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Care of School Resource Kits

Each School Resource Kit is comprised of authentic artifacts and modern reproductions.

Handling these particular objects is encouraged. Touching the objects and passing them around is allowed, but please remember that some items are delicate and should be treated with care.

Objects in plastic should remain in plastic though they may still be passed around for closer inspection.

Why do we ask you not to touch certain objects? The oils, dirt and moisture from your fingertips can stain textiles and etch metals, permanently changing them. One touch may not seem like much, but hundreds of touches in a year can wear a hole in a cotton dress or a notch in a wooden axe handle.

There are some items in certain kits that may be considered weapons in your school; be aware of your school’s policy regarding weapons and take appropriate action (i.e. inform the principal).

These items have been specially chosen for “hands on” learning and educational programs. In any museum, items on display and in the collection should never be touched unless a museum staff member has invited you to do so.

If an item is damaged, please gather all the pieces into a plastic bag and return it with the kit. When you return the kit, please let a staff member know that there is a damaged object.

If you find an item is missing or already damaged, please inform the museum’s student staff when you return the kit.
Note to the Instructor

Rocks, Minerals, and Gemstones are easily observable objects that serve to crown our jewelry, pave our sidewalks, support our buildings, and form the earth itself. Subject matter with such broad application undoubtedly deserves a liberal approach in education; therefore this packet should be viewed as a generic overview of and introduction to the combined subject of rocks and minerals, rather than a detailed study or comprehensive exegesis. The instructor will kindly forgive the compiler of these materials for any shortcomings of expectation that can be traced back to this problem. Our fondest hope as educators in all fields and of all age groups is to instill in our students a love of learning and a hunger for more information. This being agreed upon, the core value of this packet should be to instill students with an interest and desire to seek to learn more, rather than to saturate them with information.

This brief report, as it relates to reading comprehension levels, is written primarily for use of educating the instructor, who may then choose how to appropriately present the material to students. In order to facilitate valuable education along this “chain of information” a number of additions have been made to the originally proposed packet, including a vocabulary glossary and enlarged pictures for the purpose of sharing with students. Please make use of all the information contained herein as you, the instructor, see fit.
Michigan Grade Level Content Expectations

This School Resource Kit may be used to aide in teaching the state of Michigan Grade Level Content Expectations which fall under the following heading:

E.SE.M.4 - Rock Formation – Rocks and rock formations bear evidence of the minerals, materials, temperature/pressure conditions and forces that created them.

E.SE.06.41 - Compare and contrast the formation of rock types (igneous, metamorphic, and sedimentary) and demonstrate the similarities and differences using the rock cycle model.

S.IP.06.111 - Generate scientific questions based on observations, investigations, and research concerning rock samples.

S.IP.06.12 Design and conduct scientific investigations to understand rock formation.

E.ST.06.31 Explain how rocks and fossils are used to understand the age and geological history of the Earth (timelines and relative dating, rock layers).
Introduction

Minerals are the most elementary of our subjects, as not all rocks are composed of one mineral. In fact, many rocks are made of multiple minerals. A rock can be defined as a naturally formed mass of a mineral or minerals. Whereas a mineral is a very specific object.

A naturally occurring substance formed through geological processes that has a characteristic chemical composition, a highly ordered atomic structure, and specific physical properties.

A rock is sometimes defined as an aggregate of minerals, whereas minerals themselves are defined by specific characteristics. Hence the relationship between a rock and a mineral may be visualized by the following Venn diagram:

Clearly a rock may be composed of a mineral, and a mineral or multiple minerals may compose a rock. However, not all rocks are composed of one mineral, and not all minerals are grouped in masses that form rocks.
Minerals in this report will be defined primarily by their common names and their chemical compositions. Rocks, on the other hand, will be defined by their common names and the minerals which are contained in the rocks.

Some rocks, however, refuse to fall into even such a broad definition, as they have been found to have variable mineral compositions. Such rocks, such as igneous scoria, will be defined rather by whatever has traditionally been used to group them together (in scoria’s case, for example, it has very little to do with particular minerals and everything to do with the highly vesicular texture).

A short treatment will be given on the subject of the crystal structures of minerals, but this will not be a central objective. Neither will there be an in-depth discussion concerning the manner in which chemicals bond to form certain minerals. Instructors interested primarily in either of these areas of study should consider this packet as supplemental material only.

Gemstones, a term often found grouped together with rocks and minerals, are in reality neither rocks nor minerals by default, though they are usually both. For example, a fine specimen of amethyst that has been tumbled, polished, and set into a piece of jewelry is a gemstone, and likewise so is a beautiful agate. The difference is that amethyst is also a mineral, whereas agates are rocks composed of multiple varying minerals. An even more absurd example is the Petoskey stone, sometimes polished into a gemstone—but is in fact a fossil!

Throughout the body of this report we will observe a number of rocks, minerals, and gemstones. Keep their classifications and the reasons for them in mind in order to gain a better understanding of their interwoven relationships.
Mohs’ Hardness Scale

In 1812 a German mineralogist by the name of Friedrich Mohs developed a scale by which the relative hardness of minerals could be determined. Mohs used ten minerals which could all be obtained without much difficulty, and set them up in an order from softest to hardest, with talc being equivalent to 1, and diamond, the hardest known natural substance, being equivalent to 10.

