



Lighting Up the Gem & Mineral Hall

7th Grade

Duration

2 classes (depending on length of class) and a Museum visit

Location

Classroom and
Gem & Mineral Hall

Supplies

- See individual lessons

Standards

Science 6.a.b.c.e.f
CCS ELA Grades 6-12:
Language Standards 4.b
Reading Standards for
Literacy in Science and
Technical Subjects 4

Vocabulary

Refract
Reflect
Transmit
Absorb
Transparency
Translucent
Opaque
Luster



Module Overview

Gems and minerals provide a medium to explore the properties of light.

Module Purpose

This lesson set provides students with opportunities to practice literacy skills and apply content knowledge in an authentic setting.

Module Outline

1. In one class before visiting, students review their knowledge of the properties of light and build vocabulary before visiting the Museum
2. During a visit to the Museum students relate the properties of light to the properties of gems and minerals, and observe how light interacts with different specimens.
3. In 1 post-visit class, students create a poster illustrating the way light interacts with a chosen gem from the Hixon Gem Vault.

Module Prerequisite Skills & Concepts

- Students contrast visible light to other types of light.
- Students describe how the eye sees color and how color is perceived.
- Students define and distinguish between reflection, refraction, transmission, and absorption.

Assessment Opportunities

	Before and During the Lesson		End of Lesson
Lesson/Phase	Uncovers Student Ideas	Checks for New Understandings	Evaluates Learning
Pre-Visit	Building Vocabulary	Putting the Pieces Together	
Museum		Gem and Mineral Hall Discoveries	
Post-Visit			Poster

References & Resources

Diamonds: The Science Behind the Sparkle Teachers' Domain. 29 Jan. 2004. Web. 16 May. 2012. <http://www.teachersdomain.org/resource/phy03.sci.phys.matter.sparkle/>



Building Vocabulary

Pre-Visit

Duration

30-60 minutes
(and/or homework)

Location

Classroom

Supplies

- Worksheet
- Pencils
- Copies of "Diamonds: The Science Behind the Sparkle" (See Resources Section)
- Colored pencils, crayons or the like

Purpose

Before visiting the Museum, this phase assesses and develops student background knowledge and vocabulary. Most of this lesson should be review from a prior lesson or unit on the structure and function of the human eye.

Objectives

- Students will trace the path of light from a source, to an object, and into the human eye.
- Students will explain that the wavelength of light an object reflects determines its color.
- Students will define the following prefixes, roots, and suffixes:

Outline

1. Give students 5 minutes to begin the worksheet. Then allow them to share responses with their neighbors. Next call on students to share their thinking with the class. Correct misconceptions, drawing on students' prior lab experiences, readings etc. with the topic.

Worksheet: trace the path of light from the source to the grapes, and to the eye. Those familiar with the subject may show the grapes reflecting violet/indigo light to the eye, and absorbing all others. Without a light source, you are unable to see the grapes at all!

2. Introduce the vocabulary activity. This shows students they can infer the meaning of words if they know the definition of roots, prefixes, and suffixes.
3. Give students the definitions for each word (see table below) and give them time to draw their pictures representing the words.
4. Students will then brainstorm related words –words that are made with the prefix. You may need model some words, for example, *reflect* is related to both *re* and *flect*. You may have students work in small groups or as a class for this, but they should have at least one related word for each word (the more the better!).

5. Ask students to write sentences using one of the related words.
6. If students finish early, ask them to read "Diamonds: The Science Behind the Sparkle."
7. Go over your academic and behavioral expectations for your trip to the Museum and explain the activities students will be completing while there.

