Topic VIII

Rocks and Minerals

Topic: Rocks and Minerals

Aim:

1.

COLOR –

Is helpful when identifying minerals, but it is not a distinguishing characteristic because …

- some minerals have many colors
- many different types of minerals can have the same color.

2.

STREAK –

The color of a mineral's powder when rubbed against a porcelain plate (streak plate)

can be any color, white, or the mineral might have no streak

3.

LUSTER –

How a mineral shines / reflects light.

Metallic (looks like a metal)
or
Nonmetallic
(glassy, pearly, dull, earthy, etc.)

4.

HARDNESS –

A mineral's resistance to being scratched.

Moh's Scale of Hardness

1 talc	6 feldspar
2 gypsum	7 quartz
3 calcite	8 topaz
4 fluorite	9 corundum
5 apatite	10 diamond

fingernail -2.5 glass plate – 5.5
penny – 3.0

A mineral's hardness rating is determined by what common items/minerals can or cannot scratch it.

5.

BREAKAGE –

Cleavage: Mineral breaks into even or flat parallel surfaces.

Fracture: Mineral breaks rough or unevenly.

6.

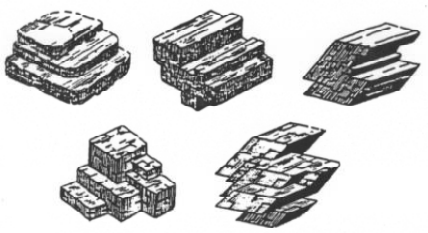
OTHER SPECIAL PROPERTIES –

1. crystal shape -
   some minerals clearly exhibit crystals in specific geometric shapes
2. magnetism –
   some minerals are attracted to a magnet
3. reaction to hydrochloric acid (HCl_{aq}) – bubbles form
4. density –
   a few minerals have a uniquely high density

SPECIAL NOTE:
A mineral's properties are a result of its internal arrangement of atoms and chemical composition**

MINERALS REVIEW

1. The diagrams below represent samples of five different minerals found in the rocks of the Earth's crust.



Which physical property of minerals is represented by the flat surfaces in the diagrams?
(1) magnetism
(2) hardness
(3) cleavage
(4) crystal size

2. Scratching a mineral against a glass plate is a method used for determining the mineral's
(1) hardness
(2) color
(3) luster
(4) cleavage

3 Minerals are identified on the basis of
(1) the method by which they were formed
(2) the size of their crystals
(3) the type of rock in which they are found
(4) their physical and chemical properties

4. Although diamonds and graphite both consist of the element carbon, their physical properties are very different. The most likely explanation for these differences is that
(1) the internal arrangement of carbon atoms is different in each mineral
(2) graphite contains impurities not found in diamonds
(3) graphite contains radioactive carbon-14 but diamonds do not
(4) diamonds contain silicate tetrahedra but graphite does not

5. Which property is most useful in distinguishing pyroxene from amphibole?
(1) sample size
(2) hardness
(3) type of luster
(4) angles of cleavage

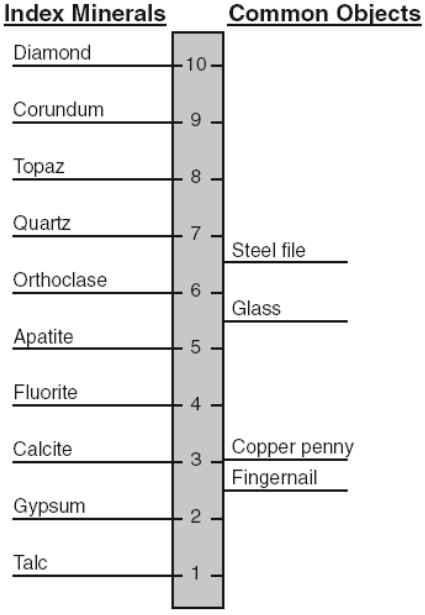
6. Which mineral has a metallic luster, a black streak, and is an ore of iron? (an ore is a mineral mined for an element of economic value)
(1) galena
(2) magnetite
(3) pyroxene
(4) graphite

7. The table below shows some properties of four different minerals.

Mineral Variety	Color	Hardness	Luster	Composition
flint	black	7	nonmetallic	SiO_2
chert	gray, brown, or yellow	7	nonmetallic	SiO_2
jasper	red	7	nonmetallic	SiO_2
chalcedony	white or light color	7	nonmetallic	SiO_2

The minerals listed in the table are varieties of which mineral?
(1) garnet
(2) magnetite
(3) quartz
(4) olivine

8. The diagram to the right shows the index minerals of Mohs hardness scale compared with the hardness of some common objects.



