Master Materials and Equipment List

Advanced Environmental Science & Earth Science

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 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 No.	Qty
1	**Determining Soil Quality** Use a carbon dioxide gas sensor, a pH sensor, and a conductivity sensor to analyze the capacity of soil to support plant growth by examining the physical, chemical, and biological characteristics of different types of soil.	Data Collection System		1
		PASPORT Carbon Dioxide Gas Sensor and sampling bottle	PS-2110	1
		PASPORT pH Sensor	PS-2002	1
		PASPORT Conductivity Sensor	PS-2116A	1
		PASPORT Sensor Extension Cable	PS-2500	1
		Beaker, 100-mL		4
		Beaker, 50-mL		1
		Digging tool		1
		Dissecting microscope		1
		Distilled or deionized water		300 mL
		Graduated cylinder, 100-mL		1
		Labeling tape		1 roll
		Microscope slides and cover slips		3
		Microscope with magnification up to 400x		1
		Microwave oven		1 per class
		Permanent marker		1
		pH calibration standard solution, pH 4		25 mL
		pH calibration standard solution, pH 7 or 10		25 mL
		Pipet, disposable, 1-mL		1
		Plastic bags		4
		Soil samples (from 3 different locations)		3
		Stirring rod		1
		Wash bottle containing distilled or deionized water		1
		Waste container		1
		White household vinegar		4 mL

Lab	Title	Materials and Equipment	PASCO Part No.	Qty
2	**Insolation and the Seasons** Use a stainless steel temperature sensor to measure the temperature of a solar panel positioned at different angles relative to the sun in order to determine how the earth's tilt and rotation around the sun is related to climate and the seasons.	Mobile Data Collection System PASPORT Stainless Steel Temperature Sensor *Black construction paper, 15 x 15 cm* *Cardboard, 15 x 15 cm* *Drinking straw* *Glue, bottle* *Protractor* *Scissors* Small Tripod Base and Rod *Tape* Three-fingered clamp	 PS-2153 ME-9355 SE-9445	1 1 1 1 1 1 1 1 1 1 roll 1
3	**Investigating Specific Heat** Use fast-response temperature probes and stainless steel temperature sensors to determine and compare the specific heat of water to that of sand, as a model of land, and consider the effects of these differences on global weather and climate.	Data Collection System PASPORT Stainless Steel Temperature Sensor PASPORT Fast Response Temperature Sensor *Beaker, glass, 500-mL* *Beakers, glass, 250-mL* *Buret clamp* *Disposable insulated cup (2) and lid* *Heat lamp or 150 W incandescent lamp* *Hot plate* Mass balance or scale *Sand, 200 g* Small tripod base, and rod *Stirring rod* *Test tube, glass, 18 x 150-mm (large)* *Tongs* *Water*	 PS-2153 PS-2135 SE-7714 SE-8785A ME-9355 	1 2 2 1 2 2 2 1 1 1 per class 200 g 1 1 1 1 650 mL
4	**Monitoring Microclimates** Use a weather/anemometer sensor to identify factors that affect measurements for reporting weather and climate information.	Mobile Data Collection System PASPORT Weather/Anemometer Sensor *Cardboard box, (20 cm)3 or larger* *Marking pen* *Scissors*	 PS-2174 	1 1 1 1 1

