STEM PBL UNITS

PROJECT-BASED LEARNING

PITSCO EDUCATION

AUTHENTIC, ENGAGING STEM LEARNING APPLICATION

Whole-class, hands-on STEM PBL Units enable students to make STEM connections locally and regionally by completing STEM projects and corresponding STEM PBL Activators. Students also develop lifelong learning skills and transferable STEM knowledge and skills to move them into a future with technological advancements moving at an unprecedented pace.

REAL-LIFE RELEVANCE

Project-based learning makes school more like real life. Naturally, STEM projects fit as they are prominently hands on.

STUDENT EMPOWERMENT

Students take ownership of their project and accomplishments within collaborative projects.

PERSONALIZATION AND FLEXIBILITY

Units can be implemented stand-alone or in supplement to existing curriculum.

"If you look at how Google hires, Google says, 'We want skill-based hires.' So, industry has been telling us that these are the people who will be successful in the modern workplace. To me, PBL does a better job producing the skills that industry wants."

– Dave Ross, teacher and former P21 CEO and Buck Institute for Education senior director

STEM PBL COMPARISON

Pitsco has designed a framework to help you create a project-based-learning unit that will engage students and provide them with deep learning experiences in STEM. The Pitsco STEM PBL model incorporates five key elements that make it successful.

STEM CHALLENGE

All Pitsco STEM PBL projects provide a meaningful STEM challenge that requires students to think critically about multiple possible solutions.

AUTHENTIC INQUIRY

Students engage in a rigorous process of creatively solving real-world problems as they apply appropriate regulations, techniques, and technologies. In the Pitsco STEM PBL model, concepts are applied locally in your community to create relevance and engagement.

STUDENT-DRIVEN LEARNING

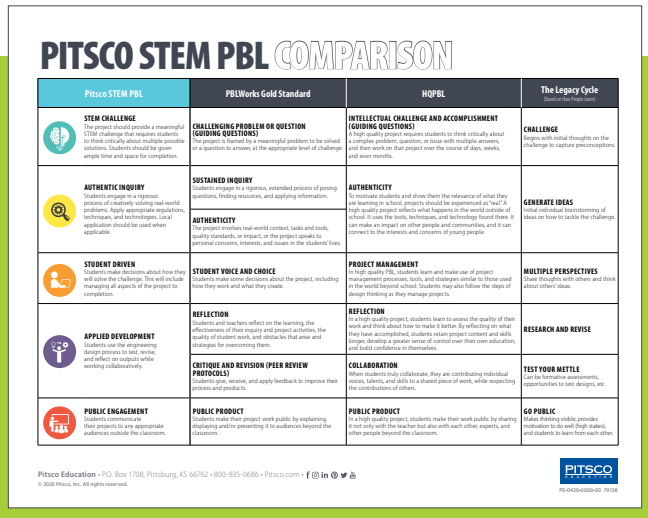
Students make decisions about how they will solve the challenge. This will include managing all aspects of the project to completion.

APPLIED DEVELOPMENT

Students use the engineering design process to test, revise, and reflect on outputs while working collaboratively.

PUBLIC ENGAGEMENT

Students communicate their projects to any appropriate audiences.



