

2006 NYS Regional Science Olympiad ♦ Rocks & Minerals ♦ ANSWER KEY

Credit. This exam was created by and submitted for publication on The Wright Center website by Gary Vorwald, New York State Science Olympiad Event Supervisor.

Station 1 Mineral Identification

(Chalcopyrite or Halite)

1. Use the materials provided to make observations of the properties of the mineral.
Record the properties of the mineral in the chart.
(luster, relative hardness, streak color, breakage, specific gravity).
2. Identify the mineral.

Station 2 Luster

[A. talc (pearly); B. kaolinite or hematite (earthy); C. satin spar gypsum (silky);
D. galena (metallic); E. quartz (vitreous)]

Describe the luster of each mineral specimen in the space provided.

(Be specific and use terms such as silky, vitreous, earthy, metallic, etc.)

3. Specimen A. **pearly**
4. Specimen B **earthy or dull**
5. Specimen C **silky**
6. Specimen D **metallic**
7. Specimen E **vitreous**

Station 3 (Rock Classification)

- | | | | |
|-----|----------------------------|-----------------------|----------------------------------------------------|
| 8. | A. fossil limestone | a. sedimentary | b. fossils |
| 9 | B gneiss | a. metamorphic | b. foliation/banding/distorted layers |
| 10. | C granite | a. igneous | b. intergrown crystals |
| 11. | D conglomerate | a. sedimentary | b. rocks/grains cemented together |
| 12 | E scoria | a. igneous | b. holes from gases/vesicular texture, etc. |

8-12.

a. Classify the five specimens at this station as:
Igneous, Metamorphic, or Sedimentary.

b. For each sample, state one characteristic that helped classify it.

Station 4 (A-Hematite, B-Bauxite, C-Galena)

13-15: Identify these ore minerals and indicate which element/ore is obtained from each.

Mineral Element

13. Mineral A: hematite iron

14. Mineral B: bauxite aluminum

15. Mineral C: galena lead

Station 5 (Please be very gentle with the sample)

16. Using the equipment provided, find the density of the sample. The volume of the sample is provided.

Answers will vary depending on sample. Density should be 5.2 g/cm³ for Magnetite.

- a. Write the formula for density.
- b. Record the volume in the space provided. *[Don't forget to provide Volume for students]*
- c. Measure the mass to the nearest .1 gram using the scale.
- d. Calculate the density to the nearest .1 g/cm³ and include the units.

Station 6 Rock Forming Minerals

- A. Quartz (crystal)
- B. Orthoclase feldspar
- C. Olivine

These minerals are known as "rock-forming minerals" and are the essential components of many igneous rocks.

- bb 17. These minerals are composed of two of the most abundant elements in earth's crust. To which mineral family do they belong?
 - a. carbonate b. oxide c. sulfide d. silicate
- A 18. Which term best describes the crystal structure of Mineral A?
 - a. hexagonal b. triclinic c. orthorhombic d. cubic
- C 19. Which mineral does not occur with the other two in an igneous rock?
 - A B C
- C 20. Mineral B is
 - a. amazonite feldspar c. orthoclase feldspar
 - b. albite feldspar d. plagioclase feldspar

Station 7 (A -pyrite, B-sphalerite)

- B** 21. Specimen A is
 a. gold b. pyrite c. bornite d. chalcopyrite
- B** 22. Specimen B is
 a. barite b. sphalerite c. apatite d. beryl
- A** 23. To which family do these minerals belong?
 a. sulfide b. oxide c. carbonate d. silicate
- D** 24. Specimen B is a source of which element?
 a. iron b. phosphorus c. beryllium d. zinc

Station 8 (A-granite, B-obsidian, C-pumice D- basalt)

- B** 25. Which specimens are felsic?
 a. B & D c. A & C
 b. A, B, C d. D only
- A** 26. Name two minerals that are essential components of felsic rocks.
 a. quartz & orthoclase feldspar c. quartz & olivine
 b. plagioclase feldspar & pyroxene d. biotite & hornblende
- A** 27. Which rock is plutonic (intrusive)?
 a. A b. B c. C d. D
- B** 28. Which two characteristics indicate a volcanic (extrusive) environment of formation?
 a. vesicular & coarse grained texture
 b. glassy & vesicular texture
 c. high density & mafic composition
 d. slow rate of cooling & porphyritic texture

Station 9 (A-Pegmatite, B-Obsidian, C-Scoria, D-Basalt)

- B** 29. What is the texture of igneous Rock A?
 a. aphanitic b. phaneritic c. glassy d. vesicular
- C** 30. What is the texture of igneous Rock B?
 a. aphanitic b. phaneritic c. glassy d. vesicular
- D** 31. What is the texture of igneous Rock C?
 a. aphanitic b. phaneritic c. glassy d. vesicular
- A** 32. What is the texture of igneous Rock D?
 a. aphanitic b. phaneritic c. glassy d. vesicular
- A** 33. Which rock cooled at the slowest rate?
 A B C D

Station 10 (A-Gneiss: B-Marble)

- C 34. Rock A is
a. schist b. granite c. gneiss d. phyllite

- C 35. Which term best describes the texture of A?
a. non-foliated b. felsic c. foliated d. layers of sediments

- C 36. Rock B will bubble with hydrochloric acid. What is the name of the rock?
a. chalk b. calcite c. marble d. quartzite

- B 37. From what original rock did Rock B form?
a. granite b. limestone c. sandstone d. schist

- D 38. Which process best describes how both of these rocks may have formed?
a. intense heat associated with contact metamorphism
b. compaction and cementation of sediments in a marine environment
c. solidification of magma in a plutonic environment
d. intense heat & pressure associated with regional metamorphism

