

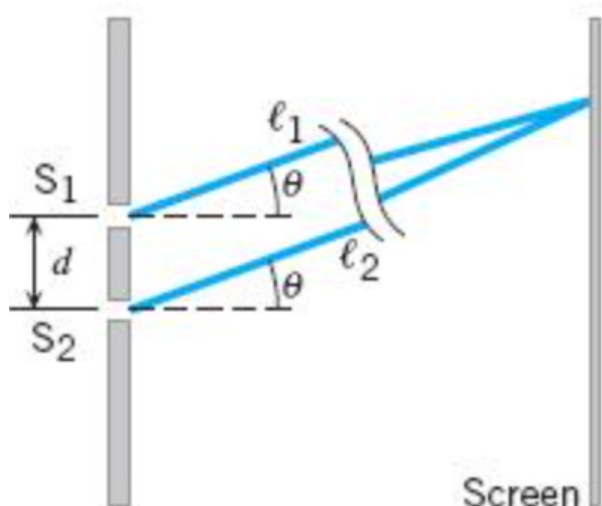
Physics 10164 – Spring 2019 Exam 4F

Partial credit will be given provided you show all work and are solving parts of the problem correctly. Points will be deducted if you don't show your work even if you get the right answer.

Clearly indicate your answer with a circle or a box and remember to include correct units and significant figures.

1. (25 pts) A light source illuminates two parallel slits separated by a distance d . One point on the screen where two rays meet is the 3rd minimum, counted relative to the central bright fringe. The difference in distances travelled by the two rays is 855 nm (ray 2 travels a little further than ray 1).

- What is the wavelength (in nm) of the incident light?
- If the slit separation $d = 5.50 \times 10^{-6}$ m, what angle θ do the rays make with the horizontal?



2. (25 pts) A uniform layer of water ($n = 1.33$) is 485 nm thick and lies on a glass plate ($n = 1.52$). Light shines perpendicularly on this layer from air. What wavelengths of light in the visible range (between 400 and 700 nm) experience constructive interference upon reflection from this surface?

3. (25 pts) Which transition has a greater energy difference, the transition from $n = 2 \rightarrow 3$ or the transition from $n = 3 \rightarrow 6$? Answer this question with 3 SF.

- a) Calculate both transition energies and compare to find an answer.
- b) From which transition is the shorter photon wavelength absorbed? What is that wavelength in nm?

4. (25 pts) Palladium-106 has a mass number of 106 and an atomic number 46. The nuclear mass is 105.878242 u.

Bismuth-212 has a mass number of 212 and an atomic number 83. The nuclear mass is 211.945721 u.

- a) Calculate the binding energy per nucleon for each nucleus and determine which has a higher value.
- b) The half-life of Bismuth-212 is 60.5 seconds. Determine the activity (in Curies) of a 1.00 milligram sample of Bismuth-212.