A problem with using the Mohs scale as the primary measurement for hardness of minerals is that although the scale is in the correct order, its minerals are not spaced in proportion to one another. For example, corundum, Mohs mineral 9, is twice as hard as topaz, mineral 8. Diamond however, mineral 10, is almost four times as hard as corundum.

Despite this complication, the Mohs scale is still largely used today, especially in the field, due to its ease of use. Kits are used with samples of each mineral in order to test minerals found in the field. If someone finds a mineral and uses the kit to determine that it is harder than apatite (5), but softer than orthoclase feldspar (6), the Mohs hardness for the new mineral is 5.6. In this manner the Mohs scale serves as an easily understood, readily available tool for the identification and classification of minerals.

The Mohs hardness scale:

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Mohs Hardness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Talc</td>
<td>1</td>
</tr>
<tr>
<td>Gypsum</td>
<td>2</td>
</tr>
<tr>
<td>Calcite</td>
<td>3</td>
</tr>
<tr>
<td>Fluorite</td>
<td>4</td>
</tr>
<tr>
<td>Apatite</td>
<td>5</td>
</tr>
<tr>
<td>Orthoclase Feldspar</td>
<td>6</td>
</tr>
<tr>
<td>Quartz</td>
<td>7</td>
</tr>
<tr>
<td>Topaz</td>
<td>8</td>
</tr>
<tr>
<td>Corundum</td>
<td>9</td>
</tr>
<tr>
<td>Diamond</td>
<td>10</td>
</tr>
</tbody>
</table>
Crystallography

Crystallography is the study of the arrangement of atoms in a given solid. The manner in which atoms arrange themselves in minerals has great bearing on the properties and identification of each mineral. The study of minerals at the atomic level is a fairly recent science, thanks to the electron microscope. Mineralogists have noted the varying geometric shapes and orientations of crystals visible to the naked eye, however, for quite some time. This is because of the mathematical precision of the geometric designs formed by atomic structures in crystals. When all the atoms in a quartz crystal are acting to form a perfect geometric shape on even the smallest observable level, that shape is repeated as the size expands, with the result being an easily visible crystal that mimics the orientation of the atoms it contains, barring distortions due to the presence of foreign chemicals and minerals.

Often the difference between one mineral and another is not the chemical composition, but rather the arrangement of crystals. This is because different crystal arrangements can result in different densities, colors, and a variety of other scientific properties pertaining to usage and aesthetic quality.

One of the most famous examples of this phenomenon is the relationship between coal and diamond.

Both diamond and the many varieties of coal are composed of carbon. The difference among them has nothing to do with what they contain, but everything to do with how it is structured. In graphite, a high-grade form of coal, carbon is organized into layers which are then bonded together loosely. In diamond, however, each carbon atom bonds tetrahedrally to four other atoms, forming a dense 3-dimensional network. As a result, graphite has no visible crystals, and is one of the softest substances, while diamond has cubic crystals and is the hardest naturally occurring substance known to humans.

Students and educators who wish to learn more about mineral crystals and their study are encouraged to investigate further sources, with an expectation to encounter a great deal of geometry and chemistry.
Amethyst

Amethyst is a mineral composed of silicon dioxide (SiO2), or silica. It is a purple variety of quartz. There is currently no consensus among geologists as to what makes amethyst purple. Most attribute this to the presence of manganese, but some disagree. The shade of color in amethyst is highly alterable under heat, which leads some to hypothesize that it is an organic substance such as sulfur acting to create the color. Still others claim that iron is the key proponent to the mineral’s color. Whatever the cause, the rich purple of amethyst has made it a valuable gemstone for millennia. From the time of the ancient Greeks, who gave the gem its name, amethyst has been prized. Today, it is often set in jewelry as shown below.

Quick Facts

- a mineral
- composed of SiO2 (Silica)
- a variety of quartz
- valued as a gemstone
- 7 on the Mohs hardness scale
Copper (Cu) is element number 29 on the periodic table, and is a valuable mineral with many employments. The metal has been in use by humans for thousands of years, with ancient civilizations making extensive use of its properties. One of the Egyptian pyramids was even built with an interior copper plumbing system.

It was the smelting of copper that allowed humans to develop Bronze, leading humankind from the Neolithic Period to the Bronze Age.

Today copper is used widely in electrical wiring, due to its excellent conducting properties. It is also used in the currency of many nations, including the U.S. penny.

Copper is an important nutrient for the human body, but too large an amount can be poisonous to the point of fatality.

**Quick Facts**

*Copper is*…
- a mineral
- a chemical
- a metal
- a good conductor
- used in many ways, including in electrical wiring and pennies
- found naturally in Michigan’s UP
- 2.5-3 on the Mohs hardness scale
Fluorite

Fluorite is a mineral made of calcium fluoride (CaF2). Its name comes from the Latin word flu-ere, "to flow," because fluorite is easily melted and used as a flux in the smelting of metal ore. Many samples of fluorite are fluorescent; that is, they fluoresce under ultra-violet light. The term fluorescent takes its name from the mineral.
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