

Master Materials and Equipment List

Italicized entries indicate items not available from PASCO. The quantity indicated is per student or group. Note: The 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	Part Number	Qty
1	Scientific Inquiry This lab is designed to help student familiarize themselves with their data collection system while engaging in scientific investigations.	Data Collection System PASPORT [®] Temperature Sensor ¹ <i>Cup, 270-mL (9-oz)</i> <i>Hot water</i> <i>Insulating materials readily available in the laboratory (polystyrene, foil, plastic wrap, cloth, wool, packing peanuts)</i>	PS-2135 (Set of 3) or PS-2170	1 1 1 500 mL A variety
2	Significant Figures Determine the correct number of significant figures to include when reporting a measurement or a calculated value based upon measurements.	From the PASCO Significant Figure Single, Four-scale meter stick <i>Graduated cylinder, 10-mL,</i> <i>Graduated cylinder, 100-mL,</i> <i>Beaker, 100-mL,</i> <i>Irregular-shaped object</i> <i>Regular-shaped object</i>	ME-9850 (Includes a four-scale meter sticks + equipment for pre-lab activities)	1 1 1 1 1 1
3	Density Determine that density is an intensive property of a substance independent of the shape or size of an object.	PASCO Density Set <i>Beaker, 150-mL</i> <i>Graduated cylinder, 50- or 100-mL</i> Balance Overflow can <i>Metric ruler (or calipers)</i> <i>Water</i> String	ME-8569 SE-8756A SE-8568 calipers: SF-8711 ME-9875 (Set of 3)	1 1 1 2 or 3 per class 1 1 500 mL 1

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4	Graphing Mass versus Volume to Determine Density Use multiple mass and volume data to graphically determine the density of a substance.	From the PASCO Discover Density Set: four different-sized rectangular aluminum pieces, four different-sized rectangular plastic pieces of the same composition	SE-9719	1 set
		Balance <i>Metric ruler (or calipers)</i>	SE-8756A calipers: SF-8711	2 or 3 per class 1
5	Percent Oxygen in Air Use an absolute pressure sensor to learn about the components of air and how to determine the percent of oxygen in air.	Data Collection System	PS-2170	1
		PASPORT Chemistry Sensor (Contains an Absolute Pressure Sensor)	PS-2170	1
		PASPORT Sensor Extension Cable	PS-2500	1
		Quick-release connector ²	(Included with PS-2170)	1
		Tubing connector ²	(Included with PS-2170)	1
		Tubing, 1- to 2-cm ²	(Included with PS-2170)	1
		<i>Beaker, 150-mL</i>		1
		<i>Test tube, 25-mm × 150-mm</i>		1
		<i>One-hole rubber stopper to fit test tubes</i>		1
		<i>Stir rod</i>		1
<i>White vinegar (~5% acetic acid)</i>		50 to 60 mL		
<i>Steel wool, fine mesh (#000)</i>		1 g		
<i>Paper towels</i>		As needed		
<i>Glycerin</i>		2 drops		
6	Conservation of Matter Test the law of conservation of matter for both physical and chemical changes by finding the mass of the reactants before the chemicals are reacted and the mass of the products after the reaction has occurred.	Balance	SE-8756A	1
		<i>Test tube, 15-mm × 100-mm</i>		2
		<i>Beaker, 250-mL</i>		1
		<i>Plastic soda bottle (with cap), 500-mL</i>		1
		<i>Sodium nitrate</i>		5 g
		<i>0.1 M Sodium sulfate</i>		5 mL
		<i>0.1 M Strontium chloride</i>		5 mL
		<i>Sodium bicarbonate</i>		8 g
<i>5% Acetic acid</i>		30 mL		
<i>Distilled (deionized) water</i>		10 mL		

