2012 NYS Regional Science Olympiad

Rocks & Minerals

STATION DIRECTIONS & QUESTIONS

Station 1 Mineral Identification & Use

Identify each mineral and match a use from the choices provided.

Uses of Minerals

a. glass b. plaster board c. dry lubricant d. ceramics

1. Identify Mineral A

2. Use of Mineral A

3. Identify Mineral B

4. Use of Mineral B

5. Identify Mineral C

6. Use of Mineral C

7. Identify Mineral D

8. Use of Mineral D

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Station 2 Luster

Match the luster of each mineral sample in the space provided. There are extra choices.

silky vitreous metallic submetallic

greasy earthy pearly resinous

9. Sample A.

10. Sample B

11. Sample C

12. Sample D

13. Sample E

14. Sample F

Station 3 (Rock Classification)

15-19.

a. Classify the five specimens at this station as:

Igneous, Metamorphic, or Sedimentary.

(DO NOT GIVE THE ROCK'S NAME!)

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

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Station 4 (Ore minerals)

20-22: Identify these ore minerals and indicate which metallic element they are a source of. Please print neatly.

	Mineral	Element

20. Mineral A:

21. Mineral B:

22. Mineral C:

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Station 5 (Specific Gravity)

23. Compare the specific gravity of the four samples by "hefting" them.

    Record the letters of each specimen in order of increasing specific gravity.

24. Identify Specimen B.

25. What is unusual about specimen B?
    a. It's color is often blue, but sometimes white.
    b. It has a high density for a non-metallic mineral.
    c. It is a source of barium.
    d. It has the lowest density of the samples.

26. Identify sample A.

27. Which special property makes identification of sample A easy?
    a. brown streak b. fluorescence c. fizzes in acid d. magnetism

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Station 6 Rock Forming Minerals

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

28. Identify Sample A

Pyroxene (Augite) Olivine Beryl Epidote

29. Identify sample B. (This mineral does NOT contain potassium)

Orthoclase Albite Augite Calcite Microcline

30. Minerals A - E are composed of two of the most abundant elements in earth's crust. Which elements are these?

a. iron & magnesium
b. potassium & oxygen
c. silicon and oxygen
d. quartz & feldspar

31. Which minerals would not occur together in an igneous rock?

a. A & B b. B & C c. C & D d. B & D

32. Which mineral is ultra-mafic, and crystallizes under high temperatures in earth's upper mantle?

A B C D

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Station 7

33. Identify Sample A.

34. Identify Sample B.

35. What is the best way to distinguish these minerals from each other?
    a. metallic luster b. specific gravity c. hardness d. streak

36. Which family do these minerals belong to?
    a. sulfide b. oxide c. carbonate d. silicate

37. Which element is obtained from these minerals?
    a. iron b. lead c. aluminum d. zinc

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Station 8 (Igneous Rock Composition)

38. List the letters of these rocks in order from felsic to mafic composition.

39. Identify Sample A.

40. Identify Sample B

41. Name two minerals that are essential components of Sample C.

a. quartz & orthoclase feldspar
b. plagioclase feldspar & pyroxene
c. quartz & olivine
d. biotite & hornblende

42. What is a characteristic of a mafic igneous rock?

a. coarse texture
b. composition high in ferro-magnesium minerals.
c. composition low in ferro-magnesium minerals.
d. low density

43. Which characteristic of these samples indicates that they are all intrusive?

a. coarse-grained texture
b. mafic composition
c. high density
d. fine-grained texture

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Station 9 (Igneous Rock Texture)

Identify the texture of each of the igneous rocks. Use the following terms for texture:

Aphanitic(fine) phaneritic (coarse) glassy vesicular

44. Rock A

45. Rock B

46. Rock C

47. Rock D

48. Which rock cooled at the slowest rate?
A B C D

49. What do all of these rocks have in common?
a. they are extrusive and formed in a volcanic environment
b. they are intrusive and formed in a batholith
c. they have a felsic composition, with quartz
d. they have a mafic composition, with pyroxene

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Station 10 (Metamorphic Rock Texture)

50. Rock A is
    a. schist b. granite c. gneiss d. phyllite

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

52. Rock B will not bubble with hydrochloric acid. What is the name of the rock?
    a. dolostone b. travertine c. marble d. quartzite

53. What original rock did Rock B form from?
    a. granite b. limestone c. sandstone d. schist

54. 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

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Station 11 (Igneous Rocks)

Each of the samples has microscopic randomly arranged inter-gown crystals when viewed under a microscope.

55. Identify igneous rock A.

56. Identify igneous rock B.

57. 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

58. These specimens are composed of similar minerals; they appear different because
    a. Rock A formed as magma cooled quickly;
       Rock B formed as lava cooled slowly.
    b. The magma that formed Rock A caused re-crystallization due to contact metamorphism
    c. The lava that formed Rock A cooled quickly and formed a glass
    d. The lava that formed Rock B had a lot of gases that were preserved when the rock solidified.

59. Which type of plate boundary is Specimen C most likely associated with?
    a. ocean-continental subduction zone such as the Andes Mountains
    b. ocean-ocean divergent boundary such as Iceland.
    c. continental collision plate boundary such as the Himalayas.
    d. mid-ocean hot spot such as Hawaii.

