



Gravity of the Situation

Boys and Girls Club After School Science
NSF Center for Chemical Innovation
Chemistry at the Space Time Limit (CaSTL)
<https://www.castl.uci.edu/>

Standard(s) Addressed:

- 2 PS 1a:** Students know the position of an object can be described by locating it in relation to another object or to the background.
- 2 PS 1b:** Students know an object's motion can be described by recording the change in position of the object over time.
- 2 PS 1c:** Students know the way to change how something is moving is by giving it a push or a pull. The size of the change is related to the strength, or the amount of force, of the push or pull.
- 2 PS 1e** Students know objects fall to the ground unless something holds them up.

Lesson Objective: The children will be able to understand that objects of the same size and shape will fall short distances at the same rate due to the pull of gravity on those objects by working in small groups and by manipulating golf and ping pong balls of different masses.

Materials Used:

golf ball
ping pong ball
meter stick
metal pan

Classroom Management:

Conversation: quiet indoor voices

Help: check with a neighbor before asking teacher

Activity: work with group, answer questions

Movement: "getter" may move to front of class to get materials; others remain at their place

Participation: working well in group, supporting teammates, doing task, working cooperatively
Get sheets of blank paper and a book for Engage.

Assemble enough materials ahead of time for groups of 3 or 4 children for Explore.

Get "Lazy Bear" book for Extend.

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ENGAGE: *Connect to Prior Knowledge and Experience, Create Emotionally Safe Learning Environment, Preview New Vocabulary* Estimated time: 5 minutes

Description of Engage: Teacher introduces the topic of gravity by asking what the children already know about falling objects. Teacher then asks the children to predict what will happen when teacher drops a piece of blank copy paper. The children make predictions. Teacher then drops the paper and asks the children if they were correct. Teacher then crumples the paper and repeats (asks the children to predict what will happen, drops the paper, then asks the children if they were correct). Teacher then places a blank piece of paper on a book, being sure that no edges of the paper extend beyond the edge of the book and asks the children to predict what will happen when teacher drops the paper on the book. The children usually are surprised by the result.

Teacher's Role	Teacher Questions	Children's Role & Answers to Teacher Questions
The teacher introduces the idea of gravity by asking the children if they have ever seen anything fall.	Have you ever seen something fall? Describe what happens.	Children describe some of their experiences. <i>Answers will vary.</i>
Teacher randomly selects children using index cards with the children's names on them.	Do you know why things fall down?	Children volunteer answers after they talk to a partner.
Teacher scripts the responses.	What does that mean? What is gravity?	"Gravity" "Something that pulls us down"
Teacher asks the children to predict what will happen when she drops a piece of paper.	What will happen when I drop this sheet of paper? Report to your partner about what you think will happen.	Children talk to a partner before answering the teacher's question. "It will float"
Teacher drops a piece of paper.	Was your prediction correct?	"Yes"
Teacher picks up the paper and crumples it.	Predict what will happen when I drop the crumpled piece of paper.	"It falls much faster."
Teacher then puts another piece of paper onto a book.	What will happen when I drop the paper and book at the same time? Report to your partner	Children share with each other first then tell teacher what they think will happen next.

<p>Teacher then drops the paper and book at the same time.</p>	<p>to share what you think will happen.</p> <p>Was your prediction correct?</p>	<p><i>“The book will fall then the paper will float”</i></p> <p><i>“No”</i></p>
<p>EXPLORE: <i>Hands-On Learning, Contextualize Language, Use of Scaffolding (Graphic Organizers, Thinking Maps, Cooperative Learning), Use of Multiple Intelligences, Check for Understanding</i></p> <p style="text-align: right;">Estimated time: 20 minutes</p> <p>Description of Explore: The children will work in groups of 3 or 4, depending on the numbers of children in the class. The children will investigate which of the two balls falls faster by dropping them from the same height at the same time. The children will make observations three times. The teacher will walk around the room checking on the children and listening to their conversations while they drop the balls. Teacher asks questions, if needed, to have the children thinking about their observations.</p>		
<p>Teacher’s Role</p>	<p>Teacher Questions</p>	<p>Children’s Role & Answers to Teacher Questions</p>
<p>Teacher tells the children that they are now going to investigate 2 falling objects by making observations and sharing answers. Once all the teams share their findings, we will see if there is a pattern.</p> <p>Teacher organizes the children into groups of 3 or 4 and assigns a getter for each.</p> <p>Teacher asks the children to hold the two white balls.</p> <p>Teacher scripts the children’s observations.</p>	<p>What do you notice about the ping pong ball and the golf ball?</p> <p>The key question in this investigation is: which ball</p>	<p>The getter goes to the front of the room to get the materials needed for the investigation: a ping pong ball, a golf ball, a meter stick, and a flat metal pan.</p> <p>Children talk to their partners before answering the teacher’s questions”</p> <p><i>“They are both round (spheres).”</i></p> <p><i>“One is heavier than the other”</i></p> <p><i>“The golf ball has holes but the ping pong ball is smooth.”</i></p>