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7	Properties of Ionic and Covalent Compounds Use a conductivity sensor to determine if an unknown substance is an ionic, polar covalent, or non-polar covalent compound based on its physical properties.	Data Collection System PASPORT Conductivity Sensor Hot plate <i>Graduated cylinder, 10-mL</i> <i>Test tube, 15-mm × 100-mm</i> <i>Test tube rack</i> <i>Stopper to fit test tubes</i> <i>Spatula</i> <i>Tongs</i> <i>Aluminum foil squares, 5-cm × 5-cm</i> <i>Masking tape</i> <i>Wash bottle and waste container</i> <i>Distilled (deionized) water</i> <i>Table salt (sodium chloride)</i> <i>Table sugar (sucrose)</i> <i>Paraffin wax</i> <i>Unknown A (use glucose)</i> <i>Unknown B (use crayon pieces)</i> <i>Unknown C (use potassium chloride)</i>	PS-2116A SE-8830	1 1 1 1 5 1 3 1 1 6 1 1 30 mL 1 g 1 g 1 g 1 g 1 g 1 g
8	Electrolyte versus Non-Electrolyte Solutions Use a conductivity sensor to determine which substances in sports drinks (water, sugars, or salts) are electrolytes.	Data Collection System PASPORT Conductivity Sensor <i>Test tube, 20-mm × 150-mm</i> <i>Beaker for collecting rinse water</i> <i>Test tube rack</i> <i>Funnel</i> <i>Wash bottle filled with distilled (deionized) water</i> <i>Sucrose solutions (0.02 M, 0.04 M, 0.06 M, 0.08 M, 0.10 M)</i> <i>Sodium chloride solutions (0.02 M, 0.04 M, 0.06 M, 0.08 M, 0.10 M)</i> <i>Distilled (deionized) water</i> <i>Sports drink</i>	PS-2116A	1 1 6 1 1 1 1 25 mL of each 25 mL of each 50 mL 25 mL
9	Boyle's Law Use an absolute pressure sensor to determine the effect of volume on the pressure of a closed system containing a fixed amount of molecules at a constant temperature.	Data Collection System PASPORT Chemistry Sensor (Contains an Absolute Pressure Sensor) PASPORT Sensor Extension Cable Tubing, 1- to 2-cm ² Quick-release connector ² Syringe, 20-mL or 60-mL ² <i>Glycerin</i>	PS-2170 PS-2500 (Included with PS-2170) (Included with PS-2170) (Included with PS-2170)	1 1 1 1 1 1 2 drops

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Act	Title	Materials and Equipment	Part Number	Qty
10	Gay-Lussacs's Law and Absolute Zero Use an absolute pressure sensor and fast response temperature sensor to determine the temperature at which all motion stops (absolute zero).	Data Collection System		1
		PASPORT Chemistry Sensor (Contains an Absolute Pressure Sensor)	PS-2170	1
		PASPORT Fast Response Temperature Sensor (Set of 3)	PS-2135	1
		PASPORT Sensor Extension Cable	PS-2500	1
		Quick-release connector ²	(Included with PS-2170)	1
		Tubing connector ²	(Included with PS-2170)	1
		Tubing, 1- to 2-cm ²	(Included with PS-2170)	1
		<i>Test tube, 15-mm × 100-mm</i>		1
		<i>One-hole rubber stopper to fit test tubes</i>		1
		<i>Beaker, 250-mL</i>		2
		Ring stand	ME-9355	1
		Three-finger clamp	SE-9445	1
		<i>Glycerin</i>		2 drops
		<i>Polystyrene cup</i>		2
		<i>Rubber band</i>		1
		<i>Crushed ice</i>		300 mL
		<i>Room temperature water</i>		300 mL
<i>~45 °C water</i>		300 mL		
<i>~55 °C water</i>		300 mL		
<i>~65 °C water</i>		300 mL		
11	Phase Change Use a fast response temperature sensor and stainless steel temperature sensor to determine how to add heat to a substance without the temperature of the substance increasing.	Data Collection System		1
		PASPORT Chemistry Sensor (Contains a Stainless Steel Temperature Sensor)	PS-2170	1
		Hot plate	SE-8830	1
		<i>Beaker, 150-mL or larger</i>		2
		<i>Graduated cylinder, 10-mL</i>		1
		<i>Test tube, 10-mm × 100-mm</i>		1
		<i>Test tube rack</i>		1
		Ring stand	ME-9355	1
		Utility clamp	SE-9446	1
		<i>Stir rod</i>		1
		<i>Tablespoon</i>		1
		<i>Distilled (deionized) water</i>		104 mL
		<i>Crushed ice to fill the beaker</i>		1
		<i>Rock salt</i>		200 g