Which statement is best supported by the diagram?
(1) A fingernail will scratch calcite but not gypsum.
(2) Calcite will be scratched by a copper penny.
(3) The mineral apatite will scratch topaz.
(4) A steel file has a hardness of about 7.5.

9. The data table below shows the density of four different mineral samples.

A student accurately measured the mass of a sample of one of the four minerals to be 294.4 grams and its volume to be 73.6 cm^3.

Which mineral sample did the student measure?
(1) corundum
(2) galena
(3) hematite
(4) quartz

Data Table

Mineral	Density (g/cm^3)
corundum	4.0
galena	7.6
hematite	5.3
quartz	2.7

10. The mineral wollastonite has a hardness of 4.5 to 5. Which New York State mineral could easily scratch wollastonite?
(1) garnet
(2) halite
(3) talc
(4) gypsum

11. A student created the table below by classifying six minerals into two groups, *A* and *B*, based on a single property.

Which property was used to classify these minerals?
(1) color
(2) luster
(3) chemical composition
(4) hardness

Group A	Group B
olivine	pyrite
garnet	galena
calcite	graphite

12. Which mineral would be attracted to a magnet?
(1) galena
(2) magnetite
(3) graphite
(4) calcite

13. The mineral graphite is often used as
    (1) a lubricant
    (2) an abrasive
    (3) a source of iron
    (4) a cementing material

14. The table below shows some observed physical properties of a mineral.

Physical Property	Observation
color	white
hardness	scratched by the mineral calcite
distinguishing characteristic	feels greasy
cleavage/fracture	shows some definite flat surfaces

    Based on these observations, the elements that make up this mineral's composition are
    (1) sulfur and lead
    (2) sulfur, oxygen, and hydrogen
    (3) oxygen, silicon, hydrogen, and magnesium
    (4) oxygen, silicon, aluminum, and iron

Base your answers to **questions 15 and 16** on the photograph. The photograph shows several broken samples of the same colorless mineral.

15. Which physical property of this mineral is most easily seen in the photograph?
    (1) fracture
    (2) hardness
    (3) streak
    (4) cleavage

16. Which mineral is most likely shown in the photograph?
    (1) quartz
    (2) calcite
    (3) galena
    (4) halite

17. How are the minerals biotite mica and muscovite mica different?
    (1) Biotite mica is colorless, but muscovite mica is not.
    (2) Biotite mica contains iron and/or magnesium, but muscovite mica does not.
    (3) Muscovite mica scratches quartz, but biotite mica does not.
    (4) Muscovite mica cleaves into thin sheets, but biotite mica does not.

18. Which home-building material is made mostly from the mineral gypsum?
    (1) plastic pipes
    (2) window glass
    (3) drywall panels
    (4) iron nails

19. The internal atomic structure of a mineral most likely determines the mineral's
    (1) color, streak, and age
    (2) origin, exposure, and fracture
    (3) size, location, and luster
    (4) hardness, cleavage, and crystal shape

20. Which is the hardest mineral on Moh's scale?
    (1) talc
    (2) diamond
    (3) quartz
    (4) garnet

21. The mineral quartz breaks unevenly. This means that quartz must have
    (1) a high density
    (2) fracture
    (3) cleavage
    (4) a metallic luster

22. A student rubs a small sample of a mineral on a tile to see the color of its powder. The student is trying to determine the mineral's
    (1) density
    (2) chemical composition
    (3) streak
    (4) luster

23. Which of the following physical properties cannot be observed with just one's eyes, but an actual physical test must be conducted?
    (1) crystal shape
    (2) hardness
    (3) color
    (4) luster

24. The mineral that reacts to hydrochloric acid is
    (1) halite
    (2) quartz
    (3) sulfur
    (4) calcite

25. Which mineral is made up of only one element?
    (1) biotite mica
    (2) quartz
    (3) olivine
    (4) sulfur

26. The mineral that has a greasy feel and is used as pencil "lead" is
    (1) halite
    (2) pyrite
    (3) graphite
    (4) quartz

27. The mineral that is found in sheets and has cleavage in one direction is known as
    (1) olivine
    (2) muscovite mica
    (3) potassium feldspar
    (4) quartz

28. Which mineral has a different color than its streak, has a metallic luster, and can be an ore of both iron and sulfur?
    (1) gypsum
    (2) galena
    (3) pyrite
    (4) magnetite

