Physics LabPaq Select

HANDS-ON LABS SCIENCE DELIVERED

- Engaging laboratory learning experiences based on modern pedagogies.
- Educational background information that fully prepares students for completing the labs.
- Clearly defined procedures, mirroring on-campus laboratory coursework.
- Comprehensive assessments bring meaning to experiment results and build critical thinking skills.

Choose one of our Signature Physics LabPaqs below or configure your own! *

	Semester 1	Semester 2	Covers Semesters 1 and 2		Introductory Survey and AP Courses	Non-Majors
EXPERIMENT	**PK-1 LP-2232-PK-01**	**PK-2 LP-2236-PK-01**	**PK-S LP-2247-PK-01**	**PK-W LP-2252-PK-01**	**PK-101 LP-2233-PK-01**	**PK-105 LP-2234-PK-01**
Acceleration	●		●	●	●	
Barometric Pressure				●		
Capacitance in a Circuit		●	●	●		
Centripetal Acceleration	●		●	●		
Conservation of Momentum				●		
Data Collection	●		●	●	●	●
Determining the Speed of Sound	●		●	●		
Diffraction Grating		●	●	●		
Electric Fields		●	●	●		
Electric Motor		●	●	●		
Experimental Errors and Uncertainty	●		●	●	●	
Friction	●		●	●	●	●
Hooke's Law	●		●	●	●	●
Introduction to Electrical Circuits		●	●	●	●	
Mapping a Magnetic Field				●		
Measurement: Length, Mass, Volume, Density, and Time	●		●	●	●	●
Optical Bench with Mirrors and Lenses				●		
Pendulum and the Calculation of g	●		●	●	●	●
Polarized Light		●	●	●		
Radioactive Decay		●	●	●	●	
Reflection and Refraction		●	●	●	●	●
Resistors in Series and Parallel		●	●	●	●	
Semiconductor Temperature Sensor		●	●	●		
Simple Machine - Lever	●		●	●	●	●
Simple Machine - Pulleys	●		●	●	●	
Specific Heat Capacity of Metals	●		●	●	●	●
Static Electricity or Electrostatics		●	●	●	●	●
Trigonometric Measurements	●		●	●	●	
NUMBER OF EXPERIMENTS	13	11	24	28	16	9

*LabPaq kits can only be configured with the experiments listed below.

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Experiment	Student Hands-On Activities
Acceleration	• Simulate Galileo's studies of objects rolling down inclines. • Observe the horizontal and vertical forces acting on a ball as it rolls down an incline. • Measure a marble's velocity as it rolls down an incline and then calculate the rate of acceleration.
Barometric Pressure	• Build a simple barometer and examine how a barometer works. • Investigate the relationship between air pressure and weather conditions. • Predict weather based on air-pressure data.
Capacitance in a Circuit	• Observe and describe the charging and discharging process for a capacitor in a resistor-capacitor circuit. • Calculate the time constant of the RC circuit and the internal resistance of the digital multimeter used in the experiment.
Centripetal Acceleration	• Assemble a centripetal apparatus to examine the forces involved in angular momentum. • Calculate the radius, theoretical centripetal force, and velocity of different masses. • Graph the relationships among velocity, centripetal force, and the radius of the circular path of an object undergoing constant circular motion.
Conservation of Momentum	• Observe conservation of momentum in a collision and calculate the velocity and momentum of a moving object. • Create collisions using marbles of varying masses and observe and measure the effects. • Calculate conservation of momentum from one marble to the other.
Contact Forces	• Calculate friction, tension, and normal forces. • Graph and interpret spring force data. • Create free-body diagrams.
Data Collection	• Estimate the velocity of a pitched ball. • Calculate the actual velocity and determine the accuracy of predictions. • Roll a large ball to and describe its horizontal motion and velocity.
Determining Speed of Sound	• Construct a resonance tube. • Calculate the velocity of sound in air using a tuning fork of known frequency. • Measure the wavelength of a sound using the resonance of an air column inside a PVC pipe submerged at various depths in water. • Calculate the speed of sound from experimental data.
Diffraction Grating	• Observe the interference pattern produced by passing a laser beam through a diffraction grating card. • Determine the distance between slits in the grating and calculate the wave-length of the laser light. • Calculate the number of grooves in an audio CD by measuring the diffraction of light spectra on a wall.
Electric Fields	• Determine the shape of equal potential lines surrounding charged objects. • Use a digital multimeter to measure electric fields created by a battery and map the fields.

