



present a Study Guide

Objects in ***Motion!***

juggling + math + science = fun

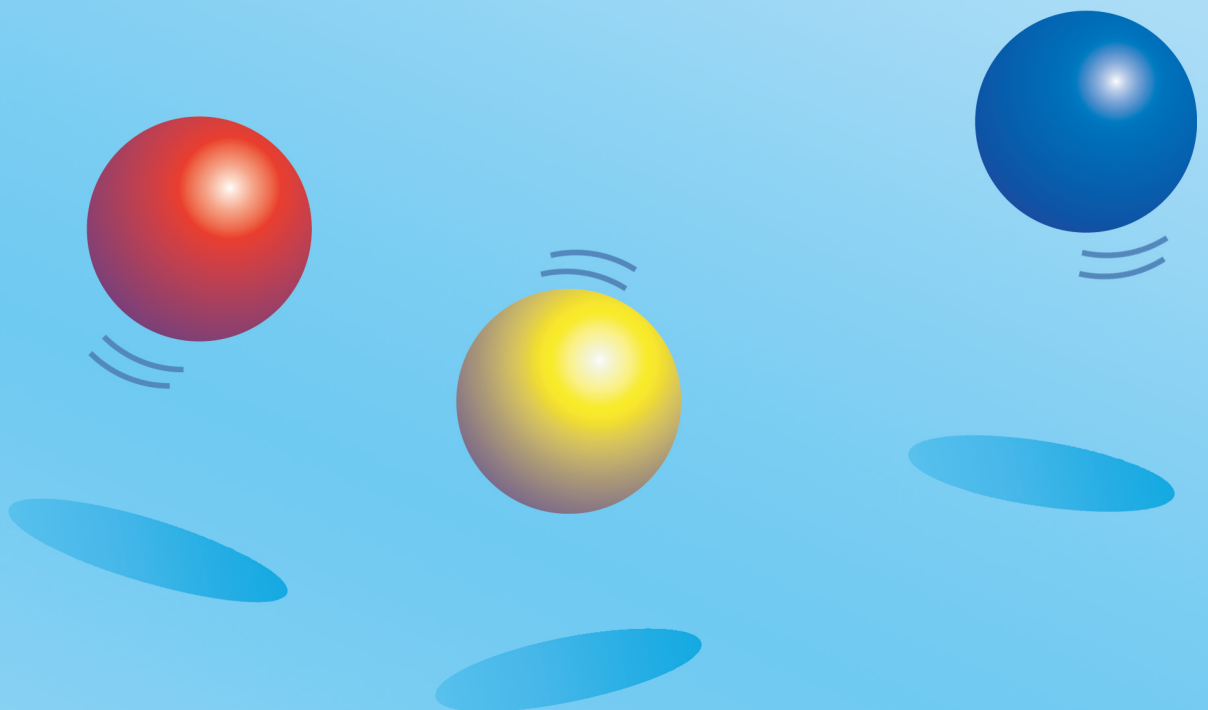


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ABOUT THIS STUDY GUIDE

The Gizmo Guys have performed and taught at all levels; elementary school, middle school, high school, university, adult and specialized schools and national circus schools around the world.

This study guide is designed for grades K-5. It includes information and worksheets to serve as a classroom extension to the performance and a curriculum tie-in. The material can be used before and after the performance.

The performance and study guide both contain elements which link juggling, math and science. Other obvious links with curriculum include theater, physical education, music and teamwork/cooperation.

Juggling is a wonderful and simple activity leading to endless possibilities. The basics are not as difficult as they may seem. Compare it to music. You could peck out a simple tune on a piano with one or two fingers fairly quickly (probably within minutes). But you could also spend a lifetime of enjoyment with the piano.

Here's a list of additional reasons to choose juggling for a school activity:

- It's cheap and materials fit in a small space.
Three old tennis (or other) balls are all you need to start.
- You don't need a special facility.
The gym, cafeteria, classroom and outside all work well.
- It emphasizes the importance of practice, cooperation and teamwork.
It's a great solo or group activity.
- Progress is easily charted.
It's a great inspiration and natural math connection.
- It improves hand-eye coordination, which is a necessary step in the development of any athlete, artist or musician.
- Simply learning the basics makes most kids (and adults) feel special.
Juggling is still a rather seldom seen activity. Learning to juggle often leads kids to participate in school plays and talent shows.

Many highly accomplished mathematicians and scientists are also jugglers. Even an astronaut has juggled during his limited time in space.

Let's see where your kids take it!

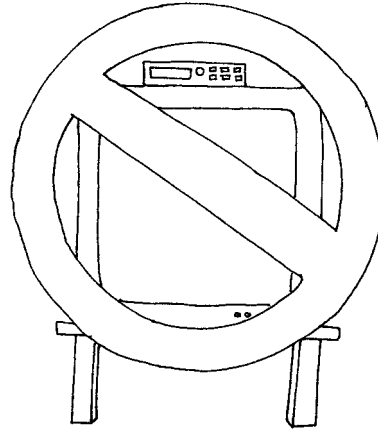
LET YOUR STUDENTS KNOW . . .

- **Live performance is not TV.**

Theater goers will not be able to switch channels or turn the show on or off.

