

Rocks and Minerals

Twin Tiers Science Olympiad Div. C Invitational Athens Area HS January 14th, 2012

Instructions:

There are 20 stations altogether. Allow 2 1/4 minutes per station for a total of 45 minutes. Each of the stations is worth 8 points for a total of 160 points. Each station indicates the value of the question in parenthesis at its end. With this breakdown in points there should be no need for any tiebreakers. Give partial credit where appropriate. If a tie breaker is needed, then the number of correctly identified specimens throughout all of the stations should be used next.

Most of the specimens are placed on labeled trays. It is imperative that the teams do not move them around. Please be vigilant in your supervision. Check the stations often.

Each team got a baggie with white and black streak plates, glass plate, magnets, and steel nails.

The test is designed so that each team receives an answer sheet at the beginning that they bring with them to each station. They may start at any station but then advance in order. The questions should be taped down at each station and should not be written on.

Some of the specimens are fragile, delicate and valuable. Tests can be done, but try to use areas that are more or less inconspicuous.

[UPLOADER'S NOTE: THE ACTUAL TEST WAS RUN WITH REAL SPECIMENS (ROCKS, MINERALS, OTHER THINGS), WHICH OBVIOUSLY DOESN'T WORK THROUGH A DIGITAL FILE. I'VE TRIED TO FIND PICTURES OF EACH SO THAT THE TEST CAN STILL BE COMPLETED, BUT BEWARE, I AM NOT A GEOLOGY EXPERT.]

TEST

Station 1:



1. Identify the rock. (2)
2. Identify the mineral. (2)
3. What term in geology is used describe an inclusion of a mineral in a larger rock during its development and hardening? (2)
- S1. What is the name of the gemstone variety of this mineral?
A. emerald B. peridot C. jade D. sapphire E. aventurine
- S2. Which of the following best applies to the rock?
A. mafic plutonic B. mafic volcanic C. felsic plutonic D. felsic volcanic E. porphyritic

Station 2:



1. Identify this mineral. (2)
2. What other mineral has the same chemical formula? (2)
3. This specimen shows pseudo-hexagonal forms due to repeated _____. (2)
- S3. Which crystal system does this mineral belong to?
A. orthorhombic B. tetragonal C. triclinic D. isometric E. monoclinic
- S4. Which environment is this mineral most closely associated?
A. arid B. mountain building C. lava plateaus D. marine E. clastic

Station 3: Multiple Choice only. No specimens

- S5. A change in magma composition due to melting of surrounding country rock is called
A. magma mixing B. assimilation C. crystal settling D. differentiation
- S6. Andesite is most often associated with what type of plate boundary?
A. divergent B. transform C. convergent D. reversible
- S7. Which of the following is NOT true of a single silica tetrahedron?
A. the atoms of the tetrahedron are strongly bonded together B. it has a net negative charge C. it has four silicon atoms D. all of these are true
- S8. Which of the following common items is NOT a mineral?
A. salt B. ice C. talcum powder D. asphalt
- S9. You would most likely find the remains of plants in a deposit of
A. lignite B. breccia C. sandstone D. limestone E. coquina
- S10. The process whereby rocks are changed to sediment is called
A. weathering B. compaction C. deposition D. erosion
- S11. The generally accepted temperature limits for metamorphism are
A. metamorphism occurs at all temperatures B. there are no temperature limits to metamorphism because it is a continuum C. metamorphism is limited by pressure, not temperature D. 200° C to rock melting
- S12. The principle agents of metamorphism are
A. heat and pressure B. heat and magma C. confining pressure and directed stress D. Austin Powers and James Bond

Station 4:



Rock A:



Mineral B:



Rock C:



Mineral D:

1. Identify rock A. (2)
2. Identify mineral B. (2)
3. Identify rock C. (2)
4. Identify mineral D. (2)

Station 5:



1. Identify this mineral. (2)
 2. It is an ore of? (2)
 3. The concentric layered round structures that cover the specimen are called? (2)
- S13. What process is used to begin to separate the ore from this mineral? B
A. Haber process B. Bayer process C. Balmer process D. Hessman process E. AMR process
- S14. What country is the top producer of this mineral?
A. Australia B. China C. Guinea D. Vietnam E. India

Station 6:



