The STEM Showdown will consist of a series of online multiple-choice questions. Participants at both levels will be expected to demonstrate their knowledge of rocks and minerals. A Showdown participant will have 50 minutes to login and answer as many questions as possible.

The Rocks & Minerals content and skills covered by the Showdown this month are as follows:

1. Minerals:
   - Identification - specimens or images used should show observable properties. Where observable properties are insufficient to identify a specimen, other diagnostic characteristics will be provided.
   - Physical Properties - color, hardness, luster, streak, cleavage/fracture, density-specific gravity/heft, diaphaneity, tenacity.
   - Other properties - reaction with acid, fluorescence, magnetism, smell, taste, double refraction, piezoelectricity, radioactivity.
   - Mineral habit - limited to acicular (needlelike), bladed, botryoidal, cubic, dendritic, dodecahedral, doubly terminated, druzy, geodic, hexagonal, hopper, massive, micaceous, octahedral, pisoliths, prismatic, radiating, rosette, stalactitic, twinning, and tabular.
   - Chemical composition.
   - Polymorphs (e.g., diamond/graphite and orthoclase/microcline).
     - Division C Only - Solid solution series (e.g., feldspar ternary diagrams).
   - Classification - mineral families based on composition. (see Rock and Mineral List).
     - Division C Only - Silicate classifications and their structures limited to the following groups: isolated tetrahedra (nesosilicates), chain silicates (inosilicates), sheet silicates (phyllosilicates) and framework silicates (tectosilicates).
   - Methods of formation (e.g., hydrothermal, crystallization from magma, evaporites, alteration under heat & pressure).
   - Minerals associated with rock-forming environments (e.g., evaporite minerals in sedimentary settings; mafic minerals in oceanic crust; minerals that form under metamorphic conditions).
   - Bowen’s Reaction Series – relationship between mineral crystallization and temperature in magma.
   - Economic importance and uses of minerals (e.g., ores, industrial uses, jewelry).

2. Rocks:
   - Identification - specimens or images used should show observable characteristics. Where observable characteristics are insufficient to identify a specimen, other diagnostic characteristics will be provided (e.g., mineral composition of fine-grained igneous rocks).
   - Classification - igneous, sedimentary, and metamorphic including observable diagnostic characteristics that facilitate classification (e.g., glassy or vesicular texture in igneous; rounded grains, fossils, or layers in sedimentary; and foliation or banding in metamorphic).
Igneous:
- Textures - including but not limited to aphanitic (fine-grained), glassy, vesicular, porphyritic, pyroclastic, phaneritic (coarse-grained), pegmatitic
- Composition and essential minerals - felsic, intermediate, mafic, ultramafic
- Intrusive and extrusive environments - including but not limited to batholith, dike, sill, volcanic neck, lava flow, pyroclastic flow, laccolith
- Relationship between textures and environments of formation (e.g. intrusive/plutonic, extrusive/volcanic and relative rates of solidification.)

Sedimentary:
- Textures - limited to clastic (detrital), chemical, and biochemical/organic
- Composition and essential minerals
- Grain sizes (e.g. clay, silt, sand, pebble, cobble, boulder), sorting, and shape
- Relationship between textures and composition to environments of deposition
- Environments of deposition - including, but not limited to alluvial fan, delta, river/stream, swamp, floodplain, beach, shallow marine, deep marine
- Primary sedimentary structures (e.g. plane bedding, cross-bedding, ripple marks, mud cracks, graded bedding, fossil tracks & trails) and their implications about depositional processes

Metamorphic:
- Textures - foliated and non-foliated
- Mineral composition
- Protoliths (parent rocks)
- Regional and contact metamorphism
- Grade of metamorphism and metamorphic index minerals (e.g. chlorite, epidote, garnet, staurolite, kyanite, sillimanite)
- Division C Only - Relationship of temperature, pressure, depth to types of metamorphism and metamorphic facies (e.g. hornfels, zeolite, greenschist, amphibolite, granulite, eclogite) based on interpretation of graphs and charts
- Division C Only - Environments of metamorphism in the context of plate tectonics - regional metamorphism and mountain building at convergent continental-continental boundary; blueschist and eclogite formation in subduction zones; greenstone/greenschist formation from basalt or gabbro at ocean crust divergent boundaries
- Rock Cycle – emphasis on the geologic processes that form rocks (e.g. melting and solidification; uplift, erosion & deposition; burial, compaction & cementation; heat & pressure resulting in recrystallization & deformation)
- Economic importance and uses of rocks

