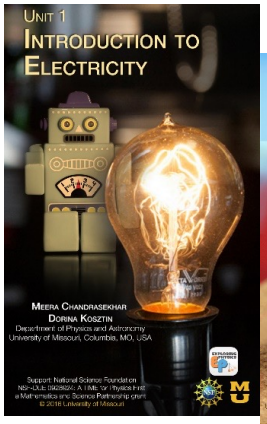
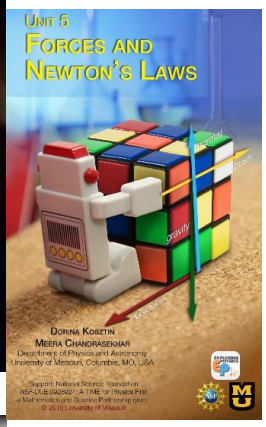
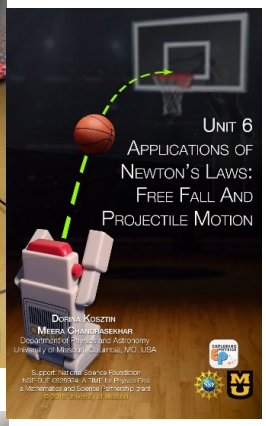
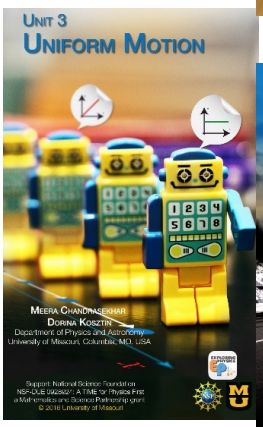
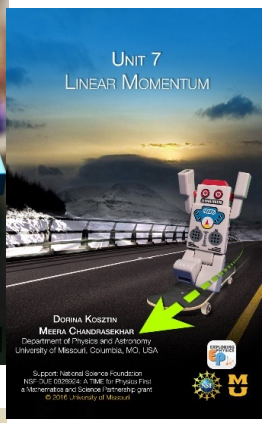
EXPLORING PHYSICS











A FREE Digital Curriculum for Students and Teachers

Hands-on Labs

Inquiry and Modeling-based Pedagogy

for grades 8 - 12

Physical Science

Physics First (Freshman Physics) and

Conceptual Physics

Available at no cost at

https://exploringhysics.com

Contact: explphys@gmail.com

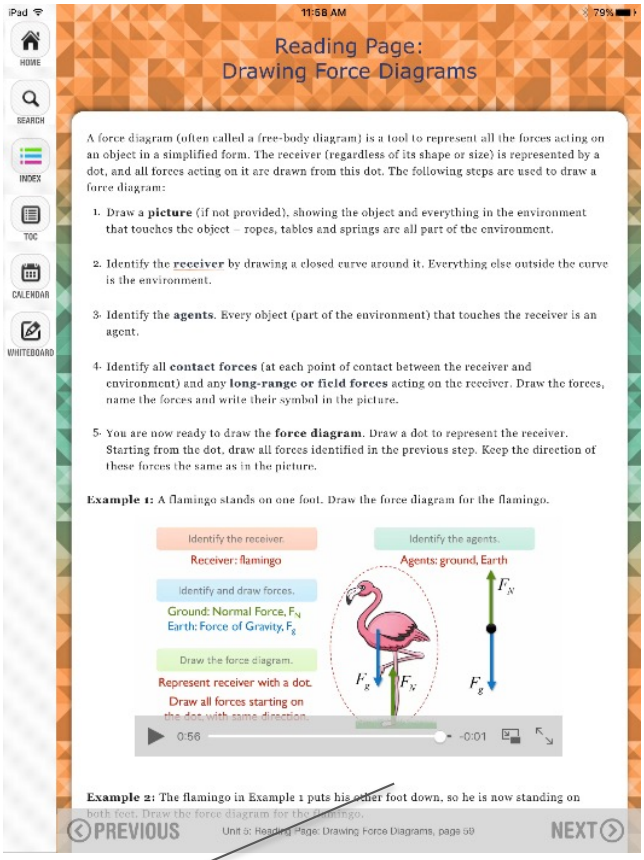
The [Exploring Physics]® curriculum is a hands-on, digital, and based on inquiry and modeling pedagogies.

