

MY SO STEM SHOWDOWN

CONTENT, RECOMMENDED MATERIALS & SCORING

STEM SHOWDOWN CONTENT

The STEM Showdown will consist of a series of online multiple-choice questions. Participants at both levels will be expected to demonstrate their understanding of the physics and principles of structural engineering. In particular, Showdown participants will need to demonstrate the ability to analyze a structure, and think about what forces/stresses members are withstanding. A Showdown participant will have 55-minutes to login and answer as many questions as possible.

The Structures content and skills covered by the Showdown this month are as follows:

1. Historic Structures:
 - a. Understand and apply the design principles employed by the Ancient Greeks
 - b. Understand and apply the design principles employed by the Ancient Romans
2. Material Properties:
 - a. Understand the various mechanical properties of materials that are typically used in construction of buildings
 - i. strength;
 - ii. toughness;
 - iii. hardness;
 - iv. brittleness;
 - v. malleability; and,
 - vi. ductility
 - b. Understand the various physical properties of materials that are typically used in construction of buildings
 - c. Understand the various chemical properties of materials that are typically used in construction of buildings
 - d. Recognize and apply the differences between Isotropic and Anisotropic material properties
 - e. Typically used construction materials include:
 - i. Steel
 - ii. Concrete
 - iii. Rebar
 - iv. Wood
 - f. Types of material deformities (i.e., warping, thermal expansion, spalling)
3. Load Scenarios:
 - a. Understand the following loading scenarios and stresses as well as their impact on structures and their structural members
 - i. Compression
 - ii. Tension
 - iii. Shear
 - iv. Bending
 - v. Torsion
 - b. Types of loads (i.e., static, dynamic)
 - c. Understand how load scenarios occur and explain the design and behavior of pressure vessels

4. Representations and Computations:
 - a. Understand and use following representations of structures and structural members
 - i. Compression
 - ii. Tension
 - iii. Shear
 - iv. Bending
 - v. Torsion
 - b. Types of loads (i.e., static, dynamic)
 - c. Understand and use the appropriate units in calculations and equations
 - d. Understand and apply the appropriate forces and equilibrium in calculations and diagrams
5. Shapes and Members:
 - a. Understand the mathematics and underlying principles behind the use of triangles in structures
 - b. Understand the underlying principles behind trusses and how they are used in a variety of structures
 - c. Understand and apply different types of joints to construction problems of structures
 - d. Understand and apply the concept of safety factor to computations, calculations and given problems
6. Unique High School (Division C) Content:
 - a. Understand the mathematics, underlying principles, and use of Zero Force Members
 - b. Understand the mathematics, underlying principles, and use of Two Force Members
 - c. Understand, interpret, and use Shear Stress Diagrams
 - d. Understand the mathematics, underlying principles, and use of pistons
 - e. Understand the mathematics, underlying principles, and occurrence of cascading failures
 - f. Understand the mathematics, underlying principles, and use of guy wires
 - g. Understand the mathematics, underlying principles, and use of tuned mass dampers

Recommended Materials

- Each Showdown participant will need a computer with internet access, scratch paper, something to write with, and a stand-alone calculator
- Showdown participants may use resources available to help them answer the questions asked during the Showdown. These resources could be a collection of notes on the topics listed below, copies of magazine or journal articles, a textbook, or any combination of these items.

Scoring

- High score wins.
- Ties will be broken using:
 - a. The time it takes to complete the test; and
 - b. The number of test questions attempted.

Additional Resources

- The Science Olympiad Store (store.soinc.org) carries the Problem Solving & Technology CD as well as various videos and resources
- Other resources can be found on the Boomilever Event Pages at <http://soinc.org/>.