- **Theater is a shared experience.**

The performers are just as aware of the audience as the audience is of them. The energy in the hall can be felt by everyone.



- **Students too, can well understand what the performers are experiencing.**

Ask them to recall how they feel when they are up in front of the class giving a report, giving a music recital, or participating in sports in front of a lot of spectators.

- **Performance can be powerful.**

Like music, painting or a good book, live performance can affect all of us emotionally. There is no right or wrong way to see the performance. Everyone experiences it differently and is affected differently. Let yourself enjoy the show.

- **The Gizmo Guys**

The Gizmo Guys do not present a typical theater performance. It is not a story acted out on stage with costumes and scenery. It is more like a music or dance performance, in that it is a collection and variety of pieces with a common thread...in this case, juggling.

MEET THE GIZMO GUYS

The Gizmo Guys are Allan Jacobs and Barrett Felker.

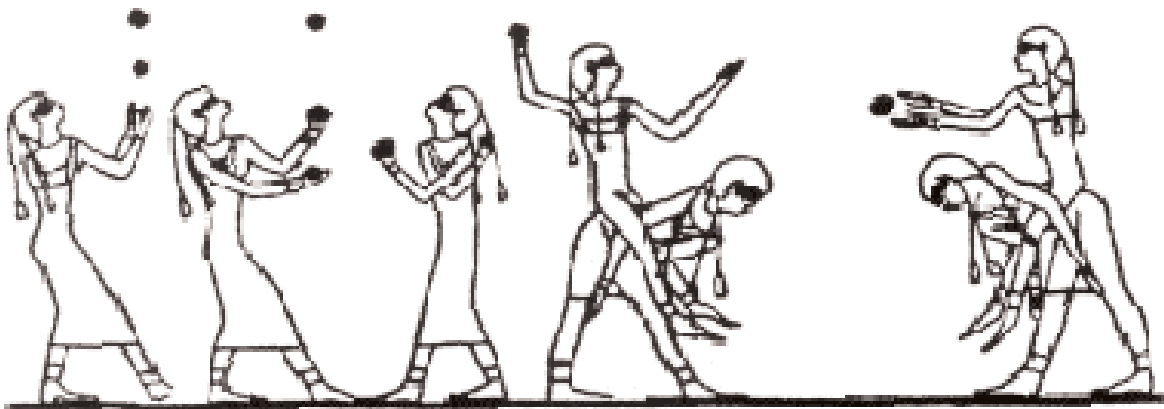
Allan and Barrett had been entertaining separately for ten years when, in 1987, they decided to combine their juggling abilities and form *The Gizmo Guys*. They have appeared all over the world combining original routines, comedic dialogue and their world class juggling skills.

Both have won individual and team championships in the International Jugglers' Association (IJA) competitions and have taught at French and Canadian National Circus Schools. *The Gizmo Guys* have appeared on many television shows and been to six of the seven continents. Allan was also technical consultant for *The Complete Juggler* and taught at Ringling Bros. and Barnum & Bailey's Clown College. Barrett also toured for three years with the Harlem Globetrotters.



Get ready to be amused and amazed as *The Gizmo Guys* entertain you.

HISTORY OF JUGGLING



Above is a picture of the earliest known depiction of juggling. Located in Egypt, it is from the 15th Beni Hassan tomb. There are 150 tombs at this location. This is the tomb of an unknown prince from the Middle Kingdom period of about 1994 to 1781 B.C. That is about 4000 years ago.

No one knows for sure where juggling started, but there is evidence that juggling has been going on for a very long time in many different parts of the world.

In some cultures juggling may have been part of religious type rituals, while in others it may have been more for sport, entertainment or recreation.

In the middle ages many kings had court jesters who, among other things, did some juggling. And of course jugglers have been seen along with clowns, acrobats and animal acts in circuses for a long time.

Jugglers were quite common and popular during the vaudeville era. Vaudeville (live variety theater) lasted from about 1880-1930 in the U.S. and roughly the same time period in Europe. It died out when movies, radio and television came along. The famous movie actor W.C. Fields started out as a juggler in vaudeville.

In 1947 the International Jugglers Association was founded and today there are thousands of jugglers worldwide.