<p>Teacher then assigns jobs: dropper, starter, eyes and ears #1, and eyes and ears #2.</p> <p>Teacher then leads the children in organizing a data table.</p> <p>Teacher walks around the room while the children are working and listens to their conversations.</p>	<p>will fall faster: the heavier one or the lighter one?</p> <p>Write your prediction on your worksheet (see attached): I think _____ because _____.</p> <p>Teachers asks questions as she observes the children working.</p> <p>What are you noticing?</p> <p>Did this happen each time you dropped the balls?</p> <p>Did you drop them from the same height?</p>	<p>Children write their predictions on their worksheet.</p> <p>Teams will drop each ball at the same time from the height of the meter stick onto the metal pan. They will do this three times. The children will record which ball hit the pan first--the heavier (h), the lighter (l), or both at the same time (s).</p> <p><i>“The balls fall together.”</i> <i>“The heavier ball falls faster.”</i> <i>“Yes”</i></p> <p><i>“Oh, the golf ball is a little bigger. When I lined up the balls so their tops were at the same height, the golf ball was a little lower.”</i></p>
<p>EXPLAIN: <i>Listening, Speaking, Reading, and Writing to Communicate Conceptual Understanding</i> Estimated time: 10 minutes</p> <p>Description of Explain: The children talk to each other to make sense of their observations. Teacher asks each team to report to the whole class. Teacher scripts the responses. Teacher encourages the children to think about the forces acting on the falling balls by asking leading questions.</p>		
<p>Teacher’s Role</p>	<p>Teacher Questions</p>	<p>Children’s Role & Answers to Teacher Questions</p>
<p>Teacher encourages the children to discuss their</p>	<p>What did you observe when you dropped the balls? Talk</p>	<p><i>“They both hit the metal pans at the same time.”</i></p>

<p>observations among themselves.</p> <p>Then teacher asks them to report their observations and the teacher scripts key ideas as the children provide them.</p> <p>Teacher tries to elicit a discussion of whether the heavy ball fell faster than the lighter ball, asking the children what they observed.</p>	<p>to your partners before answering.</p> <p>To each group: So what happened when you dropped the balls?</p> <p>What do you notice about the shape of the balls?</p> <p>Why did the balls fall this way?</p> <p>What was pulling down on the balls?</p> <p>What was pushing up on them (remember the paper I dropped in the Engage)?</p>	<p><i>“The balls fell together.”</i></p> <p><i>“They hit the pans together.”</i></p> <p><i>“They both had the same shape.”</i></p> <p><i>“They both were round and fell from the same height.”</i></p> <p><i>“Gravity pulled down on them.”</i></p> <p><i>“Like the paper, air was pushing up on them.”</i></p>
<p>EVALUATE: <i>Thinking Maps, Summarize Lesson and Review Vocabulary, Variety of Assessment Tools, Games to Show Understanding</i> Estimated time: throughout</p> <p>Description of Evaluate: The children discuss the falling balls during the Explore and Explain. The children write their Claims and Evidence on the worksheet.</p>		
Teacher’s Role	Teacher Questions	Children’s Role & Answers to Teacher Questions
<p>Teacher tells the children to record their findings in the Claims and Evidence on the worksheet.</p>	<p>Remember that the question we tried to answer was: which objects fall faster: the heavier one or the lighter one?</p> <p>In the Claims and Evidence section of your worksheet, write what you think is the answer to the question. What is your supporting evidence?</p>	<p>Children talk to each other before they complete the Claims and Evidence section.</p> <p><i>“The two balls fall at the same time. Gravity pulls down on them the same way. They both hit the pans at the same time.”</i></p>

EXTEND: Group Projects, Plays, Murals, Songs, Connections to Real World, Connections to Other Curricular Areas **Estimated Time: 10 minutes**

Description of Extend: Teacher reads “The Lazy Bear” and asks the children about the story. Teacher asks how this story relates to the investigation and to forces.

Teacher’s Role	Teacher Questions	Children’s Role & Answers to Teacher Questions
<p>The teacher reads “The Lazy Bear” using Dialogic Reading: PEER.</p> <p>The bear finds a rolling cart and rides it down the hill. Gravity acts on the cart to make it move downward.</p>	<p>The teacher <i>prompts</i> the child to say something about the book, <i>evaluates</i> the child’s response, <i>expands</i> the child’s response by rephrasing and adding information to it, and <i>repeats</i> the prompt to make sure that the child has learned from the expansion.</p> <p>There are five types of prompts that are used in dialogic reading to begin PEER sequences. We use the acronym CROWD: <i>completion prompts</i> (the child finishes a sentence the teacher starts), <i>recall prompts</i>, <i>open-ended prompts</i> (these focus on the pictures in the book), <i>wh-prompts</i> (what, where, when, why, and how questions) and <i>distancing prompts</i> (these ask children to relate the pictures or words in the book to experiences outside the book).</p>	<p>Children reply to the teacher’s questions as she reads the book.</p>

Common Characteristics of Lesson Plans

Get Children into the Learning--Connect to Their Prior Knowledge

Exploration/Investigation/Hands-On Learning

Making Meaning--Teachers and Children Together

Evaluation/Assessment

Extension to the Real World or Other Curricular Areas

Other Aspects to Consider:

The lesson is Child-Centered--the child is listening, speaking, reading, writing and drawing. The child is thinking.

There is more Child Talk than Teacher Talk.

“Gravity” of the Situation

Question: Which object falls faster: the heavier one or the lighter one?

Prediction: I think that _____ because

_____.

Materials: golf ball
 ping pong ball
 meter stick
 metal pan

Drawing of the investigation set-up:

Data Table: Which ball hits first? Put an “h” if the heavier ball hits the pan first; a “l” if the lighter ball hits the pan first; and “s” if they hit the pan at the same time.

	Trial #1	Trial #2	Trial #3
Dropper			
Starter			
Eyes & Ears #1			
Eyes & Ears #2			

Claims and Evidence:

Describing Action:

Beginning:

Student draws a picture of the equipment and labels the dropped balls to indicate which one hit the floor first.

Early Intermediate:

The _____ and the _____ hit _____.

Intermediate:

The _____ and the _____ hit _____. They are both _____.