Master Materials and Equipment List

for College Biology Manual (PS-3800A)

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).

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

Lab	Title	Materials and Equipment	PASCO Part No.	Qty
1	**pH and Buffers** Use a water quality sensor to measure the pH of buffers and the differences in pH values of various household products.	Data Collection System		1
		PASPORT Advanced Water Quality Sensor with pH Probe	PS-2230	1
		0.1 M Hydrochloric acid (HCl) solution		35 mL
		0.1 M Sodium hydroxide (NaOH) solution		35 mL
		Beaker, 100-mL		4
		Beaker, 500-mL		1
		Beaker, 50-mL		8
		Disposable pipet 1 mL		1
		Distilled water		1 L
		Electronic Balance		1
		Gelatin solution		150 mL
		Graduated cylinder, 10-mL		1
		Graduated cylinder, 25-mL		1
		Graduated Cylinder, 50-mL		1
		Hot Plate		1
		Labeling marker		1
		Labeling tape		1
		Meat tenderizer		7 g
		Paper towels		1
		Sodium acetate		2 g per class
		Standard buffer (pH 10)		25 mL
		Standard buffer (pH 4)		25 mL
		Test tube rack		1
		Test Tubes, 25 mm x 150 mm		15
		Various fruit juices, household ammonia, bleach and vinegar		25 mL
		Wash bottle with distilled water		1 per class
		Weighing paper		14

Lab	Title	Materials and Equipment	PASCO Part No.	Qty
2	**Exploring Surface Area to Volume Ratios** Use a PASCO quad temperature sensor and ice bath to explore the relationship between the inner volume of a citrus fruit and its outer surface area.	Data Collection System PASPORT Quad Temperature Sensor Fast-Response Temperature Probe Stainless Steel Temperature Probe *Citrus fruits, varying type and size* *Dissecting probe or pin* *Ice and water* *Labeling marker* *Labeling tape* *Metric ruler* *Petroleum jelly* *Polystyrene cooler, plastic bucket or other vessel for ice bath* *Twine or string*	 PS-2143 PS-2135 PS-2153	1 1 2 1 2 1 2 to 3 liters 1 1 1 1 g 1 20 to 30 cm
3	**Diffusion** Use a water quality sensor and colorimeter to measure the conductivity, pH, and absorbance of two solutions separated by a semi-permeable membrane.	Data Collection System PASPORT Advanced Water Quality Sensor with pH probe and conductivity probe PASPORT Colorimeter *Beaker 100-mL* *Beaker 400-mL* Cuvettes (with colorimeter) *Dialysis tubing* *Disposable pipet* *Distilled water* *Labeling marker* *Lint-free tissue* *Pickle juice* *Plastic wrap* *Roll of paper towels* *Scissors* *Wash bottle filled with water*	 PS-2230 PS-2121	1 1 1 2 1 2 28 cm 4 200 mL 1 1 50 mL 1 per class 1 per class 1 1 per class

Lab	Title	Materials and Equipment	PASCO Part No.	Qty
4	**Diffusion and Osmosis** Use a water quality sensor to measure the changes in conductivity in two solutions separated by a semi permeable membrane.	Data Collection System PASPORT Advanced Water Quality Sensor with Conductivity Probe *1% starch solution* *15% NaCl solution* *2% IKI solution* *2% IKI/2% NaCl solution* *Beaker or cups, 30-mL* *Beaker, 250-mL* *Cork borer* *Cover slip* *Dental floss or string* *Dialysis tubing* *Disposable pipet* *Distilled water* Electronic Balance *Forceps* *Graduated cylinder, 25-mL* *Knife* *Labeling marker and tape* Kena™ Microscope *Microscope slide* *Potato* *Red Onion* *Roll of paper towels* *Roll of plastic wrap* *Scissors* *Small funnel* *Sucrose solutions (0.2 M, 0.4 M, 0.6 M, 0.8 M and 1.0 M)* *Wash bottle*	PS-2230	1 1 30 mL 2 to 3 drops 150 mL 150 mL 6 2 1 1 10 to 20 cm 180 cm 5 1 liter 1 per class 1 1 1 per class 1 1 1 3 to 4 per class 1 per class 1 per class 1 per class 1 1 35 mL each 1
5	**Enzyme Catalysis** Use an oxygen gas sensor to measure oxygen gas production resulting from the decomposition of hydrogen peroxide under six conditions.	Data Collection System PASPORT Oxygen Gas Sensor with sampling bottle *1.0 M Hydrochloric acid (HCl) solution* *1.0 M Sodium hydroxide (NaOH) solution* *Activated yeast suspension, boiled* *Activated yeast suspension, chilled* *Activated yeast suspension, room temperature* *Graduated cylinder 10-mL* *Graduated cylinder 25-mL* *Hydrogen peroxide, 1.5%* *Saltine cracker* *Large beaker of ice*	PS-2126A	1 1 10 mL 10 mL 10 mL 10 mL 30 mL 1 1 120 mL 1 per student 1

