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Anchoring Phenomenon

Objects move in different ways during physical activities on the playground.



Lesson Concept

Develop a model showing how the strength and direction of a force can cause an object to move.



Investigative Phenomenon

A basketball on the playground moves when it is thrown.



Standards

Refer to Appendix 3.2 for NGSS, CCSS—ELA, and California ELD standards.

3.2 Forces Move Objects



Storyline Link

This lesson builds on students' prior knowledge shared in Lesson 1: Movement on the Playground. In this lesson, students explore the cause and effect of various characteristics of forces using the game of basketball. Students create a model to show that forces have strength and direction. Students are also introduced to the force of gravity.

In the next lesson, students analyze data to determine patterns and predictability of motion and apply their analysis to their engineering challenge.

Throughout the unit, a flag (▶) denotes formative assessment opportunities where you may change instruction in response to students' level of understanding and making sense of phenomena.

TEACHER NOTE

The next 3 lessons will be working on three-dimensional learning. SEPs include models in Lesson 2: Forces Move Objects, and analyzing data/arguing from evidence in Lesson 3: Patterns of Motion, and models in Lesson 4: Balanced and Unbalanced Forces. CCCs include cause & effects throughout and building on patterns in Lesson 2: Forces Move Objects to predictability in Lesson 3: Patterns of Motion and Lesson 4: Balanced and Unbalanced Forces. The DCIs for force and motion include: strength and direction, patterns and prediction of movement, and balanced and unbalanced forces. Strength, direction, patterns, and predictability are emphasized in Lesson 2: Forces Move Objects and Lesson 3: Patterns of Motion; balanced and unbalanced forces are used in Lesson 2: Forces Move Objects and Lesson 3: Patterns of Motion culminate in Lesson 4: Balanced and Unbalanced Forces.

In Lesson 2: Forces Move Objects and Lesson 3: Patterns of Motion the focus is on using balls to experience the basic concepts of force and motion. In Lesson 4: Balanced and Unbalanced Forces, the understanding of these forces is applied to a non-ball activity, a tug-of-war. This physical experience of balanced and unbalanced forces resonates with third graders who think about balance as not falling down. In the tug-of-war, when students slide or fall, it physically represents the idea of unbalanced forces.

Using different experiences of motion (i.e. a ball that is thrown, a ball that is kicked, and tug-of-war) allows students multiple opportunities to gain an understanding of third-grade concepts of forces and motion.

Although there is a zero net force discussion in this lesson in terms of equal forces acting on an object, a deeper discussion of zero net force is a middle school disciplinary core idea.

3.2 Forces Move Objects



Time

190–350 minutes: (4–6 lessons)

Part I	60–120 minutes	Engage
Part II	60–120 minutes	Explore/Explain 1
Part III	10–20 minutes	Explain 2
Part IV	30–60 minutes	Elaborate
Part V	30 minutes	Evaluate



Materials

Whole Class

- 4 to 6 basketballs (or 10-inch-diameter rubber balls)
- Chart paper or large whiteboard
- Marking pens (4–5 sets)
- 3.1.C1: Basketball (from Lesson 1: Movement on the Playground)
- 3.2.C1: Observable Features of Models
- [Boys Outside Shooting Hoops](https://www.youtube.com/watch?v=-3m202OMCsI) video (<https://www.youtube.com/watch?v=-3m202OMCsI>) (Optional)

Partners

- Ping-pong ball (or another small ball)
- Small plastic cup with a 2-inch or 3-inch diameter

Individual

- Science notebook
- 3.1.H1: Motion Observation (from Lesson 1: Movement on the Playground)

Teacher

- [TalkScience](http://stemteachingtools.org/assets/landscapes/TalkSciencePrintable.pdf) resource (<http://stemteachingtools.org/assets/landscapes/TalkSciencePrintable.pdf>)
- 3.2.R1: Rubric

3.2 Forces Move Objects

Optional

These activities/references can extend understanding of force and motion:

Computer Simulations

- ❑ Sid the Science Kid—Fun with Friction (<https://www.youtube.com/watch?v=3Qs2W7gMxDk>)
- ❑ PhET Simulation—Forces and Motion (<https://goo.gl/vUQW4E>)

Video

- ❑ Gravity, Force, and Work video (<https://goo.gl/ix3fkD>)
[Notes: has directional force, but no strength]
- ❑ Force, Work, and Energy for Kids video (<https://goo.gl/eYCCvp>)
[explains forces, has no arrows]
- ❑ For teacher: Use as a source of background information. *What Forces Are Working On You* video (<https://goo.gl/WjZ27X>)