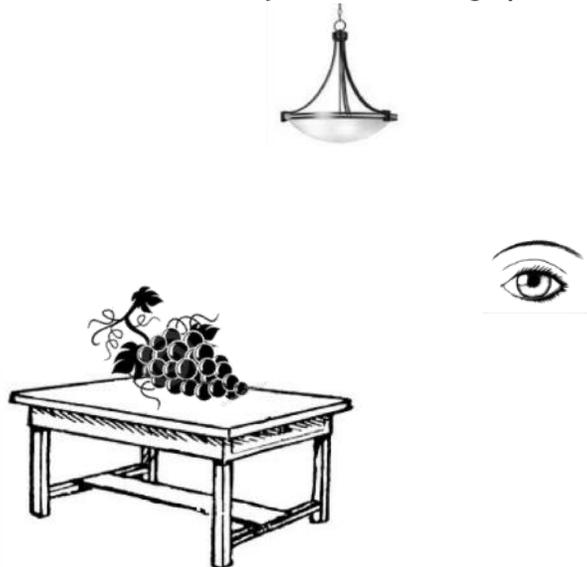
Vocabulary

"Word"	Definition	Related words	Possible Sentence
-flect	To bend	Reflect, flexible, deflect	Reflected rays bend away from the reflecting surface.
-fract	Break, broken	Refraction, fraction fracture	Refracted rays appear broken .
lu-, lum-, luc	light	translucent, luster, luminescence, luminous	Luminescence is the emission of light from an unheated object.
-mit, -miss	To send	Transmit, transmission, emit, missile	Transmitting antennas send radio signals.
opaque	From Latin <i>opacus</i> meaning "shady, shaded, dark"		
Parere	Appear, to "bring forth"	Transparent, apparent, parent	Transparent objects allow light to appear through them.
Re	Back, again	reflect, refract, react, rebound, resonance	Reflected light bounces back toward the source.
Trans	Across	transmit, transparent, translucent, transmission,	Radio transmitters send messages across long distances

It's late, and you're hungry.

So you go into the kitchen to get a midnight snack. When you turn on the lights, you see a bunch of purple grapes on the table.

1. Diagram in the picture below to show how you can see the grapes.

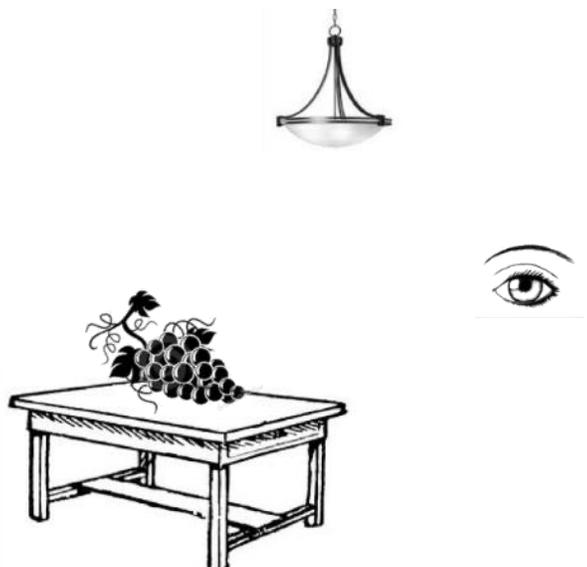


As you step into the room to get your tasty treat, the unthinkable happens— the power goes out! It's totally dark- the curtains are closed, so there is no light entering through the window either.

2. Circle the statement you believe best describes the situation:

- a. You will not see the grapes, no matter how long you are in the kitchen.
- b. You will see the purple grapes after your eyes have had time to adjust to the darkness.
- c. You will see the grapes after your eyes have had time to adjust to the darkness, but you will not see the purple color.

3. Diagram in the picture below to show what happens after the power goes out. You may choose to additionally write your explanation.





Building Vocabulary

Putting the Pieces Together

Using the prefix's, suffixes or roots in the oval, fill in the information in the tables below.

Definition:	Related Words:	flect, flex
Picture:	Sentence:	

Definition:	Related Words:	fract
Picture:	Sentence:	

Definition:	Related Words:	lu, lum, luc
Picture:	Sentence:	

Definition:	Related Words:	-mit, - miss
Picture:	Sentence:	



Building Vocabulary

Definition:	Related Words:	opaque
Picture:	Sentence:	

Definition:	Related Words:	parere
Picture:	Sentence:	

Definition:	Related Words:	re
Picture:	Sentence:	

Definition:	Related Words:	trans
Picture:	Sentence:	



Building Vocabulary

Decode!

Now, use these prefixes, roots, and suffixes to decode the following vocabulary words to the best of your ability:

Luster:

Reflect:

Refract:

Translucent:

Transmit:

Transparent:



Observation

Museum Visit

Duration

40-60 minutes

Location

Gem & Mineral Hall

Supplies

- Worksheet
- Clipboards with LED or similar lights (optional: it is quite dark in the Mineral Hall)
- Pencils

Purpose

The Museum visit allows students to authentically observe the properties of light. It promotes transfer learning by providing concrete experiences to which students may practice applying new terminology. Students also practice using inquiry skills such as observation and classification.

