# Rocks & Minerals

Georgia Tech Event Workshop Series
2025-26


Science Olympiad at Georgia Tech®

01 OVERVIEW

02 EVENT

03 EXAMPLE QUESTIONS

04 TIPS & RESOURCES

# Overview

- Rocks and minerals
- Station-style format
- Binders allowed


EVENT

# Minerals

- Properties
- Environments
- Bowen's Reaction Series

h. **Mineral Topics**
   i. Identification - specimens or images used should show observable properties. Where observable properties are insufficient to identify a specimen, other diagnostic characteristics will be provided
   ii. Physical Properties - color, hardness, luster, streak, cleavage/fracture, density/specific gravity/ heft, diaphaneity, **and** tenacity
   iii. Other properties - limited to reaction with acid, fluorescence, magnetism, smell, taste, double refraction, piezoelectricity, **and** radioactivity.
   iv. Mineral habit - limited to acicular (needlelike), bladed, botryoidal, cubic, dendritic, dodecahedral, doubly terminated, druzy, geodic, hexagonal, hopper, massive, micaceous, octahedral, pisolitic, prismatic, radiating, rosette, stalactitic, twinning, and tabular
   v. Chemical composition – chemical formulas, relationships between chemistry and properties (e.g., effect of trace elements on mineral color)
      (1) Solid solution series (e.g., feldspar ternary diagrams)
      (2) Phase diagram interpretation: temperature/pressure, temperature/ composition (limited to two component systems)
   vi. Polymorphs (e.g., **aragonite/calcite**; diamond/graphite, orthoclase/microcline; **sillimanite/ andalusite/kyanite)**
   vii. Classification - mineral families based on composition (see Rocks and Minerals List)
      (1) Mineral groups (e.g., feldspar, garnet, tourmaline) - similarities of chemical composition and shared properties
      (2) Silicate tetrahedra and their structures: isolated tetrahedra (nesosilicates), island (sorosilicates), chain (inosilicates), ring (cyclosilicates), sheet (phyllosilicates), and framework (tectosilicates)
      (3) **State and National Only** – Crystal Systems – cubic, tetragonal, orthorhombic, monoclinic, triclinic, trigonal, and hexagonal; emphasis on how crystalline structures result in certain physical properties (e.g., cleavage planes, crystal shape)
   viii. Methods of formation and environments (e.g., hydrothermal, chemical weathering, crystallization from magma, evaporites, chemical precipitation, alteration under heat & pressure)
   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
      (1) **Ores, industry, jewelry, geochronology, medicine, manufacturing, construction, electronics, etc.**
      (2) Precious and semi-precious gemstone **varieties from** minerals on the **2026** Rocks and Minerals List as well as the following, limited to: emerald, aquamarine, morganite, peridot, ruby, sapphire, pearl and amber

# Minerals

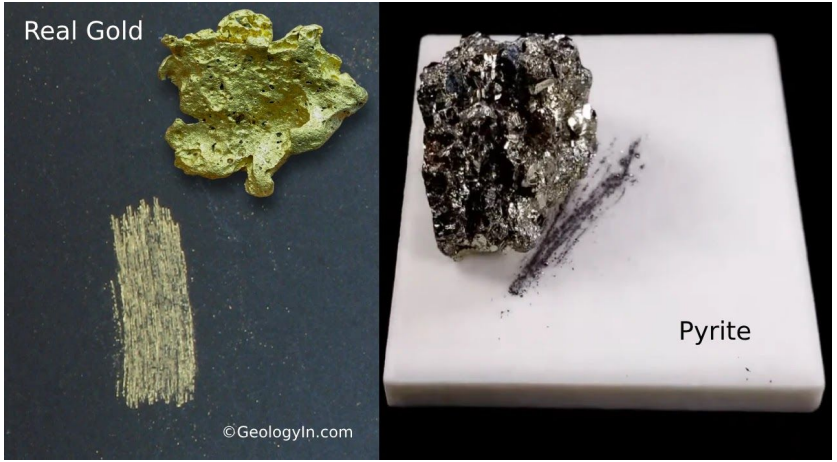
These are all quartz...

