

# Understanding Doppler Effect

## Summary

Students will inquire on the questions: What factors affect the wavelength of a wave? (Guided inquiry)  
What is the Doppler Effect? (Structured inquiry)

## Time Frame

2 class periods of 45 minutes each

## Group Size

Small Groups

## Materials

- Slinky-1 per group
- Cafeteria trays - 1 per group
- Eyedroppers - 1 per group
- Clear flat-bottom dish and overhead projector
- [Shake Your Slinky worksheet](#)  
(attached)
- [The Dropsy Family worksheet](#)  
(attached)

## Instructional Procedures

### Introduction:

Start out with a class discussion of how they think the universe might have been formed--Write down their ideas. Have them list reasons why they think the universe was created this way. Discuss ways science has tried to explain the formation of the universe.

### Teacher note:

Some historical ideas are: Earth thought to be the center of the universe. The solar system is the end of the universe. The use of telescopes and the discovery of objects outside our galaxy. DO NOT DISCUSS BIG BANG THEORY AT THIS TIME

Discuss that science uses data (evidence) to make inferences. Many past ideas of how the universe was formed do not have the evidence to support them.

### DAY # 1: SLINKY

#### Teacher demonstration:

Use a slinky and student helper to make a transverse (up-and-down) standing wave.

Draw the wave on the board and identify the following characteristics: Wave length, trough, and crest.

#### Activity:

Have students get into groups of 3-4. Provide students a slinky and this challenge: "In your group, make a standing wave with the slinky and then "figure out" what you can do to change the wavelength of your wave. There is more than one way to do this--find as many ways as possible.

\* Make sure to test only one variable at a time." (\*You may need to discuss what a variable is to you class before the activity.

#### Data Analysis: Students should conclude:

- Frequency affects wavelength  
:  
Faster frequency shorter wavelengths

Slower frequency longer wavelengths

- Movement affects wavelength

:

Moving towards = shortens wavelength

Moving away = lengthen wavelength

## DAY #2: WATER WAVES

### Activity:

Divide class into groups of 3-4 students.

Give each group 1 tray and 1 eyedropper.

Have the students put about 1 cm. of water in each tray.

Have students use the eye dropper to drop water in the tray at regular intervals (eye dropper to remain stationary.)

Have students write and draw their observations.

Have students move the eye dropper (source of wave making) in one direction along the tray while dropping the water.

Have students record and draw their observations.

### Demonstration:

Place the flat-bottom dish on an overhead and produce waves by squeezing drops of water out of the dropper at regular intervals. (Explain that this is the frequency of the wave.)

This should produce waves of the same wave length.

Continue to make waves while moving the source toward one end of the dish. Note: the demonstration is done to ensure that students have accurately observed the Doppler phenomenon.

### Data Analysis:

Notice that the distance between the waves are the same at both ends of the dish as the source of the waves stays stationary.

Notice that as the source moves, the waves are being produced at the same rate and travel at the same speed. Distance between the waves will be shorter in the direction of the source movement and longer on the other end of the tank.

Summarize the observations and explain to the students that this is called the Doppler Effect.

Have the students think of examples of the Doppler Effect in everyday life.

### Extensions

To reinforce the idea of Doppler Effect a good activity to do with your class is to show them how an object producing sound coming towards you as an observer the pitch gets higher, then as it passes by the pitch gets lower.

Activity: You can have your students investigate this in several different ways.

Go to an area near the school where cars are passing by. Have your students observe what they hear. ( See Student Work Sheet)

Have your students sit on the curb in the parking lot of the school. Then drive your car pass them honking the horn. Have your students observe what they hear. ( See Student Work Sheet)

Or the one I do, I ride my mountain bike down the road while sounding a constant tone, with my students observing on the curb.

Note: Your students should make the observation of pitch change due to the Doppler Effect.

### Bibliography

Lesson Design by Jordan School District Teachers and Staff.

### Authors