29. Which minerals is the softest?
    (1) talc
    (2) muscovite mica
    (3) amphiboles
    (4) olivine

30. Which of the following is the most difficult to scratch?
    (1) garnet
    (2) potassium feldspar
    (3) hematite
    (4) calcite

31. Which of the following is a silicate mineral? (a silicate mineral contains both silicon and oxygen)
    (1) magnetite
    (2) halite
    (3) fluorite
    (4) plagioclase feldspar

32. Which mineral cleaves in two directions at 90°?
    (1) fluorite
    (2) potassium feldspar
    (3) olivine
    (4) quartz

33. A human fingernail has a hardness of approximately 2.5.
    Which two minerals are *softer* than a human fingernail?
    (1) calcite and halite
    (2) sulfur and fluorite
    (3) gypsum and talc
    (4) pyrite and magnetite

34. Which mineral contains iron, has a metallic luster, is hard, and has the same color and streak?
    (1) galena
    (2) magnetite
    (3) graphite
    (4) pyrite

35. Which mineral would most likely break down the most after being placed in a container and shaken for 5 minutes?
    (1) quartz
    (2) garnet
    (3) halite
    (4) pyroxene

36. The photograph below shows a broken piece of the mineral calcite.
    The calcite breaks in smooth, flat surfaces because calcite
    (1) is very dense
    (2) is very soft
    (3) contains certain impurities
    (4) has a regular arrangement of atoms

37. What is the mineral name of table salt? _____

38. Which mineral has rhombohedral cleavage?
    (this means it is shaped like a parallelogram) _____

39. Which mineral has a density of 7.6 g/cm^3 - a density almost 3X the average density of minerals found at the Earth's surface? _____

40. If a mineral scratches glass, is it considered soft or hard? _____

41. What element does the chemical symbol "Fe" stand for? _____

42. Under the *Common Colors* column, many minerals are listed as having a "variable" color What is meant by the term "variable"? _____

43. Which non-metallic mineral is softer than a fingernail and displays fracture? _____

44. What is one difference between plagioclase and potassium feldspar? _____

45. Which mineral is also known as "fool's gold"? _____

46. What is the chemical composition of calcite? _____

47. Which two minerals display cubic cleavage? _____

48. Name the mineral known for its characteristic "blood red" (reddish brown) streak. _____

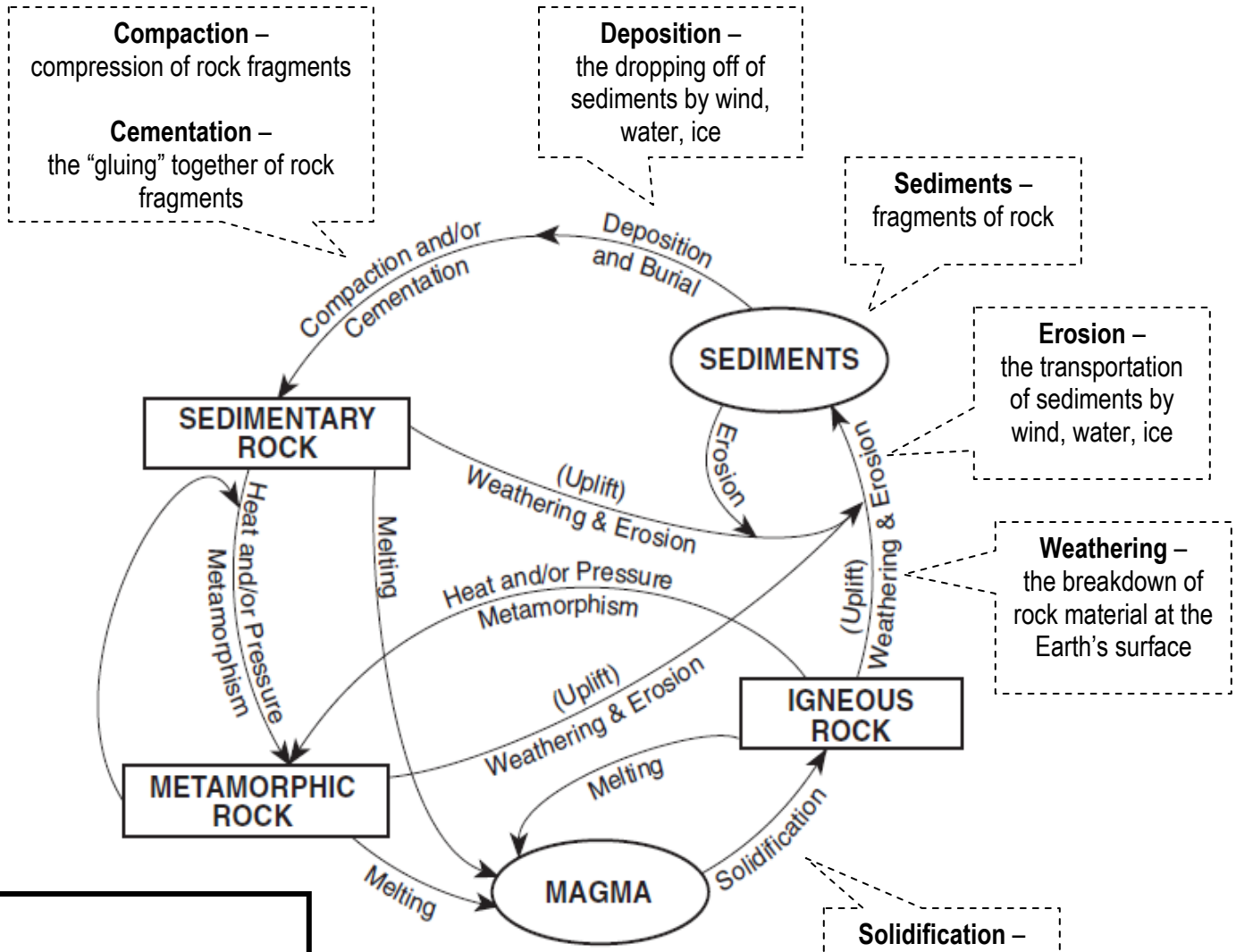
49. Which mineral has water as part of its chemical composition? _____

