INNOVATION AT PLAY

TEACHER ACTIVITY

GOAL!

Close your eyes and picture the perfect football pass, soccer goal, baseball pitch, or field hockey goal—the type that gives you chills and that's capable of winning the game. Now open your eyes and consider: Is this throw or kick one that can be replicated?

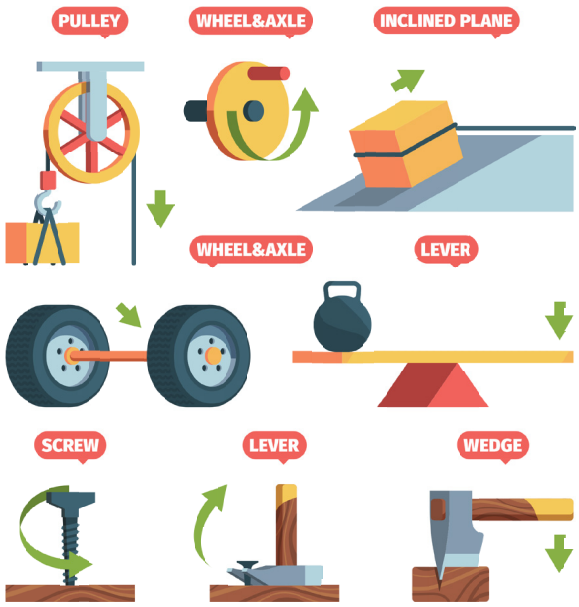
It will be up to you and a teammate to work through the following steps as you design a ball launcher and receiver that attempts to recreate this perfect moment in sports!

STEP 1: CONNECT

Through history, humans have developed inventions to assist us. What are some inventions you use to make your own life easier?

STEP 2: INVESTIGATE

Simple machines are one of the most basic but most important examples of inventions that have improved our lives. Generally speaking, simple machines are devices used to make work easier. They change the amount of force needed to accomplish something, so that humans don't have to work as hard.



Each of the images below are examples of simple machines. Take a look at them with your teammate and consider:

- Where have we seen examples of simple machines in the real world—such as at home, at school, or in different workplaces (like construction sites)?
- In what ways do simple machines make work easier?

STEP 3: DISCUSS

A *complex* machine is made up of two or more simple machines that work together to even further reduce the amount of force needed to complete a task.

To build your ball launcher, which simple machines could you seek inspiration from?

How could these simple machines work together to accurately launch a ball into a receiver?

STEP 4: MATERIALS

Now gather materials that you could use to create your own Rube Goldberg-style chain reaction, such as:

- Paper and pencil (for brainstorming)
- Aluminum foil (to create balls)
- Materials for the launcher and receiver, such as:
    - Cardboard
    - Cups
    - Craft sticks
    - Paint stirrers
    - Straws
    - Rubber bands
    - Paper clips
    - Hot glue
    - Paper clips
    - Tape
    - Paper

STEP 5: THE CHALLENGE

Work with your teammates to design and construct a complex machine that accurately launches a ball into a receiver from as far away as possible.

Reflect on the simple machines you just learned about, as well as any examples of similar devices that you've seen before. Then discuss your ideas with your teammate and sketch a picture of your design ideas before you begin building. Remember to think about both the launcher *and* the receiver.

When you think you're ready, use the materials to begin building your design. Modify and change your design as you build and new ideas strike.

Once you've built a model that may work, use the aluminum foil to create a ball and give it a try! Continue to build, test, and tweak your design until you and your teammate are happy with your results.

REMEMBER

You'll need both a launcher and a receiver! The ball should be launched directly into the receiver, with no bouncing!

TESTING TIP

It may be helpful to film your trials so you can slow down or pause the videos and really study what worked and what didn't work.

STEP 6: SHARE

Once the ball is successfully launched into the receiver from as far away as possible, create a TikTok video (three minutes or less) that shows off your innovation.

Be sure that your video:

- Displays the distance between the launcher and the receiver.
- Demonstrates your epic launch and catch in action!
- Uses several of the following terms to help others understand how and why your launcher works:
    - **Simple machine:** a basic mechanical device (such as a wheel and axle, pulley, inclined plane, wedge, or screw) that makes it easier to do work
    - **Complex machine:** two or more simple machines that work together, such as a catapult or slingshot
    - **Potential energy:** stored energy
    - **Kinetic energy:** energy of motion
    - **Projectile motion:** the motion of an object when it is thrown in the air, experiencing only the force of gravity

Use the hashtags #InnovationAtPlay _____and #balllaunchchallenge so others can learn from your design, too!

NGSS STANDARDS

- HS-PS3-2: Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects).
- HS-PS3-3: Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

COMMON CORE ELA STANDARDS

- CCSS.ELA-LITERACY.CCRA.SL.4: Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.