Lab	Title	Materials and Equipment	PASCO Part No.	Qty
5	**Sunlight Intensity and Reflectivity** Use a light sensor, a fast-response temperature probe, and a stainless steel temperature probe to explore the concept that air temperatures near the earth's surface result largely from the interplay of the sun's incoming energy and the absorption, reflection, and radiation of that energy by materials on the earth's surface.	Mobile Data Collection System PASPORT Light Sensor PASPORT Fast Response Temperature Sensor PASPORT Stainless Steel Temperature Sensor PASPORT Sensor Extension Cable *Dark rock* *Dark sand* *High intensity incandescent lamp* *Large disposable plate* *Marking pen* Mass balance *Paper* Rod and clamp *Scissors* *Small cardboard box, (20 cm)3 or larger* *Tape* *Three-finger clamp* *Tripod base and support rod* *White rock* *White sand*	 PS-2106A PS-2135 PS-2153 SE-8785A SE-9445 ME-9355 	1 1 1 1 1 500 g 500 g 1 1 1 1 per class 1 piece 1 1 1 1 roll 1 1 500 g 500 g
6	**Tracking Weather** Use a weather/anemometer sensor to determine how variations in temperature, humidity, barometric pressure, dew point, wind speed, and sky conditions relate to each other and produce specific weather conditions.	Mobile Data Collection System PASPORT Weather/Anemometer Sensor *Brick or block to lift sensor off ground (optional)* *Weather data for comparison* *Weather shield*	 PS-2174 	1 1 1 1
7	**Earth's Magnetic Field** Use a magnetic field sensor to visualize the magnetic field lines surrounding Earth.	Data Collection System PASPORT Magnetic Field Sensor Degree wheel template Magnetic field demonstrator plate, 2-D Map of Earth template *Bar magnet* *Clear plastic cup* *Pin* *Sewing needle* *Small cork (or a bit of polystyrene)* *Water, 500 mL*	 PS-2112 	1 1 1 4 1 1 1 1 1 1 500 mL
8	**Radiation Energy Transfer** Use a temperature sensor to determine the effect the color of a container has on the temperature of water in the container as it is heated using radiant energy.	Data Collection System PASPORT Temperature Sensor (stainless steel or fast response) *Graduated cylinder, 100-mL* *Heat lamp (or 150 W lamp)* *Insulated pad* *Radiation cans (one black, one silver)* *Ring stand* *Water, room temperature*	 PS-2153 or PS-2135 	1 2 of the same 1 1 2 2 1 0.5 L

Lab	Title	Materials and Equipment	PASCO Part No.	Qty
9	**Seafloor Spreading and Plate Tectonics** Use a magnetic field sensor to explore the movement of Earth's crustal plates and the evidence that is used to support the theory of plate tectonics.			
	Station 1	*Strip of paper, 10 cm × 28 cm*		1
		Cardboard or card stock, 15 cm × 20 cm		1
		Colored pencils or markers, red and green		Several
		Scissors		1
		Tape		1 roll
	Station 2	Data Collection System		1
		PASPORT Magnetic Field Sensor	PS-2112	1
		Bar magnet		1
	Station 3	Data Collection System		1
		PASPORT Magnetic Field Sensor	PS-2112	1
		Basalt, hand size specimen		1
		Magnetite, hand size specimen		1
	Station 4	Data Collection System		1
		PASPORT Magnetic Field Sensor	PS-2112	1
		Seafloor spreading model		1
10	**Modeling an Ecosystem** Use a variety of sensors to explore the use of terrariums as a closed system for environmental studies, designing ways to explore the interrelationships of biotic and abiotic structures in ecosystems.	Data Collection System		1 or more
		Sensors (some of the sensors that can be used):		1 or more
		PASPORT Oxygen Gas Sensor	PS-2126	
		PASPORT Carbon Dioxide Sensor	PS-2110	
		PASPORT Temperature Sensor*	PS-2135	
		PASPORT pH Sensor	PS-2102	
		PASPORT Conductivity Sensor	PS-2116A	
		PASPORT Weather Sensor	PS-2174	
		PASPORT Sensor Extension Cable	PS-2500	
		PASCO EcoZone™ System	ME-6668	
		PASPORT Water Quality Colorimeter and sample vials (nitrate and ammonia recommended)	PS-2179 EZ-2333B and EZ-2334	
		Compost or soil (quantity determined by student design)		1
		Different types of living organisms		Several
		Plant seeds or seedlings, or moss		Several
		Pollution sources (depends on students' design): *Detergent (10 mL liquid soap)* *Fertilizer (10 g)* *HCl or white vinegar (16.6 mL)*		1
		Strong incandescent or full-spectrum fluorescent light source		1
		USB hub (depending on data collection system)		1
		Water, dechlorinated (quantity determined by student design)		1

