Gummy Bear Wave Machine

Introduction

Amplify your students' understanding of wave motion with this captivating demonstration! Using simple materials, students can have significant influence on large-scale variables of frequency, amplitude and wave speed as they observe wave motion through a medium.

Concepts

- Wave motion
- Frequency
- Amplitude

Materials

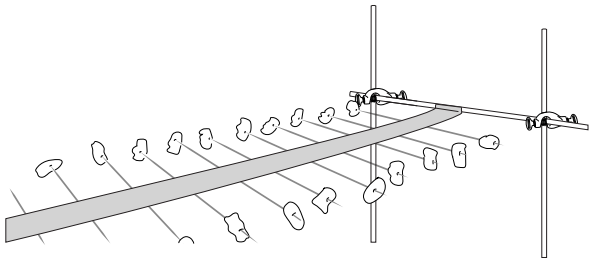
Clamp holders, 2
C-clamp (optional)
Duct tape, 1 roll
Gummy bears, 150
Support rods, 2
Support stands, 2
Wooden skewers, 75

Safety Precautions

The materials in this activity are considered nonhazardous. Exercise caution while handling pointed skewers. Do not eat the gummy bears being used for laboratory purposes. Follow all laboratory safety guidelines.

Preparation

1. Set up the support stands with support rods on opposite ends of the table. *Note:* Using C-clamps is highly recommended in order to keep the stands stable and the duct tape taut.
2. Run the duct tape (adhesive side up) slightly longer than the distance between the support rods.
3. Wrap the ends of the duct tape around each support rod. Make sure the tape is taut.
4. Place gummy bears on both ends of the wooden skewers. Use as many skewers as necessary to fit the length of the tape (with about 5 cm distance between each skewer).
5. Center skewers across the duct tape at 5-cm intervals (See Figure 1).



Procedure

1. Lift a gummy bear at one end of the machine and release. Observe the wave pulse!
2. Repeat step 1 to observe the effect of a quick pulse versus a slow pulse or of lifting the end gummy bear to different heights.
3. To observe propagation through different density media, remove both the gummy bears from the skewers leaving the empty skewers on the tape for one half of the machine—from the center to one support rod.

Tips

- If the skewers are not exactly centered, adjust the positioning of the gummy bears by sliding them to an appropriate position on the skewer to balance the machine.
- To make this a reusable demonstration, place another piece of duct tape across the top of the skewers enclosing them between the adhesive sides of the tape.
- If no C-clamps are available, use heavy weights on the base of the support stands to keep the stands from moving.
- A video of this demonstration is available as part of the Flinn Scientific Teacher Resource Minute Videos. Please visit the Flinn website at http://www.flinnsci.com for viewing information.

© 2017 Flinn Scientific, Inc. All Rights Reserved.

Publication No. 11346
121217

NGSS Alignment

This laboratory activity relates to the following Next Generation Science Standards (2013):

Disciplinary Core Ideas: Middle School
- MS-PS2 Motion and Stability: Forces and Interactions
  - PS2.A: Forces and Motion
- MS-PS3 Energy
  - PS3.A: Definitions of Energy
  - PS3.B: Conservation of Energy and Energy Transfer
- MS-PS4 Waves and Their Applications in Technologies for Information Transfer
  - PS4.A: Wave Properties

Disciplinary Core Ideas: High School
- HS-PS3 Energy
  - PS3.A: Definitions of Energy
  - PS3.B: Conservation of Energy and Energy Transfer
- HS-PS4 Waves and Their Applications in Technologies for Information Transfer
  - PS4.A: Wave Properties

Science and Engineering Practices
- Developing and using models
- Constructing explanations and designing solutions

Crosscutting Concepts
- Scale, proportion, and quantity
- Systems and system models
- Energy and matter

Discussion

The relationship between wavelength, frequency and wave speed can be easily observed with the wave machine.

$$\text{Wave speed} = \text{wavelength} \times \text{frequency}$$

If a quick pulse is used compared to a slow pulse, there is a noticeable difference in the wavelength, however, wave speed remains the same. If the pulse is shorter (frequency is higher), then the wavelength is reduced, and the product of wavelength and frequency remains the same. To portray changes in wave speed, the wave must pass into a different medium. When the gummy bears are removed from half the skewers, this can be observed. The wave emanates from a region containing gummy bears to a region without. The wave is observed to speed up in the gummy bear-free region. This models how a light wave speeds up when transitioning from water to air (transitioning from a higher index of refraction to a lower index of refraction).

The model also illustrates the concept of energy transferred through waves without the need to transfer matter itself. As a wave pulse propagates, the gummy bears remain in their position in space, meaning the gummy bears themselves do not travel down the length of the machine. The energy contained in the wave is what is observed to move through the medium. The medium is the combination of duct tape and skewers. The amount of energy in a wave is directly correlated to its amplitude, which can be shown by lifting gummy bears to different heights.

Reference

National STEM Centre. *Wave Machine.* https://www.stem.org.uk/elibrary/resource/27031/wave-machine (accessed April, 2016).

Materials for *Gummy Bear Wave Machine* are available from Flinn Scientific, Inc.

Catalog No.	Description
AP7938	Support Rod
AP5998	Support Stand, two hole
AP8219	Clamp Holder
AP1250	C-Clamp

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.

© 2017 Flinn Scientific, Inc. All Rights Reserved.