Lab	Title	Materials and Equipment	PASCO Part No.	Qty
6	**Exploring the Effects of pH on Amylase Activity** Use a water quality sensor and PASPORT colorimeter to measure the effects of pH on bacterial amylase activity.	Data Collection System		1
		PASPORT Water Quality Sensor with pH probe	PS-2230	1
		PASPORT Colorimeter	PS-2121	1
		0.1 M Hydrochloric acid (HCl) solution		30 mL
		30% Starch solution		30 mL
		Bacterial Amylase solution		4 mL
		Cuvettes (with colorimeter)		7
		Disposable graduated pipets		1
		Distilled water		200 mL
		Graduated cylinder, 10-mL		1
		Lint-free tissue		1
		Lugol's Iodine (IKI) solution		30 mL
		Saltine cracker		1
		Six buffers of varying pH (pH 3.0, 4.0, 5.0, 6.0, 7.0 and 8.0)		5 mL each
		Small beakers or plastic cups		19
		Small funnel		1
		Standard buffer (pH 10)		25 mL
		Standard buffer (pH 4)		25 mL
		Wash bottle with distilled water		1
7	**Plant Pigments and Photosynthesis** Use a colorimeter to determine the rate of photosynthesis in a suspension of chloroplasts.	Data Collection System		1
		PASPORT Colorimeter	PS-2121	1
		#1 Whatman Chromatography paper		10 to 12 cm
		0.1 M phosphate buffer		4 mL
		Chloroplast suspension		2 mL
		Chromatography solvent		5 mL
		Coin		1
		Cuvettes (with colorimeter)		5
		Distilled water		13 mL
		DPIP in small amber bottle		3 mL
		Floodlight, 100 watt		1
		Glass jar, 10-12 cm tall		1
		Graduated disposable pipet 1-mL		2
		Heat sink (large beaker or flask filled with water)		1
		Ice and water		1 L
		Lint-free tissue		1
		Roll of aluminum foil		1 per class
		Spinach		1 leaf

Lab	Title	Materials and Equipment	PASCO Part No.	Qty
8	**Factors that Affect Photosynthetic Activity** Use a water quality sensor to measure the effects of light on the dissolved oxygen production by an aquatic plant in a PASCO Photosynthesis Tank.	Data Collection System PASPORT Water Quality Sensor with Dissolved Oxygen Probe Photosynthesis Tank *Beaker, 250-mL* *Dark cloth to cover tank* *Desk lamp* *Distilled water* *Elodea, or other aquatic plant* *Florescent or incandescent light bulb* Magnetic Stirrer with Magnetic Stir Bar	 PS-2230 PS-2521B	1 1 1 1 1 1 1 L 2 to 3 sprigs 1 1
9	**Cellular Respiration** Use the carbon dioxide and oxygen gas sensors to measures changes in gas levels in a PASCO Metabolism Chamber containing respiring peas.	Data Collection System PASPORT Oxygen Gas Sensor PASPORT Carbon Dioxide Gas Sensor PASPORT Sensor Extension Cable *Dry pea seeds* *Germinating pea seeds, boiled* *Germinating pea seeds, chilled* *Germinating pea seeds, room temperature* *Glass beads* Metabolism Chamber *Large beaker of ice*	 PS-2126A PS-2110 PS-2500	1 1 1 1 25 25 25 25 25 1 1
10	**Measuring Aerobic Cellular Respiration in Yeast** Use a water quality sensor to measure the effects of temperature on the dissolved oxygen concentration of active yeast cultures.	Data Collection System PASPORT Water Quality Sensor with Dissolved Oxygen Probe *Activated yeast solution* *Beaker, 250-mL* *Distilled or deionized water* Electronic Balance *Graduated cylinder, 100-mL* Hot Plate *Ice bath, 1 L beaker filled with ice water* *Labeling marker* *Labeling tape* *Stirring rod* *Sugar* *Weighing paper*	 PS-2230	1 1 45 mL 3 1 L 1 per class 1 1 1 1 1 1 30 g 3
11	**Fermentation in Yeast** Use oxygen and ethanol gas sensors to calculate and compare the rate of fermentation in a PASCO EcoChamber containing activated yeast solution.	Data Collection System PASPORT Oxygen Gas Sensor PASPORT Ethanol Sensor *Beaker, 1000-mL* *Beaker, 500-mL* EcoChamber Magnetic Stirrer with Magnetic Stir Bar *Sucrose solution, 0.5 M* *Yeast solution*	 PS-2126A PS-2194 ME-6667 SE-7700 and PS-2565	1 1 1 1 1 1 1 500 mL 1 liter

