VOLUME 1

STEM sports®

STEM.ORG ACCREDITED™ EDUCATIONAL EXPERIENCE

INSIDE:

Turn the page to learn more about our Digital Assets!

STEM BIKE

SUPPLEMENTAL CURRICULUM

GRADES 3 - 5 AND GRADES 6 - 8

Go Digital

In addition to the classroom, STEM Sports® K-8 Supplemental Curriculum is flexible and scalable to teach and implement at home and virtually on platforms such as Zoom, Google Classroom, Microsoft Teams, and other digital learning tools. For each and every module, we provide solutions for successful remote learning with PowerPoint presentation decks and digital worksheets with keys.
To access these useful tools, visit STEMSports.com/stembikedigitaltools/

Welcome

STEM Sports® provides turnkey K-8 supplemental curricula that use sports as the real-life application to drive STEM-based, hands-on learning in classrooms, after-school programs, and camps.

We are pleased to present Volume 1 of STEM Bike, highlighted by the following:

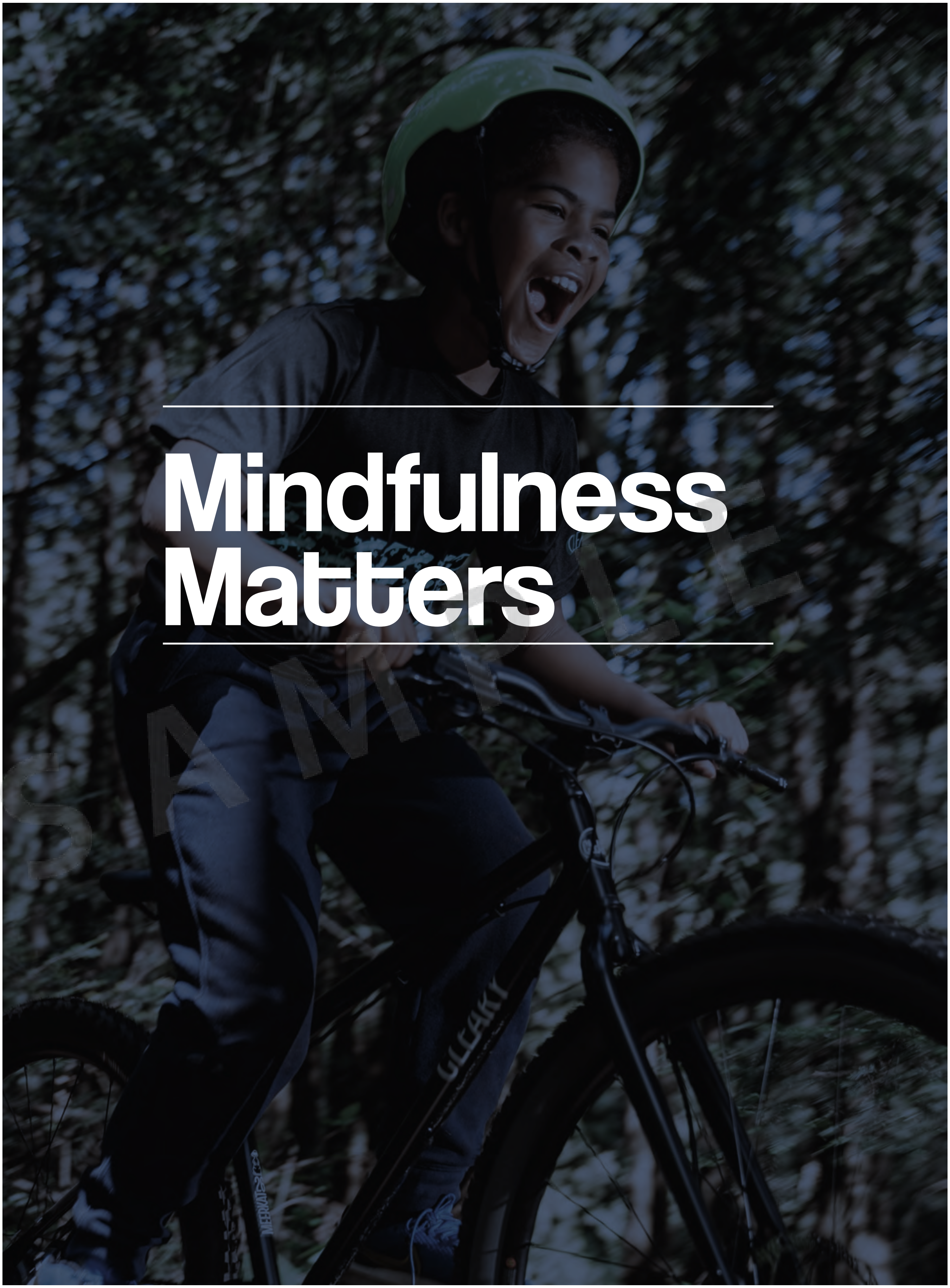
- Content for a minimum of 16 hours of instruction that includes some healthy, physical activity.
- Turnkey kits equipped with all of the relevant sports equipment along with the necessary science supplies.
- Eight lessons aligned with Next Generation Science Standards (NGSS) and/or Common Core State Standards (CCSS) and/or National Standards for K-12 Physical Education.
- STEM.org Accredited™ Educational Experience approved
- 5E lesson plans so that students will develop 21st-century skills such as critical thinking, collaboration, creative problem-solving, and leadership.
- Differentiation: lessons for kindergarten to 2nd grade, 3rd to 5th grade, and 6th to 8th grade.
- "Capstone" Project (Grades 6th to 8th) to commensurate student's knowledge of each curriculum.
- Assessments in each lesson to evaluate students effectively.
- Ready-to-use worksheets that align with each lesson and standards.
- A list of STEM-based, sports-related jobs pertinent to the lesson concept in each module.
- Engineering Design Process (EDP) woven into each curriculum.
- STEM Sports® glossary to support instructors and students as they come across key vocabulary in each module.
- Mindfulness Matters: important messaging to assist with the uniqueness of blending STEM with sports.
- Well-designed and scalable lessons for teachers, administrators, or volunteers.
- Professional development or training are not required.

