Master Materials and Equipment List

Italicized entries indicate items that are not available from PASCO. The For each student group quantity indicated is per student group, except when an asterisk * is present to indicate a per-class quantity. A double asterisk ⁑ indicates a variable quantity. The For teacher preparation quantity is the amount required per class. Teacher preparation quantities are designed for approximately 8 student groups per class. The volumes or quantities may be adjusted according to a teacher's discretion.

NOTE: *The activities also require protective gear for each student (for example, safety goggles, gloves, apron, or lab coat).*

The equipment list is the same whether PASCO Capstone or SPARKvue software is used to conduct the investigation. Spectrometer versions of investigations require Spectrometry software, which is available as a free downland on **pasco.com** for Windows and Mac computers, and is available as a free app in most mobile app stores. Teachers can conduct some lab activities with sensors and probes other than those listed here. For assistance with substituting compatible software, sensors, and probes for a lab activity, contact PASCO Technical Support (800-772-8700 inside the United States or **pasco.com/support**).

Lab #	Title	Materials and Equipment	Qty
1	Analyzing Food Dyes in Sports Drinks	For each student group:	
		Computer or mobile device	1
		PASCO Wireless Colorimeter (PS-3215)	8
		Cuvettes (included with Colorimeter, or SE-8739)	9
		Graduated cylinders, 10-mL	2
		Test tubes, 2-cm x 15-cm	6
		Test tube rack	1
		Disposable pipettes	5
		Sports drink with FD&C Blue #1 food dye	4 mL
		Permanent marker or grease pencil	1
		Lint- and scratch-free lens wipes	2+
		Wash bottle filled with distilled water	1
		Additional drink samples for dye analysis	4 mL per sample
		For teacher preparation:	
		FD&C Blue # 1 food dye stock solution	1 L
		FD&C Red #40 food dye stock solution	1 L
		FD&C Yellow #5 food dye stock solution	1 L

Lab #	Title	Materials and Equipment	Qty
2A	Investigating the Copper Content of Brass (Colorimeter)	<u>For each student group:</u>	
		Computer or mobile device	1
		PASCO Wireless Colorimeter (PS-3215)	8
		Cuvettes (10 included with Colorimeter; SE-8739)	13
		Precision balance (readability: 0.001 g; SE-8860)	2*
		Beakers, 150-mL	2
		Volumetric flask, 100-mL	1
		Funnel to fit flask	1
		Graduated cylinders, 10-mL	3
		Glass stirring rod	1
		Watch glass	1
		Test tubes, 15-mL capacity or greater	7
		Test tube rack	1
		Disposable pipets	3
		6 M Concentrated nitric acid, HNO_3	**
		Brass samples, ~0.3 to 1 g each	2
		Permanent marker or grease pencil	1
		Lint- and scratch-free lens wipes	2+
		Wash bottle filled with distilled water	1
		<u>For teacher preparation:</u>	
		0.40 M Copper(II) nitrate, $Cu(NO_3)_2$	500 mL
		1.0 M Cobalt(II) nitrate, $Co(NO_3)_2$	100 mL
		1.0 M Iron(III) nitrate, $Fe(NO_3)_3$	100 mL
		1.0 M Nickel nitrate, $Ni(NO_3)_2$	100 mL
		1.0 M Zinc nitrate, $Zn(NO_3)_2$	100 mL
2B	Investigating the Copper Content of Brass (Spectrometer)	<u>For each student group:</u>	
		Computer or mobile device with Spectrometry	1
		PASCO Wireless Spectrometer (PS-2600)	8
		Cuvettes (10 included with Spectrometer; SE-8739)	13
		Precision balance (readability: 0.001 g; SE-8860)	2*
		Beakers, 150-mL	2
		Volumetric flask, 100-mL	1
		Funnel to fit flask	1
		Graduated cylinders, 10-mL	3
		Glass stirring rod	1
		Watch glass	1
		Test tubes, 15-mL capacity or greater	7
		Test tube rack	1
		Disposable pipets	3
		6 M Concentrated nitric acid, HNO_3	**
		Brass samples, ~0.3 to 1 g each	2
		Permanent marker or grease pencil	1
		Lint- and scratch-free lens wipes	2+
		Wash bottle filled with distilled water	1
		<u>For teacher preparation:</u>	
		0.24 M Copper(II) nitrate, $Cu(NO_3)_2$	500 mL
		1.0 M Cobalt(II) nitrate, $Co(NO_3)_2$	100 mL
		1.0 M Iron(III) nitrate, $Fe(NO_3)_3$	100 mL
		1.0 M Nickel nitrate, $Ni(NO_3)_2$	100 mL
		1.0 M Zinc nitrate, $Zn(NO_3)_2$	100 mL

