Set 1 — Properties of Common Minerals

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

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

   1 [3]

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

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

   2

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

<table>
<thead>
<tr>
<th>Material</th>
<th>Hardness</th>
</tr>
</thead>
<tbody>
<tr>
<td>human fingernail</td>
<td>2.5</td>
</tr>
<tr>
<td>copper penny</td>
<td>3.0</td>
</tr>
<tr>
<td>window glass</td>
<td>4.5</td>
</tr>
<tr>
<td>steel nail</td>
<td>6.5</td>
</tr>
</tbody>
</table>

   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 fingernail.
   (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.

   3

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

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

   1

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

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

   5

6. Which mineral scratches dolomite and is scratched by olivine?

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

   3

7. Which statement about the minerals plagioclase feldspar, gypsum, biotite mica, and talc 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.

   7

8. 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

   8
9. Which home-building material is made mostly from the mineral gypsum?
(1) plastic pipes
(2) window glass
(3) drywall panels
(4) iron nails

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

11. The accompanying table shows some observed physical properties of a mineral. 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

<table>
<thead>
<tr>
<th>Physical Property</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>color</td>
<td>white</td>
</tr>
<tr>
<td>hardness</td>
<td>scratched by the mineral calcite</td>
</tr>
<tr>
<td>distinguishing characteristic</td>
<td>feels greasy</td>
</tr>
<tr>
<td>cleavage/fracture</td>
<td>shows some definite flat surfaces</td>
</tr>
</tbody>
</table>

"Herkimer Diamonds"

Gem-quality "Herkimer Diamonds" are hexagonal-shaped quartz crystals found in some of the surface bedrock of Herkimer, New York. The oldest of these gemstones are believed to be approximately 500 million years old. These quartz crystals are magnificent works of nature that have a natural diamond-like geometric shape formed when the quartz crystallized. Natural "Herkimer Diamonds" were not cut or shaped by humans. Due to their appearance, "Herkimer Diamonds" are commonly used in jewelry. These quartz crystals are not true diamonds.

Mineral Characteristics of "Herkimer Diamonds" (Quartz) and True Diamonds

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Color</th>
<th>Chemical Composition</th>
<th>Luster</th>
<th>Hardness</th>
<th>Dominant Form of Breakage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Herkimer Diamond&quot; (quartz)</td>
<td>Colorless or variable</td>
<td>SiO₂</td>
<td>Glassy</td>
<td>7</td>
<td>Fracture</td>
</tr>
<tr>
<td>True diamond</td>
<td>Colorless or variable</td>
<td>C</td>
<td>Glassy</td>
<td>10</td>
<td>Cleavage</td>
</tr>
</tbody>
</table>

12. a) List two mineral characteristics that differ between "Herkimer Diamonds" and true diamonds.
1) Hardness
2) Chemical Composition

b) State two use for "Herkimer Diamonds" (quartz), other than their use in jewelry.
1) Glass
2) Electronics
13. 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) graphite and talc
   (4) pyrite and magnetite

14. 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.

15. 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
   (2) streak
   (3) cleavage
   (4) luster

16. Mohs mineral hardness scale and the chart below showing the approximate hardness of some common objects.

<table>
<thead>
<tr>
<th>Moh's Mineral Hardness Scale</th>
<th>Approximate Hardness of Common Objects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Talc</td>
<td>Fingernail (2.5)</td>
</tr>
<tr>
<td>Gypsum</td>
<td>Copper penny (3.5)</td>
</tr>
<tr>
<td>Calcite</td>
<td>Iron nail (4.5)</td>
</tr>
<tr>
<td>Fluorite</td>
<td>Glass (5.5)</td>
</tr>
<tr>
<td>Apatite</td>
<td>Steel file (6.5)</td>
</tr>
<tr>
<td>Feldspar</td>
<td>Streak plate (7.0)</td>
</tr>
<tr>
<td>Quartz</td>
<td></td>
</tr>
<tr>
<td>Topaz</td>
<td></td>
</tr>
<tr>
<td>Corundum</td>
<td></td>
</tr>
<tr>
<td>Diamond</td>
<td></td>
</tr>
</tbody>
</table>

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 calcite.
   (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.

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

18. 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
19. Which two minerals have cleavage planes at right angles?
(1) biotite mica and muscovite mica
(2) sulfur and amphibole
(3) quartz and calcite
(4) potassium feldspar and pyroxene

Base your answers to question 20 on the accompanying diagram, which shows three minerals with three different physical tests, A, B, and C, being performed on them.

20. a) 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

b) The results of all three physical tests shown are most useful for determining the
(1) rate of weathering of the minerals
(2) identity of the minerals
(3) environment where the minerals formed
(4) geologic period when the minerals formed

21. Explain the difference between luster and streak.

Luster: Reflects light
Streak: Color of powder

22. How can you tell the difference between calcite and halite.

Calcite bubbles in acid.
23. What is an ore?

A mineral that is mined because it is extremely profitable.

24. What element is present in dolomite that is not present in calcite? Mg/magnesium

Base your answers to question 25 on the hardness of the minerals talc, quartz, halite, sulfur, and fluorite.

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

```
<table>
<thead>
<tr>
<th>Hardness</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
</tr>
<tr>
<td>9</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

Talc  Quartz  Halite  Sulfur  Fluorite
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b) Which mineral shown on the grid would be the best abrasive? State one reason for your choice.

Mineral: Quartz
Reason: High hardness

c) Which mineral(s) would halite be able to scratch? Talc/Sulfur

d) If a diamond was included on the above bar graph, up to what hardness number would be shade in? 10

26. A student created the accompanying table by classifying six minerals into two groups, A and B, based on a single property. Which property was used to classify these minerals?

<table>
<thead>
<tr>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>olivine</td>
<td>pyrite</td>
</tr>
<tr>
<td>garnet</td>
<td>galena</td>
</tr>
<tr>
<td>calcite</td>
<td>graphite</td>
</tr>
</tbody>
</table>

Luster