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| **Lesson Title:**  Diamonds in the Rough | |  |
| **Grade Level:** 3rd | **Quarter:**  1st |
| **Standards:**  Science  **S3E1** Students will investigate the physical attributes of rocks and soils.  b. Recognize the physical attributes of rocks and minerals using observation (shape, color, texture), measurement, and simple tests (hardness).  **S3CS3**. Students will use tools and instruments for observing, measuring, and manipulating objects in scientific activities utilizing safe laboratory procedures.  **S3CS5**. Students will communicate scientific ideas and activities clearly.  Math  **MGSE3.NBT.1** (Round to the nearest 10 or 100)  **MGSE3.OA.1** (Interpret multiplication)  **MGSE3.OA.3** (Solve word problems with multiplication)  **MGSE3.OA.7** (multiply within 100)  **MGSE3.MD.2** (Liquid volume and mass) | | |
| **Lesson Essential Question:**   * How can I recognize the physical attributes of rocks and minerals? * How can I measure liquids and solids? * What are some strategies for multiplying multi-digit numbers? | **Vocabulary:**  Physical attribute (shape, color, texture, streak, hardness)  Cup  Geod  Moh’s Hardness Scale  Copper Sulfate  Alum Powder  Epsom Salt  Weight | |
| **Lesson Materials:**   * Liquid Glue * Alum Powder * Epsom Salt * Copper Sulfate * Foam cup * Plastic cup * Plastic eggs * Q-Tips * Aluminum Pans * Hot water (pots or bowls) * Digital Scale * Measuring cups * Mixing Spoons * Containers/Jars * Aladin song (clip on diamonds in the rough) * Madagascar un Earth (movie clip) * SMART file | **Lesson Assessment:**  Student Journal  Teacher Observations  Commercial/Brochure | |
| **STEM Challenge Overview:**  Create 3 crystal geodes. Observe the geodes (measure and weigh). Create a pricing guide to sell the geodes to the jewelers. | | |
| **Teacher Background:**  Students will create 3 different types of Geodes. They will record their observations using the attached observation sheet. The students will measure the weight of the geodes and create a price point to sell to the jeweler. Students should recognize the physical attributes of minerals by using observations, measurement and performing simple test. Some of the physical attributes students should know are: shape, color, texture, streak, and hardness. If given a mineral students should be able to perform test to determine the streak and hardness. What Madagascar UnEarthed <https://www.youtube.com/watch?v=5PBNBBSMgK8>  Making different rocks/crystals- <http://chemistry.about.com/od/growingcrystals/tp/Make-Crystals.htm>  <http://www.feelslikehomeblog.com/2013/03/how-to-grow-your-own-crystal-geodes-cool-science-experiment-for-kids/> | | |
| **INSTRUCTION** | | |
| 1. **Ask/Engage** | | |
| **Challenge:** The mines in Dahlonega, GA have had a shortage in crystals and gems. The jewelry stores don’t have anything to sell! You are challenged to create a crystal to supply the jewelers with. | | |
| 1. **Imagine/Brainstorm** | | |
| **Criteria:**   * Create crystals * Color * Texture * Luster * Hold shape   **Constraints:**   * Use the materials provided, choosing only one vessel for the alum crystal. Choose only one Crystal to sell to Jewelers. * Complete the challenge within the time allotted * (optional) price materials and have students figure out how much it would cost them to create 1 crystal. Use this information to teach students about profit margins.   Have students individually think of a solution to the problem and draw and label their design. | | |
| 1. **Plan/Design** | | |
| Work with a partner to decide on supplies  Draw picture of materials needed  Review steps to making each crystal recipe | | |
| 1. **Create** | | |
| Student teams build their design according to their design plan and directions | | |
| 1. **Day 1 and 2 (using technology)** | | |
| Create a business plan to sell your jewelry to the jeweler  Create an advertisement to sell your jewelry to the public | | |
| 1. **Evaluate/Improve – (day 3)** | | |
| Students evaluate their design for success.  Did it meet the established criteria?  Did their final design match their planned design?  How would students improve their design? (different vessel)  Which crystal recipe turned out the best for your group? Class? | | |

Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



Diamonds in the Rough

**Challenge**: The mines in Dahlonega, GA have had a shortage in crystals and gems. The jewelry stores don’t have anything to sell! You are challenged to create a crystal to supply the jewelers with. Which Recipe produces the best Geod? Good luck and be creative!

**Criteria:**

• Use at least 2 different Recipes

• Use 2 different containers

• You must explain how to recognize the physical attributes of minerals

**Constraints:**

• Use the materials provided

• Complete the challenge within the time allotted

**Materials:** Various materials will be provided by your teacher.

1. **ASK / ENGAGE:** What is the problem you are being asked to solve?

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1. **IMAGINE/BRAINSTORM:** What are some possible solutions to the problem that you are trying to solve? After you brainstorm, draw and label your ideas below.

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| **Idea #1** | **Idea #2** |

1. **PLAN/DESIGN:** Share your ideas with your group and collaborate to decide on a final design plan. Draw your team’s design below and make a list of the materials that you will need to complete your design.

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| **Team Design Plan**  Calculate the area of your display case: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | **Materials List** |

1. **CREATE/TEST**: Use your Final Design Plan to create and build your solution. Test your design. Did it work? Why or Why not?

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1. **EVAULATE/IMPROVE:**  How well did your design work? Did your solution solve the problem within the given constraints?

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How can you improve your design? How can you make it better? Draw and label your improved design below.