Please visit **STEMSports.com** for additional information and to learn about all of the curricula that we offer.

We sincerely hope you and your students enjoy this STEM Sports® supplemental curriculum.

Please complete our Teacher Survey at **stemsports.com/teacher-survey.**

We appreciate your feedback.



Mindfulness Matters

Mindfulness may not be the first thing one thinks about STEM Sports®. However, mindfulness is essential to fully understanding the design and benefits of the STEM Sports® curricula by way of the following:

- Approximately 85% of STEM jobs anticipated for the year 2030 have yet to be invented.
- Moreover, within the next 10 years or so, 80% of all jobs will be STEM related.

The STEM Sports® curricula distinctly blends STEM content areas through hands-on/active play and sports. Active play provides a mechanism to teach STEM concepts; therefore, learning is integrated, engaging and meaningful as participants are exposed to STEM applications through real world experiences.

Teachers should be mindful of the fact STEM Sports® curricula are:

- Collaborative in nature, ensuring peer-to-peer learning opportunities
- Inquiry-based, allowing learners to discover information for themselves
- Designed for problem-solving: an essential lifelong skill
- Hands-on, engaging all types of learners
- Student-led, encouraging ownership of learning
- Active, promoting physical activity and wellbeing

Participants should be mindful of the fact STEM Sports® curricula are:

- Introduction to STEM concepts, facilitating comfort with STEM content areas
- Blending play and sport in an environment that is engaging, fun, and applicable to life outside the classroom
- Designed for all ensuring success for all participants – students do not have to be athletic or excel at science to accomplish curricula tasks
- Applicable to the real world where learning is meaningful for all participants

In sum, stakeholders should be mindful of all the STEM Sports® curricula have to offer. The unique design of the STEM Sports® curricula is essential to maximize learning and understanding of STEM concepts in sports and life applications.

 Dr. Vigil is an education consultant and mindfulness educator. For more information on mindfulness training for your school/organization, visit RayeEducationalServices.com or call 602-510-0298.

Contents
Grades 3-5

Module 1.0
The STEM Bike

PAGE 12

Objective
Students will make observations and measurements on different types of materials that make-up a bicycle. Students will explain how properties impact the function and performance of a bike.

Concept
Science: States of Matter, Observation

Time
(1) 50-minute session

Module 2.0
Ideal Pressure for Balance

PAGE 16

Objective
Students will create a model to demonstrate how increasing the pressure of a bicycle tire increases the amount of air molecules. Students will ride to test and determine a bike's performance of more or less molecules inside the bike's tires.

Concept
Science: Molecules

Time
(2) 45-minute sessions

Module 3.0
Changing Gears

PAGE 18

Objective
Students will determine which bike gears require the most and least amount of force for maximum performance. Students will justify their explanation using key terms of balanced and unbalanced forces and drawing force diagrams.

Concept
Science: Balanced and Unbalanced Forces

Time
(2) 45-minute sessions

Module 4.0
Calculating Calories and Heart Rate

PAGE 23

Objective
Students will predict and calculate calories burned while pedaling a bicycle using multiplication and division. Students will compare values by using calculations and descriptions.

Concept
Math: Multiplication and Division

Time
(2) 50-minute sessions

Contents

Grades 3-5

Module 5.0
The Need for Speed

PAGE 28

Objective
Students will conduct an informal and formal experiment riding the bikes. Students will use this data to formulate and calculate their average and median speeds.

Concept
Math: Multiplication and Division

Time
(1) 50-minute session

Module 6.0
Helmet Technology

PAGE 31

Objective
Students will observe, evaluate, and determine the effectiveness of the bike helmet. Students will brainstorm and develop a list of problems, criteria, and constraints of current bike helmet designs. Students will design a device that protects riders yet is functional during the ride.

