## Major Minerals

| GEMSTONE | CRYSTAL STRUCTURE | ORGIN & HISTORY |
|---|---|---|
| **Beryl** $Be_3Al_2Si_6O_{18}$ | Hexagonal (6-sided) | |
| **Diamond** C | Cubic (Octah-edral) | JKJ |
| **Feldspar** $AlSi_3O_8$ | Triclinic or Monoclinic | |
| **Garnet** $X_3Y_2(SiO_4)_3$ | Dodecahedron (12-sided) | From "gernet;" Middle English: "dark red" |
| Gold | | |
| Platinum | | |
| Quartz | | |
| Silver | | |
| Topaz | | |
| Tourmaline | | |

## Minor Gems

## 5 Criteria for Minerals

**Naturally Occurring**: the mineral has to be formed due to natural processes.

**Solid** at room temperature.

**Defined Chemical Formula**: follows a proscribed chemical formula within certain exceptions.

**Crystalline**: must possess a repeating crystal lattice.

**Inorganic**: must be produced abiogenetically.

## General History of Human Evolution

**Paleolithic**: Appearance of "true" humans (neanderthals), tool usage, and first jewelry.

**Neolithic**: New stone age and first agriculture.

**Chalcolithic**: Copper Age & Beginning of metallurgy.

## EXAM QUESTIONS

Feldspar has...

> **Two directions of cleavage.**

This gemstone has been described as the most colorful gemstone due to its wide range of potential colors and the fact that some gems are multicolored.

> **Tourmaline**

In the mineral with the chemical formula $Al_2SiO_4(F, OH)$, where is the water stored?

> **In hydroxyl groups.**

Which of the following gemstones is a cut rock?

> **Lapis Lazuli**

Which of the following particles define the atomic number of an element?

> **Protons**

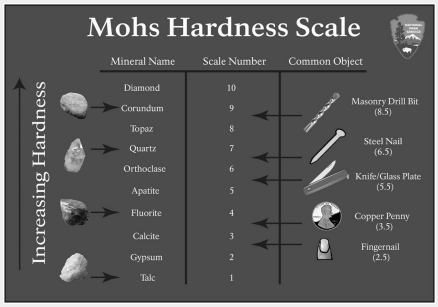
At which of the following tectonic boundaries would you be most likely to find silver?

> **Divergent**

You have a magma composed only of Calcium (Ca), Potassium (K), Aluminum (Al), Silicon (Si), and Oxygen (O). What feldspar varieties would you expect to form?

> **$KAlSi_3O_8$ and $CaAl_2Si_2O_8$**

## Mohs Hardness Scale




## Gem Anatomy





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## Terms

**Cleavage**: Plane of preferred parting along a crystal lattice.

**Convection**: “The movement caused within a fluid by the tendency of hotter and therefore less dense material to rise, and colder, denser material to sink under the influence of gravity, which consequently results in transfer of heat.”

**Convergent Plate Boundaries**: Collisional boundaries; two plates get pushed together. The denser plate (which is usually the (oldest) oceanic plate) gets pushed under. Volatiles come up to help melt the rock and magma creates mountains.

**Cut Rock**: Rocks are solid masses of minerals or mineraloids.

**Divergent Plate Boundaries**: Two plates moving away from each other and they are stretched out. The plates get thinner through time. Some of the magma can then get through and then fill the gaps which creates new crusts.

**Exsolution**: The process of ordered unmixing of immiscible liquids during crystal formation.

**Felsics**: (Silica and Feldspar) Formed in continental crust; light and low density; not subducted, usually floats.

**Igneous**: Rocks which form from molten material (i.e. freeze from liquid rock).

**Immiscible**: Unable to be mixed.

**Index Mineral**: Marks stage in metamorphism, extent of pressure (i.e. Garnet).

**Indicator Mineral**: Associated with something that’s really rare (i.e. Garnet & Diamonds).

**Intrusive**: Igneous rock, cools slowly (i.e. Granite).

**Isostasy**: The equilibrium between an object and the fluid in which it is suspended (less dense = float higher, more dense = float lower).

**Mafic**: (Magnesium and Iron) Darker-colored, denser, thinner material that is formed from oceanic crust.

**Metamorphic**: Rocks which form from re-crystallization at high temperatures and pressures (not melting).

**Mineral**: "A solid inorganic substance of natural occurrence" (specific category/chemical structure).

**Molecule**: Atoms bonded together as the smallest chemical unit.

## Terms (cont)

**Native Element**: Naturally occur in an uncombined elemental form with its own mineral structure.

**Organic Material**: Formed from living organisms (i.e. Amber).

**Orogeny**: Mountain building event, thickening of crust.

**pH**: The measure of the "power" of hydrogen in a solution.

**Sedimentary**: Cold rock processes which involve breaking up existing rocks or biologic processes.

**Silicon Tetrahedral**: A "silicon atom with four surrounding oxygen atoms arranged to define the corners of a tetrahedron ($SiO_4$). "

**Slab Pull**: “Slab pull is the pulling force exerted by a cold, dense oceanic plate plunging into the mantle due to its own weight.”

**Subduction**: “The sideways and downward movement of the edge of a plate of the earth's crust into the mantle beneath another plate.”

**Twinning**: Symmetrical growth of two crystals from the same lattice point.

**Ultramafic**: Mafic with less silica (darker and denser than mafic)

**Unit Cell**: How you conceptualize dividing up a gem. How can you recreate it in a 3D space. Find a common feature. Does it allow you to pick it up and put it anywhere on the same dimension.

**Volatiles**: Molecules which can be readily vaporized.



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