Performance Task: Forces and Interactions

3\textsuperscript{rd} Grade

\textit{Integrating Common Core English Language Arts and Next Generation Science Standards}
Overview

Researchers spend a great deal of time reading information and investigating ideas before they write reports. As science researchers, over the next few days you will explore several sources to gather information about forces and motion. We have been looking at many examples of cause and effect in our science investigations and in the texts we read. In addition to gathering information from video and text sources, you will also conduct a scientific investigation to further explore cause and effect by examining the relationship between forces and motion.

Standards and Objectives

3rd Grade Common Core Standards for English Language Arts/Literacy

Key Ideas and Details

RI.3.2: Determine main ideas of a text, recount the key details, and explain how they support the main idea.

Integration of Knowledge and Ideas

RI.3.7: Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur).

Production and Distribution of Writing

W.3.4: With guidance and support from adults, produce writing in which the development and organization are appropriate to task and purpose.

Research to Build and Present Knowledge

W.3.7: Conduct short research projects that build knowledge about a topic.

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.
Comprehension and Collaboration

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.

SL.3.1: Report on a topic…or recount an experience with appropriate facts and relevant descriptive details, speaking clearly at an understandable pace.

Third Grade Next Generation Science Standards: Physical Science Performance Expectation:

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.

Big Ideas/Enduring Understanding

Science Content Big Ideas:

- Force acts upon an object.
- Force has strength and direction.
- Patterns of an object’s motion can be observed and measured.
- Objects in contact exert forces on each other.
- Friction affects the motion of an object and the distance it travels.

Cross Cutting Concepts:

- Cause and Effect

ELA Big Ideas:

- Readers engage with a variety of text types to gather information when researching a topic or exploring a question.
- Students engage in collaborative conversations with diverse partners; these conversations are around a focused question or task.
• Writers use different sources to gather information and write knowledgeably about a topic (e.g., summarizing main ideas and conveying complex ideas clearly and accurately).

**Essential Questions**

**Essential Questions for unit:**

What is force?

What are examples of forces?

What is friction and how does it affect motion?

How do equal and unequal forces on an object affect the object’s motion and direction?

**Research Question:** How do different surfaces affect the distance an object will travel?

**Culminating Task**

You will conduct research, through reading, writing, speaking, listening, and scientific investigation to explore different types of forces and their effects. In your written research report you will explain how different forces affect the motion of an object and the distance it travels. You will present your findings in a creative oral presentation.

**Content/Sources**


**Student Directions**

**Day 1**
**Text Source and Discussion Questions**

*Introduce the Informational Text:* Using Force and Motion by Greg Phelan (pgs. 4-7, 10-11). You may introduce the text in a whole group setting using a document camera, or in small guided reading group setting with a text set.

Read the introduction and chapter one in Using Forces and Motion by Greg Phelan (Omit pgs. 8-9). Pose the following text-based questions for student response and discussion. These questions are intended to deepen understanding of the topics and they require students to return to the text and locate specific evidence for their responses. Students will record responses to these questions independently on the **Question/Response Sheet** in the **Student Notes** document (Attachment B). Then, they will gather in small collaborative groups to discuss responses. Students revise responses on the **Student Notes** document.

*Text-based questions:*
- According to the text, what are forces?
- What are some examples of effects that forces have on objects? Use specific examples from the text.
- According to the text, what is friction?
- What are some examples of ways you can increase or reduce friction?

**Follow up:** Students independently complete the **Vocabulary Task Cards** (Attachment A) to reinforce and deepen their understanding of the scientific terminology relevant to this task.

**Essential Vocabulary:** force, friction.

**Formative Assessment:** Using the **Assessment FOR Learning Rubric** (Attachment C), examine student responses to text based questions, monitor discussion groups and intervene as necessary.

**Day 2**
**Video Source and Discussion Questions**

*Introduce the Informational Source:*  
View the entire video, uninterrupted, in a whole group context; students will return to specific portions to closely examine the meaning of relevant concepts and terms. Pose the following source-based questions for student response and discussion. These questions are intended to deepen understanding of the topics and they require students to return to the source and locate specific evidence for their responses. Provide the video link to students so they may return to portions of the video independently and in their collaborative discussion groups. Students will record responses to these questions independently on the Question/Response Sheet in the Student Notes document (Attachment B). Then, they will gather in small collaborative groups to discuss responses. Students revise responses on the Student Notes document.

Source-based questions:
How is force described in the video?
Why do you need more force to move a bowling ball than a soccer ball?
How is friction described in the video?
Describe an example from the video of how friction works on the ball?