Objectives

- Students will apply knowledge of the properties of light to the appearance of gems and minerals.
- Students will define transparent, translucent, opaque, and luster in terms of minerals.

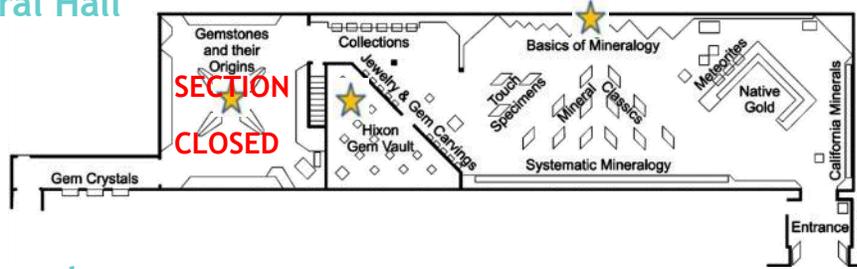
Outline

1. Verbally call on students before entering the hall and ask: What are the expectations for our visit?
2. Assign students to groups of 2-3.
3. **Whole Group:** Gather students in front of the hall, pointing out the general layout of the hall. Each student group will start in a different part of the hall to avoid "clumping" if possible. Make sure each group knows where they are starting and when and where the class will meet up again. NOTE: The "Scavenger Hunt" should be completed after the other activities (5-10 min)
4. **Small Group:** Students work in groups to complete the assignment, observing the exhibits as they go. (30 min)
5. **Whole Group:** Once it is time for your class to move on to the next part of the museum, gather the class back at the entrance to the exhibit.
6. **Small Group:** Either on the bus or back in class, allow students time to share their results with another group or two.



Gem & Mineral Observation

Gem & Mineral Hall

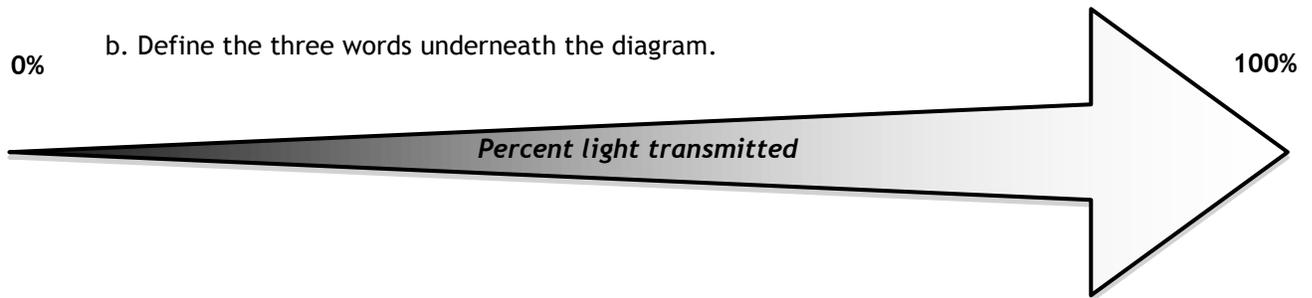


Basics of Mineralogy

1. Observe the TRANSPARENCY and LUSTER displays:

a. Place the words translucent, opaque, and transparent on the diagram below where you think they belong.

b. Define the three words underneath the diagram.



c. What two things determine the *luster* of a mineral?

d. Would a smooth surface reflect or absorb a lot of light? Would it have high or low luster?



