

# Advanced Physics

## Master Materials and Equipment List

Italicized entries indicate items not available from PASCO. The quantity indicated is per student or group. NOTE: Some activities also require protective gear for each student (for example, safety goggles, gloves, apron, or lab coat).

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>).

Act	Title	Materials and Equipment	PASCO Part Number	Qty
1	<b>Scientific Inquiry</b> Use a fast response temperature sensor in the design of a simple experiment as students attempt to slow the cooling rate of the water by adding insulation to the cup.	Data Collection System  PASPORT Fast Response Temperature Sensor <i>9-12 oz. cup</i> <i>Hot water</i> <i>Insulating devices readily available in the laboratory (styrofoam, foil, plastic wrap, cloth, wool, packing peanuts)</i>	  PS-2135 (set of 3)	1  1 1 A variety
2	<b>Measurements and Graphical Analysis</b>	<i>Circular disks with different radii</i>  Balance Meter Stick Stainless Steel Caliper	  SE-8756A SE-8695 SF-8711	5  1 1 1
3	<b>Graphical Analysis: Motion</b>	Data Collection System  PASPORT Motion Sensor Dynamics Track (PAstrack) Dynamics Cart (PAScar (Set of 2))  Meter Stick	  PS-2103A ME-6960 ME-6950 (set of 2) SE-8695	1  1 1 1 1
4	<b>1-Dimensional Motion: Inclined Plane</b>	Data Collection System  PASPORT Motion Sensor Dynamics Track (PAstrack) Dynamics Cart (PAScar (Set of 2))  Dynamics Track End Stop (2 Pack)  Large Base and Support Rod	  PS-2103A ME-6960 ME-6950 (set of 2) ME-8971 (set of 2) ME-9355	1  1 1 1 1 1

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Act	Title	Materials and Equipment	PASCO Part Number	Qty
		Dynamics Track Rod Clamp (Pivot Clamp)	ME-9810	1
5	<b>Determining the Acceleration Due to Gravity</b>	Data Collection System  PASPORT Digital Adapter PASCO Freefall Adapter Steel Ball  Right Angle Clamp Large Base and Support Rod Meter Stick	  PS-2159 ME-9207B (included with ME-9207B) SE-9444 ME-9355 SE-8695	1  1 1 1 1 1 1
6	<b>2-Dimensional Motion: Projectiles</b>	Data Collection System  PASPORT Digital Adapter Photogate (Photogate Head) Photogate Mounting Bracket PASCO Mini Projectile Launcher Mini Launcher Table Clamp  Push Rod or Plunger  Meter Stick Carbon paper	  PS-2159 ME-9498A ME-6821A ME-6825A (included with ME-6825A) (included with ME-6825A) SE-8695 SE-8693 (100 sheets)	1  1 2 1 1 1 1 1-sheet
7	<b>Coefficients of Friction</b>	Data Collection System PASPORT Motion Sensor PASPORT Force Sensor (High Resolution) PASCO Discover Friction Accessory Balance, 1200-g capacity 250 g or 500 g Masses (Compact Cart Mass, 250-g) String (Black Thread (3 pack))	PS-2103A PS-2189  ME-8574 SE-8757A ME-6755  ME-9875 (3 spools, 137-m ea.)	1 1 1 1 4  20-cm
8	<b>Atwood's Machine</b>	Data Collection System PASPORT Rotary Motion Sensor Mass and Hanger Set Right Angle Clamp Large Base and Support Rod Small Rod (Stainless Steel Rod, 60 cm Threaded) String (Black Thread (3 pack))  <i>Scissors</i>	PS-2120 ME-8979 SE-9444 ME-9355 ME-8977  ME-9875 (3 spools, 137-m ea.)	1 1 1 1 1  1.5-m
9	<b>Air Drag</b>	Meter Stick	SE-8695	2