Act	Title	Materials and Equipment	Part Number	Qty
12	Specific Heat Use a fast response temperature sensor to determine the identity of an unknown metal by calculating the specific heat of the metal and comparing it to a list of known values.	Data Collection System PASPORT Fast Response Temperature Sensor <i>Beaker, 250-mL</i> <i>Beaker, 400-mL</i> <i>Graduated cylinder, 100-mL</i> Balance, centigram Thermometer (or PASPORT Stainless Steel Temperature Sensor) Hot plate <i>Tongs</i> <i>Polystyrene cup</i> <i>Lid for the polystyrene cup</i> <i>Paper towels</i> <i>Water (from the tap)</i> <i>Distilled (deionized) water</i> <i>Metal sample, unknown, up to 4 × 4 × 4 cm</i>	PS-2135 (Set of 3) SE-8756A SE-9084A SE-8830	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 As needed 250 mL 200 mL 1
13	Heat of Fusion Use a fast response temperature sensor and calorimetry to determine the heat of fusion for water.	Data Collection System PASPORT Fast Response Temperature Sensor <i>Graduated cylinder, 100-mL</i> <i>Beaker, 250-mL</i> Hot plate <i>Polystyrene cup</i> <i>Lid for polystyrene cup</i> <i>Paper towels</i> <i>Water</i> <i>Ice cube</i>	PS-2135 (Set of 3) SE-8830	1 1 1 2 1 2 1 As needed 200 mL 2
14	Intermolecular Forces Use a stainless steel temperature sensor to determine the effects of molecular size and shape on the strength of intermolecular forces for different alcohols within the same homologous series and between isomeric pairs.	Data Collection System PASPORT Chemistry Sensor (Contains a Stainless Steel Temperature Sensor) <i>Graduated cylinder, 10-mL</i> <i>Test tube, 15-mm × 100-mm</i> <i>Test tube rack</i> <i>Stopper to fit test tube</i> <i>Wash bottle and waste container</i> <i>Masking tape, 6-cm strips</i> <i>Methanol</i> <i>Ethanol</i> <i>Propanol</i> <i>Butanol</i> <i>Pentanol</i> <i>2-Propanol</i> <i>2-Butanol</i>	PS-2170	1 1 1 7 1 7 1 2 5 mL 5 mL 5 mL 5 mL 5 mL 5 mL 5 mL

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Act	Title	Materials and Equipment	Part Number	Qty
15	<p>Concentration of a Solution: Beer's Law</p> <p>Use a colorimeter to determine the concentration of a copper(II) sulfate solution.</p>	<p>Data Collection System</p> <p>PASPORT Colorimeter</p> <p>PASPORT Sensor Extension Cable²</p> <p>Glass cuvette with cap</p> <p><i>Beaker, 100-mL</i></p> <p><i>Test tube, 20-mm × 150-mm</i></p> <p><i>Test tube rack</i></p> <p><i>Volumetric pipet with bulb or a pump, 10-mL</i></p> <p><i>Non-abrasive cleaning tissue</i></p> <p><i>0.80 M Copper(II) sulfate</i></p> <p><i>Unknown copper(II) sulfate (a solution less than 1.0 M)</i></p> <p><i>Distilled (deionized) water</i></p>	<p>PS-2121</p> <p>(Included with PS-2121)</p> <p>(5 are included with PS-2121)</p>	<p>1</p> <p>1</p> <p>1</p> <p>7</p> <p>2</p> <p>6</p> <p>1</p> <p>2</p> <p>1</p> <p>30 mL</p> <p>10 mL</p> <p>30 mL</p>
16	<p>pH of Household Chemicals</p> <p>Use a pH sensor and common household chemicals to relate pH and hydronium ion (H_3O^+) concentration, classifying solutions as acidic, basic, or neutral.</p>	<p>Data Collection System</p> <p>PASPORT Chemistry Sensor (Contains a pH Sensor)</p> <p><i>Beaker, 50-mL</i></p> <p><i>Graduated cylinder, 50-mL</i></p> <p><i>Graduated cylinder, 10-mL</i></p> <p><i>Test tube, 15-mm × 100-mm</i></p> <p><i>Test tube rack</i></p> <p><i>Wash bottle and waste container</i></p> <p>Buffer solution pH 4</p> <p>Buffer solution pH 10</p> <p><i>White vinegar (~5% acetic acid)</i></p> <p><i>Lemon Juice</i></p> <p><i>Soft drink</i></p> <p><i>Window cleaner</i></p> <p><i>Water (from the tap)</i></p> <p><i>Milk</i></p> <p><i>Coffee</i></p> <p><i>0.5 M Sodium bicarbonate</i></p> <p><i>Liquid soap</i></p> <p><i>Bleach</i></p>	<p>PS-2170</p> <p>SC-2321 (Set of pH 4, pH 7 & pH 10)</p> <p>SC-2321 (Set of pH 4, pH 7 & pH 10)</p>	<p>1</p> <p>1</p> <p>2</p> <p>1</p> <p>1</p> <p>10</p> <p>1</p> <p>1</p> <p>25 mL</p> <p>25 mL</p> <p>5 mL</p> <p>5 mL</p> <p>5 mL</p> <p>5 mL</p> <p>5 mL</p> <p>5 mL</p> <p>5 mL</p> <p>5 mL</p> <p>5 mL</p> <p>5 mL</p> <p>5 mL</p>

