



12 Broadridge Lane
Lutherville, MD 21093
410-252-8717
Fax: 410-560-0067
www.artsonstage.org

Thank you for downloading the Study Guide to go along with the performance presented by Arts On Stage. The last page of this Study Guide is a **Letter to Families** for you to send home with the child that includes information on what they saw to encourage parents to ask their child about the field trip.

Please direct any questions or correspondence (letters to performers from staff and/or students) to Arts On Stage. Make sure you note what performance and we will make sure they get into the right hands.

Contact Information:

email: info@artsonstage.org

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mail: 12 Broadridge Lane, Lutherville, MD 21093

Presenting Live Professional Theatre Field Trips for Students & Families

Mr. Fish's THE MAGIC OF SCIENCE

Teacher's Study Guide

ABOUT THE PERFORMER



John Lepiarz (aka "Mr. Fish") is a longtime professional circus performer. He toured for 7 years with the Big Apple Circus and has appeared on national television on HBO and ABC's *Great Circus Performances of the World*. He has toured his own 2-man show, *The Funny Stuff Circus*, to Hong Kong, Taiwan, and all across the United States. A graduate of Oberlin College, Mr. Lepiarz is the proud father of three children and lives in Madison, New Jersey.

ABOUT THE PERFORMANCE

Mr. Fish's new show for elementary schools introduces students to both the science of magic and the magic of science. While performing various magic tricks, Mr. Fish explains the scientific principles on which they are based. Whether it be objects that appear to move all by themselves, or very large objects being pulled out of very small containers, the "trick" involved always has a scientific

explanation. Whether the trick is accomplished by how light works, or magnetism, or simply through our psychological willingness to believe, science always has an explanation for it. Suitable and adaptable to students of all ages, *The Magic of Science* leaves audiences with a deeper understanding of magic, and a profound respect for science.

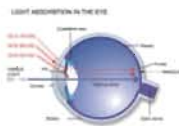
THEMES:

- BELIEF
- CREATIVITY
- ILLUSIONS
- KNOWLEDGE
- LOGIC
- MAGIC
- MATHEMATICS
- NATURE
- PHENOMENA
- REALITY
- SCIENCE

Glossary

The terms below are used and / or explained in *The Magic of Science*

absorption—When atoms of light and atoms of a surface collide



mirror—A reflective surface that is smooth enough to form an image



air pressure—An invisible force always pulling in all directions at the same time



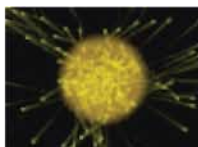
optical illusions—Something that appears to have an effect that it does not really have



illumination—When light radiates out and bounces off surfaces into our eyes



photons—The tiny particles that make up a wave



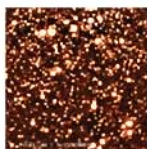
laser—A beam of light in which all of the frequencies are the same and going in the same direction



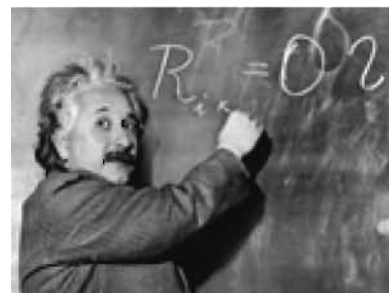
reflection—When light hits a surface, such as a mirror, and bounces back at the same angle



light—Energy in waves containing both electric and magnetic energy fields



refraction—When light hits more than one surface at a time, the wave gets out of sync with itself allowing you to see rainbows.



Albert Einstein

SCIENTIFIC THEORY - Science does not assume it knows the absolute truth about the world. Rather, it assumes that we must *discover* the truth. Science presupposes a regular order to nature and assumes there are underlying principles according to which natural phenomena work. It assumes that these principles or laws are relatively constant, but does not assume that it can know for certain what these principles are or the actual order of any set of empirical phenomena. A "theory" is our *best guess at the time* with the observations and information generally accepted by most scientists.



True Story: Albert Einstein and a friend were out walking on a cold, grey, cloudy day. Both were wearing hats and overcoats. It began to rain. Einstein immediately took off his hat and stuffed it inside his overcoat. His friend, noticing this, said, "Why did you take your hat off? It's beginning to rain!" Einstein replied: "If my hat gets wet, it will take hours to dry out. My hair I can towel dry in less than a minute!"

POST-SHOW ACTIVITY SUGGESTIONS

Here are some activities in which you may wish to engage your students after they've seen *The Magic of Science*

MAGNETIC MAGIC - You will need:

A cardboard box



A bar magnet



A small magnet



A plastic cup



1. Place the box on its side with the opening facing you.
2. Put the cup on top of the box
3. Put the small magnet in the cup
4. Hide your arm holding the bar magnet inside the box.
5. Make the cup move without touching it!