50. The term "granular" means that a mineral has a grainy / sandy feel. Which mineral is commonly granular? _____

Topic: Rocks and Minerals
Aim:

Classification of Rocks:

THE ROCK CYCLE



Compaction – compression of rock fragments

Cementation – the "gluing" together of rock fragments

Deposition – the dropping off of sediments by wind, water, ice

Sediments – fragments of rock

Erosion – the transportation of sediments by wind, water, ice

Weathering – the breakdown of rock material at the Earth's surface

Solidification – the hardening of liquid rock as it cools

Magma – molten (melted) rock beneath the Earth's surface

Lava – melted rock on the Earth's surface

Topic: Rocks and Minerals

Aim:

Formation:

_____

_____

_____

Distinguishing Properties:

1. _____

2. _____

a. _____

b. _____

c. _____

d. _____

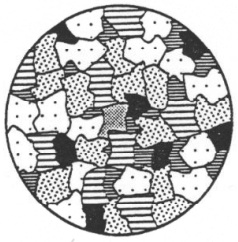
The Rock Cycle and Igneous Rocks

1. Rocks are classified on the basis of
   (1) the mass of the sample
   (2) their age in millions of years
   (3) the shape of the sample
   (4) how they were formed

2. Which statement is supported by information in the Rock Cycle diagram in the *Earth Science Reference Tables?*
   (1) Metamorphic rock results directly from melting and crystallization.
   (2) Sedimentary rock can only be formed from igneous rock.
   (3) Igneous rock always results from melting and solidification.
   (4) All sediments turn directly into sedimentary rock.

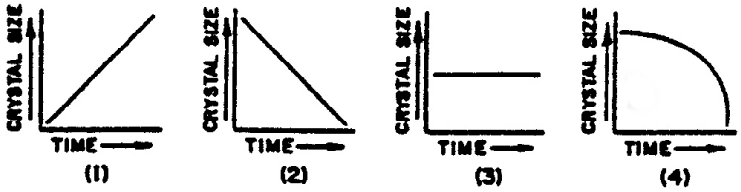
3. What do most igneous, sedimentary, and metamorphic rocks have in common?
   (1) They are formed from molten material.
   (2) They are produced by heat and pressure.
   (3) They are composed of minerals.
   (4) They all formed from sediments.

4. The diagram below shows a sample of rock material that contains coarse-grained intergrown crystals of several minerals. [Mineral crystals are shown actual size.]