PITSCO STEM PBL COMPARISON

Pitsco STEM PBL	PBLWorks Gold Standard	HQPBL	The Legacy Cycle (Based on Jean Piaget's Learn)
STEM CHALLENGE The project should provide a meaningful STEM challenge that requires students to think critically about multiple possible solutions. Students should be given ample time and space for completion.	**CHALLENGING PROBLEM OR QUESTION (GUIDING QUESTIONS)** The project is framed by a meaningful problem to be solved or a question to answer, at the appropriate level of challenge.	**INTELLECTUAL CHALLENGE AND ACCOMPLISHMENT (GUIDING QUESTIONS)** A high-quality project requires students to think critically about a complex problem, question, or issue with multiple answers, and then work on that project over the course of days, weeks, and even months.	**CHALLENGE** Begins with initial thoughts on the challenge to capture preconceptions.
AUTHENTIC INQUIRY Students engage in a rigorous process of creatively solving real-world problems. Apply appropriate regulations, techniques, and technologies. Local application should be used when applicable.	**SUSTAINED INQUIRY** Students engage in a rigorous, extended process of posing questions, finding resources, and applying information. **AUTHENTICITY** The project involves real-world context, tasks and tools, quality standards, or impact, or the project speaks to personal concerns, interests, and issues in the students' lives.	**AUTHENTICITY** To motivate students and show them the relevance of what they are learning in school, projects should be experienced as "real." A high quality project reflects what happens in the world outside of school. It uses the tools, techniques, and technology found there. It can make an impact on other people and communities, and it can connect to the interests and concerns of young people.	**GENERATE IDEAS** Initial individual brainstorming of ideas on how to tackle the challenge.
STUDENT DRIVEN Students make decisions about how they will solve the challenge. This will include managing all aspects of the project to completion.	**STUDENT VOICE AND CHOICE** Students make some decisions about the project, including how they work and what they create.	**PROJECT MANAGEMENT** In high quality PBL, students learn and make use of project management processes, tools, and strategies similar to those used in the world beyond school. Students may also follow the steps of design thinking as they manage projects.	**MULTIPLE PERSPECTIVES** Share thoughts with others and think about others' ideas.
APPLIED DEVELOPMENT Students use the engineering design process to test, revise, and reflect on outputs while working collaboratively.	**REFLECTION** Students and teachers reflect on the learning, the effectiveness of their inquiry and project activities, the quality of student work, and obstacles that arise and strategies for overcoming them.	**REFLECTION** In a high quality project, students learn to assess the quality of their work and think about how to make it better. By reflecting on what they have accomplished, students retain project content and skills longer, develop a greater sense of control over their own education, and build confidence in themselves.	**RESEARCH AND REVISE**
	CRITIQUE AND REVISION (PEER REVIEW PROTOCOLS) Students give, receive, and apply feedback to improve their process and products.	**COLLABORATION** When students truly collaborate, they are contributing individual voices, talents, and skills to a shared piece of work, while respecting the contributions of others.	**TEST YOUR METTLE** Can be formative assessments, opportunities to test designs, etc.
PUBLIC ENGAGEMENT Students communicate their projects to any appropriate audiences outside the classroom.	**PUBLIC PRODUCT** Students make their project work public by explaining, displaying and/or presenting it to audiences beyond the classroom.	**PUBLIC PRODUCT** In a high quality project, students make their work public by sharing it not only with the teacher but also with each other, experts, and other people beyond the classroom.	**GO PUBLIC** Makes thinking visible, provides motivation to do well (high stakes), and students to learn from each other.

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DOWNLOAD THE FULL COMPARISON CHART

WHAT YOU'LL GET

The unit comes with storage, materials, and equipment needed for a class of 24 students, a teacher's guide containing activity details and instructions, and a guide with three STEM PBL Activators containing starter ideas, cross-curricular connections, a concept map, and career cluster alignment. A Getting Started with STEM PBL e-learning course comes with the purchase of a unit.

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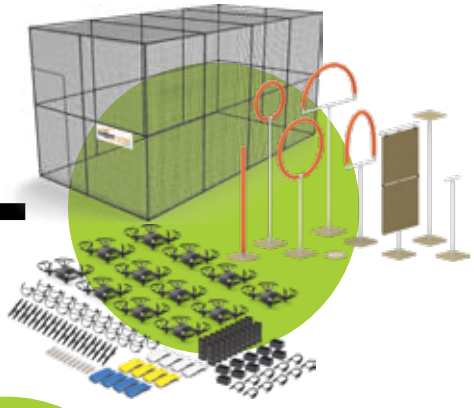

