#### Unit 3 (Mechanisms): Mechanimals Design Project

#### Concept

Mechanisms can change direction of motion.

## **Content Objective**

Teams make a toy or device from context that changes linear to rotary motion or vice-versa.

## Language Objective

Articulate cause and effect relationship using past tense verbs. Explain changes in motion using new vocabulary. Persuade using drawings and increasingly complex written sentences.

### Standards

- NGSS:
  - **3-5-ETS1-1:** Define a simple design problem, including criteria for success and constraints on materials, time, or cost.
  - **3-5-ETS1-2:** Generate and compare multiple solutions based on criteria and constraints of the problem.
- TEKS:
  - **3A** Students will analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing.
- ELPS:
  - **1E** Students will internalize new basic and academic language by using and reusing it in meaningful ways in speaking and writing activities that build concept and language attainment.
  - **3E** Students will share information in cooperative learning interactions.
  - 5G Students will narrate, describe, and explain with increasing specificity and detail to fulfill content area writing needs.

#### Materials

Construction Materials: access to all materials from Units 1 & 2 including wheels, gears and pulleys

Handouts 5.3.1-5.3.2

#### Literature Connection:

• Galimoto by Karen L. Williams

	Teacher Says/Does	Student Says/Does	Language requirements
1.	Choose a context for the toy. It could be characters from a book read in class, a zoo animal, or a local mascot, etc.		
<ol> <li>2.</li> <li>3.</li> <li>4.</li> </ol>	<ul> <li>Write the following words on the board and conduct a game of Charades where one person acts out the word and others have to guess which word it is.</li> <li>Ievers, pulleys, changing direction of motion, input motion, output motion, systems of mechanisms, black box models, cams - wheels with off-center axles or odd shapes and paths (This is introduced in 2<sup>nd</sup> grade lessons; you may wish to go over some cams and models with your students in order to have options for the design models in this lesson.)</li> <li>As each word is guessed, go into further explanation to make sure students understand the concept. Review all words once more as a class by pointing to the word and then doing the Charades motion while saying the word.</li> <li>Discuss with students the context of their design either previously chosen by the teacher or selected as a class. It could involve some of their interests from literature, other studies, or current events. Ask if they can think of some working models they could design and make to demonstrate that interest.</li> <li>Explain the vocabulary exit slip (5.3.1)</li> </ul>	Individual students act out vocabulary words while the others guess.	Vocabulary terms: Brick Words: levers, pulleys, changing direction of motion, input motion, output motion, systems of mechanisms, black box models, cams Mortar Words: cause/effect, articulate, persuade
		Students complete the exit slip.	

## Day 1: Engage Mechanisms: Mechanimals Design Project

## Day 2: Explore/Explain Mechanisms: Mechanimals Design Project

	Teacher Says/Does	Student Says/Does	Language requirements
1.	<ul> <li>Show the teams <i>Design Brief (5.3.2)</i> Mechanisms- Explore/Explain): Changes linear motion to rotary motion or rotary motion to linear motion. Use Charades motions to accompany words as a review. Remind students of the following features of creating their Design Brief: <ul> <li>Ask questions about what the words mean.</li> <li>Talk with your partner and plan what you might like to make.</li> <li>Draw a Design Brief for the work that needs to be done.</li> <li>Draw a side-view sketch of what you would like to make.</li> </ul> </li> </ul>		
2.	Let the teams begin their work on their Design Brief with access to all construction materials. Monitor the classroom asking and answering questions.	Student teams complete their Design Briefs. Once the maps are approved, they begin building the toy with changing motion.	
3.	While the students are working, use the <b>Collaborative Dialogue</b> <b>Template</b> (p. 32 in Teacher Handbook) to guide conversations and take a running record of students' progress on content and language objectives.		

## Day 3: Explain/Elaborate Mechanisms: Mechanimals Design Project

	Teacher Says/Does	Student Says/Does	Language requirements
1.	Hold a design review with the teams and their models in progress. Ask the teams to demonstrate their products as they are (it is perfectly acceptable if the mechanisms are not fully completed). Ask them to explain where and how the direction of motion was changed. Model use of the sentence stem.	Each team presents and explains its design to the class.	The input: motion changed to the output motion because
2.	Encourage the rest of the class to ask the team questions about their products.	Other teams should ask questions as well.	
3.	Explain that the teams will have the remainder of class to make adjustments to their mechanisms based on feedback from the design review.	Teams continue working on their mechanisms and incorporate feedback from the design review.	

## Day 4: Evaluate Mechanisms: Mechanimals Design Project

	Teacher Says/Does	Student Says/Does	Language requirements
1.	Explain that students will have the opportunity to create advertisements for their mechanisms that explain how the device changes motion.		
2.	Brainstorm some ideas with the group about how they could persuade their 5 <sup>th</sup> grade peers about the importance of their gadget.	Students brainstorm ways to persuade their peers.	
3.	Circulate around the room as the student teams create advertisements on chart paper.	Student teams work on their poster advertisements.	Vocabulary terms: levers, pulleys, changing direction of motion, input motion, output motion, systems of mechanisms, black box models, cams

# **Exit Slip: Mechanimals Vocabulary**

## Name Date

For each vocabulary word or phrase, rate your understanding, make a drawing, and write the definition in your own words.

1	2	3	4	
I do not know what the word means at all.	I have a vague idea of what the word means.	I know what the word means and can use it in my writing or conversations.	I know what the word means and I can use it in different ways. I can also teach the word to others.	

Term	Rating	Drawing	Definition
levers			
pulleys			
changing direction of motion			
input motion			
output motion			
systems of mechanisms			
black box models			
cams			

# **Design Brief: Mechanimals Design Project**

Design Problem: Design & make a toy that illustrates [context] & uses some of these Black Box Models:	Words to Remember/ Palabras para recordar
Input Linear Motion Input Rotary Motion	

Drawing or Model of Our Plan (You can use the back of the page, too!):

### Steps

Task	Person Responsible