Wave Motion Lab

Teacher's Guide

Topic:

Waves

The following information is provided to the student:

Question:
How are transverse, longitudinal and circular wave motion similar and different?

Purpose:
To distinguish between the three types of wave motion - transverse, longitudinal and circular.

A complete lab write-up includes a Title, a Purpose, a Data section, and a Conclusion/Discussion. The Data section should include observations of the three types of wave motion. Diagrams would be an excellent way to distinguish between the particle motion involved in each type of wave. The Conclusion/Discussion should include a well-written paragraph which responds to the purpose of the lab.

URLs: http://www.smgaels.org/physics/home/java/dukes_java/TabbedWaveTrans.htm
http://www.kettering.edu/~drussell/Demos/waves/wavemotion.html

Materials Required:

Two pages from the internet:
http://www.smgaels.org/physics/home/java/dukes_java/TabbedWaveTrans.htm
http://www.kettering.edu/~drussell/Demos/waves/wavemotion.html

Description of Procedure:

Students observe computer animations of a transverse waves, longitudinal waves and circular waves. The analyze the up and down, back and forth, and around and around movement of the individual particles. They record their observations and construct diagrams to convey information about each type of wave. After about 10-15 minutes of observing and note-taking, students then write a paragraph for the Conclusion/Discussion which responds to the question raised in the Purpose of the lab.

Alternative Materials and Procedure:

There are numerous web sites which offer informative animations of the different types of wave motion. Teachers might find several other useful pages by conducting a Google search with the keywords "physics types of waves animation Java applet physlet".

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. Student *horseplay* and off-task behaviors should not be tolerated.

Suggestions, Precautions, Notes:

The Laboratory

1. This is a quick activity which involves observation and discussion. There is no manipulation of equipment or collection of quantitative data. This lab and the previous lab - Wiggle in Time and Space Lab - can typically be done in a single period.
2. Students often confuse wave motion (the movement of a wave pattern across the medium from one end to the other end) with particle motion (the back and forth vibrational movement of the particles of the medium). This lab offers a great opportunity to distinguish between the two quantities.
3. The first listed page (above) provides an excellent animation of both transverse and longitudinal waves. The second listed page (above) shows animations of all the categories of waves, including surface waves (or circular waves); it is also accompanied by interesting textual information.
4. A computer lab is not needed for this activity if your classroom is equipped with a computer connected to a television or an LCD projection capabilities. The animation can be shown to your class and repeated over and over again as students observe and write. Students can be provided with several minutes of time viewing the different types of waves.
5. This is the one of several labs designed with the intent of conveying the nature of a wave. The labs titled A Wiggle in Time Lab and A Wiggle in Time and Space Lab are excellent complements to this lab. The take-home ideas from the collection of three labs include the following:
    - A wave is a disturbance which is introduced into the medium at one end and travels through the medium by particle to particle interaction to the other end.
    - There is a distinction between wave motion and particle motion. Wave motion is the movement of a wave pattern across the medium from one end to the other end. The wave pattern might be the sinusoidal pattern of alternating crests and troughs or it might be the pattern of a series of compressions and rarefactions. Particle motion is the back and forth vibrational movement of the particles of the medium about a fixed position. The particles might vibrate parallel to the direction of wave motion or perpendicular to the direction of wave motion (or in a circle).
    - A wave is a wiggle in time which is extended across space. Particles of the medium wiggle up and down (or back and forth) over the course of time. Neighboring particles interact with one another so as to create a pattern which is spread through space - from one end of the medium to the other.
    - A wave propagates or travels through space by particle to particle interaction. The disturbance which is introduced to the first particle of the medium travels to the last particle of the medium because the particles interact. The frequency and the amplitude (ideally) of the disturbance is maintained as one particle *passes it on* to the neighboring particle.
    - A wave is an example of periodic motion; particles of the medium undergo continuous up and down (or back and forth) periodic motion.
    - A wave is an energy transport phenomenon and not a material transport phenomenon. Matter (particles, stuff, atoms, material) is not moved from the location of the original disturbance to the opposite end of the medium. The particles simple vibrate about a fixed position as the energy is passed from one end of the medium to the other.
    - There is always something *sinusoidal* about a wave. For instance, the particles vibrate in such a manner that their distance from the resting position varies as the sine of the time. Or the entire collection of particles occupy a position at a fixed moment in time which together creates the appearance of a sine wave.

Auxiliary Materials:

None

Scoring Rubric:

W4.	**Wave Motion Lab**	**Score**
____	Included, labeled and organized all parts of the lab report.	
____	Data section includes observations of the three types of wave motion.	
	Well-labeled diagrams are included to differentiate between the particle motion of the three types of waves. Explanations are clearly and	____/____

____	accurately worded. Writing is accurate, clear and thorough. Conclusion/Discussion summarizes the way in which the three types of wave motion can be distinguished.	

Connections to The Physics Classroom Tutorial:

The following reading is a suitable accompaniment to this lab:

http://www.physicsclassroom.com/Class/waves/u10l1c.cfm

Connections to Minds on Physics Internet Modules:

Sublevel 1 of the Waves module is a suitable accompaniment to this lab:

http://www.physicsclassroom.com/mop/module.cfm