Lesson 5.2
Hoverboard
Lesson Overview

Students set a purpose for reading and then read the book Hoverboard. The text describes how hoverboards work: magnetic force pushes the board up as Earth pulls the board down with the force of gravity. It describes when the forces on the hoverboard are balanced and when they are unbalanced. After reading, students discuss balanced and unbalanced forces in the book, then use the Word Relationships routine to discuss and write about balanced and unbalanced forces. The purpose of this lesson is to help students further understand how balanced forces can become unbalanced, and to provide an exciting analogous example to help students understand the floating train.

**Anchor phenomenon**: The floating train rises, floats above the track, then later falls back to the track.

**Investigative phenomenon**: A hoverboard floats above a track.

**Students learn**:

- Hoverboards work by balancing gravity and magnetic force.
- Some engineers use the science of balanced and unbalanced forces to design inventions.
- If forces are balanced, and then a force is changed, the forces become unbalanced, which can cause an object to start moving.
Reading Hoverboard

Students set a purpose for reading, then read Hoverboard.

Instructional Guide

1. Introduce the focus of the lesson. Point out the Investigation Question and read it aloud.

   What can make forces not be balanced anymore?

   Let students know that they will continue investigating this question and thinking about balanced and unbalanced forces.

2. Introduce page 61 in the notebook, Setting a Purpose for Reading Hoverboard, and have partners set a purpose. Have students turn to page 61 of their notebooks. Point out that pairs will decide on their own reading purpose today.

   Choose a reading purpose that will help you with what we are investigating.

   Give pairs a few minutes to discuss and write down a purpose for reading.

3. Distribute copies of Hoverboard. Distribute one copy of the book to each pair of students.

4. Distribute 3–5 sticky notes to each pair. Remind students to use these sticky notes to mark particular places in the text related to the purpose for reading, and add notes about what they found to the Setting a Purpose for Reading Hoverboard notebook page.

5. On-the-Fly Assessment: Students read Hoverboard with a partner. Circulate as students mark with sticky notes the evidence related to their reading purpose, and add notes about what they found to the Setting a Purpose for Reading Hoverboard notebook page. Early finishers can record notes about the evidence they find and/or complete the optional Reading Reflection activity on page 63 in the notebook (Reading Reflection: Hoverboard).
Embedded Formative Assessment

On-the-Fly Assessment 18: Reading with a Purpose

Look for: As you circulate, make note of the purposes that students set for reading. Are students setting a purpose that is relevant to the investigation question: When forces are balanced, what happens if one of the forces changes? Also note how well students are able to use that purpose to guide their reading of the text. Are they using the sticky notes to mark places in the text that are relevant to the purpose they chose? Are they able to articulate the reasons for their choices to their partner and summarize those reasons on their notebook page?

Now what? If students have trouble, provide more reminders about how to set a purpose for reading. Find a time when you can model reading with a purpose for students who still need more support in this area. Think aloud as you set a purpose, describing your reasons for choosing that purpose. For instance, you might refer students back to the Investigation Question and remind students that scientists read to help them answer the questions they are investigating. Then read a portion of the book with students. Pause and think aloud about whether or not you have met your purpose. At this point, you may want to invite students to consider whether or not your purpose has been met. If appropriate, read on and pause again to reflect with students on the purpose you set. Then, help students set purposes, have them read, and guide them in reflecting about whether or not they have met their purposes.

Teacher Support

Instructional Suggestion

Providing More Experience: Today’s Daily Written Reflection

What questions do you have about balanced and unbalanced forces? This prompt, on page 60 of the Investigation Notebook, gives students another opportunity to ask questions about the ideas they have been discovering.

Background

About the Book: Hoverboard

Hoverboard introduces students to a real-life futuristic invention—skateboards that float! The text describes how hoverboards work: magnetic force pushes the board up as Earth pulls the board down with the force of gravity. The forces are balanced when the board floats and unbalanced when the board rests on the ground. The concluding pages offer another example of an invention that uses balanced forces and encourage students to think of more examples. The exciting analogous example presented in Hoverboard helps students understand the maglev train without giving everything away. The diagrams and explanations support students in constructing their own explanations in the unit.
Discussing Evidence from Hoverboard

Students have an opportunity to discuss how the hoverboard works and to share the evidence relevant to the reading purposes.

Instructional Guide

1. Call on volunteers to share their reading purpose and what they found related to it.

2. Project the first Think-Pair-Share question.

**Think-Pair-Share Question 1**

What can make forces not be balanced anymore?

- What can make forces not be balanced anymore?
  - [If a force is changed, added or removed.]

- Think.

- Pair.
When students share, ask them what their evidence is. Encourage other students to agree and add more evidence or to disagree and explain why.

3. Project the second Think-Pair-Share question.

**Think-Pair-Share Question 2**

What can happen to an object when forces exerted on it become unbalanced?

- What can happen to an object when forces exerted on it become unbalanced?
  - [It can start moving; it can change how it’s moving; it can start to fall.]

- Think.

- Pair.

