Light as a Wave – pHet Lab

Name:

Part I: Investigate ripple patterns.

1. *Play With The Ripple Tank* – Observe the different ripple patterns you get with changes to the waves and the ripple tank. For example:
   - See what happens with one faucet vs two faucets.
   - Turn the faucets on and off.
   - Change the frequency and amplitude of the drops.
   - Add a barrier with one slit or two slits and move the barrier left and right.
   - Change the width and spacing of the slits in the barrier.
   - Add the detector – move it around and see how it helps you understand the waves.

* Google "phet." You want "Wave Interference" simulation

Create An Interesting Ripple Pattern –

- Set the frequency near the middle of the scale.
- Set the amplitude near the right end (the high end) of the scale.
- Add a barrier and set it a little less than 6.2 cm (check the "Barrier Location" scale).
- Choose 2 slits and set the slit width to about 1 cm.
- You may choose the other variables as you like – one faucet or two, one slit or two, any faucet spacing, any slit separation, etc. But be careful, because the next step is...

2. *Draw Your Ripple Pattern* – Pause the ripple tank. Using a colored pencil for the crests and a dark pencil for the troughs, draw the ripple pattern. Pay attention to where the colors are brightest and where they are dim. Hint: you have a pause/play button on this simulation! **(2 marks)**

Part II: Identify wave behaviors.

3. *Reflection* – Circle an area of your diagram that shows wave reflection and label this area "reflection". Below the diagram, explain how you know reflection happens here. **(2 marks)**

4. *Diffraction* – Circle an area of your diagram that shows wave diffraction and label this area "diffraction". Below the diagram, describe what "diffraction" means. **(2 marks)**

5. *Constructive Interference* – Mark a point on your diagram that is an example of constructive interference. Below the diagram, describe what "constructive interference" means. **(2 marks)**

6. *Destructive Interference* – Mark a point on your diagram that is an example of destructive interference. Below the diagram, describe what "destructive interference" means. **(2 marks)**

Drawing here

Draw	/2
Reflection	/2
Diffraction	/2
+ve interference	/2
-ve interference	/2

Communication 10 /2 =	**/5**

Written information here

Part III: Measuring speed of light

7. a) Devise a way to measure the speed of a water wave in this tank. Briefly describe your method (you may use a sketch if that helps). Run your method 5 times and average the results. Show the math for the 1st calculation only. Hint: creating a quick table of measured values and calculated speed is a very convenient way to display your results.

b) Now measure the speed of a RED light wave in this tank. Describe your method ONLY if it is different from above. Run your method 5 times and average the results. Show the math for the 1st calculation only. Hint: creating a quick table of measured values and calculated speed is a very convenient way to display your results.

c) We know that blue light has a noticeably shorter wavelength than red light. Will it move faster than red light?

State your hypothesis: _____

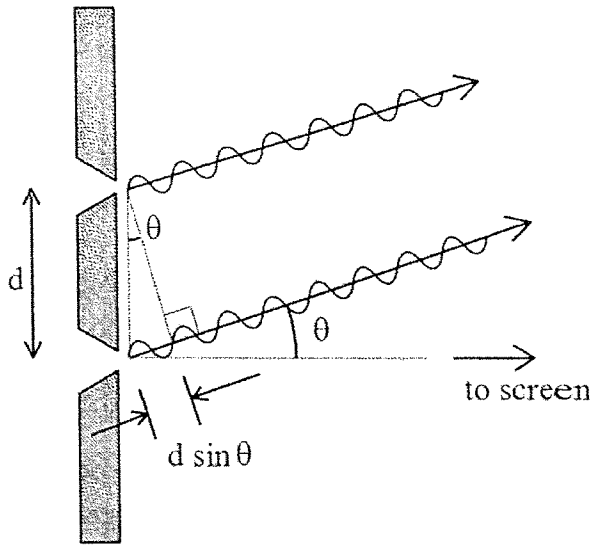
Now measure the speed of a BLUE light wave in this tank. . Run your method 5 times and average the results. Show the math for the 1st calculation only. Hint: creating a quick table of measured values and calculated speed is a very convenient way to display your results.