MATCH THESE JUGGLING PROPS WITH THEIR NAMES

Balls _____

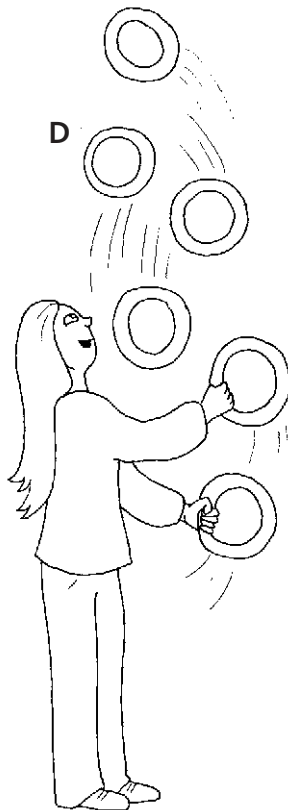
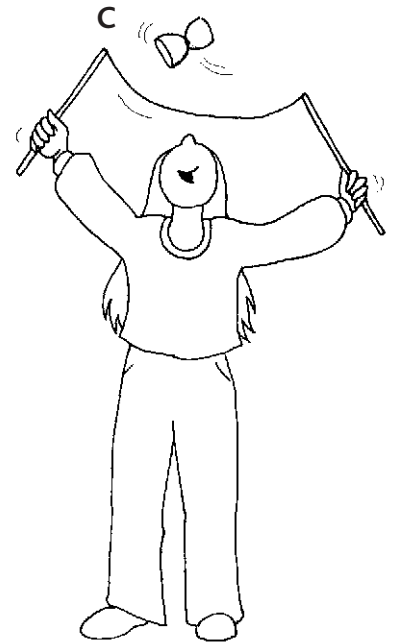
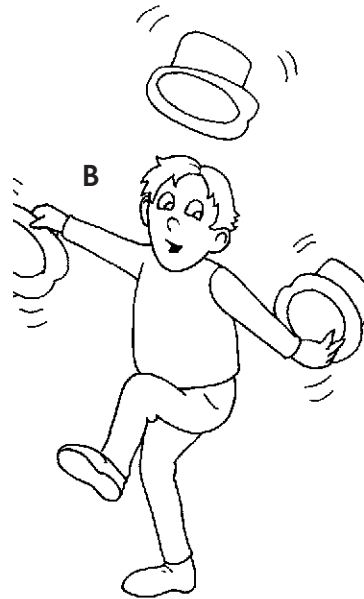
Rings _____

Hats _____

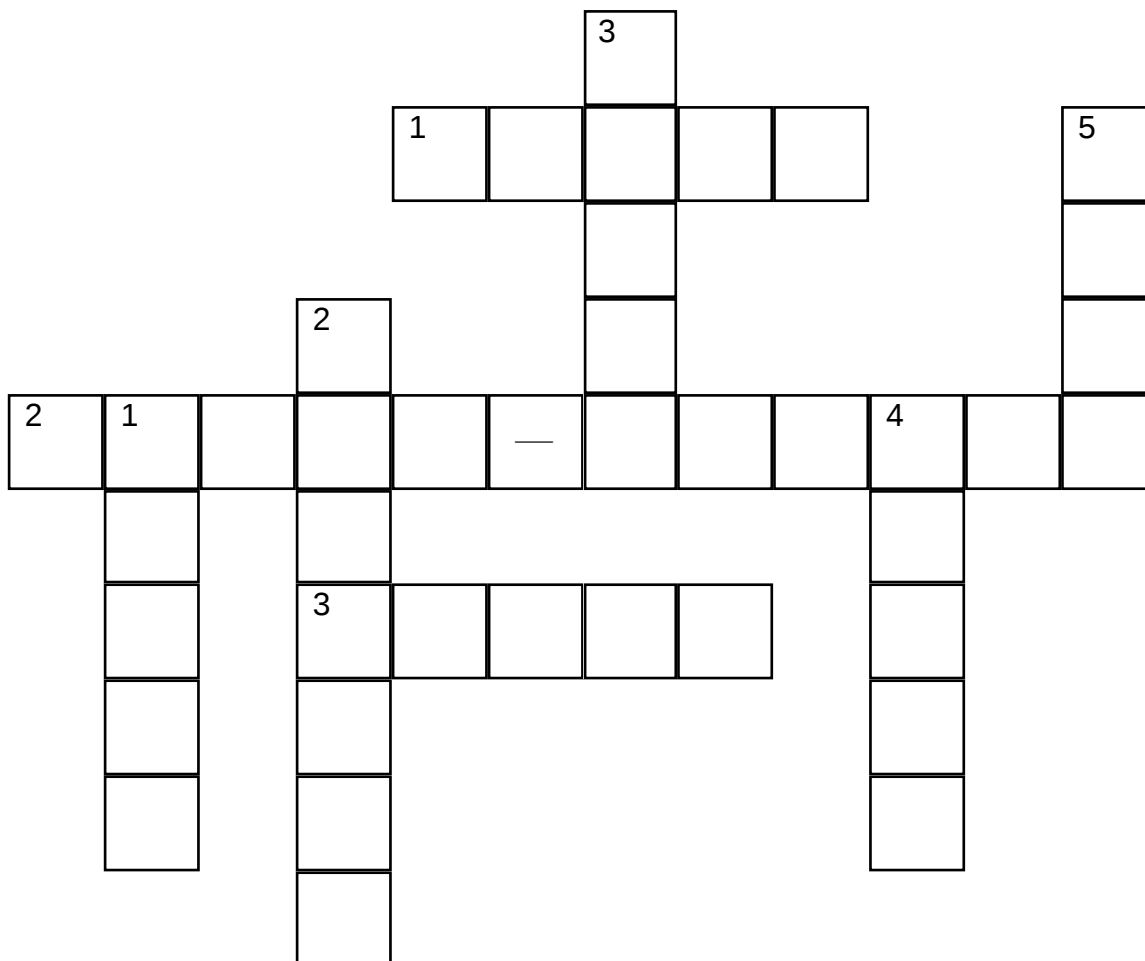
Diabolo _____

Devil
Sticks _____

Clubs _____



A CROSSWORD PUZZLE ABOUT JUGGLING



Across

- 1 Devil-Sticks and Diabolos originated in what country?
- 2 One large stick manipulated by two smaller sticks.
- 3 The most common of all juggling props

Down

- 1 Evidence that juggling occurred 4,000 years ago has been found in a drawing on the walls of a tomb in _ _ _ _ _ .
- 2 Spinning this prop makes it stable and more easily balanced on string.
- 3 These props look like hoops.
- 4 These look like bowling pins, but were originally made from items that were used as exercise equipment.
- 5 This juggling prop is also a common every day item.

