ROCKS

Aim 1: What are minerals?

HW from "Reviewing Earth Science, the Physical Setting"

- **Read "Mineral Resources" p32&82**
- **Do all questions on Part A&B-1 p36&37**

Minerals are the substances of which rocks are made of.

Minerals can be identified using different tests. See RT page 16.

- The luster test is the way light reflects on it. It can be metallic, nonmetallic or either

- The hardness test is the physical resistance compared to another mineral or material. The Moh's Mineral Hardness Scale is usually used.

Moh's Mineral Hardness Scale	
Talc	1
Gypsum	2
Calcite	3
Fluorite	4
Apatite	5
Feldspar	6
Quartz	7
Topaz	8
Corundum	9
Diamond	10

Approximate Hardness of Common Objects
Fingernail (2.5)
Copper penny (3.5)
Iron nail (4.5)
Glass (5.5)
Steel file (6.5)
Streak plate (7.0)

- The cleavage/fracture test is the way a mineral will break apart.

  If a mineral breaks along smooth and flat surfaces it shows cleavage because the atoms are regularly arranged.
  Ex: Biotite Mica

  If a mineral breaks along uneven surfaces it shows fracture because the atoms are not regularly arranged.
  Ex: Quartz

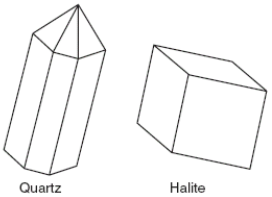
- The color test is not reliable since impurities can affect color.
  Ex: Quartz

- The streak test is the color of the powdered form of the mineral.
  The streak test is performed by rubbing a fresh corner of the mineral across a white, unglazed ceramic plate.
  Some metallic minerals leave behind a powder that is not the same color as the mineral.
  Ex: Pyrite

Test your understanding

8/07

19 The diagrams below show the crystal shapes of two minerals.



Quartz and halite have different crystal shapes primarily because

(1) light reflects from crystal surfaces
(2) energy is released during crystallization
(3) of impurities that produce surface variations
(4) of the internal arrangement of the atoms

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

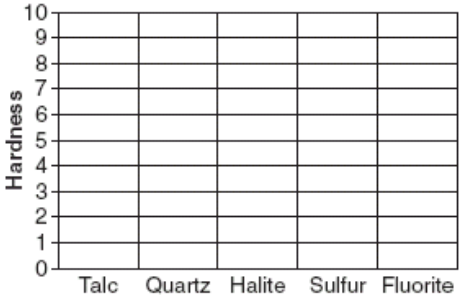
Group A	Group B
olivine	pyrite
garnet	galena
calcite	graphite

Which property was used to classify these minerals?

(1) color (2) luster (3) chemical composition (4) hardness

Base your answers to questions 81 and 82 on the hardness of the minerals talc, quartz, halite, sulfur, and fluorite.

81 On the grid *below*, construct a bar graph to represent the hardness of these minerals.



82 Which mineral shown on the grid would be the best abrasive? State *one* reason for your choice.

6/07

14 Which two minerals have cleavage planes at right angles?

(1) biotite mica and muscovite mica (2) sulfur and amphibole (3) quartz and calcite (4) halite and pyroxene

1/07

18 The mineral graphite is often used as

(1) a lubricant (2) an abrasive (3) a source of iron (4) a cementing material

8/06

33 The table below shows the hardness of four common materials.

Hardness of Four Materials

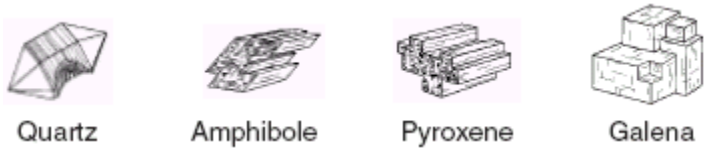
Material	Hardness
human fingernail	2.5
copper penny	3.0
window glass	4.5
steel nail	6.5

Which statement best describes the hardness of the mineral dolomite?

(1) Dolomite can scratch window glass, but cannot be scratched by a fingernail.
(2) Dolomite can scratch window glass, but cannot be scratched by a steel nail.
(3) Dolomite can scratch a copper penny, but cannot be scratched by a fingernail.
(4) Dolomite can scratch a copper penny, but cannot be scratched by a steel nail.

6/06

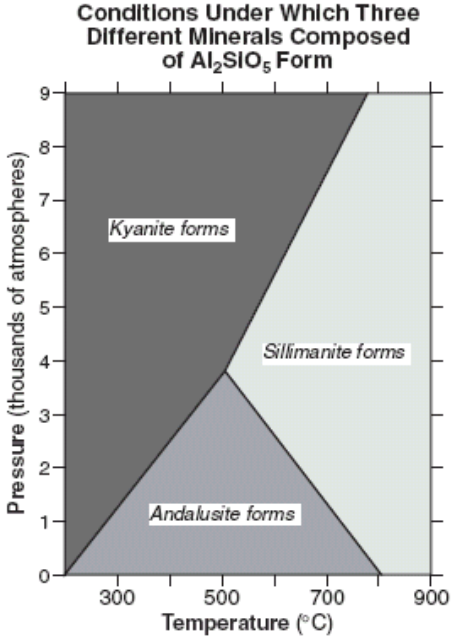
34 The diagram below shows four mineral samples, each having approximately the same mass.



If all four samples are placed together in a closed, dry container and shaken vigorously for 10 minutes, which mineral sample would experience the most abrasion?

