



Sports

GAC Pack

Here are some winning ways for you and your partner to exercise your mind and body as you "have a ball" with the Science of Sports.



A national collaboration to encourage family involvement in girls' science learning.

Developed for Girls at the Center, funded in part by the National Science Foundation.
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CREATE YOUR OWN SPORT

The way a sport is played depends a lot on the characteristics of the ball and the other equipment that is used. When baseball was invented, the ball, the bat, and the mitt; design of the field; number of players; rules; and the object of the game were all worked out together. Imagine what it would be like if a baseball was like a beach ball and the bat was like a Ping-Pong paddle? How might the field, the object of the game and the rules be different?

Try this activity with your partner. Bring your new sport with you to the next Discovery Day and receive a prize. Maybe your sport will be in the Olympics someday!

What to do:

1. Write each of the items in columns **A**, **B**, **C**, and **D** on separate pieces of paper.
2. Place the papers from each column upside down in separate piles.
3. Mix up the papers within each pile.
4. Choose one paper from each pile.
5. Invent a sport that uses all the items you picked.
6. State the object of the game, how many players are on a team, the rules of play, how points are scored, etc.



A
tennis ball
bowling ball
Ping-Pong ball
football
golf ball
basketball

B
baseball bat
tennis racket
croquet mallet
golf club
pool cue
Ping-Pong paddle

C
basketball hoop
volleyball net
soccer goal
bowling pins
football goalpost
golf hole

D
baseball diamond
tennis court
football field
golf course
bowling alley
basketball court

On Your Mark, Get Set, Throw!



Practice being a **biomechanist**, a sports scientist who studies how a body moves, by testing different ways to throw a beanbag.

What to do:

- ◆ Make a beanbag by filling an old, clean sock with one cup of uncooked (dry) beans or rice. Tie a tight knot in the sock, then cut off the extra piece at the top about one inch from the knot.
- ◆ Take turns with your partner throwing the beanbag as far as you can. Use each of the five techniques described below.
- ◆ Measure the distance of each throw and record the figure on the Throw Chart on the other side of this card.

Throwing Techniques:

- Throw #1 Keep your upper arm glued to your side and move only your forearm (the part of your arm that is below your elbow).
- Throw #2 Use your whole arm to throw, but don't lift your legs or bend your knees.
- Throw #3 Use only your forearm, but bend your knees and/or lift your legs.
- Throw #4 Use your whole arm, but bend your knees and/or lift your legs.
- Throw #5 Move any part of your body.

Throw Chart

	Throw #1	Throw #2	Throw #3	Throw #4	Throw #5
Distance beanbag was thrown in feet					

Which technique resulted in the farthest throw? Which parts of your body are important to use when you want to throw far?

Throw Grid

Throwing Technique	1										
	2										
	3										
	4										
	5										
		6	8	10	12	14	16	18	20	22	24
		Distance Thrown (in feet)									

Partner Challenge

Graph the throwing technique against the distance the beanbag was thrown on the grid. What do you notice? Try out other movement combinations. What effect do these have on the distance the beanbag is thrown?

HOW SWEET IT IS

Sweet Spot Science

Why does the ball fly farther when you hit it on the sweet spot?

When your bat hits a ball, it vibrates. The vibrations move up and down the bat. When you hit the ball at a “sour” spot on the bat, some of the energy from swinging the bat goes into those vibrations. You might even feel a kind of stinging sensation in your hands. At **the sweet spot**, those vibrations run into each other and cancel each other out. So, where does all of the energy in your swing go?

Baseball players have come up with some wild and crazy strategies to hit those tricky pitches that come their way. But they all agree that hitting the ball with the “**sweet spot**” of the bat is the way to go. Why? Because the ball flies farther. Here’s how to find the sweet spot on a baseball bat.

You will need:

a baseball bat
a heavy spoon or hammer
masking tape

What to do:

1. Curl your fingers around the knob of the bat. Let the bat hang straight down.
2. Ask your adult partner to tap on the bat with the spoon or hammer, starting at the top, near the knob, and slowly moving down the bat.

3. The bat will vibrate between your fingertips. You’ll know you’ve found the sweet spot **when the vibrations almost stop**. (The sound of the taps change too.)
4. Use tape to mark and label where the sweet spot begins and ends.