Advance Preparation

1. Gather materials.
2. Make a large chart **3.2.C1: Observable Features of Models** or use a document camera.
3. Prepare two charts on with the title Models and one with the title Patterns.
4. Have available **3.1.C1: Basketball** from Lesson 1: Movement on the Playground. Decide which questions from **3.1.C1: Basketball** you will have investigated by outside work groups. (Select 5 or 6 questions that can be answered by simple investigations.)
5. Prepare posters to display vocabulary terms and their definitions:
 - *push*: a force that moves an object away from a participant
 - *pull*: a force that moves an object towards a participant
 - *force*: pulls and pushes
 - *gravity*: a force that pulls objects down

Note: *Push* and *pull* are kindergarten vocabulary; *force* and *gravity* are used in third grade.
6. Review TalkScience resource (<http://stemteachingtools.org/assets/landscapes/TalkSciencePrintable.pdf>) to determine when best to use this resource in student-to-student discourse.

3.2 Forces Move Objects



Procedure

Part I

Engage (60–120 minutes)

*Develop a model showing how **the strength and direction of a force can cause an object to move.***

1. Have students share their science notebook with **3.1.H1: Motion Observation** (from Lesson 1: Movement on the Playground) with a partner. Ask them to discuss what they observed about not moving and moving objects and how they showed that in their drawings.

TEACHER NOTE

Find an example from a science notebook that has arrows showing motion and possible forces acting on the basketball. You will use this sample, under the doc camera, to facilitate a discussion on what might be needed in a model to represent motion and possible forces acting on an object.

2. Have students look at the sample and ask: “What do you notice about this example that helps you understand what is happening in this drawing?”

Leading Questions:

“Is the object moving or not? How can you tell? How was this represented in this drawing?”

“How are the arrows helping represent what this student observed?”

“What is happening to the object?”

“What caused it to move?”

Expected Student Responses (ESRs):

- *The object is moving because there are arrows showing the direction the object moves.*
- *There was an explanation describing what was observed and why the object moved.*

3. Tell the class that they will be having more opportunities in this lesson to create models of their investigations, adding the details needed to represent their observations and explanations just like scientists.

TEACHER NOTE

Features of a model include identification and labeling of the parts, how the parts relate to one another, and how the model can be used to make a prediction or explanation. These features will be explored throughout the rest of the lesson using **3.2.C1: Observable Features of Models.**

3.2 Forces Move Objects

4. Explain that in addition to explaining the things we can observe about movement, scientists often use models to help them think about and explain how movement works (cause and effect).

TEACHER NOTE

When thinking about force and motion, scientists use labels and arrows to show the direction of the force (cause) to an object and the strength of the force causing the object to remain in place or move (effect). They add supporting details to better explain what is happening.

5. Have the class look at the chart **3.1.C1: Basketball** from Lesson 1: Movement on the Playground. Explain that we can create a model of this basketball adding more details than we had on **3.1.H1: Motion Observation**.
6. Place a basketball in front of the class on a flat desk. Direct students not to touch the ball. Make sure it is stationary.
7. Direct students to observe the basketball, and in their science notebook make an initial model to describe what the ball is doing (not doing) and identify what they think might be causing it to do what it is doing (not doing).

TEACHER NOTE

Not all of the students were able to draw a basketball on **3.1.H1: Motion Observation**. This gives all students the opportunity to draw a model of a basketball. Encourage students who drew a basketball on **3.1.H1: Motion Observation** to transfer their model of the basketball from the ground onto a desk and label it.

8. Ask a few students to share their initial models and ideas with the class. “What detail or labels did you add to represent what you observed? What do you think is causing the basketball not to move?” *ESRs: I labeled the ball and the desk. The basketball is staying still on the desk. The basketball is not moving because no one is touching it.*

TEACHER NOTE

There will be many steps in the scaffolding of “creating a model” within this lesson. Students will be given multiple opportunities to revise and add to models throughout this lesson. Therefore, basic models without details representing or explaining cause-and-effect relationships are acceptable at this time.

► As students revise their models, notice how their thinking is changing both in terms of developing models (i.e., the observable features of models) and using models to describe the scientific concepts.

3.2 Forces Move Objects

9. Explain that now they will make a model of the ball in motion. Ask a student to come to the front of the class and move the ball (without picking it up) across the desk until it falls off.