   This rock sample should be identified as
   (1) rhyolite
   (2) granite
   (3) scoria
   (4) basalt

5. Which graph shows the relationship between the size of the crystals in an igneous rock and the length of time it has taken the rock to solidify

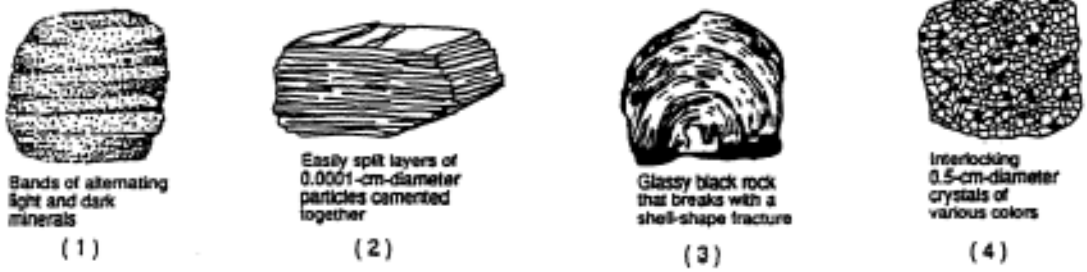


6. Which is the best description of the properties of gabbro?
   (1) fine-grained and mafic
   (2) coarse-grained and mafic
   (3) fine-grained and felsic
   (4) coarse-grained and felsic

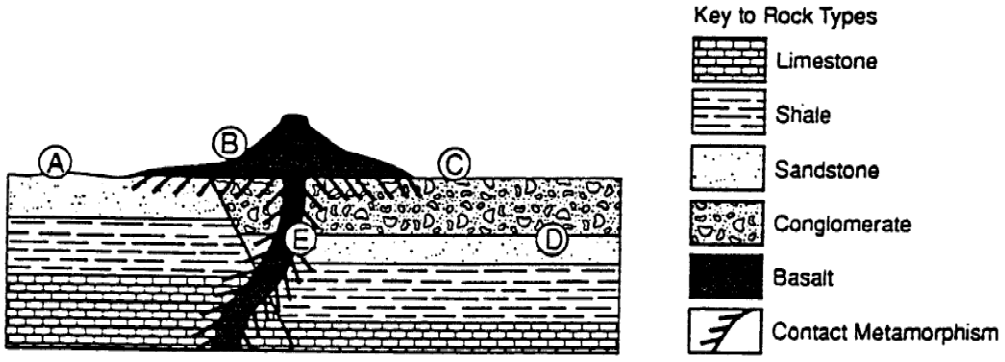
7. According to the Scheme for Igneous Rock Identification, compared to basalt, granite is
   (1) lighter in color
   (2) more mafic in composition
   (3) greater in density
   (4) more fine grained in texture

8. What is the origin of fine-grained igneous rock?
   (1) lava that cooled slowly on Earth's surface
   (2) lava that cooled quickly on Earth's surface
   (3) silt that settled slowly in ocean water
   (4) silt that settled quickly in ocean water

9. The diagrams below represent four rock samples. Which rock took the longest to solidify from magma deep within the Earth?



Base your answers to questions 10-11 on the diagram below which represents a geologic cross-section.



10. In which location is a geologist most likely to find a mafic rock composed of small intergrown crystals?
   (1) A
   (2) B
   (3) C
   (4) D

11. The rock at B most likely contains
   (1) quartz, only
   (2) quartz and potassium feldspar, only
   (3) potassium feldspar, pyroxene, and olivine
   (4) plagioclase feldspar, pyroxene, and olivine

Topic: Rocks and Minerals

Aim:

Formation:

_____

_____

Locations Found:

1. _____

_____

2. _____

Distinguishing Properties:

1. _____ 3. _____

2. _____ 4. _____

Types of Sedimentary Rocks

a. CLASTIC / FRAGMENTAL (inorganic land-derived)	b. CHEMICAL / CRYSTALLINE (evaporites)	c. BIOCLASTIC / ORGANIC
pieces of other rocks cemented together classified by particle size	seawater evaporates, minerals precipitate (fall out of solution) and get cemented together	organic remains (remains of living things) get compacted together

Sedimentary Rocks

1. Which sequence of events occurs in the formation of a sedimentary rock?

(1) Source material eroded → Sediments deposited → Sediments compacted and cemented

(2) Sediments compacted and cemented → Sediments deposited → Source material eroded

(3) Sediments deposited → Sediments compacted and cemented → Source material eroded

(4) Source material eroded → Sediments compacted and cemented → Sediments deposited

2. A chemically formed sedimentary rock composed of halite should be identified as
   (1) gypsum rock
   (2) rock salt
   (3) limestone
   (4) coal

3. Which rock type most likely would contain fossils?
   (1) sedimentary rock
   (2) intrusive igneous rock
   (3) metamorphic rock
   (4) extrusive igneous rock