# Minerals

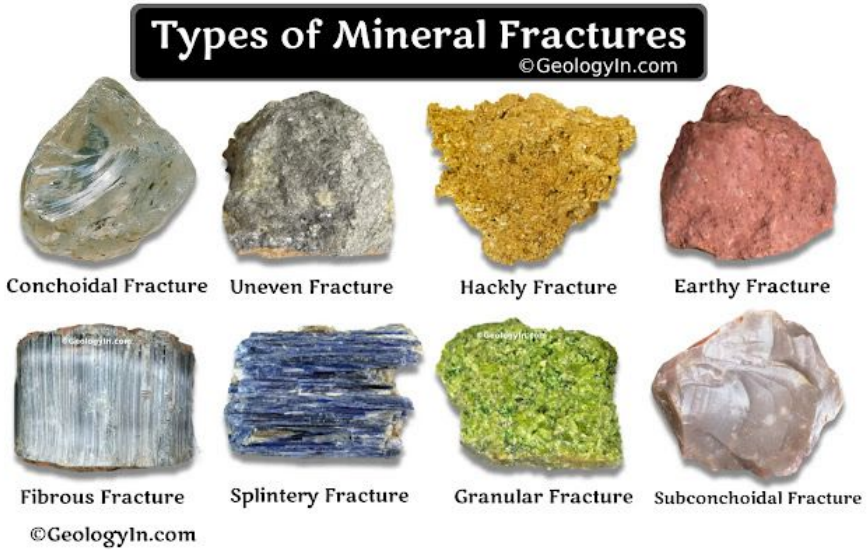

Types of Mineral Luster
GeologyIn.com
Metallic Luster
Dull Luster
Greasy Luster
GeologyIn.com
Resinous Luster
GeologyIn.com
Silky Luster
Vitreous Luster

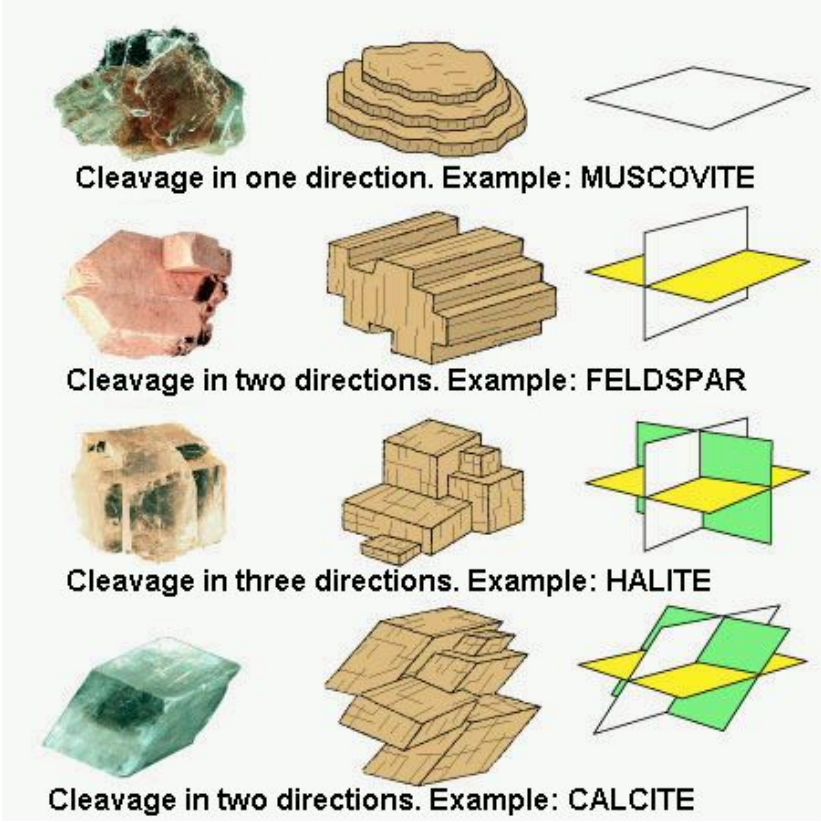
# Minerals


The Streak of Minerals
Galena
Malachite
Azurite
Pyromorphite
Chalcanthite
Sphalerite
Orpiment
Hematite
Geologyin.com


