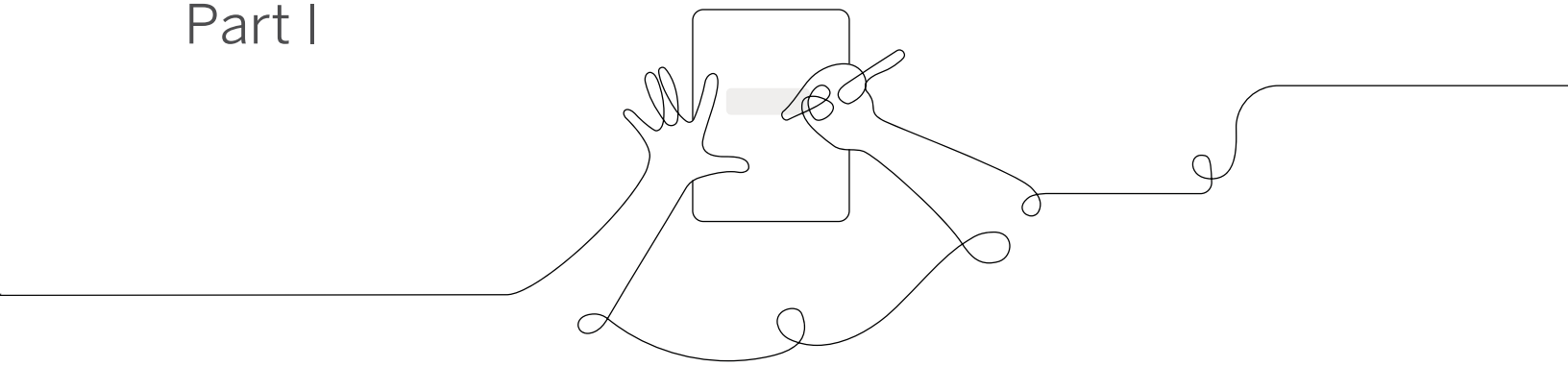
AmplifyScience

Participant Notebook

Grade K: Pushes and Pulls
Guided Unit Internalization with @Home Resources
Part I



Unit Guide resources

Once a unit is selected, select **JUMP DOWN TO UNIT GUIDE** in order to access all unit-level resources in an Amplify Science unit.

Planning for the unit

Unit Overview	Describes what's in each unit, the rationale, and how students learn across chapters
Unit Map	Provides an overview of what students figure out in each chapter, and how they figure it out
Progress Build	Explains the learning progression of ideas students figure out in the unit
Getting Ready to Teach	Provides tips for effectively preparing to teach and teaching the unit in your classroom
Materials and Preparation	Lists materials included in the unit's kit, items to be provided by the teacher, and briefly outlines preparation requirements for each lesson
Science Background	Adult-level primer on the science content students figure out in the unit
Standards at a Glance	Lists Next Generation Science Standards (NGSS) (Performance Expectations, Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts), Common Core State Standards for English Language Arts, and Common Core State Standards for Mathematics

Teacher references

Lesson Overview Compilation	Lesson Overview of each lesson in the unit, including lesson summary, activity purposes, and timing
Standards and Goals	Lists NGSS (Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts) and CCSS (English Language Arts and Mathematics) in the unit, explains how the standards are reached
3-D Statements	Describes 3-D learning across the unit, chapters, and in individual lessons
Assessment System	Describes components of the Amplify Science Assessment System, identifies each 3-D assessment opportunity in the unit
Embedded Formative Assessments	Includes full text of formative assessments in the unit
Books in This Unit	Summarizes each unit text and explains how the text supports instruction
Apps in This Unit	Outlines functionality of digital tools and how students use them (in grades 2-5)

Printable resources

Copymaster Compilation	Compilation of all copymasters for the teacher to print and copy throughout the unit
Investigation Notebook	Digital version of the Investigation Notebook, for copying and projecting
Multi-Language Glossary	Glossary of unit vocabulary in multiple languages
Print Materials (8.5" x 11")	Digital compilation of printed cards (i.e. vocabulary cards, student card sets) provided in the kit
Print Materials (11" x 17")	Digital compilation of printed Unit Question, Chapter Questions, and Key Concepts provided in the kit

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Unit Map

How can we create a pinball machine for our class?

Students take on the role of pinball engineers as they investigate the effects of forces on the motion of an object. They test their own prototypes (models) of a pinball machine and use what they learn to contribute to the design of a class pinball machine. Over the course of the unit, students construct a foundational understanding of why things move in different ways.

Chapter 1: How do we make a pinball start to move?

