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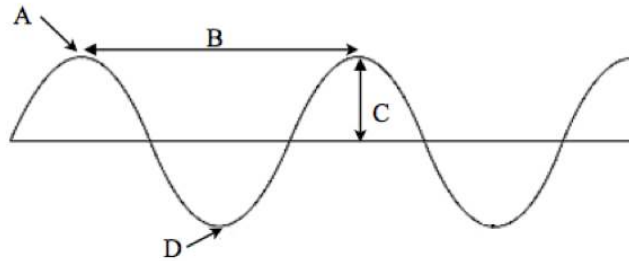
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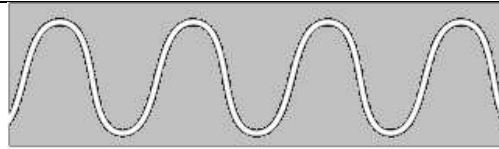
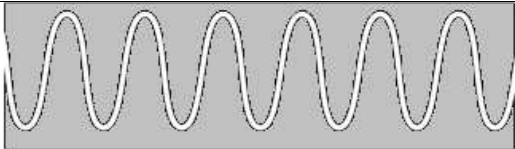
Waves Review – Answer Key

Use the figure below to answer questions 1-4.



1. What does letter A represent? **Crest**
2. What does letter B represent? **Wavelength**
3. What does letter C represent? **Amplitude**
4. What does letter D represent? **Trough**
5. What wave property affects:
 - The pitch of sound: **Frequency and Wavelength**
 - The volume of sound: **Amplitude**
 - The color of light: **Frequency and Wavelength**
 - The brightness of light: **Amplitude**
6. High amplitude = **High** energy
7. High frequency = **High** energy
8. High wavelength = **Low** energy

Compare the figures below by answering Questions 9-16 with the words **low**, **high**, or **the same**:



- | | |
|------------------------------------|------------------------------------|
| 9. Frequency: High | 14. Frequency: Low |
| 10. Wavelength: Short (low) | 15. Wavelength: Long (high) |
| 11. Pitch: High | 16. Pitch: Low |
| 12. Volume: Same | 17. Volume: Same |
| 13. Brightness: Same | 18. Brightness: Same |

19. Describe the differences between mechanical waves and electromagnetic waves.

Mechanical waves require a medium to travel, whereas electromagnetic waves can travel through

the vacuum of space (they DO NOT require a medium to travel).

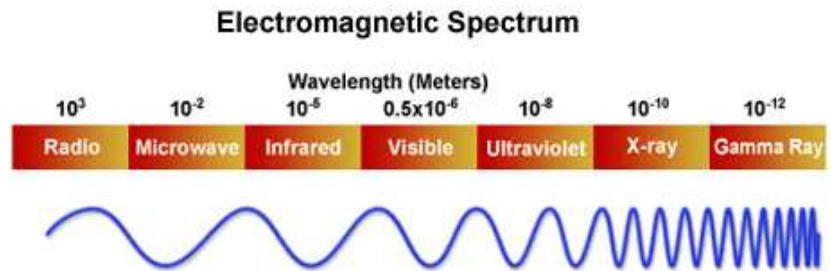
20. Which type of wave cannot travel through space? **Mechanical Waves**
- Explain why: **Mechanical waves require a medium to travel (for example, air or water). The vacuum of space does not have a medium—there is no matter.**

21. Vibrating matter is likely to create a **sound**/light wave.

22. Using the Electromagnetic Spectrum diagram to the right, which electromagnetic wave transfers the most energy? **Gamma Rays**

- Explain:

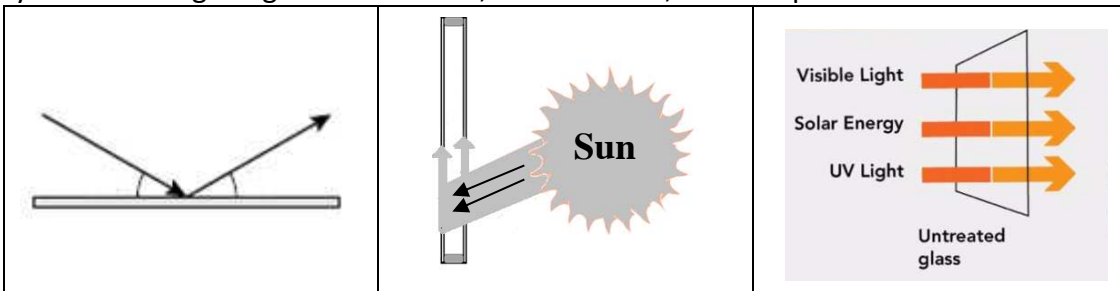
Gamma Rays have the greatest frequency (shortest wavelength), therefore transfer the MOST energy.



