Double-slit interference

1. HR.p967. What is the distance on the screen between adjacent maxima near the center of the interference pattern?
The wavelength of the light is $\lambda = 546\ nm$, the slit separation is $d = 0.12\ mm$, and the slit-screen separation is $L = 55\ cm$. Assume small-angle-approximation is valid.
Answer: $\Delta y = 2.5\ mm$

2. HR.35.21. In a double slit-experiment the distance between slits is $5\ mm$ and the slits are $1\ m$ from the screen. Two interference patterns can be seen on the screen: one due to light of wavelength $480\ nm$ and the other due to light of wavelength $600\ nm$.
What is the separation on the screen between the 3rd order bright fringes of the two interference patterns?
Answer: $\Delta y = 7.2\ 10^{-5}\ m$

3. YF.35.43. Suppose you illuminate two thin slits by monochromatic coherent light in air and find that they produce their 1st interference minima at $\pm 35.2°$ on either side of the central bright spot.
You then immerse these slits in a transparent liquid and illuminate them with the same light. Now you find that the 1st minima occur at $\pm 19.46°$ instead.
What is the index of refraction of this liquid?
Answer: $n = 1.79$

Thin-film interference <u>in air</u>

4. HR.p976. White light with a uniform density across the visible wavelength range of 400 to $690\ nm$ is perpendicularly incident on a water film of index of refraction $n_2 = 1.33$ and thickness $L = 320\ nm$ that is suspended in air.
At what wavelength λ is the light reflected by the film the brightest to an observer?
Answer: $\lambda = 567\ nm$

Thin-film interference – lens coating

5. HR.p.977. A glass lens is coated on one side with a thin film of magnesium fluoride (MgF_2) to reduce reflection from the lens surface. The index of refraction of MgF_2 is 1.38 and that of glass 1.50. Assume that the light is approximately perpendicular to the surface.
What is the least coating thickness that eliminates via interference the reflections at the middle of the visible spectrum $(\lambda = 550\ nm)$?
Answer: $L = 100\ nm$

Thin-film interference – oil on water

6. HR.35.55. A disabled tanker leaks kerosene $(n = 1.2)$ into the ocean, creating a large slick on top of the water $(n = 1.3)$.
a) If you are looking straight down from an airplane, while the Sun is overhead, at a region of the slick where the thickness is $460\ nm$, for which wavelengths of visible light is the reflection brightest because of constructive interference?
b) If you are scuba diving directly under the same region of the slick, for which wavelengths of visible light is the transmitted intensity strongest?
Answer: $a)\ 552\ nm\ (green);\ b)\ 442\ nm\ (blue)$