Lab #	Title	Materials and Equipment	Qty
3	How Hard is Your Tap Water?	<u>For each student group:</u>	
		Computer or mobile device	1
		PASCO Wireless Conductivity sensor (PS-3210)	1
		PASCO Wireless Drop Counter with accessories (PS-3214)	1
		Precision balance (readability: 0.001 g; SE-8860)	2*
		Beakers, 100-mL	3
		Beakers, 250-mL	2
		Graduated cylinder, 10-mL	1
		Graduated cylinders, 25-mL	2
		Graduated cylinder, 50-mL	1
		Watch glass	1
		Stirring rod	1
		Funnel	1
		Filter paper to fit funnel	1
		Clamp to fit funnel	1
		Ring stand	1
		Magnetic stirrer with stir bar (SE-7700)	1
		Waste beaker	1
		Rinse bottle filled with distilled water	1
		Optional: Drying oven	1*
		<u>For teacher preparation:</u>	
		0.10 M Sodium carbonate, Na_2CO_3	1 L
		0.50 M Sodium carbonate, Na_2CO_3	1 L
		0.075 M Calcium chloride, $CaCl_2$	1 L
		0.10 M Calcium chloride, $CaCl_2$	1 L
		0.15 M Calcium chloride, $CaCl_2$	1 L
		0.50 M Calcium chloride, $CaCl_2$	1 L
		Various hard water samples, concentrated	⁑
4	How Much Acid is in Your Fruit Juice?	<u>For each student group:</u>	
		Computer or mobile device	1
		PASCO Wireless pH sensor (PS-3204)	1
		Electrode support or test tube clamp (PS-3505)	1
		Beakers, 150-mL	6
		Beaker, 250-mL	1
		Graduated cylinder, 10-mL	1
		Magnetic stirrer with stir bar (SE-7700)	1
		Buret, 50-mL	1
		Buret clamp	1
		Ring stand	1
		Funnel to fit buret	1
		Fruit juices, variety	⁑
		Wash bottle filled with distilled water	1
		<u>For teacher preparation:</u>	
		0.10 M Sodium hydroxide, NaOH	1 L
		0.10 M Acetic acid, CH_3COOH	1 L

Lab #	Title	Materials and Equipment	Qty
5	Separating Food Dyes Using Chromatography	<u>For each student group:</u>	
		Computer or mobile device	1
		PASCO Wireless Colorimeter (PS-3215)	1
		Cuvettes (included with Colorimeter, or SE-8739)	4+
		Graduated cylinder, 10-mL	1
		Beakers, 50-mL	5
		Test tubes, 15-cm x 2-cm	5
		Test tube rack	1
		Chromatography chambers with lids†	6
		Chromatography paper strips, 2-cm wide	6
		Sep-Pak® C18 chromatography cartridge	1
		Syringe‡ with 4-mm (outer diameter) Leur tip, 10-mL or larger	1
		Disposable pipet	1
		70 % Isopropyl alcohol	30 mL
		Small plastic plate	1
		Toothpicks, flat	3
		Metric ruler	1
		Permanent marker or grease pencil	1
		Mechanical pencil	1
		Rinse bottle filled with distilled water	1
		Zip-seal sandwich bag	1
		Lint- and scratch-free lens wipes	2+
		Paper towels	1 roll*
		Distilled water	60 mL
		Waste beaker	1
		<u>For teacher preparation:</u>	
		0.1 % Sodium chloride, NaCl	1 L
		2.0 % Sodium chloride, NaCl	1 L
		5 % Isopropyl alcohol solution	1 L
		25 % Isopropyl alcohol solution	1 L
		1 % Red #40 solution	100 mL
		0.5 % Blue #1 solution	100 mL
		Unsweetened dilute Grape Kool-Aid™ solution	50 mL
		Unsweetened concentrated Grape Kool-Aid™ solution	400 mL