Concepts
Engineering Design Process
Use of Technology

Time
(2-3) 45-minute sessions

Module 7.0
Energy of the Ride

PAGE 34

Objective
Students will experiment with the functionality and energy of a STEM Bike by riding both uphill and downhill. Students will explore and define the relationship between the velocity and energy of a bike.

Concept
Science: Energy

Time
(2) 50-minute sessions

Module 8.0
Advancements in Bike Technology

PAGE 37

Objective
Students will make detailed observations by using their senses and measurements to make inferences about changes in technology.

Concept
Science: Observations

Time
(2) 45-minute sessions

Contents
Grades 6-8

Module 1.0
The Bicycle
PAGE 43

Objective
Students will examine the history and composition of the bicycle. Students will use key ideas in the text about engineering to explain how the bicycle and its equipment has changed over time. Students will use key themes from the text to explain why the technology of the bicycle and equipment has changed.

Concepts
Engineering
Science: Physics

Time
(2) 50-minute blocks

Module 2.0
Ideal Pressure for Balance
PAGE 50

Objective
Students will describe how temperature changes the properties of the bike's tires by drawing a diagram of molecular motion in a bicycle tire. Students will describe how temperature changes the properties of a bicycle tire by drawing a diagram of the molecular motion of solid tire material. Students will explain how properly inflated tires ensure ideal friction and performance.

Concept
Science: Molecules and Heat

Time
(2) 50-minute blocks

Module 3.0
What's your Angle?
PAGE 54

Objective
Students will measure the lengths and angles on two different sized bike frames. Students will determine if the relationship between the bikes is proportional. Students will use a protractor to sketch the angle relationships of the bikes.

Concept
Math: Geometric and Proportional Relationships

Time
(2) 50-minute sessions

Module 4.0
Heart Rate and Calories
PAGE 59

Objective
Students will create and interpret line graphs by using calculated and collected data. Students will explain the relationship between the MET and time variables by using key vocabulary like increasing, steep, slope, and decreasing. Students will use a line to predict outputs (y).

Concepts
Math: Graphing Functions/Slope
Technology: Use of a heart rate monitor

Time
(2) 50-minute blocks

Module 5.0
Changing Gears

PAGE 64

Objective
Students will calculate the force used while pedaling with different gears by using Newton's Second Law. Students will explain how a change in force affects the acceleration of the bike (when mass remains constant) by using experimental data to support a claim. Students will design an experiment to compare forces.

Concept
Science: Force, Acceleration, and Mass (Newton's Second Law)

Time
(3) 50-minute blocks

Module 6.0
Helmet Technology

PAGE 68

Objective
Students will describe the engineering design process as a cycle. Students will review data about equipment to determine criteria for safety. Students will brainstorm new solutions for equipment.

Concept
Engineering Design Process

Time
(2) 50-minute blocks

Module 7.0
Energy of the Ride

PAGE 73

Objective
Students will collect and graph data of a controlled experiment by using a line graph. Students will explain the relationship between velocity and kinetic energy by making a claim about the relationship using evidence and reasoning.

Concept
Science: Physics

Time
(2) 50-minute blocks

Module 8.0
Advancements in Hockey

PAGE 77

Objective
Students will use quantitative information to evaluate and improve bike technology by using the engineering design process.

Concept
Engineering

Time
(2) 50-minute blocks

Capstone
Using the world of STEM to bring the Tour de France into focus.

PAGE 85

Objective
Students will learn about the challenges a race course can present: gradient/slopes, curves/bends, terrain/surface. Students will use this knowledge to learn about the different stages and challenges of the Tour de France. Students will evaluate and present stages of the course with the least and greatest challenges using qualitative data and qualitative descriptions as a group.

Supplies Checklist

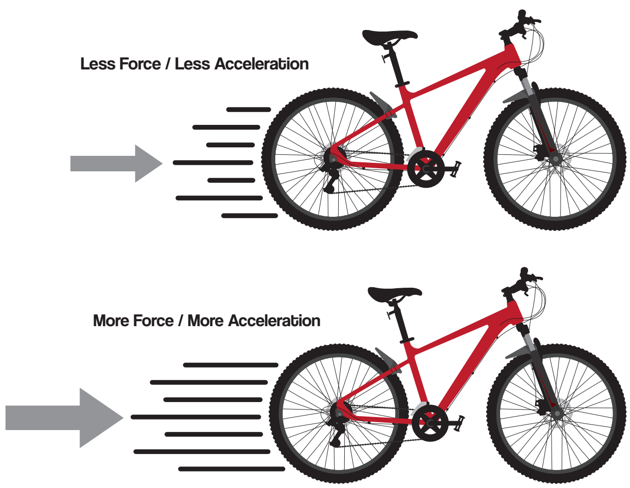
- ☐ **Six (6)** Tape Measures
- ☐ **Six (6)** Disc Cones
- ☐ **Six (6)** Bike Helmets
- ☐ **Six (6)** Digital Stopwatches
- ☐ **Three (3)** Cleary Bikes - 24" Meerkat
- ☐ **Three (3)** Cleary Bikes - 26" Meerkat
- ☐ **Six (6)** Heart Rate Monitors
- ☐ **One (1)** Tire Pump with Pressure Gauge
- ☐ **One (1)** Allen Wrench Multi-Tool Kit
- ☐ **One (1)** Pedal Wrench
- ☐ **One (1)** STEM Bike Curriculum Manual