Students figure out: To make our pinball start to move, we must exert a force on the pinball. We can use a rubber band launcher to exert a force on the pinball.

How they figure it out: Students investigate how to make objects in the classroom start to move. They talk about cause and effect, read a book that introduces key scientific language and use it to practice talking about forces and observed motion. Finally, students create models for testing their ideas about making the pinball start to move.

Chapter 2: How do we make a pinball move as far as we want?

Students figure out: To make our pinball go the distance we want, the rubber band launcher has to exert a strong force. To make it go a short distance, the rubber band launcher has to exert a gentle force. Attaching a shoelace to the rubber band launcher can help us adjust the force.

How they figure it out: Students investigate how to make a pinball move short or long distances by testing their ideas in the Box Models. They describe how the launcher can be used to exert gentle and strong forces to move a pinball different distances.

Chapter 3: How do we make a pinball move to a certain place?

Students figure out: To get the pinball moving in the direction we want (left or right), we must exert a force on the pinball in the direction that we want it to move.

How they figure it out: Students investigate how to control the pinball's direction of movement by controlling the direction of applied forces. They read to obtain information from a book on building with forces and use this language to talk about forces moving in a particular direction.

Chapter 4: How do we make a moving pinball change direction?

Students figure out: To make a moving pinball change direction, we have to exert another force on it, either from a moving object or from a still object in its path.

How they figure it out: Students investigate how to change the direction of a moving pinball. Ultimately, the class decides whether and how to add flippers, targets, and a bumper to the Class Pinball Machine and use Explanation Language Frames to help them discuss and write about how forces cause a moving object to change direction.

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Chapter 5: How can we make the pinball machine do all the things we want it to do?

Students figure out: As pinball engineers, we plan, make, test, and modify our designs based on what we learn. In our pinball machine, forces from the rubber band launcher make the ball start moving in the direction and over the distance we want, and forces from blocks and flippers cause the pinball to change direction.

How they figure it out: Students create and then improve a pinball machine, first on their own in their Box Models and then in the Class Pinball Machine. Students draw their plans and write a mini-book to explain what they have learned.

Chapter 6: Where are forces around us?

Students figure out: There are strong and gentle forces in different directions all around us. We know a force has been exerted on an object whenever that object starts moving, changes direction, or stops moving.

How they figure it out: Students tour their school to identify evidence of forces. Then students read and discuss a book that shows forces at work in the world.

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Progress Build

Overview: Progress Build

A Progress Build describes the way in which students' explanations of the central phenomenon should develop and deepen over the course of a unit. It is an important tool in understanding the design of the unit and in supporting students' learning. A Progress Build organizes the sequence of instruction, defines the focus of the assessments, and grounds inferences about students' understanding of the content, specifically at each of the Critical Juncture Assessments found throughout the unit. A Critical Juncture Assessment provides information to help guide decisions related to the instruction designed to address specific gaps in students' understanding. This document will serve as an overview of the *Pushes and Pulls: Designing a Pinball Machine* Progress Build. Since the Progress Build is an increasingly complex yet integrated explanation, we represent it below by including the new ideas for each level in bold. Depending on the standards for a given grade level, a unit may include additional supporting content; however, the Progress Build serves as the conceptual core of the unit.

In the *Pushes and Pulls* unit, students will learn to construct scientific explanations that describe the different ways that an object moves as caused by different forces exerted on the object. In particular, students will focus on investigating and explaining the different distances and directions that a pinball can be made to move in a pinball machine.

Prior knowledge (preconceptions): There is no significant prior knowledge assumed. Students will certainly have experience with observing moving objects, including rolling balls, as well as making objects move in different ways. Students will have experience moving objects by pushing or pulling, but they likely have not thought carefully about how those objects do so. Students will have opportunities to explore these kinds of actions more carefully over the course of the unit.

Progress Build Level 1: An object starts moving when a force is exerted on it.

When an unmoving object starts to move, it is because another object exerted a force on it.

Progress Build Level 2: Stronger force causes an object to move a longer distance.

When an unmoving object starts to move, it is because another object exerted a force on it. **A strong force will cause the object to move a long distance, while a gentle force will cause the object to move a short distance.**

Progress Build Level 3: An object starts to move in the direction of the force exerted on it.

When an unmoving object starts to move, it is because another object exerted a force on it. A strong force will cause the object to move a long distance, while a gentle force will cause the object to move a short distance. **The object starts moving in the same direction as the force that was exerted on it.**

Progress Build Level 4: Moving objects can change direction because of a force from a moving or still object.

