Anchoring Phenomena with Light and Contact Forces

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Anchoring Phenomena with Light and Contact Forces

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Why do things sometimes get damaged when they hit each other?

Contact Forces: Collisions

OpenSciEd Unit 8.1
Exploring a Phenomenon

Cell Phone Damage

- Americans break 2 smartphone screens every second.
- More than 50 million phone screens are cracked each year.
- An estimated 95 million phones were damaged in the world by dropping them.
- We spend $3.4 BILLION each year in replacing cracked screens—not counting the 38% of smartphone owners who don’t replace them at all.
- 27% of people said that their phone was in a case when they broke it.

Source: Miami Herald
Have you or someone you know ever broken a phone? What caused it to break? Describe your experience(s).

Be ready to share your experiences with the class!
What damage to phones have you seen or experienced?

A few volunteers will use this CD case in place of a phone to show the class what happened to the phone. Your teacher will draw a model to represent what happened as you share.
Related Phenomena - Other Collisions

Brainstorm Other Collisions

- List a collision where objects were damaged during the collision on a red index card.

- List a collision where objects were surprisingly not damaged on a green index card.

Do the following on each index card:

- Identify the objects that came into contact with each other during the collision.

- Underline which object or objects were moving before the collision occurred.
Related Phenomena - Other Collisions

Categorizing Examples

Are your collisions examples of scenario A, B, or C?

Label each of your red and green cards “A”, “B”, or “C”.

The object that was damaged OR that you were surprised wasn’t damaged

The other object

A

was moving at first

B

was motionless at first

C

was moving at first
Related Phenomena - Other Collisions

Partner Share

In a moment, we will go to the areas of the room that go with our cards. First we will do red cards (damage), then green cards (no damage).

- While you are in your area, share your collision with a partner.
- Look for any similarities and differences in how the collisions occurred.
- How did damage (or no damage) occur?

The object that was damaged OR that you were surprised wasn’t damaged

The other object

A was moving at first

A was motionless at first

B was motionless at first

B was moving at first

C was moving at first

C was moving at first
Identifying Factors in a Collision

Looking for Patterns and Variables

Create a T-chart in your notebook. Label one side “Patterns in collisions” and the other side “Factors and variables that might cause damage in a collision.”

Record any patterns you notice between collisions and collision types.

List any factors or variables that you think contributed to why some items got damaged and other items did not get damaged in a collision.
Modeling Collisions

Initial Model: Objects During Collisions

What two objects collided? ___________________________ and ___________________________

Is this a scenario from A, B, or C? _______ Was there damage in this collision? _______

Imagine you had special glasses that could stop time and let you watch both objects. Describe what you think you would see happening at these two points in time:

<table>
<thead>
<tr>
<th>Time point 1: What would you see the materials they were made of doing if you could stop time the moment they first touch?</th>
<th>Time point 2: What would you see the materials they were made of doing if you could stop time a split second later?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Why do things sometimes get damaged when they hit each other?

This unit on contact forces begins as students consider situations in which they have seen their phones break. They contrast these situations with others where something else collided with another object and either did break or, surprisingly, did not. Attempting to identify the factors that contribute to damage occurring in some collisions and not others, as well as trying to explain what is happening during the collision that causes one type of result versus another, sparks a series of questions and ideas for investigations around the question why do things sometimes get damaged when they hit each other? This drives the work for the first two parts of the unit.

The final part of the unit re-anchors around a related question and a design problem to figure out what kinds of solutions we can design to protect fragile things from breaking.
Why do we sometimes see different things when looking at the same object?

Light & Matter: One-Way Mirror

OpenSciEd Unit 6.1
Explore an Interesting Phenomenon
Explore an Interesting Phenomenon

Make a 2-column chart on a blank page on the left side of your science notebook and record what you notice and wonder about.

