

MY SO STEM SHOWDOWN

CONTENT, RECOMMENDED MATERIALS & SCORING

STEM SHOWDOWN CONTENT

The STEM Showdown will consist of a series of online multiple-choice questions. Middle school (Grade 6-9) Participants in both Middle School (Grade 6-9) and High school (9-12) will answer questions about the science and mechanics of flight. A Showdown participant will have 50-minutes to answer as many questions as possible.

The content and skills for both middle school (Grade 6-9) and high school (Grade 9-12) covered by the Showdown this month are as follows:

Topic I: History of flight

- a. History of heavier-than-air man-carrying flight
 - i. Significant Events & People
 - 1. Historic Flights
 - 2. Famous Flyers, Inventors, & Engineers
 - 3. Historic Crashes
 - ii. Types of man-carrying crafts
 - 1. Balloons
 - 2. Planes
 - 3. Helicopters
 - 4. Rockets
- b. History of heavier-than-air model planes
 - i. Types of Models
 - ii. Significant Models
 - iii. Famous Engineers & Modelers
 - iv. Reasons for Modelling
 - v. Modeling Competitions, Contests, & Organizations

Topic II: Vocabulary

- a. Parts of man-carrying crafts
 - i. Balloons
 - ii. Planes
 - iii. Helicopters
 - iv. Rockets
- b. Forces of flight

opic III: Basic forces of flight

- a. Lift, Drag, mass (gravity), propulsion
- b. Stability
 - i. Center of mass
 - ii. Center of lift
 - iii. Stability margin
- c. Calculations
 - i. Wing area
 - ii. Tail area
 - iii. Tail moment
 - iv. Prop pitch vs. pitch angle vs. location on the prop (radius)
 - v. Maximum turns calculation for Super Sport rubber
 - vi. Rubber winds with various winder ratios (10:1, 15:1, 20:1 are common)
 - vii. Approximate Energy storage (area under the rubber winding or unwinding curve)
- d. Model trimming
 - i. Impacts of various adjustment
 - 1. Decalage
 - 2. Tail tilt
 - 3. Rudder
 - 4. Thrustline
 - 5. Wash-in
 - 6. Motor stick flexibility (lengthwise and torsional)
 - ii. Energy management
 - 1. Flaring props

Topic IV: The science of rubber

- a. Hysteresis
- b. Stretch winding
- c. Torque
- d. Lube
- e. Matching of prop to rubber
 - i. Understanding what adjustments to make to prop, rubber, and winds for given situations, such as:
 - 1. Running out of winds before landing
 - 2. Excessive winds at end of flight
 - 3. Hits ceiling

Topic V: Materials used in modeling

- a. Balsa
 - i. Grain (A, B, C) and applications
 - ii. Density (calculations as well as impact)
 - iii. Bending strength
- b. Carbon laminates
 - i. Advantages
 - ii. Disadvantages
- c. Covering materials
- d. Adhesives
 - i. CA's
 - ii. Cellulose-based glues
 - iii. Weight management
- e. Propellers
 - i. Helical pitch
 - ii. Wash-out
 - iii. Flaring
 - iv. Variable pitch
 - v. Impacts of diameter, pitch, number of blades

Recommended Materials

- Each Showdown participant will need a computer with internet access, scratch paper, something to write with, and a stand-alone, non-programmable, non-graphing calculator (e.g., a TI-83 or NSPIRE)
- 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 results to the questions indicated as tiebreakers.

Additional Resources

- The Science Olympiad Store (store.soinc.org) carries a variety of resources for Electric Wright Stuff and Wright Stuff that may be useful for this topic.
- Other resources can be found on the Electric Wright Stuff (middle school) and Wright Stuff (high school) Event Pages at soinc.org.