4. Which rocks form relatively thin layers, compared to the thickness of the continent, over large areas of the continents?
   (1) granite and gabbro
   (2) metamorphic rocks
   (3) sandstone and shale
   (4) intrusive igneous rocks

5. According to the Earth Science Reference Tables, which sedimentary rock would be formed by the compaction and cementation of particles 0.7 centimeters in diameter?
   (1) shale (2) siltstone (3) sandstone (4) conglomerate

6. Large rock salt deposits in the Syracuse area indicate that the area once had
   (1) large forests
   (2) a warm, shallow sea
   (3) many terrestrial animals
   (4) a range of volcanic mountains

7. Which rock is most likely organic (biologic) in origin?
   (1) limestone
   (2) sandstone
   (3) basalt
   (4) conglomerate

8. Dolostone is classified as which type of rock?
   (1) land-derived sedimentary rock
   (2) foliated metamorphic rock
   (3) chemically formed sedimentary rock
   (4) nonfoliated metamorphic rock

9. Which rock was organically formed and sometimes contains fossilized plant impressions?
   (1) rock gypsum
   (2) phyllite
   (3) breccia
   (4) coal

Topic: Rocks and Minerals
Aim:

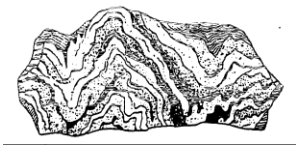
Formation:

_____

_____

Distinguishing Properties:

1. _____

a.	b.
	

2.

Types of Metamorphism:

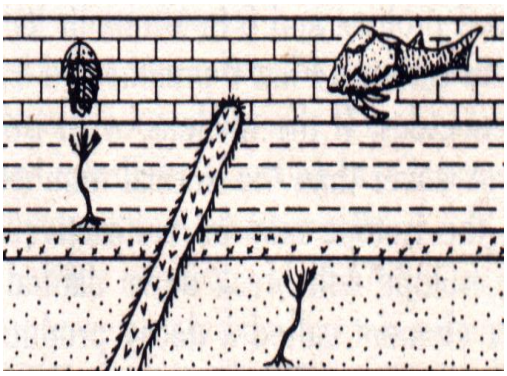
1. **<u>Regional</u>**

   large-scale mountain building events or other zones where the crust is active

2. **<u>Contact</u>**

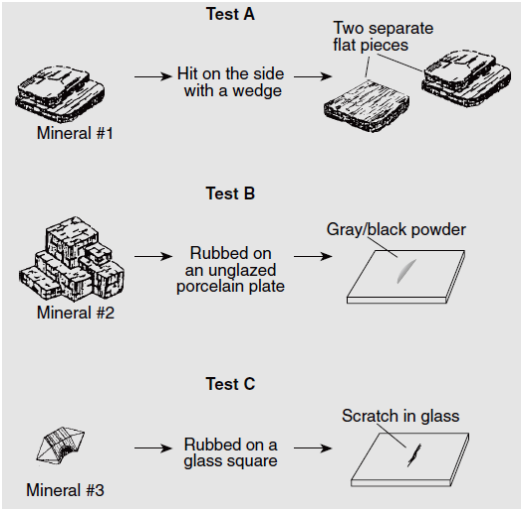
   magma touches nearby rock and changes it into a metamorphic rock

   "tick marks" on edge of magma intrusion indicate an area where heat alters rock



Rocks and Minerals Practice Exam

1. Which sequence correctly matches each test, *A, B,* and *C,* with the mineral property tested?
   (1) *A*—cleavage; *B*—streak; *C*—hardness
   (2) *A*—cleavage; *B*—hardness; *C*—streak
   (3) *A*—streak; *B*—cleavage; *C*—hardness
   (4) *A*—streak; *B*—hardness; *C*—cleavage



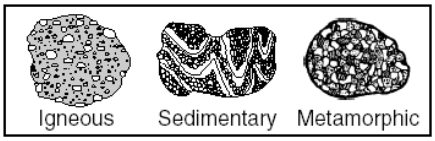
2. Which process most likely formed a layer of the sedimentary rock, gypsum?
   (1) precipitation from seawater
   (2) solidification of magma
   (3) folding of clay-sized particles
   (4) melting of sand-sized particles

3. The photograph shows an igneous rock with a vesicular texture. What is the origin and rate of formation of this rock?

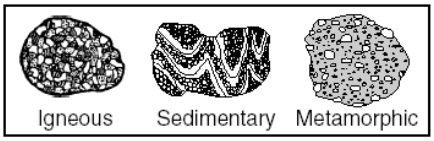
   (1) intrusive with slow cooling
   (2) extrusive with rapid cooling
   (3) extrusive with slow cooling
   (4) intrusive with rapid cooling

4. Which mineral has lead in its composition?
   (1) hematite
   (2) quartz
   (3) graphite
   (4) galena

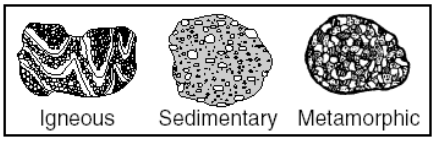
5. In which set are the rock drawings labeled with their correct rock types?