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Act	Title	Materials and Equipment	PASCO Part Number	Qty
		Coffee filter (500 pack)	SE-7252 (set of 500)	6
10	<b>Conservation of Energy</b>	Data Collection System Photogate (Photogate Head) PASPORT Digital Adapter Photogate Bracket  PAStrack Curved PAStrack PAStrack Connector Pieces  Dynamics Cart (PAScar (Set of 2))  Meter Stick Large Base and Support Rod Dynamics Track Rod Clamp (Pivot Clamp) Dynamics Cart Picket Fence	ME-9498A PS-2159 ME-9806 (set of 2) ME-6960 ME-6841 (included with ME-6841) ME-6950 (set of 2) SE-8695 ME-9355 ME-9810 ME-9804 (set of 2)	1 1 1 1  1 1 2  1  1 1 1 1
11	<b>Work and Power</b>	Data Collection System PASPORT Force Sensor (High Resolution) Photogate (Photogate Head) PASPORT Digital Adapter Balance, 1200-g capacity Dynamics Track (PAStrack) Dynamics Cart (PAScar (Set of 2))  Photogate Bracket  Dynamics Cart Picket Fence  Dynamics Track Rod Clamp (Pivot Clamp) <i>Carpet strip or other high-friction surface</i> Meter Stick Large Base and Support Rod Stopwatch String (Black Thread (3 pack))	PS-2189  ME-9498A PS-2159 SE-8757A ME-6960 ME-6950 (set of 2) ME-9806 (set of 2) ME-9804 (set of 2) ME-9810  SE-8695 ME-9355 ME-1234 ME-9875 (3 spools, 137-m ea.)	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 20-cm
12	<b>Momentum and Impulse</b>	Data Collection System  PASPORT Force Sensor (High Resolution) PASPORT Motion Sensor Balance, 1200-g capacity Dynamics Cart (PAScar (Set of 2))	  PS-2189 PS-2103A SE-8757A ME-6950	1  1 1 1 1

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Act	Title	Materials and Equipment	PASCO Part Number	Qty
		Dynamics Track (PAStrack)	(set of 2) ME-6960	1
		PASCO Discover Collision Bracket	ME-8973	1
		Dynamics Track Rod Clamp (Pivot Clamp)	ME-9810	1
		Large Base and Support Rod	ME-9355	1
13	<b>Circular Motion</b>	Data Collection System		1
		PASPORT Force Sensor (High Resolution)	PS-2189	1
		PASCO Discover Centripetal Force Kit	ME-9837	1
		Balance	SE-8756A	1
		Universal Table Clamp	ME-9376B	1
		Pulley Mounting Rod	SA-9242	1
		Meter Stick	SE-8695	1
		Rubber Stopper with Hole, Size 10	(included with ME-9837)	1
		Durable String	(included with ME-9837)	1.5-m
		Plastic Tie	(included with ME-9837)	1
		Hollow Tube	(included with ME-9837)	1
		<i>Permanent marker</i>		1
14	<b>Periodic Motion: Mass and Spring System</b>	Data Collection System		1
		PASPORT Force Sensor (High Resolution)	PS-2189	1
		Mass and Hanger Set	ME-8979	1
		PASCO Demonstration Spring Set	ME-9866	1
		Spring ( $k < 20$ N/m)	(included with ME-9866)	1
		Meter Stick	SE-8695	1
		Large Base and Support Rod	ME-9355	1
		Right Angle Clamp	SE-9444	1
		Small Rod (Stainless Steel Rod, 60 cm Threaded)	ME-8977	1
15	<b>Simple Harmonic Motion and Pendulums</b>	Data Collection System		1
		Photogate (Photogate Head)	ME-9498A	1
		PASPORT Digital Adapter	PS-2159	1
		PASCO Photogate Pendulum Set	ME-8752	1
		Pendulum Bob	(included with ME-8752)	1
		Pendulum Clamp	SE-9443	1
		Meter Stick	SE-8695	1
		Large Base and Support Rod	ME-9355	1
		Small Rod (Stainless Steel Rod, 60 cm Threaded)	ME-8977	1
		String (Black Thread (3 pack))	ME-9875	2-m