Materials Needed

- ☐ Pencils
- ☐ Plain Paper or Notebook
- ☐ Cotton Balls or Beads
- ☐ Calculators
- ☐ Protractors
- ☐ Plastic Bags
- ☐ Ramp or Hill
- ☐ Space to Ride: Minimum of 90 feet wide x 200 feet long
- ☐ Optional yet recommended: Additional Bikes

Bike STEM Sports® Glossary

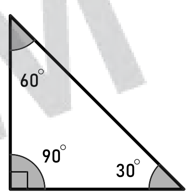
Acceleration: Change in speed over time.



Angle: A figure formed by two rays that have the same endpoint.

Balanced Force: Two forces acting in opposite directions on an object, equal in size.

Complementary Angles: When the sum of the measure of two angles equals 90 degrees.



Constraint: A restriction that keeps something from being the best it can be.

Criteria: A set of rules or directions that must be followed.

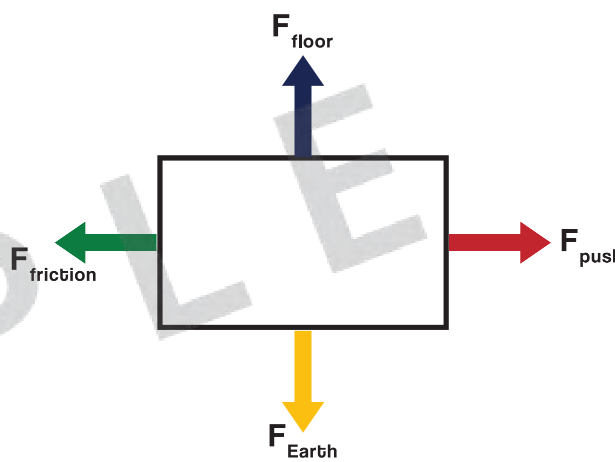
Engineering: A system of thinking that uses science and technology to solve problems.

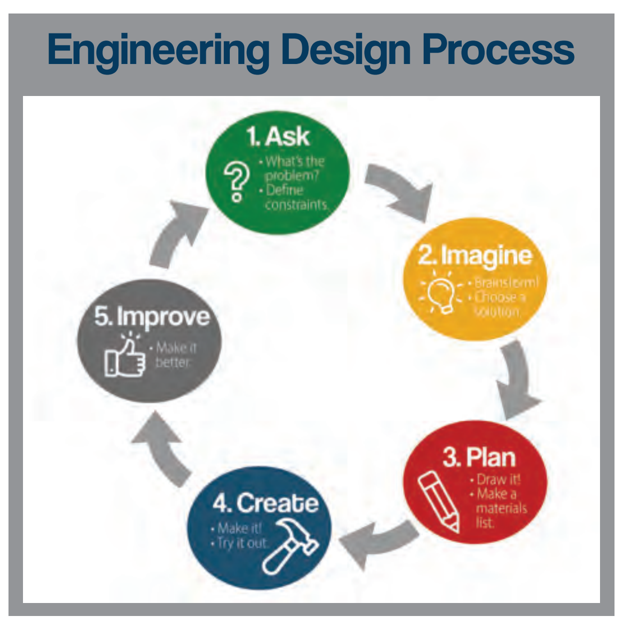
Engineering Design Process (EDP): An organized series of steps that engineers use to develop functional products or processes.

Gravity: A force of attraction inclined to bring particles or bodies together.

Force: Something that causes a change in the motion of an object. Force = mass of object x acceleration.

Force Diagram: A diagram showing all the forces acting on an object, the force's direction and its magnitude.



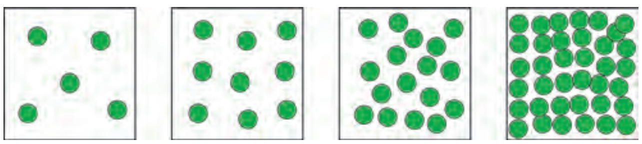


Function: The relationship or expression involving one or more variables.

Inference: The process of drawing logical conclusions from known facts or circumstances.

Kinetic Energy: The energy an object possesses due to its motion.

Molecules: A group of two or more atoms connected by electrons in a chemical bond.



Molecular Collision: The physical interaction of atoms and molecules.

Molecular Motion: Movement of integral particles in a specific direction.

Observation: The process of carefully watching or examining a person or object.

Properties: Any traits that can be measured, such as mass, color, density, length, odor, and temperature.

Slope: The steepness of a line; rising or falling of a surface.

System: A group of parts working together.