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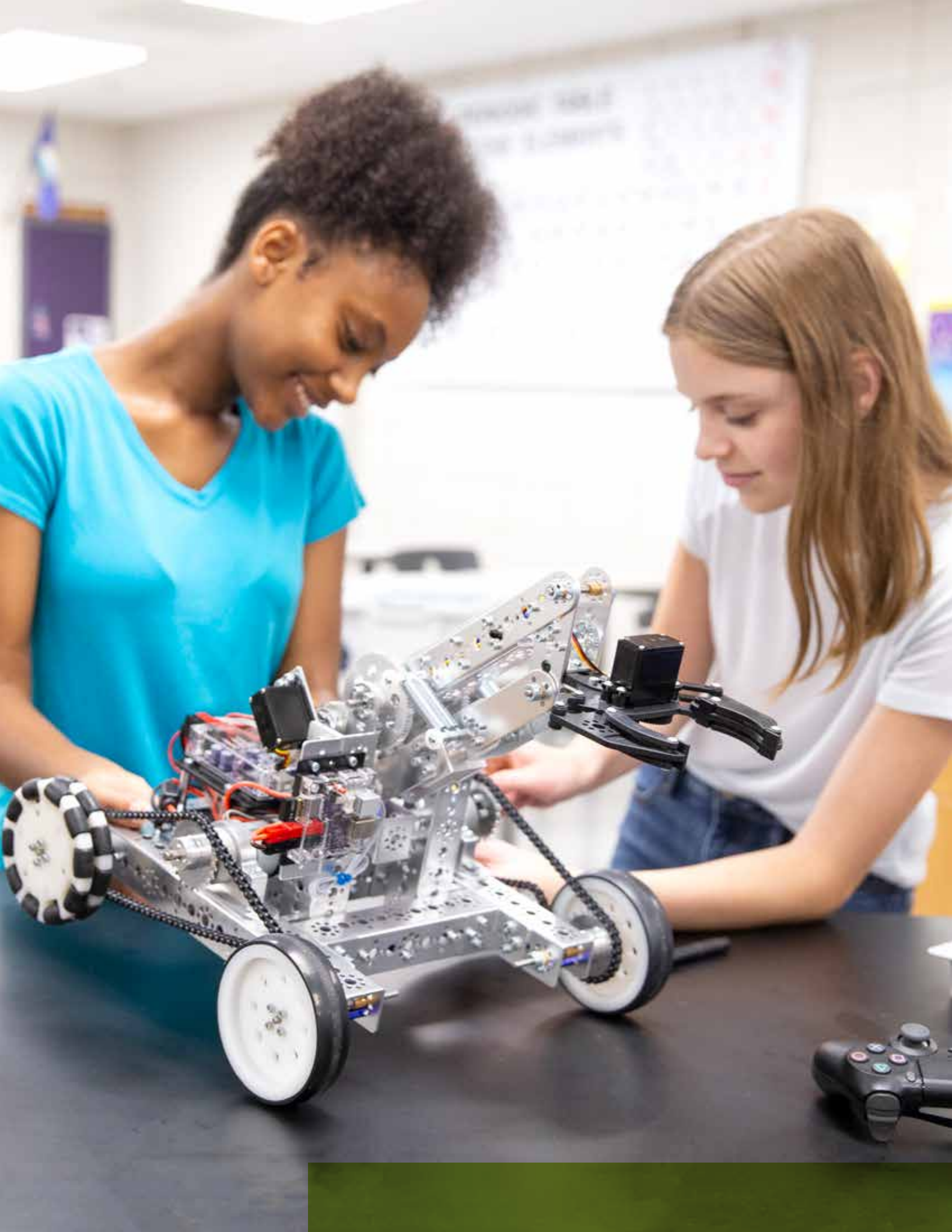
DRONE AVIATION STEM PBL UNIT



STEM PBL UNIT TITLES

All titles follow a design/redesign structure using the engineering design process, but titles are named and categorized based on their primary focus of creating, researching, sustainability, or tech.

