Science in Motion - Ursinus College

https://www.ursinus.edu/offices/science-in-motion/

Physics Activities – High School

Air Resistance

Students observe the effect of air resistance on falling coffee filters, and determine how the terminal velocity of a falling object is affected by air resistance and mass.

Acceleration

Using Vernier Low-G accelerometers, students can study the forces of a simulated bungee jump or other real-life scenarios.

Ball Toss (vertical)

Distance, velocity, and acceleration: Students collect distance, velocity, and acceleration data as a ball travels straight up and down. Then they analyze the distance vs. time, velocity vs. time, and acceleration *vs.* time graphs.

Kinetic and potential energy: Students measure the change in the kinetic and potential energies and observe how the total energy of a ball changes as it moves in free fall

Density

Students will predict if a material will sink or float. Then they will measure mass and volume to determine density of a variety of cubes (metals, woods, plastics).

Exploring Machines – K'nex

This K'nex kit has the students build a variety of machines that use levers, pulleys, wheels and axles, inclined planes, and gears. Kit comes with a teacher's guide and CD. We have four kits, which accommodates 16 groups.

Forces

We have a Vernier Force Plate – a larger force plate for use with human interactions. It can be used to measure the change in normal force during an elevator ride, the impulse delivered by the floor during a jump, the reaction force as a student leans against a wall, and even to test Newton's 3rd Law: Equal and Opposite Reactions. If you have other ideas to test, let us know!

Forces, Energy, and Motion – K'nex

This K'nex kit has the students build a variety of machines to study forces, energy, and motion. Kit comes with a teacher's guide and CD. We have one kit, which accommodates 4 groups.

Friction – Friend or Foe? – a Sphero activity

Students study the beneficial effects of friction on movement, by racing programmable Spheros around an oval path. First, the Spheros have just their normal plastic cover. Then, students use a provided

cover to compare, and finally they make their own cover to compare the speed, time, and ability of the Sphero to stay on track. Who will make the most effective Sphero cover? (This activity does not require any prior programming experience.)

Kinematics Graphs (graph matching)

Students walk across the room and use a motion sensor to predict, sketch, and test distance vs time and velocity vs time kinematics graphs.

Nuclear Radiation

Students study nuclear radiation with small radioactive sources of Polonium-210, Strontium-90, and Cobalt-60. Activities can include some or all of the following: the penetrating ability of alpha, beta, and gamma radiation; the effect of distance on nuclear radiation; shielding and radiation.

Ocean Floor Mapping

Students use Vernier Motion Sensors to determine the terrain of an "ocean floor". Activity uses the property of echosounding, and students learn to read the information that comes back to the computer. The activity concludes with a challenge for the students to describe a hidden "ocean floor".

Pendulums

Students use a photogate to measure the effects of amplitude, length, and bob mass on the period of a pendulum.

Picket Fence Freefall

Students use a picket fence and photogate to measure the acceleration of a falling body. Extensions involve the students calculating g from distance vs time data, adding additional force to the falling body, and changing the air resistance acting on the picket fence.

Projectile Motion

Students roll a ball down an inclined plane and off a table, use a photogate to measure velocity, and use two-dimensional kinematics to predict the impact point of the ball.

Pulleys

Students measure the force needed and efficiency of three different pulley systems.

Review / Test prep activities

We can design fun, unique review sessions for nearly any topic using our programmable Spheros. (No prior programming experience needed.) Ask us for suggestions for your next review session!

Ski Jump – Energy and Distance – a Sphero activity

Students use programmable Spheros to determine how far a Sphero can jump given its speed and kinetic energy. After they analyze the relationship between energy and jump distance, they pick their own distance, make a prediction, and test it out. (No prior programming experience needed.)

Sound

Sound waves and beats: Uses a Vernier microphone to measure the frequency, period, amplitude, and beats of sound waves from tuning forks.

Speed of sound in air: Uses a Vernier microphone to measure how long it take sound to travel down

and back in a long tube. Students then calculate the speed of their sound, and compare their calculated value to the accepted value for the speed of sound in air.

Spheros

Spheros are paired with a Kindle Fire (provided) through the SpheroEdu app. Beginners can draw a path for the Sphero robot to follow, intermediate users can drag and drop blocks of code, and advanced users can write text programs using JavaScript. Provide your own activities, or use one of the SpheroEdu prepared modules aligned to NGSS, CCSS, and various state standards.

Static & Kinetic Friction

Students use a force sensor and motion detector to measure the force of static and kinetic friction, determine the relationship between the force of static friction and the weight of an object, measure the coefficients of static and kinetic friction for a particular block and track, and determine if the coefficient of kinetic friction depends on weight.

Tractor Pull: Power, Mass, and Velocity – a Sphero activity

Students use programmable Spheros to investigate the relationships between power, mass, and speed. The students are challenged to build a tractor that Sphero will drive. Then they vary the power of the Sphero and the mass of the tractor, and measure the velocity of their tractor for each variable. (No prior programming experience needed.)

Other Equipment:

Vernier LabQuests
Vernier LabPros
Vernier sensors:
- Voltage
- Magnetic field
- Barometer
- Light
- Motion detectors
- Flow rate
- Photogates
- Dual force
- Gas pressure
- Temperature
- Low-g Accelerometer
- Force plates
- Microphone
- Radiation
- Sound Level Meter
- Watts Up Pro

Pendulum hooks
Bobs
Picket fences
Hooks & weight sets
Carts
Single & double pulleys
Fulcrums
Absolute zero demo apparatus
Mini black lights
Density equipment

We are always working on new activities to bring to your classroom. If you have any curriculum for which you do not see an activity, please let us know! We may be able to design one for you.