Station 11 (A-Granite, B-Rhyolite)

- B 39. Identify igneous rock A.
a. pegmatite b. granite c. diorite d. gabbro

- A 40. Identify igneous rock B.
a. rhyolite b. andesite c. pumice d. limestone

- D 41. What minerals are both of these rocks likely to have?
a. olivine, pyroxene, hornblende, biotite, plagioclase feldspar
b. plagioclase feldspar, hornblende, biotite
c. quartz, potassium feldspar, olivine, pyroxene, biotite, hornblende
d. quartz, orthoclase feldspar, plagioclase feldspar, biotite, hornblende

- C 42. Even though both these specimens are composed of similar minerals, they appear different because
a. They are found in different parts of the world.
b. Rock A formed by metamorphism; Rock B formed by cementation of skeletal remains.
c. Rock A cooled slowly below the earth's surface; Rock B formed above the surface from lava.
d. Rock A cooled quickly above the surface; Rock B cooled slowly below the earth's surface.

Station 12 (A- Selenite Gypsum, B-Calcite)

43. Identify specimen A. **Selenite Gypsum** (2 points for selenite gypsum; 1 point for gypsum)

44. Identify specimen B. **Calcite**

B 45. Observe the properties of the minerals. Which statement best describes the differences between them?

- a. Specimen A is harder than specimen B.
- b. Specimen A has single refraction and specimen B has double refraction.
- c. Both are colorless.
- d. Both have a white streak and non-metallic luster

C 46. Compare the breakage patterns of both minerals. **(Do not damage the specimens!!!!)** Which statement best describes the breakage patterns of the two minerals.

- a. Both exhibit fracture.
- b. Specimen A has more cleavage planes than Specimen B.
- c. Specimen A has basal cleavage; Specimen B has rhombic cleavage.
- d. Specimen A fractures; specimen B shows cleavage in 3 directions.

Station 13 (A- Fluorite, B-Corundum, C-Feldspar D-Talc)

D, A, C, B 47. Using the materials provided, list the minerals in order from softest to hardest.

B 48. Which specimen is corundum?

- A B C D

C 49. Specimen A is

- a. quartz (amethyst) b. lepidolite c. fluorite d. apatite

Station 14 (A-Rose Quartz, B-Chalcedony, C-Amethyst)

A 50. Specimen A is

- a. rose quartz b. rhodonite c. almandine garnet d. pink tourmaline

A 51. Specimen B is

- a. chalcedony b. chert c. opal d. feldspar

A 52. How does specimen B differ from specimens A & C?

- a. Specimen B is cryptocrystalline while A & C can form large crystals.
- b. Specimen B fractures; A & C have cleavage.
- c. Specimen B is a sulfate; A & C are silicates.
- d. Specimen B has an isometric crystal structure; B & C are hexagonal.

C 53. What do these specimens have in common?

- a. They form as chemical precipitates.
- b. They form in metamorphic environments.
- c. They all have the same chemical formula: SiO₂
- d. All of these minerals are common in New York State.

Station 15 (A- Biotite; B-Lepidolite)

(Do Not Damage the Specimens)

54. Identify specimen A. (*biotite*)

55. Identify specimen B. (*lepidolite*)

A 56. How many directions of cleavage are shown by each specimen?
a. 1 b. 2 c. 3 d. 4

C 57. To which mineral group do these minerals belong?
a. feldspar b. amphibole c. mica d. pyroxene

B 58. Specimen B is a source of which element?
a. iron b. lithium c. aluminum d. chromium

Station 16 (A-copper, B-bornite, C-malachite)

59. Identify specimen A. *Copper*

60. Identify specimen B. *Bornite*

61. Identify specimen C. *Malachite*

D 62. How does specimen A differ from B & C?
a. Specimen A is a mineral; B & C are rocks.
b. Specimen A is less dense than B & C.
c. Specimen A has a metallic luster; B & C do not have a luster.
d. Specimen A is a native element; B & C are chemical compounds.

A 63. What do these minerals have in common?
a. They all contain copper.
b. They are all ores for various metals.
c. They all are sulfides.
d. They are all chemical compounds.

Station 19 (A-shale, B-sandstone, C-arkose)

- B** 73. Which specimen is sandstone?
 A B C D
- C** 74. Which specimen is arkose?
 A B C D
- B** 75. Which mineral is most common in arkose?
 a. calcite b. feldspar c. quartz d. kaolinite
- D** 76. What do these specimens have in common?
 a. They have the same minerals.
 b. They formed in an alluvial fan environment.
 c. They formed by compaction of fine sediments.
 d. They are composed of rock fragments.

Station 20 (A Garnet, B Tourmaline)

- C** 77. Identify mineral A using the materials provided.
 a. tourmaline b. staurolite c. almandine garnet d. corundum (ruby)
- C** 78. In which type of rock is this mineral common?
 a. igneous b. sedimentary c. metamorphic
- A** 79. Identify mineral B using the materials provided.
 a. tourmaline b. apatite c. beryl d. hornblende
- B** 80. What do these minerals have in common?
 a. Their crystal form is hexagonal.
 b. High quality forms are used as semi-precious gemstones.
 c. Both have a hardness of 5.
 d. Both are often found in igneous pegmatites.

Instructional Kit This 12-station rock study kit includes a CD with three PowerPoint presentations entitled "Introduction to Rocks" addressing each of the three classes of rocks -- igneous, sedimentary, metamorphic; three 12-Station Labs, each with up to ten questions; a rock kit containing 30 labeled specimens; coaches guide; participant response sheet, and an answer key. This 12-Station Rock Kit is a powerful study tool for independent study at home or at school. CD runs on Windows only. Visit: <http://www.otherworlds-edu.com>