Slinky Waves Teacher's Notes

Main Topic	Waves
Subtopic	Properties of Waves
Learning Level	Middle
Technology Level	Low
Activity Type	Student

Description: Students use a "Slinky" spring to investigate wave properties.

Required Equipment	Springy, masking tape, stopwatch, string, helical spring
Optional Equipment	

Educational Objectives

- Observe and investigate wave properties, including wave type, speed, interference, reflection, and travel through different mediums.

Concept Overview

Wave Speed: Students will observe that neither amplitude nor frequency affects wave speed. Only changing the tension of the spring (changing a property of the medium) can change the speed.

Interference: Students will observe that wave pulses can interfere constructively (adding together when on the same side of the spring) or destructively (canceling out when on opposite sides of the spring).

Waves at Boundaries: Waves will invert upon reflecting from a rigid boundary, but not from a flexible boundary. When a wave meets a similar medium, part of the wave will transmit and part will reflect. The transmitted wave will change length and speed. The reflected wave may invert or not, depending on the two media.

Acknowledgement

Thank you to Dwight "Buzz" Putnam for developing and contributing this lab.

Name: _____

Class: _____

The "Slinky" & The Wave Model Lab

→ *"YOU TANGLE IT, YOU BUY IT!"*

ANSWER ALL QUESTIONS BY EXPLANATION OR DIAGRAM *FOR FULL CREDIT*

PROCEDURE

1. TRANSVERSE WAVES

YOU & YOUR PARTNER STRETCH A **SLINKY** ABOUT 10 METERS. PLACE **A PIECE OF MASKING TAPE** AT ABOUT THE MIDDLE OF THE SLINKY. PRACTICE PRODUCING PULSES ALONG THE SPRING BY SHAKING IT **SIDEWAYS** ON THE FLOOR. EACH PARTNER SHOULD SEND **SINGLE PULSES** ALONG THE SPRING.

A. DRAW A DIAGRAM OF WHAT THE PULSE LOOKS LIKE.

B. WHAT DIRECTION DOES THE **PIECE OF MASKING TAPE** MOVE AS THE PULSE TRAVELS DOWN THE SPRING?

C. WHAT IS THE DIRECTION OF THE PULSE AS THE PULSE TRAVELS DOWN THE SPRING?

D. WHICH WAY DO YOU VIBRATE A SLINKY TO PRODUCE A **TRANSVERSE** WAVE?

2. LONGITUDINAL WAVES

GRAB SEVERAL COILS DOWN THE SLINKY, PULL, AND RELEASE TO PRODUCE A LONGITUDINAL WAVE. PUT A PIECE OF MASKING TAPE NEAR

THE CENTER OF THE STRETCHED COILS.

1. DRAW A DIAGRAM OF WHAT THE PULSE LOOKS LIKE.

B. WHAT IS THE DIRECTION OF THE PULSE MOVES AS THE PULSE TRAVELS DOWN THE SPRING?

C. WHAT DIRECTION DOES THE **PIECE OF MASKING TAPE** MOVE AS THE PULSE TRAVELS DOWN THE SPRING?

D. WHICH WAY DO YOU VIBRATE A SLINKY TO PRODUCE A **LONGITUDINAL** WAVE?

3. SPEED OF A PULSE

PRODUCE TRANSVERSE PULSES & RECORD THE **TIME** IT TAKES FROM WHEN THEY ARE PRODUCED TO WHEN THEY TO RETURN TO YOU.

TIME FOR SMALL PULSE	
TIME FOR LARGE PULSE	

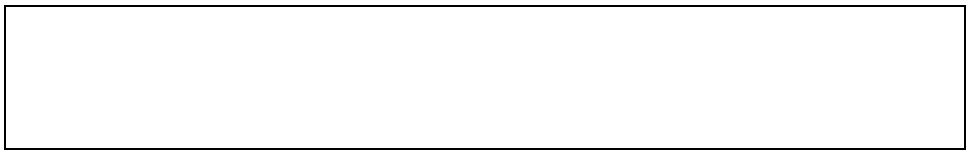
WHAT CONCLUSION CAN YOU MAKE ABOUT THE SPEED OF ANY SIZE PULSE THAT MOVES THROUGH THE SAME MEDIUM?

4. INTERFERENCE OF PULSES

MOVE THE SLINKY ABOUT **1 METER** FROM THE WALL. PRODUCE A PULSE ON THE SIDE TOWARD THE WALL, BUT NOT TOUCHING THE WALL. NOW HAVE YOUR PARTNER PRODUCE A PULSE ON THE **SAME SIDE** & AT THE SAME TIME.

A. DRAW A DIAGRAM OF THE PULSES JUST BEFORE THEY MEET

EACH OTHER.



B. DRAW A DIAGRAM OF THE TWO PULSES WHEN AS THEY MEET EACH OTHER IN THE MIDDLE.

C. WHAT RULE COULD YOU MAKE WHEN TWO "SAME-SIDE" PULSES MEET?

PRODUCE TWO PULSES ON **OPPOSITE SIDES** OF THE SLINKY AT THE SAME TIME.

A. DRAW A DIAGRAM OF THE PULSES JUST BEFORE THEY MEET EACH OTHER.

B. DRAW A DIAGRAM OF THE TWO PULSES WHEN AS THEY MEET EACH OTHER IN THE MIDDLE.

C. WHAT RULE COULD YOU MAKE WHEN TWO "OPPOSITE-SIDE" PULSES MEET?

5. PRODUCE A TRANSVERSE PULSE WITH YOUR PARTNER FIRMLY GRIPPING THE OTHER END OF THE SLINKY.

A. WHEN A PULSE REFLECTS FROM A **RIGID BOUNDARY** WHAT

HAPPENS TO THE REFLECTED PULSE?

B. NOW TAPE A FEW COILS OF THE SLINKY TOGETHER AND TIE ABOUT 2 METERS OF **STRING** TO THE COILS. PRODUCE A TRANSVERSE PULSE & OBSERVE THE REFLECTED PULSE. WHEN A PULSE REFLECTS FROM **A LESS-RIGID** BOUNDARY, WHAT HAPPENS TO THE REFLECTED PULSE?

6. SPEED & DIFFERENT MEDIUMS

TAPE THE **SMALLER COILED SPRING** TO THE SLINKY. PRODUCE PULSES FROM **BOTH** ENDS OF THE TWO-SPRING SYSTEM. CLOSELY OBSERVE THE SPEEDS, TRANSMITTED PULSES, & THE REFLECTED PULSES.

A. WHEN A PULSE WENT FROM THE **SLINKY** TO THE **SMALLER SPRING**, WHAT HAPPENED TO THE SPEED AND SIZE OF THE TRANSMITTED PULSE?

B. WHEN A PULSE WENT FROM THE **SMALLER SPRING** TO THE **SLINKY**, WHAT HAPPENED TO THE SPEED AND SIZE OF THE TRANSMITTED PULSE?

CONCLUSION QUESTIONS

DRAW A **TRANSVERSE** WAVE USING THE LINE OF EQUILIBRIUM BELOW AND LABEL THE FOLLOWING CHARACTERISTICS ON THE DIAGRAM…

WAVELENGTH

AMPLITUDE

DRAW 2 POINTS THAT WOULD BE IN PHASE

DRAW 2 POINTS THAT WOULD BE 180^{O} OUT OF PHASE

DIRECTION OF VIBRATION & THE DIRECTION OF THE WAVE

CREST

TROUGH

REST POSITION