<table>
<thead>
<tr>
<th>Notice</th>
<th>Wonder</th>
</tr>
</thead>
</table>

Watch the video closely and record things you notice and wonder about.

INDIVIDUAL → WHOLE CLASS
Slide B

Share Noticings and Wonderings

What did you notice happening in the video? What did you wonder about?
What do we think is happening?

Turn and Talk

- Why does the teacher see the music student?
- Why does the music student see themself and not the teacher?
Let’s figure out...

- What “parts” or “components” from the scene in the video do we think are important for explaining the phenomenon?
- What’s not important?
- What are we not certain about?
Develop a Diagram

Write these two questions in your science notebook:
- Why does the teacher see the music student?
- Why does the music student see themselves and not the teacher?

Create a diagram to explain as much as you know about the two questions.
- Include all the important parts we agreed on and label them.
- Use pictures, symbols, and words to explain how the parts interact to cause the phenomenon.
- Record questions that you have if you get stuck.
A **scale model** is a physical representation of something in the world. It can help us explain phenomena or solve problems.

Where have you seen or used scale models in your life?

Students would recall prior experiences and consider parts that should be represented in scale model.
Construct your light box!

Use the instructions provided to build your lightbox for the anchoring phenomenon (lesson 1).
Construct your light box!

Use the instructions provided to build your lightbox for the anchoring phenomenon (lesson 1).
6.1 Light & Matter Unit Overview

This unit on light and matter begins with a perplexing phenomenon of one-way mirrors and how this material can act as both a mirror and a window at the same time. Students directly observe and investigate the one-way mirror phenomenon using a scaled box model built from two combined boxes with a flashlight in one box, darkness in the other box, and a one-way mirror in between the two. Through this initial investigation, students figure out that the one-way mirror acts like a mirror on the light side of the system and a window on the dark side of the system. This experience prompts students to wonder: Why do we sometimes see different things when looking at the same object?

Students articulate a set of classroom norms to promote a safe and equitable classroom culture that they will use as they investigate and explain phenomena. They learn how to ask different kinds of questions about the phenomenon and how to model what they figure out to explain the phenomenon. Through their investigations, students figure out that the one-way mirror transmits about half the light and reflects about half the light that shines on it due to its microscale structures. Students engage in productive dialogue with their peers to come to consensus about how to model the unseen light interactions with the people and one-way mirror. Students then convince themselves that on the light side of the system, the one-way mirror reflects light as the strongest input to the eye, which is why a person sees their own reflection on this side. On the dark side of the system, the transmitted light from the light side is the strongest input to the eye, therefore why a person can see through to the light side. Using these ideas, students explain how light on either side of a material changes the light input entering the eyes, which affects what we see. Students apply these science ideas to explain why window glass can act like a one-way mirror in certain light conditions.
Anchor Phenomenon Routine

This routine positions students to make sense of a phenomenon, grounding all students in a common experience and raising student questions.

**Element #1:**
Explore the phenomenon

**Element #2:**
Attempt to make sense

**Element #3:**
Identify related phenomena

**Element #4:**
Questions and next steps
Using Storylines to Support Coherence

**Navigation Routine**
We figure out where we are and where we need to go next.

**Anchoring Phenomenon Routine**
We share an experience.

**Driving Question Board**
We develop questions for the Driving Question Board.

**Investigation Routine**
We develop evidence from investigations to explain parts of the phenomena.

**Putting the Pieces Together Routine**
We come to a consensus on what we’ve figured out so far.

**Problematizing Routine**
But new questions emerge through evidence we find.

**Putting the Pieces Together Routine**
We come to a consensus on what we’ve figured out, and have a more complete explanation of the phenomenon.

**Investigation Routine**
We develop evidence from investigations to explain parts of the phenomena.

**Questions Answered**
We’ve answered many of the questions from our Driving Question Board and are ready to explain some new phenomena.
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Added to notebook

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Student Consumables
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3. Select the format you would like for the unit - PDF or Google
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