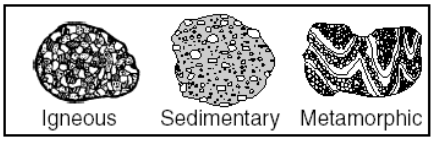
(1)



(3)

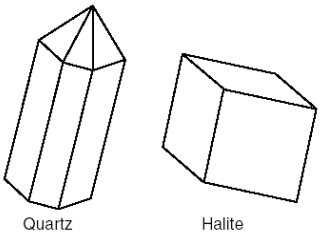


(2)



(4)

6. The diagrams below show the crystal shapes of two minerals.
Quartz and halite have different crystal shapes primarily because
(1) energy is released during crystallization
(2) of the internal arrangement of the atoms surfaces
(3) of impurities that produce surface variations
(4) light reflects from crystal



7. Which igneous rock has a vesicular texture and contains the minerals potassium feldspar and quartz?
(1) andesite
(2) pegmatite
(3) pumice
(4) scoria

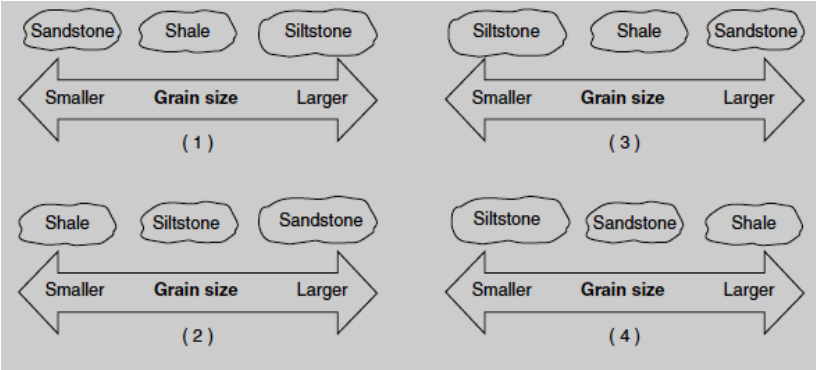
8. Dolostone is classified as which type of rock?
(1) chemically formed sedimentary rock
(2) land-derived sedimentary rock
(3) foliated metamorphic rock
(4) nonfoliated metamorphic rock

9. Which processes most likely formed the shale bedrock found near Ithaca, New York?
(1) burial and compaction
(2) uplift and solidification
(3) heat and pressure
(4) melting and recrystallization

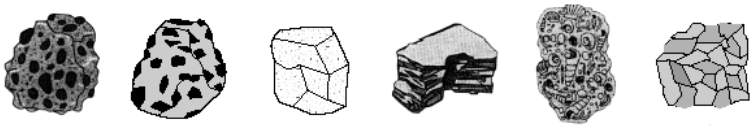
10. Which rock was organically formed from plant remains?
(1) rock gypsum
(2) breccia
(3) coal
(4) phyllite

11. Wavy bands of light and dark minerals visible in gneiss bedrock probably formed from the
(1) cementing together of individual mineral grains
(2) heat and pressure during metamorphism
(3) cooling and crystallization of magma
(4) evaporation of an ancient ocean

12. Which diagram best shows the grain size of some common sedimentary rocks?



Base your answers to **questions 13 through 15** on the drawings of six sedimentary rocks labeled *A* through *F*.



A Conglomerate B Breccia C Sandstone D Shale E Limestone F Rock salt

13. The rocks shown were formed by
    (1) melting and/or solidification
    (2) volcanic eruptions and crystallization
    (3) heat and pressure
    (4) compaction and/or cementation

14. Which two rocks are composed primarily of quartz, feldspar, and clay minerals?
    (1) rock salt and conglomerate
    (2) sandstone and limestone
    (3) rock salt and breccia
    (4) sandstone and shale

15. Rock salt is classified as a(n)
    (1) intrusive rock
    (2) clastic rock
    (3) evaporite
    (4) bioclastic rock

16. The three statements below are observations of the same rock sample:
    • The rock has intergrown crystals less than 1 millimeter in diameter.
    • The minerals in the rock are gray feldspar, green olivine, green pyroxene, and black amphibole.
    • There are no visible gas pockets in the rock.

