

Circle your lab day and time.

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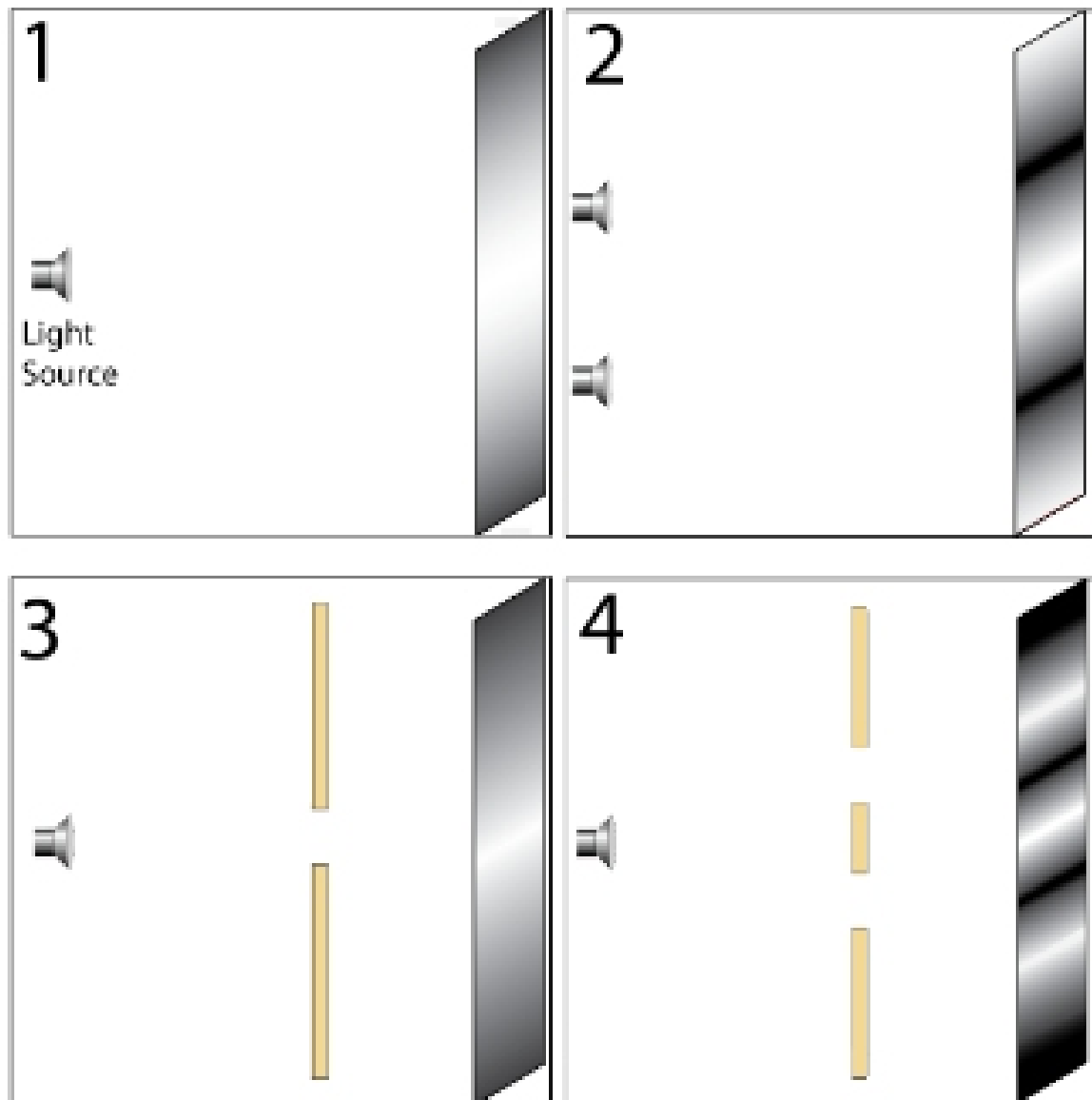
	Tue	Tue	Tue	Wed	Th	Th	Th	Fri
	10-12	12-2	2-4	12-2	10-12	12-2	2-4	12-2

Lab 11: Wave Interference

INTRODUCTION

Consider the four pictures shown below, showing pure yellow lights shining toward a screen. In pictures 3 and 4 below, there is a solid wall between the light and screen, with one or two slits cut in to let the light through. Compare the four scenarios.

- What do you think might be happening to the light to create these different patterns? Discuss with your group and write your ideas in the space below.



