# Math
# Math Topic: 3-D figures
# Science Topic: minerals
# Math and Science
# Correlated Lesson # 1

**Written by: Jake Hammons/Darla Michaelidis – Mix It Up 2008**

**Amount of time taken to write this lesson: 8-10hrs**

# Lesson Objectives

## At the end of this lesson students will be able to:

- Identify a variety of three dimensional figures, i.e. prisms, pyramids.
- Discuss connections to the real world.
- Identify specific types of minerals based on their shapes (atomic structure) as they relate to mathematical three dimensional figures.
- Explain the difference between the mathematical terms and the variations used to name minerals due to the patterns that develop due to their atomic structure.

| National Standard Strand | Code | National Standard Strand | Code |
|---|---|---|---|
| Algebra | A | Problem Solving | P |
| Geometry | G | Reasoning and Proof | R |
| Measurement | M | Communication | CM |
| Data Analysis and Probability | D | Connections | CN |
| | | Representations | R |

Resources:

Benchmarks for Science literacy provided by American Association for the Advancement of Science http://www.project2061.org/publications/bsl/online/bolintro.htm

National Science Education Standards provided by National Academy of Science http://www.nap.edu/readingroom/books/nses/6d.html

Texas Essential Knowledge and Skills (TEKS) for middle school Mathematics/Science http://www.tea.state.tx.us/teks/

National Standards provided by National Council for Teachers of Mathematics http://standards.nctm.org/document/chapter6/index.htm

| Math Lesson Objectives | | | Science Lesson Objectives | | |
|---|---|---|---|---|---|
| At the end of this lesson, students will be able to | Nat'l Standards | State Standards (TEKS) | At the end of this lesson, students will be able to | Nat'l Standard | State Standards (TEKS) |
| Identify a variety of 3-D figures and discuss connections to real world. | NCTM standard G, RP, CM, CN, R | 8.7B use geometric concepts 8.16AB make conjectures and validate conclusions | Identify specific types of minerals based on their shapes as they relate to 3-D figures. Explain differences between math terms and the variations of those used to name minerals. | NSES standard F BSL standard for process and compo-sition of earth | 8.8A Identify structure to describe atomic structure. 8.2BCD collect data by observing, organizing, analyzing, and communi-cating valid results. |

# Materials

- Provide a list of materials needed for the students to complete each activity in the correlated lesson.
- Use a different row if materials needed for different activities.
- Include a list of additional resources used to prepare the lesson, if appropriate.

| Math Lesson Materials | Science Lesson Materials |
|---|---|
| 3-D figures | Rock and mineral samples |
| | Magnifying glasses/hand lenses |
| Pre-developed work sheets | Pre-developed work sheets |

**Additional Resources:**
Textbooks as provided by school with additional information or worksheets.

Geology websites for pictures of minerals: rockimage.com, mineralminers.com, chem.ox.ac.uk, mineral.galleries.com, clairelibrary.com, galleries.com, geology.csupomona.edu

# Terms and Definitions

- Provide the math and science terms and definitions used in the lesson.
- Bold the term being defined.

| Math Definitions and Terms | Science Definitions and Terms |
|---|---|
| Right hexagonal prism | Hexagonal mineral/crystal formation |
| Cube – right square prism | Cubic mineral/crystal formation |
| Right rectangular prism | Tetragonal mineral/crystal formation |
| Oblique square prism | Rhombic mineral/crystal formation |
| | Orthorhombic mineral/crystal formation |
| | |
| | |

**Discuss the differences and similarities in language that need to be emphasized in the lesson.**

- QUARTZ vs. quarts – important to distinguish for students with limited experience and to prevent confusion for all students.
- Much of the vocabulary while similar is not exact in the science as it would be in the math.

# Parallel Concepts

- The concept pertaining to shape and the naming of the shape is a parallel concept between the math and science.

# Misconnections

- The concept of the orthorhombic and the rhombic formations is not quite connected as it would be in math. Also, the monoclinic and triclinic mineral forms did not meet the overall shape standards because their definitions can be combined with or used independently and actually counter the definitions of other words and should be addressed in a separate lesson where the mineral/rock concept is more fully developed.