Real Gold
Pyrite
©Geologyin.com

# Minerals

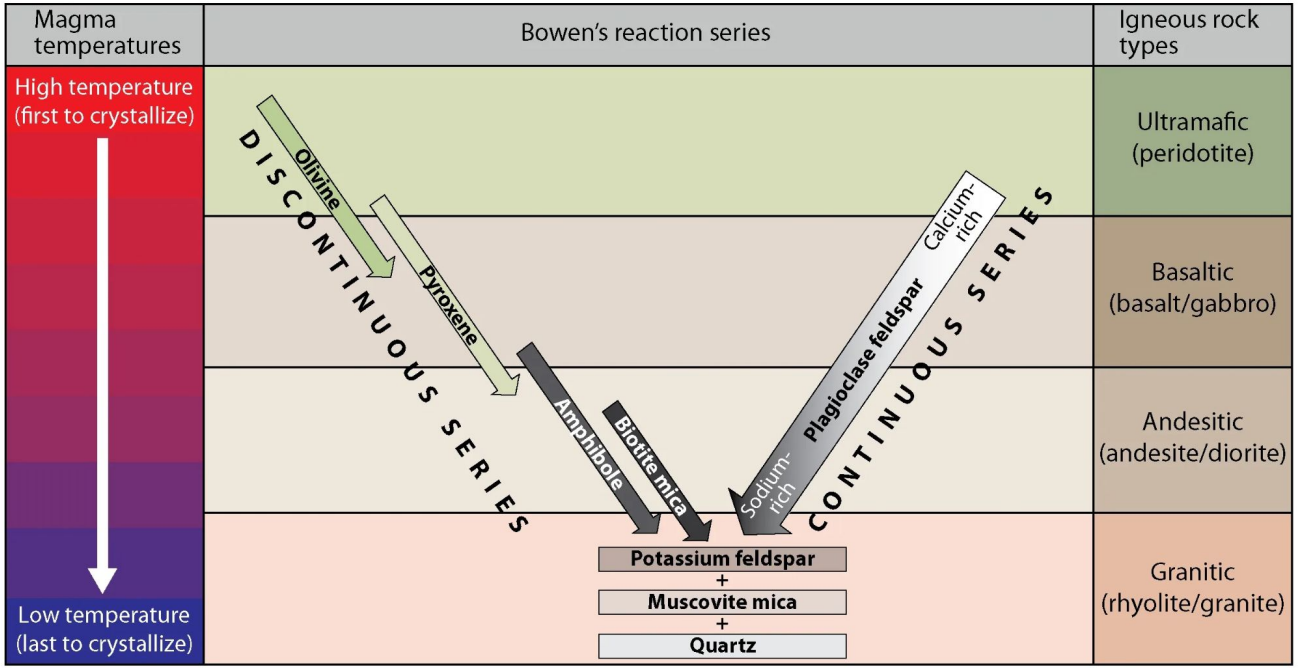

Types of Mineral Fractures
©GeologyIn.com
Conchoidal Fracture
Uneven Fracture
Hackly Fracture
Earthy Fracture
Fibrous Fracture
Splintery Fracture
Granular Fracture
Subconchoidal Fracture
©GeologyIn.com


Cleavage in one direction. Example: MUSCOVITE
Cleavage in two directions. Example: FELDSPAR
Cleavage in three directions. Example: HALITE
Cleavage in two directions. Example: CALCITE

# Minerals


Crystal Habits, Forms & Shapes
© GeologyIn.com
Equant Cubic Pyrite
Botryoidal chalcedony
Reniform Hematite
Mamillary (Mammillary) Malachite
Dendritic Native Copper
Stellated Rutile
Fibrous Chrysotile
Filiform Native Silver
Acicular Mesolite
Reticulated Cerussite
Micaceous (or foliated) Muscovite
©GeologyIn.com
Tabular Wulfenite
Radiating Wavellite
Prismatic Aquamarine
Lamellar Hematite
Bladed Selenite