†Use either commercial chambers, or construct each with a 400-mL beaker, paper clip, and aluminum foil

‡The syringe included with either the Wireless Pressure sensor (PS-3203) or the Wireless Drop Counter (PS-3214) is suitable for this investigation

Lab #	Title	Materials and Equipment	Qty
6	A Chemistry Mystery: Name That Unknown!	<u>For each student group:</u>	
		Computer or mobile device	1
		PASCO Wireless Conductivity sensor (PS-3210)	1
		PASCO Wireless pH sensor (PS-3204)	1
		Hot plate (PS-3401)	1
		Beakers, 100-mL	3
		Beaker, 250-mL	1
		Graduated cylinders, 10-mL	3
		Graduated cylinder, 100-mL	1
		Test tubes, 15-cm x 2-cm	10
		Test tube rack	1
		Stirring rod	1
		Tongs	1
		Table salt	pea-sized sample of each
		Table sugar	
		Paraffin wax	
		Aluminum foil squares, 5-cm x 5-cm	3
		Masking tape	~10 cm
		Permanent marker	1
		Rinse bottle filled with distilled water	1
		<u>For teacher preparation:</u>	
		0.10 M Sodium hydroxide, NaOH	1 L
		0.10 M Hydrochloric acid, HCl	1 L
		Aspartame or Equal™ sweetener ($C_{14}H_{18}N_2O_5$), or xylitol ($C_5H_{12}O_5$)	¼ cup
		Potassium chloride, KCl	¼ cup
		Potassium bitartrate or cream of tartar ($KC_4H_5O_6$), or potassium hydrogen tartrate (KHT)	¼ cup
		Sodium carbonate, Na_2CO_3	¼ cup
		Salicylic acid, $C_7H_6O_3$	¼ cup
7	Stoichiometry in Solutions	<u>For each student group:</u>	
		Computer or mobile device	1
		PASCO Wireless Conductivity sensor (PS-3210)	1
		PASCO Wireless Temperature sensor (PS-3201)	1
		PASCO Wireless Drop Counter with accessories (PS-3214)	1
		Beakers, 150-mL	2
		Waste beaker, 250-mL	1
		Graduated cylinder, 10-mL	1
		Graduated cylinders or volumetric pipets with bulbs, 25-mL	2
		Ring stand	1
		Magnetic stirrer with stir bar (SE-7700)	1
		Phenolphthalein	Dropper
		Rinse bottle filled with distilled water	1
		<u>For teacher preparation:</u>	
		1.0 M Sodium hydroxide, NaOH	1 L
		0.10 M Hydrochloric acid, HCl	1 L
		0.20 M Hydrochloric acid, HCl	1 L
		Hydrochloric acid, varied concentrations	‡

Lab #	Title	Materials and Equipment	Qty
8	Percentage of H_2O_2 In Your Drugstore Hydrogen Peroxide	<u>For each student group:</u>	
		Computer or mobile device	1
		PASCO Oxidation Reduction Potential (ORP) Probe (PS-3515)†	1
		PASCO Wireless Drop Counter with accessories (PS-3214)	1
		Magnetic stirrer with stir bar (SE-7700)	1
		Precision balance (readability: 0.001 g; SE-8860)	1
		Ring stand	1
		Beakers, 150-mL	2
		Waste beaker, 250-mL	1
		Graduated cylinders, 10-mL	2
		Volumetric pipet with bulb, 10-mL	1
		Disposable pipet graduated to 2-mL	1
		3.0 % Hydrogen peroxide, H_2O_2	2 mL
		Distilled water	~250 mL
		Rinse bottle filled with distilled water	1
		<u>For teacher preparation:</u>	
		4.0 M Sulfuric acid, H_2SO_4	500 mL
		0.020 M Potassium permanganate, $KMnO_4$	1 L
		0.10 M Ferrous ammonium sulfate (FAS), $Fe(NH_4)_2(SO_4)_2$	1 L