FOLLOW THE TRAIL . . . A NEW JUGGLING PROP

Juggling clubs look like bowling pins to many people. But they originated from Indian swinging clubs so they are known as juggling clubs not juggling pins.

Here is the story: Many years ago, a form of exercise was developed using wooden clubs of different size, shape and weight. These sometimes very heavy clubs were swung in many variations. This form of exercise was developed in India.

British military personnel stationed in India made the club swinging a popular form of exercise by teaching it when they went back to England.

American physical educators studying and working in England also appreciated the benefits of club swinging and started teaching it when they returned to the United States.

Some jugglers in a YMCA liked the shape of the swinging clubs for juggling. They hollowed out the clubs to make them lighter and better suited for juggling. This happened in Massachusetts.

- Can you find India, England, the United States and Massachusetts on the world map below?



WHAT IS MATHEMATICS?

When asked this question most people would respond with “the study of numbers” or the “science of numbers”.

Up until 500 BC that was true.

Today the definition of mathematics has a much broader meaning.

Most mathematicians now agree that math is “the science of patterns”.

Mathematicians study all sorts of patterns:

- patterns of numbers
- patterns of shape
- patterns of motion
- patterns of behavior, etc.

These patterns can be:

- real or imagined
- visual or mental
- stationary or moving
- useful or just for fun

Observing and studying patterns is an important step for any student of math and science.

Jugglers are also constantly looking for patterns. They may learn patterns simply because they look and feel good. But those patterns can also be used in many other activities and fields of study.

PATTERNS THAT PEOPLE LOOK FOR

1) Draw a line to match the person with the type of pattern they look for.

<u>PERSON</u>	<u>PATTERN</u>
Musician	Behavior
Meteorologist	Traffic
Sociologist	Rhythmic
City Planner	Sales
Merchant	Study
Student	Weather

2) Study the number patterns below and fill in the blank.

- A. 0, 3, 6, 9, 12, 15, _____
- B. 2, 4, 8, 16, 32, 64, _____
- C. 1, 2, 3, 5, 8, 13, _____
- D. 1, 4, 9, 16, 25, 36, _____

3) What patterns have you observed or used today?

MAKE A GRAPH

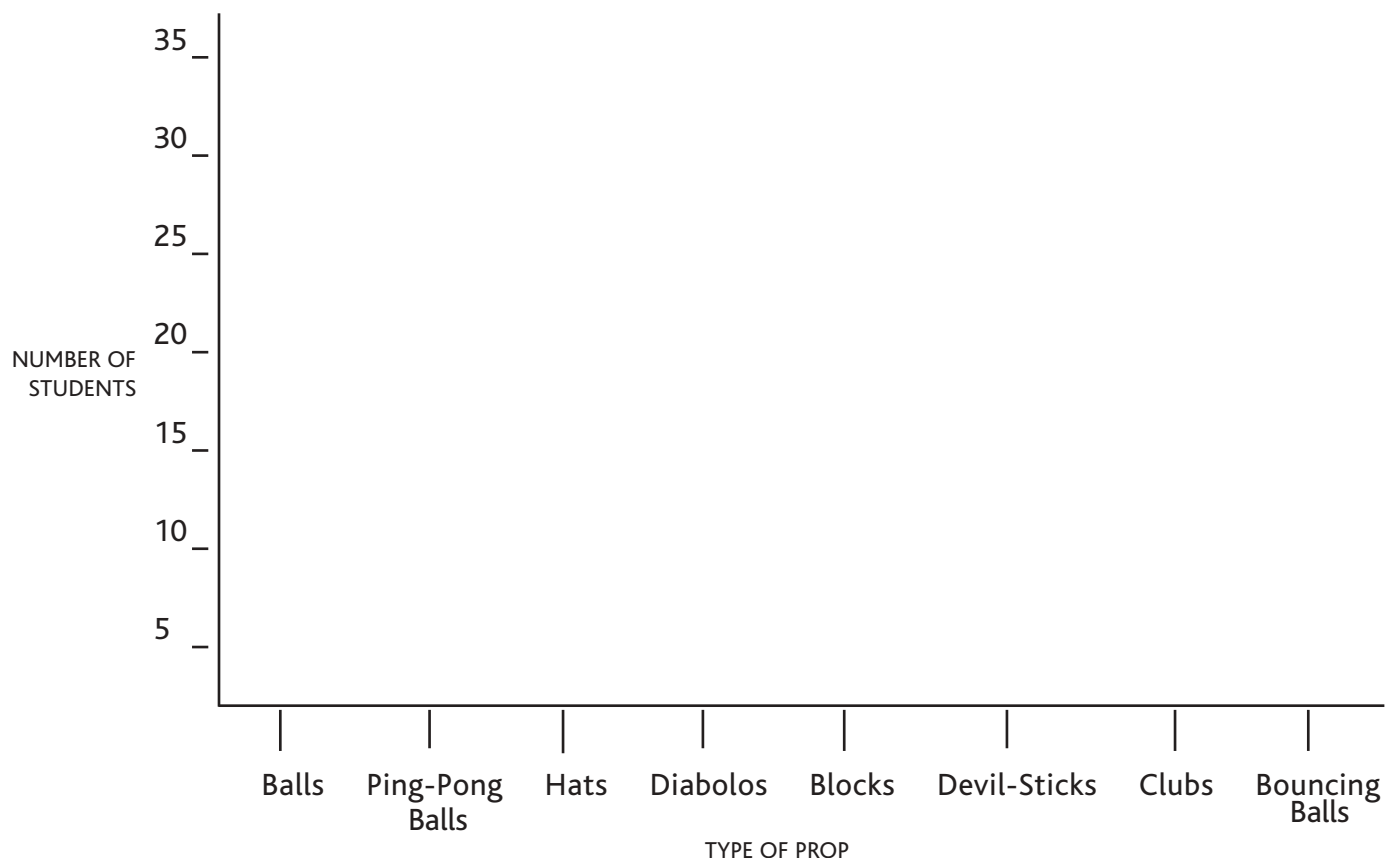
Ask everyone this question: **What type of juggling prop did you enjoy the most?**