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| **Improved Design Plan** |

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| **Chemical A Recipe** | **Chemical B Recipe** | **Chemical C Recipe** |
| **3/4 of a cup of alum powder** [Alum Crystals](http://chemistry.about.com/cs/howtos/ht/alumcrystal.htm)  These crystals resemble diamonds, except they are much larger [than any diamond crystals](http://chemistry.about.com/od/jewelrychemistry/ig/Gemstone-Photo-Gallery/Diamond-Crystal.-1BQ.htm) you're likely to see! Alum is a cooking spice, so these crystals are non-toxic, although they don't taste good, so you won't want to eat them. To make alum crystals, simply mix:   * 2-1/2 tablespoons alum * 1/2 cup very hot tap water   Crystals should start forming in your container within a few hours. You can also grow these crystals on rocks or other surfaces for a more natural look. Individual crystals may be scraped off of the container with a fingernail and allowed to dry on a paper towel. [More »](http://chemistry.about.com/cs/howtos/ht/alumcrystal.htm)  **Or**  You will need to measure 3/4 of a cup of alum powder.  Read more: <http://www.feelslikehomeblog.com/2013/03/how-to-grow-your-own-crystal-geodes-cool-science-experiment-for-kids/> | **Epsom Salt** [Epsom Salt Crystal Needles](http://chemistry.about.com/od/crystalrecipes/ht/cupofcrystals.htm)  These [delicate crystal spikes](http://chemistry.about.com/cs/howtos/ht/crystalspikes.htm) grow in a cup in your refrigerator within a couple of hours, or sometimes more quickly. Simply mix together:   * 1/2 cup Epsom salt * 1/2 cup very hot tap water * food coloring (optional)   Place the cup in the refrigerator. Use care when scooping out the crystals to examine them, as they will be fragile.  **Tips:**   1. Don't use [boiling water](http://chemistry.about.com/od/howthingswork/f/boiling-point-of-water.htm) to prepare your solution. You will still get crystals, but they will be more threadlike and less interesting. The temperature of the water helps control the concentration of the solution. 2. If you like, you can place a small object at the bottom of the cup to make it easier to remove your crystals, such as a quarter or plastic bottle cap. Otherwise, carefully scoop [the crystal needles](http://chemistry.about.com/od/growingcrystals/ig/Crystal-Projects-Photo-Gallery/Epsom-Salt-Crystal-Needles.-PNW.htm) from the solution if you wish to examine them or save them. | **Copper Sulfate**  [Copper sulfate](http://chemistry.about.com/od/growingcrystals/ig/Crystal-Photo-Gallery/Copper-Sulfate-Crystals.-jve.htm)  crystals are among the easiest and most beautiful crystals that you can grow. The [brilliant blue crystals](http://chemistry.about.com/od/growingcrystals/ig/Crystal-Photo-Gallery/Copper-Sulfate-Crystals.htm) can be grown relatively quickly and can become quite large. Here's how you can grow copper sulfate crystals yourself. Copper Sulfate Crystal Materials  * [copper sulfate](http://aax-us-east.amazon-adsystem.com/x/c/QpfmcIL7tgIhPlqeY8VJtc4AAAFWuOaJ-QEAAAFKAb4O0hU/http:/www.amazon.com/Copper-Sulfate-Pentahydrarte-99%25-Crystals/dp/B007HU4Y5I/ref=as_at/?linkCode=w50&tag=aboutcom02chemistry-20&imprToken=dBYY6s1a-NYl0Zh2-HS8DQ&slotNum=0&s=industrial&ie=UTF8&qid=1445526781&sr=1-1&keywords=copper+sulfate) * water * jar  Make a Saturated Copper Sulfate Solution Stir copper sulfate into very hot water until no more will dissolve. You can just pour the solution into a jar and wait a few days for crystals to grow, but if you grow a seed crystal, you can get much larger and better-shaped crystals. Grow a Seed Crystal Pour a little of the saturated copper sulfate solution into a saucer or shallow dish. Allow it to sit in an undisturbed location for several hours or overnight. Select the best crystal as your 'seed' for growing a large crystal. Scrape the crystal off of the container and tie it to a length of nylon fishing line. Growing a Large Crystal  1. Suspend the seed crystal in a clean jar that you have filled with the solution you made earlier. Don't allow any undissolved copper sulfate to spill into the jar. Don't let the seed crystal touch the sides or bottom of the jar. |

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| Collect and record your data from each recipe | A | B | C |
| [Luster](http://www.mineralogy4kids.org/mineral-properties/luster)  metallic and nonmetallic  Vitreous: The luster of glass  Resinous: The luster of resin.  Pearly: The luster of pearls.  Greasy: Looks like it is covered in a thin layer of oil.  Silky: The luster of silk.  Adamantine: A hard, brilliant luster. |  |  |  |
| [Hardness](http://www.kidsloverocks.com/html/friedrich_mohs.html) Mohs Hardness Scale |  |  |  |
| Color |  |  |  |
| Weight |  |  |  |
| Crystal Shape  Cleavage or Fracture  [Cleavage](http://www.kidsloverocks.com/html/mineral_cleavage.html) |  |  |  |

Data

**Math Extension Questions:**

**1. Which recipe has your group chosen to sell to the mines in Dahlonega ? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**2. How much are you selling it for?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**

**3. How much did your materials cost you?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**4. How many rocks can you make with those materials?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**5. How much would it cost you to produce 20 crystals? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**6. How much profit would you make if you sold all 20 crystals?\_\_\_\_\_\_\_\_\_\_\_\_\_\_**