

# 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 engineering and physics principles. A Showdown participant will have 55-minutes to login and answer as many questions as possible.

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

1. *Engineering Design Process*
  - a. Prototyping & Testing
  - b. Cost Benefits vs. Constraints
  - c. Similarities to Scientific Method
2. *Applicable Physics Concepts*
  - a. *Classical Mechanics*
    - i. *Forces*
      1. Including Lift & Drag
    - ii. *Velocity, Speed & Acceleration*
    - iii. *Newton's Laws*
    - iv. *Work & Energy*
    - v. *Free Body Diagrams*
      1. *Applications*
        - a. *Space Elevators*
        - b. *Submarines/Bridges*
  - b. *Mechanical Efficiency*
  - c. *Material Strength & Properties*
    - i. *Deflection*
    - ii. *Applications*
      1. *Mars Helicopter*
  - d. *Coefficient of Friction*
    - i. *Applications*
      1. *Joint Implants*
      2. *Contact Lenses*
      3. *Race Car Tires*
    - ii. *Dimensional Analysis*
3. *Energy Conservation*
  - a. *Potential & Kinetic*
  - b. *Elastic vs. Inelastic Collisions*
  - c. *Elastic Potential Energy*
  - d. *Springs/Spring Constants*

- i. Damping
  - ii. Applications
    - 1. Shock Absorbers
- 4. Projectile Motion
- 5. Simple Machines & Pendulums
  - a. Pulleys + Efficiency
  - b. Wheels & Axle
    - i. Rotational Motion
      - 1. Converting between linear and rotational motion
      - 2. Differential Gears
      - 3. Belt-driven vs. Chain-driven gears
  - c. Pendulums

### **Unique High School (Division C) Content:**

- 6. Fluid Mechanics
  - a. Fluid mechanics
  - b. Bernoulli's Equation
  - c. Different types of flow
  - d. No-slip boundary condition
  - e. Applications
    - i. Fluid Transport
    - ii. Blood Vessels and blood viscosity
    - iii. Fluidic Fabric Muscle Sheets

## **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](http://store.soinc.org)) carries the Chemistry & Physics CD as well as other resources

