

# Magic Circus

## STUDY GUIDE

### THE AMAZING SCIENCE WHIZ SHOW



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## THE AMAZING SCIENCE WHIZ SHOW

Magic circus demonstrates seemingly impossible science effects, together with magic and circus tricks that actually have scientific explanations.

We explore states of matter, awesome forces, earth science, visual arts optical illusions and color perception.

This program addresses the 21st Century Learning Skills and aligns with STEM science standards and visual arts & common core standards.

### STUDY GUIDE

**Albert Einstein** (1879 – 1955) was a German-born theoretical physicist<sup>[5]</sup> who developed the [theory of relativity](#), one of the two pillars of modern physics (alongside [quantum mechanics](#)).<sup>[3][6]</sup> His work is also known for its influence on the [philosophy of science](#).

He is best known to the general public for his [mass–energy equivalence](#) formula  $E = mc^2$ , which has been dubbed "the world's most famous equation."

Albert Einstein quotes: "Imagination is more important than knowledge."

"Learn from yesterday, live for today, hope for tomorrow. The important thing is to not stop questioning."

**Archimedes** of Syracuse (c. 287 – c. 212 BC) was a [Greek mathematician](#), [physicist](#), [engineer](#), [inventor](#), and [astronomer](#).<sup>[3]</sup> Although few details of his life are known, he is regarded as one of the leading [scientists](#) in [classical antiquity](#). Considered to be the greatest mathematician of [ancient history](#), and one of the greatest of all time.

**Atom** - the smallest component of an element, the building blocks of matter. An *atom* is the smallest unit of ordinary matter that forms a chemical element. Every solid, liquid, gas, and plasma is composed of neutral or ionized *atoms*.

**Color** - the white light from the sun is actually a combination of colors called the spectrum. You can see the rainbow spectrum after the sun's light has been reflected from water drops in the air.



Isaac Newton proved that the white light from the sun is composed of all the colors of the rainbow. He used a prism, channeling the white sunlight so it creates a rainbow and then channeling the rainbow light through a second prism, which makes it white again. So the white light from the sun really has hidden in it all the colors of the rainbow. We call this our color spectrum.

**Sir Isaac Newton** (1642 – 1726) was an English mathematician, [physicist](#), [astronomer](#), theologian, and author (described in his own day as a "[natural philosopher](#)") who is widely recognized as one of the most influential scientists of all time and as a key figure in the [scientific revolution](#).

**Primary colors** - the primary colors of paints are red, blue, yellow (or magenta, cyan, yellow) - mixed in equal amounts they make black. The primary colors of light are red, blue, green, when they are mixed in equal amounts they make the color white.

**Complementary colors**-(like the blue/yellow picture in our show) when mixed, can cancel each other out and produce a neutral gray/white. Red, green and white appear by spinning the picture.

**Dimensional space** - One dimension - a single line; two dimensions - height and width, we refer to a painting on a flat surface. Three-dimensional space - we add depth to height and width. We live in a three dimensional world. In the Renaissance time artists learned to paint pictures that look three dimensional, these paintings have perspective. - With special glasses you can watch a 3-D movie. Spinning one of the optical illusion makes it appear to be 3 dimensional.



**Leonardo da Vinci** (1452 – 1519) was an Italian of the [High Renaissance](#) who is widely considered one of the most diversely talented individuals ever to have lived. While his fame initially rested on his achievements as a painter, he also became known for [his notebooks](#), in which he made drawings and notes on [science and invention](#).

Leonardo da Vinci's Mona Lisa, oil painting on wood.