TEACHER NOTE

Encourage the student to push the ball so that it falls off the desk. This gives students the chance to add it falling in their model. At this time students might not mention gravity.

10. Direct students to observe the basketball and in their science notebook make an initial model to describe what the ball is doing (not doing) and identify what they think might be causing it to do what it is doing (not doing).
11. Look for sample models as students are drawing: look for samples where there is an arrow showing the ball being pushed; an arrow showing it traveling across the desk; an arrow pointing down when it falls off the desk; and notes of supporting details or explanations.
12. Have selected students present their models and have a class discussion about these models—asking if they think there are any more forces causing action on the ball. If they make suggestions, write them on the board.

TEACHER NOTE

Students should discuss *push* and *pull* which they learned in kindergarten. They may bring up the word *force*. If they do, you should discuss its meaning. If they don't bring up this word, you can use it in relation to their model by saying, "Do you know what a scientist calls a push or a pull? They are both called a *force*."

Students are not expected to draw different size arrows to indicate the strength of the force at this time. Force/strength arrows will be added later in the lesson.

13. Call two students to the front of the classroom and ask them to extend one arm with their palm up. Place a basketball in each student's hand.
14. Ask the class to think about what forces are working on the basketball, based on what forces were evidenced acting on their basketball in their models:

Leading Questions:

"Is the basketball moving or not moving? Why?"

"What forces might be causing the basketball to move or remain still?"

"What can you say about the forces on each side of the basketball (top/bottom, side/side)?"

3.2 Forces Move Objects

Expected Student Responses (ESRs):

- The hand is sort of moving because the basketball is heavy, but the ball itself is not moving.
- Gravity is pulling on the basketball.
- His/Her hand is holding up the ball.
- There are no forces on the sides of the basketball.

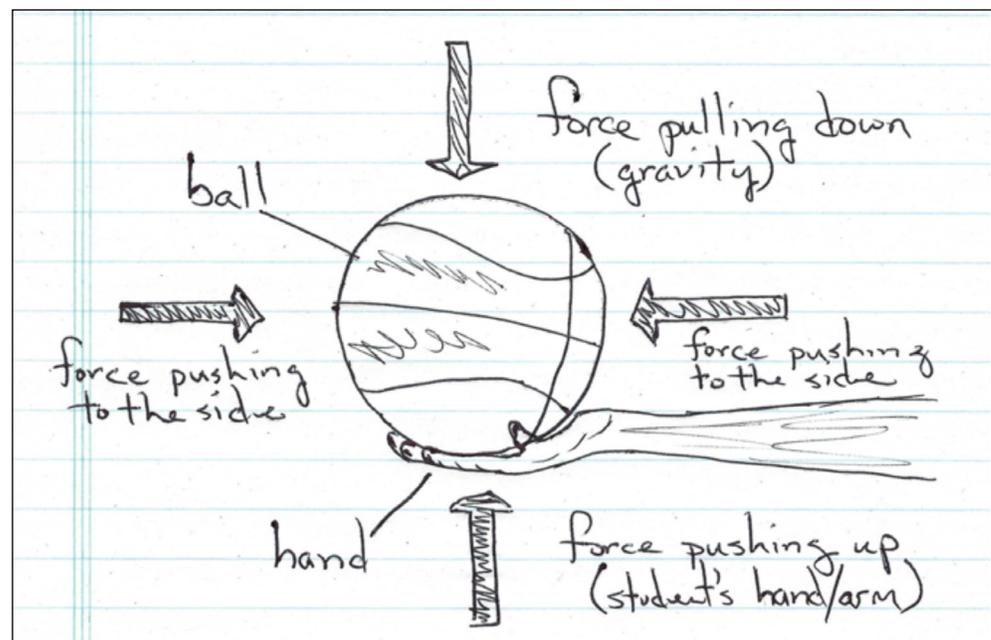
15. Challenge them to consider what is holding up the basketball and if there is anything pulling down on the basketball.

TEACHER NOTE

Students are not expected to be able to explain equal forces or gravity at this point, but it will be made explicit in the class model that follows. They may mention that a force is “pulling the ball down.”

16. ► As a class, create a model of the forces acting on the basketball and write an explanation of what the forces are doing. Ask the class what should be included in the model. Chart their ideas on the Model chart you made in Advance Preparation and compare them to the characteristics that scientists use on **3.2.C1: Observable Features of Models**.
17. Based on their ideas, discuss the importance of making a drawing and labeling every part. They should label the ball and any forces acting on the ball.