Lab	Title	Materials and Equipment	PASCO Part No.	Qty
11	**Photosynthesis and Primary Productivity** Use a dissolved oxygen sensor to determine the primary productivity of an aquatic plant.	Data Collection System		1
		PASPORT Optical Dissolved Oxygen Sensor or PASPORT Advanced Water Quality Sensor	PS-2196 or PS-2230	1
		Black cloth, opaque, 50 cm x 50 cm		1
		Dechlorinated tap water		1 L
		Elodea sp. plant		Several
		Lamp, 100 W or high-intensity		1
		Magnetic stirrer and stir bar	SE-7700	1
		Photosynthesis Tank	PS-2521A	1
		Rubber stopper, #3 (included with Photosynthesis Tank)		1
		Alternative to the photosynthesis tank:		
		Erlenmeyer flask, 250-mL		1
		Large base and support rod	ME-9355	1
		Mineral oil		1
		Shallow pan or dish, large	SE-9445	1
		Three-finger clamp		1
12	**Photosynthesis and Cell Respiration in a Terrarium** Use an oxygen sensor, a carbon dioxide sensor, and a temperature sensor to demonstrate that a terrarium, as a closed system, is an excellent tool for conducting environmental studies and to design additional investigations on photosynthesis and cellular respiration.	Data Collection System		1
		PASPORT Oxygen Gas Sensor	PS-2126	1
		PASPORT Carbon Dioxide Gas Sensor	PS-2110	1
		PASPORT Temperature Sensor*	PS-2125	1
		PASPORT Sensor Extension Cable	PS-2500	1
		PASCO EcoChamber	ME-6667	1
		Fast-growing, small, potted plant		1
		Opaque cloth, about 1 m^2		1
		Strong incandescent or full-spectrum fluorescent light source		1
		USB hub (depending on data collection system)		1
13	**Cellular Respiration and Carbon Cycle** Use a carbon dioxide sensor to compare the respiration of dormant bean sees with germinating bean seeds, and to observe the contribution of cellular respiration to the global carbon cycle.	Data Collection System		1
		PASPORT Carbon Dioxide Gas Sensor	PS-2110	1
		PASPORT Sensor Extension Cable	PS-2500	1
		Dissecting microscope or magnifying glass		1
		Dry bean seeds		22
		Knife or scalpel		1
		Parafilm® for Erlenmeyer flask		1
		Sampling bottle or Erlenmeyer flask, 125-mL		2

Lab	Title	Materials and Equipment	PASCO Part No.	Qty
14	**Energy Content of Food** Use a fast response temperature sensor to investigate and compare the energy content of four different food items: marshmallow, popcorn, peanut, and cashew.	Mobile Data Collection System PASPORT Fast Response Temperature Sensor *Aluminum pie pan* *Aluminum soda can* *Cardboard box, large* Electronic balance *Food samples: marshmallow, popcorn, peanuts, cashew* *Graduated cylinder, 100 mL* Large base and support rod *Marking pen* *One-hole rubber stopper, ~1 1/2" top diameter* *Paperclip, large* *Plastic straw* Rod and clamp *Tape* *Water* *Wooden matches (or starter wand)*	 PS-2135 SE-8785A ME-9355 	1 1 4 4 1 1 per class 1 each 1 1 1 4 5 1 1 1 roll 200 mL Several
15	**Weather in a Terrarium** Use a weather sensor and light sensor in a terrarium to conduct and design an investigation of weather, using this closed system to help identify independent variables, dependent variables, and controlled variables.	Data Collection System PASPORT Light Sensor PASPORT Weather Sensor PASPORT Sensor Extension Cable PASCO EcoChamber *Fast-growing, small, potted plant* *Strong incandescent or full-spectrum fluorescent light source*	 PS-2106A PS-2154A PS-2500 ME-6667 	1 1 1 2 1 1 1
16	**Yeast Respiration** Use a dissolved oxygen sensor, a carbon dioxide sensor, and the EcoChamber™ to analyze aerobic and anaerobic respiration by yeast cells.	Data Collection System PASPORT Optical Dissolved Oxygen Sensor PASPORT Carbon Dioxide Gas Sensor PASCO EcoChamber *Activated baker's yeast, 7-g packet* *Beaker, 1 L* *Graduated cylinder, 500-mL or 1-L* *Hot plate with magnetic stirrer and stir bar* *Magnetic stir plate with stir bar* *Microscope slide and cover slip* *Microscope with 400x magnification* *Pipet, disposable* *Sugar*	 PS-2196 PS-2110 ME-6667 	1 1 1 1 1 1 1 1 1 1 1 1 100 g 1 L

