

Unit Review: Nature of Light

1. Give a short explanation of each of the following models of light:
 - a) Emission theory.
 - b) Tactile theory.
2. What is the source of electromagnetic waves?
3. Is the color spectrum simply a small segment of the electromagnetic spectrum? Explain your answer.
4. How do the frequencies of infrared, visible, and ultraviolet light compare?
5. What evidence can you cite to support the idea that light can travel through a vacuum?
6. By referring to the electromagnetic spectrum in your notes, answer the following questions:
 - a) Which has the longer wavelength, radio waves or visible light?
 - b) Which has the longer wavelength, visible light or gamma rays?
 - c) Which has the higher frequency, ultraviolet or infrared?
 - d) Which has the higher frequency, ultraviolet or gamma rays?
7. Which has more energy, low frequency light or high frequency light?
8. What is a photon?
9. How long does it take for light to travel across the diameter of Earth's orbit around the sun ($d = 3.0 \times 10^{11} \text{ m}$)?
10. How long does light take to travel a distance of one light year?
11. Waves spread out when they pass through an opening. Does spreading become more or less pronounced for narrower openings? What is this behavior called?
12. Is it possible for a wave to be canceled by another wave? Explain.
13. Does wave interference occur for waves in general, or only for light waves? Give examples to support your answer.

14. The speed of light in an unknown medium is measured to be $2.21 \times 10^8 \text{ m/s}$.
- What is the index of refraction of the medium?
 - What is the unknown medium? (Hint: Check the table in your notes.)
15. Determine the speed of light in cubic zirconia ($n = 2.16$).
16. A ray of light is passing from water ($n = 1.33$) into an unknown solid. The incident angle in the water is 56.4° and the refracted angle in the unknown solid is 42.1° . Determine the index of refraction of the unknown solid.
17. A ray of light strikes the boundary between air and oil at an incident angle of 36.1° . The speed of light in the oil is $2.27 \times 10^8 \text{ m/s}$. Determine the angle of refraction.
18. What was Thomas Young's discovery?
19. What is the cause of the fringes of light in Young's experiment?
20. In our everyday environment, diffraction is much more evident for sound waves than for light. Why?
21. Why do radio waves diffract around buildings while light waves do not?
22. When monochromatic light illuminates a pair of thin slits, an interference pattern is produced on a wall behind. How will the distance between the fringes of the pattern for red light differ from that for blue light?
23. In one trial of Young's experiment, two slits separated by 0.25 mm produce an interference pattern in which the fifth bright band is located 12.8 cm from the central bright band when the screen is placed 8.2 m away. Determine the wavelength of the light used.
24. In another trial of Young's experiment, two slits separated by 0.5 mm produce an interference pattern on a screen 525 cm away. The fifth and second bright bands are 98 mm apart. Determine the wavelength of the light used.
25. Suppose a pair of loudspeakers a meter or so apart emit pure tones of the same frequency and loudness. When a listener walks past in a path parallel to the line that joins the loudspeakers, the sound is heard to alternate from loud to soft. What is going on?
26. A tuning fork of frequency 440 Hz is sounded at the same time as a guitar string. If 6 beats are heard in 3 seconds, what are the possible frequencies of the guitar string?
27. According to the Doppler effect, when the source of a sound is moving towards you, you will hear a _____ frequency than the source is actually producing.

28. According to the Doppler effect, when the source of a sound is moving away from you, you will hear a _____ frequency than the source is actually producing.
29. How do the wave speeds compare for high frequency and low frequency electromagnetic waves?
30. Which has more energy per photon, red light or blue light?
31. What is the photoelectric effect?
32. Why does blue light eject electrons from a certain surface, while red light does not?
33. Will bright blue light eject more electrons than dim blue light?
34. Does the photoelectric effect support the wave model or the particle model of light?