

Physics 31B Final Part II (175 pts) Spring, 2003

1. Suppose that the beam of light in the following figure travels in air before it's incident on the glass plate ($n_g = 1.5$) at 60° . (a) At what angle will it be transmitted into the block? (b) show that the beam emerges from the far side parallel to the original incoming light.

2. Suppose we wish to make a microscope (which can be used with a relaxed eye) out of two positive lenses both of focal length 25 mm. Assuming the object is positioned 27 mm from the objective, (a) how far apart should the lenses be and (b) what magnification can we expect?

3(a). What is the minimum incident angle for internal reflection at the interface between two materials of indices 1.33 and 2.40, respectively?

3(b). A block made of a light crown glass, with an index of refraction of 1.501, is incidence if a ray is to be totally internally reflected within the glass? How will that change if the water is replaced by benzene?

4(a). Blue light at 480 nm impinges perpendicularly on a pair of very narrow parallel slit apertures separated by 0.15 mm. A fringe pattern appears on a screen 2.00 m away.

How far from the central axis on either side will we find the second-order bright bands?

4(b). Parallel rays of blue light from an argon ion laser ($\lambda = 487.99\text{nm}$) are incident on a screen containing two very narrow slits separated by 0.200 mm. A fringe pattern appears on a sheet of film held 1.00 m away.

5(a). A rather expensive well-corrected (for aberrations) lens consists of three simple lenses of focal lengths +10 cm, -20 cm, and +5.0 cm all glued together. What is the combined focal length? Can it form real images?

5(b). Someone wearing corrective contact lenses having a focal length of -5.0 m can see quite normally. Determine this person's unaided far-point.

6. Use $F = \gamma^3 ma$ and $w = \int F dx$ to derive the relativistic kinetic energy.

7(a). Use thick lens formula to derive the focal length of the combination of two thin lens with separation d .

7(b).