Triangle Inequality Theorem: The sum of the lengths of any two sides must be greater than or equal to the length of the remaining side of a triangle.

Triangle Sum Theory: The sum of all internal angles of a triangle is equal to 180 degrees.

Unbalanced Forces: A force that changes the position, speed, or direction of the object to which it is applied.

Velocity: The rate of change of position with respect to time.

$$\text{Velocity} = \frac{s \text{ (displacement)}}{t \text{ (time)}}$$

Module 4.0

GRADES 3-5

Calculating Calories and Heart Rate

Concept
Math: Multiplication and Division

Objective
Students will predict and calculate calories burned while pedaling a bicycle using multiplication and division. Students will compare values by using calculations and descriptions.

Time
(2) 50-minute sessions

Standards

Common Core State Standards Connections

CCSS.MATH.CONTENT.3.OA.C.7: Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division (e.g., knowing that $8 \times 5 = 40$, one knows $40 \div 5 = 8$) or properties of operations. By the end of Grade 3, know from memory all products of two one-digit numbers.

CCSS.MATH.CONTENT.5.OA.A.1: Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.

National Standards for K-12 Physical Education Connections

Standard 1: The physically literate individual demonstrates competency in a variety of motor skills and movement patterns.

Standard 3: The physically literate individual demonstrates the knowledge and skills to achieve and maintain a health-enhancing level of physical activity and fitness

Standard 4: The physically literate individual exhibits responsible personal and social behavior that respects self and others.

Standard 5: The physically literate individual recognizes the value of physical activity for health, enjoyment, challenge, self-expression and/or social interaction.

Background
Racing bikes is a highly intense activity that places significant physical demands on riders. An average race lasts less than 60 seconds, so riders have to be able to go from resting to a maximum speed as quickly as possible, and maintain that speed throughout. Over the course of a race, a rider's heart rate can change as much as 60-75% to 80-90% of maximum beats per minute (BPM). Measuring a heartbeat during a race was once impossible, but technology has made it easier to monitor bikers and their heart rates to calculate how many calories were burned during a race. At rest, your body uses energy to maintain the function of cells essential for life. Energy is needed for your heart to pump blood and breath. The average person burns 45 calories an hour just sitting. It stands to reason that racing bikes (or any physical activity) burns calories. Every activity has its own Metabolic Equivalent of Task (MET) value that reflects how much oxygen your body uses during an activity. The resting MET is 1.5 versus 7.3 for riding a bike quickly.

Supplies Provided

Worksheets, STEM Bikes, Bike Helmets, and Heart Rate Monitors

Visit STEMSports.com/digitaltools to access presentation decks, worksheets, and answer keys.

Materials Needed

Pencils, Calculator, and Flat Surface with Space to Ride

Sequence of Lesson

Have your students take this lesson's assessment prior to engaging by visiting: STEMSports.com/assessments

If you have limited digital capability, please email Info@STEMSports.com to access the Assessment & Key.

Engage: Use your index and middle finger on your neck to count the number of heart beats in 30 seconds and multiple by two. This is your resting heart rate in beats per minute. Now let's find your maximum heart rate. To do this, subtract your age from the number 220. If you are 12 years old, you would calculate 220 minus 12, which means your max heart rate is 208.

Teacher note: If 30 seconds is too long, ask your students to count the beats for 15 seconds, then double the number to get the beats for 30 seconds and double the number again to get the beats for 60 seconds. If students have difficulty finding their own pulse, use the heart rate monitor (provided) to measure their resting heart rate.

Explore: Have your students work with partners and take turns riding the bike, collecting and recording data from the heart rate monitor. Students will ride the bike as fast/far as they can for 15 seconds and record their heart rate on the worksheet provided. Repeat the process for all time intervals.

Explain: Tell students that measuring their heart rate can help them determine how many calories they burn when riding. Explain there is also an equation to help them predict how many calories they would burn for any amount of time riding; the equation is C = MET * Weight * Time: C is the total calories burned, MET is either 1.5 for resting or 7.3 for riding, your weight is in kilograms, and your time is in hours. Model for students how to use the formula to calculate the total calories burned with a MET of 1.5, Weight of 45 kilograms, and a time of 0.25 hours (15 minutes).

Elaborate: Guide students in calculating the number of calories they would burn for 15 minutes of resting. We will use a MET value of 1.5 for this exercise.

