

Lesson 1: Fun with Springs

Overview

Students explore a simple spring simulation to see how springs behave, given different characteristics. Students can change the springiness, the resistance, and the amount of push or pull.

Learning goals:

- Represent and interpret data on a line graph.
- Compare/contrast how different types of springs behave.
- Describe how a push or pull of a spring affects its motion and position over time.
- Identify and describe other examples that oscillate in a similar fashion as a spring.



Figure 1: Title Screen

Student Challenge

Design a spring that behaves differently than the examples. Tell the story of how the spring's motion changes over time.

Lesson 1 - Level A - Ages 5-9

Time:

Two 45-minute sessions

Materials:

- One computer for every 2-3 students
- Simulation online at http://www.clexchange.org/curriculum/complexsystems/oscillation/Oscillation_SpringA.asp
- Handouts (See page 4.)
- Slinky® or other springs and rubber bands of different sizes to use for demonstration (optional)

Curricular Connections:

- An object's motion can be described by tracing and measuring its position over time.
- The position and motion of objects can be changed by pushing or pulling. The size of the change is related to the strength of the push or pull.

Key system dynamics concepts and insights:

- Springs move as they do because of how they are made; they have the potential to oscillate but can be at rest.
- Movement is affected by characteristics of the spring, such as mass and "springiness."

Lesson Details

Preparation:

1. Create groups of two to three students each.
2. Copy included handouts for each student group.
3. Check computers to make sure you can access the simulation.

Session 1

1. Introduce students to springs and the key concepts in the simulation. You may also want to have actual springs in the classroom for students to explore (e.g., a Slinky®). These concepts should include:
 - a. Springiness – How easy is the spring to pull apart? What if it were really hard to pull? Really easy?
 - b. Push or Pull - How can we move the spring before releasing it? What will happen if we push it up? Pull it down?
 - c. Resistance – Is there anything that slows down the spring? Does air slow down the spring? What if it were in outer space?
2. Show students the simulation in the classroom and read the introduction together (Figure 2) and go over the “Get Started” section.
3. Using the handouts, have students work in their small groups to “Make Decisions” (Figure 3).
4. Have students continue to “See What Happens,” recording data on the handout after the simulation run is complete (Figure 4). Students can run the simulation multiple times for different springs and record their data on the simulation handout for each one.

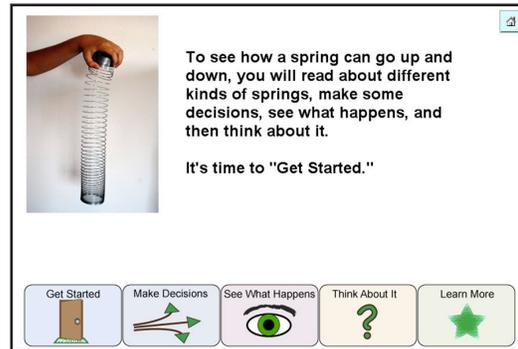


Figure 2: Introduction

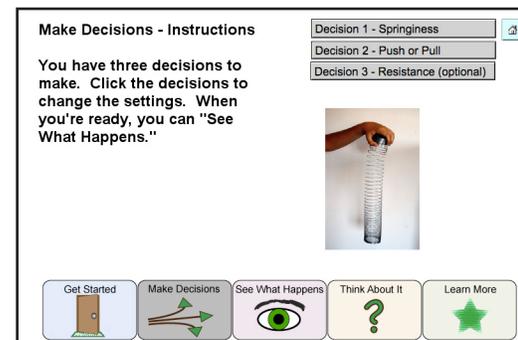


Figure 3: Make Decisions

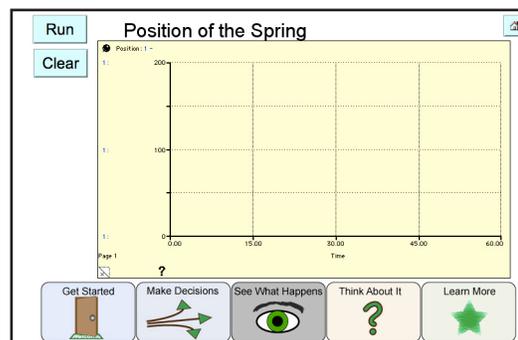


Figure 4: See What Happens

Lesson Details

Session 2:

1. If needed, have students complete the simulation within their small groups.
2. After running the simulation multiple times, students can continue to the “Think About It” section (Figure 5). Depending on student age and reading level, students may need guidance with this section.

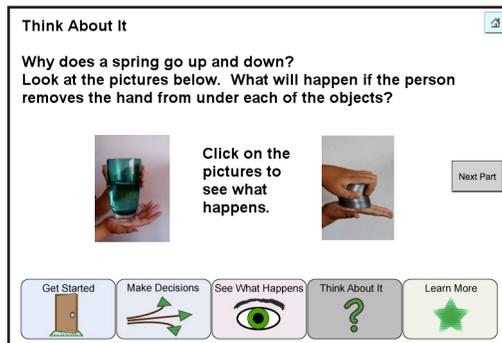


Figure 5: Think About It

3. Debrief the simulation experience using ideas for bringing the lesson home and assessment. You can also explore additional models described in the “Learn More” section (Figure 6).

