Student Name: _____ Date: _____ Class: _____

Waves- Study Guide

Students will explore the wave nature of sound and electromagnetic radiation.

a. Identify the characteristics of electromagnetic and mechanical waves.

b. Describe how the behavior of light waves is manipulated causing reflection, refraction, diffraction, and absorption.

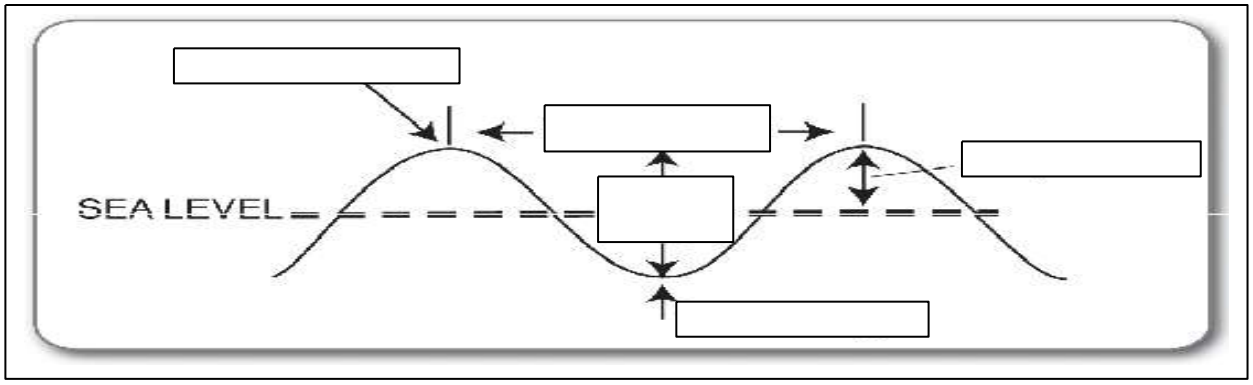
c. Explain how the human eye sees objects and colors in terms of wavelengths.

d. Describe how the behavior of waves is affected by a medium (such as air, water, solids).

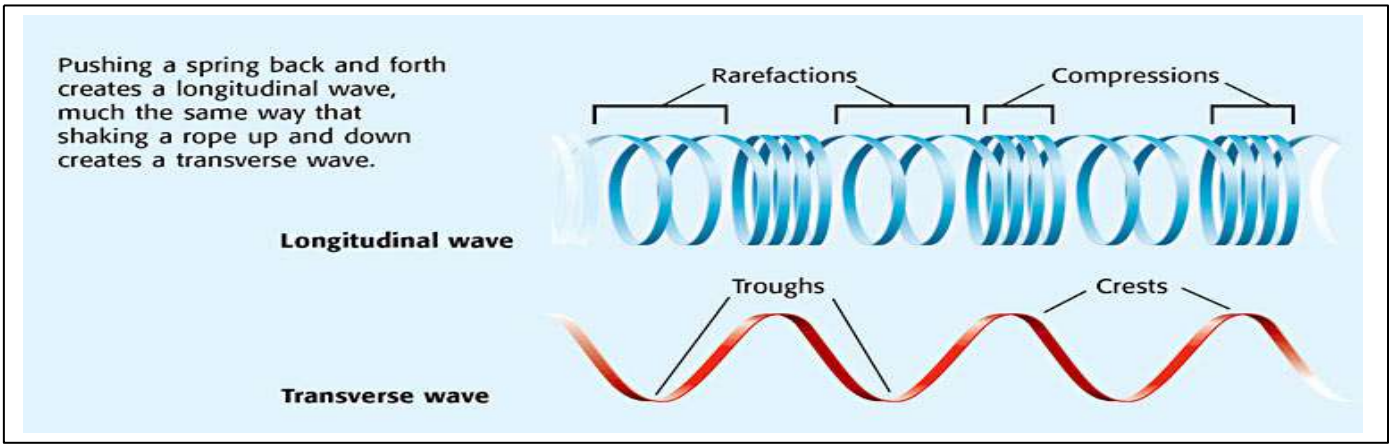
e. Relate the properties of sound to everyday experiences.

f. Diagram the parts of the wave and explain how the parts are affected by changes in amplitude and pitch.