†The ORP must be attached to PASCO's Wireless pH sensor box (PS-3204)

Lab #	Title	Materials and Equipment	Qty
9	Investigating Physical and Chemical Changes of Matter	<u>For each student group:</u>	
		Computer or mobile device	1
		PASCO Wireless pH sensor (PS-3204)	1
		PASCO Wireless Temperature sensor (PS-3201)	1
		PASCO Wireless Conductivity sensor (PS-3210)	1
		PASCO Wireless Pressure sensor with accessories (PS-3203)	1
		Stopcock† to fit syringe from Pressure sensor	1
		Graduated cylinder, 50-mL	1
		Beakers, 100-mL	6
		Stirring rod	1
		Test tubes, 15-cm x 2-cm	2
		Two-hole stopper, size #2	1
		Test tube rack	1
		Tongs	1
		Glycerin	Dropper
		Paper towels	⁂
		Labeling pen or wax pencil	1
		Rinse bottle filled with distilled water	1
		70 % Ethanol, CH_3CH_2OH	2 mL
		<u>For teacher preparation:</u>	
		Blue food coloring solution	1 L
		Yellow-orange food coloring solution	1 L
		0.10 M Hydrochloric acid, HCl	1 L
		0.10 M Sodium hydroxide, NaOH	1 L
		Steel wool soaked in vinegar	~8 cm^3
		Sucrose, $C_{12}H_{22}O_{11}$	Each group requires a pea-sized sample
		Sodium chloride, NaCl	
		Sodium acetate, $NaCH_3COO$	
		Calcium (Ca), metal turning	
		Ammonium nitrate, NH_4NO_3	

†Stopcocks included with PASCO's Wireless Drop Counter (PS-3214) are suitable for this investigation

Lab #	Title	Materials and Equipment	Qty
10	What Does Acid Rain Do to Coral Reefs?	<u>For each student group:</u>	
		Computer or mobile device	1
		PASCO Wireless Pressure sensor with accessories (PS-3203)	1
		Erlenmeyer flasks, 250-mL	4
		Graduated cylinder, 10-mL	1
		Digital balance (readability: 0.01 g; SE-8823A)	1
		Scoopula	1
		Ring stand and flask clamp	1
		Mortar and pestle	1
		Calcium carbonate ($CaCO_3$) marble chips	~5 g
		Optional: Limestone samples	**
		Optional: Blackboard chalk	**
		Waste container	1
		Rinse bottle filled with distilled water	1
		<u>For teacher preparation:</u>	1 L
		1.0 M Hydrochloric acid, HCl	200 mL
		3.0 M Hydrochloric acid, HCl	200 mL
		6.0 M Hydrochloric acid, HCl	1 L
11A	Kinetics of Crystal Violet Fading (Colorimeter)	<u>For each student group:</u>	
		Computer or mobile device	1
		PASCO Wireless Colorimeter (PS-3215)	1
		Cuvettes (included with colorimeter, or SE-8739)	10
		Graduated cylinder, 10-mL	1
		Test tubes, 15-cm x 2-cm	4
		Test tube rack	1
		Disposable pipettes	5
		Distilled water	3 mL
		Marking pen	1
		Lint- and scratch-free lens wipes	2+
		Rinse bottle filled with distilled water	1
		<u>For teacher preparation:</u>	
		0.020 M Sodium hydroxide, NaOH	1 L
		0.10 M Sodium hydroxide, NaOH	1 L
		0.20 M Sodium hydroxide, NaOH	1 L
		2.5×10^{-5} M Crystal violet solution	1 L