CONSTRUCTION

- Engineering Bridges
- Packaging Design
- Structural Design

R&D

- Air-Powered Rocketry
- Automotive Design and Testing
- Balloon Flight
- Transportation Innovation
- Water-Powered Rocketry

GREEN

- Air-Powered Racing
- Magnetic Transportation
- Solar Transportation
- Wind Energy

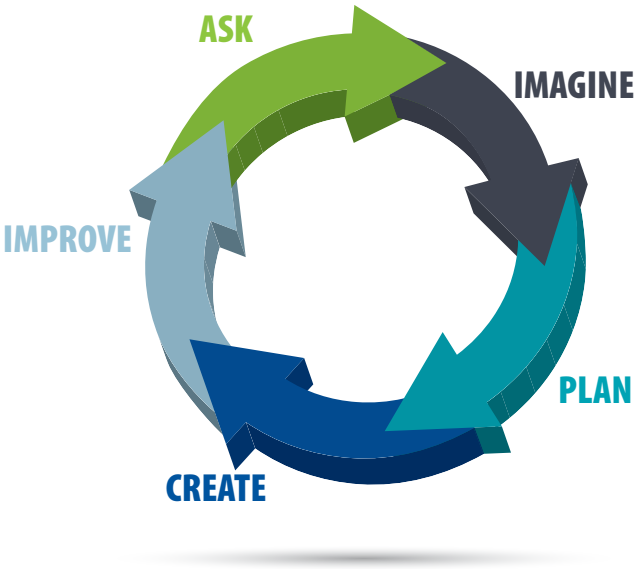
TECH

- Autonomous Robotics
- Drone Aviation
- Remote Control Robotics

ENGINEERING DESIGN PROCESS

Design thinking is a mind-set and approach to learning that involves collaboration and problem-solving. Using an engineering design process to solve STEM challenges, students build confidence in content knowledge and the 4Cs – communication, creativity, collaboration, and critical thinking.

The engineering design process used for the STEM PBL experience is based on the NASA BEST Engineering Design Model – Ask, Imagine, Plan, Create, and Improve.



CONSTRUCTION

ENGINEERING BRIDGES

In the Engineering Bridges STEM PBL Unit, students are challenged by completing any of the three Activators chosen by them or the teacher. PBL Activators available include Community Bridge, where students research places in their community where bridging supports are used; Pedestrian Path, where students research an area of high foot traffic (school grounds, park, and so on) where a bridge could help reduce the distance people have to walk; and Accessibility Across, where students find a local stream in a park or backyard and model a bridge to scale that would hold a 300 lb person in a wheelchair going across the bridge.

LENGTH OF UNIT: 21-42 days

46561

PACKAGING DESIGN

In the Packaging Design STEM PBL Unit, students are challenged to complete any of the three Activators chosen by them or the teacher. PBL Activators available include Ready to Go, where students design to-go boxes for restaurants in their community; Commercial Package, where students choose an existing product and redesign the packaging; and Local Improvement, where students design packaging for a product that is manufactured in their community.

LENGTH OF UNIT: 17-49 days

46486

STRUCTURAL DESIGN

In the Structural Design STEM PBL Unit, students are challenged to complete any of the three Activators chosen by them or the teacher. PBL Activators available include Growing Green, where students will present a working prototype of their greenhouse to greenhouse operators and school administrators; Building Here, where students use a straw structure to model the shape of a building for their community that reflects the architecture or terrain around it; and Geodesic Greens, where students engineer a geodesic dome greenhouse to be used on a Martian base for growing food.

LENGTH OF UNIT: 23-33 days

46490

R&D

AIR-POWERED ROCKETRY

In the Air-Powered Rocketry STEM PBL Unit, students are challenged to complete any of the three Activators chosen by them or the teacher. PBL Activators available include Straw Games, where students design a fun game for all ages; Bird Brigade, where students create an automatic bird scatterer for their community; and Straw Wars, where students participate in a simulated war using straw projectiles.