Station 12

60. Identify sample A.

61. Identify sample B.

62. Observe the properties of the minerals. Which statement best describes the differences between them?
    a. Sample A has cleavage in 3 directions, Sample B has 2 directions.
    b. Sample A has single refraction and Sample B has double refraction.
    c. Both samples are colorless.
    d. Both samples have a white streak and non-metallic luster

63. Compare the breakage patterns of both minerals. **(Do not damage the samples!!!!!)** Which statement best describes the breakage patterns of the two minerals.
    a. They both exhibit fracture.
    b. Sample A has more cleavage planes than Sample B.
    c. Sample A has cubic cleavage; Sample B has rhombic cleavage.
    d. They both have cleavage in 6 directions.

64. What best describes how these minerals formed?
    a. Sample A formed by precipitation in an evaporitic environment.
    b. Sample B formed by crystallization in igneous rocks.
    c. Sample A formed by crystallization due to high heat and pressure.
    d. Sample B formed as a hydrothermal mineral in a plutonic environment.

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Station 13 (Hardness)

65. Using the materials provided, list the minerals in order from softest to hardest.

66. Which sample is used for making baby powder?

A B C D

67. Which sample is corundum?

A B C D

68. Which sample is apatite?

A B C D

69. Which sample scratches a fingernail, but not copper?

A B C D

70. Which sample easily scratches glass?

A B C D

Station 14

71. Sample A is

orange calcite sphalerite topaz citrine

72. Sample C is

chert chalcedony opal milky quartz

73. How is Sample C different from Samples A & B?

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

74. What is true about samples A & B?

a. They have different crystal forms.
b. They both contain traces of iron that gives them their color.
c. They were both heated that gives them their color.
d. Sample A contains calcium, Sample B contains fluorine.

75. What do all of the samples have in common?

a. They form as chemical precipitates.
b. They form in metamorphic environments.
c. They all have the same chemical formula: SiO_2
d. They all have the same number of cleavage planes.

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Station 15

(Do Not Damage the Samples)

76. Identify Sample A

77. Identify Sample B

78. How many directions of cleavage are shown by the samples?
    1 2 3 4

79. Which mineral group do these minerals belong to?
    a. feldspar b. amphibole c. mica d. pyroxene

80. Which element is present in Sample B that gives it the black color?
    a. iron b. lithium c. aluminum d. chromium

Station 16

81. Identify sample A

82. Identify Sample B

83. Identify Sample C

84. How does sample A differ from B & C?
    a. Sample A is a sulfide; B & C are carbonates.
    b. Sample A is less dense than B & C.
    c. Sample A has a metallic luster, B & C do not have a luster.
    d. Sample A is a native element; B & C are chemical compounds.

85. What do all of 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

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Station 17

86. Which term best describes the texture of these metamorphic rocks?

a. coarse-grained
b. non-foliated
c. schistose
d. foliated

87. Which characteristic of these rocks makes them useful for building stone?

a. They are crystalline.
b. They are hard & dense.
c. They break easily into thin slabs.
d. They have a foliated texture.

88. Arrange these rocks in order of increasing grade of metamorphism.
(Place the letter of each sample in order from lowest to highest)

89. Identify Rock B.

90. Identify Rock C

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Station 18

Samples A, B, and C will effervesce strongly in dilute solution of hydrochloric acid.

91. The name of Rock A is:
diatomite chalk calcite kaolinite

92. Rock A was formed from the microscopic skeletons of
a. diatoms b. coccolithophores c. radiolarians d. molluscs

93. Identify sample B.
Coquina Oolitic limestone Fossil LimestoneChalk

94. All of these sedimentary rocks would be classified as
a. Organic b. Inorganic c. Chemical d. Felsic

95. Which rock formed in the highest energy environment?
a. A b. B c. C d. D

96. Which statement is true about Sample D?
a. It is made of carbon.
b. It formed from plants in a swamp environment.
c. It is organic.
d. All are true.
e. None are true

Station 19

97. Identify Sample A

98. Identify Sample B

99. Identify Sample D

100. Which mineral is present in sample C that is not in Sample B?
a. calcite b. feldspar c. quartz d. kaolinite

101. What do these samples have in common?
a. they have the same minerals
b. they formed in the same environment
c. they are non-clastic
d. they are composed of rock fragments

102. Which sample formed in the lowest energy environment?
A B C D

f

Station 20

103. Identify mineral A using the materials provided.
tourmaline staurolite garnet corundum

104. What type of rock is Mineral A normally found in?
a. Igneous b. Sedimentary c. Metamorphic

105. Identify mineral B using the materials provided.
a. tourmaline b. apatite c. beryl d. hornblende

106. 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 minerals have a hardness of 5
d. they both are often found in igneous pegmatites

107. These minerals are classified in which mineral group?
a. silicates b. sulfates c. oxides d. phosphates

108. Which statement is most accurate?
a. Both of these minerals occur in a variety of colors.
b. Both of these minerals have tabular crystals.
c. Both of these minerals are used as a birthstone for January.
d. Sample B is a common rock-forming mineral in granite.