

## Workshop module 12 - Physics 114, Spring 2015

1. A two-slit interference experiment is set up, and the fringes are displayed on a screen. Then the whole apparatus is immersed in a swimming pool. How does the fringe pattern change?
2. Monochromatic light is directed at normal incidence on a thin film. There is destructive interference for the reflected light, so its intensity is very low. If the thickness of the film is  $d$  and the index of refraction of the film substance is  $n$  (assume the film is in air), what is the equation that determines which wavelengths will exhibit destructive interference. Ponder and discuss this, if the light is not reflected, what happened to the energy of the incident light? How does this relate to the need for coatings on a camera lens?
3. The human ear is especially sensitive to sounds at frequencies around 3500 Hz. Show that this can be understood by regarding the ear's auditory canal, which extends about 2.5 cm from the outside ear to the eardrum, as a "nonreflecting coating" for sound. ... waves is waves! Ain't this cool?
4. A plane transmission grating has 4000 slits/cm. Assume normal incidence. The  $\alpha$  and  $\delta$  lines emitted by atomic hydrogen have wavelengths 656 nm and 410 nm, respectively. Compute the angular separation in degrees between these lines in a) the first order spectrum and b) the second order spectrum.
5. You find that when UV light with a wavelength of 254 nm from a mercury arc falls upon a clean copper surface, the stopping potential necessary to stop emission of photoelectrons is 0.181 V. a) What is the photoelectric threshold wavelength for this copper surface? b) What is the work function for this surface?
6. How would you expect the ionization energy of Ne to compare to Li? How about the radius? Why?
7. How would you expect the wavelength of the  $K\alpha$  x-ray line for tungsten to compare to that for gold? Do you understand why  $Z-1$  comes into the relevant equation?
8. Which device can resolve smaller details in a sample: an electron microscope or a visible light microscope? Why?