**Earthquake Proof Structure Performance Task**

You have been hired as the structural engineer in charge of designing a new 2-story art building. You must design and build a structure that is earthquake proof. There are many building codes you must follow. The building will be located near an earthquake fault; therefore your building must be able to withstand ***both*** small and large earthquakes. Since the building will be used for art classes, you may be as creative as you like with the shape and design of the building (it does not need to be box shaped).You may choose materials that are convenient to you and ability to gather resources. Encourage yourself to use items that you already have or repurpose old items. Be creative with your materials. Remember you are making a PROTOTYPE not an actual building that humans will live in. So, think marshmallows, cotton balls, springs, spaghetti or pasta, straws, popsicle sticks, pipe cleaners, PVC piping, etc.

**What must my project include?**

* **(20 points)** A clear, ***detailed construction sketch*** that label important design features and all critical measurements should be labeled on the sketch. You may use graph paper or paint.net, Publisher, or other software to produce a computer drawn sketch. It must be YOUR design (academic honesty) and the sketch must give all the information needed to recreate the design. BE CREATIVE!
* **(20 points)** A ***structural analysis*** of your building. This written analysis must be clearly handwritten or typed. The analysis must be at least 2 detailed paragraphs. The following questions should be answered clearly and completely:
1. During construction, how did you test the strength and stability of your structure?
2. During construction, what strategies did you use to strengthen the weaker areas? Why?
3. What are the strongest parts of your building? Why?
4. What are the weakest parts of your building? Why?
5. Why do you think your design will withstand an earthquake?
* **(20 points)** And of course, a ***prototype*** of your design. (An actual structure we can test on the Earthquake Simulator!)
* **(20 points)** Bibliography of research sources.

**The structure must comply with the following specifications:**

1. The total mass of the structure may not exceed 2.3 kilograms or 5 pounds.
2. No piece that is used to make the structure may be taller than 30 centimeters.
3. The elements or pieces of the structure may not interlock or stick together in any way. (NO Legos, MegaBlocks, Lincoln logs, or Knex type toys)
4. Glue and other fasteners may be used to hold parts together within the single element height limit of 30 centimeters.
5. The structure must be freestanding. (It may not be stuck in any way to the table.) The base must not exceed a 12 inch by 12 inch square in order to fit on the earthquake simulator.
6. Any materials may be used as long as they do not violate any other rule.
7. Students may create shock absorbers or include any new idea that is not suggested in the previous activities as long as it does not violate any other rule.
8. Materials may be placed under the structure as long as they do not in any way harm the earthquake simulator. These materials are included in the total mass of the structure.

**How will my design be tested?**

**ALL PROJECTS ARE DUE ON November 25th.**

**SIMULATION DAYS (November 25th and 26th)**

On the simulation days, you will test your structure on our earthquake simulator. You will receive BONUS points if:

2 points Building remains standing for 30 seconds after a mild earthquake.

5 points Building remains standing for 30 seconds after a major earthquake.

Top of Form

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| **Earthquake Proof Structure**  |
|  | **Meets****20 pts**  | **Approaches****15 pts**  | **Falls Far Below****10 pts**  |  |
| **Construction Sketch**  | Meets • Very or Fairly neat• Materials and measurements are clearly defined• Most areas are understandable• Colorful  | Approaches • Some area appear incomplete• Some materials and measurements are hard to figure out• A little hard to follow• Not very colorful  | Falls Far Below • No attempt was made to be neat• Sketch was sloppy• Quite hard to follow• No attempt to makeit interesting or colorful  |  |
| **Structural Analysis**  | Meets •Answers all the questions with details.•Is at least 2 paragraphs in length.•Evidence of a well thought out design and troubleshooting.  | Approaches •Answers some of the questions with details.•Is only 1 paragraph in length.•Evidence of some troubleshooting.  | Falls Far Below •No attempt was made to answer all the questions with details.•No structural analysis included.•Lack of evidence of well thought out design.  |  |
| **Prototype**  | Meets •Creative design and use of materials.•Follows the structural guidelines.•Effort is evident and much time was taken to complete project.  | Approaches •Somewhat creative design and use of materials.•Follows some of the structural guidelines.•Some effort is evident and some time was taken to complete project.  | Falls Far Below •Lacks a creative design or use of materials.•Structural guidelines were ignored.•No effort was made to build a structure.  |  |
| **Earthquake Proof Research**  | Meets • Research on earthquake proofing is highly evident.• Student spent an obvious amount of time researching all the expected details and more.  | Approaches • Research on earthquake proofing is somewhat evident.• Student spent some amount of time researching all the expected details.  | Falls Far Below • Research on earthquake proofing is barely evident.• Student spent very little amount of time researching all the expected details.  |  |

Bottom of Form

*\*\*\*You may work in pairs to design and build one prototype. The grade for the prototypes will be the same for each student. HOWEVER, each student must complete their own design sketch, structural analysis, and research bibliography.*

Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_

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Total Points \_\_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_ % + \_\_\_\_\_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_\_ %

 80 Bonus Points