Collect and organize the responses by filling in the items below.

This is your data.

Balls	was the favorite for how many people?	_____
Diabolo	was the favorite for how many people?	_____
Devil-Sticks	was the favorite for how many people?	_____
Ping-pong balls . .	was the favorite for how many people?	_____
Blocks	was the favorite for how many people?	_____
Hats	was the favorite for how many people?	_____
Clubs	was the favorite for how many people?	_____
Bouncing balls . .	was the favorite for how many people?	_____

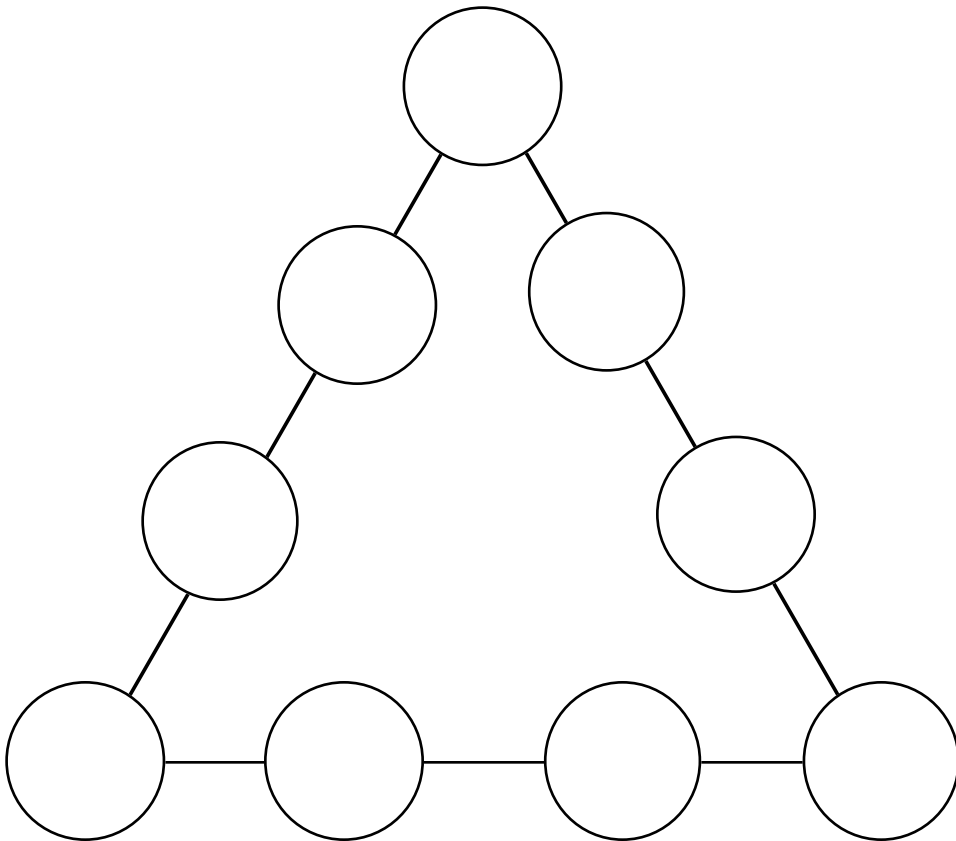
Use the graph below to show the results of your survey of your class' favorite props.



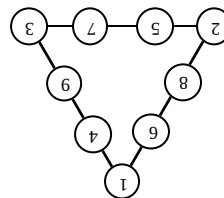
NUMBER JUGGLING

- Use each of the numbers from 1 through 9.
- Put a different number in each circle.
- Make the sum of each side of the triangle add up to 17.