Example of a Student Model



3.2 Forces Move Objects

18. Discuss how they can indicate the relationships between the parts in their models. How did they show the upward force from their hand or downward force from gravity? What did they label to show the side forces? If these are not labeled, explain that models need to show invisible as well as visible components. How can they show that there are invisible sideway forces acting on the ball?

Leading Questions:

“What forces might be causing the basketball to remain still? Is there only one force or many?”

“What can you say about the forces on each side of the basketball (top/bottom, side/side)? Are they equal?”

“How do these side/side forces relate to each other? Is one stronger or weaker than the other?”

Expected Student Responses (ESRs):

- *There are many forces acting on a ball when it is not moving*
- *His/Her hand is holding the ball still.*
- *His/Her hand is pushing up on the ball. Gravity is pulling down on the basketball so it is not moving.*
- *There are the same forces on the sides of the basketball so it doesn't move.*
- *The forces on the sides are equal. They're the same.*
- *The forces are balanced all around.*

TEACHER NOTE

It is important for students to understand that an object at rest typically has multiple forces acting on it and that these forces are equal or balanced. Most likely students will use the word *equal*. If they do, introduce that equal forces are balanced. Use the leading questions above to facilitate this discussion.

19. Finally, discuss how the model could be used to explain their observations.

Possible explanations include:

- *Equal forces pushing up (arm) and pulling down (gravity) cause the forces on the ball to be balanced and the ball to stay still.*
- *Equal forces pushing on the sides of the ball keep it balanced.*

3.2 Forces Move Objects

20. Have students return to their model of the basketball on the desk. Explain that now, based on their class basketball model, they are to revise the model they made of the basketball 'at rest' on the desk. Have them consider what they can add (not erase) to their model focusing on explaining the cause and effect of the forces applied to the ball (upward force from the desk; pulling down force from gravity).

TEACHER NOTE

It is not necessary to explain gravity at this point (it will be explained at the middle school level). Only label it as the force that pulls down. Also, point out that it is a force that causes motion without contact.