23. Define the following wave interactions with matter:

- Reflection: **The bouncing back of waves when they strike a surface**
- Transmission: **The passing of a wave through a material**
- Absorption: **The transfer of energy from a wave into a material**
- Refraction: **The bending of a wave when it enters a new medium**

24. Identify the following images as Reflection, Transmission, or Absorption.



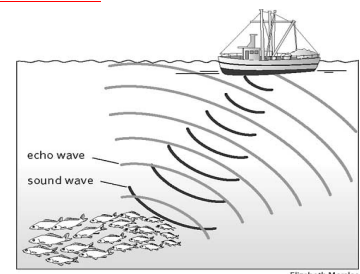
Reflection

Absorption

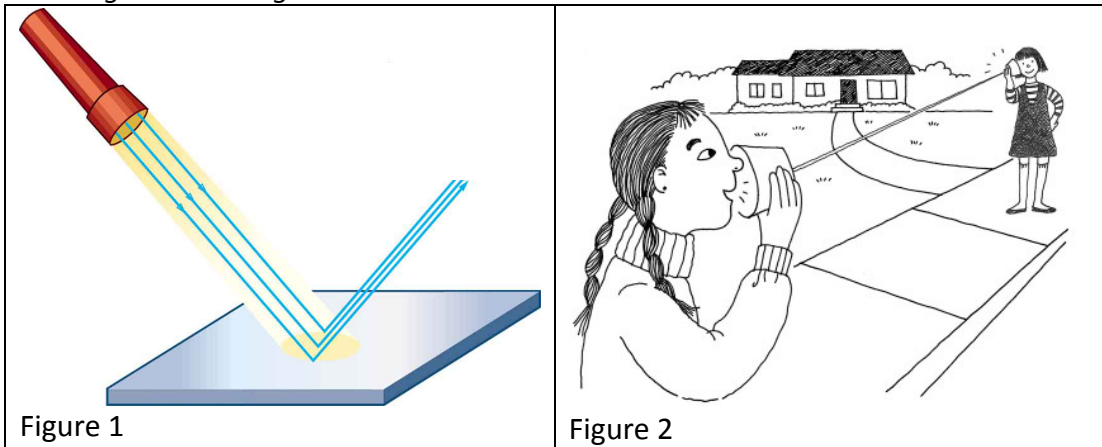
Transmission

25. Sonar uses sound waves to measure the distance between objects underwater. What wave interaction is used in sonar? **Reflection**

- Explain: **The sound waves strike objects underwater and bounce back (echo). Sonar must therefore be reflection.**



Use Figure 1 and Figure 2 below to answer Questions 26-29.



26. Which Figure shows electromagnetic waves? **Figure 1 (light waves are electromagnetic waves)**

27. Which Figure requires a medium to transfer energy? **Figure 2 (Sound waves are mechanical waves, which require a medium to travel)**

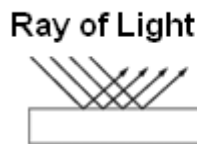
28. Which Figure shows reflection? **Figure 1 (Light waves strike the surface and bounce off)**

29. Which Figure shows transmission? **Figure 2 (Sound is being transferred through the string)**

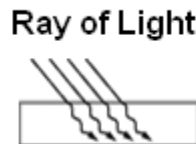
30. Explain how a light wave's properties relate to its color.

Frequency and wavelength affect the color of light. The order of colors from lowest to greatest frequency (or longest to shortest wavelength) are: Red, Orange, Yellow, Green, Blue, Indigo, Violet.

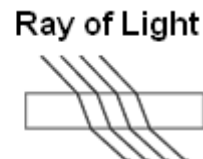
Each picture below shows a ray of light interacting with a different material. One material is a shiny metal, one material is clear plastic, and one material is painted black.



Material A



Material B



Material C

31. Identify the surfaces as shiny metal, clear plastic, or painted black. Explain your answer for each.

a) Material A: **Shiny metal**

- Explanation: **Shiny metal reflects light rays (e.g., aluminum foil).**

b) Material B: **Painted black**

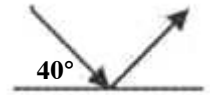
- Explanation: **A surface that is painted black absorbs light rays without reflecting any back (e.g., asphalt).**

c) Material C: **Clear Plastic**

- Explanation: **Clear plastic is transparent, allowing light to be transmitted through the material.**

32. If the light ray hits a mirror at a 40° angle, what angle will the ray of light be reflected? 40°

- Explanation: The Law of Reflection states that the angle of incidence will always equal the angle of reflection.



33. When the amplitude of a wave is doubled, its energy **quadruples**.

- Explanation using the relationship between the variables: Energy is proportional to the square of the amplitude ($E \propto A^2$)

34. When the frequency of a wave is doubled, its energy **doubles**.

- Explanation using the relationship between the variables: Energy is proportional to frequency ($E \propto F$)

35. How does a digital signal differ from an analog signal?

In an analog signal, information is translated into a CONTINUOUS signal with VARYING amplitudes. In a digital signal, information is translated into BINARY format with only TWO amplitudes.

36. Explain the advantages of digital signals over analog signals.

Digital recordings are more reliable, can be stored for future use, and can be transmitted over long distances without degradation.

37. Which color of light refracts (bends) the most? **Violet**

- Explanation: Violet has the greatest frequency (shortest wavelength), therefore refracts the most.

38. Which color of light refracts (bends) the least? Red

- Explanation: Red has the lowest frequency (longest wavelength), therefore refracts the least.