(Hint: Put the 1 in one of the corners)



ANSWER:



GRAVITY

We are all being pulled to the center of the earth by the invisible force called gravity. Gravity is why pencils and papers don't fly off our desk. It's also why we don't float around.

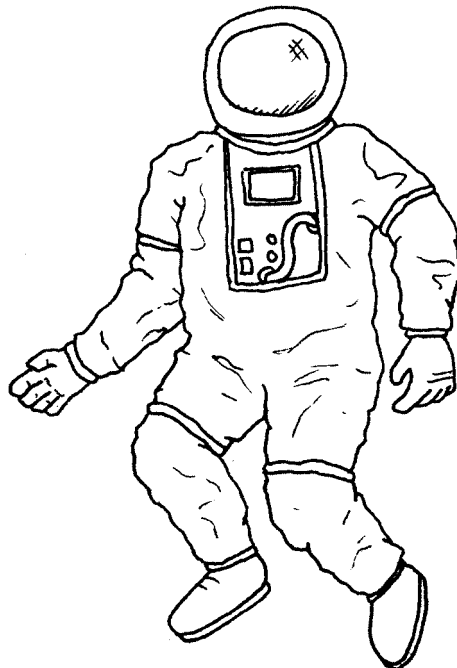
When we weigh something we are measuring the force with which gravity is pulling that object down.

Every object has some gravitational pull. Objects with the greatest mass (weight) have the greatest gravitational pull. So, mostly we think of just the planets and stars as having gravitational pull. Bigger planets have greater mass and more gravitational pull than smaller planets.

Our moon is much smaller and has much less gravitational pull than the earth. Astronauts on the moon can jump much higher because the gravity on the moon is not as strong as it is on earth.

Jugglers need to be aware of gravity when throwing, catching and balancing objects.

To balance an object one must be under that object's center of gravity.



ISAAC NEWTON

Isaac Newton was born in England in 1642.

There is a famous story about Newton that states that one day he was sitting by an apple tree and noticed an apple fall to the ground. This got him thinking about gravity.

Isaac Newton did a lot of experimentation and found that gravity was responsible for:

- the motion of the planets around the sun
- the motion of the moon around the earth and
- the motion of the ocean tides

He also found that the more massive an object, the more gravitational pull it has.

In his book *Principia* he presents many of his findings. Among the many, are the Three Laws of Motion, which established the beginning of the study of physics.



Sir Isaac Newton

BE A SCIENTIST...USE THE SCIENTIFIC METHOD

- Observe
- Guess
- Check

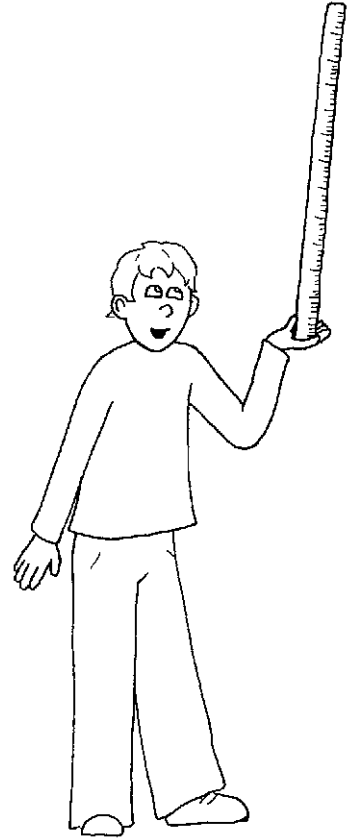
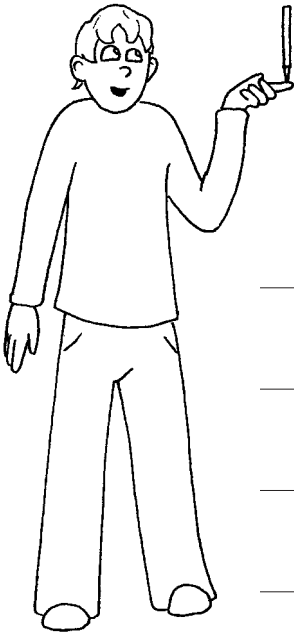
Which would be easier to balance:

—a short object (like a pencil)?

OR

—a long object (like a yardstick) ?

Why?



Which would be easier to balance, a top when it is spinning or a top when it is not spinning? Why?

GALILEO GALILEI?

Galileo was born in Pisa, Italy in 1564. He discovered he had a talent for mathematics and became an astronomer and physicist.

He designed a variety of scientific instruments and improved the telescope, though he did not invent it. He used the telescope to study the moon and planets.

He lived at a time when most people thought that the sun and all planets revolved around the earth.

But he agreed with Nicolaus Copernicus, that all planets, including the earth, revolved around the sun. His observations proved him right.