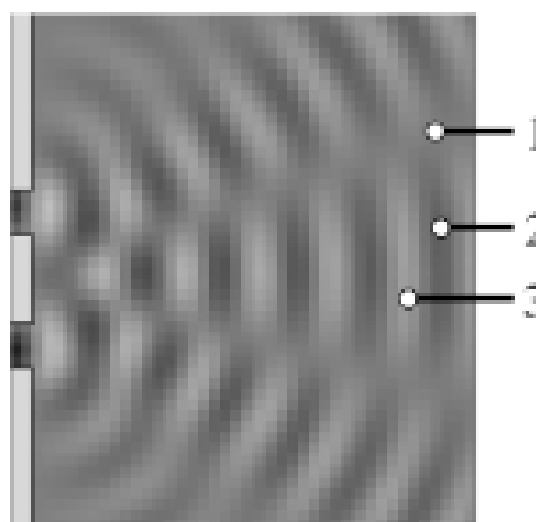
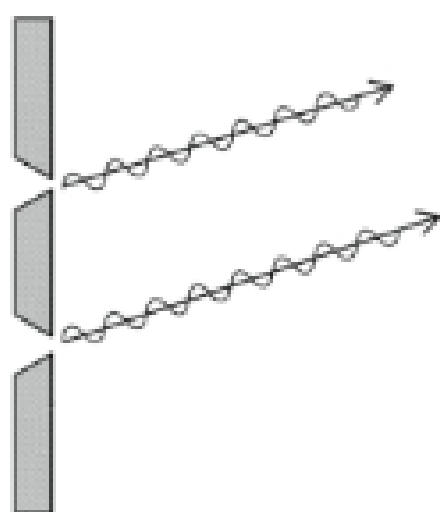
PART 1: Wave Interference Simulation

A. Open the PhET simulation “Wave Interference.” Explore the simulation to get a feel for the controls.

- Try to recreate the pictures shown on page 1 with the simulation. Describe what you had to do with the simulation to reproduce the pictures.
- Compare what you learned from the simulation to your ideas from page 1. Which ideas would you keep? What ideas would you change? (*Did you notice the third bright spot right behind the wall in case 4?*)
- What happens to the pattern on the screen when the *lights* are brought closer to each other?
- What happens to the pattern on the screen when the *lights* are farther apart?
- What happens to the pattern when the *slits* are brought closer and farther apart?

B. Interference from Two Slits

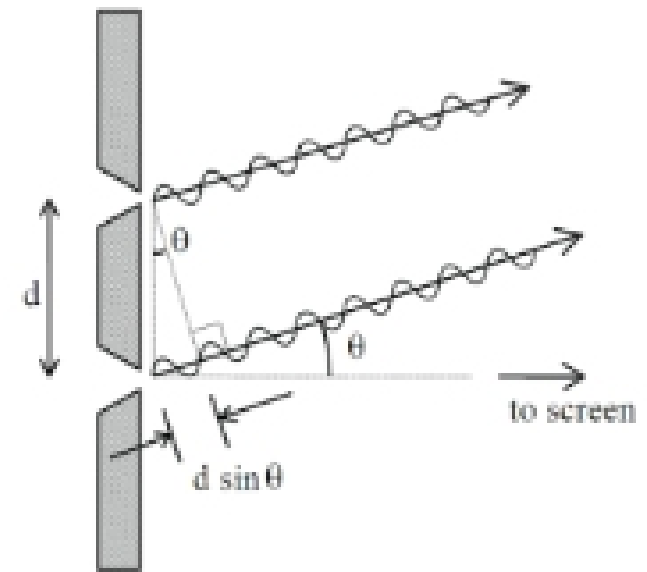
The pictures below show two ways of representing light waves from two slits. On the right picture, three points are marked 1, 2, and 3.



- Estimate the brightness of the light you would see on a screen placed at points 1, 2, and 3.
- Describe how you might use a picture like the one on the left to support your prediction and explain what is happening at points 1, 2, and 3 on the right. *We are interested in your ideas. Write down all the ideas you can think of. You can use the simulation to help you.*

PART 2: Double Slit Interference

- A. In the pictures on the last page, the rays were emitted in all directions from the slits. But now, let's concentrate on the rays that are emitted in a direction θ toward a distant screen (θ is measured from the normal to the barrier). One of these rays has a further distance to travel to reach the screen; this *path difference* is equal to $d \sin(\theta)$.
- 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.



- Predict the brightness if the path difference is $\lambda/2$, $3\lambda/2$, or $5\lambda/2$, etc.?
- For each equation below, identify which one would tell you the angles (θ) at which you would see bright spots and which one will tell you the angles (θ) for dark spots.

		Bright or Dark?
$m = 0, \pm 1, \pm 2, \dots$	$d \sin \theta = m\lambda$	
	$d \sin \theta = (m + \frac{1}{2})\lambda$	

- What ideas from part 1B would you keep and which would you revise?
- How do the equations above support your predictions of brightness and the pattern shown on the right?

