Study Guide: Geometrical Optics

1. Distinguish between *light rays* and *light waves*.

2. State the *law of reflection*.

3. State *Snell's law of refraction*.

4. Define *index of refraction* and give typical values for glass, water, and air.

5. Explain the *critical angle* of incidence for the interface between two optical media.

6. Describe the process of *total internal reflection*.

7. Describe how total internal reflection can be used to trap light in fibers for use in telecommunication.

8. Describe *dispersion* of white light.

9. Describe the relationship between *collimated light* and the *focal points* of convex and concave *mirrors*.

10. Describe the shapes of three typical *converging (positive)* thin lenses and three typical *diverging (negative)* thin lenses.

11. Describe the relationship between *collimated light* and the *focal points* of a *thin lens*.

12. Describe the *f-number* and *numerical aperture* for a lens and explain how they control image brightness.

13. State the *ray-tracing rules* to locate the images formed by plane and spherical mirrors.

14. State the *ray-tracing rules* to locate the images formed by lenses.

15. State the summary of ray optics for mirrors.

16. Identify the four "special" prisms listed in reading.

17. The speed of light in a transparent semiconductor material is measured to be 7.37×10^7 m/s. What is the index of refraction of this material? What is a good guess for the identity of this material?

18. A laser beam is incident on a quartz prism of index *n* = 1.46 at an angle of incidence of 60º. What are the angles of reflection and refraction at the air-quartz interface?

19. An isosceles prism with equal base angles of 75º produces an angle of minimum deviation of 30º when a laser beam is passed through it. What is the index of refraction of this material? What might the material be?

20. Based on the dispersion curve for light flint glass given in Figure 4-12, estimate to 2 decimal places the value of n_λ at λ = 400 nm and λ = 650 nm.