Lab	Title	Materials and Equipment	PASCO Part No.	Qty
12	**Bacterial Transformation** Use the tools of biotechnology to transform competent *E.coli* cells and then select for antibiotic resistance.	*Calcium chloride solution* *Clear labeling tape* *E.Coli starter plate* *Ice bath* *LB/Amp agar plate* *Luria Bertani (LB) agar plate* *Micropipettor with sterile tips* *pAmp plasmid* *Sterile test tubes, 15-mL* *Sterile, glass spreading rod* *Water bath (42ºC)* *Wax labeling pencil* *Wire inoculating loop*		500 ul 1 1 1 2 2 1 10 ul 2 1 1 per class 1 1
13	**Mitochondrial Genetics and Biotechnology** Use restriction endonuclease digests and agarose gel electrophoresis to diagnose an inherited mitochondrial disease.	Electrophoresis buffer (1x) *Automatic micropipet (5-50 µL), with tips* Agarose gel, 0.8% *Disposable gloves* *Distilled or deionized water* *Horizontal gel electrophoresis apparatus and D.C. power supply* Edvotek QuickStrip™ DNA sample for Mitochondrial Genetics InstaStain® Blue Card *Plastic wrap* *Small plastic tray (for gel staining)* *DNA visualization system* *Waste receptacle*	BP-6946* BP-6946* BP-6946* BP-6946*	300-400 mL 1 1 1 pair 1 gallon per class 1 1 1 1 roll per class 1 1 per class 1
14	**Mitosis and Meiosis** Use a microscope and prepared slides to explore the stages of mitosis and meiosis.	*Chromosome simulation kit or colored beads an magnets* Kena™ Microscope *Onion root tip prepared slide* *Sordaria ascospore (cross-over) prepared slide* *Whitefish blastula prepared slide*	 SE-7236	1 1 1 1 1
*	*Contained in the BP-6946 Mitochondrial Genetics Kit*			

Lab	Title	Materials and Equipment	PASCO Part No.	Qty
15	**Genetics of Organisms with *Drosophila melanogaster*** Use the common fruit fly, *Drosophila melanogaster*, to create and statistically analyze genetic crosses.	*Anesthetizing material* *Culture vial* *Culture vial label or labeling tape* Kena™ Microscope *Fly morgue* *Foam plug* *Index cards* *Instant Drosophila culturing medium* *Mutant flies (autosomal monohybrid F1 cross)* *Mutant flies (autosomal recessive dihybrid F1 cross)* *Mutant flies (sex-linked F1 cross)* *Petri dish* *Screens* *Small, thin, camel hair paint brush* *Wild type flies*	 SE-7236	1 1 1 1 1 1 2 1 to 2 g 1 vial per class 1 vial per class 1 vial per class 1 1 1 3 vials per class
16	**Evolution and Population Genetics** Use the Hardy-Weinberg equations to solve genetics problems.	*3x5 index card labeled with "A"* *3x5 index card labeled with "a"* *Calculator* *Coin*		2 2 1 1
17	**Transpiration** Use a barometer to explore the effects of environmental factors, such as air movement, on the rate of transpiration in a plant.	Data Collection System PASPORT Barometer/Low Pressure Sensor PASPORT Sensor Extension Cable *100-watt light source* *Compound light microscope* *Dicot stem prepared slide* *Disposable pipet* Electronic Balance *Fan* *Glycerin* *Heat sink (large beaker or aquarium filled with water)* *Knife or single-edge razor blade* Large Base and Support Rod *Monocot stem prepared slide* *Petroleum jelly* *Plant seedlings, 12-25 cm tall* *Scissors* *Spray bottle with water* Three-Finger Clamp *Transparent plastic bag* Utility Clamp *Wide, shallow bowl or tub filled with water*	 PS-2113A PS-2500	1 1 1 1 1 1 1 1 per class 1 A few drops 1 1 1 1 2 to 3 g 1 1 1 1 1 1 1 1