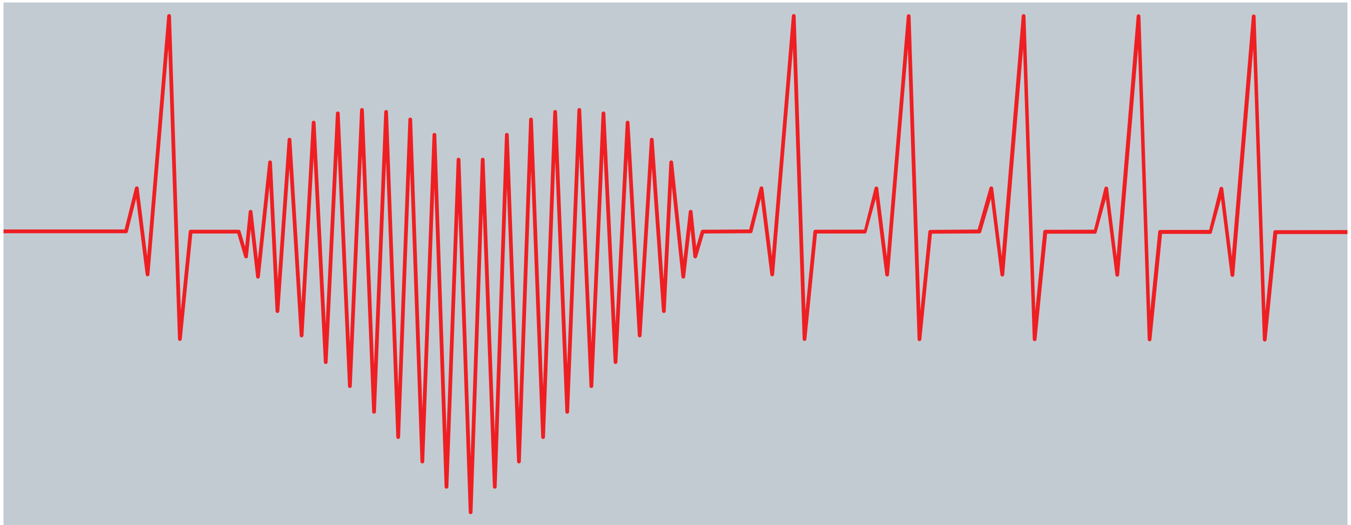
STEP 1: Convert your weight in pounds to kilograms by dividing your weight by 2.2.
Example: 100 pounds = 45.5 kilograms.

STEP 2: Multiply the MET value by your weight in kilograms. If you weigh 45.5 kilograms and use the MET value of 1.5, this would give you 68.25 as a product.

STEP 3: Multiply the product (68.25) by the time spent resting in hours to get the number of calories burned. *Example: 15 minutes (15 / 60) = 0.25 hours and 30 minutes (30 / 60) = 0.50 hours.*

STEP 4: Ask students to repeat the process for all time intervals.

Evaluate: Ask students to now calculate the number of calories they would burn for 5 minutes of racing using the steps from *Elaborate*. You will use a MET value of 7.3 for this exercise.



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Extend: Similar to *Explore*, students could peddle for 15 seconds and record their heart rate using the heart rate monitor. Rest for 15 seconds and measure the heart rate again: What do you notice about these numbers? Repeat the process for all time intervals.

Teacher note: The time spent peddling should be the same as the time spent resting when recording the results from the heart rate monitor.

STEM Jobs in Sports

- Sports Nutritionist
- Spin Class Instructor
- Bicycle Racing Escort
- Cycling Photography
- Strength & Conditioning Coach

For a growing list of occupations throughout the sports industry, click on the resource tab at STEMSports.com.

Fun Facts

Top Tour de France cyclists who complete all 21 stages burn about 120,000 calories during the race – or an average of nearly 6,000 calories per stage.

Module 4.0

Name: ____

Calculating Calories and Heart Rate

GRADES 3-5

Engage and Explore

	Partner 1	Partner 2
Resting Heart Rate (measured)		
Maximum Heart Rate (calculated)		
Heart Rate (15 seconds peddling)		
Heart Rate (30 seconds peddling)		
Heart Rate (45 seconds peddling)		
Heart Rate (60 seconds peddling)		
Heart Rate (75 seconds peddling)		
Heart Rate (90 seconds peddling)		

Explain/Elaborate

Weight in Kilograms = ________________

Use the resting MET of 1.5 to calculate the total number of calories burned.

Time of Activity (hours) t	C = (MET * weight) * t	Calories Burned C
15 minutes = _____ hours		
30 minutes = _____ hours		
45 minutes = _____ hours		

Module 4.0

Name: ____

Calculating Calories and Heart Rate

GRADES 3-5

Evaluate

Use the racing MET of 7.3 to calculate the total number of calories burned.

Time of Activity (hours) t	C = (MET * weight) * t	Calories Burned C
15 minutes = _____ hours		
30 minutes = _____ hours		
45 minutes = _____ hours		

Extend

	Peddling	Resting
Heart Rate (15 seconds)		
Heart Rate (30 seconds)		
Heart Rate (45 seconds)		

Module 4.0

GRADES 6-8

Heart Rate and Calories

Concepts
Math: Graphing Functions/Slope
Technology: Use of a heart rate monitor

Objective
Students will create and interpret line graphs by using calculated and collected data. Students will explain the relationship between the MET and time variables by using key vocabulary like increasing, steep, slope, and decreasing. Students will use a line to predict outputs (y).

