Slo-Mo Slinky Solution

The slinky appears to defy gravity! The bottom remains suspended in mid-air until the coils have fully collapsed

Before the slinky is dropped, the downwards pull of gravity is balanced by the upwards pull of the tension in the coils.

When the slinky is released, the coils collapse downwards. This is called a compression wave. The bottom remains motionless until the wave reaches it. At this point the slinky falls.

Watch a clip at www.mwmresearchgroup.org/floating-slinky

Did You Know?

The slinky was invented by accident by engineer Richard James in 1943, when he was searching for a way to stabilise shipping equipment against vibrations caused by rough seas. Richard's wife, Betty gave the toy its famous name.

Have a go at some of these slinky challenges, and tick the boxes when you have tried them!

About The Mathematics of Waves and Materials

We are a research group at the University of Manchester. We use maths to model and test the properties of materials and waves. Examples of our research include understanding and reducing noise; modelling the mechanics of tendons; and designing special materials with extraordinary properties.

Mathematics of Waves and Materials

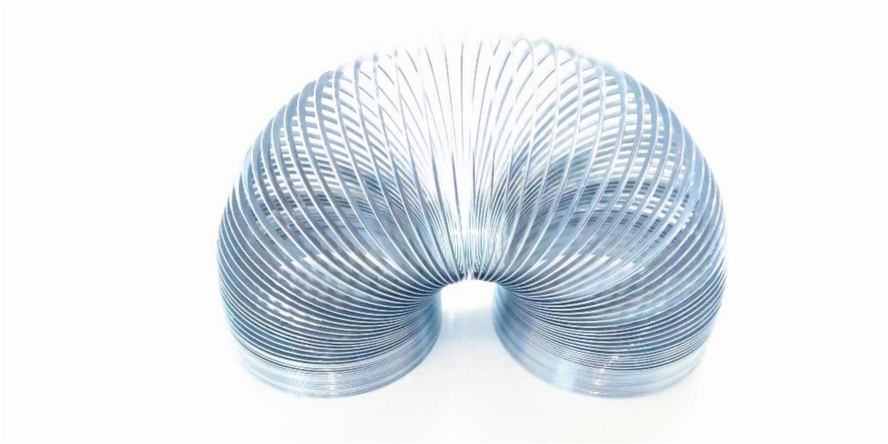
www.mwmresearchgroup.org/engagement

MANCHESTER 1824

The University of Manchester

Name

Slinky Science!



GLASGOW SCIENCE FESTIVAL

☐ I tried this!

Slinky Stairs Challenge

What to do

1. Build a staircase for your mini slinky to walk down. You could use a pile of books or cardboard boxes.
2. Hold one end of the slinky near the edge of the top step so that the other end hangs down towards the next step.
3. Let go. The slinky should flip end to end as it “walks” down the stairs. It takes practice, if the slinky tumbles, have another go!
4. Experiment with the height and width of the steps. What works best?

What I noticed

☐ I tried this!

Stringy Slinky Sounds

What to do

1. Tie two 30cm strings to the top of the slinky. Tie finger loops in the ends.
2. Shake the slinky and listen to the sound.
3. Put your index fingers in the loops and press them to your ears (not in your ears!).
4. Wiggle about so that the slinky moves. Is the sound different now? Can you say why?

What is going on?

- Most of the sounds we hear travel through the air around us, but sound can travel through solids, liquids or gases.
- Sounds travel more easily through solids than through air because the molecules in solids are closer together.
- What can you say about how the sound travelled from the slinky to your ears in each case?

What I noticed

Mathematics of Waves and Materials

☐ I tried this!

Sci-Fi Slinky Sounds

What to do

1. Hold the slinky up and let the coils dangle. Shake it about and listen to the sound.
2. Tape a plastic flowerpot to the top of the slinky so that its open end points away from the slinky.
3. Holding flowerpot, shake the slinky about.
4. Is the sound different now? Can you say why?

What is going on?

- We hear sounds when a vibrating object makes the air around it vibrate.
- The vibrating air particles make the ones next to them vibrate and so on, until the vibration reaches our ears.
- On its own, the slinky only has a small surface area to “push” against the air particles.
- With the pot attached, the vibrating slinky makes the pot and the air in and around it vibrate, too. The sound is much louder than the slinky alone. This is called *amplification.*

What I noticed

☐ I tried this!

MANCHESTER 1824 The University of Manchester

Slo-Mo Slinky

What to do

1. Make sure there is lots of free space around you.
2. Hold the slinky up and away from you. Let the coils dangle. *Can you predict what will happen when you let go? Will the coils close up as the slinky falls, before or after it falls, or not at all?*
3. Let the slinky go and watch carefully. You might have to repeat the experiment a few times! If you have a mobile phone, try filming it, and watching it in slow motion.
4. Find the answer on the back page!

My prediction:

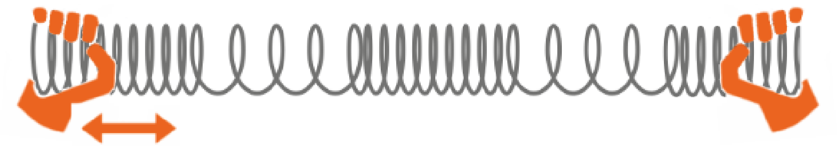
What I noticed

I tried this!

Slinky Waves 1

What to do

1. Hold your slinky stretched out with one hand at each end.
2. Keeping one hand still, move your other hand back and forth towards the still hand.
3. Experiment with different speeds. What happens to the coils? Try marking a coil with a sticker or piece of string to help you see what is happening.



What is going on?

- The coils of the slinky bunch together and stretch apart.
- This is called a *longitudinal wave*. The particles in a longitudinal wave vibrate back and forth in the same direction that the wave energy travels.
- Sound waves in air are longitudinal. The air particles in a sound wave alternately bunch together and stretch apart, like the slinky coils.

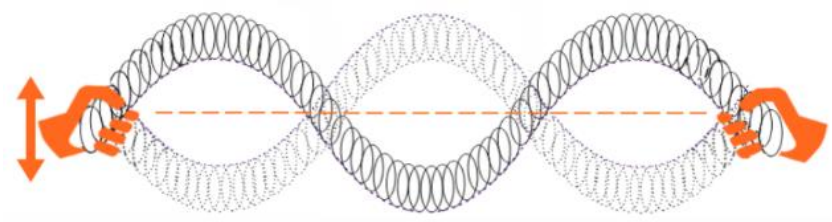
What I noticed

I tried this!

Slinky Waves 2

What to do

1. Now wiggle your moving hand up and down, keeping the other hand still.
2. Start slowly and gradually increase the speed. What do you notice about the coils?



What is going on?

- You have made a *transverse* wave with your slinky.
- Transverse waves vibrate at right angles to direction the wave energy travels.
- The high points are called *peaks* and the low points *troughs*.
- The more rapidly you move your hand, the more peaks and troughs you can make with the slinky.
- Ocean waves and light waves are transverse waves.

What I noticed