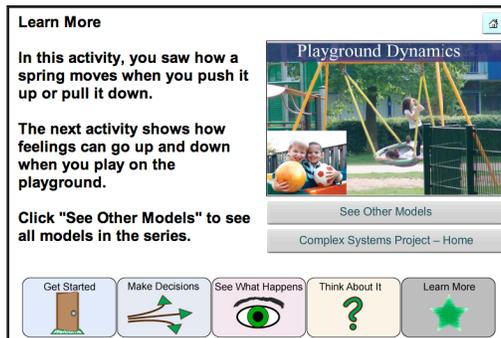


Figure 6: Learn More

Bringing the Lesson Home:

Run some experiments back in the classroom. Ask students to give you settings for a spring that would move in different ways:

- very fast
- very slowly
- very high/low
- start near the floor
- stop moving over time
- never stop moving over time
- others?

Discuss why the spring behaves the way it does for each experiment.

Assessment Ideas:

- Have students complete the assessment section of the handout.
- Have students create a picture of another example of something that oscillates like a spring.

“Fun with Springs” Simulation

Spring #1

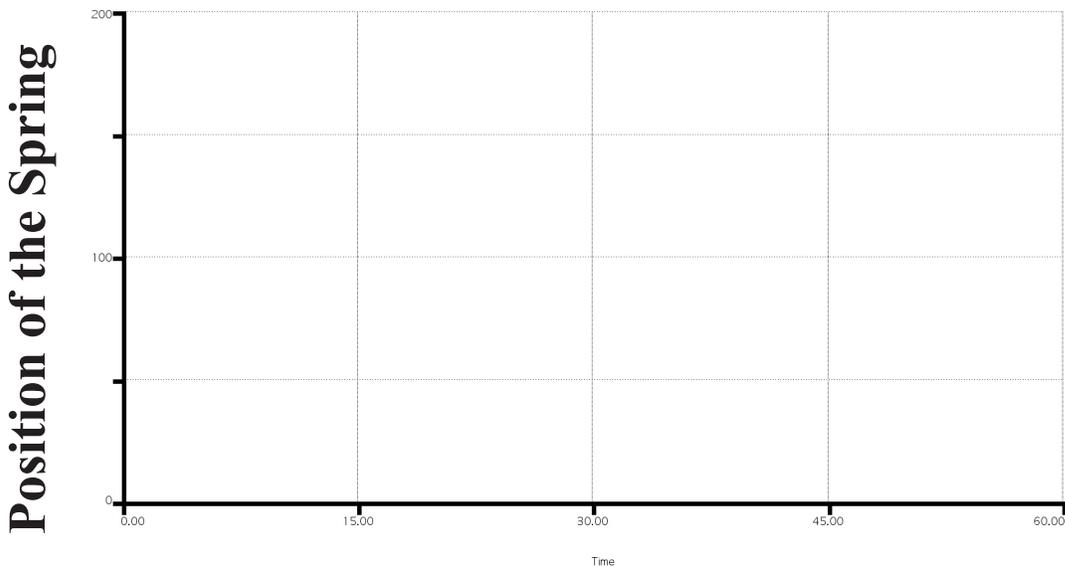
Your spring is very **easy to pull**.

Your spring is **pushed up all the way**.

Your spring is here on Earth, so it has **some resistance**.

What happened? Draw the graph of your spring.

My Spring



Tell the story of what happened to your spring.

Spring #2

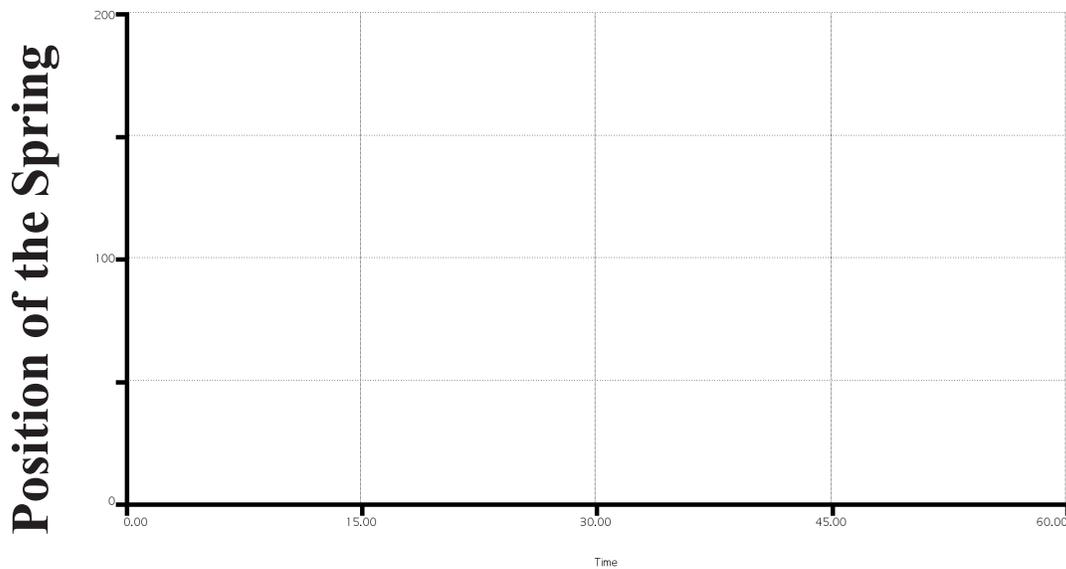
Your spring is very **hard to pull**.