Lab	Title	Materials and Equipment	PASCO Part No.	Qty
17	**Properties of Water** Use a stainless steel temperature sensor to explore how the properties of water can be explained by the molecular structure of water.	Data Collection System PASPORT Stainless Steel Temperature Sensor *Beaker, 100-mL* *Beaker, 600-mL* *Crushed ice* *Eyedropper or disposable pipet* *Foam tray* *Hot pads or mittens* *Hot plate* *Other materials to test* *Paper towel* *Ring stand* *Utility clamp* *Water* *Waxed paper*	 PS-2135	1 1 1 1 300 mL 1 1 1 1 1 2 1 50 mL 1
18	**Air Pollution and Acid Rain** Use a pH sensor to investigate chemical reactions important in the formation of acid rain to understand the relationship between man-made emissions, acid rain, and problems arising from acid rain.	Data Collection System PASPORT pH Sensor *1 M HCl* *1-hole rubber stopper for flask* *Beaker, 40-mL* *Erlenmeyer flask, 50-mL* *Flexible Teflon® tubing to fit glass tubing* *Glass tubing for rubber stopper* *Graduated cylinder, 50- or 100-mL* *Graduated pipet, 4-mL and pipet bulb* *Sodium bicarbonate* *Sodium bisulfite* *Sodium nitrite* *Wash bottle containing distilled or deionized water* *Water or deionized water*	 PS-2102	1 1 15 mL 1 1 1 20 cm 1 1 1 5 g 5 g 5 g 1 1 L
19	**Monitoring Water Quality** Use a water quality sensor, turbidity sensor, and weather/anemometer sensor to monitor the pH, dissolved oxygen content, conductivity, and turbidity of a natural body of water, determining how water quality changes in response to changes in environmental factors.	Mobile Data Collection System PASPORT Advanced Water Quality Sensor PASPORT Turbidity Sensor PASPORT Weather/Anemometer Sensor PASPORT GPS Position Sensor (optional) Sensor User Guides with calibration instructions and tables Chemical test kit (optional) *Duct tape, roll* *Long-handled sampling device* *Scissors* *Wading boots (optional)* *Wash bottle containing distilled or deionized water* *Wide-mouth sampling jar or small*	 PS-2230 PS-2122 PS-2174 PS-2175 EZ-xxxx	1 1 1 1 1 Several 1 1 1 1 1 pair 1 1