2. Observe the display about DOUBLE REFRACTION and draw an illustration of “double refraction” below:

3. Observe the display on FLUORESCENCE:

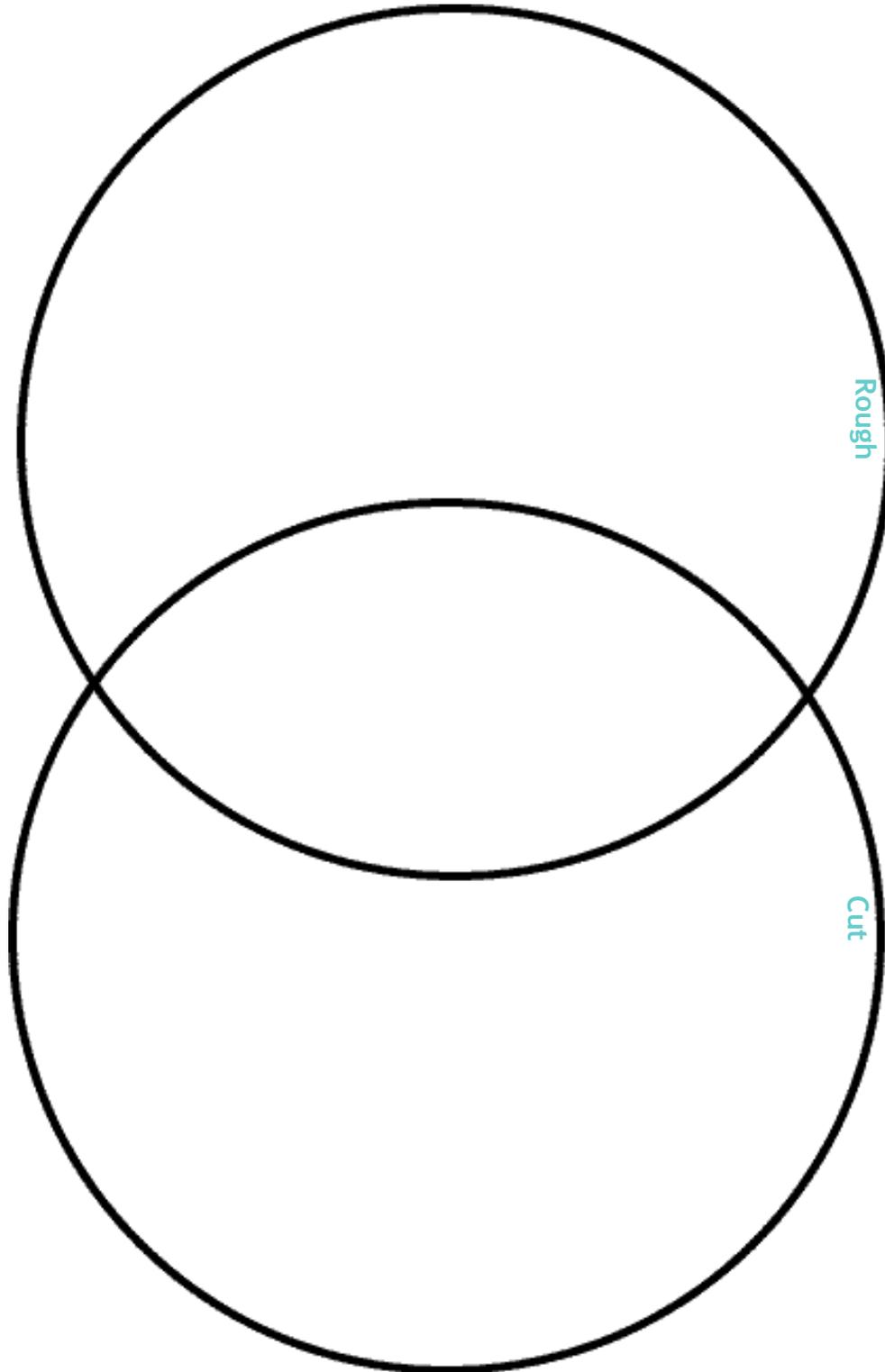
a. What causes some minerals to fluoresce?

b. Can we actually see UV light? Why or why not?



Gemstones and their Origins

Compare the appearance of several "rough" gemstones to "cut" gemstones, paying particular attention to how the light interacts differently with each of them. Summarize your findings in the Venn diagram below.