# Sequencing of the Lesson

**Transition: Mention of prerequisite knowledge of 2-D polygons as geometric shapes.**

**Introduction: Have students look at some "rock" samples to determine whether they are mineral or rock. They are to complete a brief worksheet to explain why they sorted in the manner they did.**

START WITH SCIENCE AS THE INTRODUCTION TO GET THINGS GOING

Good afternoon, today we are going to be learning math and science. Specifically we are going to start with a box of rocks. Please take a look at the rocks provided for you. You may already know some things about rocks and what I want you to do is look at these rocks and decide which are mineral and which are not. Group them by some characteristic that you know or in some way that seems to make sense to you. Complete the questions on the paper provided so you don't lose your thoughts about why you are sorting in this way. You need to think about what you are doing as you sort, even though you may not be sure right now. Think about the similarities of the rocks in each group. Think about the differences between the groups. ***Do not tell them whether they are right yet.***

Set your rocks aside for now – but leave them in the groups that you determined.

**Switch: Math/math shapes – see Jake.**

MATHEMATICS ENTERS HERE

Pre-requisite math knowledge – students should have already learned about polygons prior to this lesson.

Student will have a set of geometric solids. They will be asked to classify the solids by similarities they see. We will now discuss the five major types of 3-D solid, Prism, Pyramid, Cylinder, Cone, and Sphere. Today we will focus our discussion on the properties of Prisms. Prisms have two parallel, polygon bases. The sides, or lateral faces, are parallelograms. There are two types of prism, Right and Oblique. Right Prisms are defined by a perpendicular line that passes through the center of both bases. In Oblique Prisms the perpendicular line through the center of one base does not pass through the center of the opposite base.

*Have the 3-D shapes on hand, pyramid, prism, cone, cylinder, and sphere for use to identify and then to reclassify.*

**Activity: Go back to the "rocks". Give students a hand lens/magnifying glass and have them look at the "rocks" again. Using what they have learned in math and science about shapes and their importance to minerals, they should now be able to reclassify if necessary.**

SCIENCE COMES BACK HERE

Now we are going to take another look, but a closer look. Before you were just looking at the rocks with the naked eye – now your eyes will be assisted by a magnifying glass or what is also called a hand lens.

1. use a magnifying glass to examine the rocks you had before
2. determine which samples are made of one type of material
   These should be classified as minerals.
3. determine which samples are made of more than one type of material
   These should be classified as rocks. But we are not going to worry about rocks right now – we will come back to rocks later.

How many did you get right the first time you looked at them?

Discussion – this is one way to classify minerals. First of all, what is a mineral? Think about what you might use as a definition. Is it man-made or naturally occurring? Is it organic or inorganic? Is its composition definite or not? Is the arrangement haphazard or does it have an orderly arrangement? A mineral is a naturally occurring, inorganic solid with a definite chemical composition and an orderly arrangement of atoms.

So what does all this mean about minerals? This means that minerals have the following characteristics.

1. **they are made by natural processes** – man did nothing – mineral salts form by the evaporation of sea water and give us the mineral halite – salt that is formed by evaporation in laboratories does not get classified as a mineral because it is formed by man
2. **they are inorganic** – no life processes are involved
3. **they are either an element or a compound of elements** – halite is NaCl which is what humans use to flavor foods, commonly called salt, and
4. **they are crystalline** – this means they are solid and have a definite shape and volume with a pattern

What does it mean to be crystalline? Does it mean like a crystal? When you think of a crystal – what do you think of? Quartz (The capacity measure)? Diamonds? Shiny rocks?

The word **crystalline** means that the atoms are arranged in a pattern that is repeated over and over again. This pattern is based on the atomic structure of the mineral.

Some crystals are formed in definite shapes that you can see from the outside – like clear or amethyst quartz. Other crystals form in other pattern types that are not as obvious.

This is where we can make connections to the 3-D figures in math. While the words are not used in exactly the same way – it is very close.

Some of the crystal family types include:

Hexagonal – in hexagonal crystals, horizontal distances between opposite crystal surfaces are equal. These crystal surfaces intersect to form 60 or 120 degree angles. The vertical length is longer or shorter than the horizontal lengths. Example: clear quartz.

Cubic – minerals in the cubic system are equal in size along all three principal dimensions. Example: halite (salt).

Tetragonal – are similar to cubic except that one of the principal dimensions is longer or shorter than the other two. Example: crocoite.

Rhombic – are similar to cubic except that they fracture on the diagonal.
Examples: monoclinic – calcite.

Orthorhombic – these crystals have dimensions that are unequal in length which results in a brick like effect in the formation. Example: sulfur crystal.