3. Identification and specifics about Rocks & Minerals will be limited to the following:

Minerals
- Borate Family
  - Ulexite
- Carbonate Family
  - Aragonite
  - Azurite
  - Calcite
  - Dolomite
  - Malachite
  - Rhodochrosite
- Native Element Family
  - Copper
  - Diamond
  - Gold
  - Graphite
  - Silver
  - Sulfur
- Halide Family
  - Fluorite
  - Halite
- Oxide/Hydroxide Families
  - Corundum
  - Goethite/Limonite
  - Hematite
  - Magnetite
  - Pyrolusite
  - Rutile
  - Zincite
- Phosphate Family
  - Apatite Group
  - Pyromorphite
  - Turquoise
  - Vanadinite
- Sulfate Family
  - Barite
  - Celestite
  - Gypsum
  - Alabaster (massive)
  - Satin Spar (fibrous)
  - Selenite (crystalline)
- Sulfide Family
  - Bornite
  - Chalcopryite
  - Galena
  - Pyrite
  - Sphalerite
  - Stibnite
- Silicate Family
  - Apophyllite
  - Beryl
  - Epidote
  - Kaolinite
  - Kyanite
  - Olivine
  - Quartz varieties:
    - Aventurine
    - Agate
    - Amethyst
    - Chalcedony
    - Citrine
    - Jasper
    - Milky Quartz
    - Opal
    - Rock Crystal
      - Rose Quartz
    - Smoky Quartz
  - Sodalite
  - Staurolite
  - Stilbite
  - Talc
  - Topaz
- **Tourmaline Group**
  - Willemite
  - Zircon
- **Amphibole Group**
  - Actinolite
  - Hornblende
  - Tremolite
- **Feldspar Group**
  - Plagioclase feldspars
    - Albite
    - Labradorite
  - Potassium feldspars
    - Amazonite
    - Orthoclase/Microcline (pink)
- **Garnet Group**
  - Almandine
- **Mica Group**
  - Biotite
  - Lepidolite
  - Muscovite
- **Pyroxene Group**
  - Augite
  - Rhodonite
  - Spodumene
- **Rocks**
  - **Igneous Rocks**
    - Andesite
    - Basalt
    - Diorite
    - Gabbro
    - Granite
    - Obsidian
    - Pegmatite
    - Peridotite
    - Pumice
    - Rhyolite
    - Scoria
    - Syenite
    - Tuff
  - **Sedimentary Rocks**
    - Banded Iron
    - Bauxite
    - Breccia
    - Chert
    - Conglomerate
    - Diatomite
    - Dolostone
    - Rock Salt (Halite)
    - Rock Gypsum
    - Shale
  - **Coal varieties:**
    - Anthracite
    - Bituminous
    - Lignite
• Limestone varieties
  o Chalk
  o Coquina
  o Fossil Limestone
  o Oolitic Limestone
  o Travertine
• Sandstone varieties:
  o Arkose
  o Greywacke
  o Quartz Sandstone

Metamorphic Rocks
• Amphibolite
• Gneiss
• Marble
• Phyllite
• Quartzite
• Schist Varieties
  o Garnet Schist
  o Mica Schist
  o Talc Schist (Soapstone)
• Serpentinite
• Slate

**Recommended Materials**
• Each Showdown participant will need a computer with internet access, scratch paper, something to write with, and a stand-alone calculator of any type
• 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](http://store.soinc.org)) carries a variety of resources for Rocks & Minerals.
• Other resources can be found on the Rocks & Minerals Event Pages at [soinc.org](http://soinc.org).