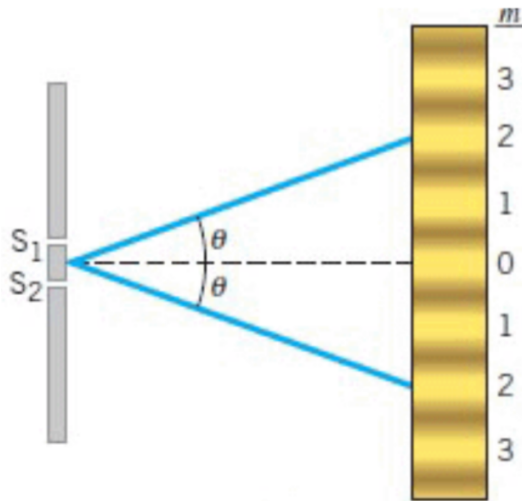# Physics 10164 – Spring 2020 Exam 4

1. (25 pts) Light of wavelength 550 nm is incident on two slits separated by 0.25 mm. The resulting interference pattern is projected on to a screen 7.2 meters away from the slits.

a) What is the path difference (in waves) between light from the slit S_1 and light from slit S_2 that is incident on the wall exactly in between the locations marked m = 2 and m = 3?

b) What is the same path difference in nanometers?

c) If the two slits S1 and S2 are moved further apart, does your answer to (a) increase, decrease or stay the same? Justify your answer qualitatively or mathematically.

d) Suppose the screen is centered on the point opposite the two slits, as shown, and is 85 cm wide. How many complete bright fringes will fit on the screen (don't forget the count the central bright fringe)?

2) (25 pts) What wavelengths of visible light (400 - 700 nm) will transmit brightly through a 950 nm thick film of soap with n = 1.41? Assume the soap is surrounded by air on both sides. Answer with 3 SF. Be sure to show all steps in your solution to this problem for full credit.

3) (25 pts) To determine the properties of a metal, an experimenter illuminates the surface with light of differing wavelengths to observe the resulting behavior.

With a wavelength of 585 nm, nothing happens.

With a wavelength of 534 nm, electrons escape with a maximum velocity of 3.40 x 10^5 m/s.

a) What will be the maximum speed of escaping electrons if the surface is illuminated with light of wavelength 458 nm?

b) What is the work function of the metal, in eV?

4) (25 pts) Radium-224 decays into Radon-220 with a half-life of 3.63 days.

a) What is the activity of 16.0 milligrams of Radium-224, in Curies? Assume the mass of Ra-224 is 224 u, and answer with 3 SF.

b) After how many days will the activity drop to 1/2500th of its initial activity? Answer with 3 SF.