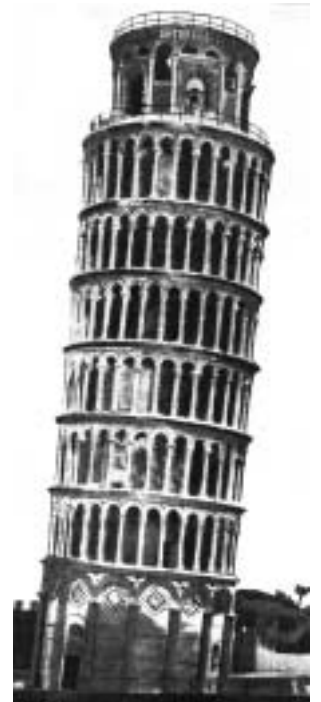
When Galileo wrote about his discoveries, the church leaders punished him because they believed everything revolved around the Earth.

Amazingly, it took more than 350 years (until 1983) for the church to admit they were wrong to treat Galileo the way they did.

He conducted many experiments during his lifetime. His most famous experiment proved that objects with different masses fall at the same speed. He dropped balls of different weights from the top of the Leaning Tower of Pisa. They all fell at the same speed.



Galileo Galilei



Leaning Tower of Pisa

TEST GALILEO'S DISCOVERY

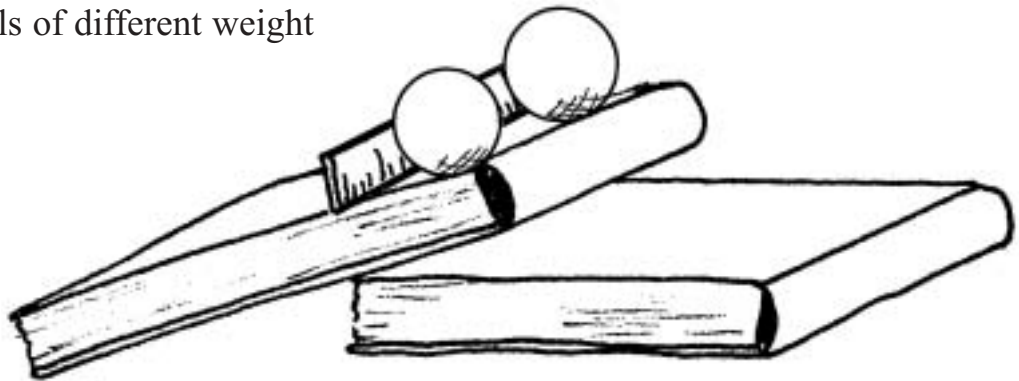
Remember to use the scientific method:

- **Observe**
- **Guess**
- **Check**

What you need:

- Two books
- One ruler
- Two balls of different weight

Set up like this:



What to do:

- Use one book as a ramp.
- Use a second book to lift the ramp into position.
- Use a ruler as a starting gate, so the balls start at the same time.
- Lift the ruler and let the two balls roll down the ramp.

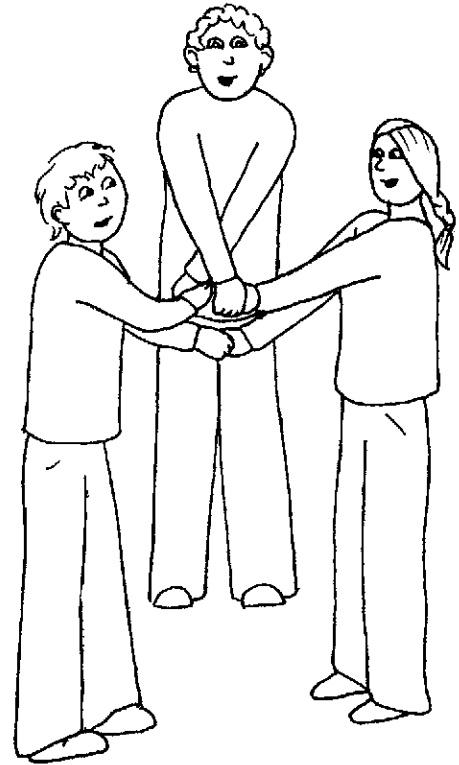
Does one ball fall faster than the other? _____

Your observations:

COOPERATION AND TEAMWORK

Human Knot

- Students stand in a circle
- Everyone puts in their right hand and grabs hold of one other person's right hand.
- Repeat the same thing with the left hand, making sure to grab another person's hand.
- Group now tries to untangle itself without letting go.
- Successfully complete this with cooperation and communication.



Cooperative Drawing

- Students sit in a circle.
- Each has blank paper on a clipboard and a marker.
- Teacher lets everyone know that everyone contributes to each drawing.
- Teacher gives everyone 1 minute to start a drawing.
- At the end of a minute everyone passes the drawing to their right.
- Keep repeating with all students given the same time to draw before passing.
- Share the drawings for all to see.