Act	Title	Materials and Equipment	Part Number	Qty
17	<p>Electrochemical Battery: Energy from Electrons</p> <p>Use a voltage sensor to place metal reactants in their proper order on the table of standard electrode potentials.</p>	<p>Data Collection System PASPORT Chemistry Sensor (Contains a Voltage Sensor) <i>Beakers, 50-mL</i> Alligator clips, 1 black, 1 red <i>Wash bottle and waste container</i> <i>Thick string or yarn</i> <i>Knife to cut fruit</i> <i>Paper towels</i> <i>0.1 M Sodium chloride</i> <i>0.1 M Hydrochloric acid</i> <i>Copper strip</i> <i>Zinc strip</i> <i>Magnesium strip</i> <i>Nickel strip</i> <i>Iron strip</i> <i>Lemon</i> <i>Tomato</i></p>	<p>PS-2170 PS-9756 (Set of 5 black & 5 red)</p>	<p>1 1 2 2 1 20 cm 1 As needed 5 to 10 mL 50 mL 1 1 1 1 1 1 1 1</p>
18	<p>Evidence of a Chemical Reaction</p> <p>Use a fast response temperature sensor to distinguish between physical changes and chemical reactions and identify unknown changes as either physical changes or chemical reactions using evidence to support your decision.</p>	<p>Data Collection System PASPORT Fast Response Temperature Sensor Balance Hot plate <i>Graduated cylinder, 100-mL</i> <i>Graduated cylinder, 10-mL</i> <i>Beakers, 250-mL</i> <i>Test tubes, 15-mm × 100-mm</i> <i>Test tube rack</i> <i>Test tube holder</i> <i>Stir rod</i> <i>Spatula</i> <i>Beaker for collecting rinse water</i> <i>Weighing paper</i> <i>Wash bottle filled with distilled (deionized) water</i> <i>Water (from the tap)</i> <i>Calcium carbonate</i> <i>White vinegar (~5% acetic acid)</i> <i>1.0 M Citric acid</i> <i>1.0 M Sodium bicarbonate</i> <i>0.5 M Copper(II) sulfate</i> <i>1.0 M Sodium hydroxide</i> <i>0.05 M Silver nitrate</i> <i>0.1 M Sodium chloride</i> <i>Lauric acid</i> <i>Effervescent tablet</i> <i>Colored drink powder</i></p>	<p>PS-2135 (Set of 3) SE-8765A SE-8830</p>	<p>1 1 2 or 3 per class 1 1 1 2 7 1 1 1 1 1 1 1 255 mL ~0.2 g 2 mL 2 mL 2 mL 2 mL 2 mL 2 mL 2 mL 2 mL ~0.5 g 1 ~0.2 g</p>

