THE FRANKLIN INSTITUTE

SPORTSZONE

K-12 EDUCATOR'S GUIDE

EVERY SPORT IS A GAME OF INCHES. SCIENCE HELPS YOU GO THE EXTRA MILE.

Find out how and why as you explore the *SPORTSZONE* exhibit.

HOW DO ATHLETES PREPARE FOR PLAY?
WHAT KIND OF EQUIPMENT GIVES YOU AN EDGE?
HOW DOES PHYSICAL SCIENCE INFLUENCE PERFORMANCE?

The *SPORTSZONE* exhibit invites you and your students to consider these questions as you discover the science behind the sports.

DURING YOUR VISIT, STUDENTS WILL:

- Discover foundational sport science concepts.
- Interact with devices and displays that challenge them to discover the science behind sports.

AFTER YOUR VISIT, STUDENTS WILL:

- Recognize how practice leads to better performance.
- Understand that every sport involves science of some kind.

QUICK TIPS

- The exhibit is located on the third floor of the main science center. There are two entrances to the exhibit; one is at the top of the Pendulum Staircase while the other is from the main elevator "B" lobby.
- On average, most groups will spend about 45 minutes in the exhibit, if carefully examining all of the displays. Restrooms and a water fountain are located near the exhibit entrance in the elevator lobby. There are no restrooms inside the exhibit.
- No food or beverages are allowed in any of the exhibit galleries.
- Running through the exhibit is not allowed, except where specifically intended. Designate a meeting location within the exhibit when you arrive in case someone gets separated. Please do not congregate at the entrance/exit, however, so as to enable other guests to enter and exit easily.
- This exhibit invites your students to run, jump, and throw—among other physical activities. The exhibit gets loud and boisterous. ***Advise your chaperones to provide the needed adult supervision so that all students have a fun and positive experience***.

EXHIBIT OVERVIEW

The *SPORTSZONE* exhibit is organized into three areas: Ready?, Set., and GO!

In general, the intent is that you and your students will follow the path through the exhibit from the Introduction area through to the end. However, each area's content does stand on its own, so it is not essential to follow the main path. This is particularly helpful to know that if one area is crowded, you can bypass it and come back to it when it becomes free for use.

ARE YOU IN THE *SPORTSZONE*?

Learn how nutrition and hydration help you stay **READY FOR ACTION**.
See how materials and equipment help you get **SET TO SUCCEED**.
Have fun while you learn how science helps you **GO THE DISTANCE**.

Ready? Set. Go!