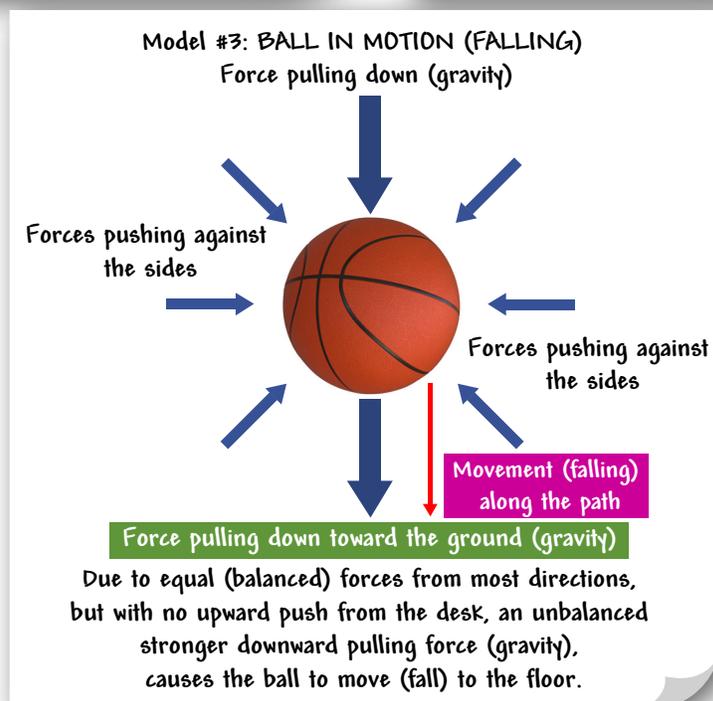
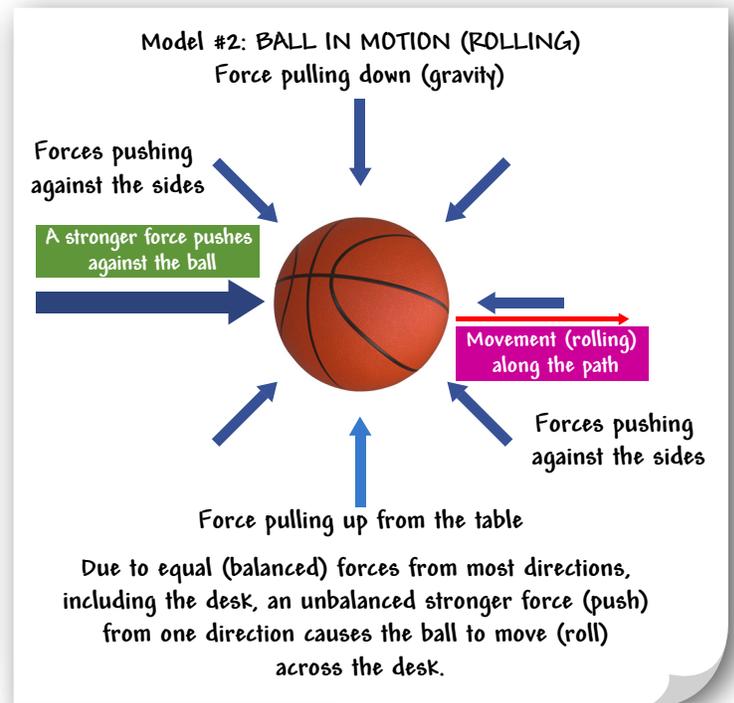
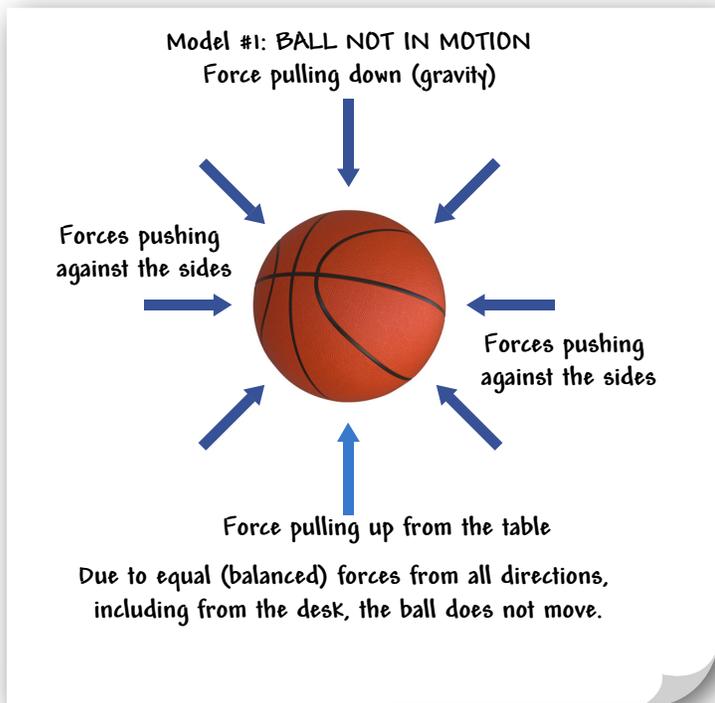
21. Explain that when the forces are equal the object is said to have a *net force of zero*, and there is no change in movement. Therefore, it is balanced.
22. Call two new students to the front of the classroom and ask them to extend one arm, with their palm up. Place a basketball in each student's hands.
23. Ask the class, "What will happen if the students drop their arms?" (*ESR: The basketball will fall.*) Have the students holding the balls drop their arms to demonstrate.

TEACHER NOTE

At this point label (or confirm) that the downward-pulling force is called gravity. Explain that this force pulls things down. Also, point out that gravity is a force that causes motion without contact.

3.2 Forces Move Objects

24. Ask students to return to their earlier model about the basketball in motion (on the desk and falling off) and make revisions based on what they now understand about making a model that includes 'directional' and 'strength of a force' arrows. Suggest that students draw three models: model #1 is the basketball at rest; model #2 is the basketball moving across the desk, and model #3 is the basketball falling off the desk onto the floor.



3.2 Forces Move Objects

25. Ask students to write an explanation of the changes in the motion of the basketball and the forces that caused those changes in the three models.