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19	Stoichiometry Use a temperature sensor to determine the mole ratio between the reactants sodium hypochlorite and sodium thiosulfate.	Data Collection System PASPORT Temperature sensor ¹ <i>Graduated cylinder, 10-mL</i> <i>Graduated cylinder, 50- or 100-mL</i> <i>Transfer pipet</i> <i>Test tube, 20-mm × 150-mm</i> <i>Test tube rack</i> <i>Wash bottle filled with water</i> <i>Waste container</i> <i>0.5 M Sodium hypochlorite</i> <i>0.5 M Sodium thiosulfate, in 0.2 M sodium hydroxide</i>	PS-2135 (Set of 3) or PS-2170	1 1 2 2 2 7 1 1 1 1 35 to 40 mL 35 to 40 mL
20	Single Replacement Reactions Use a colorimeter to determine the mass of copper consumed and silver deposited in a single replacement reaction.	Data Collection System PASPORT Colorimeter PASPORT Sensor Extension Cable ² Glass cuvette with cap ² Balance, centigram <i>Test tube, 20-mm × 150-mm</i> <i>Test tube rack</i> <i>Graduated cylinder, 100-mL</i> <i>Sand paper or steel wool</i> <i>Non-abrasive cleaning tissue</i> <i>0.5 M Silver nitrate solution</i> <i>Copper wire</i> <i>Paper towels</i>	PS-2121 (Included with PS-2121) (5 included with PS-2121) SE-8756A	1 1 1 1 1 1 1 1 1 1 30 mL 20 cm As needed
21	Molar Mass of Copper Use a voltage-current sensor to determine the molar mass of copper through electroplating in an electrolytic cell.	Data Collection System PASPORT Voltage-Current Sensor Balance, centigram <i>Beaker, 250-mL</i> Utility clamps, insulated Ring stand Magnetic stirrer Magnetic stir bar ² DC power supply Red patch cord, 4-mm banana plug ² Black patch cord, 4-mm banana plug Alligator clip ² <i>Copper electrode</i> <i>Stainless steel spoon (or other item to electroplate)</i> <i>0.5 M Copper(II) sulfate</i>	PS-2115 SE-8756A SE-9446 ME-9355 SE-7700 (Included with SE-7700) SE-8828 (Included with PS-2115) SE-9751 (Set of 5) (Included with PS-2115)	1 1 1 2 1 1 1 1 2 1 1 2 1 1 150 mL

Act	Title	Materials and Equipment	Part Number	Qty
22	Double Replacement Reactions Using a titration, determine the amount of chloride ion in water samples.	Ring stand <i>Buret clamp</i> <i>Buret, 50-mL</i> <i>Funnel</i> Magnetic stirrer Magnetic stir bar ² <i>Transfer pipet</i> <i>Waste container</i> <i>Erlenmeyer flask, 125-mL</i> <i>Graduated cylinder, 50-mL</i> <i>0.2% Disodium salt fluorescein indicator</i> <i>1% Dextrin solution</i> <i>0.020 M Silver nitrate</i> <i>0.010 M Sodium chloride</i> <i>Swimming pool water</i>	ME-9355 SE-7700 (Included with SE-7700)	1 1 1 1 1 1 1 1 4 1 2 mL 100 mL 200 mL 100 mL 100 mL
23	Rates of Reaction Use an absolute pressure sensor to determine the effect of temperature, concentration, and surface area on the rate of a chemical reaction by measuring changes in absolute pressure as a reaction proceeds.	Data Collection System PASPORT Chemistry Sensor (Contains an Absolute Pressure Sensor) PASPORT Sensor Extension Cable <i>Test tube, 20-mm × 150-mm</i> <i>Test tube rack</i> <i>One-hole rubber stopper to fit test tube</i> Quick-release connector ² Tubing, 1- to 2-cm ² Tubing connector ² <i>Glycerin</i> <i>4.0 M Hydrochloric acid</i> <i>2.0 M Hydrochloric acid</i> <i>1.0 M Hydrochloric acid</i> <i>0.1 M Hydrochloric acid</i> <i>Warm and cold water baths</i> <i>Magnesium ribbon, 1-cm pieces</i> <i>Magnesium powder</i>	PS-2170 PS-2500 (Included with PS-2170) (Included with PS-2170) (Included with PS-2170)	1 1 1 3 1 1 1 1 1 1 1 5 mL 5 mL 20 mL 5 mL One per class 18 0.05 g