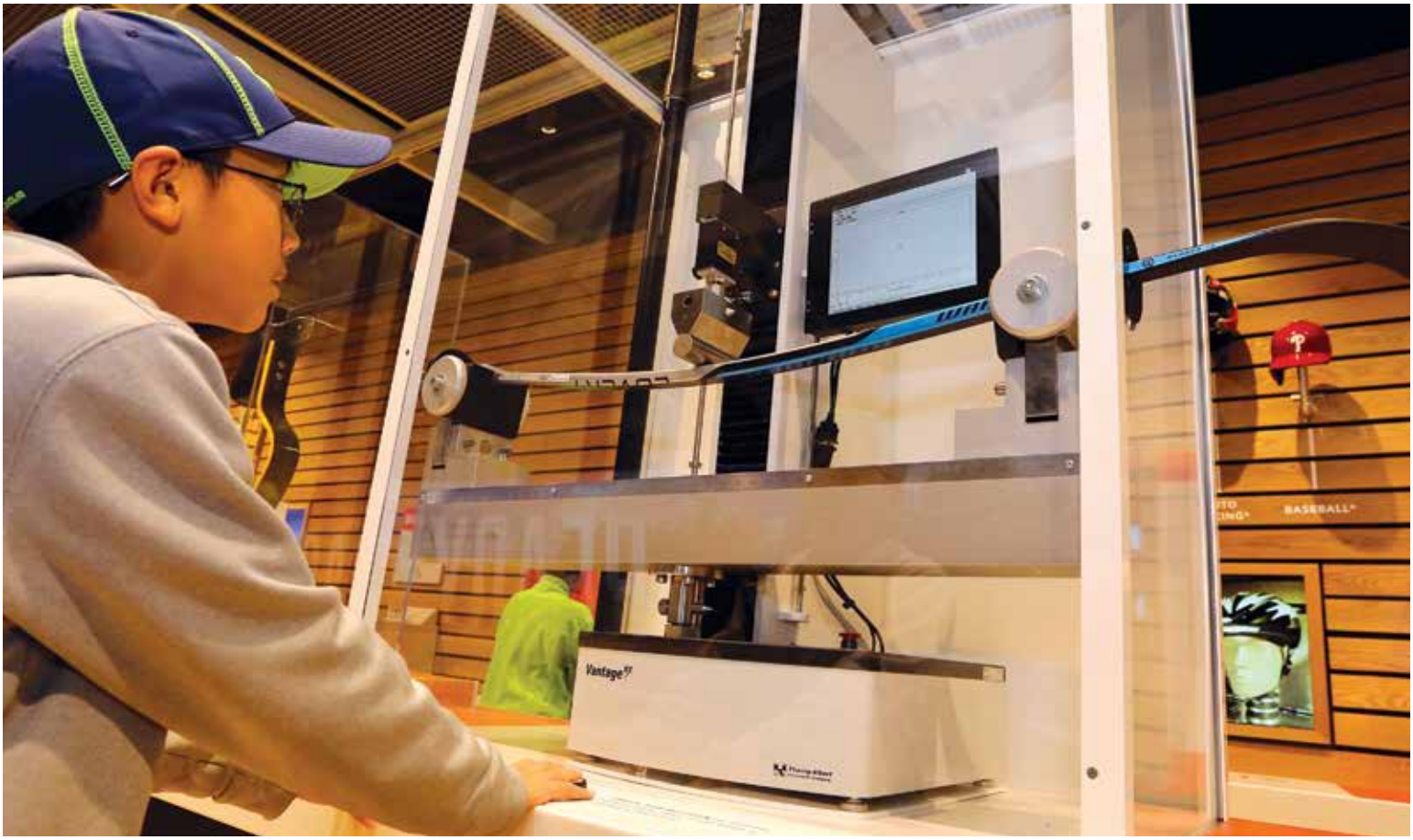
READY? SET YOUR GOAL

Each sport demands a particular set of abilities, so athletes come in all shapes and sizes. Yet all athletes benefit by setting personal goals to keep them motivated. Goals should be achievable and measurable—like trying to score more points than last year.

What personal goals make sense for your sport? Prepare yourself for success by being as healthy as you can. Physical and mental fitness will help you get ready to go.

The goals for this area of the exhibit are:

- Students will explore how nutrition impacts body form and function in sports.
- A theme of this area is how to find your personal "ready zone," no matter your level of skill or fitness, to get you ready for action.



SET. GET YOUR GEAR

Thanks to scientists, engineers, and designers, sports gear is always evolving. Materials get stronger, lighter, and faster. Designs become increasingly specialized.

New clothing and equipment certainly look cool. They also help athletes perform better and avoid injuries. At the same time, some wonder if high-tech gear distracts from an athlete's performance.

The goals for this area of the exhibit are:

- Students will test how materials science and design create the right equipment for the right sport.
- The theme of this section is specialization, with the central equipment providing a broad overview with other interactives creating opportunities to explore particular applications of specialization in more depth.

GO! CHALLENGE YOUR LIMITS

Top athletes inspire awe as we watch them test the limits of human ability. How can they be so fast? So strong? So in control?

In a word? Science!

Great athletes appreciate the science behind their sport. By training hard, they know how to move and think effectively. Learning the science of sports can help you go the extra mile.