Follow up: Students independently complete the Vocabulary Task Cards (Attachment A) to reinforce and deepen their understanding of the scientific terminology relevant to this task.
Essential vocabulary: force, friction, gravity

Formative Assessment: Using the Assessment FOR Learning Rubric (Attachment C) examine student responses to text based questions, monitor discussion groups and intervene as necessary.

Day 3
Investigating: Applying the Concepts Learned

Display Research Question: How do different surfaces affect the distance an object will travel?
Ask students to turn and talk about how this question relates to the sources explored on day one and two.

Investigation:
Students should be familiar with the scientific inquiry process before proceeding with this investigation. Given a selection of materials, students will design an investigation that measures the effects of different surfaces on the distance an object will travel. They should use their collective knowledge from sources, questions, and discussions to think carefully about their
procedure for testing these effects. Students may be in pairs or small groups to conduct this investigation.

*Materials:* standard toy car, standard ramp, variety of six preselected surfaces (e.g., carpet, sandpaper, aluminum foil, tile, sidewalk), measuring tool (e.g., yardstick, measuring tape), recording chart (Investigation section of Student Notes) or science notebook, tools that could be used to control starting force (e.g., index cards, blocks, etc.) Be sure materials are consistent for each group.

*Planning Questions:*

Students will complete the following planning questions in the *Planning Notes* section of the *Student Notes* document (Attachment B).

1. How will you ensure the starting force is equal for each trial?
2. Choose three surfaces you will explore today.
3. How will you measure the distances?
4. How will you record the data?

*Prediction:*

Provide students with the question and response frames in the *Investigation Notes* section of the *Student Notes* document (Attachment B):

- **Question frame:** Based on your surface selection and your knowledge about forces and motion, make a prediction. What do you think will happen when the car moves across these different surfaces?
- **Student response frame:** When the car moves across ______, I think that ______ because______.

*Procedure/Results/Conclusion:*

Students will complete the table in the *Investigation Notes* section of the *Student Notes* document (Attachment B) to explain their procedure, record their results and summarize their conclusions.

**Formative Assessment:** Using the *Assessment FOR Learning Rubric* (Attachment C), examine note taking strategies and content knowledge for the investigation.
Day 4
Written Report

As a group, have a discussion to review the results from the previous day’s investigation. Possible guiding questions include:

- What surfaces did you use?
- What were your results?
- Did your results support your predictions?
- What did you learn about the effect of friction on the motion and distance of an object?

Present the writing task to students: You will write a research report to explain how different forces affect the motion of an object and the distance it travels. Your report should include information about the results and conclusions of your investigation. You should use evidence — from the sources and the investigation — to support your conclusions. You may also choose to include a scientific drawing to illustrate your results. In your writing, be sure to organize your ideas clearly and carefully. Here are some questions to guide your writing:

- What was your research question?
- How did you investigate your research question?
- What were your results?
- What did your results show you about the effect of friction on the motion and distance that an object travels?

Share the performance task rubric *Assessment OF Learning (Attachment C)* with students so that they are aware of the criteria by which their writing will be measured.

Day 5
Oral Presentation

*Oral Presentation of Findings:*

Student pairs, or groups, will orally present the results and conclusions of their investigation. They may incorporate digital or other creative formats, while presenting their findings. They should include pertinent vocabulary and concepts learned to explain their findings.

Share the performance task rubric *Assessment OF Learning (Attachment C)* with students so that they are aware of the criteria by which their writing will be measured.
Evaluation

(Attachment C)

Use the Assessment FOR Learning Rubric to formatively assess students throughout the task. Provide appropriate feedback to students and use data to guide future instruction.

Use the purpose/organization, evidence/elaboration, and conventions section of the Assessment OF Learning Rubric to evaluate students' written reports.

Use the oral communication section of the Assessment OF Learning Rubric to evaluate students' oral presentation.
<table>
<thead>
<tr>
<th>Vocabulary Cards</th>
</tr>
</thead>
<tbody>
<tr>
<td>This is my <strong>Vocabulary</strong></td>
</tr>
<tr>
<td><img src="image.png" alt="Image of a child writing" /></td>
</tr>
<tr>
<td>This is my <strong>DEFINITION</strong>, or what the word means to me.</td>
</tr>
<tr>
<td>This is my <strong>SENTENCE</strong> using the word.</td>
</tr>
<tr>
<td>This is my <strong>PICTURE</strong> featuring the word.</td>
</tr>
<tr>
<td>This is my <strong>Vocabulary</strong></td>
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</tr>
</tbody>
</table>
# Question/Response Sheet

**Source 1**

<table>
<thead>
<tr>
<th>Response</th>
<th>Revised Response</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

**Source 2**

<table>
<thead>
<tr>
<th>Response</th>
<th>Revised Response</th>
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<tr>
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</table>
# Investigation: Exploring Forces and Motion

