

Absorbing Shock	Grade 5 – Forces acting on Structures and Mechanisms
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<h2 style="margin: 0;">Lesson Plan</h2>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%; padding: 5px; vertical-align: top;">Safety Notes</td> <td style="padding: 5px;">Remind students that springs can become dangerous projectiles if compressed and released. They are NOT to be shot around the room.</td> </tr> </table>	Safety Notes	Remind students that springs can become dangerous projectiles if compressed and released. They are NOT to be shot around the room.
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<h3 style="margin: 0;">Big Ideas</h3> <p>Structures and mechanisms throughout our environment have forces that act on and within them.</p> <p>We can measure forces in order to determine how they affect structures and mechanisms. This information can be used to guide the design of new structures and mechanisms.</p>	<h3 style="margin: 0;">Specific Expectations</h3> <p>2.5 use appropriate science and technology vocabulary, including tension, compression, torque, system, and load, in oral and written communication.</p> <p>3.1 identify internal forces acting on a structure and describe their effects on the structure</p> <p>3.2 identify external forces acting on a structure, and describe their effects on the structure.</p> <p>3.3 explain the advantages and disadvantages of different types of mechanical systems.</p> <p>3.5 describe how protective sports equipment protects the body from the impact of forces.</p>		
<h3 style="margin: 0;">Description</h3> <p>In this lesson students build a shock absorber do experiments to understand how it works and why it is useful. They will start by comparing different materials ability to absorb shocks.</p>			
<h3 style="margin: 0;">Materials</h3> <p>Per student team:</p> <ul style="list-style-type: none"> • Four small compression springs (e.g. from Canadian Tire or Amazon) • One or two skewers (or straws) • Cardboard • Masking tape • Play dough • Other shock absorbing materials (such as sponge, towel, etc). 	<h3 style="margin: 0;">Accommodations/Modifications</h3> <p>N/A</p>		

Introduction

Show a part of a video of a mountain bike racer. E.g. starting at the 2:40 mark:

https://www.youtube.com/watch?v=xQ_IQS3VKjA

Discuss how bumpy the ride is.

- Does the rider have something to protect himself from the bumps? (Yes, several shocks – you may want to review a shot in the video where the shocks at work are obvious).
- This is an example of a structure experiencing a lot of internal forces due to outside impacts.

Today we will build our own shocks and do experiments to see how well they work.

Action

You may want to build an example shock absorbing platform before class to show to students as an example. Alternatively let them explore how to build the best shock with the materials given. The goal is to have a shock absorber that can be placed between two surfaces (such as hands).

Building the shocks

- Give each team three or four springs, a skewer or two, cardboard and masking tape
- Cut out two equally sized cardboard pieces.
- Decide where to place the shocks between the two cardboard pieces. Pierce holes in both cardboard pieces with a skewer in those locations.
- Cut a skewer piece that is about 2 cm longer than the spring for each shock.
- Insert the skewer into one cardboard, slide spring onto it. Place second cardboard on top.
- Attach skewers on ONE SIDE ONLY with masking tape.

Testing the shock absorber

- Instruct students to gently push the cardboard surfaces toward each other.
 - If the loose cardboard does not slide past the skewers easily make the holes a bit bigger. The only resistance you encounter should be from the springs as they compress.
 - One student should place the shock absorber on their hand. Have a second student place their hand on top of the shock absorber. Gently push on it. What do they notice? (Shock absorber provides resistance)
 - One student should now gently bounce hand up and down. What do they notice?
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(“Impacts” from other hand are softened by the absorber. To verify they can do the same experiment just with hands touching).

Complete the experiments on the worksheet.

Consolidation/Extension

Extension:

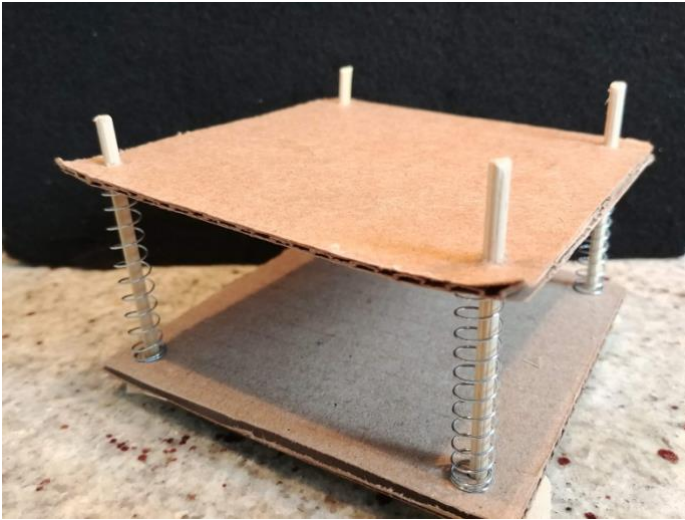
Have students use several balls of play dough (distributed evenly on their hands) and/or have them repeat the experiments several times. Then ask them to calculate averages of the heights of the play dough before and after. This will yield more accurate results and is how science experiments should be done in general.

Additional Resources

Though springs can be bought locally at a hardware store, here is also an amazon link:

<https://www.amazon.ca/Forney-72610-Spring-Compression-035-Inch/dp/B00G34Q8UI/>

Photos



Shock absorbing platform



Example springs that will work well for this lesson (from Canadian Tire).