Partner Challenge

Not all bats are the same. But are all sweet spots the same? Try some experiments with your partner to answer these questions and sweeten up your game.

Is the sweet spot in just about the same place on every bat? Do longer bats have longer sweet spots? Do lighter bats have shorter sweet spots? Is there a difference in sweet spots between a wooden and metal bat?

BATTER UP

Most athletes must be strong, fast, and have quick reflexes (**reaction time**). Did you know that a baseball batter has about **one-tenth of a second** to decide whether or not to swing at a 90-mile-per-hour fast ball? Try this experiment with your partner to test your reflexes. How fast are your reactions?

What to do:

1. Find the **Batter Up** card and cut out the bat.
2. Ask your adult partner to hold the bat at the top.
3. Place your thumb and forefinger on either side of the bottom of the bat near the “start here” point. (Your fingers should be about 2 inches apart, not touching the bat.)
4. When your partner drops the bat, catch it between your fingers as fast as you can.

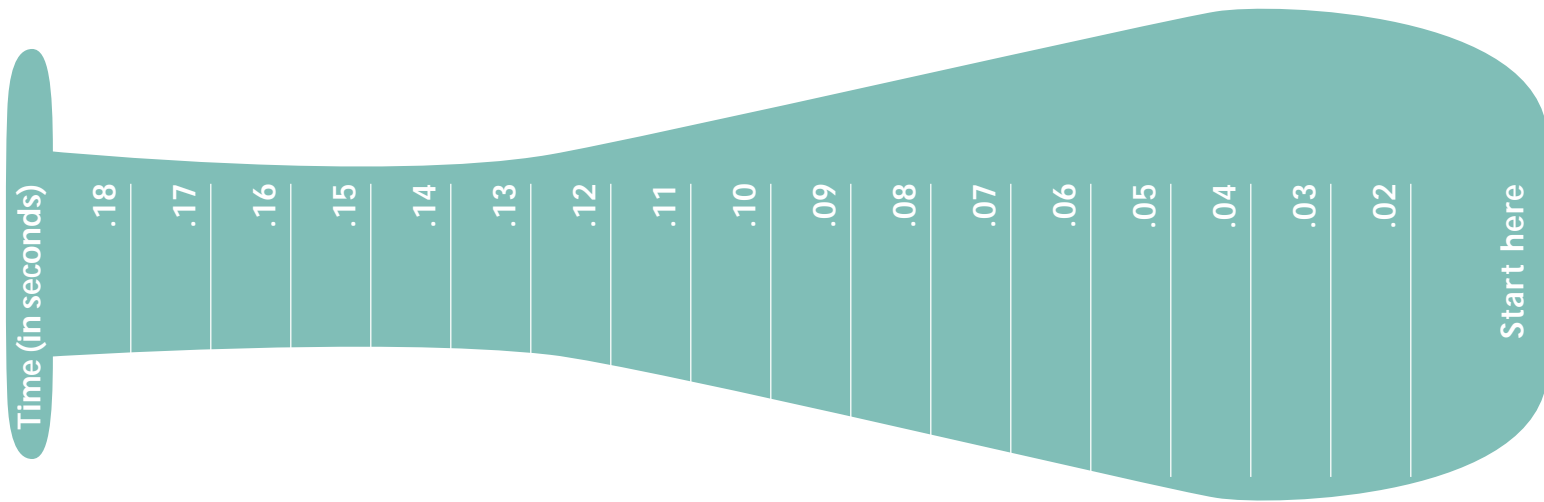
Partner Challenge

Athletes use many different clues to anticipate and predict what will happen in their sport. What clues did you and your partner use to figure out when the bat would be dropped? Can you make changes in the experiment that will eliminate the clues? What happens to reaction time?

5. Read your reaction time on the card (the number nearest your finger).
6. Perform this test 10 times. Record your time for each try and then calculate your average reaction time. (Add the 10 reaction times and divide the sum by 10.)

Is your reaction time short enough for you to react to a 90-mile-per-hour fast ball? Did your reaction time improve with practice? What about your partner’s reaction time?