1. What is the proper name of this geologist's tool? (2)
 2. What rock would the material in the bottom two trays form? (2)
 3. The general term for turning sediment into a rock is _____. (2)
- S15. The rocks that would form from the material in this tool would be classified as
A. organic B. chemical C. extrusive D. clastic E. contact
- S16. Sand is mostly comprised of
A. feldspar B. kaolinite C. quartz D. gypsum E. talc

Station 7:



1. Identify this mineral. (2)
 2. What term is used to describe a mineral's habit when it doesn't form visible crystals? (2)
 3. What metal is this mineral a minor ore of? (2)
- S17. This mineral is a ____ silicate.
A. framework B. ring C. double chain D. single tetrahedron E. single chain
- S18. Which of the following is the most common environment where it forms?
A. hydrothermal replacement deposits B. plutons C. placer deposits D. secondary replacement deposits E. pegmatites

Station 8:



1. Identify the two minerals of this specimen. (4)
 2. What term is used to describe how the group of minerals on this specimen?(2)
- S19. What mineral group does both of these minerals belong to?
A. halides B. sulfides C. sulfates D. oxides E. carbonates
- S20. How many directions of cleavage does the clearer mineral have?
A. none B. one C. two D. three E. four

Station 9:



1. Identify this mineral. (2)
 2. What is the name of this particular variety? (2)
 3. A helpful identification mark for this mineral are the lines along the side of the crystal. What is the proper name for these lines? (2)
- S21. Which is the best word to describe its luster?
A. earthy B. fibrous C. resinous D. vitreous E. dull
- S22. Of the following, which is considered the least helpful in identifying minerals?
A. streak B. color C. luster D. hardness E. cleavage

Station 10:



1. Identify this weathered rock specimen. (2)
 2. Identify the two main minerals that comprise it. (4)
- S23. According to the rock cycle, which metamorphic rock would eventually form from the sediment of this rock?
A. quartzite B. sandstone C. phyllite D. anthracite E. marble
- S24. This rock is most closely associated with
A. volcanoes B. ocean crust C. subduction zones D. transform boundaries E. continental crust

Station 11:



Mineral A:



Mineral B:

1. Identify Mineral A. (2)
 2. Identify Mineral B. (2)
 3. Mineral B is a _____ because its presence in a rock gives a great deal of information about the processes that formed the rock. (2)
 4. Extra Question: What is the name for the type of twinning shown in mineral B? (2)
- S25. Which of the following is the environment of formation for these minerals?
- A. plutonic igneous
 - B. volcanic igneous
 - C. chemical sedimentary
 - D. regional metamorphic
 - E. contact metamorphic
- S26. Which of the following is a common use of mineral A?
- A. electrical semiconductors
 - B. porcelain
 - C. sandpaper
 - D. glass
 - E. food additive

Station 12:



1. Identify this mineral. (2)
 2. What is its hardness? (2)
 3. What clay group does it belong to? (2)
- S27. Which of the following is NOT one of its uses?
- A. lubrication
 - B. making acid resistance porcelain
 - C. facial powder
 - D. filler for paints
 - E. plasticizer in molding sands
- S28. Around what year did Friedrich Moh develop his scale of hardness?
- A. 1705
 - B. 1925
 - C. 1890
 - D. 1770
 - E. 1815

Station 13:



1. Identify both the current mineral and the mineral it replaced. (4)
 2. What is the mineral crystal called when it does this? (2)
- S29. One way to identify the replaced mineral is to use the rule that "the angles between corresponding faces on crystals are the same for all specimens of the same mineral." Who developed this law? (Hint: He was honored with a Google Doodle just a few days ago!)
- A. Hess B. Steno C. Goethe D. Wegener E. Agassiz
- S30. What color is this specimen's streak?
- A. white B. black C. green D. blue E. brown

Station 14:



Rock A:



Rock B:

1. Identify rock A. (2)
 2. Identify rock B. (2)
 3. What is the most likely parent rock for rock A? (2)
- S31. Which statement is correct?
- A. Both rocks are foliated. B. Both rocks are not foliated. C. A is foliated, B is not. D. B is foliated, A is not. E. One of them is stratified.
- S32. Under high grade metamorphism, rock B will turn into
- A. gneiss B. marble C. shale D. quartzite E. scoria

Station 15:



1. Both of these are varieties of which mineral? (2)
2. The clear one is a specimen showing _____ twinning. (2)
3. By what nickname is the other one called? (2)
4. The variety (not shown here) that has a compact fibrous aggregate is called: (2)