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Act	Title	Materials and Equipment	PASCO Part Number	Qty
		<i>Scissors</i>	(3 spools, 137-m ea.)	1
16	<b>Hooke's Law</b>	Data Collection System PASPORT Force Sensor (High Resolution) PASCO Demonstration Spring Set Spring ( $k < 20$ N/m) Meter Stick	PS-2189 ME-9866 (included with ME-9866) SE-8695	1 1 1 2 1
17	<b>Rotational Dynamics</b>	Data Collection System PASPORT Rotary Motion Sensor Mass and Hanger Set PASCO Mini Rotational Accessory Balance, 400-g capacity Stainless Steel Caliper Large Base and Support Rod Meter stick String (Black Thread (3 pack))  <i>Scissors</i>	PS-2120 ME-8979 CI-6691 SE-8756A SF-8711 ME-9355 SE-8695 ME-9875 (3 spools, 137-m ea.)	1 1 1 1 1 1 1 1 1.5-m 1
18	<b>Buoyant Force</b>	Data Collection System PASPORT Force Sensor (High Resolution) <i>Beaker, glass with graduations, 500-mL</i> PASCO Density Set Metal Cylinder  Large Base and Support Rod Right Angle Clamp <i>Pen, black marker</i> String (Black Thread (3 pack))  <i>Water,</i> Meter Stick Small Rod (Stainless Steel Rod, 60 cm Threaded)	PS-2189   ME-8569 (included with ME-8569) ME-9355 SE-9444 ME-9875 (3 spools, 137-m ea.) SE-8695 ME-8977	1 1 1 1 1 1 1 1 10-cm ~ 400 mL 1 1
19	<b>Static Pressure and Flow</b>	Data Collection System  PASPORT Low Pressure Sensor Quick-Release Connectors  Plastic Tubing, 1/4" diameter  <i>Support stand, 10 cm tall</i> Meter stick	  PS-2113A (included with PS-2113A) (included with PS-2113A)  SE-8695	1  1 2 1 1 1

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Act	Title	Materials and Equipment	PASCO Part Number	Qty
		Water reservoir with a nozzle at the bottom Water catch basin Pen, felt marker Distilled water		1 1 1 1
20	<b>Latent Heat and Specific Heat of Water</b>	Data Collection System  PASPORT Temperature Sensor (Absolute Pressure/Temperature) PASPORT Stainless Steel Temperature Probe Calorimeter Cup  Balance Beakers, glass, 400-mL Stopwatch Hot Plate Distilled water Ice	  PS-2146 PS-2153 TD-8825 (set of 12) SE-8756A ME-1234 SE-8830	1 1 1 1 2 1 1 ~200 mL ~200 mL
21	<b>Thermal Expansion</b>	Data Collection System PASPORT Rotary Motion Sensor PASPORT Temperature Sensor (Absolute Pressure/Temperature) PASCO Computer Based Thermal Expansion Apparatus PASCO Steam Generator Oven Mitts or Towels to protect hands Meter Stick Tray (to catch condensed steam)	 PS-2120 PS-2146 TD-8579A TD-8556A SE-8695	1 1 1 1 1 1 1 1
22	<b>Gas Laws</b>	Data Collection System PASPORT Absolute Pressure Sensor (Absolute Pressure/Temperature) Plastic Tubing, 1/4" in diameter  Quick-Release Connectors  Syringe	 PS-2146 (included with PS-2146) (included with PS-2146) (included with PS-2146)	1 1 ~5 cm 2 1
23	<b>Ohm's Law: Series and Parallel Resistors</b>	Data Collection System  PASPORT Voltage-Current Sensor AC/DC Electronics Laboratory Variable DC Power Supply Resistors, 330-Ω  Alligator Clip Adapters  Wire leads	  PS-2115 EM-8656 SE-8828 (included with EM-8656) (included with PS-2115) (included with EM-8656)	1 1 1 3 4 4