BATTER UP



This GAC Pack has been made possible through generous support from:

- National Science Foundation
- Lockheed Martin Corporation
- General Motors Foundation
- The UPS Foundation
- The St. Paul Companies
- Merck Company Foundation and Crum & Forster Insurance
- The William M. King Charitable Trust
- Minnesota Mining and Manufacturing Foundation, Inc. (3M)
- The Valentine Foundation
- First Union
- The Boeing Company
- Alcoa Foundation
- Bank of America
- George and Frances Armour Foundation
- Best Buy Children's Foundation

GETTING FIT

Partner Challenge

Which fitness component would you each like to develop? You'll need to find a way to measure your present level of fitness in each of the categories. (Hint: see Target Heart Rate on the other side of this card.) Then try one of the sports for at least one month and observe the effect on your level of fitness.

Muscular **strength, endurance, flexibility,** and **cardiovascular endurance** are important components of fitness. Different kinds of exercise develop different components. Check out the activities below and see how they affect each of the fitness categories. (3 ♥'s are the best!)

Activity	Strength	Endurance	Flexibility	Cardiovascular
Aerobics	♥♥	♥♥♥	♥♥	♥♥♥
Basketball	♥♥	♥♥♥	♥	♥♥♥
Biking	♥♥	♥♥♥	♥	♥♥♥
Gymnastics	♥♥♥	♥♥	♥♥♥	♥
Jogging	♥♥	♥♥♥	♥	♥♥♥
Jump roping	♥	♥♥♥	♥	♥♥♥
Roller skating	♥	♥♥	♥	♥♥
Soccer	♥♥	♥♥♥	♥	♥♥♥
Swimming	♥♥	♥♥♥	♥	♥♥♥
Walking	♥	♥♥	♥	♥♥

Find Your Target Heart Rate

Your **target heart rate (THR)** tells you the rate (number of beats per minute) at which your heart should beat when you are exercising. Your target heart rate should fall in a range that includes a lower limit and an upper limit. Complete the chart to determine your THR.

Here's how:

1. Subtract your age from 220.
2. Multiply that number by 60% (.60) to get your THR lower limit.
3. Multiply that same number by 80% (.80) to get your THR upper limit.

Your THR Lower Limit

$$(220 - \underline{\quad}) \times .60 = \underline{\quad} \text{ beats/minute}$$

Your age

Your THR Upper Limit

$$(220 - \underline{\quad}) \times .80 = \underline{\quad} \text{ beats/minute}$$

Your age

Your Partner's THR Lower Limit

$$(220 - \underline{\quad}) \times .60 = \underline{\quad} \text{ beats/minute}$$

Her age

Your Partner's THR Upper Limit

$$(220 - \underline{\quad}) \times .80 = \underline{\quad} \text{ beats/minute}$$

Her age

When you exercise (run, do aerobics, or jump rope), you want your pulse rate to fall between the low and high ends of your THR range.

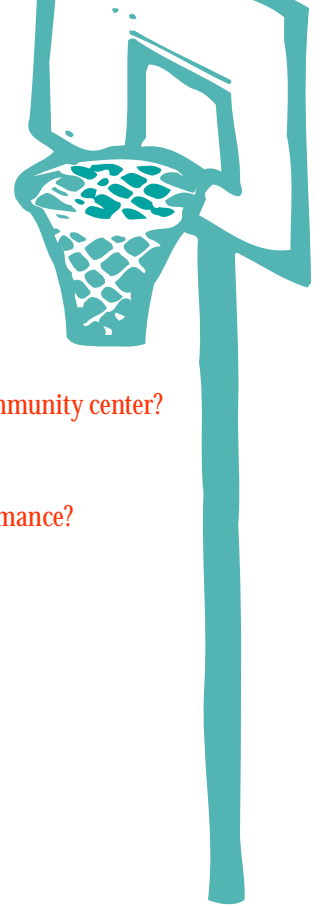


Partner Challenge

- ◆ Try some of the ♥♥♥ activities on the other side of this card for 3-5 minutes.
- ◆ Take your pulse at the inside of your wrist with your index and middle fingers for 20 seconds.
- ◆ Count how many times your heart beats. Multiply that number by three to get beats per minute.

