Reflection & Refraction

1. Define Reflection:

2. Define Refraction:

Reflection

3. Reflection:
   When the boundary is very rigid:
   ____________________________________________________________
   When the boundary is less rigid:
   ____________________________________________________________

4. Law of Reflection
   (1) _______________________________________________________
   (2) _______________________________________________________
   (3) _______________________________________________________
   (4) _______________________________________________________

5. Mirrors:
   The number of reflecting rays is ____________________________
   and every one obeys the ________________________________.
   ____________ are created through reflection that can be seen by an observer but cannot be projected on
   a screen because ________________________________________.

6. Define Diffuse Reflection:

   _________________________________________________________
   ______________________________

Draw a picture to compare a diffuse reflection and a regular reflection:

Regular Reflection       Diffuse Reflection

Though these many different angles that incident light rays encounter cause reflection in many directions, each ray
still obeys the ________________________________,

7. If differences in elevations of a surface are less than
   __________________________________________ of the light that falls
   on it, that surface is considered polished.
   Whether a surface is a diffuse reflector depends on the
   __________________________________________ of the waves it reflects.

8. Reflection of Sound: ______________________ is an example of reflected sound.
   Fraction of sound energy reflected from a surface is more
   when the surface is ______________________________, but
   less when the surface is ________________________________.
   Non-reflected sound energy is ____________________________.

9. Define Reverberation:

   _______________________________________________________

   A balance of __________________________ and ___________________
   must be held into account while doing acoustic design.

10. Reflection example: Light is incident on a flat surface, making an angle of 10° with that surface.
    (a) What are the angle of incidence and the angle of reflection?

    (b) Sketch the path of the reflected beam on the diagram.

    (c) If the mirror rotate counter-clockwise 20° without changing the light source, what are the new angle of incidence and the new angle of reflection?
11. Define Wavefronts:
________________________
_______________________________

12. At each point along a wavefront, wave is moving
_________________________ to the wavefront. ____________ can be used to represent the direction of motion of the wave.

Sketch a diagram to show the wavefronts of an incident ray from air entering water and the wavefronts of the refracted ray in water. Identify the angle of incident, the angle of refraction, and the wavelength.

13. Waves travel faster in deep water than in shallow water. If the water waves move toward the right, complete the follow diagram. Show the incident ray, refracted ray, normal, wavelengths before/after the refraction, and the wavefronts of the refracted water waves.

14. What is the refraction of sound? When will it happen?
________________________
_______________________________

15. During the day, the ground is warmer than the air, the sound waves travels ___________ near the ground, so the sound waves ___________.
During the night, the ground is cooler than the air, the sound waves travels ___________ near the ground, so the sound waves ___________.

16. When light rays enter a medium in which their speed decreases, rays __________________________.
When light rays enter a medium in which their speed increases, rays __________________________.

17. Sketch the path of the light ray passing from air to a rectangular glass block at an angle and then back to the air.

18. Light paths are __________________________ for both reflection and refraction.

19. Law of refraction (Snell’s Law)
Define the refraction index (n) and write its formula:
________________________
_______________________________

Snell’s Law: ___________________________________.

n₁ = 

Mr. Lin
20. Example: What’s the speed of light in diamond?

Identify the colors of light after dispersion:

21. Example: A ray of light travels from air to corn oil. If the ray of light in air makes an angle of 30.00 degrees to the normal, (a) what is the angle of refraction in corn oil? (b) What’s the speed of light in corn oil?

22. Example: A ray of light travels from air to water. If the ray of light in water makes an angle of 10.00 degrees to the normal, what is the angle of incidence in air?

23. Example: The speed of light in an unknown medium is measured to be $2.206 \times 10^8$ m/s. (a) What is the index of refraction of the medium? (b) Does it match any of the materials listed in your Reference Table?

Atmospheric Refraction

24. What is mirage:

Dispersion in a Prism

25. Light of frequencies closer to the ___________ of electron oscillators in a medium travels more slowly in the medium.

Visible light of higher frequencies travels ___________ than light of lower frequencies, as the natural frequency of most transparent materials in the ___________ part of the spectrum.

Light of different frequencies travel at different ___________ in transparent materials, they will refract differently and bend at different ___________.

26. What are the conditions to see a rainbow?

27. How do raindrops make a rainbow—Identify the color of light in the following diagram. Explain the process of color dispersion.

28. How do raindrops make a rainbow—Identify the colors of a rainbow in the following diagram. Explain why all the rainbows have the same color arrangement.

Total Internal Reflection

29. At ________________, a light ray is totally reflected within a medium, and is called ________________.

This type of reflections can reach ___________% of reflection.

30. Optical fibers uses ________________ to transmit light.