

# MASTER MATERIALS AND EQUIPMENT LIST

This Master Materials and Equipment List shows the equipment required to perform the *Structured* version of each lab activity from the *Advanced Physics 1 Lab Manual*. Italicized entries indicate items not available from PASCO. The quantity indicated is per student or group.

Teachers can conduct some lab activities with sensors and probes other than those listed here. For assistance with substituting compatible sensors and probes for a lab activity, contact PASCO Teacher Support (800-772-8700 inside the United States or <http://www.pasco.com/support>).

Lab	Title	Materials and Equipment	PASCO Part Number	Qty
1	GRAPHICAL ANALYSIS: MOTION Students measure the position and velocity of a cart on a track to determine the graphical relationship between position, velocity, and acceleration versus time graphs.	<b>FOR EACH STUDENT STATION</b> Data Collection System PASCO Smart Cart PASCO PAsTrack PASCO Dynamics Track End Stop Four Scale Meter Stick <i>Thick Text Book</i>	  ME-1240 ME-6960 w/ME-8971 SE-8695	  1 1 1 1 1 1
2	NEWTON'S SECOND LAW Students use a Smart Cart to determine the relationship between a system's mass, acceleration, and the net force being applied to the system.	<b>FOR EACH STUDENT STATION</b> Data Collection System PASCO Smart Cart PASCO PAsTrack PASCO Dynamics Track End Stop PASCO Super Pulley with Clamp* PASCO 250-g Compact Cart Mass PASCO Mass and Hanger Set Thread  <b>FOR THE ENTIRE CLASS</b> Ohaus Scout Pro Balance 2,000-g	  ME-1240 ME-6960 w/ME-8971 w/ME-9433 ME-6755 ME-8979 ME-9875  SE-8757B	  1 1 1 1 1 2 1 1 m  1
3	ATWOOD'S MACHINE Students use a photogate and pulley system to determine the mathematical relationship between the acceleration of an Atwood's machine, the difference between its two masses, and the sum of those two masses.	<b>FOR EACH STUDENT STATION</b> Data Collection System PASCO Wireless Smart Gate PASCO Super Pulley with Mounting Rod* PASCO Mass and Hanger Set PASCO Aluminum Table Clamp 60-cm Stainless Steel Rod Right Angle Clamp Thread <i>Scissors</i>	  PS-3225 w/ME-9433 ME-8979 ME-8995 ME-8977 SE-9444 ME-9875	  1 1 1 1 1 1 1 m 1

Lab	Title	Materials and Equipment	PASCO Part Number	Qty
4	<b>COEFFICIENTS OF FRICTION</b> Students use a Smart Cart to determine the static and kinetic friction coefficients between two contacting surfaces.	<b>FOR EACH STUDENT STATION</b> Data Collection System PASCO Smart Cart with hook PASCO Discover Friction Accessory tray PASCO 250-g Cart Mass* Thread  <b>FOR THE ENTIRE CLASS</b> Ohaus Scout Pro Balance 2,000-g	 ME-1240 w/ME-8574 w/ME-6757A ME-9875  SE-8757B	 1 1 1 5 1 m  1
5	<b>TWO-DIMENSIONAL MOTION: PROJECTILES</b> Students use a photogate and mini launcher to measure the variables that affect the two-dimensional motion of a projectile launched horizontally, and then use those variables to accurately predict and test the projectile's horizontal range.	<b>FOR EACH STUDENT STATION</b> Data Collection System PASCO Wireless Smart Gate PASCO Photogate Mounting Bracket PASCO Mini Launcher Mini launcher bracket* Launcher loading rod* Steel ball, 1.6-cm diameter* PASCO Aluminum Table Clamp Four Scale Meter Stick Carbon Paper* <i>White Paper, sheet</i> <i>Cardboard, square piece, 10 × 10 inch</i>	 PS-3225 ME-6821A ME-6825B w/ME-6825B w/ME-6825B w/ME-6825B ME-8995 SE-8695 w/SE-8693	 1 1 1 1 1 1 1 1 1 sheet 1 sheet 1
6	<b>CONSERVATION OF MECHANICAL ENERGY</b> Students use a Smart Cart and dynamics system to explore how the kinetic energy, gravitational potential energy, and total mechanical energy of a cart/earth system changes as the cart rolls down an inclined track.	<b>FOR EACH STUDENT STATION</b> Data Collection System PASCO Smart Cart PASCO PASTrack PASCO Dynamics Track Rod Clamp PASCO Angle Indicator PASCO Dynamics Track End Stop PASCO Aluminum Table Clamp 45-cm Stainless Steel Rod Four Scale Meter Stick  <b>FOR THE ENTIRE CLASS</b> Ohaus Scout Pro Balance 2,000-g	 ME-1240 ME-6960 ME-9836 ME-9495A w/ME-8971 ME-8995 ME-8736 SE-8695  SE-8757B	 1 1 1 1 1 1 1 1 1 1 1