Lab	Title	Materials and Equipment	PASCO Part No.	Qty
18	**Reflex versus Reaction** Use a ruler, stopwatch, and reflex hammer to measure and compare human reflexes and reactions.	*Metric ruler* *Reflex hammer* Stop Watch	 ME-1234	1 1 1
19	**Endotherms and Ectotherms: Temperature Regulation in Animals** Use a carbon dioxide gas sensor to explore how an endotherm and an ectotherm regulate internal temperatures by measuring the respiration rates of two different organisms exposed to varying temperatures.	Data Collection System PASPORT Carbon Dioxide Gas Sensor PASPORT Quad Temperature Sensor* PASPORT Sensor Extension Cable *Beaker, 2 L (or similarly sized container)* *Beaker, 350-mL or smaller* *Crickets* Electronic Balance *Ice and water* Large Base and Support Rod *Lint-free tissue* *Mouse, 5 to 10-g* Sampling bottle (with sensor) Three-Finger Clamp	 PS-2110 PS-2143 PS-2500 SE-8758A ME-9355 SE-9445	1 1 1 1 1 1 10 1 per class 1 liter 1 1 1 1 1
20	**Physiology of the Circulatory System** Use a blood pressure sensor to measure the changes in the blood pressure and heart rate of a patient in different body positions. Use a temperature probe and the Kena™ microscope to measure the changes in heart rate of *Daphnia magna* under different temperature conditions.	Data Collection System PASPORT Fast-Response Temperature Probe PASPORT Blood Pressure Sensor *Container of room temperature water* *Container of warm water* *Daphnia Magna, large, living* *Depression slide* *Disposable pipet* Kena™ Microscope *Petri Dish* *Small container of crushed ice or an ice pack* *Small rubber band*	 PS-2135 PS-2207	1 1 1 1 1 1 or 2 2 1 1 1 1 2
21	**Animal Behavior** Use a choice chamber to measure an organism's preference for different environmental factors.	*Additional stimulus agents* *Adhesive tape* *Filter paper, round* *Petri dish with lid* *Pillbugs, living* *Scissors*		1 1 3 to 4 2 10 to 15 1

Lab	Title	Materials and Equipment	PASCO Part No.	Qty
22	**Air Pollution and Acid Rain** Use a water quality sensor to measure the effects of CO_2, SO_2, and NO_2 on the pH of water.	Data Collection System		1
		PASPORT Advanced Water Quality Sensor with pH Probe	PS-2230	1
		1 M HCl solution		15 mL
		1-hole rubber stopper for flask		1
		Beaker, 40-mL		1
		Electronic Balance	SE-8758A	1 per class
		Erlenmeyer flask, 50-mL		1
		Flexible Teflon tubing to fit glass tubing		20 cm
		Glass tubing for rubber stopper		
		Graduated cylinder, 10-mL		1
		Graduated disposable pipet		1
		Labeling marker		1
		Latex or polypropylene gloves		1
		Masking tape		1
		Planting pots, 2 inch		3
		Radish seeds		15
		Sodium bicarbonate($NaHCO_3$)		5 g
		Sodium bisulfite($NaHSO_3$)		5 g
		Sodium nitrite ($NaNO_2$)		5 g
		Vinegar		400 mL
		Wash bottle containing distilled or deionized water		1
23	**Population Ecology** Use a colorimeter to explore the effects of habitat size, nutrient availability, initial population density and temperature on the growth rate of *E.coli* bacteria.	Data Collection System		1
		PASPORT Colorimeter	PS-2121	1
		Culture vessels, 15-mL		3
		Culture vessels, 250-mL		3
		Culture vessels, 50-mL		3
		Cuvettes (with colorimeter)		4
		Disposable gloves		1
		Labeling marker		1
		Labeling tape		1
		Lint-free tissue		1
		Luria-Bertani (LB) broth		40 mL
		Overnight (O/N) culture of E.coli *in a 15-mL culture tube*		4 mL
		Shaking Incubator (optional)		1 per class
		Squirt bottle with 10% bleach		1
		Sterile transfer or Pasteur pipets, toothpicks, or inoculating loop		1
		Sterile water		10 mL