The goals for this area of the exhibit are:

- Students will discover that applying knowledge of physical forces can improve the precision and efficiency of their performance.
- In this area, several interactive experiences for each concept are paired, with one experience showing the concept in action, and another demonstrating the key scientific principle.

TRY THIS!

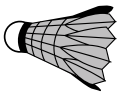
SPORTS MATH

Use the table of sports records to fill in the numbers and solve the math problems below.

WORLD RECORD SPEEDS

						
badminton	golf	squash	tennis	soccer	hockey	baseball
306 MPH	210 MPH	174 MPH	163 MPH	130 MPH	113 MPH	105 MPH

 +  = _____ _____ _____

 +  -  = _____ _____ _____ _____

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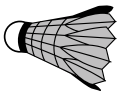
 -  -  = _____ _____ _____ _____

 x  = _____ _____ _____

 x  = _____ _____ _____

TRY THIS!

REACTION TIME

Many sports depend on reaction time. Information travels from the eye to the brain, where the brain interprets the data and then tells the body what to do. This is a complex process.

The more you practice your sport, the more quickly your brain can process the information. Over time, your reaction becomes second nature.

Are you ready to face the pitch?

When baseball players step up to bat, they have about one-tenth of a second (0.10 sec) to decide whether to swing at the pitch which is coming at them at speeds up to ninety miles per hour (90 MPH).

How fast is your reaction time?

SUPPLIES:

Bat-shaped data sheet (see below), Scissors, Pencil

INSTRUCTIONS:

- Cut out the bat-shaped data sheet below.
- Working with a partner, take turns dropping the bat and measuring reaction times.
- Have your partner hold the top of the bat while you have your hand ready beneath it to catch it between your thumb and index finger. Your thumb and index finger should be 2 inches apart.
- Have your partner say “ready, set, go” and release the bat on “go.” Keep your thumb and finger 2 inches apart until you hear “go.” Then, catch the paper as quickly as you can. Hold the paper in place until you mark on it the closest reaction time to where you caught it.
- Take turns with your partner and repeat to see if your reaction time improves. Figure out your average reaction time. If your reaction time is .10 or lower, you might be ready to face the pitch!

PROS THINK FAST

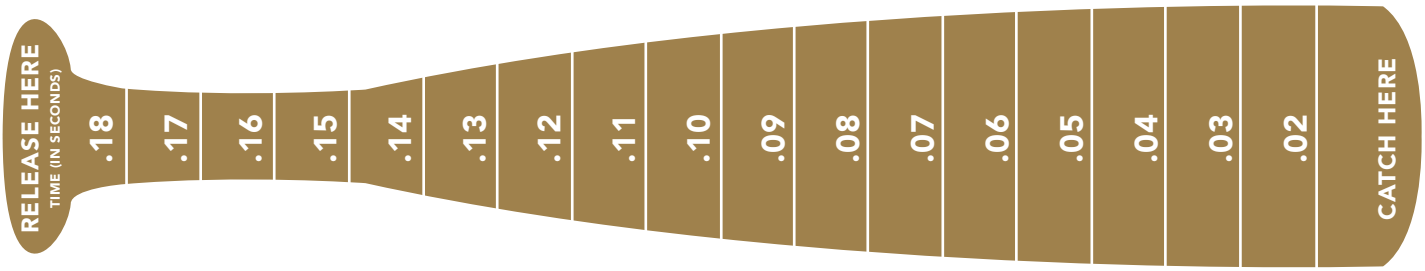
Hockey (goalie) — 152 ms

Soccer (goalkeeper) — 270 ms

Table Tennis — 274 ms

Volleyball — 280 ms

Taekwondo — 200 ms



Cut along this line

TRY THIS!

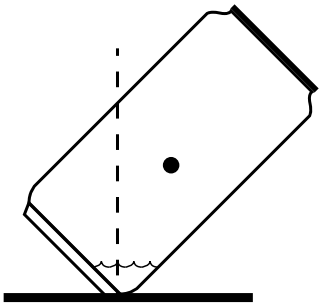
THE LEANING CAN

In the GO! section of the exhibit, students explore the concept of center of mass. Prepare them by trying this simple demonstration or small group activity.