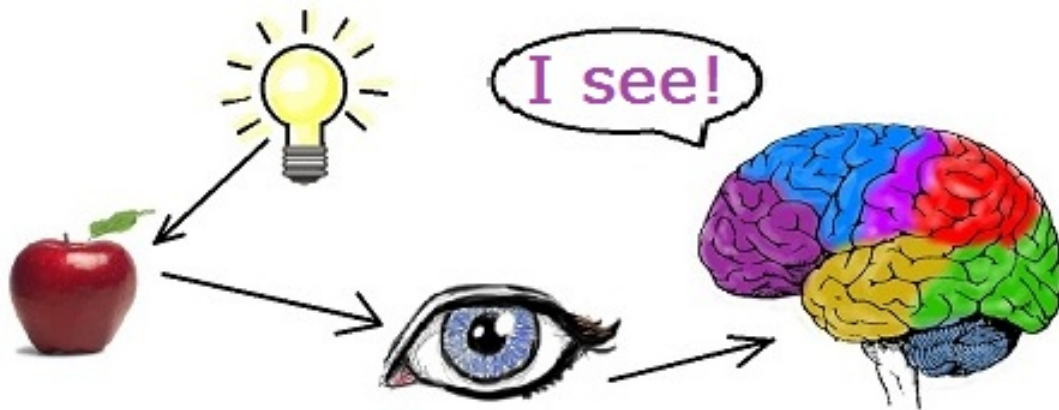




**Michelangelo** (1475 – 1564), was an [Italian](#) sculptor, painter, architect and poet of the [High Renaissance](#) born in the [Republic of Florence](#), who exerted an unparalleled influence on the development of [Western art](#). Several scholars have described Michelangelo as the greatest artist of his age and even as the greatest artist of all time.

Michelangelo's David - drawing of part of the sculpture. David is a masterpiece of Renaissance sculpture.

The light gets reflected off the apple. The eyes are connected with the optic nerve to the brain.

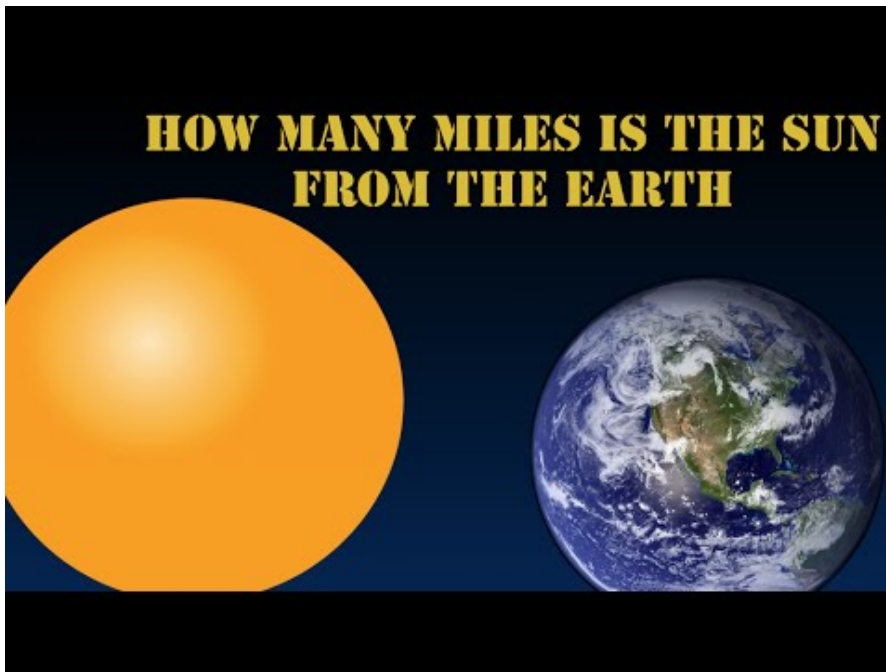


The brain lets us know that we see an apple.

