Lesson Topic: Reflection, Absorption, and Transmission of Light

Objective:
Students will be able to:

1. Understand that light waves are reflected, absorbed, and transmitted when interacting with materials.
2. Recognize that light waves respond differently depending on material type.
3. Describe how different wavelengths correspond to color.
4. Explain how color is perceived.

Time Required: 75 minutes

Materials Needed:

- 2 handheld mirrors (locker mirrors, any mirror large enough to bounce light off)
- Flashlight
- Piece of glass (square, large enough to shine light through)
- Solid colored cube, block, or Lego
- Teacher computer with internet access
- Projector/interactive whiteboard
- 1 computer/laptop/iPad per student with internet access
- Reflection, Absorption, and Transmission of Light Worksheet (attached)

Teacher Preparation:

- Assign a Legends of Learning Instructional Quick Play playlist for the day(s) you will be teaching the lesson.
    - Instructional - Middle School - Reflection, Absorption, and Transmission of Light
- Assign a Legends of Learning Content Review Quick Play playlist for the day(s) you will be teaching the lesson.
    - Content Review - Middle School - Reflection, Absorption, and Transmission of Light
- Make copies of Reflection, Absorption, and Transmission of Light Worksheet (1 per student)

Engage (10 minutes):

1. Explain to students that they will see three possible outcomes for light when it interacts with a material.
2. Hold up the piece of glass for the students to see.
3. Ask for a student volunteer to dim the classroom lights and to shine the flashlight on the glass.
4. Ask students to describe what happened and why.
    a. Answer: The light passed through the glass because the glass is transparent.
5. Explain to students that they have observed one possible outcome of light interacting with a material called transmission.
6. Write the definition of transmission on the board.
    a. Transmission – the movement of light through a material
7. Hold up the colored cube for the students to see.

8. Ask for a student volunteer to dim the classroom lights and to shine the flashlight directly on the cube.
9. Ask students why the light was not able to transmit through the cube.
    a. Answer: The cube is solid, opaque, not transparent.
10. Explain to students that they have observed a second possible outcome of light interacting with a material called absorption.
11. Write the definition of absorption on the board.
    a. Absorption – the capturing of light waves by a material
12. Ask for four student volunteers to assist in lighting a small area using light reflection.
13. Have a student volunteer dim the lights while giving Student One and Student Two each a handheld mirror.
14. Give Student Three the flashlight and ask them to shine it in the area, but not at a mirror yet. Advise students on proper safety and avoid shining the flashlight directly into another student's eyes.
15. Ask Student Four to position Student One and Student Two so that when Student Three shines the flashlight at one mirror, the light will bounce to the second mirror.
16. After the demonstration is complete, ask students to describe what they observed.
    a. Answer: The light reflected off the mirror and onto the second mirror. The area lit up more than with just the flashlight alone.
17. Explain to students that they have observed one possible outcome of light interacting with a material called reflection.
18. Write the definition of reflection on the board.
    a. Reflection – the bouncing back of a wave of light when it hits a smooth surface.
19. Explain to students that they will learn more about how light interacts with different objects and materials during the lesson.

Explore (30 minutes):

1. Have your students sign in to Legends of Learning. Instruct students to complete the Instructional playlist.
2. As students complete the assigned games, students will complete the Reflection, Absorption, and Transmission of Light Worksheet.
3. Circulate as students work through the playlist and complete the handout. Listen for evidence of understanding and use this opportunity to correct any misconceptions.

Explain (20 minutes):

1. Review the answers to Reflection, Absorption, and Transmission of Light Worksheet by drawing the diagrams on the whiteboard or using Smartboard. Ask for student volunteers to read a completed sentence from the paragraph.
2. Relate student knowledge to the demonstration at the beginning of the lesson.
    a. What kind of interaction did the light wave have with the mirror? (reflection)
    b. Why did the light reflect and not absorb or transmit? (the mirror is a smooth surface; smooth surfaces reflect light)
    c. What would happen if we used a piece of white poster board instead of a mirror? (the light would be absorbed)
    d. Why would that happen? (because the poster board is opaque)
    e. When we looked at the colored cube, we now understand that the light was absorbed. Who can explain why we see the cube to be a specific color? (the

wavelength associated with that color is reflected from the cube)