LENGTH OF UNIT: 19-42 days

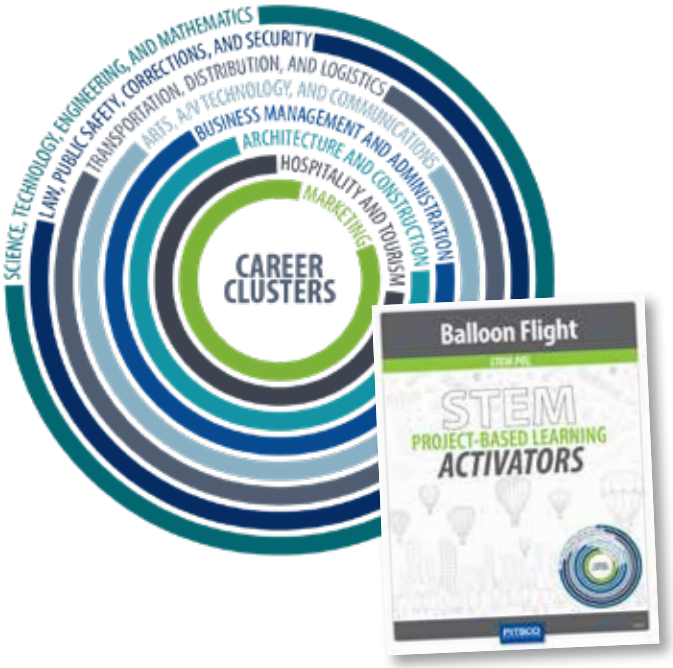
46488

AUTOMOTIVE DESIGN AND TESTING

In the Automotive Design and Testing STEM PBL Unit, students are challenged to complete any of the three Activators chosen by them or the teacher. PBL Activators available include Rolling Games, where students create a game similar to shuffleboard or curling; Bigger Fun, where students design and construct a scaled-up vehicle; and Best in Show, where students design a vehicle for a car show.

LENGTH OF UNIT: 23-40 days

46480



BALLOON FLIGHT

In the Balloon Flight STEM PBL Unit, students are challenged by completing any of the three Activators chosen by them or the teacher. PBL Activators available include A Regal Regatta, where students design and build a balloon that carries a lighting device for a nighttime regatta; Carnival Floats, where students create a simulated balloon ride for a school carnival that carries action figures to the gym ceiling; and Balloon Rides, where students create a model of an amusement park ride that gives people the opportunity to experience a hot-air balloon ride.

LENGTH OF UNIT: 21-34 days

46558

TRANSPORTATION INNOVATION

In the Transportation Innovation STEM PBL Unit, students are challenged to complete any of the three Activators chosen by them or the teacher. PBL Activators available include Moving Art, where students create a kinetic art installation for their community; Tense Transportation, where students replace their spring with a different passive assistance device to power their racer; and Pulling Power, where students use their knowledge to design and build a winch.