Lab #	Title	Materials and Equipment	Qty
11B	Kinetics of Crystal Violet Fading (Spectrometer)	<u>For each student group:</u>	
		Computer or mobile device with Spectrometry	1
		PASCO Wireless Spectrometer (PS-2600, or the UV-Vis Spectrometer, SE-3607)	1
		Cuvettes† (included with spectrometer, or SE-8739)	10
		Graduated cylinder, 10-mL	1
		Test tubes†, 15-cm x 2-cm	4†
		Test tube rack	1
		Disposable pipettes	5
		Distilled water	3 mL
		Marking pen	1
		Lint- and scratch-free lens wipes	2+
		Rinse bottle filled with distilled water	1
		<u>For teacher preparation:</u>	
		0.020 M Sodium hydroxide, NaOH	1 L
		0.10 M Sodium hydroxide, NaOH	1 L
		0.20 M Sodium hydroxide, NaOH	1 L
		2.5 x 10^{-5} M Crystal violet solution	1 L
12	Building a Better Hand Warmer	<u>For each student group:</u>	
		Computer or mobile device	1
		PASCO Wireless Temperature sensor (PS-3201)	1
		Calorimeter‡ (TD-8825A)	1
		Magnetic stirrer with stir bar (SE-7700)	1
		Graduated cylinder, 100-mL	1
		Beaker, 250-mL	1
		Digital balance (readability: 0.01 g; SE-8823A)	1
		Ring stand and ring clamp	1
		Heat-resistant gloves	1 pair
		Distilled water	500+ mL
		Waste container	1
		Magnesium sulfate, $MgSO_4$	15 g
		Any combination of 3 of the following solids:	
		• *Ammonium chloride, NH_4Cl*	15 g
		• *Calcium chloride, $CaCl_2$*	15 g
		• *Lithium chloride, LiCl*	15 g
		• *Sodium acetate, $NaCH_3COO$*	15 g
		• *Sodium carbonate, Na_2CO_3*	15 g
		• *Sodium chloride, NaCl*	15 g
		<u>For teacher preparation:</u>	
		Hot distilled water bath, ~80 °C	1

†If 20.0-mL volumetric pipets with bulbs are not available, substitute with (2) 25-mL graduated cylinders plus (2) additional disposable pipettes

‡Or, substitute a calorimeter with two nested 10-oz polystyrene cups and a corrugated cardboard top

Lab #	Title	Materials and Equipment	Qty
13	Applications of Le Châtelier's Principle	<u>For each student group:</u>	
		Computer or mobile device	1
		PASCO Wireless Colorimeter (PS-3215)	1
		Cuvettes (included with Colorimeter, or SE-8739)	2
		Beakers, 50-mL	3
		Beakers, 250-mL	2
		Graduated cylinder, 10-mL	1
		Graduated disposable pipettes, 3-mL	2
		Test tubes, 15-cm x 2-cm	3
		Test tube rack	1
		Glass stirring rod	1
		Hot plate (PS-3401)	1
		Ice	~125 mL
		Cobalt(II) chloride, $CoCl_2$	1.5 g
		Scoopula	1
		Marking pen or grease pencil	1
		Distilled water	Dropper
		Lint- and scratch-free lens wipes	2+
		<u>For teacher preparation:</u>	
		0.0080 M Iron(III) nitrate, $Fe(NO_3)_3$	1 L
		0.0030 M Potassium thiocyanate, KSCN (to dilute to a 0.0010 M solution)	1 L
		Distribute in pipets or dropper bottles:	1 L
		0.10 M Silver nitrate, $AgNO_3$	1 L
		6.0 M Hydrochloric acid, HCl	1 L
14	Investigation of Acid-Base Titrations	<u>For each student group:</u>	
		Computer or mobile device	1
		PASCO Wireless pH sensor (PS-3204)	1
		Wireless Drop Counter with accessories (PS-3214)	1
		Magnetic stirrer with stir bar (SE-7700)	1
		Beaker, 150-mL	1
		Waste beaker, 250-mL	1
		Waste beaker, 1-L	1
		Graduated cylinder, 50-mL	1
		Disposable pipet	1
		Volumetric pipets with bulbs†, 20-mL	2
		Ring stand	1
		Phenolphthalein solution	Dropper
		Distilled water	200+ mL
		Rinse bottle filled with distilled water	1
		<u>For teacher preparation:</u>	
		0.10 M Sodium hydroxide, NaOH	1 L
		0.50 M Sodium hydroxide, NaOH	1 L
		0.10 M Hydrochloric acid, HCl	1 L
		0.10 M Acetic acid, CH_3COOH	250 mL
		0.050 M Maleic acid, $H_2C_4H_2O_4$	1 L

