

Study Guide: Optical Handling and Positioning

1. Describe the nature of optical materials and their transmission and reflection characteristics as a function of wavelength.
2. Define the term *refractive index*. Why does it vary with wavelength?
3. What are the factors that determine the transmission of light through a medium?
4. Record the thermal, mechanical, and chemical properties of optical materials used in making optical components.
5. Briefly explain how materials are chosen for specific use in the visible, ultraviolet, and infrared region.
6. Describe how single and multiple anti-reflection coatings and filters are made and used. Be sure to include: How optical coatings are deposited on a substrate. How can the thickness of the coating be controlled and measured?
7. Explain the use of 4 different mountings for lenses, mirrors, and other optical components.
8. Tell how single and multi-dimensional translational and rotational stages work.
9. Describe how to inspect surfaces of optical elements for scratches, chips, or digs.
10. Tell how to handle, clean, and store optical elements. Be sure to include: What are the precautions to be taken in cleaning an optical element such as a lens or a mirror? What are the materials that are required to clean a lens?
11. Name some of the materials that can be used as a window in the ultraviolet, visible, and infrared regions respectively.
12. What are the important criteria in choosing a window material?
13. Why is germanium more suitable as a window material for a CO₂ laser than NaCl?
14. Explain what Brewster's angle is and where is it useful?
15. How does a change in temperature affect the optical properties of a material?

16. What are the important thermal properties that have to be considered when selecting a material for an optical component?
17. How does mechanical stress affect the optical properties of a window material?
18. How is the thickness of an AR coating determined?
19. Describe the following type of filters and state what they are used for:
 - a. Neutral density
 - b. Short wavelength pass filter
 - c. Band pass
 - d. Multiple layer
20. Name five different types of lens and filter holders. Explain their advantages and disadvantages.
21. What are the types of surface defects that can occur on an optical surface? How can they be observed?
22. Name three types of optical benches. State one advantage and one disadvantage of each.
23. Explain the experimental procedure for determining the flatness of an optical element.
24. What are the precautions to be taken for storing optical components?
25. If the wavelength of light incident perpendicular to an interface in air is 650 nm and its wavelength changes to 644 nm in the medium, what is the refractive index of the medium?
26. The absorption coefficient of a material is 4.5 cm^{-1} . If the thickness of the material is 12 mm, find the percentage of light transmission.