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24	Ideal Gas Law Use an absolute pressure sensor and stainless steel temperature sensor to determine the number of moles of carbon dioxide gas generated during a reaction between hydrochloric acid and sodium bicarbonate.	Data Collection System		1
		PASPORT Chemistry Sensor (Contains an Absolute Pressure Sensor)	PS-2170	1
		PASPORT Chemistry Sensor (Contains a Stainless Steel Temperature Sensor)	(Included with PS-2170 listed above)	1
		Blue plastic tubing for the temperature sensor ²	(Included with PS-2170)	1
		PASPORT Sensor Extension Cable	PS-2500	1
		Balance, centigram	SE-8756A	1
		Graduated cylinder or volumetric pipet, 10-mL		1
		<i>Graduated cylinder, 1000-mL</i>		1
		<i>Test tube, 15-mm × 100-mm</i>		1
		<i>Plastic bottle, 300- to 500-mL</i>		1
		<i>Two-hole rubber stopper that fits the plastic bottle</i>		1
		Quick-release connector ²		1
		Tubing, 1- to 2-cm ²		1
		Tubing connector ²		1
		<i>1.0 M Hydrochloric acid</i>		10 mL
		<i>Sodium bicarbonate</i>		0.80 g
		<i>Glycerin</i>		2 drops
<i>Paper towels</i>		As needed		
25	Heats of Reaction and Solution Use a temperature sensor to determine the molar heat of solution for sodium hydroxide and ammonium chloride when they are dissolved in water, and the molar heat of reaction when magnesium reacts with hydrochloric acid.	Data Collection System		1
		PASPORT Temperature Sensor ¹	PS-2135 (Set of 3) or PS-2170	1
		<i>Beaker, 250-mL</i>		1
		<i>Graduated cylinder, 50-mL</i>		1
		Balance, centigram	SE-8756A	1
		<i>Polystyrene cup</i>		2
		<i>Spatula</i>		1
		<i>Stir rod</i>		1
		<i>Paper towels</i>		As needed
		<i>Weighing paper</i>		1
		<i>Sand paper or steel wool</i>		1 piece
		<i>Wash bottle and waste container</i>		1
		<i>Sodium hydroxide pellets</i>		1 g
		<i>Ammonium chloride</i>		1 g
		<i>Magnesium metal ribbon</i>		0.10 g
		<i>1.0 M Hydrochloric acid</i>		25 mL
		<i>Distilled (deionized) water</i>		50 mL

Act	Title	Materials and Equipment	Part Number	Qty
26	Hess's Law Use a temperature sensor to show that the change in enthalpy for the reaction between solid sodium hydroxide and aqueous hydrochloric acid can be determined using both a direct and an indirect method.	Data Collection System PASPORT Temperature Sensor ¹ <i>Beaker, 250-mL</i> <i>Graduated cylinder, 50-mL</i> <i>Spatula</i> <i>Polystyrene cup</i> <i>Lid for polystyrene cup</i> <i>Weighing paper</i> <i>Wash bottle and waste container</i> <i>1.0 M Hydrochloric acid</i> <i>0.5 M Hydrochloric acid</i> <i>1.0 M Sodium hydroxide</i> <i>Sodium hydroxide pellets</i> <i>Distilled (deionized) water</i>	PS-2135 (Set of 3) or PS-2170	1 1 1 1 2 1 2 1 25 mL 50 mL 25 mL 2.0 g 50 mL
27	An Acid-Base Titration Use a drop counter and pH sensor to determine the concentration of a hydrochloric acid solution and the concentration of an acetic acid solution by titration.	Data Collection System PASPORT Drop Counter PASPORT Chemistry Sensor (Contains a pH Sensor) <i>Acetic acid solution</i> Magnetic stirrer Micro stir bar ² <i>Beaker, 250-mL</i> <i>Beaker, 50-mL</i> <i>Graduated cylinder, 100-mL</i> <i>Volumetric pipet or graduated cylinder, 10-mL</i> <i>Buret, 50-mL</i> Ring stand Right-angle clamp <i>Buret clamp</i> <i>Funnel</i> <i>Transfer pipet</i> <i>Waste container</i> <i>Wash bottle filled with distilled (deionized) water</i> Buffer solution, pH 4 Buffer solution, pH 10 <i>Distilled (deionized) water</i> <i>Hydrochloric acid solution (~0.1 M)</i> <i>Acetic acid solution (~0.1 M)</i> <i>Standardized sodium hydroxide solution (~0.1 M)</i>	PS-2117 PS-2170 SE-7700 (Included with SE-2117) ME-9355 SE-9444 SC-2321 (Set of pH 4, pH 7 & pH 10) SC-2321 (Set of pH 4, pH 7 & pH 10)	1 1 1 10 mL 1 1 2 2 1 1 1 1 1 1 1 1 1 1 1 25 mL 25 mL 200 mL 10 mL 10 mL 120 mL