**Student Name:** _______________________

## Planning Notes

1. **How will you ensure the starting force is equal for each trial?**

2. **Choose three surfaces you will explore today.**

3. **How will you measure the distances?**

4. **How will you record the data?**

## Teacher Feedback
<table>
<thead>
<tr>
<th>Research Question</th>
<th>How do different surfaces affect the distance an object will travel?</th>
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</thead>
<tbody>
<tr>
<td>Materials</td>
<td></td>
</tr>
<tr>
<td>Prediction</td>
<td>Based on your surface selection and your knowledge about forces and motion, make a prediction. What do you think will happen when the car moves across these different surfaces?</td>
</tr>
<tr>
<td></td>
<td>When the car moves across _________________________________, I think that</td>
</tr>
<tr>
<td></td>
<td>______________________________________________________________________</td>
</tr>
<tr>
<td></td>
<td>because __________________________________________________________________.</td>
</tr>
</tbody>
</table>
**Procedure**

Explain with writing and drawings how you set up and performed your investigation. Be sure you use the exact same procedure for each surface and each trial.

**Results**

Explain what happened during each trial. How far did the car travel?

<table>
<thead>
<tr>
<th>Surface 1:</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Average Distance</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>Add the distances for all three trials and divide the result by three.</td>
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<td>Enter the average distance the car traveled:_________</td>
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<tr>
<td>Surface 2:</td>
<td>Trial 1</td>
<td>Trial 2</td>
<td>Trial 3</td>
<td>Average Distance:________</td>
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</tr>
<tr>
<td>Surface 3:</td>
<td>Trial 1</td>
<td>Trial 2</td>
<td>Trial 3</td>
<td>Average Distance:________</td>
</tr>
</tbody>
</table>
Summary

Was your prediction correct? Check the appropriate box. Explain what you learned about the effect of friction on the motion and distance of the object. Use the terms "force" and "friction" in your explanation.

My data supports my prediction. □

My data does not support my prediction. □

Explanation:
### Formative Assessment
Assessment FOR Learning

**Assessment Measures for Building Content Knowledge Across Disciplines**

<table>
<thead>
<tr>
<th></th>
<th>Progressing Adequately</th>
<th>Developing: Requires minimal prompting or assistance</th>
<th>Needs Immediate Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student name</td>
<td>Teacher comment</td>
<td>Student name</td>
<td>Teacher comment</td>
</tr>
</tbody>
</table>

- **Scientific Drawings and Diagrams**

- **Written Explanations (responses to text based questions)**

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**Attachment C**
<table>
<thead>
<tr>
<th>Effective Collaborative Discussions (building on self- and collectiveKnowledge)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Note Taking Strategies</td>
</tr>
<tr>
<td>Scientific Content Knowledge</td>
</tr>
<tr>
<td>Score</td>
</tr>
<tr>
<td>-------</td>
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<tr>
<td><strong>Purpose/Organization</strong></td>
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<tr>
<td><strong>Evidence/Elaboration</strong></td>
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<tr>
<td></td>
</tr>
<tr>
<td>Conventions</td>
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<tr>
<td>-------------</td>
</tr>
</tbody>
</table>
| multiple sources is integrated to respond accurately to all essential questions.  
  - Content knowledge is clearly and thoroughly demonstrated.  
  - Use of domain-specific vocabulary is appropriate for task, audience, and purpose. | Student presents knowledge **thoroughly** and accurately to communicate ideas clearly:  
  - Addresses all essential questions accurately. |
| The response demonstrates a **thorough** command of conventions:  
  - Adequate use of correct sentence formation, punctuation, capitalization, grammar, and spelling.  
  - No systematic pattern of errors is displayed. | The response demonstrates **partial** knowledge and communicates some ideas with clarity. |
| The response demonstrates **partial** command of conventions: | Student presents minimal knowledge of content and ideas are presented with little clarity. |
| The response demonstrates **minimal** command of conventions: | The response shows no evidence of the criteria in this category, or is not scoreable:  
  - Unintelligible.  
  - In a language other than English.  
  - Off-topic.  
  - Copied text.  
  - No evidence of criteria. |
| The response shows no evidence of the criteria in this category, or is not scoreable: | The response shows no evidence of the criteria in this category, or is not scoreable: |
| Develops main ideas accurately and completely | | Unintelligible |
| Organizes information in a clear, logical manner | | In a language other than English |
| Speaks clearly at an understandable pace with appropriate intonation, maintaining eye contact with audience | | Off-topic |
| | | Copied text |
| | | No evidence of criteria |

Resources


Smarter Balanced Assessment Consortium: www.smarterbalanced.org