Lab	Title	Materials and Equipment	PASCO Part No.	Qty
20	**Toxicology Using Yeast** Use a carbon dioxide gas sensor and a pH sensor to evaluate the role of pH in toxicity and the role of cell culture in toxicology studies.	Data Collection System PASPORT Carbon Dioxide Gas Sensor PASPORT pH Sensor PASPORT Sensor Extension Cable PASCO EcoChamber *Beaker, 100-mL (for vinegar)* *Beaker, glass, 2-L* *Erlenmeyer flask, 125-mL* *Graduated cylinder, 1-L or 500-mL* *Graduated cylinder, 25-mL or 10-mL* *Household bleach, half-strength* *Magnetic stir plate and stir bar* *Rapid-rise activated baker's yeast (7-g packet)* *Rubber stopper for Erlenmeyer flask* *Stirring rod* *Sugar* *Water* *White vinegar*	 PS-2110 PS-2102 PS-2500 ME-6667	1 1 1 1 1 1 1 1 1 1 50 mL 1 1 1 1 100 g 1 L 50 mL
21	**Water Treatment** Use pH, conductivity, and turbidity sensors to demonstrate how water treatment processes such as filtration, flocculation, and sedimentation improve water quality.	Data Collection System PASPORT Advanced Water Quality Sensor (or PASPORT pH and PASPORTConductivity Sensors) PASPORT Turbidity Sensor *Activated charcoal* Balance *Beaker, 150-mL* *Beaker, 50-mL* *Beaker, large ("wastewater" container)* *Graduated cylinder, 100-mL* *Graduated pipet, 50-mL, and bulb* *Lint-free lab tissue* *Paper napkins, dinner, white, smooth* *Paper towels, white* *Soda bottle, empty, 500-mL* *Stirring rod* *Swimming pool water clarifier solution, 4%* *Test tube, 18-mm OD or greater* *Wash bottle containing water* *Wastewater sample (made from coffee, soil, and kitty litter if the soil has a low clay content)* *Water*	 PS-2230 (or PS-2102 and PS-2116A) PS-2122 SE-8785A	1 1 1 2 g 1 per class 4 1 1 1 1 box 12 4 1 1 2 to 4 mL 1 1 500 mL 300 mL

Lab	Title	Materials and Equipment	PASCO Part No.	Qty
22	**Greenhouse Gases** Use a fast response temperature sensor and an EcoChamber to determine the effect of a man-made organofluorine compound, a greenhouse gas, on the trapping of heat in an isolated system.	Data Collection System PASPORT Fast Response Temperature Sensor EcoChamber with stoppers Balance *Canned keyboard duster (fresh)* *Dark aquarium rocks or dark sand* *Heating lamp* *Heavy-duty tape* *Ring stand* *Size 5 or 5 1/2 solid stoppers*	 PS-2135 SE-8785A	1 2 1 1 per class 1 ~200 g 1 1 1 2

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

Activity by PASCO Equipment

This list shows the sensors and other PASCO equipment used in the lab activities.

Items Available from PASCO	**Qty**	**Activity Where Used**
Data Collection System	1	1, 3, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22
Mobile Data Collection System	1	6, 14, 19
PASCO EcoChamber	1	12, 15, 16, 20
PASCO EcoZone System	1	10
PASPORT Carbon Dioxide Gas Sensor	1	1, 10[1], 12, 16, 20, 22
PASPORT Conductivity Sensor	1	1, 10[1]
PASPORT Fast Response Temperature Sensor	1	3, 5, 22
PASPORT GPS Position Sensor	1	19 (optional)
PASPORT Light Sensor	1	5, 15
PASPORT Magnetic Field Sensor		7, 9
PASPORT Oxygen Gas Sensor	1	10[1],12
PASPORT pH Sensor	1	1, 10[1], 18, 22
PASPORT Stainless Steel Temperature Sensor	2	3
PASPORT Stainless Steel Temperature Sensor	1	2, 5
PASPORT Temperature Sensor[2]	1	8, 10[1], 12, 14
PASPORT Turbidity Sensor	1	19, 21
PASPORT Water Quality Colorimeter and sample vials	1	10[1]
PASPORT Water Quality Sensor	1	19, 22
PASPORT Weather Sensor	1	15, 10[1]
PASPORT Weather/Anemometer Sensor	1	4, 19
PASPORT Sensor Extension Cable	1	5

[1] The actual quantity of these items is determined by the student design of the activity.

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