LENGTH OF UNIT: 21-31 days

46484

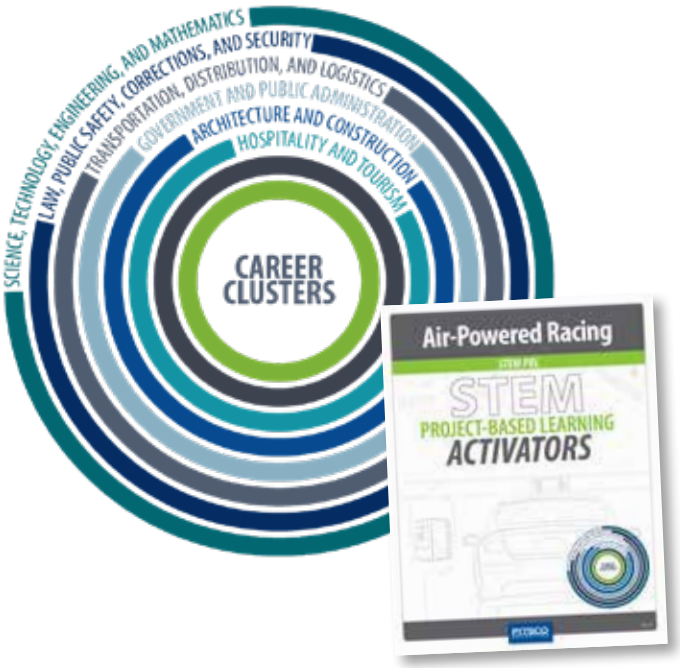
WATER-POWERED ROCKETRY

In the Water Powered Rocketry STEM PBL Unit, students are challenged to complete any of the three Activators chosen by them or the teacher. PBL Activators available include Ready, Aim, FIRE, where students create a model water-delivery rocket for fighting forest, house, or high-rise apartment fires, whichever is more applicable to their location; More Fuel, where students work to improve the fuel for a water rocket launch system to achieve different results in the flight properties of the rocket; and Low-Gravity Rockets, where students choose a known comet or asteroid and, based on experimentation with their rocket on Earth, determine what velocity must be achieved to escape the gravity well of the asteroid or comet.

LENGTH OF UNIT: 16-32 days

46492

GREEN



AIR-POWERED RACING

In the Air-Powered Racing STEM PBL Unit, students are challenged to complete any of the three Activators chosen by them or the teacher. PBL Activators available include Pressurized Delivery, where students create an air-powered delivery system in their community; Compressed Travel, where students design a green mass transit system for their community that uses compressed air, and Pneumatic Coaster, where students design an air-powered roller coaster for their community or a theme park.

LENGTH OF UNIT: 23-30 days

46477

MAGNETIC TRANSPORTATION

In the Magnetic Transportation STEM PBL Unit, students are challenged to complete any of the three Activators chosen by them or the teacher. PBL Activators available include Floating Freeways, where students design a maglev transportation system for their community; Magnetic Ramps, where students design a magnetic ramp system to assist individuals to exit a building without electricity; and Helpful Magnets, where students research magnetic levitation to design novel uses in their community.

LENGTH OF UNIT: 19-29 days

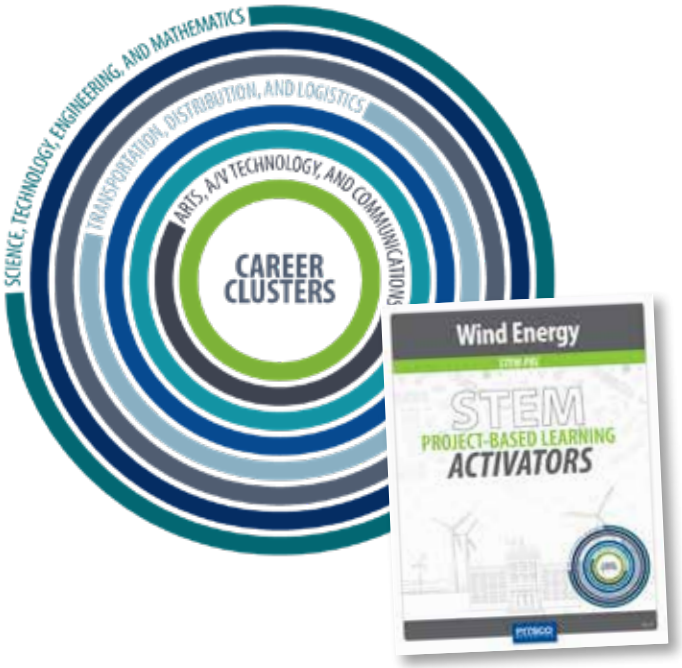
46482

SOLAR TRANSPORTATION

In the Solar Transportation STEM PBL Unit, students are challenged by completing any of the three Activators chosen by them or the teacher. PBL Activators available include Storing the Sun, where students research ways of storing solar power without the use of batteries; Solar Conversion, where students convert a battery-powered toy vehicle to be powered by solar panels; and Solar-Powered Amusement Ride, where students design a solar-powered amusement park ride and build a working model where the cars are powered strictly through solar power and are guided by a ground track system.