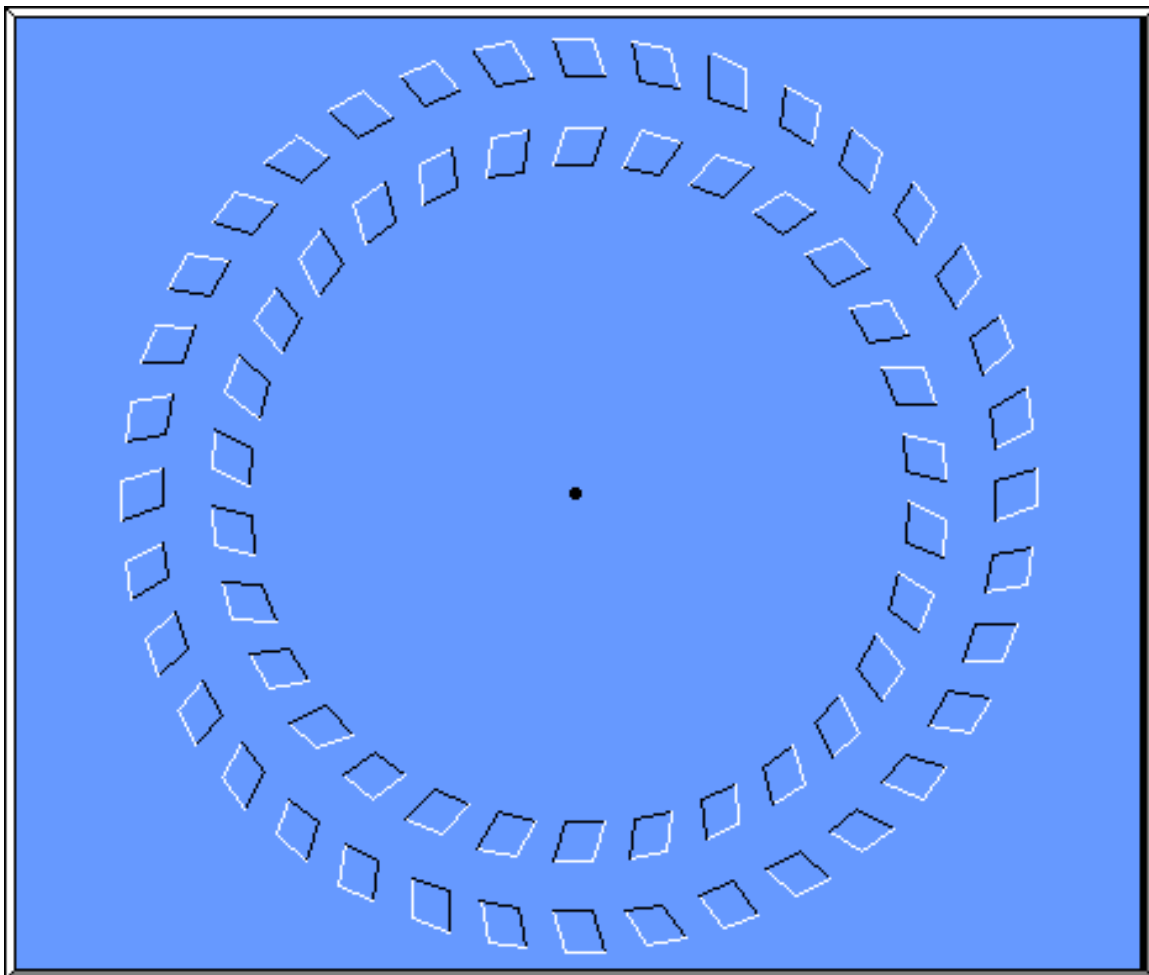
**Field of vision** - each eye gives a slightly different view of the world, it sees an object from a slightly different angle. Close one eye and line up a finger with a distant object. Now, without moving the finger, open the other eye and close the first one. Your finger seems to have moved.

**Light** - during the day, all of the light we have outside comes from the sun. Light travels at nearly 186,000 miles per second - nothing we know can travel faster than that. It takes more than 8 minutes for light to travel from the sun to our planet earth. The sun is about 92 million miles away from the earth.





**Orbit** - To revolve around (a center of attraction): The earth orbits the sun.



Check out the optical illusion above by looking in the center point and moving your head back and forth. It looks like the circles are moving.

**Optical illusions** - transformation of colors, shapes and dimensions. " Floating finger hot dog"  
- stare past your fingers as you touch the tips of your index fingers. Slowly pull your fingers apart. You will see a floating hot dog. Each eye has a separate view. The part of the finger that was seen by both eyes appeared as a separate piece floating between your fingertips.

**Air Pressure** - The amount of force that the atmosphere exerts upon all objects. Normal air pressure on earth is 15 pounds per square inch.

