

Astrophysical Optics

Optics · Answer Key · 10 Questions

1. What is the physical phenomenon that allows the James Webb Space Telescope to observe the light from the earliest galaxies despite its redshift?

- A) Quantum tunneling
- B) Infrared detection**
- C) Nuclear fusion
- D) Doppler shifting

2. Which optical aberration is corrected by the Advanced Camera for Surveys on the Hubble Space Telescope to achieve high-resolution imaging?

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

3. What is the specific name for the optical effect where light from a distant quasar is bent and magnified by a foreground galaxy cluster?

- A) Rayleigh scattering
- B) Gravitational lensing**
- C) Diffraction spikes
- D) Total internal reflection

4. What optical principle describes the angular resolution limit of the Keck Observatory telescopes?

- A) Rayleigh criterion**
- B) Brewster's angle
- C) Snell's law
- D) Malus's law

5. In spectroscopy, which series of spectral lines in hydrogen is primarily responsible for the red color observed in H-alpha emission nebulae?

- A) Lyman series
- B) Paschen series
- C) Balmer series**
- D) Brackett series

6. What is the primary function of a coronagraph within a space telescope?

- A) To amplify infrared signal
- B) To block light from a central star**
- C) To filter cosmic radiation
- D) To calculate stellar parallax

7. Which mechanism causes the twinkle effect, or scintillation, of stars when viewed from the surface of Earth?

- A) Interstellar dust absorption
- B) Atmospheric refractive index turbulence**
- C) Gravitational time dilation
- D) Photon polarization

8. In the context of the Cosmic Microwave Background, what is the optical term for the shift in photon energy as they traverse large-scale gravitational potentials?

- A) Sachs-Wolfe effect**
- B) Zeeman effect
- C) Stark effect
- D) Photoelectric effect

9. What is the optical limitation that prevents a ground-based optical telescope from resolving a feature smaller than the wavelength of light divided by the telescope's aperture?

- A) Diffraction limit**
- B) Chromatic distortion
- C) Polarization shift
- D) Phase mismatch

10. Which phenomenon involves the splitting of spectral lines in the presence of strong magnetic fields, frequently observed in the solar atmosphere?

- A) Zeeman effect**
- B) Compton scattering
- C) Doppler broadening
- D) Faraday rotation