1. What are waves? A **wave** is any disturbance that transmits energy through matter or empty space.
2. What is a medium? A **medium** is a substance through which a wave can travel. A medium can be a solid, a liquid, or a gas. **MECHANICAL WAVES NEED A MEDIUM.**
3. Some waves can transfer energy ***without*** going through a medium. These types of waves are called **electromagnetic waves**. Some examples are visible light, microwaves, radio signals, and x-rays.
4. **Label the parts of a wave by filling in the boxes on the diagram below:**

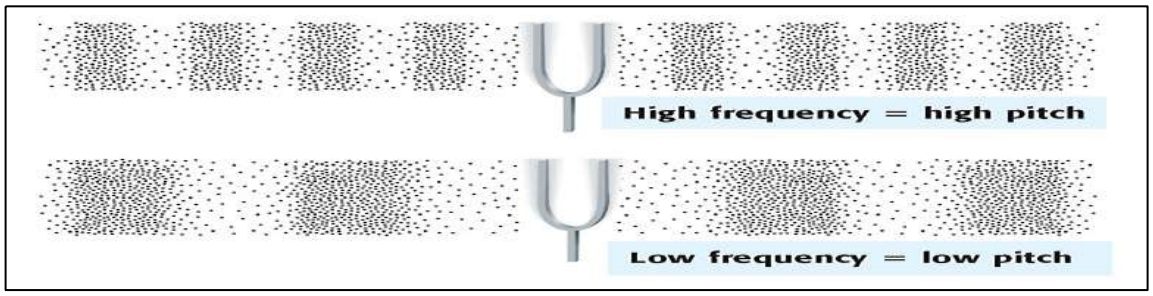


5. The two main types of **mechanical** waves are called ***transverse*** and ***longitudinal waves***.
6. Waves in which the particles vibrate in an up-and-down motion are called **transverse.**
7. In a **longitudinal wave,** the particles of the medium vibrate back and forth along the path that the wave moves.

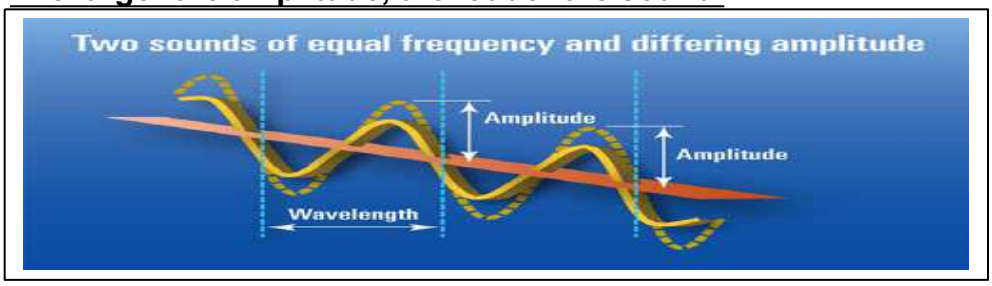


8. A **sound wave** is an example of a longitudinal wave. Sound waves travel by **compressions** and **rarefactions** of air particles.
9. All sound waves require a medium (plural, *media*). Most of the sounds that you hear travel through air at least part of the time. But sound waves can also travel through other materials, such as water, glass, and metal.

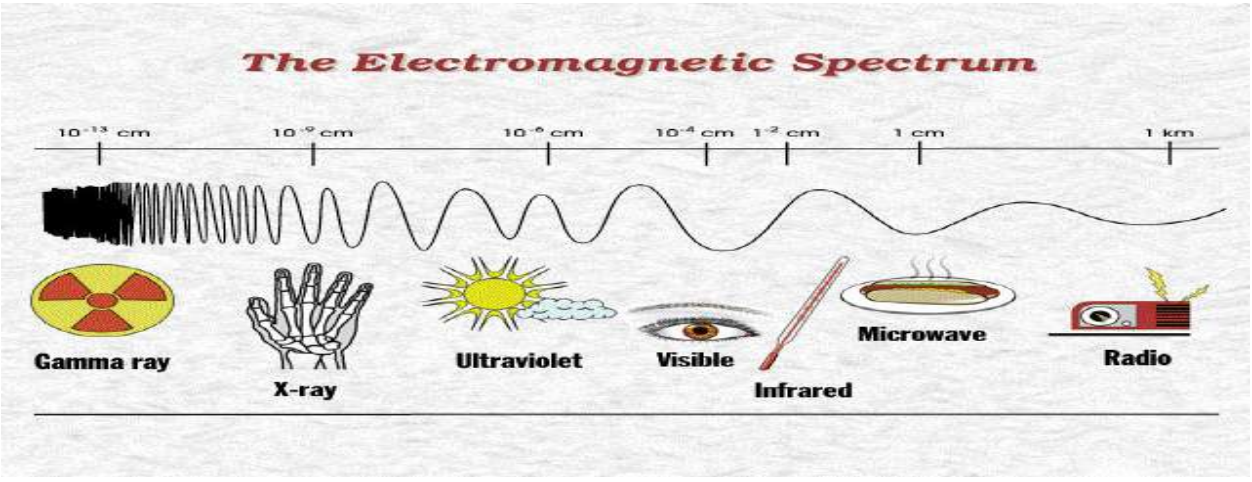
10. ***Reflection*** is the bouncing back of a wave after it strikes a barrier. A reflected sound wave is called an **echo.**
11. How low or high a sound seems to be is the **pitch** of that sound.
12. The ***frequency*** of a wave is the number of crests or troughs that are made in a given time.