Lab	Title	Materials and Equipment	PASCO Part Number	Qty
7	<b>WORK AND KINETIC ENERGY</b> Students use a Smart Cart and dynamics system to investigate the relationship between the change in kinetic energy of an object experiencing a non-zero net force and the work done by that net force on the object, and then use their data to establish a measurement-based relationship between work and kinetic energy.	<b>FOR EACH STUDENT STATION</b> Data Collection System PASCO Smart Cart with hook PASCO PASTrack PASCO Super Pulley with Clamp* PASCO 250-g Cart Mass* PASCO Mass and Hanger Set Thread  <b>FOR THE ENTIRE CLASS</b> Ohaus Scout Pro Balance 2,000-g	 ME-1240 ME-6960 w/ME-9433 w/ME-6757A ME-8979 ME-9875  SE-8757B	1 1 1 1 4 1 1 m  1
8	<b>CONSERVATION OF MOMENTUM</b> Students use two Smart Carts and a dynamics system to demonstrate that linear momentum and kinetic energy are conserved in an elastic collision, and linear momentum is conserved but kinetic energy is not conserved in an inelastic collision.	<b>FOR EACH STUDENT STATION</b> Data Collection System PASCO Smart Cart, red, with magnetic bumper PASCO Smart Cart, blue, with magnetic bumper PASCO PASTrack PASCO Dynamics Track End Stop PASCO 250-g Cart Mass*  <b>FOR THE ENTIRE CLASS</b> Ohaus Scout Pro Balance 2,000-g	 ME-1240 ME-1241 ME-6960 w/ME-8971 w/ME-6757A  SE-8757B	1 1 1 1 2 2  1
9	<b>MOMENTUM AND IMPULSE</b> Students use a Smart Cart and dynamics system to investigate the relationship between the change in momentum of a cart undergoing a collision and the impulse imparted to the cart to change its momentum, and then use their data to establish a measurement-based relationship between change in momentum and impulse.	<b>FOR EACH STUDENT STATION</b> Data Collection System PASCO Smart Cart PASCO PASTrack PASCO Dynamics Track End Stop PASCO Light Spring Bumper*  <b>FOR THE ENTIRE CLASS</b> Ohaus Scout Pro Balance 2,000-g	 ME-1240 ME-6960 w/ME-8971 w/ME-9884  SE-8757B	1 1 1 1 1  1

