



VIDEO SERIES GUIDE

HIGH SCHOOL PHYSICS

ABOUT INNOVATION AT PLAY

Innovation At Play provides educators with a digital sandbox to explore the building blocks of STEM problem solving and apply these skills to create real-world change. These five high school physics videos and accompanying learning resources foster hands-on experiential learning through student activations that are aligned to the future of STEM.

USING THE VIDEOS IN YOUR CLASSROOM

The videos in this five-part series can be used in a variety of ways, depending on the needs of your students and device access. They were designed with flexibility in mind and can be used in any order, by choosing only one, or by using all five!

Watch and Discuss: Watch one or more of the videos as a whole group or assign them to students to watch independently. We recommend watching together as a class, as it creates the foundation for more engaging discussion.

Classroom Activities: Each video has three accompanying national-standards-aligned classroom activities that are designed to each be completed in a single session. The video is designed to provide foundational knowledge for students to apply to each activity, which includes detailed implementation strategies. Instruction is divided into the following sections:

- **Connect:** An opening discussion question that connects the upcoming activity with real-world situations.
- **Investigate:** An opportunity for students to visit websites or watch videos that will enhance their understanding of the topic.
- **Discuss:** Students are encouraged to share with teammates what they have discovered.
- **Materials:** A detailed list of what students will need to complete the challenge.
- **The Challenge:** A hands-on experience to apply their learning to real-world problems.
- **Share:** A creative method for students to share their understanding of the topic.

AFTER-SCHOOL ACTIVITIES

Each video has a related after-school activity that highlights the content and physics concepts present in students' everyday lives with an engaging activity that is easy to implement in any environment. The [After-School Facilitator Guide](#) is available as a resource to help educators implement the five Innovation at Play activities in after-school and out-of-school spaces.

READY-TO-USE ACTIVITIES

Also available are ten ready-to-use Studio Boards with curated program resources to support students' learning experience directly within Discovery Education's daily learning platform.

VIDEO 1—FORCES AND MOTION

VIDEO OVERVIEW

This video aims to Inspire students to interact with their environment, investigate important challenges, and create original solutions by tapping into the universal laws of nature. Students will explore how they can harness the Laws of Motion to ignite innovation and pursue exciting STEM careers emerging in the Industry 4.0 revolution.

CLASSROOM ACTIVITY: [CHAIN REACTIONS](#)

Students can explore the power of their decisions by investigating the cause-and-effect relationships involved in chain reactions. They will consider the possibilities of automation before constructing a Rube Goldberg machine designed to improve everyday life.

CLASSROOM ACTIVITY: [GOAL!](#)

Students will investigate the human fascination with technology and innovation as they learn about simple and complex machines. They will collaborate to create a machine capable of launching an object at a desired target.

CLASSROOM ACTIVITY: [HEAD PROTECTION](#)

Students will put their design skills to the test as they explore the laws of motion involved in creating the perfect piece of head protection. After investigating the impacts of head trauma, they will apply what they have learned in an egg drop challenge.

AFTER-SCHOOL ACTIVITY: [MAGNUS EFFECT](#)

Uncover the mysteries of the Magnus Effect as students learn how this unique phenomenon of motion is used to achieve amazing effects in sports, engineering, and beyond. Kickstart creative problem solving with a series of hands-on student activations that put the fundamentals of motion into action. Reference the [After-School Facilitator Guide](#) for more information about implementing this activity in an after-school or out-of-school space.

READY-TO-USE ACTIVITIES:

[FORCES AND MOTION: THEY SAID WHAT? STUDENT ACTIVITY](#)

Learn about Newton's Laws of Motion using the SOS Instructional Strategy They Said What?

[LAWS OF MOTION: STUDENT INVESTIGATION](#)

Learn about how and why objects move as they do.

VIDEO 2—STABILITY AND INSTABILITY

VIDEO OVERVIEW

By watching this video, students will examine the complex ways that the human body self-regulates to maintain stability while interacting with the forces of gravity, and they will find out the difference between center of gravity and center of mass.

CLASSROOM ACTIVITY: [BUILD-A-BRIDGE](#)

Students can explore the keys to strong infrastructure as they collaborate to build a working bridge and test how much weight it can handle.

CLASSROOM ACTIVITY: [FINDING BALANCE](#)

Students will discover the science behind seasickness with an activity in which they design a boat and investigate how to give it stability.

CLASSROOM ACTIVITY: [ROLLER COASTER DESIGN](#)

Students unravel the power of centripetal force as they build their own marble roller coaster and work to complete a 360-degree loop.

AFTER-SCHOOL ACTIVITY: [STABILIZE YOURSELF](#)

Students will explore the role of center of gravity on balance and stability by changing positions or adding objects that shift the center of gravity as they repeat this activity. Afterwards, students will consider how advancements in robotics have pushed Industry 4.0 primarily through stabilization and how it may continue to influence Industry 4.0. Reference the [After-School Facilitator Guide](#) for more information about implementing this activity in an after-school or out-of-school space.