Does blue light travel faster than red light in the same medium? _____
Make sense of this answer (explain why this result is logical).

Knowledge & Understanding	**/5**

Part IV: Using a double slit equation

The rays from a given source are emitted in all directions from the slits, but let's concentrate on the rays that are emitted in a direction θ toward a distant screen (θ measured from the normal to the barrier). One of these rays has further to travel to reach the screen, and the *path difference* is given by $d \sin\theta$.



8.

a) Predict the brightness on the distant screen if the path difference is **exactly** one wavelength λ (or any integer number of wavelengths)? Explain your reasoning. Include a diagram. **(2 marks)**

b) Predict the brightness if the path difference is λ/2, 3λ/2, or 5λ/2, etc.? **(1 mark)**

c) Which equation below tells you the angles (θ) at which you will see bright spots and which one tells you the angles (θ) for dark spots?

Circle one: Bright or Dark $d \sin\theta = m\lambda$

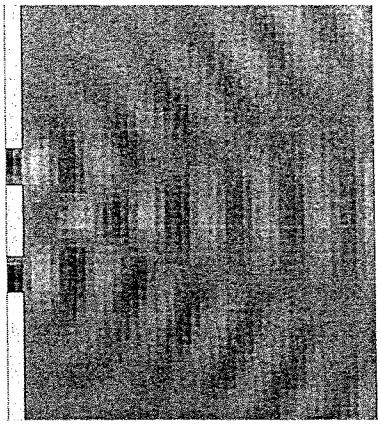
Circle one: Bright or Dark $d \sin\theta = (m+\frac{1}{2})\lambda.$

$m = 0, \pm 1, \pm 2..$

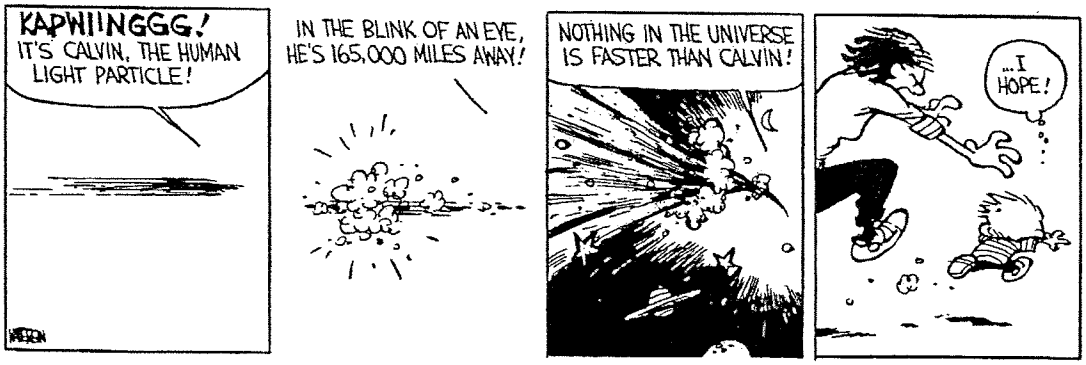
(1 mark)

d) The white rectangle is a screen to capture the light interence pattern. Draw & label the light and dark bands that would be result from this set-up. Be accurante!

(1 mark)



Inquiry	**/5**



* Part V must be done in class *

Part V: Measuring the wavelength of a laser

9. Determine the wavelength of our red laser light. Do 2-3 trials and average your results. For each trial, vary the distance between the laser and the screen. [Standard equipment is available in class. If you feel you need something else, please let me know and I'll see what I can do.]

a) Draw a labelled diagram of your set-up. You would have chosen one of the 3 formulas to use. Label all your variables in your diagram. ie: I should know where your 'givens' came from looking at your diagram. **(2 marks)**

b) Use GRASP method to clearly show one calculation. For the others, you need only write the givens and then the final value for λ. **(2 marks)**

c) Look up the wavelength of red laser light from a reliable source. Calculate the % deviation from this standard value. **(1 mark)** source: www._____

Application	/5