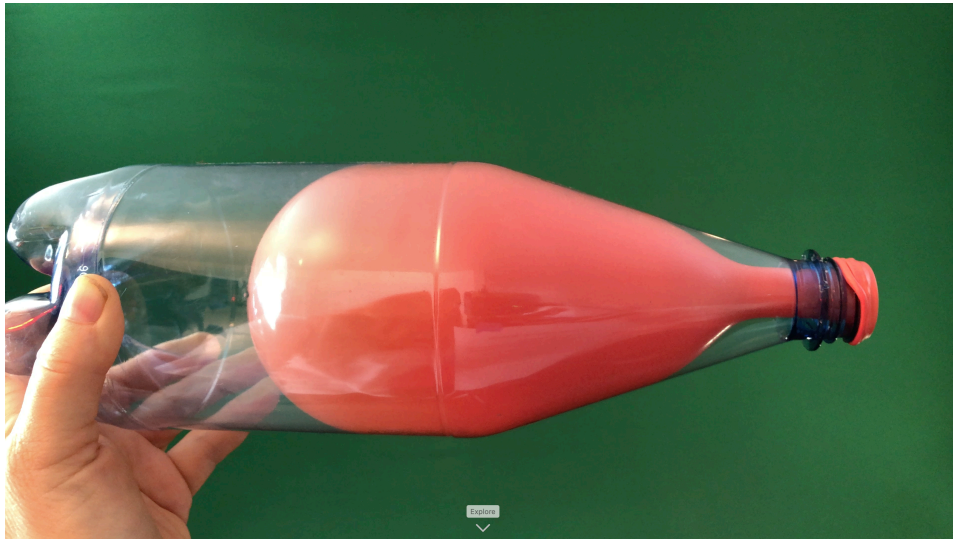
**Centrifugal force** – the outward force on a body moving in a curved path around another body

**Friction** - the resistance that one surface or object encounters when moving over another.

**Gravity** - The downward pull on all objects toward the center of earth. The center of gravity is found when the plate spinning stick stays on the finger in perfect balance. The English scientist Isaac Newton studied gravity. The moon's gravitational pull causes the ocean's high and low tide.

The tidal force causes Earth—and its water—to bulge out on the side closest to the Moon and the side farthest from the Moon. These bulges of water are high tides.

**Inertia** - The tendency of a body to resist acceleration; the tendency of a body at rest to remain at rest. or of a body in motion to stay in motion in a straight line unless acted on by an outside force. It takes energy to change motion and position of an object



### **Professor Conrad's Amazing Bottle Challenge**

Think like a Scientist:

#### **Hypothesis**

it is possible to blow up a balloon inside an empty bottle, if you have strong lungs.  
Let's put this to the test! Why was only one of the scientists able to do it?

#### **Solution**

The bottle is not really empty, it is filled with air.  
The balloon actually traps the air inside the bottle, so no new air can enter the bottle. –  
How is it still possible to blow up the balloon?  
You have to do something to the bottle.

## Result

Blowing up a balloon inside of an empty bottle has nothing to do with the strength of the lungs. Professor Conrad put a small hole in the bottom of her bottle – the new air can come in when old air can escape the bottle.

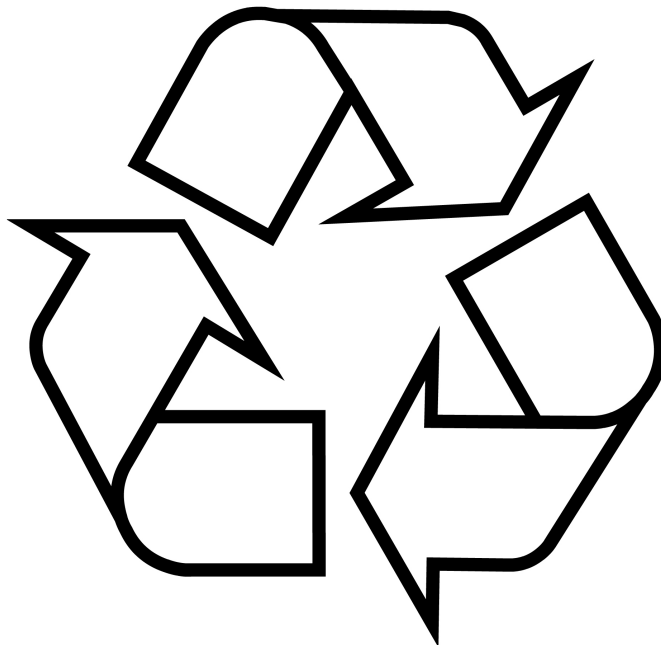
When she keeps the hole closed, after the old air escaped, the balloon still stays inflated, even though the mouth piece is open. Like a vacuum it creates pressure inside the bottle.