Does that number fall within your THR range? If it is below the range then you may need to be exercising harder. If the number is above your range, then it may be time to slow down.

SCIENCE IN SPORTS



Be a sports scientist! Here are some activities to try with your partner that involve skills a scientist uses and questions she asks.

Strategize ways to improve your time or performance in a sport.

Predict what a ball will do as you golf, bowl, or play tennis.

Observe a professional team in action. **How is it different** from one at school or a community center?

Record scores for a new sport, like golf, tennis, or bowling.

Test different types of balls when playing your favorite ball game. **What happens?**

Sample different clothing and equipment in a sport. **What is the effect** on your performance?



SPORTS SCIENCE

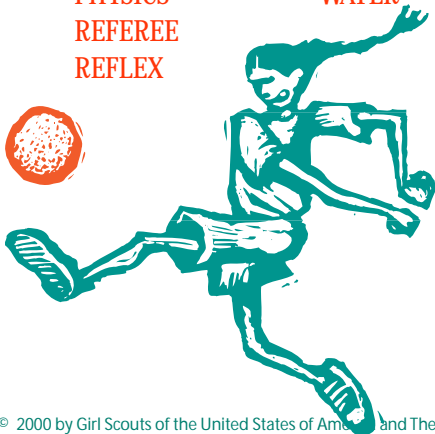
Some basic science principles are at work behind many successful sports actions including a curve ball, free throw, kick, and flip.

Look for sports and science in the **Word Find** below.

AEROBICS
ATHLETE
BALANCE
BASEBALL
CURVE
ENERGY
EXERCISE

GOLF
GRAVITY
GYMNASTICS
HEART
JUMP
OLYMPICS
PHYSICS
REFEREE
REFLEX

RUN
SCORE
SOCCER
SOFTBALL
TENNIS
TRACK
WATER



BOOKS about SPORTS



Girl Scout Program Links

For Brownie Girl Scouts:

Experience the thrill of playing sports and being physically active. Run and jump your way through the **Ready, Set, Go!** Try It patch.

For Junior Girl Scouts:

Stay fit through exercise and body movement with the **Health and Fitness** and **Dance** badges. Try a sports workout with the **Sports** and **Sports Sampler** badges.

For Cadette and Senior Girl Scouts:

Expand your health knowledge with the **Women's Health** interest project patch. Sport new skills and knowledge with any of the **Sports and Recreation** projects.



Wilma Unlimited: How Wilma Rudolf Became the World's Fastest Woman, by Kathleen Krull. Harcourt Brace & Company, 1992.

Once told she would never walk again, Wilma became an Olympic athlete. (Early to middle readers.)

Bounce Back, by Sheryl Swoopes with Greg Brown. Taylor Publishing, 1996. Learn about a seven-year-old's dream that led to a career in sports. (Middle readers and up.)

The Sporting Life – Discover the Unexpected Science Behind Your Favorite Sports and Games, by Susan Davis and Sally Stephens with the Exploratorium. Henry Holt and Company, 1997. (Middle readers and up.)

In These Girls, Hope Is a Muscle, by Madeleine Blais. Warner Books, 1996. She Shoots! She Scores! Experience the excitement of girls high school basketball as the Hurricanes of Amherst, Massachusetts, fight for success and respect. (Middle to advanced readers.)

G.A.C. SNACK

G.A.C. Energy Mix



- 1/2 cup of dry roasted peanuts (unsalted)
- 1/2 cup of raisins
- 1/2 cup of your favorite dry cereal (oat, rice, corn, wheat, or a mixture)
- 1/2 cup sunflower seeds (without the shell)
- 1/2 cup carob or semi-sweet chocolate morsels

Put everything into a large, zip-lock plastic bag. Seal the bag, shake it, and you're ready to go!

Athletes know it is important to eat a balanced diet, but when they need to boost their energy they eat **carbohydrates**. Carbohydrates are sugars and starches that provide the body with the energy it needs to grow, heal, play, and exercise. Carbohydrates are found in fruits, vegetables, and grains. Make your own high energy snack to share with your G.A.C. partner the next time you need a quick pick-me-up.