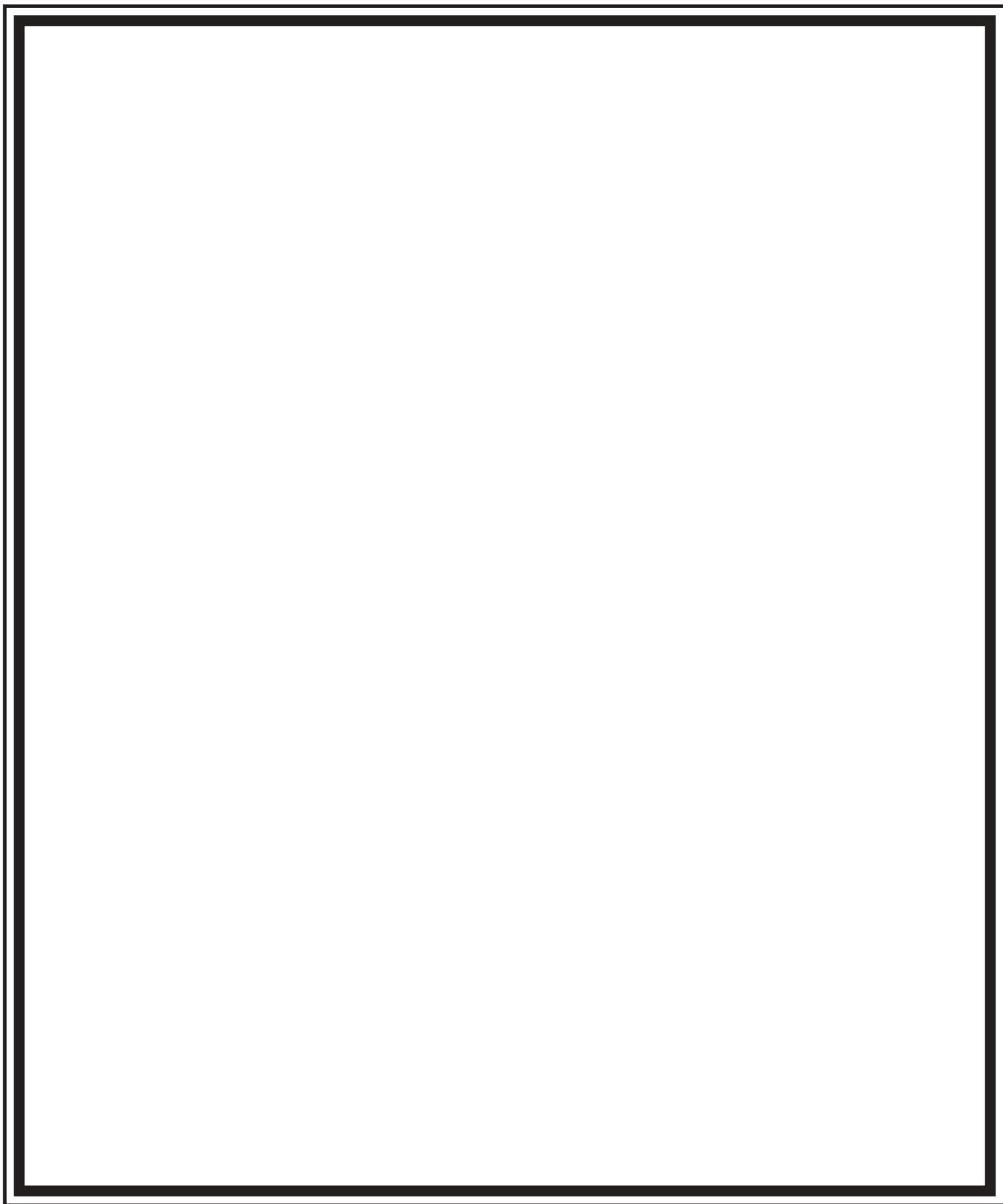
Your observations:

WRITE A LETTER

Dear Gizmo Guys,

[illegible]

MAKE A DRAWING



ONLINE RESOURCES

Juggling

- <http://www.juggle.org>

Internet home of the **International Jugglers Association**

For information (or for links) to:

Prop Suppliers (juggling props, instructional videos, books, etc.)

Juggling Clubs and Festivals (local, national, and worldwide listings)

History of Juggling

IJA Membership (*Juggle* magazine, festivals, video discounts, etc.)
and much more

Math

- <http://mathforum.org>

Internet home of **The Math Forum**

Online resource for students, teachers, and math enthusiasts of all levels

Science

- <http://www.madsci.org/libs/libs.html>

Internet home of the **Mad Scientist Library**

Online starting point for exploring many science and math resources
of all levels—including more links and free search engines

The Gizmo Guys

- <http://www.thegizmoguys.com>

Internet home of **The Gizmo Guys**

BIBLIOGRAPHY

Alvarez, Fransisco

Juggling—Its history and greatest performers

Part I: Early History

<http://www.juggling.org/bin/mfs/JIS/books/alvarez/part1.html?7#mfs>

Part II: The Formative Years

<http://www.juggling.org/bin/mfs/JIS/books/alvarez/part2.html?329#mfs>

Finnigan, Dave

The Complete Juggler

New York: Vintage Books 1987

Gillen, Billy

Remember the Force Hassan!

Juggler's World: Vol 38, No.2, Summer 1986, pp. 9-10

Lewbel, Arthur

Research in Juggling History

www.juggling.org/papers/history-1/#fn15

Towsen, John

Clowns

New York: Hawthorne Books, Inc., 1976

Truzzi, Marcello

Notes Toward a History of Juggling

Bandwagon, Vol 18 No 2, Mar-Apr 1974

Zeithen, Karl Heinz

4000 Years of Juggling

Sainte Genevieve, France, Michel Poignant P.L.V., 1981