LENGTH OF UNIT: 22-45 days

46563



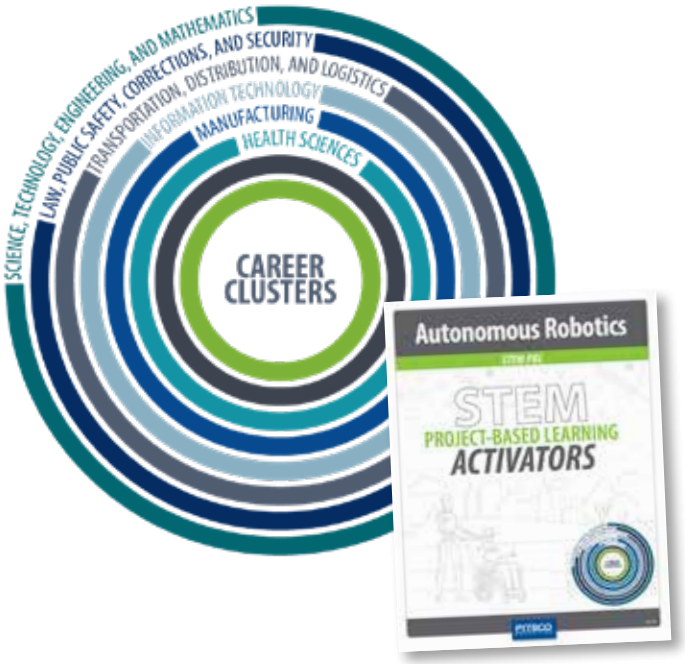
WIND ENERGY

In the Wind Energy STEM PBL Unit, students are challenged to complete any of the three Activators chosen by them or the teacher. PBL Activators available include Wind Flow, where students research wind patterns to determine a location for a wind turbine for their community or school; Wind Chargers, where students design a method to use wind energy to charge cell phones; and Wind Art, where students design a site-specific art installation that is powered by wind generators for their community.

LENGTH OF UNIT: 20-38 days

46494

TECH



AUTONOMOUS ROBOTICS

In the Autonomous Robotics STEM PBL Unit, students are challenged by completing any of the three Activators chosen by them or the teacher. PBL Activators available include Assistive Robotics, where students design, build, and program a robot that helps meet the needs of people who are disabled; Community Cleaners, where students design, build, and program an army of sanitation or cleaning robots; and Robo-facturing, where students design, build, and program a robot that performs a manufacturing task from a local manufacturing company.

LENGTH OF UNIT: 25-30 days

46560

DRONE AVIATION

In the Drone Aviation STEM PBL Unit, students are challenged to complete any of the three Activators chosen by them or the teacher. PBL Activators available include Isolated Inspection, where students develop a plan to utilize a small drone to inspect difficult-to-reach areas within the school or other location; Drone Patrol, where students present a drone security solution to interested parties that includes a demonstration of their plan using a scaled model of the suggested area to be monitored; and Avalanche Analysis, where students use the drone to simulate looking for potential avalanche locations at a new mountain ski resort.