Expected Student Responses (ESRs):

- *In model #1 the ball is not moving because all of the forces (up and down; left and right) are balanced.*
 - *In model #2 the ball begins to move across the desk because of a student pushed it. The force from the left is stronger than the force from the right. This makes an unbalanced force that causes the ball to move to the right. So I put a strong arrow on the left of the ball to show the strength of the force moving it toward the right. I put another arrow to show the direction of the ball moving across the desk. The top and down forces are balanced, making the ball stay on the desk.*
 - *In model #3 the ball falls off the desk. I drew a directional arrow to show it falling off the desk. I also drew a strong down arrow and labeled it gravity. It is stronger than the upward force, which causes the forces to be unbalanced and the ball to fall down.*
26. Have several students share their models (on the doc camera). Discuss the models in terms of the drawing, labels, and explanations of the balanced and unbalanced forces that caused the movement.
27. Provide one more opportunity for students to revise their models based on the class discussion.
28. Ask students to self-assess their models using **3.2.C1: Observable Features of Models**. Did they include a drawing with labels? How did they indicate the relationship between the parts of the model? What were they able to explain about forces and motion using their model?
29. Have students think about the differences between the models they made of the basketball at rest and in motion. Discuss with a partner the relationship between cause and effect when the basketball doesn't move or moves in the models they made. Share a few comments.

Part II

Explore/Explain 1 (60–120 minutes)

Develop a model to describe movement on the playground, noting what causes the movement.

30. Remind students of their playground design challenge as they think about going outside to investigate how a basketball moves on the playground.
31. Have the class look at **3.1.C1: Basketball** from Lesson 1: Movement on the Playground. "Which questions can we investigate to gather evidence about force and motion? How can we use what we know from our models of basketball motion to apply to our new playground design?" Circle the questions the students want to investigate.

3.2 Forces Move Objects

TEACHER NOTE

Make sure the circled questions support the students' understanding that the strength and direction of forces can cause a basketball to move and how balanced and unbalanced forces impact that motion. If the questions do not allow for this, add several of your own questions that do.

32. Divide the class into groups of 3–5 students. The groups will go to the basketball court to investigate one of the class questions. Give each group one question, and ask them to discuss what they will need to do outside to create a model that helps gather evidence to answer that question.
33. Have groups discuss what they will record on their individual model about the movement of the basketball (e.g., force of ball push, angle of ball travel). How does this help answer their question? Remind students that they will be using their observations to make a model of what they did to move the basketball. They will draw their model in their science notebook and write a description of the cause-and-effect relationship to change the ball from not moving to moving.
34. Take the class outside to the basketball court. Remind groups to take turns collecting evidence, making observations about the forces causing the movement of the basketball, and drawing individual models in their science notebook that they can contribute to their group model. The goal of this activity is to have students apply various amounts of force and direction to get the basketball into the basket and answer their question. *ESRs: Students make observations of the strength of the force applied to push the basketball towards the basket and that the basketball is pulled down.*

TEACHER NOTE

If your students are not ready to work independently, you may want to have one group model the activity while the other students record observations. Allow student teams to take turns with the activity.

TEACHER NOTE

If time, or lack of available playground equipment, does not allow for the class to participate with the basketball, you can show [Boys Outside Shooting Hoops](#) video instead. Stop the video at 20 seconds (repeat if necessary).

35. Allow groups 15 minutes on the playground to investigate the movement and create the models in their science notebook. Then return to the classroom.

3.2 Forces Move Objects

36. Distribute chart paper or a whiteboard to each group and ask them to draw a group model of the evidence that supports their observations.
37. Remind students that their model must include:
 - arrows showing direction and strength
 - a written explanation of the basketball at rest
 - a written explanation of what caused the basketball to move
 - a written explanation and models showing the pattern of motion as evidence
 - the relationship of cause and effect related to the movement of the basketball
38. Conduct a science talk where each group presents its poster (one at a time) to the class. Encourage students to ask questions of the presenters about the models and the explanations.
39. In table groups, ask students to discuss what they noticed that was similar in all of the presentations about force and motion. Ask table groups to chart their ideas on Patterns chart you made in Advance Preparation. Look for the ideas that there were patterns in the movement; all involved balanced and unbalanced forces; forces have strength and direction; and the ball moves according to force strength and direction. If these ideas are not stated, add them to the chart.
40. Ask students to record these patterns about motion in their science notebook.

Part III

Explain 2 (10–20 minutes)

Obtain and communicate information describing characteristics of the *cause and effects of force on motion*.

41. Assign a reading from the Literacy Link list on page 3.2.16. Ask students to find sentences from the reading that add key details to their understanding of the characteristics of forces. Have students record these key details in their science notebook.

TEACHER NOTE

When selecting a book or reading passage from the recommended list:

- choose one passage for all students OR
- choose various ‘leveled’ passages based on student reading ability.

42. Have students share one of their sentences within their groups.

3.2 Forces Move Objects

TEACHER NOTE

You may choose to have students share selected sentences with the whole class. Write them on sentence strips. Group similar sentence strips that support learning concepts on the wall as a visual summary of the reading. These can be referenced throughout subsequent lessons as needed.

