

Physics 1 AP

Core Lab Summaries

Revised 2014

ACTIVITY 1

One-Dimensional Motion Lab

CONCEPTS:	Velocity is measurable and describes the change of position of an object.
EQUIPMENT:	Grooved wooden track or air track ring stand or blocks to incline the track ball for wooden track or air track glider or wheeled toy meter sticks stopwatches masking tape
SUMMARY:	Students collect data for analysis via a distance vs. time graph and invent the concept of velocity.
SAFETY:	Tracks can slip and cause injury if elevated too high.

ACTIVITY 2

Vectors Lab

CONCEPTS:	A model which provides the magnitude and direction of a measurable quantity is a vector.
EQUIPMENT:	force tables with pulleys, strings, weight holders, ring one slotted weight set protractor, ruler blank paper, graph paper
SUMMARY:	Students construct a force vector diagram using data from the force tables. It is shown that one force on the table will always be the equilibrant of the other two.
SAFETY:	no special concerns

Physics 1 AP

Core Lab Summaries

Revised 2014

ACTIVITY 3

Forces and Acceleration Lab

CONCEPTS:	A constant, unbalanced force acting on any movable object produces a constant acceleration in the direction of the force. A certain amount of unbalanced force will result in a specific acceleration of an object in the direction of the force. (Force and acceleration are directly proportional.)
EQUIPMENT:	air track air track glider string/fishing line weight holder slotted weights OR tilt blocks stopwatch
SUMMARY:	Students investigate how a constant force yields constant acceleration. They also collect data to construct and interpret a graph of force vs. acceleration.
SAFETY:	No special concerns

ACTIVITY 4

Inertial Balance

CONCEPTS:	Weight is a result of gravity acting on an object. Mass is the quantity of matter in an object and responsible for its inertia.
EQUIPMENT:	Inertial balance masking tape 250 g cylinder blank paper 500 g mass
SUMMARY:	The concept of mass invented when it is shown that gravity cannot account for the decreased oscillations of the balance when more weight (actually mass) is added.
SAFETY:	The 500 g mass must be taped into the balance securely to prevent it from falling out and possibly causing injury.

Physics 1 AP

Core Lab Summaries

Revised 2014

ACTIVITY 5

Mass and Acceleration

CONCEPTS:	Acceleration is inversely proportional to the mass being accelerated when a constant force is applied.
EQUIPMENT:	air track air track glider string/fishing line weight holder slotted weights OR tilt blocks stopwatch
SUMMARY:	Students collect data to construct and interpret graphs of mass vs. acceleration and $1/\text{mass}$ vs. acceleration.
SAFETY:	No special concerns.

ACTIVITY 6

The Law of Inertia

CONCEPTS:	An object in motion will remain in motion at a constant velocity and an object at rest will remain at rest unless an external unbalanced force acts upon it. The acceleration of an object is directly proportional to the magnitude of the unbalanced force applied to it and inversely proportional to the object's mass. If one body exerts a force upon another, the second body will exert an equal but opposite force back upon the first.
EQUIPMENT:	3 or 4 different masses blank paper 5 nickels and 1 penny masking tape ruler teacher demo requires ring stand, string, large double-hooked mass
SUMMARY:	Students use the results (graphs) of core labs 3 and 5 to mathematically derive the second law of motion. Students perform the "tablecloth trick" and "coin trick" and observe an inertia demonstration to develop the first law of motion.
SAFETY:	Students must be careful not to pull the masses off the table in the tablecloth trick to avoid possible injury. In the inertia demonstration, the lecturer needs to be careful that the falling mass does not strike his hand.

Physics 1 AP

Core Lab Summaries

Revised 2014

ACTIVITY 7

Friction Lab

CONCEPTS: When one object moves over another, a retarding force called friction acts opposite to the direction of motion. Both surface types, the force pressing the surfaces together, and whether the objects are in motion or not each affect friction between solids.

EQUIPMENT: surface blocks (plain, mirrored, sandpaper)
surface board (e.g. Masonite)
long narrow mirror
metal plate
newton scales
200, 250, 500, and 1000 gram masses

SUMMARY: Students pull blocks with various surfaces across various surfaces to identify the primary factors affecting friction.

SAFETY: Use caution with mirrors.

ACTIVITY 8

Linear Momentum Lab

CONCEPTS: The momentum of an object is the product of its mass and velocity. The momentum of an isolated system (one upon which no net external force acts) is conserved.

