With this assignment you will be using the JABE software to perform a series of "virtual" light experiments. You will find it beneficial to review Chapter 9 in your text (Physics 12). You will also find it beneficial to peruse Sections 14.4, 14.6 & 14.7 of the older text Fundamentals of Physics: A Senior Course (FOP). As you complete the activities keep the following in mind:

{2,2} ① be sure to provide sample calculations for part B & C;

{6,3} ② for part D & E you will need to show your calculations for each experiment; and

③ watch your units.

{3} **PART A: GAINING FAMILIARITY**

1. Open JABE (G:\Science\Young\JABE Software).
2. Select "Slits" & then "Double Slit".
3. What do you notice about the pattern (ie does Δx increase, decrease or stay the same) when:
   a) screen distance = 100 cm, slit separation = 50 μm & you increase lambda (ie wavelength) from 296 to 696 nm?
   b) screen distance = 100 cm, lambda = 500 nm & you increase slit separation from 1 to 200 μm?
   c) slit separation = 50 μm, lambda = 500 nm & you increase screen distance from 100 to 500 cm?

{6} **PART B: DOUBLE-SLIT EXPERIMENTS (PHYSICS12: P.477-481; FOP: P.524-531)**

4. Open JABE (G:\Science\Young\JABE Software).
5. Select "No Experiment", "Double Slit", "Screen distance = 100 cm", "Slit Separation = 80 μm", & "Lambda = 400 nm".
6. Select "Measure" & then measure the distance between adjacent nodal lines (ie from one dark band to the next).
7. Record this information in the chart below (1 dec. pl.).
8. Using the formula $\lambda = d\Delta x/L$ calculate the value of Δx (1 dec. pl.).
9. Repeat steps 6 to 8 for the other values listed.

NO Experiment (single/double slit?)	screen distance L (cm)	slit separation d (μm)	wavelength λ (nm)	distance between adjacent nodal lines Δx (mm)	
				measured (1 dec. pl.)	calculated (1 dec. pl.)
Double Slit	100	80	400		
Double Slit	200	70	470		
Double Slit	300	120	550		

{6} **PART C: SINGLE-SLIT EXPERIMENTS (PHYSICS12: P.512-515; FOP: P.536-541)**

10. Open JABE (G:\Science\Young\JABE Software).
11. Select "No Experiment", "Single Slit", "Screen distance = 100 cm", "Slit Width = 80 μm", & "Lambda = 400 nm".
12. Select "Measure" & then measure the distance between adjacent nodal lines (but not across the central maximum). You may find it easier to measure across several nodal lines & determine the average distance.
13. Record this information in the chart below (1 dec. pl.).
14. Using the formula $\lambda = w\Delta y/L$ calculate the value of Δy (1 dec. pl.).
15. Select "Measure" & then measure the width of the central maximum. Verify that the central maximum is $2\Delta y$.
16. Repeat steps 12 to 15 for the other values listed.

NO Experiment (single/double slit?)	screen distance L (cm)	slit width w (μm)	wavelength λ (nm)	distance between adjacent nodal lines Δy (mm)	
				measured (1 dec. pl.)	calculated (1 dec. pl.)
Single Slit	100	80	400		
Single Slit	200	70	470		
Single Slit	300	120	550		

{9} **PART D: SINGLE- & DOUBLE-SLIT EXPERIMENTS**

17. Open JABE (G:\Science\Young\JABE Software).
18. Select the experiment # indicated in the chart.
19. Record the information given.
20. Perform the necessary measurement (1 dec. pl.) & calculations to determine the unknown information.

Experiment (Single or Double Slit?)	screen distance L (cm) - 0 dec. pl.	slit separation/width d/w (μm) - 0 dec. pl.	wavelength λ (nm) - 0 dec. pl.	distance between adjacent fringes Δx (mm) - 1 dec. pl.
1 -				
2 -				
3 -				
4 -				
5 -				
6 -				

{3} **PART E: INTERFERENCE EFFECTS - AIR WEDGE (PHYSICS12: P.508-509; FOP: P.549-550)**

21. Open JABE (G:\Science\Young\JABE Software).
22. Select "Wedge". It should be on "Air Wedges" now. If it isn't, select "Wedge" towards the bottom.
23. Experiment with different air wedge thicknesses as well as the wavelength of light used.
24. Using the appropriate measurements (3 dec. pl.) & formula what is the thickness of material X & Y (2 dec. pl.).

Experiment	length of air wedge L (cm) - 1 dec. pl.	thickness of wedge base t (mm) - 2 dec. pl.	wavelength λ (nm) - 0 dec. pl.	distance between adjacent fringes Δx (mm) - to 3 dec. pl.
Material X				
Material Y				

{5} **PART F: INTERFERENCE EFFECTS - THIN FILMS (PHYSICS12: P.502-505; FOP: P.545-549)**

25. Open JABE (G:\Science\Young\JABE Software).
26. Select "Wedge".
27. Now select "Soap Film", "Reflection", & "White Light".
28. Click "Dip in Soap". What do you observe? Explain this phenomena with the aid of a diagram(s).

PART G: MORE QUESTIONS (watch your spelling & grammar)

{4} 1. Double-slit interference patterns form with equal spacing between light & dark fringes. Single-slit diffraction generates an interference pattern containing a central bright fringe that is twice as wide as any other. Explain these differing results. You may find the use of a diagram(s) useful!

{3} 2. With a single-slit interference pattern the central maximum appears much more intense than subsequent fringes. Explain this phenomena.

{3} 3. What is a diffraction grating? Why does it produce much narrower bright fringes than a double-slit interference pattern?

{4} 4. Describe why an astronomer would pass light from a distant star through a diffraction grating? Provide the name of the instrument used & possible facts that could be learned from its use.

{3} 5. An ingenious physics student wants to remove the amount of glare reflecting from her computer screen. Describe, with the aid of a diagram, how she could make use of her knowledge of thin films to accomplish her task.

{3} 6. Many butterflies have coloured wings due to pigmentation. In some, however, such as the Morpho butterfly, the colours do not result from pigmentation and, when the wing is viewed from different angles, the colours change. Explain how these colours are produced.