Lab	Title	Materials and Equipment	PASCO Part Number	Qty
10	<b>ROTATIONAL DYNAMICS</b> Students use a rotary motion sensor to determine the mathematical relationship between torque, rotational inertia, and angular acceleration of a rotating object.	<b>FOR EACH STUDENT STATION</b> Data Collection System PASCO Wireless Rotary Motion Sensor PASCO Pendulum Accessory PASCO Super Pulley with Clamp* PASCO Mass and Hanger Set PASCO Aluminum Table Clamp 60-cm Stainless Steel Rod Four Scale Meter Stick Thread Stainless Steel Calipers <i>Scissors</i>  <b>FOR THE ENTIRE CLASS</b> Ohaus Scout Pro Balance 2,000-g	PS-3220 ME-8969 w/ME-9433 ME-8979 ME-8995 ME-8977 SE-8695 ME-9875 SF-8711  SE-8757B	1 1 1 1 1 1 1 1 2 m 1 1  1
11	<b>ROTATIONAL STATICS</b> Students use the Smart Cart force sensor and tension protractors to demonstrate that the sum of the forces acting on an object in static translational equilibrium is equal to zero, and the sum of the torques acting on an object in static rotational equilibrium is equal to zero.	<b>FOR EACH STUDENT STATION</b> Data Collection System PASCO Smart Cart with rubber bumper PASCO Smart Cart Rod Stand Adapter PASCO Tension Protractor PASCO Aluminum Table Clamp 90-cm Stainless Steel Rod 60-cm Stainless Steel Rod Right Angle Clamp Hooked Mass Set Four Scale Meter Stick Thread <i>Tape</i> <i>AA-cell battery or similar cylindrical object</i> <i>Scissors</i>	ME-1240 ME-1244 ME-6855 ME-8995 ME-8738 ME-8977 SE-9444 SE-8759 SE-8695 ME-9875	1 1 1 2 2 1 2 2 1 1 1 2 m 1 roll 1 1
12	<b>PERIODIC MOTION: MASS AND SPRING</b> Students use a Smart Cart to determine the physical properties of a vertical mass and spring system that affect its period of oscillation, and then use their data to support a mathematical model relating period, mass, and spring constant.	<b>FOR EACH STUDENT STATION</b> Data Collection System PASCO Smart Cart with hook PASCO Smart Cart Rod Stand Adapter PASCO Aluminum Table Clamp 90-cm Stainless Steel Rod 45-cm Stainless Steel Rod Right Angle Clamp Springs, same diameter and length, different spring constant 1–15 N/m Springs, same diameter and spring constant, different length 0.1–0.3 m Hooked Mass Set Four Scale Meter Stick	ME-1240 ME-1244 ME-8995 ME-8738 ME-8736 SE-9444 w/ME-9866 w/ME-9866 SE-8759 SE-8695	1 1 1 1 1 1 1 1 3 2 1 1

Lab	Title	Materials and Equipment	PASCO Part Number	Qty
13	<p><b>SIMPLE PENDULUM</b> Students use a photogate and pendulum to determine the physical properties of a simple pendulum that affect its period, and then use their data to support a mathematical model relating period to pendulum arm length.</p>	<p><b>FOR EACH STUDENT STATION</b> Data Collection System PASCO Wireless Smart Gate PASCO Photogate Pendulum Set PASCO Pendulum Clamp PASCO Aluminum Table Clamp 90-cm Stainless Steel Rod Four Scale Meter Stick Thread <i>Scissors</i></p> <p><b>FOR THE ENTIRE CLASS</b> Ohaus Scout Pro Balance 2,000-g</p>	 PS-3225 ME-8752 ME-9506 ME-8995 ME-8738 SE-8695 ME-9875  SE-8757B	 1 1 1 1 1 1 1 2 m 1  1
14	<p><b>RESONANCE AND STANDING WAVES</b> Students use a resonance air column, tuning forks, and the principles of resonance and standing waves for a pipe with one closed end to experimentally determine a value for the speed of sound in air.</p>	<p><b>FOR EACH STUDENT STATION</b> PASCO Resonance Air Column Tuning Fork Set Four Scale Meter Stick</p>	 WA-9606 SE-7342 SE-8695	 1 1 1
15	<p><b>DC CIRCUITS</b> Students use a voltage sensor, a current sensor, and an AC/DC electronics laboratory to construct simple resistor circuits with resistors in series or in parallel, or both (with at most one parallel loop of resistors), to demonstrate the validity of Kirchhoff's loop rule (conservation of energy), and Kirchhoff's junction rule (conservation of charge).</p>	<p><b>FOR EACH STUDENT STATION</b> Data Collection System PASCO Wireless Voltage Sensor PASCO Wireless Current Sensor PASCO AC/DC Electronics Lab Kit Resistor, 4.7-<math>\Omega</math>* Resistor, 33-<math>\Omega</math>* Resistor, 10-<math>\Omega</math>* 4-mm banana plug patch cord with alligator clip* <i>D-cell Battery</i></p>	 PS-3211 PS-3212 EM-8656 w/EM-8656 w/EM-8656 w/EM-8656 w/PS-3211 & w/PS-3212	 1 1 1 1 1 1 1 4 1