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Act	Title	Materials and Equipment	PASCO Part Number	Qty
		Patch Cord, 4 mm Banana Plug, Black Patch Cord, 4 mm Banana Plug, Red	SE-9751 (set of 5) (included with PS-2115)	2 2
24	<b>RC Circuits</b>	Data Collection System PASPORT Voltage-Current Sensor AC/DC Electronics Laboratory Alligator Clip Adapters  <i>Batteries, D-cell</i> Patch Cord, 4 mm Banana Plug, Red	PS-2115 EM-8656 (included with PS-2115)  (included with PS-2115)	1 1 1 2 2 2
25	<b>Electric Field Mapping</b>	Data Collection System PASPORT Voltage-Current Sensor DC Power Supply (up to 20 V) PASCO Field Mapper Kit Alligator Clip Adapters  <i>T-pins (or metal pins or thumbtacks)</i> Conductive Paper	PS-2115 SE-8828 PK-9023 (included with PS-2115)  (included with PK-9023)	1 1 1 4 4 3 to 6
26	<b>Electromagnetic Fields</b>	Data Collection System PASPORT Voltage-Current Sensor PASPORT Magnetic Field Sensor PASPORT Sensor Extension Cable PASCO Primary and Secondary Coil Set Variable DC Power Supply, 1 A Large Base and Support Rod Three Finger Clamp Patch Cord, 4 mm Banana Plug	PS-2115 PS-2112 PS-2500 SE-8653  SE-8828 ME-9355 SE-9445 (included with PS-2115)	1 1 1 1  1 1 2 3
27	<b>Wave Speed</b>	PASCO Snakey (or other long spring with length > 2 m) Stopwatch Meter Stick	SE-7331  ME-1234 SE-8695	1  1 1
28	<b>Resonance and Standing Waves</b>	Tuning Forks (each with different frequency) Graduated cylinder, 1-L, or other tall water reservoir Meter stick <i>Plastic pipe, both ends open, 3 cm or larger diameter</i> <i>Water to fill reservoir</i>	SE-7342 (set of 8) ME-8594  SE-8695	5  1 5 1
29	<b>Index of Refraction</b>	PASCO Basic Optics Kit Basic Optics Ray Table	OS-8515C (included with OS-8515C)	1 1

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Act	Title	Materials and Equipment	PASCO Part Number	Qty
		Basic Optics Light Source with Power Supply D-shaped Lens	(included with OS-8515C) (included with OS-8515C)	1 1
30	<b>Focal Length of a Lens</b>	PASCO Basic Optics Kit Optics Bench, 1.2-m Viewing Screen Basic Optics Light Source with Power Supply Lens in Holder (“unknown” focal length) Stainless Steel Calipers	OS-8515C (included with OS-8515C) (included with OS-8515C) (included with OS-8515C) (included with OS-8515C) SF-8711	1 1 1 1 1 1
31	<b>Spherical Mirror Reflection</b>	PASCO Basic Optics Kit Optics Bench, 1.2-m Half Viewing Screen Stainless Steel Calipers Basic Optics Light Source with Power Supply Concave Mirror in Holder (“unknown” radius of curvature)	OS-8515C (included with OS-8515C) (included with OS-8515C) SF-8711 (included with OS-8515C) (included with OS-8515C)	1 1 1 1 1 1
32	<b>Interference and Diffraction of Light</b>	Data Collection System PASPORT Rotary Motion Sensor PASPORT High Sensitivity Light Sensor PASPORT Sensor Extension Cable Linear Translator – Basic Optics Optics Bench, 1.2-m Red Diode Laser – Basic Optics ( $\lambda=632\text{nm}$ ) Precision Diffraction Slits – Basic Optics Aperture Bracket	 PS-2120 PS-2176 PS-2500 OS-8535 OS-8508 (also included with OS-8515C) OS-8525A OS-8453 OS-8534	1 1 1 1 1 1 1 1



## Equipment List by Item

This list shows each item needed for the activities and where the item is used.

