

## Young's Experiment Lab

### Teacher's Guide

**Topic:**

Light and Color

**The following information is provided to the student:**

**Question:**

What is the wavelength of red laser light?

**Purpose:**

To determine the wavelength of red laser light in units of nanometers.

A complete lab write-up includes a Title, a Purpose, a Data section, a Conclusion and a Discussion of Results. The Data section should include a *top view* of the experimental set-up with measured values labeled on the diagram; the measurements should be related to the variables  $y$ ,  $d$ ,  $m$ , and  $L$  and the units should be clearly stated. Calculations should be clearly and systematically shown; conversion of units should be part of the work; units should be stated. The Conclusion should state the experimentally-determined value for the wavelength of red light. The Discussion of Results section should include an error analysis; a percent error calculation should be included in the discussion; work should be shown.

**Materials Required:**

Laser light; slide with a double slit of known separation distance; slide holder; projection screen; meter stick; measuring tape.

**Description of Procedure:**

A laser light is placed on a table in the back of the room. A slide holder is positioned in front of the laser on the same table. A slide containing a double slit is placed in the slide holder. The laser is directed at the double slit and the resulting pattern is projected onto a screen in the front of the room. Once the projected two-point source interference pattern is projected onto the screen, measurements are made to determine the wavelength of light. The slit separation distance is retrieved from the slide.

**Alternative Materials and Procedure:**

An online interactive version of Young's Experiment is available at the Shockwave Physics Studios section of The Physics Classroom web site. Visit:

<http://www.physicsclassroom.com/shwave/youngs.cfm>

An extensive set of directions for the activity is available. View [directions](#).

**Safety Concern:**

There is always a higher than usual level of risk associated with working in a science lab. Teachers should be aware of this and take the necessary precautions to insure that the working environment is as safe as possible. Light from lasers should never be pointed into a person's eye. Caution should be taken to avoid such mishaps. Student *horseplay* and off-task behaviors should not be tolerated.

## The Laboratory

### Suggestions, Precautions, Notes:

1. Warn students in advance of the lab of the need to never direct laser light at another person's eye.
2. Slides containing a double slit for the purpose of performing Young's experiment are available from science supply houses. The slit separation distance is usually printed upon the slide.
3. The theoretical wavelength of the light emitted by the laser is usually stamped at some location on the housing of the laser. This value can be used in a percent error calculation. Student results for the calculated wavelength are usually within 5% of the expected value.

### Auxiliary Materials:

The following page is provided to the student for completion and inclusion in their lab notebook.

### Scoring Rubric:

<b>L3. Young's Experiment Lab</b>	<b>Score</b>
____ Included, labeled and organized all parts of the lab report. ____ Data section includes a <i>top view</i> of the experimental set-up; measurements of $y$ , $d$ , $m$ and $L$ are shown on the diagram and equated with their symbol; units are stated. Wavelength calculation is shown; work is clear and accurate; attention is given to the conversion of units. Used nanometers for the wavelength. ____ Conclusion stated the wavelength of red light in nanometers. The proper number of significant digits is used. ____ Discussion of Results includes an error analysis; work is shown and labeled for a percent error calculation.	____/____

### Connections to The Physics Classroom Tutorial:

The following readings are a suitable accompaniment to this lab:

<http://www.physicsclassroom.com/Class/light/u12l3a.cfm>

<http://www.physicsclassroom.com/Class/light/u12l3b.cfm>

<http://www.physicsclassroom.com/Class/light/u12l3c.cfm>

<http://www.physicsclassroom.com/Class/light/u12l3d.cfm>

### Connections to Minds on Physics Internet Modules:

There are no sublevels of Minds on Physics which pertain to the topic of Young's experiment.