So, we know that minerals are classified according to characteristics, such as how they are formed and what shape they have. But there are still more ways that scientists classify minerals when they are not sure what mineral they have. In our next class period we will discuss more about minerals and ways to tell what mineral we have. This will include the Mohs Hardness Scale as well as other mineral characteristics that can identify which mineral you have.

Evaluation: Give students a worksheet with the math/science words on it and have them cut out some pictures of each item and place them in the appropriate space under the correct new words.

Summary: Define mineral (table rock), address language issues. (It is important to know the language of what you are learning.)

Transition:  Introduction to possible next lesson – Nets in geometry, how else can you identify minerals?

# Is it a mineral or is it just a rock?

## Read the following statements and questions and do or answer what is asked.

1. Look at the “rock” samples provided for you. Try to determine which ones are mineral and which are not. Use whatever knowledge you already have as you think and decide. Put them into two categories.

2. Why did you make the decisions you made? What characteristic did you choose to make your decisions?

_____
_____
_____
_____

3. What similarities do you find with each group? What are the differences? _____
_____
_____
_____

4. Set these aside to learn more.

5. Take another look after the math lesson and see if you might change your mind.

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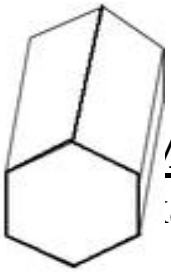
# Matching Science to Math



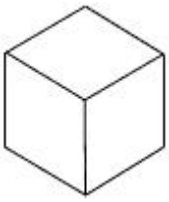
**Math**
agonal prism

**Science**
hexagonal

clear quartz

cube – right square prism

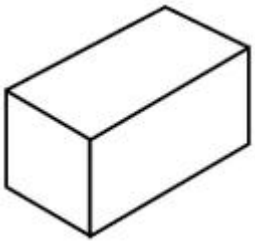
cubic



halite

right rectangular prism

tetragonal



crocoite

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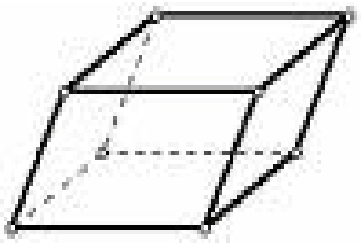
oblique square prism

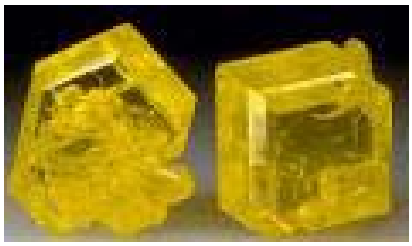


rhombic/rhomboid
monoclinic

calcite

*right rhombus?*

orthorhombic



sulfur crystals

Define mineral -

# Matching Science to Math

| **Math** | **Science** |
| --- | --- |
| right hexagonal prism | hexagonal |
| cube – right square prism | cubic |
| right rectangular prism | tetragonal |

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oblique square prism

rhombic/rhomboid
monoclinic

*right rhombus?*

orthorhombic

Define mineral -

## Assessments

Answer the following multiple choice items by reading each question and choosing the correct answer.

1. A right rectangular prism has how many right angles?

a. 24 b. 8 c. 6 d. 12 e. 4

2. The word “oblique” means what in mathematical terms?

a. to be required to follow the rules

b. neither perpendicular nor parallel to a given line or surface

c. to be flat

d. square rock

3. Quartz is a type of…

a. measurement for capacity b. monetary denomination

c. nutritional health drink d. mineral in a hexagonal shape

4. The word “tetragonal” is most closely related to what term in mathematics?

a. diagonal b. hexagonal

c. rectangle d. rhombus

5. Minerals are always found in the exact shape of 3-D mathematical figures?

a. Agree b. Disagree

Justify your answer. _____
_____
_____

## Guidelines for PowerPoint Presentation

- Resources for creating PowerPoint Presentations:
  - http://www.crocker.k12.mo.us/tech/pptrules.htm
  - http://www.hesston.edu/academic/lrc/fits/POWERPNT/PPTguidelines/sld001.htm
  - http://www.mang.canterbury.ac.nz/people/jfraffen/WritingSuggestions_files/PresentationSuggestions.htm

- Include copyright clarifications (i.e. if you use graphics or ideas from other resources, such as books or the Web).

PowerPoint Presentation for this lesson includes one pertaining to prisms and one pertaining to minerals.