Part IV

Elaborate (30–60 minutes)

Using the characteristics of forces and their effects on motion, design a solution for a new piece of playground equipment or activity.

43. Explain that students will now have an opportunity to apply what they know about basketball movement to their engineering design. Connect the patterns of motion that students wrote in their science notebook to the criteria list they created in Lesson 1: Movement on the Playground. Review design criteria (*must have motion; change in direction and strength of motion; pattern of predictability; balanced and unbalanced forces*).
44. Ask students to discuss with a partner, “How do we design activities or structures that are fun and allow for movement? How will the motion happen, and what patterns will I see in that motion? How can we use what we’ve learned about basketball to help explain our design?”
45. Tell the class that each set of partners will be given a paper cup and ping pong ball. They will have 15 minutes to create a smaller version of an activity or structure that would meet the criteria. They can only use one desktop as their “activity/structure” space. Students will be creating a model in their science notebook and sharing this model of their activity with another group. Remind students that models are used to help explain how movement works.

TEACHER NOTE

You may add any other constraints you want to this investigation.

46. After 15 minutes ask partners to trade their science notebook with another pair to provide feedback on their design models. Using sticky notes, students provide comments about student models and meeting criteria.
Tell students, “With each science notebook you view, provide your classmate with feedback using a sticky note that uses one of these sentences”:
I agree with _____.
I wonder _____.
This makes me think _____.
I disagree because _____.
47. Have students review feedback and make revisions to their model.

3.2 Forces Move Objects

Part V

Evaluate (30 minutes)

Communicate information describing patterns of movement on the playground.

48. Assign students to write a paragraph stating why they agree and disagree with the statement, “An object always moves when a force acts on it.” They must support their statement using evidence from the models they made in their investigations.

If students need support, offer these sentence frames and word bank for those that need these supports:

I agree that an object always moves when a force acts on it because _____.

I disagree that an object always moves when a force acts on it because _____.

Word Bank:

force

balanced or unbalanced

ball

equal

gravity

cause and effect

49. ► Collect paragraphs to evaluate student understanding. Use **3.2.R1: Rubric** to evaluate/ assess how students applied their understanding of force and motion to answer the question.

TEACHER NOTE

The question is designed so that students who really understand force and motion would both agree and disagree with the statement based on balanced and unbalanced forces, and strength and direction of forces.

50. Close this lesson by referring the class back to **3.1.C1: Basketball** from Lesson 1: Movement on the Playground. Have students share any wonderings/questions that they had for which they now have explanations.
51. Ask the class to share any new wonderings they would like to add to the “Soccer” chart for their next investigation. Also add any questions that will help them gather evidence for their final design for the new playground or further their understanding of movement on the playground.

3.2 Forces Move Objects

Literacy Links

- *Making Things Move: Force and Motion* by Adriana Frost
- *Give It a Push! Give It a Pull! A Look at Forces* by Jennifer Boothroyd
- *First Science: Motion* by Kay Manolis
- *Simply Science: Motion* by Melissa Stewart

ReadWorks (Online Passages available at www.readworks.org)

- *Will You Push or Pull?* (240L) (K level)
- *A Big Push* (320L) (K level)
- *What is Gravity?* (500L) (1st grade level)
- *Machines Can Move* (580L) (3rd grade level)
- *Famous Scientists Sir Isaac Newton* (560L) (3rd grade level)
- *The Motion of a Baseball* (900L) (5th grade level)
- *How Soccer Can Help Us Understand Physics* (1060L) (7th grade level)

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Toolbox Table of Contents

3.2.C1	<u>Observable Features of Models</u>	3.2.19
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Observable Features of Models

- **Identification and labeling of the components (parts)**
- **How the components (parts) relate to one another**
- **How the model can be used to form an explanation or to make a prediction**

Rubric

An object always moves when a force acts on it.

