

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 basic botany and select agricultural science topics. A Showdown participant will have 55-minutes to login and answer as many questions as possible.

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

1. Plant Anatomy, Development, Taxonomy and Evolution

- a. Bryophytes, Angiosperms and Gymnosperms
 - i. General features and similarities of all of these groups
 - ii. Distinguishing features and differences between each group
 - iii. Evolutionary relationships between these groups
- b. Understand the structure and function of Angiosperms and their general biology
 - i. Cells as fundamental components of plants
 - ii. Common plant cell organelles
 - iii. Fundamental cell types in plants
 - iv. Development and reproduction
 1. Life cycle (introduction to alternation of generations, sporophyte generation, gametophyte generation, pollination, fertilization)
 2. Anatomy and physiology (e.g., seeds, roots, leaves, flowers, fruits, phloem transport)

2. Plant Genetics and Classical Plant Breeding

- a. Genetic material
 - i. Ploidy
 - ii. Mitosis
 - iii. Meiosis
- b. Selection and Hybridization
- c. Pedigree, Backcross, Mass Selection, Bulk Method
- d. Understand how crops can be improved genetically
 - i. Selective breeding
 - ii. Biotechnology (GMOs, etc.)
 - iii. Other technological tools (e.g., CRISPR)

3. Photosynthesis

- a. Photochemical reactions
- b. Photophosphorylation and carbon fixation (C3, C4, CAM)

4. Plant community interactions: general knowledge in or interpretation of case studies relating to:

- a. Plant-plant (e.g., competition for resources, parasitism)
- b. Plant-herbivore (e.g., secondary metabolites)
- c. Plant-microbe: mutualism and parasitism
- d. Plant-pollinator: mutualism

5. Soil
 - a. Process of soil formation
 - b. Soil fertility: what it is
 - c. Soil chemistry/mineralogy and composition/layers: major soil horizons
 - d. Major soil types
 - e. Ecological function of soil invertebrates
 - f. Effect of tilling on soil chemistry
 - g. Erosion and soil conservation
 - h. Role of plants in nutrient cycling in soils (carbon and nitrogen)
6. Agricultural practices
 - a. Monoculture
 - b. Crop terracing
 - c. Crop rotation (mixed cropping)
 - d. Nitrogen, phosphorus, and potassium fertilization (maintaining soil fertility)
 - e. Historical vs modern farming techniques
 - i. Large scale vs. small scale farming (similarities and differences)
 - ii. use of crop protection products and/or GMOs
 - iii. What is organic farming?
 - iv. Hydroponics
 - f. Impact and importance of the Choice of Farming Techniques
 - i. Till vs. No Till
 - ii. Conventional vs. organic
 - g. Agricultural Runoff
 - i. Impact on the local watershed
 - ii. Similar concerns in other settings (i.e., fertilizer use on home lawns)
 - h. Water usage (e.g., irrigation practices)
7. Pest and plant pathogen management
 - a. Integrated pest management (IPM)
 - b. Biological control
 - c. Chemical control
 - d. Mechanical control
 - e. Common diseases and predators and agricultural techniques associated with wheat, maize, rice, cotton, soybeans, sugarcane, tobacco, and coffee
8. Methods of measuring plant and soil health
 - a. Measuring crop yield
 - b. Non-responsive fields (when a change in farming technique does not improve crop yield as expected)
 - c. Integrative health management
 - d. Relationship between soil properties (especially minor nutrients) and plant growth

Unique High School (Division C) Content:

1. Agricultural Case Studies
2. Agricultural Data & Statistical Analysis

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

Participants preparing for the MY SO STEM Showdown on Plants may find the following resources helpful:

- The Science Olympiad MY SO Lesson Plan on Plants as well as the Monthly Slideshow and Practice questions can be accessed at www.soinc.org/myso.
- Information about Bees and Other Pollinators can be found in this resource from the Food and Agriculture Organization of the United Nations (<http://www.fao.org/3/i9527EN/i9527en.PDF>)
- The Penn State University Extension has information about fertilizers as well as this Fertilizer Calculator (<https://extension.psu.edu/how-to-calculate-a-fertilizer-ratio>)
- Information about nitrification and agricultural runoff can be found in this report from the Environmental Protection Agency (https://www.epa.gov/sites/production/files/2015-09/documents/nitrification_1.pdf)
- The Nutrients for Life Foundation provides a wide range of information and resources for students about plant nutrient literacy, soil health knowledge and fertilizer's role in sustaining a growing population on their website (<https://nutrientsforlife.org/for-students/>).