Elaborate (5 minutes):

1. Explain to students that the use of mirrors to collect and focus light has real-world applications. For example, the Hubble Telescope uses an 8ft mirror to collect light in part to create pictures of distant parts of our galaxy. Laser security systems also use mirrors to reflect a laser around a room; if the beam is broken, the alarm is triggered.
2. Show this video of a laser bouncing around an area: Laser and Mirrors
3. Ask students to describe what they see happening in the video.
    a. Answer: The light is reflected from one mirror, which reflects the light to another mirror, and so on.

Evaluate (10 minutes):

1. Have your students sign in to Legends of Learning. Instruct students to complete the Content Review playlist.
2. Analyze student results to determine what concepts need to be a focus for reteaching.

Additional Lesson Strategies:

- To use Legends for additional instruction, create a custom playlist with an instructional game and pre and post assessment.
- To use Legends for a quick formative assessment, create a 5-question assessment in a playlist.
- To use Legends for a student-directed experience, create a targeted freeplay playlist.
- Encourage students to play on their own at home in Legends of Learning: Awakening for a student-driven experience including avatars, battling, and quests all centered around topics they are covering in class.

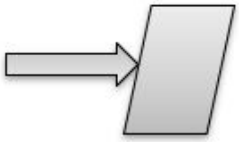
Reflection, Absorption, & Transmission of Light

Name:_____

Directions: While playing the games in Legends of Learning, use what you learn to complete the diagrams and answer the questions below.

Part 1. Guess the material. Observe the interaction of light with each material. Identify the type of interaction **(reflection, absorption, or transmission)** that occurs and the composition of the material **(transparent, opaque, or smooth)**. Write your answer in the space provided.

Mystery material #1



Type of Interaction:_____

Material Composition:_____

Mystery material #2

Type of Interaction:_____

Material Composition:_____

Mystery Material #3

Type of Interaction:_____

Material Composition:_____

Part 2. Use the word bank to complete the following paragraph about visible light.

Prisms separate _____ light into the colors of the visible spectrum. Our eyes perceive a certain color because the wavelength associated with that color is _____ off the object and into our eyes. The wavelengths, which we do not see, are _____ by the object. When wavelengths of light are absorbed by an object, the object gains _____ because the light energy transforms to _____. This concept explains why it is not a good idea to wear dark-colored clothing on a hot, summer day.

Word Bank				
thermal energy	*absorbed*	*reflected*	*heat*	*white*

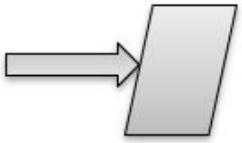
Reflection, Absorption, & Transmission of Light

Name:_____*KEY*_____

Directions: While playing the games in Legends of Learning, use what you learn to complete the diagrams and answer the questions below.

Part 1. Guess the material. Observe the interaction of light with each material. Identify the type of interaction (reflection, absorption, or transmission) that occurs and the composition of the material (transparent, opaque, or smooth). Write your answer in the space provided.

Mystery material #1



Type of Interaction:_____*Absorption*_____

Material Composition:_____*Opaque*_____

Mystery material #2

Type of Interaction:_____*Reflection*_____

Material Composition:_____*Smooth*_____

Mystery Material #3

Type of Interaction:_____*Transmission*_____

Material Composition:____*Transparent*_____

Part 2. Use the word bank to complete the following paragraph about visible light.

Prisms separate __*white*_____ light into the colors of the visible spectrum. Our eyes perceive a certain color because the wavelength associated with that color is ___*reflected*_____ off the object and into our eyes. The wavelengths, which we do not see, are ____*absorbed* _____ by the object. When wavelengths of light are absorbed by an object, the object gains _____*heat*_____ because the light energy transforms to _____*thermal energy*_____. This concept explains why it is not a good idea to wear dark-colored clothing on a hot, summer day.

Word Bank				
thermal energy	*absorbed*	*reflected*	*heat*	*white*