\* These items are included with the specific kit, apparatus, or sensor used in the experiment.

## ACTIVITY BY PASCO ITEM

This table indicates which lab activities use the PASCO scientific sensors or special equipment listed. The quantities shown indicate the number of each item required to complete all the activities that require the specified item.

Items Available from PASCO	PASCO Part Number	Qty	Activity Where Used
<b>PASCO SENSORS</b>			
PASCO Smart Cart, red	ME-1240	1	1, 2, 4, 6, 7, 8, 9, 11, 12
PASCO Smart Cart, blue	ME-1241	1	8
PASCO Wireless Current Sensor	PS-3212	1	15
PASCO Wireless Rotary Motion Sensor	PS-3220	1	10
PASCO Wireless Smart Gate	PS-3225	1	3, 5, 13
PASCO Wireless Voltage Sensor	PS-3211	1	15
<b>PASCO LABWARE</b>			
PASCO 250-g Cart Mass	ME-6757A	5	4, 7, 8
PASCO 250-g Compact Cart Mass	ME-6755	2	2
PASCO AC/DC Electronics Lab Kit	EM-8656	1	15
PASCO Angle Indicator	ME-9495A	1	6
PASCO Aluminum Table Clamp	ME-8995	2	3, 5, 6, 10, 11, 12, 13
PASCO Bumper Accessory Set	ME-9884	1	9
PASCO Demonstration Spring Set	ME-9866	1	12
PASCO Discover Friction Accessory	ME-8574	1	4
PASCO Dynamics Track End Stop	ME-8971	2	1, 2, 6, 8, 9
PASCO Dynamics Track Rod Clamp	ME-9836	1	6
PASCO Mass and Hanger Set	ME-8979	1	2, 3, 7, 10
PASCO Mini Launcher w/bracket	ME-6825B	1	5
PASCO PAsTrack	ME-6960	1	1, 2, 6, 7, 8, 9
PASCO Pendulum Accessory	ME-8969	1	10
PASCO Pendulum Clamp	ME-9506	1	13
PASCO Photogate Mounting Bracket	ME-6821A	1	5
PASCO Photogate Pendulum Set	ME-8752	1	13
PASCO Resonance Air Column	WA-9606	1	14
PASCO Smart Cart Rod Stand Adapter	ME-1244	1	11, 12
PASCO Super Pulley Kit	ME-9433	1	2, 3, 7, 10
PASCO Tension Protractor	ME-6855	2	11
<b>OTHER LABWARE</b>			
45-cm Stainless Steel Rod	ME-8736	1	6, 12
60-cm Stainless Steel Rod	ME-8977	2	3, 10, 11
90-cm Stainless Steel Rod	ME-8738	1	11, 12, 13
Carbon Paper	SE-8693	1 sheet	5
Four Scale Meter Stick	SE-8695	1	1, 5, 6, 10, 11, 12, 13, 14

Items Available from PASCO	PASCO Part Number	Qty	Activity Where Used
Hooked Mass Set	SE-8759	1	11, 12
Ohaus Scout Pro Balance 2,000-g	SE-8757B	1	2, 4, 6, 7, 8, 9, 10, 13
Right Angle Clamp	SE-9444	2	3, 11, 12
Stainless Steel Calipers	SF-8711	1	10
Thread	ME-9875	9 m	2, 3, 4, 7, 10, 11, 13
Tuning Fork Set	SE-7342	1	14