# Minerals

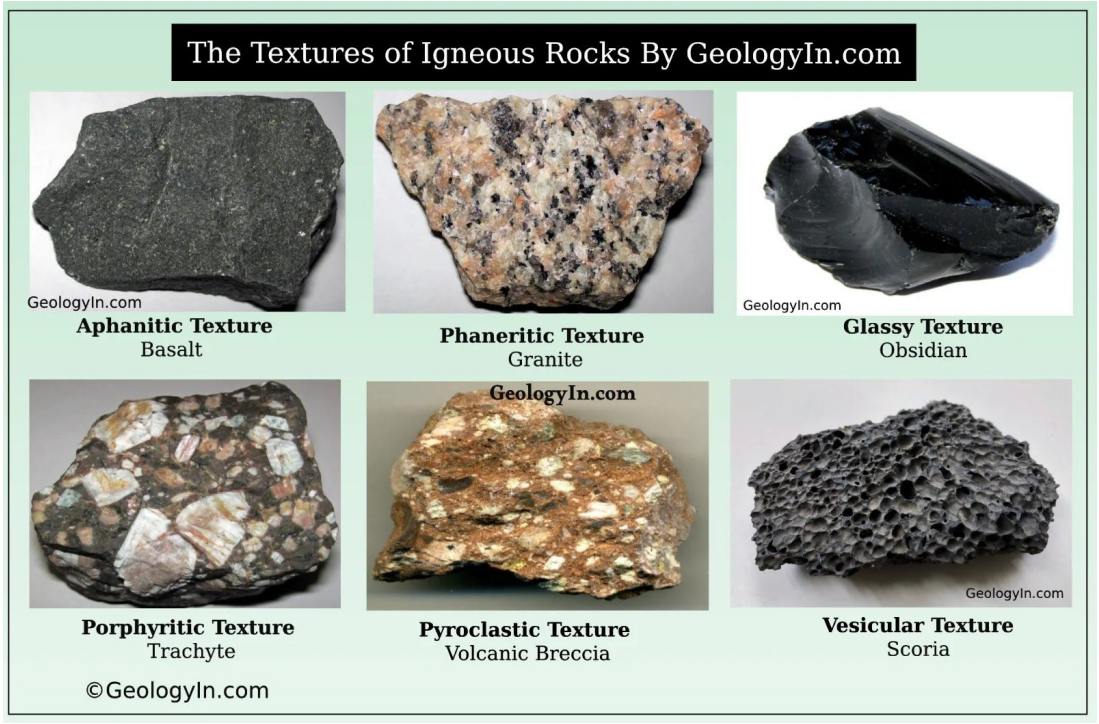

Magma temperatures
Bowen's reaction series
Igneous rock types
High temperature (first to crystallize)
Low temperature (last to crystallize)
DISCONTINUOUS SERIES
CONTINUOUS SERIES
Olivine
Pyroxene
Amphibole
Biotite mica
Calcium-rich
Plagioclase feldspar
Sodium-rich
Potassium feldspar
+
Muscovite mica
+
Quartz
Ultramafic (peridotite)
Basaltic (basalt/gabbro)
Andesitic (andesite/diorite)
Granitic (rhyolite/granite)

# Rocks

- Split on rock types
- Properties
- Rock cycle

i. **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, **reaction to acid of chalk or diatomite**)
   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 aphanitic (fine-grained), glassy, vesicular, porphyritic, pyroclastic, phaneritic (coarse-grained), **and** pegmatitic
      (2) Composition and essential minerals - felsic, intermediate, mafic, **and** ultramafic
      (3) Intrusive and extrusive environments a**nd formations** - limited to batholith, dike, sill, volcanic neck, lava flow, pyroclastic flow, **and** laccolith
      (4) Relationship between textures and environments of formation (e.g., intrusive/plutonic, extrusive/volcanic and relative rates of solidification.)
      (5) **Types of igneous rocks and constituent minerals at various types of plate boundaries (e.g., basalt at mid-ocean ridge; andesite/diorite at subduction zones; granite at convergent boundaries)**
   iv. Sedimentary Rocks:
      (1) Textures - limited to clastic (detrital or terrigenous), chemical (**crystalline**), and biochemical **(organic/bioclastic)**
      (2) Composition and essential minerals
      (3) Grain sizes (e.g., clay, silt, sand, pebble, cobble, boulder), sorting, and shape **(round vs angular) and their implications for energy and conditions of environments of deposition (e.g., fine grained-low energy; coarse-grained-high energy)**
      (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, **and** deep marine
      (6) Primary sedimentary structures and their implications about depositional processes and environments (e.g., plane bedding, crossbedding, ripple marks, mud cracks, graded bedding, **and** fossil tracks & trails)
   v. Metamorphic Rocks:
      (1) Textures - foliated **(e.g., slaty cleavage, schistose, banding)** and non-foliated
      (2) Mineral composition
      (3) **Metamorphic minerals that form in existing rocks due to heat and pressure (e.g., garnet, corundum, kyanite, staurolite, epidote, andalusite, sillimanite, chlorite)**
      (4) Protoliths (parent rocks); e.g. **shale for slate, limestone for marble, sandstone for quartzite.**
      (5) Regional and contact metamorphism
      (6) Grade **(intensity)** of metamorphism **(low, medium, high)** and index minerals (e.g., chlorite, epidote, garnet, staurolite, kyanite, **and** sillimanite) **that indicate the degree of metamorphism**