Lab	Title	Materials and Equipment	PASCO Part No.	Qty
24	***Elodea* and the Snail** Use a water quality sensor to measure pH changes in a series of simulated closed systems containing various organisms.	Data Collection System PASPORT Advanced Water Quality Sensor with pH Probe *Aquatic snails* *Bromothymol blue solution (in dropper bottle)* *De-chlorinated water* *Drinking straw* Elodea *sprigs (or other aquatic plant)* *Labeling marker* *Labeling tape* *Large test tubes* *Standard Buffer (pH 10)* *Standard Buffers (pH 4)* *Test tube rack* *Test tube stoppers*	 PS-2230 	1 1 2 500 mL 500 mL 1 2 to 4 1 1 4 25 mL 25 mL 1 4
25	**Interrelationship of Plants and Animals** Use carbon dioxide and oxygen gas sensors to measure changes in gas levels in a terrestrial ecosystem created within a PASCO EcoChamber.	Data Collection System PASPORT Oxygen Gas Sensor PASPORT Carbon Dioxide Gas Sensor PASPORT Sensor Extension Cable EcoChamber *Potting soil* *Small animal (Ex. Crickets)* *Small plant, variety*	 PS-2126A PS-2110 PS-2500 ME-6667 	1 1 1 1 1 2 to 3 cups 10 1
26	**AP 12 – Dissolved Oxygen and Primary Productivity** Use a temperature probe and a water quality sensor to measure the effects of temperature on the dissolved oxygen concentration of water. Use a dissolved oxygen sensor to measure the effects of light intensity on the photosynthetic activity of algae.	Data Collection System PASPORT Advanced Water Quality Sensor with Optical Dissolved Oxygen Probe and Stainless Steel Temperature Probe Aquatic Productivity Bottles *Beaker, 250-mL* *Dilute green algae culture* *Fluorescent light source* *Ice water* *Large vessel, 2 L (to fill bottles)* *Room temperature water* *Warm water* *Wash bottle* *Wax pencil or stickers and labeling marker*	 PS-2230 ME-6737 	1 1 1 3 2 L 1 200 mL 1 200 mL 200 mL 1 1

*Either the PASPORT Fast Response Temperature Probe or the Stainless Steel Temperature Probe can be used for this experiment

Calibration materials

If you want to calibrate various sensors, you will need the following:

pH Sensor

Item	Quantity	Where Used
Buffer solution, pH (4) Buffer solution, pH (10) Beaker, small Wash bottle with deionized or distilled water	25 mL 25 mL 3 1	1,6,22,24

Oxygen Gas Sensor

Item	Quantity	Where Used
Sampling Bottle (included with the sensor)	1	5,11,25

Carbon Dioxide Gas Sensor

Item	Quantity	Where Used
Sampling Bottle (included with the sensor)	1	9,19,25

Ethanol Sensor

Item	Quantity	Where Used
1% ethanol solution Beaker, small	25 mL 1	11

Colorimeter

Item	Quantity	Where Used
Cuvette (included with colorimeter) Distilled water	1 7 mL	3,6,7,23

Activities by PASCO Equipment

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

Items Available from PASCO	Qty	Where Used
PASPORT Carbon Dioxide Gas Sensor	1	9,19,25
PASPORT Barometer/Low Pressure Sensor	1	17
PASPORT Colorimeter	1	3,6,7,23
PASPORT Oxygen Gas Sensor	1	5,9,11,25
ASPORT Quad Temperature Sensor with Fast-Response and Stainless Steel Temperature Probes	1	2,19,20
PASPORT Water Quality Sensor with pH probe	1	6,18,22,24
PASPORT Water Quality Sensor with Dissolved Oxygen Probe	1	8,10,26
PASPORT Water Quality Sensor with Conductivity Probe	1	3,4
PASPORT Blood Pressure Sensor	1	20
PASPORT Ethanol Sensor	1	11
PASPORT Sensor Extension Cable	1	9,17,19,25
Photosynthesis Tank	1	8
EcoChamber	1	11,25
Metabolism Chamber	1	9
Aquatic Productivity Bottles	1	26
Kena™ Microscope	1	4,14,15
Mitochondrial Genetics Kit	1	13
Large Base and Support Rod	1	17,19
Magnetic Stirrer with Magnetic Stir Bar	1	8,11
Stop Watch	1	18
Electronic Balance	1	1,4,11,13,17,19,22
Hot Plate	1	1,10
Three-Finger Clamp	1	19,17
Utility Clamp	1	17

*Either the PASPORT Fast Response Temperature Probe or the Stainless Steel Temperature Probe can be used for this experiment.