top, front, side). Fully dimensioned and gemometry projected.
Bridge Project (50)	25-34.5	35-42	42.5-50
Project constructed	The project created follows all requirements, only uses correct materials, student follows the design process, and produces a poorly thought out and uncreative design. Little effort displayed.	The project created follows all requirements, only uses correct materials, student follows the design process, and produces a working moderately thought out and creative design. Moderate effort displayed.	The project created follows all requirements, only uses correct materials, student follows the design process, and produces a working well thought out and creative design. A lot of effort displayed.
Project Summary (20)	10-13	14-16	17-20
Evauluate your work in the Maglev process	Few questions complete with well thought out responses.	All answers completed with not well thought out or incomplete responses.	All questions answered fully with well thought out responses.

FORMATIVE

Category	Bottom 3rd	Middle 3rd	Top 3rd
Performance (10)	7-7.9	8-8.9	9-10
How well did the project work?			