Lighting up Gems & Minerals: Observation

Hixon Gem Vault

After looking around at each of the pedestals in the vault, choose one gemstone to observe closely. Draw a sketch of the gem and describe its properties (color, luster, transparency, double refraction, etc...). *Draw carefully and take complete notes, you will need this for reference later!*



Lighting up Gems & Minerals: Observation

Reflects AND refracts light		How can you tell that it refracts light?
reflects AND absorbs light, but do NOT transmit any		What word could you use to describe this mineral?
<i>absorbs</i> blue light		How do you know it absorbs blue light?
<i>reflects</i> green light.		How do you know it reflects green light?
<i>is translucent</i>		What does it look like?
has low <i>luster</i>		What does it look like?
exhibits <i>double refraction</i> .		How can you tell?
has high <i>luster</i>		What does it look like?
<i>absorbs</i> all colors of light, but has <i>high luster</i> .		What does it look like?
is your favorite mineral in the exhibit		What colors of light does it <i>reflect</i> ? <i>Absorb</i> ? Is it <i>transparent, translucent, or opaque</i> ? Does it <i>refract</i> light? Does it have high or low <i>luster</i> ?



Review and Reflect

Post-Visit

Duration

30-60 minutes

Location

Classroom

(and/or Homework)

Supplies

- Worksheets & Rubric
- How Light Interacts with a Gem: Rubric
- Posters, poster board, etc...
- Construction paper, Markers, color pencils, crayons
- Scissors
- Glue

Purpose

Following the visit to the Museum, students use sketches of actual gems from the Hixon Gem Vault to create a poster presentation of the properties of light. They should accurately apply scientific concepts and terminology learned throughout the unit to explain why their chosen gem appears as it does. You may have them work in groups or independently.

Objectives

- Students will present possible answers to each other and listen critically to other students' explanations.
- Students will accurately apply their knowledge of the properties of light to scientifically explain the appearance of gems and minerals.
- Students will create a poster, using a rubric as a guide.

Outline

1. Together, introduce students to the "How Light Interacts with a Gem" rubric. Give them a reasonable completion date, depending upon if you will give them time to work on the assignment in class or not.
2. Place students in purposeful groups of 3-4 to work on their posters. They may use past notes and the student worksheets for information.
3. Observe students as they work, correcting misconceptions as you see them.
4. If you would like, have students present their posters when they are finished, either as a gallery walk, or as oral presentations.



Lighting Up the Gem & Mineral Hall

Gem Drawing Rubric

Choose a specimen to carefully draw using two-point perspective. Take the time to note details about your specimen, and present it in an interesting way. You will be assessed using the rubric below:

	4	3	2	1	Score
Content	Poster clearly and accurately explains how light interacts with the gem, including the concepts of reflection, refraction, absorption, and transmission. Clearly and accurately explains why the gem has specific properties, including its transparency, color, and luster.	Poster accurately explains how light interacts with the gem, including at least 3 of the concepts. Accurately explains at least 2 of the gem's properties.	Poster explains how light interacts with the gem, including at least 2 of the concepts. Explains at least 1 of the gem's properties.	Poster does not explain how light interacts with the gem OR any of its properties.	
Labels	All items of importance on the poster are clearly labeled with labels that can be read from at least 3 ft. away.	Almost all items of importance on the poster are clearly labeled with labels that can be read from at least 3 ft. away.	Several items of importance on the poster are clearly labeled with labels that can be read from at least 3 ft. away.	Labels are too small to view OR no important items were labeled.	
Graphics - Clarity	Graphics are all in focus and the content easily viewed and identified from 6 ft. away.	Most graphics are in focus and the content easily viewed and identified from 6 ft. away.	Most graphics are in focus and the content is easily viewed and identified from 4 ft. away.	Many graphics are not clear or are too small.	
Graphics - Originality	Several of the graphics used on the poster reflect a exceptional degree of student creativity in their creation and/or display.	One or two of the graphics used on the poster reflect student creativity in their creation and/or display.	The graphics are made by the student, but are based on the designs or ideas of others.	No graphics made by the student are included.	
Attractiveness	The poster is exceptionally attractive in terms of design, layout, and neatness.	The poster is attractive in terms of design, layout and neatness.	The poster is acceptably attractive though it may be a bit messy.	The poster is distractingly messy or very poorly designed. It is not attractive.	
Use of Class Time	Used time well during each class period. Focused on getting the project done. Never distracted others.	Used time well during each class period. Usually focused on getting the project done and never distracted others.	Used some of the time well during each class period. There was some focus on getting the project done but occasionally distracted others.	Did not use class time to focus on the project OR often distracted others.	