

Advanced Optics Concepts

Optics · Answer Key · 12 Questions

1. Which phenomenon is primarily responsible for the formation of a rainbow?

- A) Diffraction
- B) Polarization
- C) Reflection and Refraction**
- D) Scattering

2. The Abbe number quantifies what property of a transparent material?

- A) Its refractive index at a specific wavelength
- B) Its ability to transmit light
- C) The variation of refractive index with wavelength (dispersion)**
- D) Its resistance to scratching

3. What is the primary mechanism behind the operation of a laser?

- A) Stimulated emission**
- B) Spontaneous emission
- C) Absorption
- D) Fluorescence

4. The phenomenon of 'waveguide dispersion' in optical fibers is caused by:

- A) The scattering of light by imperfections in the core
- B) The dependence of the speed of light in the cladding on frequency
- C) The confinement of light within the fiber structure and the resultant wavelength-dependent propagation modes**
- D) The absorption of specific wavelengths by the fiber material

5. What is the fundamental principle behind holographic image formation?

- A) Refraction and reflection of light from a single point
- B) Interference and diffraction of light waves**
- C) Absorption and re-emission of photons
- D) Total internal reflection within a crystal

6. In a Michelson interferometer, a shift of one interference fringe corresponds to a change in optical path length of:

- A) Half a wavelength**
- B) One wavelength
- C) Two wavelengths
- D) One quarter of a wavelength

7. Which type of optical aberration is characterized by the inability of a lens to focus all wavelengths of light to the same point?

- A) Spherical aberration
- B) Coma
- C) Astigmatism
- D) Chromatic aberration**

8. The polarization of light by reflection from a non-metallic surface, as described by Brewster's Law, occurs when:

- A) The angle of incidence equals the angle of reflection
- B) The reflected and refracted rays are perpendicular**
- C) The incident light is monochromatic
- D) The surface is perfectly smooth

9. What property of a material determines its transparency to specific wavelengths of electromagnetic radiation?

- A) Its density
- B) Its crystal structure
- C) Its electronic band gap**
- D) Its surface reflectivity

10. In the context of Fourier optics, what does a lens do to an object's light distribution?

- A) It inverts the image
- B) It performs a spatial filtering operation
- C) It performs a spatial Fourier transform**
- D) It amplifies the intensity

11. What is the primary basis for the operation of a 'quarter-wave plate'?

- A) It reflects half the incident light
- B) It induces a specific phase shift between orthogonal polarization components**
- C) It absorbs all light except for specific wavelengths
- D) It doubles the frequency of the incident light

12. The phenomenon of Snell's Law governs the behavior of light at the interface between two media, and it is a consequence of:

- A) Newton's laws of motion
- B) The conservation of momentum
- C) Fermat's principle of least time**
- D) The uncertainty principle