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28	Diprotic Titration: Multi-Step Chemical Reactions Use a drop counter and a pH sensor to determine the concentration of a sodium carbonate solution, learning that chemical reactions can be the sum of several individual reactions.	Data Collection System		1
		PASPORT Drop Counter	PS-2117	1
		PASPORT Chemistry Sensor (Contains a pH Sensor)	PS-2170	1
		Micro stir bar ²	(Included with PS-2117)	1
		Magnetic stirrer	SE-7700	1
		<i>Beaker, 50-mL</i>		2
		<i>Beaker, 250-mL</i>		1
		<i>Graduated cylinder, 50-mL</i>		1
		<i>Graduated cylinder, 100-mL</i>		1
		<i>Transfer pipet</i>		1
		<i>Buret, 50-mL</i>		1
		<i>Buret clamp</i>		1
		Ring stand	ME-9355	1
		Right-angle clamp	SE-9444	1
		<i>Funnel</i>		1
		<i>Waste container</i>		1
		<i>Wash bottle filled with distilled (deionized) water</i>		1
		Buffer solution, pH 4	SC-2321 (Set of pH 4, pH 7 & pH 10)	25 mL
		Buffer solution, pH 10	SC-2321 (Set of pH 4, pH 7 & pH 10)	25 mL
		<i>Distilled (deionized) water</i>		200 mL
<i>Sodium carbonate solution</i>		40 mL		
<i>1.0 M Hydrochloric acid</i>		110 mL		

Act	Title	Materials and Equipment	Part Number	Qty
29	Le Chatelier's Principle Use a pH sensor to determine the effect of concentration changes on the equilibrium of a system, relating pH values with the acid-base indicator phenolphthalein.	Data Collection System		1
		PASPORT Chemistry Sensor (Contains a pH Sensor)	PS-2170	1
		<i>Beaker, 100-mL</i>		2
		<i>Beaker, 50-mL</i>		2
		<i>Graduated cylinder, 25-mL</i>		1
		<i>Graduated cylinder, 50- or 100-mL</i>		1
		<i>Transfer pipet</i>		3
		<i>Waste container</i>		1
		<i>Wash bottle filled with distilled (deionized) water</i>		1
		Buffer solution pH 4	SC-2321 (Set of pH 4, pH 7 & pH 10)	25 mL
		Buffer solution pH 10	SC-2321 (Set of pH 4, pH 7 & pH 10)	25 mL
		<i>Distilled (deionized) water</i>		100 mL

¹Either the PASPORT Fast Response Temperature Sensor or the PASPORT Chemistry Sensor (which contains a PASPORT Stainless Steel Temperature Sensor) can be used for this activity.

²These items are included with the specific apparatus or sensor used in the experiment.

Activity by PASCO Equipment

This list shows the PASCO specific equipment used in each lab activity. The Chemistry Sensor is a MultiMeasure™ sensor that contains a PASPORT Absolute Pressure Sensor, a PASPORT pH Sensor, a PASPORT Stainless Steel Temperature Sensor, and a PASPORT Voltage Sensor.

Items Available from PASCO	Qty	Activity Where Used
PASCO Density Set	1	3
PASCO Discover Density Set	1	4
PASCO Significant Figure Set	1	2
PASPORT Absolute Pressure Sensor ¹	1	5, 9, 10, 23, 24,
PASPORT Colorimeter	1	15, 20
PASPORT Conductivity Sensor	1	7, 8
PASPORT Drop Counter	1	27, 28
PASPORT Fast Response Temperature Sensor	1	10, 12, 13, 18
PASPORT pH Sensor ¹	1	16, 27, 28, 29
PASPORT Stainless Steel Temperature Sensor ¹	1	11, 14, 24
PASPORT Temperature Sensor ²	1	1, 19, 25, 26
PASPORT Voltage Sensor ¹	1	17
PASPORT Voltage-Current Sensor	1	21

¹This sensor is part of the Chemistry Sensor

²Either the PASPORT Fast Response Temperature Sensor or the PASPORT Stainless Steel Temperature Sensor can be used for this activity.