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Activity #1

Pattern Activity (Qualitative study)

At any given time, you will find yourself in the need to perform a measurement. Almost any occupation some type of measurement is required: carpenters, mechanics, nurses, tailor engineers, marketing strategies, just to mention a few. Don't be surprised finding yourself utilizing measurement of some kind in your chosen career. In science, measurements play a rather large role in an experiment. Scientists measure the concentration of solutions, the growth of populations of different organisms under various conditions, the speed of biochemical reactions, the distances between celestial bodies in the universe, the distance between atomic particles and great number of other things.

As measurements form the basis of scientific inquiry, they are deserving of in-depth analysis in lab. In a scientific experiment, examining the effects of variations during an experiment, can only be explain if those variations are measured. Therefore, a major part of any experiment is to determine ways in how to measure those changes. Such data is analyzed and used to determine any necessary changes in the experiment.

Prior knowledge:

Define the following terms:

1. **Electromagnetic Spectrum:**

   _____

   _____

2. **Visible Light:**

   _____

   _____

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3. **Wavelength:**

_____

_____

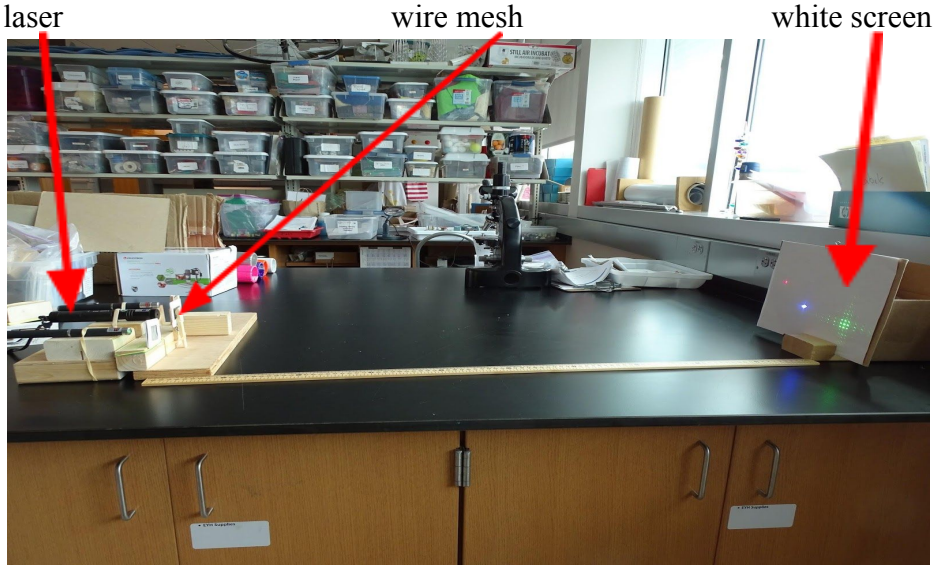
4. **Nanometer:**

_____

_____

Procedure:

1. Each group should be assigned one color laser. However, the whole class should be instructed on safety procedures in the use of the laser.
2. Every group should have a set of four different coarse wire mesh. They should not be interchanged.
3. The set up might depends on the type of supplies. However, the basic set up could look like the picture.



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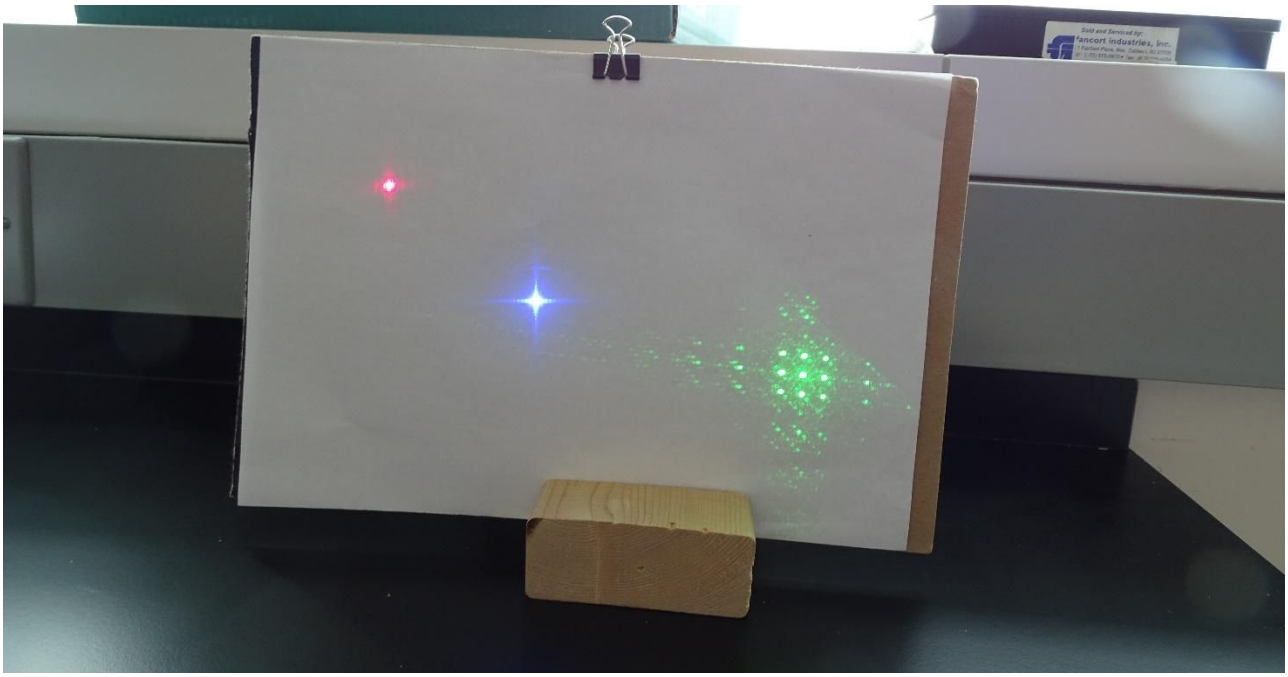
4. Patterns for different distances should be sketched on the white screen. The same screen can be used to place as many patterns as can be fitted a they are labeled.
5. First pattern should be sketched from a 1.00 meters distance. The next sets of sketches should be done on increments of 25.00 cm until the final distance of 2.00 meters (You might increase the distance as much as you want base on your available space or desire results).