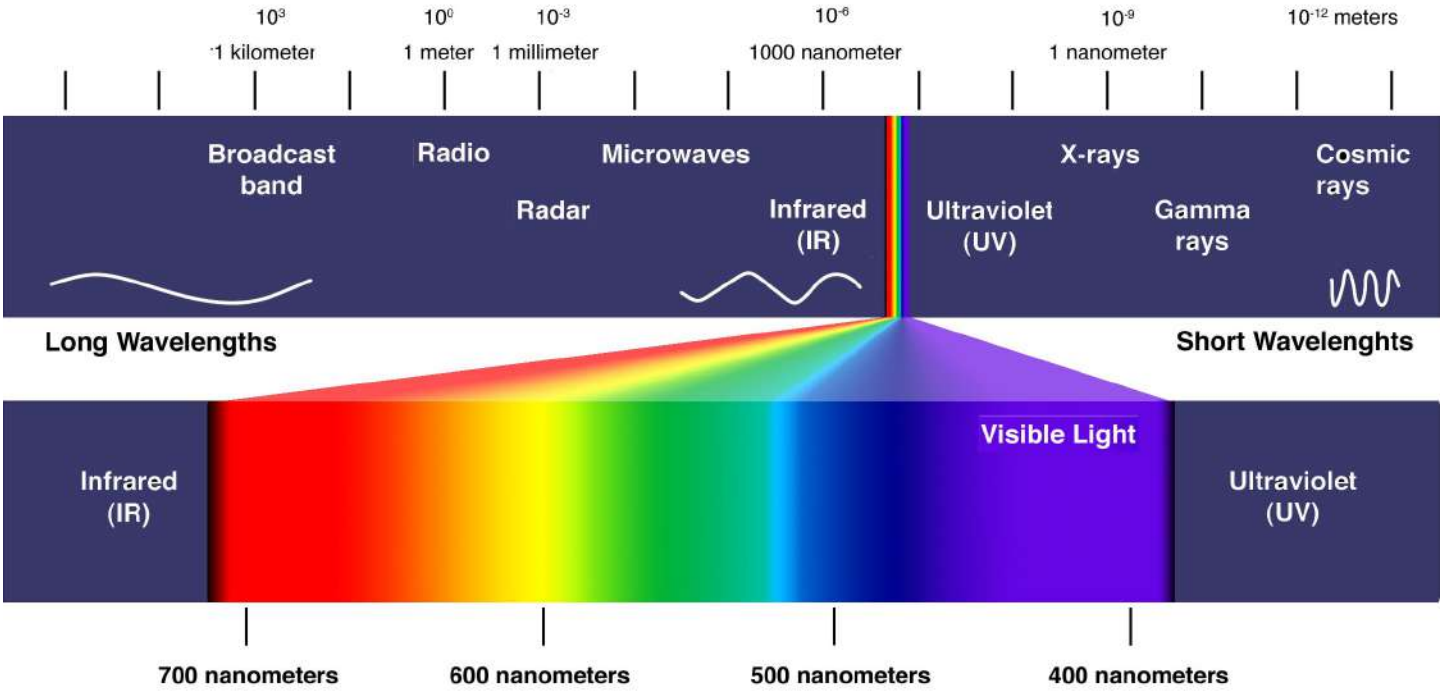
13. The **Doppler Effect** is the apparent change in the frequency of a sound caused by the motion of either the listener or the source of the sound.
14. **Loudness** is a measure of how well a sound can be heard. The ***amplitude*** of a wave is the largest distance the particles in a wave vibrate from their rest positions.
    The larger the amplitude, the louder the sound.