	4	3	2	1
	agrees and disagrees with the statement	agrees or disagrees with the statement	agrees or disagrees with the statement	no response
Balanced and Unbalanced Forces	agrees because when the forces are unbalanced, the ball will move AND disagrees because if all the forces are balanced, the ball will not move	EITHER agrees because when the forces are unbalanced, the ball will move OR disagrees because if all the forces are balanced, the ball will not move	EITHER agrees because when if someone pushes it, the ball will move OR disagrees because if no one pushes the ball, it will not move	provides no "because" statement
Strength of Force	In my model if the unbalanced force is strong, the ball moves farther. AND In my model if the balanced forces are all equally strong, the ball won't move.	EITHER In my model if the force is strong, the ball moves farther. OR In my model if the forces are all equally strong, the ball doesn't move.	EITHER Strong pushes make the ball go far. OR Strong pushes on all sides will make the ball stay still and not move.	Hard goes far.
Cause and Effect (if the prompt was used, "because" should be addressed)	My models show that unbalanced forces cause the ball to move. AND My models show that balanced forces caused the ball not to move.	EITHER My models show that unbalanced forces cause the ball to move. OR My models show that balanced forces caused the ball not to move.	EITHER My models show that a push causes the ball to move. OR My models show that if no one gives the ball a push, the ball will not move.	My models show a push moves the ball and that no push makes the ball stay still and not move.

Appendix 3.2

Forces Move Objects

Next Generation Science Standards (NGSS)

This lesson is building toward:

PERFORMANCE EXPECTATIONS (PE)

3-PS2-1	Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. <i>[Clarification Statement: Examples could include an unbalanced force on one side of a ball can make it start moving; and, balanced forces pushing on a box from both sides will not produce any motion at all.] [Assessment Boundary: Assessment is limited to one variable at a time: number, size, or direction of forces. Assessment does not include quantitative force size, only qualitative and relative. Assessment is limited to gravity being addressed as a force that pulls objects down.]</i>
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NGSS Lead States. 2013. Next Generation Science Standards: For States, By States. Washington, DC: The National Academies Press.

SCIENCE AND ENGINEERING PRACTICES (SEP)

Developing and Using Models

- Collaboratively develop and/or revise a model based on evidence that shows the relationships among variables for frequent and regular occurring events.
- Develop and/or use models to describe and/or predict phenomena.

Engaging in Argument from Evidence

- Construct an argument with evidence, data, and/or a model.

PS2.A FORCES AND MOTION

PS2.A: Forces and Motion

- Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion.

PS2.B: Types of Interaction

- Objects in contact exert forces on each other.

Appendix 3.2

CROSSCUTTING CONCEPTS (CCC)

Cause and Effect

- Students routinely identify and test causal relationships and use these relationships to explain change. ~~They understand events that occur together with regularity might or might not signify a cause and effect relationship.~~ (3–5 Progression)

Patterns

- Students identify similarities and differences in order to sort and classify natural objects and designed products.
- They identify patterns ~~related to time, including simple rates of change and cycles;~~ and to use these patterns to make predictions.

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Common Core State Standards (CCSS)

CCSS ELA READING

CCSS.ELA-LITERACY.RI.3.1

Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.

CCSS.ELA-LITERACY.RI.3.3

Describe the relationship between a series of historical events, scientific ideas or concepts, ~~or steps in technical procedures in a text;~~ using language that pertains to time, sequence, and cause/effect.

CCSS.ELA-LITERACY.RI.3.10

~~By the end of the year,~~ read and comprehend informational texts, including ~~history/social studies,~~ science, and technical texts, at the high end of the grades 2–3 text complexity band independently and proficiently.

CCSS ELA WRITING

CCSS.ELA-LITERACY.W.3.8

Recall information from experiences ~~or gather information from print and digital sources;~~ take brief notes on sources and sort evidence into provided categories.

CCSS ELA SPEAKING AND LISTENING

CCSS.ELA-LITERACY.SL.3.1

Engage effectively in a range of collaborative discussions (~~one-on-one, in groups, and teacher-led~~) with diverse partners on grade 3 topics and texts, building on others’ ideas and expressing their own clearly.

CCSS.ELA-LITERACY.SL.3.4

Report on a topic or text, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable level.

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Appendix 3.2

California English Language Development (ELD) Standards

CA ELD		
Part 1.3.1 Exchanging information and ideas.		
EMERGING	EXPANDING	BRIDGING
Contribute to conversations and express ideas by asking and answering <i>yes-no</i> and <i>wh-</i> questions and responding using short phrases.	Contribute to class, group, and partner discussions, including sustained dialogue, by following turn-taking rules, asking relevant questions, affirming others, and adding relevant information.	Contribute to class, group, and partner discussions, including sustained dialogue, by following turn-taking rules, asking relevant questions, affirming others, adding relevant information, building on responses, and providing useful feedback.
In addition to the standard above, you may find that you also touch on the following standard in this lesson as well: P1.3.9 Plan and deliver brief oral presentations on a variety of topics and content areas.		

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