Available for FREE at https://exploringhysics.com

Exploring Physics®, and is geared for conceptual physics, physical science and 9th grade physics (Physics First). Selected units can be used for 10-12 grades.

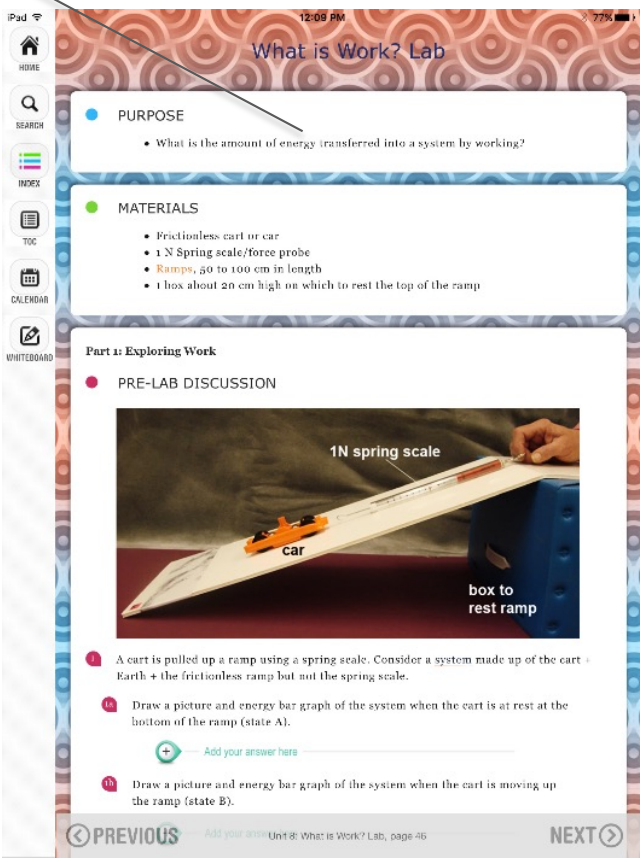
FOR STUDENTS the curriculum provides:

- Hands-on laboratories
- Reading pages
- Video tutorial problems
- Animations
- Practice problems



Reading Pages with embedded video tutorial exercises and animations

Hands-on labs include pre and post lab questions, experimental design, and discussions for model construction



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FOR TEACHERS the curriculum provides:

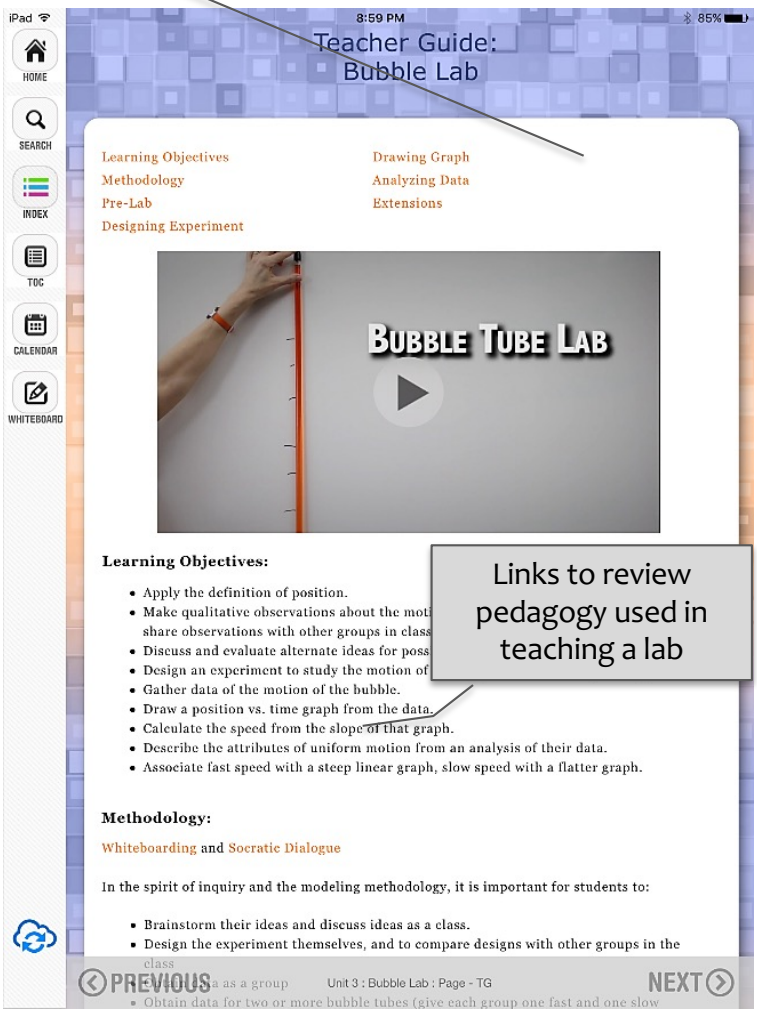
- Big Ideas and Storyline
- Learning Goals and Objectives
- Student Misconceptions
- Next Generation Science Standards and Math Common Core Alignment
- Teacher Guides for each activity (labs, readings and practices)
- Movies on setting up labs and analyzing the collected data
- Materials lists for each unit