Items Available from PASCO	Qty	Where Used
PASPORT Temperature Sensor	1	19, 20
PASPORT Motion Sensor	1	2, 3, 6, 11
PASPORT Force Sensor	1	6, 10, 11, 12, 13, 15, 17
PASPORT Rotary Motion Sensor	1	7, 16, 20, 31
PASPORT Low Pressure Sensor	1	18
PASPORT Absolute Pressure Sensor	1	21
PASPORT Voltage and Current Sensor	1	22, 23, 24, 25
PASPORT Magnetic Field Sensor	1	25
PASPORT High Sensitivity Light Sensor	1	31
PASPORT Sensor Extension Cable	1	25, 31
PASPORT Digital Adapter	1	4, 5, 9, 10, 14
PASCO Field Mapper Kit	1	24
PASCO Photogate	2	5, 9, 10, 14
PASCO Calorimeter	1	19
PASCO Basic Optics Ray Table	1	28
PASCO Basic Optics Bench	1	29, 30
PASCO Freefall Adapter	1	4
PASCO Mini-Projectile Launcher	1	5
PASCO Discover Collision Bracket	1	11
PASCO PASTrack	1	3, 9, 10, 11
PASCO PASCAR	1	2, 3, 9, 10, 11
PASCO Curved PASTrack	1	9
Balance	1	1, 2, 6, 10, 11, 12, 16, 19
Hot Plate	1	19
Large Base and Support Rod	1	3, 4, 7, 9, 10, 11, 13, 15*, 16, 17, 25
Small Rod	1	14, 18
Quick Release Connector <sup>1</sup>	2	18, 21
Three-Finger Clamp	1	25
Dynamics Track Rod Clamp	1	3, 9, 10, 11
Steam Generator	1	20
Stainless Steel Caliper	1	1, 2, 16, 29, 30
Cart Picket Fence	1	9, 10
End Stop	1	3
Right Angle Clamp	1	4, 7, 13, 17
Meter Stick	1	4, 5, 8, 9, 10, 12, 13, 14, 15, 16, 18, 20, 27
Photogate Mounting Bracket	1	5
Photogate Bracket	1	9, 10
Pushrod or Plunger <sup>1</sup>	1	5
Discover Friction Accessory	1	6
Mass and Hanger Set	1	6, 7, 13, 16
Universal Table Clamp	1	12
Pulley Mounting Rod	1	12
Rubber Stopper with Hole, Size 10 <sup>1</sup>	1	12

## Equipment List by Item

Items Available from PASCO	Qty	Where Used
Plastic Tie <sup>1</sup>	1	12
Durable String <sup>1</sup>	1	12
Hollow Tube <sup>1</sup>	1	12
Spring <sup>1</sup>	1	13, 15, 26
Pendulum Bob <sup>1</sup>	1	14
Pendulum Clamp	1	14
Mini-Rotational Accessory	1	16
Metal Cylinder <sup>1</sup>	1	17
Plastic Tubing, 1/4 inch diameter <sup>1</sup>	1	18,21
Water Reservoir (with a nozzle at the bottom)	1	18, 27*
Stopwatch	1	10, 19, 26
Syringe <sup>1</sup>	1	21
AC/DC Electronics Laboratory	1	22, 23
Variable DC Power Supply	1	22, 24, 25
Resistors, 330 ohm <sup>1</sup>	3	22
Alligator Clip Adapters <sup>1</sup>	4	22, 24, 24
Patch Cord, 4 mm Banana Plug	4	22, 23, 24
Conductive Paper <sup>1</sup>	1	24
Primary and Secondary Coils Set	1	25
Tuning Fork Set	1	27
Laser – Basic Optics	1	31
Basic Optics Light Source <sup>1</sup>	1	28, 29, 30
D-Shaped Lens – Basic Optics <sup>1</sup>	1	28
Viewing Screen – Basic Optics <sup>1</sup>	1	29
Half Viewing Screen – Basic optics <sup>1</sup>	1	30
Concave Mirror – Basic Optics <sup>1</sup>	1	30
Linear Translator – Basic Optics	1	31
1.2 m Optics Track – Basic Optics <sup>1</sup>	1	31
Precision Diffraction Slits – Basic Optics	1	31
Aperture Bracket – Basic Optics	1	31

<sup>1</sup> These items are included with the specific apparatus or sensor used in the experiment