Your spring is **pushed up all the way**.

Your spring is here on Earth, so it has **some resistance**.

What happened? Draw the graph of your spring.

My Spring



Tell the story of what happened to your spring.

Spring #3 – Design your own spring

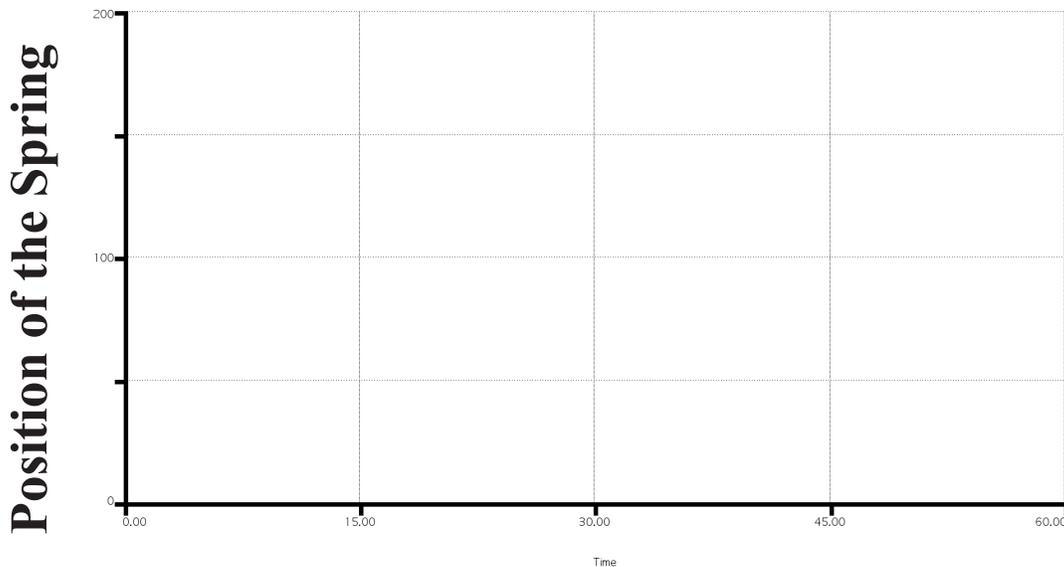
Springiness: _____

Push or Pull: _____

Resistance: _____

What happened? Draw the graph of your spring.

My Spring



Tell the story of what happened to your spring.

If you have time, you can design some more springs. Try to make just one change at a time to see what happens.

Assessment – Comparing Springs

Choose the graphs for two of the springs.

I choose Spring # _____ and Spring # _____.

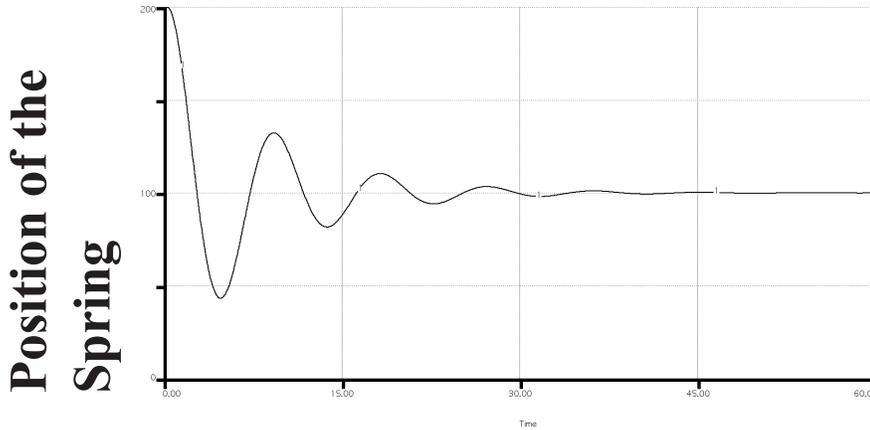
How are the graphs different?

Why do you think this?

How are the graphs similar?

Why do you think this?

If you wanted to make a graph like this one, how would you set up your spring?



Springiness: _____

Push or Pull: _____

Resistance: _____

What else goes up and down like a spring? Write your ideas and draw some pictures below.