STUDENT QUOTES

"I liked how after reading a lesson the examples were videos and not just pictures. The videos really helped me learn more about the information and helped me understand what I read. " (Abbie Bender)

"I liked being able to access class content wherever I was via the iPad. I also thought the videos were very helpful in explaining concepts and helping facilitate labs. (Matthew Peterson)

Each teacher guide includes learning objectives and suggested methodology. Instructional videos describe how to set up labs and analyze data, and discuss common pitfalls.



Links to review pedagogy used in teaching a lab

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Exploring Physics® is based on inquiry and modeling pedagogies, and is geared for conceptual physics, physical science and 9th grade physics (Physics First). Some units are suitable for 10-12 grades.

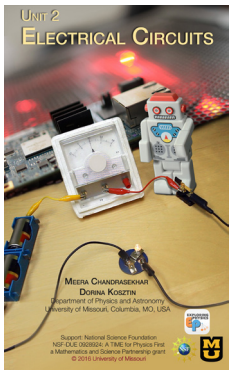
Works on any device connected to the internet Aligned to NGSS HS Physical Science
Available at not cost at https://exploringphysics.com

Unit 1: Introduction to Electricity

Students experience static electricity and develop a model of electrical current using buzzers, motors, bulbs and switches. They use multimeters to measure voltage. Questions answered by this Unit:

- What happens when objects get charged?
- What does it take to light a bulb?
- What materials conduct electric current?
- Is there a direction in which electric current flows?
- How do a switches, LEDs and photoresistors work?
- What does it take to make a battery?

Middle and High School Courses: Physical Science



Unit 2: Electrical Circuits

Students build and analyze simple circuits, compare and contrast series and parallel circuits, and calculate current, voltage and resistance in a circuit. Questions answered by this Unit:

- What are the factors that affect the resistance of a resistor?
- How do current and voltage qualitatively predict the brightness of a bulb in a circuit?
- How are voltage, current and resistance related?
- How do you calculate the voltage across a resistor and the current through a resistor in a series circuit, and in a parallel circuit?
- How do you calculate the power and the energy expended by a resistor?

High School Courses: Physics First / Physics

Unit 3: Uniform Motion

Students study uniform motion using bubble tubes, battery cars, and motion detectors. They build position-time and velocity-time graphs, and describe motion via verbal, pictorial, graphical and mathematical representations. Questions answered by this Unit:

- How do you define the position, change in position, and distance traveled by an object?
- How do you define and measure speed? How do you calculate average speed?
- How do you pictorially and graphically represent uniform motion?
- How do you mathematically calculate the factors involved in uniform motion?
- How do you predict where the paths of two objects traveling at a constant speed intersect?

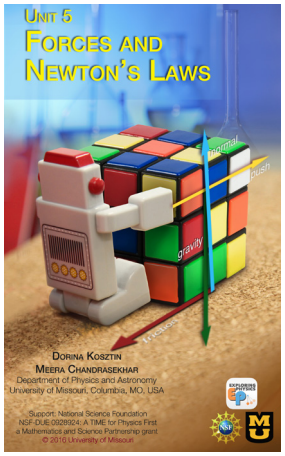
High School Courses: Physical Science / Physics First

Unit 4: Accelerated Motion

Students design experiments for objects that speed up or slow down using toy cars, ramps, spark timers and technology. They collect data, build position-time graphs, interpret slope, learn about instantaneous velocity and acceleration, and make motion diagrams. Questions answered by this Unit:

- What does the position-time graph of a car traveling down an incline look like?
- How does one obtain a velocity-time graph from a position-time graph?
- What does the slope of a velocity-time graph represent?
- How do you represent and mathematically calculate the factors involved in accelerated motion?
- How can you predict where two objects, one accelerating and one at constant speed, meet?