Lab #	Title	Materials and Equipment	Qty
15	Introduction to Buffers	<u>For each student group:</u>	
		Computer or mobile device	1
		PASCO Wireless pH sensor (PS-3204)	1
		Beakers, 50-mL	5
		Beakers, 100-mL	2
		Graduated cylinder, 10-mL	1
		Graduated cylinders, 25-mL	2
		Graduated cylinder, 50-mL	1
		Stirring rod	1
		Spatula	1
		Mortar and pestle	1
		Disposable pipets	6
		Bufferin™ tablet, 325-mg	1
		Aspirin tablet, 325-mg	1
		Sodium acetate, $NaCH_3COO$	~1 g
		5% Distilled white vinegar	20 mL
		Distilled water	120 mL
		Labeling pen or grease pencil	1
		Rinse bottle filled with distilled water	1
		Waste container	1
		<u>For teacher preparation:</u> All of the following are required to prepare additional solutions:	
		1.0 M Sodium hydroxide, NaOH	100 mL
		1.0 M Acetic acid, CH_3COOH	100 mL
		Sodium bisulfite, $NaHSO_3$	2.075 g
		Sodium bicarbonate, $NaHCO_3$	1.680 g
16	Evaluation of Lemonade as a Buffer	<u>For each student group:</u>	
		Computer or mobile device	1
		PASCO Wireless pH sensor (PS-3204)	1
		Wireless Drop Counter with accessories (PS-3214)	1
		Magnetic stirrer with stir bar (SE-7700)	1
		Beaker, 150-mL	1
		Waste beaker, 250-mL	1
		Waste beaker, 1-L	1
		Graduated cylinders, 25-mL	2
		Disposable pipets	4
		Ring stand	1
		Distilled water	200+ mL
		Rinse bottle filled with distilled water	1
		<u>For teacher preparation:</u>	
		0.10 M Sodium hydroxide, NaOH	2 L
		0.0080 M Citric acid, $H_3C_6H_5O_7$	500 mL
		Country Time® lemonade (made from powder mix)	~235 mL/8 oz
		Variety of fruit-flavored powdered drink mixes (Kool-Aid®, Crystal Light®, Monster Energy®, Mountain Dew®, etc.)	⁑

Activity by PASCO Sensors and Equipment

This table indicates which lab activity uses the sensors or special equipment listed.

Items available from PASCO	Lab activity where used
PASCO Wireless sensors	
PASCO Wireless Colorimeter (PS-3215) *Includes 10 polystyrene cuvettes; Replacement cuvettes: SE-8739*	1, 2A, 5, 11A, 13
PASCO Wireless Conductivity Sensor (PS-3210)	3, 6, 7, 9
PASCO Wireless Temperature Sensor (PS-3201)	7, 9, 12, 13
PASCO Wireless pH Sensor (PS-3204)	4, 6, 7, 8 (sensor box only), 9, 14, 15, 16
PASCO Oxidation-Reduction Potential Probe (PS-3515) *Attaches to the Wireless pH sensor box (PS-3204)*	8
PASCO Wireless Drop Counter (PS-3214) *Accessories included: Syringe reservoir, drop tip, clamp, micro stir bar, 2 stopcocks*	3, 5 (syringe only), 7, 8, 9 (stopcock only), 14, 16
PASCO Wireless Pressure Sensor (PS-3203) *Accessories included: Syringe, tubing, connectors, size #6 one-hole rubber stopper*	5 (syringe only), 9, 10
PASCO Wireless Spectrometer (VIS) (PS-2600) *Includes 10 polystyrene cuvettes; Replacement cuvettes: SE-8739*	2B, 11B
Lab equipment available from PASCO	
Precision balance readable to 0.001 g (SE-8860)	2A, 2B, 3, 8
Digital balance readable to 0.01 g (SE-8823A)	10, 12
Magnetic stirrer with stir bar (SE-7700)	3, 4, 7, 8, 12, 14, 16
Electrode support (PS-3505)	4
Hot plate (PS-3401)	6, 13
Calorimeter (TD-8825A)	12