6. Groups of different laser patterns should get together and exchange their results. They should discuss the differences on their patterns.

_____

_____

_____

_____

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7. Hold on to the patterns for activity 2.

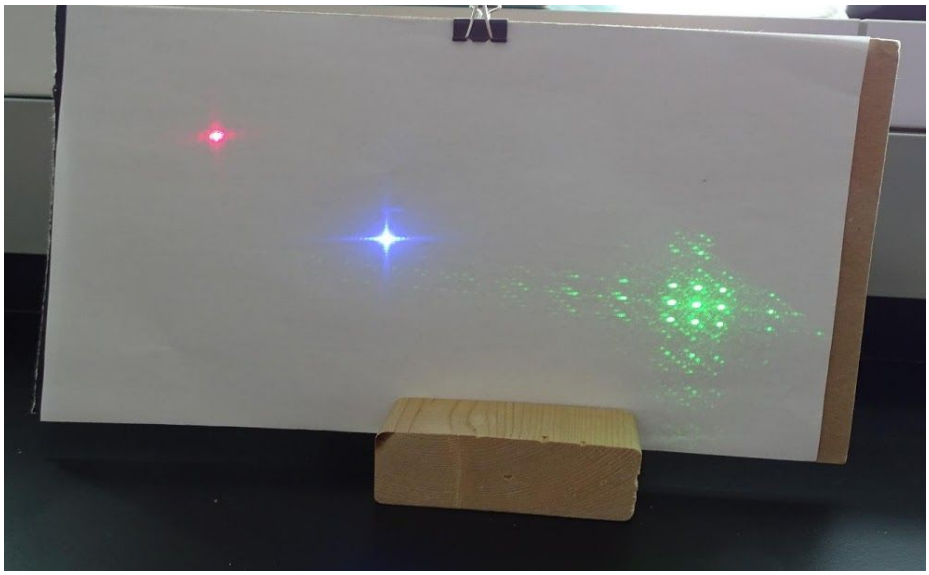
Activity #2

Measuring Spacing using different Wavelength

Part 1:

Using the coarse wire mesh:

1. Measure the diffraction pattern spacing from each laser and record them in the data table (w).



2. Record the different distances (m) used in each trial.
3. Calculate the size of the spacing between the wires in the coarse mesh. Use the following formula:

$$D = L \times \lambda \div w$$

Do not forget to change to the correct units. Determine the average value of D for each laser

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4. Measure the number of wires within one centimeter of the mesh. Determine the distance between wires **d′** using the following relation

d′ = 1 / # of wires.

d′ = _____ meters.

5. Compare **d′** with the average value of **d** for each laser.

_____

_____

_____

6. Which of the three lasers has better results? Explain

_____

_____

_____

OPTIONAL: Standard Deviation

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Data Tables:

Color Laser _____ Wavelength _____ (nm)			
Distance	**Distance in meters (L)**	**Distance of Pattern Spacing (w) in meters**	**Size of the Spacing (d) in meters.**
1			
2			
3			
4			
5			
Average d: _____ meters			

Color Laser _____ Wavelength _____ (nm)			
Distance	**Distance in meters (L)**	**Distance of Pattern Spacing (w) in meters**	**Size of the Spacing (d) in meters.**
1			
2			
3			
4			
5			
Average d: _____ meters			

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Color Laser _____ Wavelength _____ (nm)			
Distance	**Distance in meters (L)**	**Distance of Pattern Spacing (w) in meters**	**Size of the Spacing (d) in meters.**
1			
2			
3			
4			
5			
Average d: _____ meters			

Color Laser _____ Wavelength _____ (nm)			
Distance	**Distance in meters (L)**	**Distance of Pattern Spacing (w) in meters**	**Size of the Spacing (d) in meters.**
1			
2			
3			
4			
5			
Average d: _____ meters			

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7. Convert each "d" value to millimeters, micrometers, nanometers and picometers. Do you see any pattern? Explain

_____

_____

_____

_____

_____

_____

Part 2:

Using the work done in part 1, can you come up with a way to determine the spacing on the other wire meshes? Explain the procedure

_____

_____

_____

_____

_____

_____

_____

_____

_____

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You must:

1. **Have a data table.**
2. **Calculations.**
3. **Analysis.**
4. **Conclusions.**

Assessment

Questions:

1. **Do you need to see something to be measured? Explain**
2. **In theory, can we measure anything? Explain**
3. **Research the term "optical resolution" and how it limits the use of a light microscope.**
4. **Research the term optical magnification.**
5. **Research the basics of electron microscopy and how the electron microscope works.**
6. **If we look at the magnetic spectrum, in theory, what are our limits of measurement? Explain**