READY-TO-USE ACTIVITIES:

[TYPES OF INTERACTIONS: WHITTLE IT DOWN STUDENT ACTIVITY](#)

Learn about gravitational and electromagnetic forces using the SOS Instructional Strategy Whittle It Down.

[INTERACTING FORCES: STUDENT INVESTIGATION](#)

Learn about electromagnetic fields and gravity.

VIDEO 3—TYPES OF INTERACTIONS

VIDEO OVERVIEW

This video helps students understand how the universal laws of nature explain the interactions that occur in the world around them.

CLASSROOM ACTIVITY: [HEAVY LIFTING](#)

Students will unlock the power of magnetic attraction as they build a simple crane out of household materials and use it to create an original game.

CLASSROOM ACTIVITY: [INVISIBLE FORCES](#)

Students can explore the creative ways natural forces can be harnessed with an activity in which they design a tabletop game using electromagnetic game pieces.

CLASSROOM ACTIVITY: [POWER OF GRAVITY](#)

Students take a closer look at the everyday effects of gravity on their lives as they are challenged to make their own DIY helium balloon and achieve liftoff.

AFTER-SCHOOL ACTIVITY: [ELECTRIC TRAIN](#)

After designing their train tracks and successfully getting their train to traverse it, students will learn about the connection of synchronous AC motors with the shift in the electric car market, and how that can push into Industry 4.0. Reference the [After-School Facilitator Guide](#) for more information about implementing this activity in an after-school or out-of-school space.

READY-TO-USE ACTIVITIES:

[STABILITY AND INSTABILITY: STEM COMPLETION STUDENT ACTIVITY](#)

Learn about balanced and unbalanced forces using the SOS Instructional Strategy Stem Completion.

[EXPLORING EQUILIBRIUM: STUDENT INVESTIGATION](#)

Learn about various forms of stability and instability.

VIDEO 4—CONSERVATION OF ENERGY & ENERGY TRANSFER

VIDEO OVERVIEW

This video facilitates students' understanding of what energy is, the different types of energy, and how energy is conserved, transformed, and transferred.

CLASSROOM ACTIVITY: [ECO-FRIENDLY INFRASTRUCTURE](#)

Students will dive into the world of infrastructure as they work to design a unique way to transport people within a community.

CLASSROOM ACTIVITY: [ERGO-LIFTING](#)

Students will explore the science of energy transformation as they consider how manual workers can lift heavy loads all day without tiring. They will participate in a hands-on activity to learn how to make lifting easier with science.

CLASSROOM ACTIVITY: [EXO-SKELETON SOLUTIONS](#)

Students will investigate different forms of energy as they explore how technology can help your muscles be even more efficient. They will be challenged to create an exoskeleton model designed to help humans perform a physical task.

AFTER-SCHOOL ACTIVITY: [POCKET CHANGE TO POWER](#)

Students will explore how batteries work to transform chemical energy into electrical energy while creating voltaic cell batteries to use with LEDs. Students will also see how the power generated changes with the number of voltaic cells and how different LEDs require different power thresholds. Reference the [After-School Facilitator Guide](#) for more information about implementing this activity in an after-school or out-of-school space.

READY-TO-USE ACTIVITIES:

[CHAIN REACTIONS: STUDENT INVESTIGATION](#)

Learn about how one reaction causes another.

[CONSERVATION OF ENERGY: MYTH BUSTING STUDENT ACTIVITY](#)

Learn about how energy is conserved.

VIDEO 5—THE RELATIONSHIP BETWEEN ENERGY AND FORCES

VIDEO OVERVIEW

This video guides students in exploring the gravitational, magnetic, and electrical forces that transmit energy across space from one object to another.

CLASSROOM ACTIVITY: [MIXED REALITY HEADSETS](#)

Students will collaborate to create a design for a headset geared towards making mixed reality experiences as realistic as possible.

CLASSROOM ACTIVITY: [VIRTUAL GRAVITY](#)

Students will design a simulation that recreates the gravity of different places in outer space for an out-of-this-world mixed reality experience.

CLASSROOM ACTIVITY: [WORLD OF FORCE FIELDS](#)

Students take a closer look at how the laws of physics apply, and do not apply, to the world of video games. They will apply their understanding to create an idea for a game that incorporates force fields to enhance the user's experience.

AFTER-SCHOOL ACTIVITY: [SENSING AND COMMUNICATING](#)

Students will use their knowledge of circuits to implement different types of switches that work to sense certain environmental changes. The sensors can be used to sense moisture, position, or touch. Reference the [After-School Facilitator Guide](#) for more information about implementing this activity in an after-school or out-of-school space.

READY-TO-USE ACTIVITIES:**[POWERING INDUSTRY 4.0: STUDENT INVESTIGATION](#)**

Learn about how industry 4.0 is powered.

[THE RELATIONSHIP BETWEEN ENERGY AND FORCES: Z CHART STUDENT ACTIVITY](#)

Learn about various relationships between energy .