Name: _____

Class: _____

Due Date: _____

34 – Multiple Slit Diffraction and Diffraction Gratings

Answer the following questions. The solutions to this worksheet can be found on the YouTube channel Go Physics Go.

1. C: **Use a pencil!** Use the two simulations below to draw an *intensity vs. displacement* graph for Young's double slit experiment.

   https://sciencesims.com/sims/double-slit/

   https://www.physicsclassroom.com/Physics-Interactives/Light-and-Color/Youngs-Experiment/Youngs-Experiment-InteractiveV1

2. C: State the equation for *double slit constructive interference* and define each variable.

3. C: State the equation for *double slit destructive interference* and define each variable.

4. **C: Use a pencil and ruler!** Go to the following websites and carefully draw an *intensity vs. distance* graph for the following number of slits:

   For one slit: https://sciencesims.com/sims/single-slit/
   For 2-10 slits: https://www.geogebra.org/m/g6fsxcyn

One slit
Two slits
Three slits

Four slits
Five slits
Six slits
Seven slits
Eight slits

Nine slits
Ten slits

5. C: Describe the meaning of the single slit *envelope*.

6. C: What happens to the intensity pattern as the number of slits increases?

   https://www.geogebra.org/m/g6fsxcyn

7. C: What is a *diffraction grating*? What is its purpose?

8. C: Describe the equation $n\lambda = d \sin\theta$ for multiple slit diffraction.

9. E: While observing a gas discharge tube through a diffraction grating, which has 600 slits/mm, you note that the first bright yellow emission line is visible at an angle of 20.6° from the center antinode. What is the wavelength of this yellow light?

10. E: A diffraction grating which contains 600 slits/mm is used to observe a gas discharge tube containing mercury gas and the first bright violet light is visible at an angle of 15.1° from the central antinode.

    a. What is the wavelength of this light?

b. At what angle will the second order antinode appear?

11. E: While looking through a diffraction grating at a nitrogen discharge tube you note that light with a known wavelength of 5679 angstroms is visible at an angle of 37.0° from the central antinode. How many slits are there in this diffraction grating for each millimeter of width?

12. E: You are looking through a diffraction grating, which contains 520. slits for each millimeter of width, at a light source emitting light with a wavelength of 5890 angstroms. At which angles will the first and second order antinodes be visible?