- Share.

When students share, ask them what their evidence is. Encourage other students to agree and add more evidence or to disagree and explain why.

4. **Post the new key concept.** Read aloud, then post the new key concept: *If forces exerted on an object are balanced, and then a force changes, the forces become unbalanced, which can cause the object to start moving.*
Teacher Support

Instructional Suggestion

Providing More Experience: Small-Group Discussions
If you have more time and want to give students more opportunity to prepare for the whole-class discussion, first have students discuss in groups of four. Have each pair join with another pair. Have each pair take a turn telling the other pair about the evidence they found.
Setting a Purpose for Reading Hoverboard

Directions:
1. Discuss with your partner and decide on a purpose for reading Hoverboard.
2. Check to make sure that your purpose will help you explain to the people of Faraday why the train floats even though gravity is acting on it.
3. Read Hoverboard and mark places in the book that have to do with your reading purpose.
4. Write notes about what you found in the book.

Reading purpose: To learn more about ______________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
Notes about what you read that has to do with your reading purpose:
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
Reading Hoverboard

Students set a purpose for reading, then read Hoverboard.

Instructional Guide

1. **Introduce the focus of the lesson.** Point out the Investigation Question and read it aloud.

¿Qué puede hacer que las fuerzas ya no estén en balance?

Let students know that they will continue investigating this question and thinking about balanced and unbalanced forces.

2. **Introduce page 61 in the notebook, Setting a Purpose for Reading Hoverboard, and have partners set a purpose.** Have students turn to page 61 of their notebooks. Point out that pairs will decide on their own reading purpose today.

Elijan un propósito de lectura que les ayude con lo que estamos investigando.

Give pairs a few minutes to discuss and write down a purpose for reading.

3. **Distribute copies of Hoverboard.** Distribute one copy of the book to each pair of students.

4. **Distribute 3–5 sticky notes to each pair.** Remind students to use these sticky notes to mark particular places in the text related to the purpose for reading, and add notes about what they found to the Setting a Purpose for Reading Hoverboard notebook page.

5. **On-the-Fly Assessment: Students read Hoverboard with a partner.** Circulate as students mark with sticky notes the evidence related to their reading purpose, and add notes about what they found to the Setting a Purpose for Reading Hoverboard notebook page. Early finishers can record notes about the evidence they find and/or complete the optional Reading Reflection activity on page 63 in the notebook (Reading Reflection: Hoverboard).
Embedded Formative Assessment

On-the-Fly Assessment 18: Reading with a Purpose

Look for: As you circulate, make note of the purposes that students set for reading. Are students setting a purpose that is relevant to the investigation question: When forces are balanced, what happens if one of the forces changes? Also note how well students are able to use that purpose to guide their reading of the text. Are they using the sticky notes to mark places in the text that are relevant to the purpose they chose? Are they able to articulate the reasons for their choices to their partner and summarize those reasons on their notebook page?

Now what? If students have trouble, provide more reminders about how to set a purpose for reading. Find a time when you can model reading with a purpose for students who still need more support in this area. Think aloud as you set a purpose, describing your reasons for choosing that purpose. For instance, you might refer students back to the Investigation Question and remind students that scientists read to help them answer the questions they are investigating. Then read a portion of the book with students. Pause and think aloud about whether or not you have met your purpose. At this point, you may want to invite students to consider whether or not your purpose has been met. If appropriate, read on and pause again to reflect with students on the purpose you set. Then, help students set purposes, have them read, and guide them in reflecting about whether or not they have met their purposes.

Teacher Support

Instructional Suggestion

Providing More Experience: Today’s Daily Written Reflection

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Instructional Guide

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2. Project the first Think-Pair-Share question.

Pregunta 1 de Pensar-Juntarse-Compartir

¿Qué puede hacer que las fuerzas dejen de estar en balance?

¿Qué puede hacer que las fuerzas ya no estén en balance? [Si se cambia, agrega o elimina una fuerza].

A pensar.

A juntarse.
When students share, ask them what their evidence is. Encourage other students to agree and add more evidence or to disagree and explain why.

3. Project the second Think-Pair-Share question.

A compartir.

When students share, ask them what their evidence is. Encourage other students to agree and add more evidence or to disagree and explain why.

4. **Post the new key concept.** Read aloud, then post the new key concept: *If forces exerted on an object are balanced, and then a force changes, the forces become unbalanced, which can cause the object to start moving.*
Establecer un propósito para leer Tabla voladora

Instrucciones:
1. Discute con tu compañero/a y establece un propósito para leer Tabla voladora.
2. Chequea para verificar que tu propósito te ayudará a explicarle a la gente de Faraday por qué el tren flota aunque la gravedad está actuando sobre él.
3. Lee Tabla voladora y marca las partes en el libro que estén relacionadas con tu propósito de lectura.
4. Toma notas acerca de lo que encontraste en el libro.

Propósito de lectura: Aprender más sobre __________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________

Notas acerca de lo que leíste que está relacionado con tu propósito de lectura:
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________