  Investigation 11

Springs Making Things Move

Many amusement parks have a ride in which you and your thrill partner are strapped into a two-person capsule that is connected to two large tethers. A combination of springs propels you high into the sky, reaching speeds of 100 km/hr. The design of this type of ride allows you to be pulled up until you reach the height of the top of the towers and then the tethers begin to apply a downward force on the capsule. Imagine what you are feeling as you are being propelled up, focusing on that initial launch up to the level of the top of the towers. What is going to affect how fast you are moving at the top of the towers?

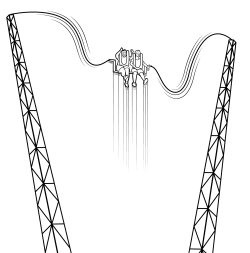


Figure 1

Preliminary Observations

Stretch a spring back and forth. Do you recall the relationship between force and the distance the spring is stretched? Consider the system you viewed in class: a cart on a track, propelled to some final speed by a spring. Your challenge is to determine how you will propel your cart to achieve the final speed set by your instructor.

Procedure

1. Take measurements for your group's spring to establish a force vs. displacement graph and overlay the spring constant line for the spring used in the demonstration.
2. Develop a purpose and a procedure for your investigation.
   * Propose a hypothesis for your test. Use the spring constant graph as a guide.
   * Identify the measurement equipment you will use.
   * Decide how much data to take in order to satisfy your purpose and stand up to questioning by your peers.
   * Identify what assumptions you are making as a result of your experimental design.
3. Carry out the investigation and record your data and observations. Refine/revise your hypothesis as necessary. Make sure all group members have access to the data.

Analysis

Consider your trials for each hypothesis tested. If a test disproved a relationship, provide a written explanation that supports why you think this makes sense. If a test confirms (or at least doesn't disprove) a relationship, explain the results.

Consider the component of the graph that holds meaning in this investigation. Are there other relationships in your experience of physics that are represented in this same way? You may wish to look back at your previous work in class, or do some research.

Extensions

1. Consider the units associated with the graph factor that proved to be important. Try to determine what factors can be used for a cart in motion to obtain the same units. Explain and comment.
2. Create a video explaining motion transformations in a complex system. Be creative in choosing your examples.
3. Devise a way to visually represent the transformation of the state of the spring and the cart.