Station 16:



Mineral A by itself



Mineral A with the red mineral

1. Identify this mineral. (Let's call it mineral A) (2)
 2. In the middle of the specimen, there is a red band. What mineral is it? Be specific! (2)
 3. What is mineral A the principal ore of? (2)
- S33. How did the mineral A get its name?
- A. Because of its streak
 - B. Because of the location it was first found at
 - C. Because of its discoverer
 - D. Because of its chemical composition
 - E. Because of its color
- S34. Does mineral A ever form crystals?
- A. Yes
 - B. No

Station 17:



Mineral A:



Mineral B:

1. Identify mineral A. (2)
 2. Identify mineral B. (2)
 3. Mineral B has a high specific gravity. What 4 letter word is often used by geologist as a synonym of specific gravity? (2)
- S35. What class do both of these belong to?
A. oxides B. sulfides C. halides D. silicates E. native minerals
- S36. What metal is mineral B an ore of?
A. lead B. sulfur C. iron D. titanium E. zinc

Station 18:




Mineral A:



Mineral B:



Mineral C: 

1. Identify mineral A. (2)
 2. Identify mineral B. (2)
 3. Identify mineral C. (2)
- S37. These are all different varieties of
A. micas B. quartzes C. gypsums D. amphiboles E. feldspars
- S38. Mineral C has perfect cleavage at ____ degrees.
A. 78 B. 120 C. 45 D. 60 E. 90

Station 19:



Rock A:

Rock B:

1. Identify rock A. (2)
 2. Identify rock B. (2)
 3. Both of these rocks are made of what? Be careful – the answer we are looking for concerns their origin. (2)
- S39. If rock B undergoes metamorphism, what rock will result?
A. phyllite B. quartzite C. marble D. Slate E. Schist (Garnet)
- S40. The study of rocks is called
A. Lithology B. Petrology C. Steinology D. Aesthology
E. RockandRollology

Station 20:



1. Identify this mineral. (2)
 2. What is its chemical composition? (2)
 3. Name either of the two major uses of this mineral. (2)
 4. Extra Question: Many samples of this mineral will glow when exposed to UV light. This is called (2)
- S41. What crystal system does it belong to?
A. isometric B. orthorhombic C. hexagonal D. triclinic E. tetragonal
- S42. When a crystal is broken, a smooth and flat surface may result. If this is caused by structural imperfections then it is called
A. cleavage B. fracture C. directivity D. fissile E. parting

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ANSWER KEY

Station 1:

1. Identify the rock. (2) **basalt**
2. Identify the mineral. (2) **olivine**
3. What term in geology is used describe an inclusion of a mineral in a larger rock during its development and hardening? (2) **xenolith**
- S1. What is the name of the gemstone variety of this mineral? **B**
A. emerald B. peridot C. jade D. sapphire E. aventurine
- S2. Which of the following best applies to the rock? **B**
A. mafic plutonic B. mafic volcanic C. felsic plutonic D. felsic volcanic E. porphyritic

Station 2:

1. Identify this mineral. (2) **aragonite**
2. What other mineral has the same chemical formula? (2) **calcite**
3. This specimen shows pseudo-hexagonal forms due to repeated _____. (2) **twinning**
- S3. Which crystal system does this mineral belong to? **A**
A. orthorhombic B. tetragonal C. triclinic D. isometric E. monoclinic
- S4. Which environment is this mineral most closely associated? **D**
A. arid B. mountain building C. lava plateaus D. marine E. clastic

Station 3: Multiple Choice only. No specimens

- S5. A change in magma composition due to melting of surrounding country rock is called **B**
A. magma mixing B. assimilation C. crystal settling D. differentiation
- S6. Andesite is most often associated with what type of plate boundary? **C**
A. divergent B. transform C. convergent D. reversible
- S7. Which of the following is NOT true of a single silica tetrahedron? **C**
A. the atoms of the tetrahedron are strongly bonded together B. it has a net negative charge C. it has four silicon atoms D. all of these are true
- S8. Which of the following common items is NOT a mineral? **D**
A. salt B. ice C. talcum powder D. asphalt
- S9. You would most likely find the remains of plants in a deposit of **A**
A. lignite B. breccia C. sandstone D. limestone E. coquina
- S10. The process whereby rocks are changed to sediment is called **A**
A. weathering B. compaction C. deposition D. erosion
- S11. The generally accepted temperature limits for metamorphism are **D**
A. metamorphism occurs at all temperatures B. there are no temperature limits to metamorphism because it is a continuum C. metamorphism is limited by pressure, not temperature D. 200° C to rock melting
- S12. The principle agents of metamorphism are **A**
A. heat and pressure B. heat and magma C. confining pressure and directed stress D. Austin Powers and James Bond