HOT LINKS

Be a sports scientist! Explore the science of baseball, cycling, hockey, skateboarding and bouncing balls at <http://www.exploratorium.edu/sports/index.html>

Want to eat right for sports? Check out <http://kidshealth.org/kid/food/sports.html> for great tips on sports nutrition.

Go for the Gold! Find out all about science, technology, and the **2000 Olympic Games** at <http://www.olympics.com/eng/kids/techno/zone/>

What's a healthy lifestyle? Visit <http://www.bennygoodsport.com>, a place for kids to have fun and learn how to be healthy.

Learn the facts about women and sports. **Myth Busting: What Every Female Athlete Should Know** includes information about Title IX and the Amateur Sport Act. <http://www.lifetimetv.com/WoSport/LIBRARY/INFO/myth.htm>

GirlSports 2000



GirlSports 2000 is a series of sports and fitness events organized by Girl Scouts throughout the country and overseas. This project helps girls get in shape and stay fit as they countdown the days in 2000. Just imagine — somewhere in the world an event will take place each day in 2000. **GirlSports** is about teamwork, friendship, exercise, healthy eating, and **fun!**

In 1999, more than 125,000 Girl Scouts of all ages organized and enjoyed health and fitness activities ranging from volleyball and Double Dutch to wall-climbing and in-line skating. We believe it was the world's largest-ever series of sporting events for girls!

To find out more about *GirlSports 2000* log on to the Girl Scouts **Just for Girls** web site at <http://www.girlscouts.org/girls>, e-mail a *GirlSports 2000* representative at girlsports2000@octagon.com, or call 770-984-5132 or 1-877-GIRLS2K (1-877-447-5725).

Sports + Science = Careers



From helping people make the right moves, to designing a ball that bounces higher, sports science offers a wide range of career opportunities. Can you and your partner match the description of the job to the career? Check out your answers below, then choose a career to investigate.



Career

1. Design engineer
2. Materials scientist
3. Sports biomechanist
4. Athletic trainer
5. Sports nutritionist
6. Sports psychologist
7. Sports doctor
8. Aerobics instructor
9. Sports statistician
10. Physical education teacher



Job Description

- A. Plans a good diet for athletes
- B. Designs equipment that is safe and appropriate for a sport
- C. Helps you use your head to win
- D. Designs and leads an exercise routine that's good for your heart
- E. Collects, analyzes, and interprets numerical sports data
- F. Studies how your body moves, then designs a new way of moving that's right for you
- G. Provides systematic instruction in sports, exercise, and hygiene as part of a school or college program
- H. Helps protect muscles and ligaments from injury
- I. Experiments with the properties of materials to make better clothing and equipment
- J. Helps heal athletic injuries

Answers: Please note that some of the tasks might be performed by more than one career area. 1B;2I;3E;4H;5A;6C;7I;8D;9E;10G



WOMEN IN SCIENCE

Meet Dr. Colleen Hacker, coach, writer, consultant, professor, and sports psychologist. Colleen teaches sports psychology and is the sport psychologist for the U.S. Women's National Soccer Team. She helps the players build concentration skills, boost confidence, and deal with the pressures of competition.

Although always passionate about playing sports, Colleen was also fascinated by the emotional aspect of sports—what it is like to achieve; to fall short; and to succeed despite severe hardships. Left on her own as a young teen, she worked hard, believed in herself, and went on to earn a doctorate in exercise and movement science.

Colleen is the first woman head coach to lead a collegiate soccer team to a national title; her win total ranks her first among all coaches in her field; and she is the first woman recipient of the soccer coaches' merit award for her exemplary behavior in relationships with other coaches, soccer officials, and players.

What is the secret to her success? As she tells girls in *Cool Careers for Girls in Sports*, “believe in the possibilities of your own greatness and be prepared to do the work that is necessary...to do great things.”

What is a sports psychologist?

The mind is as important as the body in sports. A sports psychologist trains athletes to use their minds to improve their performance. From setting goals, to overcoming performance anxiety, to building self-confidence, to learning concentration and relaxation skills, sports psychologists teach athletes to understand the power that is inside of them.

Sports psychologists work with teams as well as individual athletes. Building team unity, establishing trust and effective communication, and developing problem-solving skills to help handle stressful situations, are some of the valuable ways sports psychologists help winning teams achieve their goals.