Learning Target: I can read passages about wave behavior and then use the information gathered to answer comprehension questions.

FSI 8th Grade Science Reading for Meaning – Wave Behavior

"The Journey of Waves: Light and Sound in Motion"

When you shout across a canyon or shine a flashlight on a lake, you are witnessing how waves interact with the world. Both **light and sound travel as waves**, yet they behave very differently depending on what they encounter.

Light waves are electromagnetic—they do not require a medium and can move through empty space. This is why sunlight reaches Earth through the vacuum of space. **Sound waves**, in contrast, are mechanical—they need a medium such as air, water, or solids to travel. That's why astronauts can see each other in space but cannot hear each other without radios.

When light or sound meets a surface, several interactions may occur: **reflection, refraction, absorption, diffraction,** or **transmission.**

- **Reflection** occurs when waves bounce back. Light reflecting off a smooth surface like a mirror creates a clear image because the surface is even. Sound reflection, or an echo, happens when waves bounce off a hard surface like a canyon wall. A rough surface scatters light or sound in many directions, reducing clarity.
- **Refraction** happens when a wave changes speed and direction as it moves from one medium to another. When light enters water, it slows down, bending toward the normal line, which makes objects under water appear bent. Sound also refracts—air near the ground at night can be cooler than air above it, causing sound to bend and travel farther.
- **Absorption** occurs when materials take in wave energy. A black shirt absorbs most light wavelengths and converts them to heat. Thick curtains or foam panels absorb sound waves, preventing echoes.
- **Diffraction** is the bending of waves around barriers or through openings. Sound can easily diffract—this is why you can hear someone talking even when they're around a corner. Light, with much shorter wavelengths, diffracts far less noticeably, so you can't see around corners.
- **Transmission** occurs when waves pass through a material. Transparent materials like glass transmit light, while translucent materials scatter it. For sound, walls made of thin wood may allow sound to transmit, while dense concrete blocks most of it.

Understanding these interactions helps scientists and engineers design everything from **noise-reducing walls** along highways to **fiber-optic cables** that transmit light signals for high-speed internet. Both light and sound can reflect, refract, absorb, diffract, and transmit—but their differences in wave type and wavelength explain why we experience them so differently.

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DOK 3–4 Multiple Choice Questions

1. When light passes from air into water, it slows down and bends. Which best explains why this happens? (DOK 3)
A. The water reflects all light frequencies equally.
B. Light changes speed due to a difference in medium density.
C. Water absorbs all wavelengths of light.
D. Light waves require a medium to travel through space.

2. A student shines a flashlight at different materials: glass, wood, and metal. Which observation correctly matches the wave interaction with the material? (DOK 3)
A. Glass absorbs light; wood reflects it; metal transmits it.
B. Glass transmits light; wood absorbs it; metal reflects it.
C. Glass refracts light; wood transmits it; metal absorbs it.
D. Glass reflects light; wood refracts it; metal absorbs it.

3. On a foggy night, a car's headlights appear dimmer and spread out. Which interaction primarily explains this effect? (DOK 3)
A. Reflection B. Diffraction C. Refraction D. Scattering (a form of diffraction)

4. Why can you hear someone talking behind a corner but cannot see them? (DOK 3)
A. Sound diffracts more easily because of its longer wavelength.
B. Light waves travel faster than sound waves.
C. Sound reflects better off smooth surfaces.
D. Light is absorbed by air particles.

5. Engineers designing recording studios often use foam panels on the walls. What function do these panels serve? (DOK 3)
A. Increase sound reflection to amplify the music.
B. Absorb sound waves to reduce echoes.
C. Refract sound waves to change pitch.
D. Transmit sound to other rooms.

6. A student observes that when sunlight hits a mirror at a 30° angle, it reflects off at the same angle. What model best explains this behavior? (DOK 3)
A. Waves scatter in all directions from the surface.
B. The angle of reflection equals the angle of incidence.
C. Light energy is absorbed and converted to heat.
D. Light changes speed and bends toward the normal line.

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7. A scientist creates a model comparing sound and light waves passing through different materials. Which observation best describes how their transmissions differ? (DOK 4)
A. Both travel faster in denser materials.
B. Light slows down in denser materials; sound speeds up.
C. Light and sound travel at the same speed in solids.
D. Sound and light both travel slower in solids than in gases.

8. During a temperature inversion, cooler air is trapped near the ground with warmer air above. Distant sounds seem louder. Which wave interaction explains this? (DOK 4)
A. Refraction of sound waves bending toward cooler air
B. Reflection of sound waves off the warm layer
C. Absorption of sound energy by cooler air
D. Diffraction of sound waves through warm air gaps

9. A black t-shirt and a white t-shirt are left in the sun. The black one feels hotter. Which statement best models the difference in light wave interactions? (DOK 3)
A. The white shirt transmits more light energy.
B. The black shirt absorbs more light wavelengths.
C. The white shirt refracts light toward the surface.
D. The black shirt reflects most light energy.

10. Engineers are developing windows that reduce outside noise while allowing sunlight in. Which combination of wave interactions would best achieve this? (DOK 4)
A. Transmit sound and reflect light
B. Absorb sound and transmit light
C. Reflect sound and absorb light
D. Refract both sound and light

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