LIGHT & MIRRORS

1. Turn the lights out in your class or gymnasium.



2. Have students hold up small mirrors at various points around the room.

3. Shine a flashlight at the first mirror.



4. Angle the mirror so the beam of light hits the second mirror.



5. Angle the second mirror to hit the third.

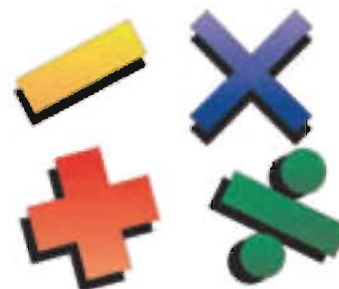


6. See how many mirrors through which you can bounce the light.

MATHOMAGIC—Math teachers may want to try this with their class:

1. Have each student choose a different number between 1 and 100
2. MULTIPLY that number by 2 ADD 10 to that number
3. DIVIDE that number by 2
4. SUBTRACT the original number
5. Have six or eight students reveal their result

Be prepared to explain why they all came up with the same answer!

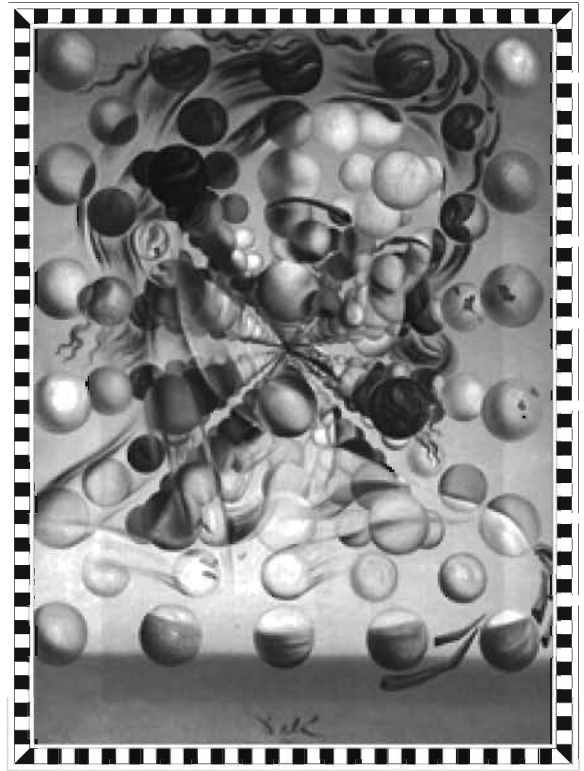


DISCUSSION TOPIC: OPTICAL ILLUSIONS

Discuss the phrase, "I can't believe my eyes". Ask the students if they ever saw something that they could not believe they saw. If possible, seek out pictures by M.C. Escher or Salvador Dali. Many of their drawings and paintings are based on an optical illusion that results in optical confusion.



Waterfall by MC Escher



The Spheres by Salvador Dali

RECOMMENDED RESOURCES

EVERYDAY SCIENCE EXPLAINED, published by The National Geographic Society. This hard bound book is one of the best and complete science books ever published for general audiences. It contains in-depth explanations of scientific principals, has an extensive vocabulary listing, and explains the history of scientific discoveries.

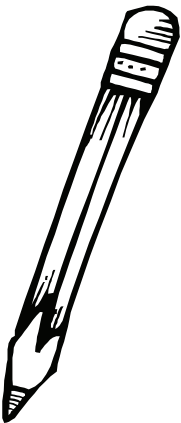
Books by Janice Van Cleave, the author of numerous books that teach science to children. The subjects range from magnets to microscopes, geography to astronomy. Many are designed specifically to aid students in their work on science projects. For a complete list of all titles available, visit her website at <http://janicevanclave.com/>

Dear Family,

Today, I saw a live, professional theatre performance presented by Arts On Stage called, The Magic of Science! The show included magic, circus skill and audience participation. Everything we see can be broken down into molecules, which combine in different densities to create liquids, solids, and gasses. Attending a live performance is very different from watching a television show or a movie. Please ask me about my favorite parts of the show. I would like to tell you all the things I learned and remember best.

Love,

Child's Name



We welcome you and/or your child's comments. Artwork is always appreciated too! Contact information below.



info@ArtsOnStage.org



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Mail: Arts On Stage, Attn: Jamie Papas, 12 Broadridge Lane, Lutherville, MD 21093