1. Which of the following best explains why light exhibits diffraction?
    - a) Light is a stream of particles.
    - b) Light travels in a straight line.
    - c) Light behaves as a wave when it encounters an obstacle or slit.
    - d) Light changes speed when moving through different media.
2. What happens to the wavelength of light as it passes from air into water?
    - a) It increases.
    - b) It decreases.
    - c) It remains the same.
    - d) It becomes zero.
3. In Young's double-slit experiment, the separation between adjacent bright fringes will increase if:
    - a) The distance between the slits increases.
    - b) The distance between the screen and the slits decreases.
    - c) The wavelength of the light decreases.
    - d) The wavelength of the light increases.
4. Which phenomenon provides evidence that light has a wave nature?
    - a) Photoelectric effect
    - b) Interference
    - c) Reflection
    - d) Refraction
5. What happens to the speed of light when it passes into a medium with a higher refractive index?
    - a) Increases
    - b) Decreases
    - c) Remains the same
    - d) Becomes zero

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6. Describe how Young's double-slit experiment demonstrates the wave nature of light. Include a diagram.

7. Explain the relationship between wavelength, frequency, and speed of light. Provide an example calculation using values for visible light.
8. What is the path difference required for constructive interference in a two-slit interference experiment?
9. Compare and contrast the phenomena of diffraction and refraction. Provide one real-world example of each.
10. A laser beam with a wavelength of 650 nm650 \, \text{nm}650nm shines through a diffraction grating with 5000 lines/cm5000 \, \text{lines/cm}5000lines/cm. Calculate the angle of the first-order diffraction maximum.

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11. A monochromatic light source of wavelength 600 nm600 \, \text{nm}600nm is used in a double-slit experiment. The screen is placed 2.0 m2.0 \, \text{m}2.0m away from the slits, which are separated by 0.20 mm0.20 \, \text{mm}0.20mm. Calculate the distance between the central maximum and the first-order bright fringe.
12. A beam of white light passes through a prism and separates into a spectrum of colors. Explain this phenomenon in terms of the wave nature of light and refractive index.
13. In a single-slit diffraction experiment, the width of the central maximum is observed to be 4.0 mm4.0 \, \text{mm}4.0mm on a screen 2.0 m2.0 \, \text{m}2.0m away. The wavelength of the light is 500 nm500 \, \text{nm}500nm. Determine the slit width.
14. Light with a wavelength of 450 nm450 \, \text{nm}450nm falls on a soap film of refractive index n=1.4n = 1.4n=1.4. If constructive interference is observed, calculate the minimum thickness of the film.
15. A student uses a diffraction grating with 600 lines/mm600 \, \text{lines/mm}600lines/mm to analyze the spectrum of a light source. The first-order maximum is observed at an angle of 25∘25^\circ25∘. Determine the wavelength of the light.

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16. Why does the color of the sky appear blue during the day but red/orange during sunrise and sunset? Use the concept of scattering to explain your answer.
17. Explain why interference patterns are not observed when two flashlights are used instead of coherent light sources.
18. Discuss how the wave nature of light is crucial in the design of optical instruments such as microscopes and telescopes.
19. Describe the conditions required for total internal reflection to occur and how this phenomenon is utilized in fiber optics.
20. If light is both a wave and a particle, how does the wave nature explain phenomena like interference, while the particle nature explains the photoelectric effect?