EQUIPMENT: air track
3 air track gliders (two 300 gram and one 150 gram)
photogates with basic timers
electric glider launcher

SUMMARY: Students collect data for elastic collisions that leads to the law of conservation of momentum.

SAFETY: no special concerns

Physics 1 AP

Core Lab Summaries

Revised 2014

ACTIVITY 9

Circular Motion Lab

CONCEPTS:	When an object is moving in a circle about a central point, a force acts at right angles to the tangential motion of the object and toward the center of the circular path. The force is centripetal force.
EQUIPMENT	100 gram mass string narrow glass or metal rod, approximately 6" long rubber stopper Demo: air table, puck, fishing line
SUMMARY:	Students observe the trajectory of a circling puck released on an air table, analyzing its behavior. They analyze the forces acting when they twirl a stopper using a tube device.
SAFETY:	The mass and stopper must be securely tied, or the equipment may unexpectedly enter projectile, not circular, motion and cause injuries.

ACTIVITY 10

Rotation Lab

CONCEPTS:	pending; lab under development for new Physics 1 AP curriculum
EQUIPMENT:	pending
SUMMARY:	pending
SAFETY:	pending

Physics 1 AP

Core Lab Summaries

Revised 2014

ACTIVITY 11

Work Lab

CONCEPTS: The mathematical product of a force and the parallel distance through which it operates is known as work. A system can do work only if it has energy.

EQUIPMENT: inclined plane
Hall's carriage
500, 750, and 1000 gram masses
newton scale
masking tape
meter stick

SUMMARY: Students collect data for towing objects of varying mass up an inclined plane at various angles to develop the concept of work.

SAFETY: no special concerns

Physics 1 AP

Core Lab Summaries

Revised 2014

ACTIVITY 12

Power

CONCEPTS: Power is work done divided by time. The power a person generates climbing stairs can be calculated.

EQUIPMENT: stadium stairs meter stick
stopwatch bathroom scale

SUMMARY: Students run stairs to calculate their horsepower.

SAFETY: Students must be careful not to trip when climbing stairs.

ACTIVITY 13

Ammeters and Voltage Meters; Ohm's Law Lab

CONCEPTS: An electrical circuit is present when there is evidence that electrical energy is being used. An electrical current moves or flows in an electrical circuit and is measured with an ammeter. Electrical voltage is related to energy and is measured with a voltmeter. In an electrical circuit, a strict relationship among voltage, current, and resistance exists ($V = IR$). That relationship is Ohm's Law.

EQUIPMENT: hookup wire
ammeter
voltmeter
three 1.3V light bulbs / 5, 10, and 20 Ω resistors
12 V variable power supply
two 1.5 dry cells

SAFETY: Because low voltages are being used, risk of dangerous electric shock is minimal. Students should be monitored in battery hookup to avoid overheating due to improper connections. Meter hookup should be monitored to avoid equipment damage.

Physics 1 AP

Core Lab Summaries

Revised 2014

ACTIVITY 14

Resistors & Series Circuits Lab

CONCEPTS:	A resistor is a device especially designed for a certain amount of resistance and is coded using colored bands. A series circuit has one loop. In a series circuit, the voltage is additive, the current is constant, and the total resistance equals the sum of the individual resistances.
EQUIPMENT:	hookup wire 3 high-power color-coded resistors of varying sizes (5, 10, and 20 ohms) ammeter voltmeter 12V variable power supply
SUMMARY:	Students test color-coded resistors by collecting current and voltage data. They then collect similar data across the elements of a series circuit to determine its basic properties.
SAFETY:	Because low voltages are being used, risk of dangerous electric shock is minimal. Meter hookup should be monitored to avoid equipment damage. Also, resistors should be checked for overheating.

ACTIVITY 15

Parallel Circuits Properties

CONCEPTS:	A parallel circuit has multiple loops. In a parallel circuit, the voltage is constant, the current is additive, and the inverse of the total resistance equals the sum of the inverses of the individual resistances.
EQUIPMENT:	Hookup wire 3 high-power resistors varying sizes (5, 10, 20 ohms) ammeter voltmeter 12 V variable power supply
SUMMARY:	Students collect voltage and current data across the elements of two parallel circuits to determine their basic properties.
SAFETY:	See activity 13.

Physics 1 AP

Core Lab Summaries

Revised 2014

ACTIVITY 16

Waves Lab

CONCEPTS: pending; lab under development for new Physics 1 AP curriculum

EQUIPMENT: pending

SUMMARY: pending

SAFETY: pending