Station 4:

1. Identify rock A. (2) **quartzite**
2. Identify mineral B. (2) **barite**
3. Identify rock C. (2) **arkose**
4. Identify mineral D. (2) **silver**

Station 5:

1. Identify this mineral. (2) **bauxite**
 2. It is an ore of? (2) **aluminum**
 3. The concentric layered round structures that cover the specimen are called? (2) **pisolites**
- S13. What process is used to begin to separate the ore from this mineral? **B**
A. Haber process B. Bayer process C. Balmer process D. Hessman process E. AMR process
- S14. What country is the top producer of this mineral? **A**
A. Australia B. China C. Guinea D. Vietnam E. India

Station 6:

1. What is the proper name of this geologist's tool? (2) **sieve**
 2. What rock would the material in the bottom two trays form? (2) **shale**
 3. The general term for turning sediment into a rock is _____. (2) **lithification or consolidation**
- S15. The rocks that would form from the material in this tool would be classified as **D**
A. organic B. chemical C. extrusive D. clastic E. contact
- S16. Sand is mostly comprised of **C**
A. feldspar B. kaolinite C. quartz D. gypsum E. talc

Station 7:

1. Identify this mineral. (2) **rhodonite**
 2. What term is used to describe a mineral's habit when it doesn't form visible crystals? (2) **massive**
 3. What metal is this mineral a minor ore of? (2) **Mn or manganese**
- S17. This mineral is a ____ silicate. **E**
A. framework B. ring C. double chain D. single tetrahedron E. single chain
- S18. Which of the following is the most common environment where it forms? **A**
A. hydrothermal replacement deposits B. plutons C. placer deposits D. secondary replacement deposits E. pegmatites

Station 8:

1. Identify the two minerals of this specimen. (4) **dolomite and calcite**
 2. What term is used to describe how the group of minerals on this specimen?(2) **druze or druzey**
- S19. What mineral group does both of these minerals belong to? **E**
A. halides B. sulfides C. sulfates D. oxides E. carbonates
- S20. How many directions of cleavage does the clearer mineral have? **D**
A. none B. one C. two D. three E. four

Station 9:

1. Identify this mineral. (2) **tourmaline**
 2. What is the name of this particular variety? (2) **schorl**
 3. A helpful identification mark for this mineral are the lines along the side of the crystal. What is the proper name for these lines? (2) **striations**
- S21. Which is the best word to describe its luster? **D**
A. earthy B. fibrous C. resinous D. vitreous E. dull
- S22. Of the following, which is considered the least helpful in identifying minerals? **B**
A. streak B. color C. luster D. hardness E. cleavage

Station 10:

1. Identify this weathered rock specimen. (2) **granite**
 2. Identify the two main minerals that comprise it. (4) **quartz and feldspar**
- S23. According to the rock cycle, which metamorphic rock would eventually form from the sediment of this rock? **A**
A. quartzite B. sandstone C. phyllite D. anthracite E. marble
- S24. This rock is most closely associated with **E**
A. volcanoes B. ocean crust C. subduction zones D. transform boundaries E. continental crust

Station 11:

1. Identify Mineral A. (2) **almadine garnet**
 2. Identify Mineral B. (2) **staurolite**
 3. Mineral B is a _____ because its presence in a rock gives a great deal of information about the processes that formed the rock. (2) **index mineral**
 4. Extra Question: What is the name for the type of twinning shown in mineral B? (2) **penetration, 1 pt for "cross"**
- S25. Which of the following is the environment of formation for these minerals? **D**
A. plutonic igneous B. volcanic igneous C. chemical sedimentary D. regional metamorphic
E. contact metamorphic
- S26. Which of the following is a common use of mineral A? **C**
A. electrical semiconductors B. porcelain C. sandpaper D. glass E. food additive

Station 12:

1. Identify this mineral. (2) **talc**
 2. What is its hardness? (2) **1**
 3. What clay group does it belong to? (2) **montmorillonite or smectite or both together**
- S27. Which of the following is NOT one of its uses? **A**
A. lubrication B. making acid resistance porcelain C. facial powder D. filler for paints E. plasticizer in molding sands
- S28. Around what year did Friedrich Moh develop his scale of hardness? **E**
A. 1705 B. 1925 C. 1890 D. 1770 E. 1815

Station 13:

1. Identify both the current mineral and the mineral it replaced. (4) **limonite after pyrite**
 2. What is the mineral crystal called when it does this? (2) **pseudomorph**
- S29. One way to identify the replaced mineral is to use the rule that "the angles between corresponding faces on crystals are the same for all specimens of the same mineral." Who developed this law? (Hint: He was honored with a Google Doodle just a few days ago!) **B**
A. Hess B. Steno C. Goethe D. Wegener E. Agassiz
- S30. What color is this specimen's streak? **E**
A. white B. black C. green D. blue E. brown

Station 14:

1. Identify rock A. (2) **marble**
 2. Identify rock B. (2) **slate**
 3. What is the most likely parent rock for rock A? (2) **limestone**
- S31. Which statement is correct? **D**
A. Both rocks are foliated. B. Both rocks are not foliated. C. A is foliated, B is not. D. B is foliated, A is not. E. One of them is stratified.
- S32. Under high grade metamorphism, rock B will turn into **A**
A. gneiss B. marble C. shale D. quartzite E. scoria

Station 15:

1. Both of these are varieties of which mineral? (2) **gypsum**
2. The clear one is a specimen showing _____ twinning. (2) **"fishtail" or "dovetail"**
3. By what nickname is the other one called? (2) **desert rose or gypsum flower**
4. The variety (not shown here) that has a compact fibrous aggregate is called: (2) **satin spar**

Station 16:

1. Identify this mineral. (Let's call it mineral A) (2) **hematite**
 2. In the middle of the specimen, there is a red band. What mineral is it? Be specific! (2) **quartz (jasper)**
 3. What is mineral A the principal ore of? (2) **iron**
- S33. How did the mineral A get its name? **A**
A. Because of its streak B. Because of the location it was first found at C. Because of its discoverer
D. Because of its chemical composition E. Because of its color
- S34. Does mineral A ever form crystals? **A**
A. Yes B. No

Station 17:

1. Identify mineral A. (2) **pyrite**
 2. Identify mineral B. (2) **galena**
 3. Mineral B has a high specific gravity. What 4 letter word is often used by geologist as a synonym of specific gravity? (2) **heft**
- S35. What class do both of these belong to? **B**
A. oxides B. sulfides C. halides D. silicates E. native minerals
- S36. What metal is mineral B an ore of? **A**
A. lead B. sulfur C. iron D. titanium E. zinc

Station 18:

1. Identify mineral A. (2) **amazonite**
 2. Identify mineral B. (2) **albite**
 3. Identify mineral C. (2) **orthoclase**
- S37. These are all different varieties of **E**
A. micas B. quartzes C. gypsums D. amphiboles E. feldspars
- S38. Mineral C has perfect cleavage at ____ degrees. **E**
A. 78 B. 120 C. 45 D. 60 E. 90

Station 19:

1. Identify rock A. (2) **chalk**
 2. Identify rock B. (2) **coquina**
 3. Both of these rocks are made of what? Be careful – the answer we are looking for concerns their origin. (2) **shells**
- S39. If rock B undergoes metamorphism, what rock will result? **C**
A. phyllite B. quartzite C. marble D. Slate E. Schist (Garnet)
- S40. The study of rocks is called **B**
A. Lithology B. Petrology C. Steinology D. Aesthology E. RockandRollology

Station 20:

1. Identify this mineral. (2) **Fluorite**
 2. What is its chemical composition? (2) **CaF₂**
 3. Name either of the two major uses of this mineral. (2) **steel manufacture, hydrofluoric acid**
 4. Extra Question: Many samples of this mineral will glow when exposed to UV light. This is called (2) **fluorescence**
- S41. What crystal system does it belong to? **A**
A. isometric B. orthorhombic C. hexagonal D. triclinic E. tetragonal
- S42. When a crystal is broken, a smooth and flat surface may result. If this is caused by structural imperfections then it is called **E**
A. cleavage B. fracture C. directivity D. fissile E. parting