

Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Answer Key: Operation Midnight Sun: 3rd Grade Light Benders Quiz

Construct solutions for optical puzzles involving total internal reflection in fiber optics and the precision mechanics of periscope Design.

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**1. A team of deep-sea explorers is using a fiber-optic cable to send light to a dark trench. Why does the light stay inside the curvy cable instead of shining out the sides?**

**Answer:** B) The light bounces off the inside walls repeatedly

This is called total internal reflection; light hits the boundary of the cable at a specific angle that causes it to bounce back inward rather than passing through.

**2. A magician places a coin at the bottom of a bowl and fills it with water. Even though the coin hasn't moved, it now looks higher up because light \_\_\_\_ as it exits the water.**

**Answer:** A) speeds up and bends

Refraction occurs because light changes speed when moving from water to air, causing our eyes to perceive the object at a shallower depth.

**3. Smooth, shiny surfaces like a polished silver trophy cause light rays to scatter in many different directions.**

**Answer:** B) False

Smooth surfaces create regular reflection where light bounces off at the same angle it hit; rough surfaces are what cause light to scatter.

**4. If you were building a periscope to see over a high wall, how would you need to position the two mirrors to be successful?**

**Answer:** A) Facing each other at 45-degree angles

To direct light around corners, mirrors must be angled at 45 degrees so the reflection travels down the tube to the second mirror.

**5. An optometrist gives a patient a pair of glasses. These lenses work because they \_\_\_\_ light to hit the back of the eye perfectly.**

**Answer:** B) refract

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Lenses use refraction (the bending of light) to correct vision by changing the focal point of the light entering the eye.

**6. A prism creates a 'rainbow' effect because different colors of light bend at slightly different angles when passing through the glass.**

**Answer:** A) True

White light is made of many colors; each color has a different wavelength and refracts at a different amount, causing them to spread out.

**7. You are designing a solar oven. Which material would be most effective at gathering light to create intense heat at one specific point?**

**Answer:** B) A curved, bowl-shaped mirror

A concave (curved inward) mirror reflects light toward a single focal point, concentrating the energy to create heat.

**8. Light travels fastest through \_\_\_\_, which is why it bends when it enters a denser material like a glass marble.**

**Answer:** C) the air

Light travels faster in less dense mediums like air or a vacuum; the change in speed upon entering a denser medium causes refraction.

**9. If you shine a flashlight at a blue wall in a completely dark room, why do you see the color blue?**

**Answer:** C) Blue light is reflected back to your eyes

Objects appear a certain color because they reflect that specific wavelength of light while absorbing the other colors in the spectrum.

**10. Light can only be reflected by man-made objects like mirrors and metals.**

**Answer:** B) False

Many natural objects reflect light, including water, ice, the moon, and even the waxy surface of a leaf.