    This rock sample is most likely
    (1) gabbro
    (2) basalt
    (3) granite
    (4) sandstone

17. Rocks are classified as igneous, sedimentary, or metamorphic based primarily on their
    (1) texture
    (2) crystal or grain size
    (3) method of formation
    (4) mineral composition

18. When extreme heat and pressure is added to shale it can become
    (1) granite
    (2) slate
    (3) marble
    (4) quartzite

19. Which mineral has a metallic luster, a black streak, and is an ore of iron?
    (1) pyroxene
    (2) galena
    (3) magnetite
    (4) graphite

20. Which intrusive igneous rock could be composed of approximately 50% potassium feldspar, 20% quartz, 15% plagioclase feldspar, 5% biotite, and 5% amphibole?
    (1) basalt
    (2) rhyolite
    (3) granite
    (4) gabbro

21. What is the best way to distinguish between the inorganic land-derived sedimentary rocks conglomerate, sandstone, and shale?
    (1) composition
    (2) particle size
    (3) color
    (4) number of fossils

22. What is the best way to determine if a mineral sample is calcite or quartz?
    (1) Observe the color of the mineral.
    (2) Place the mineral near a magnet.
    (3) Measure the mass of the mineral.
    (4) Place a drop of acid on the mineral.

23. As the rate of cooling increases, the crystal size of an igneous rock
    (1) increases
    (2) decreases
    (3) remains the same

24. Which of the following lists features associated with sedimentary rocks?
    (1) foliation, distortions, interlocking crystals
    (2) layering, cemented fragments, fossils
    (3) interlocking crystals, banding, gas pockets
    (4) cleavage, luster, streak

25. How can a person tell the difference between quartz and potassium feldspar?
    (1) quartz has fracture and potassium feldspar has cleavage
    (2) quartz can scratch glass and potassium feldspar cannot scratch glass
    (3) quartz is always clear and potassium feldspar is always pink
    (4) quartz is metallic and potassium feldspar is nonmetallic

26. A student finds a rock and identifies some of its physical features:

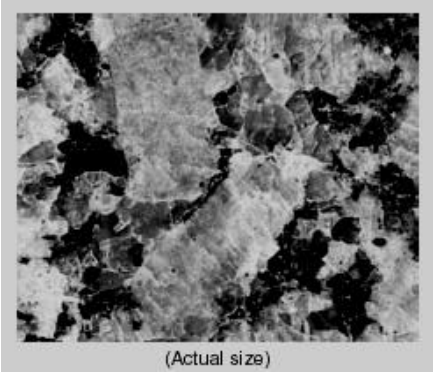
    Color: green-gray
    Texture: foliated
    Unique Feature: platy mica crystals visible

    What is the name of the rock the student found?
    (1) gneiss
    (2) shale
    (3) biotite mica
    (4) schist

27. Which elements would be found in olivine?
    (1) iron, magnesium, silicon, oxygen
    (2) sodium, aluminum, silicon, oxygen
    (3) potassium, aluminum, silicon, oxygen
    (4) calcium, iron, silicon, oxygen

28. The photograph shows the intergrown crystals of a pegmatite rock.

    Which characteristic provides the best evidence that this pegmatite solidified deep underground?
    (1) low density
    (2) light color
    (3) felsic composition
    (4) very coarse texture


(Actual size)

29. Which minerals could be used in the construction industry?
    (1) dolomite, mica, gypsum, olivine
    (2) talc, pyroxene, amphibole, garnet
    (3) quartz, fluorite, sulfur,
    (4) pyrite, graphite, amphibole, galena

30. A clastic sedimentary rock composed of grains that are .01 cm in diameter would be classified as
    (1) sandstone
    (2) siltstone
    (3) conglomerate
    (4) shale

31. Which rock is monomineralic?
    (1) rock salt
    (2) phyllite
    (3) breccia
    (4) diorite

32. If igneous rocks have pyroxene and olivine in their composition they are considered to be
    (1) mafic and low in density
    (2) felsic and low in density
    (3) mafic and high in density
    (4) felsic and high in density

33. Igneous rocks form as a result of
    (1) extreme heat and pressure
    (2) evaporation of seawater
    (3) cementation of rock fragments
    (4) cooling of lava