(1) quartz (2) amphibole (3) pyroxene (4) galena

Base your answers to questions 36 through 38 on the graph below, which shows the crustal temperature and pressure conditions under which three different minerals with the same chemical composition (Al_2SiO_5) crystallize.



37 Which mineral has a chemical composition most similar to andalusite, sillimanite, and kyanite?

(1) pyrite (2) gypsum (3) dolomite (4) potassium feldspar

38 If bedrock at a collisional plate boundary contains andalusite crystals, these crystals are changed into sillimanite and/or kyanite as temperature and pressure conditions increase. What is this process called?

(1) weathering (2) solidification (3) metamorphism (4) cementation

1/06

Base your answers to questions 42 through 46 on the two tables below and on your knowledge of Earth science. Table 1 shows the composition, hardness, and average density of four minerals often used as gemstones. Table 2 lists the minerals in Moh's Scale of Hardness from 1 (softest) to 10 (hardest).

Table 1

Gemstone Mineral	Composition	Hardness	Average Density (g/cm^3)
emerald	$Be_3Al_2(Si_6O_{18})$	7.5–8	2.7
sapphire	Al_2O_3	9	4.0
spinel	$MgAl_2O_4$	8	3.8
zircon	$ZrSiO_4$	7.5	4.7

Table 2

Moh's Scale of Hardness
1 talc
2 gypsum
3 calcite
4 fluorite
5 apatite
6 feldspar
7 quartz
8 topaz
9 corundum
10 diamond

KEY	
Al = aluminum	O = oxygen
Be = beryllium	Si = silicon
Mg = magnesium	Zr = zirconium

42 Part of a gemstone's value is based on the way the gemstone shines in reflected light. The way a mineral reflects light is described as the mineral's

(1) fracture (2) hardness (3) luster (4) streak

43 Sapphire is a gemstone variety of which mineral on Moh's scale of hardness?

(1) corundum (2) diamond (3) fluorite (4) topaz

44 If the mass of a spinel crystal is 9.5 grams, what is the volume of this spinel crystal?

(1) 0.4 cm^3 (2) 2.5 cm^3 (3) 5.7 cm^3 (4) 36.1 cm^3

45 The hardness and density of each gemstone is based primarily on the gemstone's

(1) internal arrangement of atoms (2) geologic time of formation (3) oxygen content (4) natural abundance

46 Which gemstone minerals contain the two most abundant elements by mass in Earth's crust?

(1) emerald and spinel (2) emerald and zircon (3) sapphire and spinel (4) sapphire and zircon

2004/1

19 Which mineral will scratch glass (hardness = 5.5), but not pyrite?

(1) gypsum (3) orthoclase (2) fluorite (4) quartz

29 The photograph below shows a piece of halite that has been recently broken.

Which physical property of halite is demonstrated by this pattern of breakage?

(1) hardness (3) cleavage (2) streak (4) luster

35 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) Place a drop of acid on the mineral. (4) Measure the mass of the mineral.

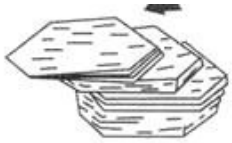
2003-1

22 An unidentified mineral that is softer than calcite exhibits a metallic luster and cubic cleavage. This mineral most likely is

(1) galena (2) pyrite (3) halite (4) pyroxene

2002-8

35 The diagram below shows how a sample of the mineral mica breaks when hit with a rock hammer. This mineral breaks in smooth, flat surfaces because it



(1) is very hard (2) is very dense (3) contains large amounts of iron (4) has a regular arrangement of atoms

2002-6

Base your answers to questions 41 through 44 on the "Properties of Common Minerals" chart in the Earth Science Reference Tables.

41 Which mineral leaves a green-black powder when rubbed against an unglazed porcelain plate?

(1) galena (2) graphite (3) hematite (4) pyrite

42 Which mineral scratches dolomite and is scratched by olivine?

(1) galena (2) quartz (3) potassium feldspar (4) muscovite mica

43 Which statement about the minerals plagioclase feldspar, gypsum, biotite mica, and tale can best be inferred from the chart?

(1) These minerals have the same chemical and physical properties.

(2) These minerals have different chemical properties, but they have similar physical properties.

(3) These minerals have different physical and chemical properties, but they have identical uses.

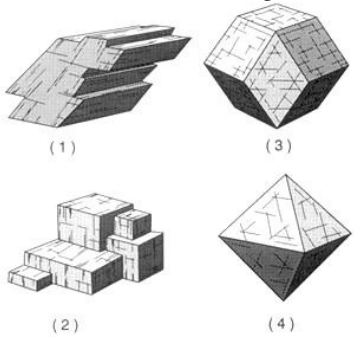
(4) The physical and chemical properties of these minerals determine how humans use them.

44 Minerals from this chart are found in several different rocks. Which two rocks are primarily composed of a mineral that bubbles with acid?

(1) limestone and marble (2) granite and dolostone (3) sandstone and quartzite (4) slate and conglomerate

2001-6

17 Halite has three cleavage directions at 90^{o} to each other. Which model best represents the shape of a broken sample of halite?



Base your answers to questions 39 and 40 on Moh's mineral hardness scale and on the chart below showing the approximate hardness of some common objects.

39 Which statement is best supported by this scale?

(1) A fingernail will scratch calcite, but not quartz.
(2) A fingernail will scratch quartz, but not cal- cite.
(3) A piece of glass can be scratched by quartz, but not by calcite.
(4) A piece of glass can be scratched by calcite, but not by quartz.

40 The hardness of these minerals is most closely related to the

(1) mineral's color
(2) mineral's abundance in nature
(3) amount of iron the mineral contains
(4) internal arrangement of the mineral's atoms