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Productive Prompts to Support K–2 Student Engagement with Physical Science

Use these short, productive prompts to spark curiosity and deepen science discourse in your K–2 classroom explorations of physical science. Instead of checking for the "right answer," productive prompts help students share their ideas, test out explanations, and engage with the practices of science. Try choosing one or two prompts that fit the moment and adjust the wording to your students' level.

This resource is for **teachers of K–2 students**, **science specialists**, and **instructional coaches** who support early elementary classrooms. It may also be useful for **informal educators** who want to encourage young children's engagement with science practices.

About this Resource

Teachers ask questions all day long, but not all questions have the same effect. **Productive prompts** spark curiosity, promote deeper thinking, and engage students in the practices of science. Unlike questions that check what children know and can do, productive prompts encourage students to:

- ✓ Observe
- ✓ Wonder
- ✓ Test
- ✓ Explain in their own words

This resource offers ready-to-use examples of prompts you can try in your classroom related to physical science. The prompts are organized by the NGSS science and engineering practices, with clear purposes and sample questions. You don't need to use them all – pick one or two that fit the moment and adjust the wording for your students.

Teaching physical science offers many opportunities to apply productive prompts when questioning students.

Explorations in physical science can be done indoors across the year, allow for multiple explorations over relatively short spans of time, provide a more actionable context for students' engagement with the science practices, and enable students to immediately observe the effects of their actions on objects and materials. The table below provides specific purposes and examples of productive prompts in a kindergarten study of "Motion and Stability: Forces and Interactions" using a variety of balls and ramps. Keep the following in mind:

- **Force and motion with balls and ramps** can be an exciting study that continues over a long period of time as students' engagement with the practices deepens. The sample questions here are meant to be illustrative and are not intended to all be used in any one exploration.
- **Adjust how many and what kinds of prompts** you use to be responsive to students' behavior and willingness to engage at any given point. For example, when children are busy directly exploring, questions and comments can be distracting.
- **Use "why" questions judiciously and with caution**, especially with children who are used to being asked questions that are evaluated as correct or incorrect. Ensure that children have had multiple experiences on which to draw before being asked to suggest or explain why something happens the way it does, instead focus on framing "why" questions at this grade level as, "Why do you think ..." questions.

Practices, Purposes, and Sample Productive Prompts in a Kindergarten Study of Motion and Stability: Forces and Interactions

Science and Engineering Practices	Purpose: *To help students...*	Sample Productive Prompts
Asking questions (science) and defining problems (engineering)	Express their curiosity and wonderings about how different objects move in different situations and why they move that way; begin to think about how they might investigate those questions.	• What does each of these balls look like/feel like? How are they the same? How are they different? • Where/when have you used one of these balls before? • How did you use it? How well did it work? • What did you notice about how it moved? Have you ever tried rolling these balls? • Which one do you think will be the best roller? The worst? What makes you think so? • Do you think it matters if we roll them on the floor or the rug? Why/why not? • What do you wonder about how each of these balls will roll? • How could we find out?
Developing and using models	Create something that helps them share their observations and ideas or	• Can you use your bodies (or gesture) to show how you think these balls will roll on these wooden ramps?

Science and Engineering Practices	Purpose: *To help students...*	Sample Productive Prompts
	helps them investigate a question that is hard to investigate in the real world.	• What about using these smaller marbles and books as ramps to show what we think will happen? • How is this the same or different as when we rolled the basketball on the hill outside? • How can you show in your drawing which balls went the furthest/rolled the fastest? • Could you use this clay and these rulers to show how different balls moved?
Planning and carrying out investigations	Articulate their questions about how balls move; prepare to investigate; make predictions; engage in a direct exploration to gather information in relation to the questions; and collect and record their observations.	So, it seems like we have three big questions: How far will these balls roll on the floor and the rug? How can we use these ramps to change how fast and far the balls roll? And what happens when balls bump into things in the classroom? Let's start by making some predictions and sharing our thinking. Here are three exploration stations. What other materials could we add to each one? Great idea! Let's add cups to see if any of the balls knock them down. What are you noticing so far about how far each ball rolls? How can you make each one roll differently using the ramps?; What happened when that ball bumped into the chair? I notice that you tried something different to make the ball roll further! What did you try and what happened? Does anyone want tape to mark how far the balls go? How will you show how fast/how far/what happened when you did that with the balls?
Analyzing and interpreting data	Collaboratively look at and compare their observations of how balls moved in different situations and look for cause and effect relationships and patterns.	• What are some things you noticed about how the balls moved on different surfaces (floor, rug, and ramps)? • I heard you say they rolled slower and faster on different ramps. Can you say more about that? • Some people tried pushing the balls with their hands instead of just letting them go on the ramps. What

Science and Engineering Practices	Purpose: *To help students...*	Sample Productive Prompts
		happened when you did that? Did you try pushing in different ways? • Share your drawing with a partner and talk about how you showed what you observed and how you showed it in different ways. • Are we ready to share some ideas about the best and worst roller?
Using mathematics and computational thinking	Use mathematics and mathematical thinking as a way of describing and organizing information and tasks.	• What do you notice about the size/shape/ weight of each of these balls? • Let's try putting the balls in order from smallest to biggest; sorting them by shape/weight. • If a friend of yours wanted to investigate how far balls roll, what would you tell them to do first? Second? Third? • Can we sort these balls based on how many cups they knocked down? • What's different about the balls that knocked down the cups and the ones that didn't?
Constructing explanations (for science) and designing solutions (for engineering)	Generate claims or ideas about why the balls and other objects behaved the way they did in different situations.	• Why do you think this ball knocked down more cups than the other ones? What ideas do you have? • Let's check the chart where we wrote our predictions. • Before, you said you thought this ball would go further because it was light. Do you still think that, or do you have a different idea? • We seem to have different ideas about which ball is the best roller. Let's take turns saying more about our thinking.
Engaging in argument from evidence	Describe the reasons for their claims and ideas based on how they observed the balls moving, and pulling in evidence from other experiences.	• You said when you put the end of the ramp up super high, the balls didn't roll very far. What did happen? Why do you think so? • Do you agree or disagree with the idea that putting the end of the ramp super high always makes balls roll further? What did you notice that makes you agree/disagree? • Can you show us what happened to the ball on the rug that helped you come up with that idea?

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		• When the ball bumped into something did it always stop? Did different balls do different things? What ideas do you about why?
Obtaining, evaluating, and communicating information	Choose and use resources for obtaining more information and sharing our observations, experiences, and ideas about how balls move.	• I wonder if we could observe better if we made a slow-motion video of the balls coming down the ramps. What do you think? • What do you think the author was trying to tell us about how balls roll on smooth and rough surfaces? • How was that the same or different from what we observed on the floor and the rug? • What's the most surprising thing you want to share about how balls move? • Let's plan to do some demonstrations about all the things you learned about how balls move, and I can make a video to share with your families.

IES Institute of Education Sciences

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November 2025

The research reported here is based upon work supported by equal joint funding from the Institute of Education Sciences, U.S. Department of Education, and the U.S. National Science Foundation through Grant R305C240014 to Education Development Center, Inc. Any opinions, findings, and conclusions are those of the author(s) and do not necessarily represent the views of the Institute, the U.S. Department of Education, or the National Science Foundation.