# Rocks


The Textures of Igneous Rocks By GeologyIn.com
GeologyIn.com
Aphanitic Texture
Basalt
Phaneritic Texture
Granite
GeologyIn.com
Glassy Texture
Obsidian
Porphyritic Texture
Trachyte
GeologyIn.com
Pyroclastic Texture
Volcanic Breccia
GeologyIn.com
Vesicular Texture
Scoria
©GeologyIn.com

# Rocks

| Inorganic Clastic Sedimentary Rocks | | | | | | |
|---|---|---|---|---|---|---|
| Texture | Grain size | Composition | Comments | Rock name | Map symbol | Picture |
| Clastic (fragmental) | Pebbles, cobbles, and/or boulders in a matrix of sand, silt and/or clay | Mostly quartz, feldspar, and clay minerals; may contain fragments of other rocks and minerals | Rounded fragments | Conglomerate | | |
| | | | Angular fragments | Breccia | | |
| | Sand (0.063 to 2 mm) | | Fine to coarse in a variety of colors | Sandstone | | |
| | Silt (0.039 to 0.063 mm) | | Very fine grained, massive, usually dark | Siltstone | | |
| | Clay (<0.0039 mm) | | Compact, brittle, usually dark | Shale | | |
| **Chemically and/or Organically Formed Sedimentary Rocks** | | | | | | |
| Texture | Grain size | Composition | Comments | Rock name | Map symbol | Picture |
| Crystalline | Fine to coarse grains | Quartz | Chemical precipitates and evaporites | Chert | | |
| | | Halite | | Rock salt | | |
| | | Gypsum | | Rock gypsum | | |
| | | Dolomite | | Dolostone* | | |
| Crystalline or bioclastic | Microscopic to very coarse | Calcite | Biologic precipitates or cemented shell fragments | Limestone* | | |
| Bioclastic | Clay (< 0.0039 mm) | Carbon | Black, compacted plant remains | Coal | | |
| Bioclastic | Clay (< 0.0039 mm) | Clay and kerogen | Dark, may have oily smell or burn | Oil shale | | |

Other types of sandtone are arkose and graywacke. Varieties of limestone include chalk, coquina, micrite, travertine, oolite, tufa,and fossiliferous limestone.
* These react with dilute acid.



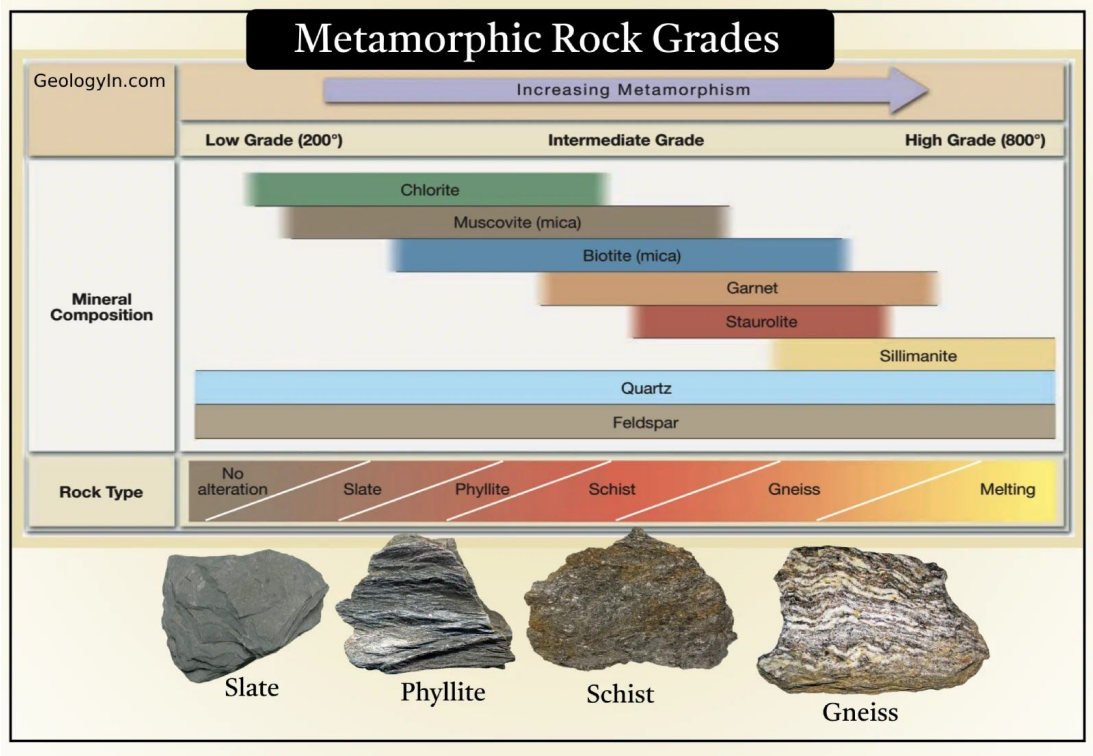
Conglomerate
(large grain size)