Time
(2) 50-minute blocks

Standards

Common Core State Standards Connections

CCSS.MATH.CONTENT.8.F.B.5: Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

CCSS.MATH.CONTENT.7.RP.A.2.C: Represent proportional relationships by equations. *For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as t = pn.*

CCSS.MATH.CONTENT.7.RP.A.2.D: Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, r) where r is the unit rate.

CCSS.MATH.CONTENT.6.RP.A.3.A: Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.

National Standards for K-12 Physical Education Connections

Standard 1: The physically literate individual demonstrates competency in a variety of motor skills and movement patterns.

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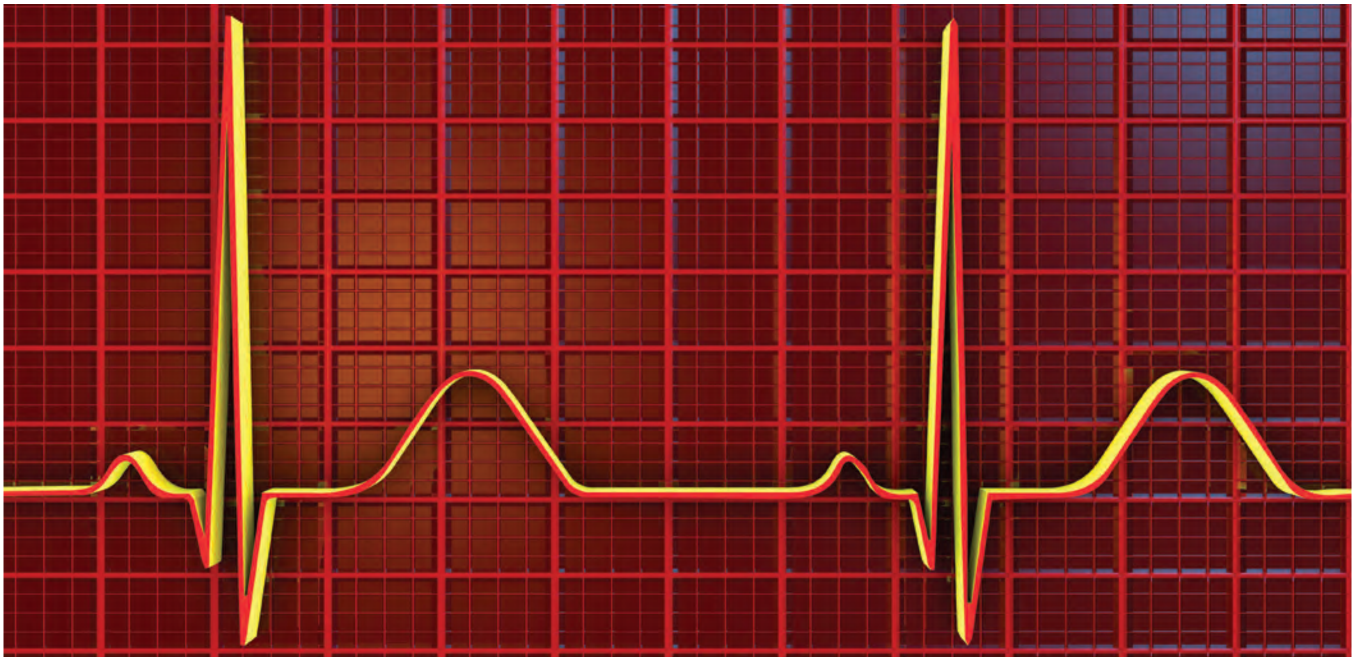

Background

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Supplies Provided

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Materials Needed

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Sequence of Lesson

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Engage: Use your index and middle finger on your neck to count the number of heart beats in 30 seconds and multiple by two. This is your resting heart rate in beats per minute. Now let's find your maximum heart rate. To do this, subtract your age from the number 220. If you are 12 years old, you would calculate 220 minus 12, which means your max heart rate is 208.

Explore: Have students work with partners and take turns riding the bike, collecting and recording data from the heart rate monitor. Students will ride the bike as fast/far as they can for 15 seconds and record their heart rate on the worksheet provided. Repeat the process for all time intervals.

Explain: Explain to your students that we can use a function table to calculate the number of calories burned for any amount of time, providing the example below of how a function table works. Explain your input is your "x" values and that you substitute those values into your function (equation). You then use the function rule to simplify to get your output: "y" values.

Input (x values)	Function (Equation)	Output (y values)
10	y = 4x → 4(10)	40
15	y = 4x → 4(15)	60
10	y = 2x → 2(10)	20
15	y = 2x → 2(15)	30

The function use to calculate the number of calories burned is C = (MET * Weight) * Time: C is the total calories burned, MET is either 1.5 for resting or 7.3 for riding, your weight is in kilograms, and your time is in hours. This can also be thought of as the equation y = mx " : y is the total calories burned, MET * weight is the slope, and x is the time.

Elaborate: Guide students in calculating the number of calories they would burn for 5 minutes of resting. We will use a MET value of 1.5 for this exercise.

STEP 1: Convert your weight in pounds to kilograms by dividing your weight by 2.2.
Example: 100 pounds = 45.5 kilograms.