High School Courses: Physical Science / Physics First

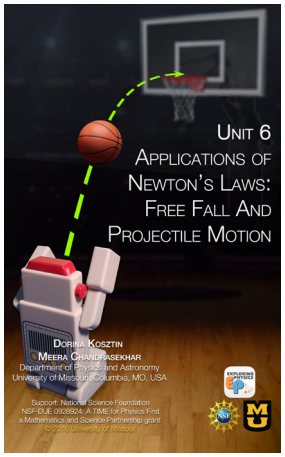


Unit 5: Forces and Newton's Laws

Students investigate forces through several hands-on activities and labs, develop mathematical relationships between force of gravity and mass, and between the elastic force and the stretch of a spring. They investigate the concept of inertia (Newton's First Law), develop the relationship between mass and acceleration (Newton's Second Law) and investigate the nature of action and reaction forces (Newton's Third Law). Questions answered by this Unit:

- What is a force, and how can we represent it? How does one draw a force diagram?
- How does normal force act? How are gravitational force and mass related? How does the elastic force in a spring depend on its stretch?
- What is inertia? How are force and acceleration related? When two objects are in contact, how do the forces between them compare to each other?
- What is the connection between force and motion?

High School Courses: Physical Science / Physics First



Unit 6: Applications of Newton's Laws

Students study motion under gravity: In Sec. 1 they study objects as they fall, and are thrown upward. In Sec. 2, they learn about motion in two-dimensions for an object that is thrown horizontally. In Sec. 3 they qualitatively analyze the motion of an object thrown at an angle. These labs connect concepts in Units 3, 4 and 5. Questions answered by this Unit:

- How do you describe the motion of an object as it travels upward and downward under the force of gravity (free fall)? Use motion diagrams and position-time, velocity-time and acceleration-time graphs to describe an object in free fall, on Earth and on another planet.
- How do you calculate the factors involved in free fall, and for an object thrown horizontally?
- For an object that is thrown with a horizontal velocity, how do you draw motion diagrams for the horizontal and vertical motion, and how do you graphically represent the motion?
- How do you qualitatively describe the trajectories of an object thrown at an angle?

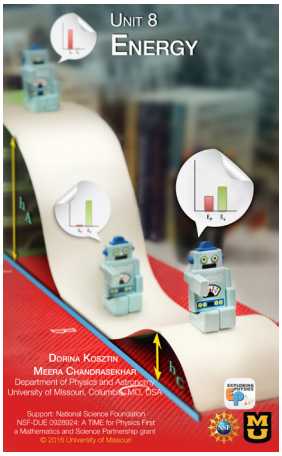
High School Courses: Physics First / Physics

Unit 7: Linear Momentum

Students study elastic and inelastic collisions using hands-on activities and labs to understand linear momentum and impulse. Qualitative and quantitative labs are used to investigate the conservation of linear momentum in elastic and inelastic collisions. Questions answered by this Unit:

- What is linear momentum?
- How is linear momentum connected to the mass and velocity of an object?
- What is impulse?
- How is impulse connected to linear momentum?
- What is the connection among impulse, forces in a collision and the time of impact?
- What are the different types of collisions?
- What is the difference between elastic and inelastic collisions?
- What stays the same during a collision?

High School Courses: Physics First / Physics



Unit 8: Energy

Building on knowledge from previous units, students connect forces and motion to energy. Students design their own experiments to study different types of energy storage, energy transfers and transformations. Questions answered by this Unit:

- What are some different types of energy storage?
- How can one represent energy transfers and transformations using pie charts and bar graphs?
- How is energy related to work?
- How can we calculate the energy stored in a system?
- How do you mathematically calculate kinetic energy, elastic potential energy and gravitational potential energy?
- How can you use the conservation of energy theorem to find position or velocity of an object?

High School Courses: Physical Science / Physics First / Physics

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