Chalk
(small grain size)

# Rocks

| TEXTURE | CHARACTERISTICS | PROTOLITH | METAMORPHIC ROCK | |
|---|---|---|---|---|
| NON FOLIATED | Blocky grains of quartz (hardness 7). | Sandstone or Siltstone | Quartzite |  |
| | Blocky grains of calcite (hardness 3). Fizzes with dilute HCl. | Limestone | Marble |  |
| | Fine-grained, various colours. | Shale or Basalt | Hornfels |  |
| | Soft (hardness ~3), glossy, and black, with low specific gravity (~1.4). | Bituminous coal | Anthracite |  |
| FOLIATED (INCREASING PRESSURE & TEMPERATURE) | Alternating bands of light- and dark-coloured minerals (dark minerals are usually biotite or amphibole), called gneissic banding. | Shale or Igneous Rock | Gneiss |  |
| | Contains shiny muscovite (light) or biotite (dark) micas. May also have quartz, talc, garnet (red arrow), amphibole. Schistose pattern of foliation. | Shale | Schist |  |
| | Fine-grained rock with the grains only visible as a satin sheen. Similar to slate, but with a satin lustre and may have wrinkled cleavage. | Shale | Phyllite |  |
| | Very fine-grained rock, tends to split in parallel fragments (known as slaty cleavage). | Shale | Slate |  |

# Rocks


Metamorphic Rock Grades
GeologyIn.com
Increasing Metamorphism
Low Grade (200°)
Intermediate Grade
High Grade (800°)
Mineral Composition
Chlorite
Muscovite (mica)
Biotite (mica)
Garnet
Staurolite
Sillimanite
Quartz
Feldspar
Rock Type
No alteration
Slate
Phyllite
Schist
Gneiss
Melting
Slate
Phyllite
Schist
Gneiss

# Rocks

- Split on rock types
- Properties
- Rock cycle

(7) Relationship of temperature, pressure, depth to types of metamorphism and metamorphic facies (hornfels, zeolite, greenschist, amphibolite, granulite, **blueschist, and** eclogite) based on interpretation of graphs and charts
(8) 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 **&** 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. **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)

# Notes

- Division B vs. Division C
- New line (C):

e. **Identification of rocks and minerals should be at least 30% but not more than 50% of available points.**

# EXAMPLE QUESTIONS

All of the following questions have been pulled from past YJI exams (which can be found on our website) or the Text Exchange on SciOly Wiki

# Question 1

29. Identify the following mineral. [2] Jasper

30. This mineral's red color comes from what element? [2] Iron (III)

31. The name for this mineral means what? [2] Spotted or speckled stone

32. The specific gravity for this mineral is what? [2] Approximately 2.7

# Question 2

128. Minerals with pearly luster typically have what type of cleavage? [2] Perfect

129. Define sectile cleavage. [2] The mineral can be separated with a knife

130. How many crystal systems are there? [2] 32

131. How many crystal classes are there? [2] 6

# Question 3

113. Kevin finds two white rocks and is trying to identify them as chalk or diatomite. The heavier rock is more likely to be (chalk/diatomite).

114. Kevin finds two white rocks and is trying to identify them as chalk or diatomite. The rock with a chemical texture is more likely to be (chalk/diatomite).

115. Kevin finds two white rocks and is trying to identify them as chalk or diatomite. The rock formed in a deep marine environment is more likely to be (chalk/diatomite).

# Tips from a Veteran

- “Make your own field guide”
  - Include properties listed in the event description
  - Treat your binder/field guide as supplementary (time constraints!)
- Charts listing hardness, crystallinity, etc.
- If possible, get hands-on experience beforehand
- Event description!
- Random stuff?
- Divide and conquer...?

# Resources

- mindat.org
- scioly mineral ID
- soinc: Division C or Division B
- scioly

# THANKS!