2023 ROCKS AND MINERALS LIST

See General Rules, Eye Protection & other Policies on www.soinc.org as they apply to every event.

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[4]

Oxide/Hydroxide Families
Corundum
Goethite/Limonite
Hematite
Magnetite
Pyrolusite*
Rutile*
Zincite*

Phosphate Family
Apatite
Pyromorphite*
Turquoise*
Vanadinite*

Sulfate Family
Barite
Celestite*
Gypsum[4] varieties:
- Alabaster (massive)
- Satin Spar (fibrous)
- Selenite (crystalline)

Sulfide Family
Bornite*
Chalcopyrite
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[1]
- Willemite*
- Zircon*

Amphibole Group
- Actinolite*
- Hornblende
- Tremolite*

Feldspar Group
- Plagioclase feldspars
  - Albite
  - Labradorite
- Potassium feldspars
  - Amazonite
  - Orthoclase/Microcline (pink)[2]

Garnet Group[1]
- 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 Formation
Bauxite[3]
Breccia
Chert/Flint
Conglomerate
Diatomite
Dolostone
Rock Salt (Halite)[4]
Rock Gypsum[4]
Shale
Coal varieties:
- Anthracite
- Bituminous
- Lignite

Limestone varieties:
- Chalk
- Coquina
- Fossil Limestone
- Oolitic Limestone
- Travertine

Sandstone varieties:
- Arkose
- Greywacke
- Quartz Sandstone

METAMORPHIC ROCKS
Amphibolite
Gneiss
Marble
Phyllite
Quartzite
Schist Varieties:
- Garnet Schist
- Mica Schist
- Talc Schist (Soapstone)

Serpentinite
Slate

*Specimens marked with an asterisk (*) are for State and National Tournaments

1 - Garnet and Tourmaline varieties should be identified at the group level, except for Almandine.

2 - This pink variety of feldspar should be identified as Potassium feldspar and not specifically as Orthoclase or Microcline.

3 - Bauxite has been reclassified as a sedimentary rock.

4 - Rock Salt and Rock Gypsum for identification purposes are considered the same, respectively, as the minerals Halite and Gypsum and do not need to be distinguished.

ix. Minerals associated with rock-forming environments (e.g., evaporite minerals in sedimentary settings; mafic minerals in oceanic crust; minerals that form under metamorphic conditions)
x. Bowen's Reaction Series – relationship between mineral crystallization and temperature in magma
xi. Uses of minerals (e.g., ores, **industry**, jewelry, **geochronology**)
(1) **Precious and semiprecious gemstones including minerals on the Rocks & Minerals List as well as the following varieties, limited to: emerald, aquamarine, morganite, peridot, ruby, sapphire, pearl and amber.**

g. **Participants are expected to be able to answer questions about the following Rock topics:**
i. 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)
ii. 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)
iii. Igneous Rocks:
(1) Textures - including but not limited to aphanitic (fine-grained), glassy, vesicular, porphyritic, pyroclastic, phaneritic (coarse-grained), pegmatitic
(2) Composition and essential minerals - felsic, intermediate, mafic, ultramafic
(3) Intrusive and extrusive environments - including but not limited to batholith, dike, sill, volcanic neck, lava flow, pyroclastic flow, laccolith
(4) Relationship between textures and environments of formation (e.g., intrusive/plutonic, extrusive/volcanic and relative rates of solidification.)
iv. Sedimentary Rocks:
(1) Textures - limited to clastic (detrital), chemical, and biochemical/organic
(2) Composition and essential minerals
(3) Grain sizes (e.g., clay, silt, sand, pebble, cobble, boulder), sorting, and shape
(4) Relationship between textures and composition to environments of deposition
(5) Environments of deposition - including, but not limited to alluvial fan, delta, river/stream **(fluvial), lake (lacustrine)**, swamp, **wind (aeolian)**, floodplain, beach, shallow marine/**shelf,** deep marine
(6) Primary sedimentary structures and **their implications about depositional processes and environments** (e.g., plane bedding, cross-bedding, ripple marks, mud cracks, graded bedding, fossil tracks & trails)
v. Metamorphic Rocks:
(1) Textures - foliated and non-foliated
(2) Mineral composition
(3) Protoliths (parent rocks)
(4) Regional and contact metamorphism
(5) Grade of metamorphism and metamorphic index minerals (e.g., chlorite, epidote, garnet, staurolite, kyanite, sillimanite)
(6) 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
(7) 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
vi. 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)
vii. Economic importance and uses of rocks **(e.g., building stone, ores, ornamental, agriculture, fossil fuels)**

viii. **Division C, States and National Only - Thin Sections of Rocks; using photographs taken through a microscope (photomicrographs)**
   (1) **Identify minerals using their optical properties and features in polarized light (twinning, extinction, cleavage planes, birefringence); limited to microcline, plagioclase, calcite, augite, and garnet.**
   (2) **Distinguish rock types and characteristics of igneous, sedimentary, metamorphic rocks by their microscopic textures limited to:**
      a. **Igneous - fine grained crystalline (holocrystalline), vesicular, glassy, porphyritic (e.g., basalt vs. pumice)**
      b. **Sedimentary – rounded, angular, well sorted vs. poorly sorted, skeletal fragments (e.g., oolites, sandstone vs. arkose)**
      c. **Metamorphic – foliated (e.g., schistose)**

4. **SAMPLE ACTIVITIES:**
   a. **Using the materials provided, determine the relative hardness of the mineral specimens.**
   b. **Identify the minerals and describe each specimen's luster.**
   c. **Determine the breakage pattern (cleavage or fracture) of the minerals.**
   d. **The color of the specimen is caused by which element?**
   e. Based on the texture of the metamorphic rocks, list the specimens in order from lowest to highest grade of metamorphism.
   f. Based on the provided diagram of igneous environments, **which specimen cooled at the slowest rate in a batholith?**
   g. Based on the grain size of the shale, sandstone, and conglomerate, which one formed in the lowest energy environment?
   h. Classify the specimens into igneous, sedimentary, or metamorphic based on observable characteristics and state one reason for each classification.

5. **SCORING:**
   a. High score wins.
   b. Selected questions will be used to break ties.

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries a variety of resources to purchase for this event; other resources are on the Event Pages at soinc.org