When an unmoving object starts to move, it is because another object exerted a force on it. A strong force will cause the object to move a long distance, while a gentle force will cause the object to move a short distance. The object starts moving in the same direction as the force that was exerted on it. **If the object changes the direction it is moving, it is because a moving or still object exerted a force on it.**

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Chapters at a Glance

Unit Question

Why do things move in different ways?

Chapter 1: How do we make a pinball start to move?

Chapter Question

How do we make a pinball start to move?

Investigation Questions

- What makes an object start to move? (1.1, 1.2, 1.3, 1.4)

Key Concepts

- An object starts to move when another object exerts a force on it. (1.3)
- Forces happen between two objects. (1.3)

Chapter 2: How do we make a pinball move as far as we want?

Chapter Question

How do we make a pinball move as far as we want?

Investigation Questions

- What makes an object move shorter or longer distances? (2.1, 2.2, 2.3)

Key Concepts

- An object moves a long distance when a strong force is exerted on it. (2.2)
- An object moves a short distance when a gentle force is exerted on it. (2.2)

Chapter 3: How do we make a pinball move to a certain place?

Chapter Question

How do we make a pinball move to a certain place?

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Investigation Questions

- What makes an object start moving in a certain direction? (3.1, 3.2)
- What makes an object move to a certain place? (3.3, 3.4, 3.5)

Key Concepts

- An object starts to move in the same direction as the force that starts the motion. (3.2)
- Every force has a strength—gentle or strong—and a direction. (3.3)
- Every force has a strength—gentle or strong—and a direction, which makes the object move a certain distance and direction. (3.4)

Chapter 4: How do we make a moving pinball change direction?

Chapter Question

How do we make a moving pinball change direction?

Investigation Questions

- What can make a moving object change direction? (4.1, 4.2)

Key Concepts

- A moving object changes direction when another moving object exerts a force on it. (4.2)
- A moving object changes direction when a still object in its way exerts a force on it. (4.2)

Chapter 5: How can we make the pinball machine do all the things we want it to do?

Chapter Question

How can we make the pinball machine do all the things we want it to do?

Investigation Questions

- How do engineers make their solutions do all the things they want them to do? (5.1)

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Chapter 6: Where are forces around us?

Chapter Question

Where are forces around us?

Investigation Questions

- Where are forces in the world? (6.1)

Key Concepts

- Whenever we see an object start to move, stop moving, or change direction, that is evidence that something exerted a force on it. (6.1)

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Guided Unit Internalization Planner

Part 1: Unit-level internalization

Unit title:

What is the phenomenon students are investigating in your unit?	
Unit Question:	**Student role:**
By the end of the unit, students figure out ...	
What science ideas do students need to figure out in order to explain the phenomenon?	

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Part 2: Chapter internalization

Complete the tables below using information in the Lesson Overview Compilation.

	Chapter 1	Chapter 2
This chapter mostly focuses on…		
Important science concepts students learn include…		

	Chapter 3	Chapter 4
This chapter mostly focuses on…		
Important science concepts students learn include…		

	Chapter 5	Chapter 6
This chapter mostly focuses on…		
Important science concepts students learn include…		

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Part 3: Key routines and activities

As the presenter talks through the unit, use this table to make space about key routines and activities.

Key routine or activity	Notes

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@Home Resources Scavenger Hunt

Directions: Use this scavenger hunt to practice navigating the Program Hub and decide which @Home Resources best supports your current instructional needs.

Part 1: @Home Units Task	**Notes**
Navigate to the @Home Unit resources. ● Select Remote learning: Amplify Science @Home ● Select Grade-level resources → Grade-level → Unit	
How long is each @Home lesson? Hint: Teacher Overview	
Which types of activities are recommended for synchronous and in-person learning? Hint: Teacher Overview	
How many @Home lessons are in Chapter 1 of your unit? Hint: Teacher Overview	
In which lesson is your unit's phenomenon introduced? Hint: Teacher Overview	
How does the @Home Packet for Lesson 1 differ from the @Home Slides for that same lesson? Hint: Student Materials	
When would you use @Home Student Sheets? Hint: Teacher Overview	
How does the @Home Family Overview support caregivers? Hint: Family Overview	

Part 2: @Home Videos Task	**Notes**
Navigate to the @Home Unit resources. ● Select Remote learning: Amplify Science @Home ● Select Grade-level resources → Grade-level → Unit ● Scroll down to the @Home Video Playlist ● Select the lesson in which the problem or phenomenon is introduced	
Describe the phenomenon (or observable event, something that students can see or experience) in your unit.	

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Notes

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