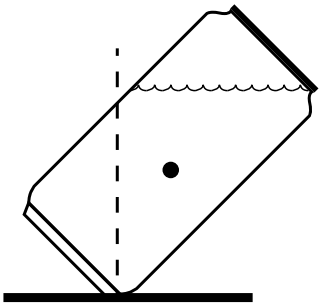
Balance the can on its edge. Once you find the center of mass, it's easy!

You'll need a 12 ounce soda can and access to water. You'll also need a waterproof surface and a towel in case any water spills.

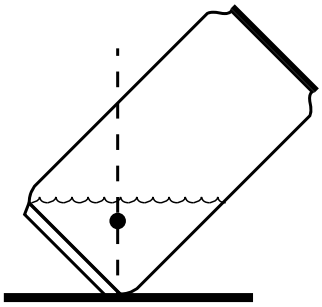
Start by trying to balance the empty can. Then, add water until you succeed.



The dot is where the can's center of mass is located. With too little water, the can will not balance.



With too much water, the can will also not balance.



With just the right amount of water, the center of mass will be in line with the base so it balances.

In many sports, being aware of your center of mass helps you stay in the game.

For most people, the center of mass is near the stomach—about half of your mass is above it and about half is below it. We use our head, arms, and legs to help us keep our center of mass balanced so that we stay upright.

Surfers bend their knees and use their arms to keep their body close to their board. Basketball players use their knees and elbows to help them jump. When we start to lose our balance, we move our head and pump our arms to bring our bodies back into balance.

DID YOU KNOW?

It is impossible to jump forward while holding your toes. Bend over and hold onto the front of your shoes (or feet). Without letting go, jump forward. Some people call it the "impossible hop" trick.

SUGGESTED RESOURCES FOR K-12 CLASSROOMS AND LIBRARIES

Elementary School

Yummy! Good Food Makes Me Strong!
by Shelley Rotner
ISBN 082342426X

Newton and Me
by Lynne Mayer
ISBN 160718866X

Bodyscope: Movers and Shapers
by Patricia Macnair
ISBN 0753457911

Muscles: Our Muscular System
by Seymour Simon
ISBN 0688177204

Middle School

Sports Science for Young People
by George Barr
ISBN 0486265277

Sports Science: 40 Goal-Scoring, High-Flying, Medal-Winning Experiments for Kids
by Jim Wiese
ISBN 0471442585

The Leaping, Sliding, Sprinting, Riding Science Book: 50 Super Sports Science Activities
by Bobby Mercer
ISBN 1579907857

High School

Why a Curveball Curves: New & Improved Edition: The Incredible Science of Sports
by William Hayes
ISBN 1618371223

Gold Medal Physics: The Science of Sports
by John Eric Goff
ISBN 0801893224

Recommended Websites

Sport Science at the Exploratorium
www.exploratorium.edu/sports

Fuel Up to Play 60
www.fueluptoplay60.com

SPORTS MATH ANSWER KEY

210 + 105 = 315
306 + 130 – 113 = 323
174 + 163 – 105 = 232
306 – 174 – 113 = 19
210 x 113 = 23,730
163 x 130 = 21,190

CURRICULAR STANDARDS

An exploration of the *SPORTSZONE* exhibit can help students achieve learning objectives as called for by national standards.