STEP 2: Multiply the MET value by your weight in kilograms. If you weigh 45.5 kilograms and you use the MET value of 1.5, this would give you 68.25 as a product.

STEP 3: Multiply the product (68.25) by the time spent resting in hours to get the number of calories burned.
Example: 1 minute (1 / 60) = 0.017 hours and 5 minutes (5 / 60) = 0.083 hours.

STEP 4: Ask students to repeat the process for all time intervals.

Evaluate: Ask students to now calculate the number of calories they would burn for 5 minutes of racing using the steps from *Elaborate*. We will use a MET value of 7.3 for this exercise.

***The University of South Carolina has published one of the most extensive charts available. It can be found at STEMSports.com; click on "Resources" and then "STEM Bike".*

Have your students retake this lesson's assessment to effectively evaluate their comprehension by visiting: STEMSports.com/assessments

If you have limited digital capability, please email Info@STEMSports.com to access the Assessment & Key.

Extend: Ask students to create three different graphs and compare the slopes of each graph:

- One for their heart rate (data) as it changed during racing.
- One for the total calories burned when resting.
- One for the total calories burned when racing.

STEM Jobs in Sports

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- Spin Class Instructor
- Bicycle Racing Escort
- Cycling Photography
- Strength & Conditioning Coach

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Fun Facts

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Name: ______________________________ Class: __________

Heart Rate and Calories

GRADES 6-8

Engage/Explore

	Partner 1	Partner 2
Resting Heart Rate (measured)		
Maximum Heart Rate (calculated)		
Heart Rate (15 seconds peddling)		
Heart Rate (30 seconds peddling)		
Heart Rate (45 seconds peddling)		
Heart Rate (60 seconds peddling)		
Heart Rate (75 seconds peddling)		
Heart Rate (90 seconds peddling)		

Explain/Elaborate

Weight in Kilograms = ________________

Use the resting MET of 1.5 to calculate the total number of calories burned.

	C = (MET * weight) * t	Calories Burned C
5 minutes = _____ hours		
10 minutes = _____ hours		
15 minutes = _____ hours		
20 minutes = _____ hours		
25 minutes = _____ hours		
30 minutes = _____ hours		

Name: ______________________________ Class: __________

Heart Rate and Calories

GRADES 6-8

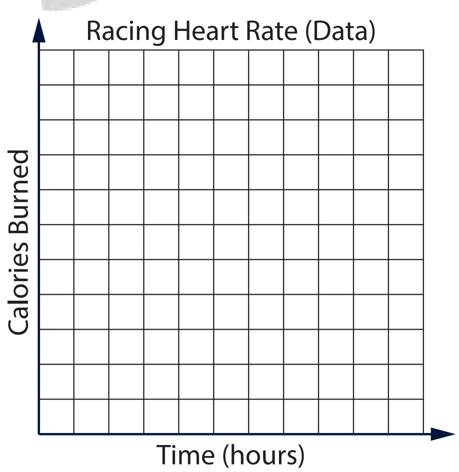
Evaluate

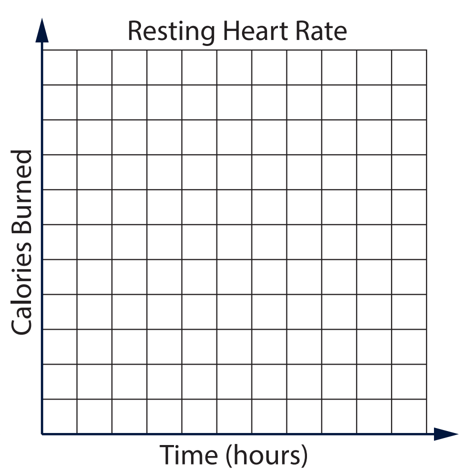
Use the racing MET of 7.3 to calculate the total number of calories burned.

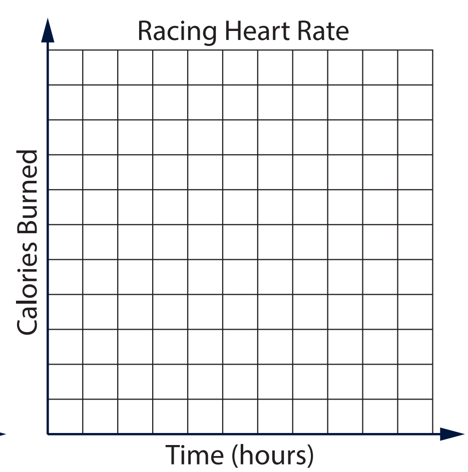
Time of Activity (hours) t	C = (MET * weight) * t	Calories Burned C
5 minutes = _____ hours		
10 minutes = _____ hours		
15 minutes = _____ hours		
20 minutes = _____ hours		
25 minutes = _____ hours		
30 minutes = _____ hours		

Extend

Use the values from the function tables in *Elaborate* and *Evaluate* to graph.







How do the slopes of the graphs compare? ______________________________

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