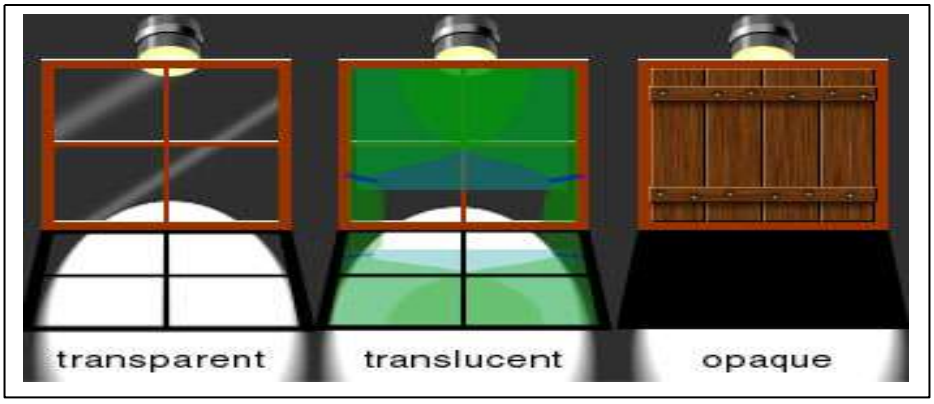


15. **Resonance** happens when a vibrating object causes a second object to vibrate also.
16. Light is an electromagnetic wave. Electromagnetic waves interact in predictable ways.
17. An **electromagnetic wave** is a wave that can travel through empty space or matter and consists of changing electric and magnetic fields.



18. Some of the energy that reaches Earth from the sun is visible light. The visible light from the sun is white light. ***White light* is visible light of all wavelengths combined.**
19. Humans see the different wavelengths of visible light as different colors**.** The **longest** wavelengths are seen as **red** light. The **shortest** wavelengths are seen as **violet** light.





20. **Reflection** happens when light waves **bounce off an object**. Light reflects off objects all around you.
21. **Refraction** is the ***bending*** of a wave as it passes **at an angle from one substance, or material, to another.** Refraction of light waves occurs because the speed of light varies depending on the material through which the waves are traveling.
22. **Diffraction** is the ***bending*** of waves **around barriers or through openings**. The amount a wave diffracts depends on its wavelength and the size of the barrier or the opening.

Practice Questions

23. Refraction occurs when a wave changes its _____ as it passes through a different medium.

A. color B. frequency C. intensity D. speed

24. Houses with carpet are much quieter than houses with tile or hardwood floors because of _____.

A. absorption B. diffraction C. reflection D. refraction

25. Which is an example of a compressional wave?

A. X-ray B. gamma ray C. sound wave D. water wave

26. What causes refraction?

A. Electromagnetic waves cannot travel through solids. B. Electromagnetic waves travel at different speeds through different mediums. C. Electromagnetic waves compress more when they travel through denser mediums. D. Electromagnetic waves get closer together when they go through dense mediums like glass.

27. 8. An echo is an example of sound wave ____.

A. absorption B. reflection C. diffraction D. refraction

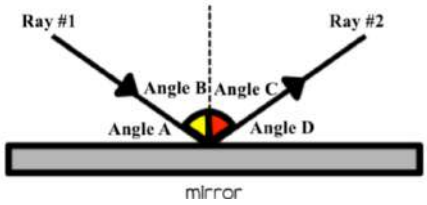
28. X-rays, UV waves, and sound waves all have what in common?

A. They are all part of the electromagnetic spectrum. B. They all transmit energy.
C. They all need a medium to be transmitted. D. They can all travel in a vacuum like outer space.

29. Which of the following would result in constructive interference if they were to collide?

A. a crest and a trough B. two crests C. a compression and a rarefaction D. a crest and a rarefaction

30. In the figure to the right, the angle of incidence is identified by:



A. angle A B. angle C C. angle B D. angle D ____

31. In the same figure ray #2 is called the:

A. reflected ray B. normal C. refracted ray D. incident ray

32. Light waves travel the fastest in _____.

A. a solid B. a liquid C. a gas D. empty space

33. Sound waves travel the fastest in _____.

A. a solid B. a liquid C. a gas D. empty space