The magic of science!

The principle of pushing air or fluids from one compartment to another is used in machines.

For liquids it is called **hydraulics**. You might have seen for example a bus stopping at a bus station. When the door opens, the bus kneels, so it is easier to get in and out.

Then it rise up again. Hydraulics is the liquid counterpart of **pneumatics**, which concerns gases.



**Recycle, Re-use, Reduce, Rot - The four R's of waste reduction**



### Become a Citizen Scientist:

the choices you make every day affect everybody and everything on our planet.

**Recycle** glass bottles, plastic bottles and recyclable plastic containers, cans, aluminum, paper and cardboard. Some big chain stores offer bins to recycle plastic bags and clean plastic film. Recycle old batteries - bring them to a recycling center, battery store, some fire departments and libraries take back old batteries as well.. It is illegal to throw batteries into the trash.

**Re-use** things rather than throwing everything away. Use your imagination how you can make something from reusable items. For example an old jeans is used to make a shopping bag. Plastic containers and bags can be washed and reused. Use paper for printing or writing on the front and back side.

**Reduce** the daily waste by buying things that are packaged in recyclable material rather than plastics. There is alternative packaging that looks like plastic, but it is made from corn or cellulose. Those materials can break down at the landfill to become dirt.

Buy products made from recycled material. It helps to reduce the use of new raw materials. It often needs less energy, water, etc. to make new products out of recycled material.

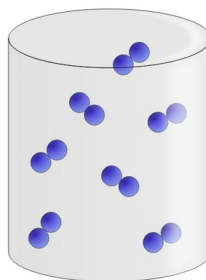
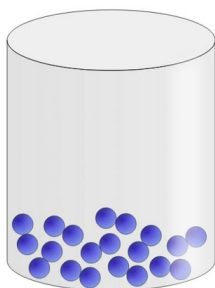
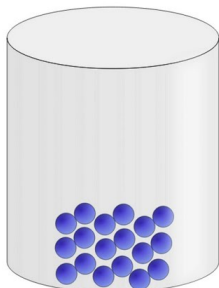
Things you do not need anymore may be donated or sold in a garage sale.

**Rot** means for example to put compostable food scraps in the green bin for waste pick up, or starting a compost bin yourself. This process makes great soil to grow plants and vegetables. Some schools have their own vegetable planting projects.



**Sundial**, Isaac Newton built sundials, when he was a teenager. You can make a simple sundial by drawing a circle on the ground and put a stick in the middle. In the photo you see a professionally build sundial in a park.

## States of Matter



**States of Matter** - we explore states of matter:

liquid matter (water), solid matter (earth's surface), gas (air, atmosphere),  
plasma ([Neon signs](#) and [lightning](#) are examples of partially ionized plasmas. The Earth's [ionosphere](#) is a plasma and the [magnetosphere](#) contains plasma in the Earth's surrounding [space environment](#).

**Water** - liquid matter, evaporates or freezes and changes its state of matter.

Air pressure pushes against a postcard on top of a glass. It helps to keep the water inside the glass, when the glass is turned upside down.

## **READING**

The First Book of Color, by Herbert P. Paschel, published by Franklin Watts,

Smart Science, Sound and Light by R. Snedden, Heinemann Library,

Optical Illusion Magic by Michael A, DiSpezio, Sterling Publishing Co.,

101 Amazing Optical Illusions by Terry Jennings, Sterling Publishing Co.,

Simple Science Fun, Teacher Created Materials, Inc.,

The Science Book of Water, Neil Ardley, Gulliver Books,

Fun with Science, Air, Brenda Walpole, Warwick Press

## **Science on TV**

NOVA, Seen in more than 100 countries, NOVA is the most watched science television series in the world and the most watched documentary series on PBS.

Other science shows feature for example: Bill Nye, Jaques Cousteau, Neill de Grass Tyson

## **STEM**

Science framework

Environmental principals and concepts

## **Next Generation Science Standards**

Forces and interactions

Matter and its interaction

Earth's systems

Earth and human activity

## **Core Standards**

Science and technical subjects

## **Arts Standards**

Artistic ideas and work

Analyze and interpret artistic work

**MAGIC CIRCUS** provides assembly programs with science enrichment, performing arts education, rewards programs and multicultural learning.

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