Next Generation Science Standards

K, 3: Forces & Interactions
4: Energy
MS, HS: Forces & Interactions

Common Core English Language Arts

K-5: Reading Informational Text
6-12: Literacy in Science & Technical Subjects

National Science Education Standards

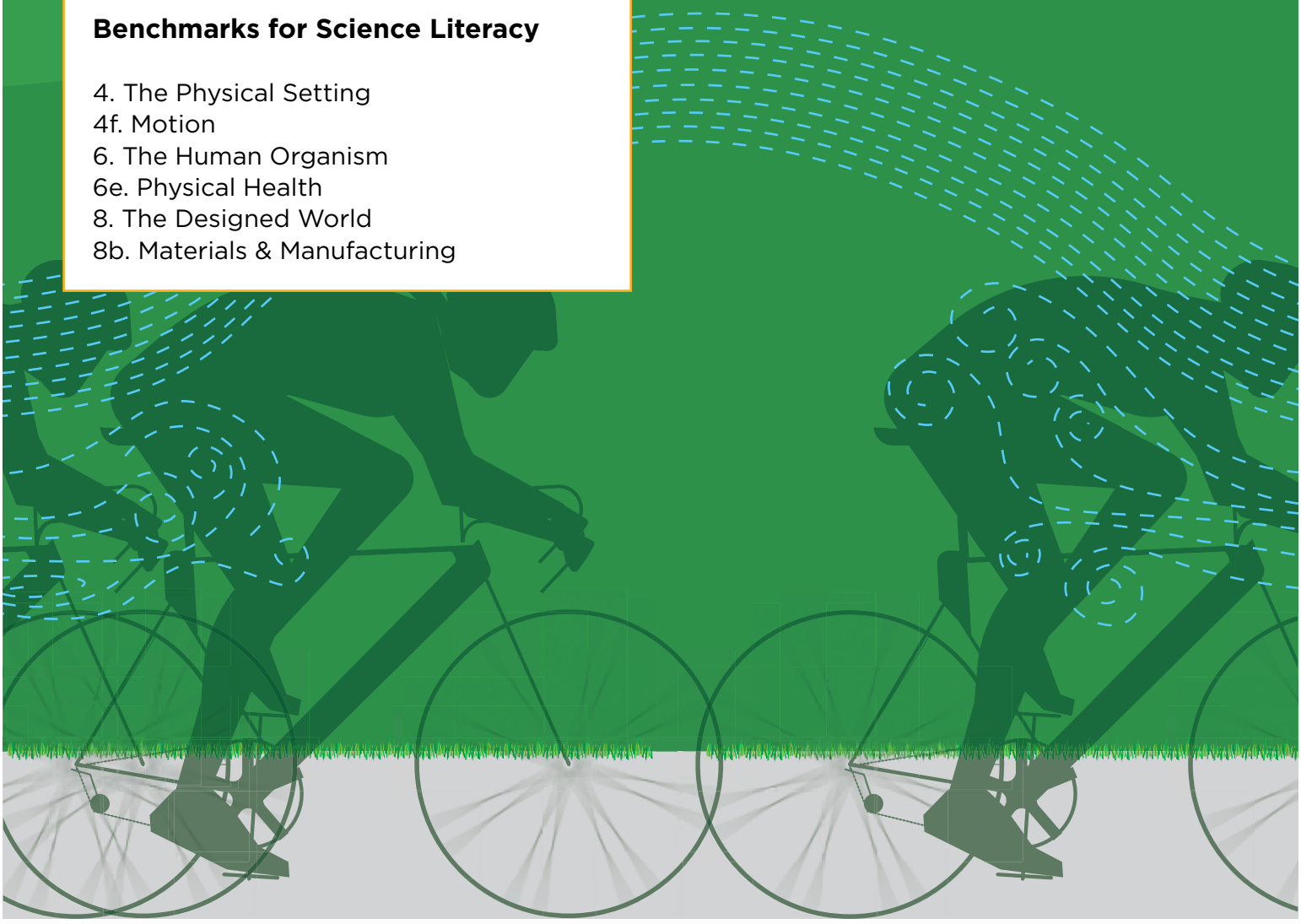
K-12 B: Physical Science
K-12 C: Life Science

Common Core Mathematics

K-12: Measurement & Data

Benchmarks for Science Literacy

4. The Physical Setting
4f. Motion
6. The Human Organism
6e. Physical Health
8. The Designed World
8b. Materials & Manufacturing



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