LENGTH OF UNIT: 22-42 days

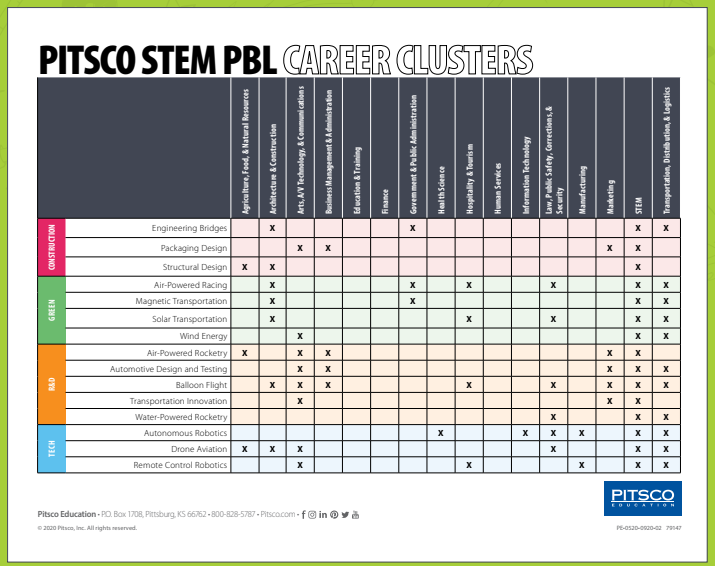
46479

REMOTE CONTROL ROBOTICS

In the Remote Control Robotics STEM PBL Unit, students are challenged to complete any of the three Activators chosen by them or the teacher. PBL Activators available include Routing Robots, where students design a robotic logistics system to ship packages and other goods to locations around their community; Vendor Machines, where students create concession robots to deliver food and souvenirs at a local venue; and Robo Do-Si-Do, where students build model robots to perform a choreographed dance.

LENGTH OF UNIT: 13-25 days

46476



PITSCO STEM PBL CAREER CLUSTERS

		Agriculture, Food, & Natural Resources	Architecture & Construction	Arts, A/V Technology, & Communications	Business Management & Administration	Education & Training	Finance	Government & Public Administration	Health Science	Hospitality & Tourism	Human Services	Information Technology	Law, Public Safety, Corrections, & Security	Manufacturing	Marketing	STEM	Transportation, Distribution, & Logistics
CONSTRUCTION	Engineering Bridges		x					x								x	x
	Packaging Design			x	x										x	x	
	Structural Design	x	x													x	
GREEN	Air-Powered Racing		x					x		x			x			x	x
	Magnetic Transportation		x					x								x	x
	Solar Transportation		x							x			x			x	x
	Wind Energy			x												x	x
R&D	Air-Powered Rocketry	x		x	x										x	x	
	Automotive Design and Testing			x	x										x	x	x
	Balloon Flight		x	x	x					x			x		x	x	x
	Transportation Innovation			x											x	x	
	Water-Powered Rocketry												x			x	x
TECH	Autonomous Robotics								x			x	x	x		x	x
	Drone Aviation	x	x	x									x			x	x
	Remote Control Robotics			x						x				x		x	x

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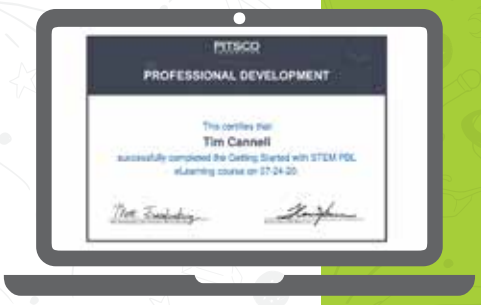
TAKE A LOOK AT HOW PITSCO'S STEM PBL UNITS ALIGN TO THE NATIONAL CAREER CLUSTERS® FRAMEWORK.

ONLINE LEARNING



With every STEM PBL Unit purchase, the Getting Started with STEM PBL e-learning course is included. This is an eight-hour course that provides an overview of project-based learning, explains all the components of STEM PBL, and instructs how to complete the planning form. Examples, assessments, and reflections are included, and upon completion of the course, a certificate is provided with contact hours noted.

In-person, customizable STEM PBL professional development opportunities are also available. Contact us at 800-828-5787 to learn more.

LEARN MORE ABOUT STEM PBL UNITS

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