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Experiment	Student Hands-On Activities
Electric Motor	• Simulate a simple electric motor by constructing an armature out of coiled wire. • Use a magnet to spin the armature and reverse the direction of the spinning motor.
Experimental Errors and Uncertainty	• Measure the acceleration of a falling object and graphically analyze the data. • Calculate the slope of a line, gravitational force, and percent error.
Friction	• Measure friction using a spring scale. • Calculate the coefficient of friction from experimental data. • Compute forces for static and kinetic friction required to move a wooden block.
Hooke's Law	• Calculate the spring constant for two springs and a rubber band. • Calculate the elastic potential energy in Joules, and then compare spring data to that of the rubber band.
Hypotheses, Laws, and Theories	• Correlate a real-world scenario with the steps of the scientific method. • Compare and contrast scientific law and theory and create a Venn diagram to illustrate attributes of each. • Classify and explain real-world examples of hypotheses, laws, theories, and opinions.
Introduction to Electrical Circuits	• Draw circuit diagrams and interpret the codes on resistors. • Measure voltage, current, and resistance in a simple circuit using a digital multimeter.
Introduction to Experimental Errors and Uncertainty	• Measure and record time and distance data. • Calculate percent error and percent uncertainty from experimental data. • Relate experimental error to measuring devices and techniques.
Mapping a Magnetic Field	• Measure the magnetic field of a bar magnet using a compass. • Map the data to visualize the magnetic field of a bar magnet.
Measurement: Length, Mass, Volume, Density, and Time	• Measure distance, mass density and time. • Calculate volume and density; use spreadsheet software to graph circumference and diameter relationships; estimate and measure distance, time, and mass; measure the circumference of various round objects, plot the data, calculate the slope, and determine the value of pi; use the Archimedes principle to determine density; and calculate percent error.
Newton's Laws of Motion	• Analyze scenarios to determine if the net force is zero or nonzero. • Identify scenarios as demonstrating Newton's first, second, or third law of motion. • Sketch an example for each of Newton's laws of motion to illustrate the relevant forces.
Non-Contact Forces	• Describe types of forces and discuss gravitational, electrostatic, and magnetic force. • Graph the inverse square force data and apply the right hand rule to predict magnetic field deflections.
Optical Bench with Mirrors and Lenses	• Calculate the focal length and magnification of a mirror and two lenses using several convex lenses and a spherical converging mirror. • Produce images using a candle and determine whether the images are real or virtual.

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Experiment	Student Hands-On Activities
Pendulum and the Calculation of g	• Construct a pendulum and experiment with length and starting position effects on period. • Calculate the force of gravity from experimental data.
Polarized Light	• Determine the amount of light able to pass through crossed polarizers using both qualitative and quantitative methods. • Determine quantitative measurements of resistance using a cadmium sulfide photocell with electrical readings collected by a digital multimeter.
Propagation of Uncertainty	• Calculate measurements and uncertainties using addition, multiplication, division, and power operators. • Calculate measurements and uncertainties using functions and partial derivatives (optional).
Radioactive Decay	• Simulate the decay of a hypothetical radioactive element using split peas. • Graph the results of the simulated decay. • Determine the half-life and decay constant of the element.
Reflection and Refraction	• Measure incident and reflection angles from a mirror and determine the relationship between the refraction of light and Snell's law. • Study how various angles of light reflect off a mirror using a laser and determine whether the image in the mirror is real or virtual. • Study refraction through both water and a translucent block. • Calculate the refractive indexes for these materials using Snell's law and compare the indexes to those of other materials.
Resistors in Series and Parallel	• Perform a series of experiments with different configurations of resistors, measuring the voltage and current across each resistor. • Determine calculated values using Ohm's law and compare them with actual readings taken with the digital multimeter.
Semiconductor Temperature Sensor	• Calibrate diodes with a glass thermometer to measure changes in temperature. • Construct an electric thermometer using a silicon diode, a 10K resistor, and a 1.5V battery connected in series. • Explore the relationship between voltage and temperature.
Simple Machine-Lever	• Calculate the efficiency of a machine by constructing first, second, and third class levers using both a ruler and a meter stick. • Test different loads in the levers, use a spring scale to measure force, and calculate the mechanical advantage of each type of lever.
Simple Machine-Pulleys	• Construct a simple machine using pulleys rigged with strings. • Calculate the mechanical advantage with varying amounts of strings. • Examine a single fixed pulley, a single movable pulley, and double pulleys and calculate the work, efficiency, and mechanical advantage of each system.
Specific Heat Capacity of Metals	• Construct a calorimeter. • Measure heat changes of two metals. • Calculate specific heat of metals from experimental data.
Static Electricity or Electrostatics	• Generate static electricity using a variety of materials. • Collect data and use it to rank materials through the triboelectric series.
Trigonometric Measurements	• Calculate the height of a building using a weight hanging from a protractor. • Calculate the degree of accuracy of the calculations.