Name: _____Date:_____Class:_____

Student Worksheet 2
Interference Patterns

Safety

Never shine a laser into a person's eyes, as permanent damage may occur. Be aware that the laser will reflect off of the transparency. Be sure that the manila folders catch both the reflected beam and the beam passing straight through.

Introduction

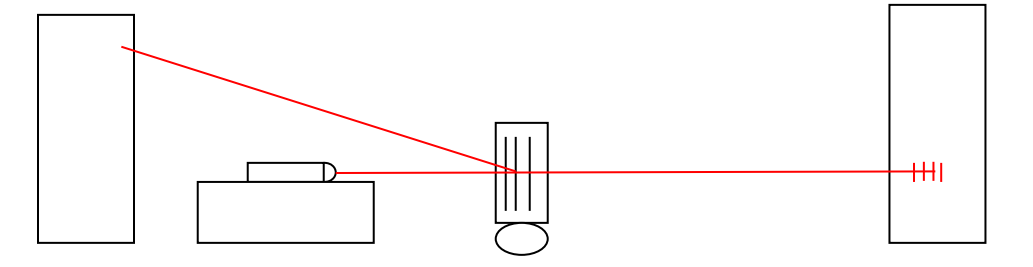
Light doesn't always seem to travel in straight lines, but why haven't you ever noticed that before? In this portion of the lab you will try to answer that question by determining the relationship between different gratings with different patterns on them. This will lead you to understand how nanoscale researchers use X-ray diffraction to determine the structure of materials that they cannot see.

Materials:
- 2 manila folders
- laser pointer and stand
- masking tape
- diffraction gratings
- modeling clay
- meter stick

Question: How is the spacing between lines on your diffraction grating related to the interference pattern that you see on the other side?

Procedure:

1. Set up two manila folders so that they hold themselves up in a V shape. You may want to attach a length scale to the manila folder to monitor distance during the activity.
2. Attach your laser pointer to your stand (a piece of wood, a ring stand, or a piece of clay).
3. Wrap masking tape around the laser to keep it turned on. Be sure to keep your laser pointed at the manila folder.
4. Use a piece of modeling clay to hold your transparency gratings so that the laser beam shines through one and projects an interference pattern onto the manila folder.
5. The beam will reflect off the transparency. Be sure the reflected beam hits the other manila folder.



*Note the lines in the grating will be facing the source of light

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6. Adjust the distance between the manila folder screen and the grating until you see a clear interference pattern. Distance between the grating and the folder is _____. Now DON'T CHANGE IT!
7. Either draw the pattern directly onto the manila folder, or take a picture of it with your cell phone or digital camera.
8. Do the same with the other two gratings. Make sure that you keep the distance between the grating and the manila folder constant.

Analyze the Results

1. Compare the different gratings that you have tested.

   All the __*gratings*_____, have ____*very small vertical lines on them*_____

   _____.

   Some of the ___*gratings*_____, have _____*a larger space between the lines*_____

   _____

   while others have _____*a smaller space between the lines*_____

   _____.

2. Compare the interference patterns that you saw.

   All the _____*interference patterns*_____, have ____*a horizontal line of many small dots*___

   _____.

   Some of the __*interference patterns*__, have _*dots close together*_____

   _____

   while others have _____*dots farther apart*_____

   _____.

Draw Conclusion

3. Describe how the diffraction gratings are related to the interference pattern that they create.

   Diffraction gratings with ___*lines that are close together*_____

   _____

   create interference patterns with __*dots that are farther apart*_____

   _____.

4. BONUS: Pick one of the diffraction gratings. Measure the distance between the different dots in the interference pattern. Predict how far apart the dots would be if the spacing on the grating were 10 lines/mm. Show your work in the space below.

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