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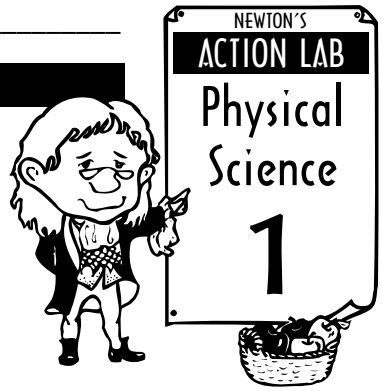
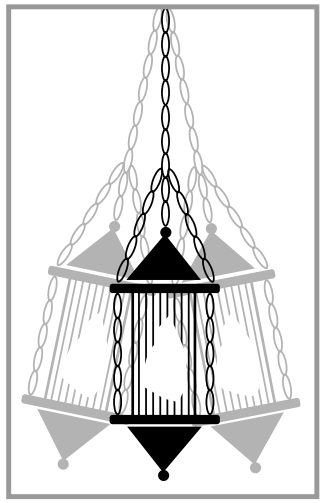
Science Action Labs

Name _____



Fun with Physical Science

Two Great Physical Scientists



The study of matter, motion and energy is called **physics**. Scientists who study these subjects are called physicists. Here is some background on two of the world's greatest physicists.

Galileo Galilei was born in Pisa, Italy, in 1564. Before his death in 1642, he made many discoveries about astronomy and the physics of falling objects. As a child, Galileo showed unusual skill in making toys. He became an accomplished musician and printer. Galileo studied both philosophy and medicine in college.

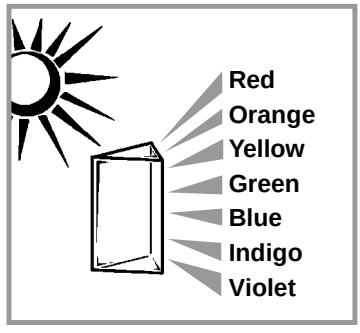
Galileo was only 20 when he discovered the law of the pendulum. He used his pulse to time the swing of lamps in the Pisa Cathedral. Supposedly he dropped different size cannonballs from Pisa's Leaning Tower in his experiments about gravity.

Galileo improved the telescope and became convinced that the Earth was not the center of the universe. He was punished for teaching what he knew was right.

Sir Isaac Newton was born in England in 1642 and died in 1727. After receiving his degree at Cambridge University, he went home to study and think. In less than 18 months at home, this very young man discovered laws of light, color, motion and gravity. Newton will be your guide to help you study physics in this book.

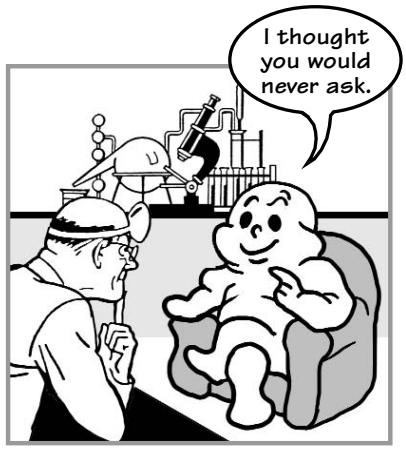
If I have seen further in physics, it is from standing on the shoulders of giants.

–Sir Isaac Newton



Name _____

Newton's Favorite Scientific Fairy Tale



Newton likes to tell the imaginary story of a tiny green "thing" that landed on Earth one day from outer space. It was soft, shapeless and completely motionless. It had none of the characteristics of life as we know it on Earth. Scientists poked it and examined it. They did countless experiments but could learn nothing about its nature or whether it was really alive. The green blob just sat there without moving or reacting in any way.

Finally one brilliant scientist sat down next to the green "thing" and asked how it felt, how it liked being on Earth and what it thought about the weather. The green "thing" began to talk and answer all sorts of questions.

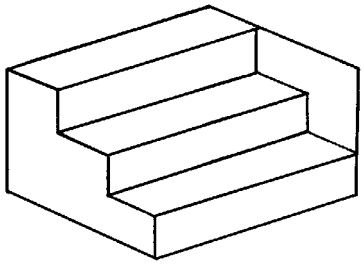
The lesson to be learned from our mysterious green friend is simple. If you want to learn something, you must ask the **right questions**. Physicists are skilled at asking the right questions of nature.

Physicists Observe Carefully

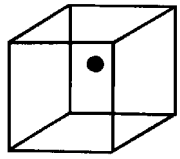
Newton has picked optical illusions to help you improve your observation powers. Study them carefully.

What's wrong with this sentence?

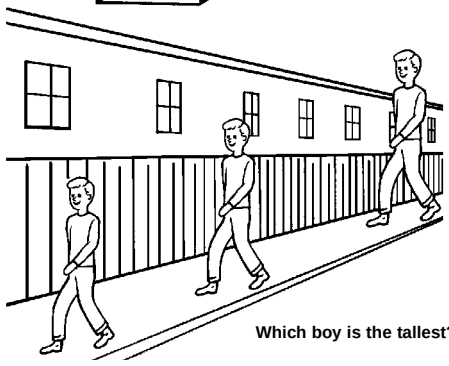
Can you see TWO faces?



Stare at these steps. They can change direction.



Is the dot at the front or back of the cube?



Which boy is the tallest?

NEWTON'S ACTION LAB Physical Science 2

Name _____

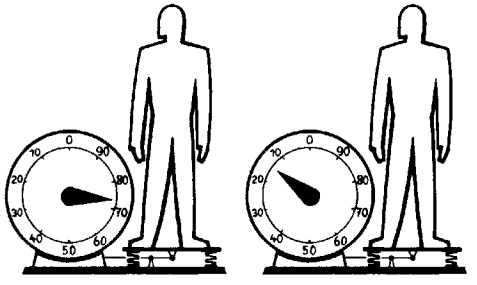
What's the Matter?

Newton Explains Mass and Weight

Just what is matter? This book, your pen, the desk, the air and the Earth are all made of matter. *Matter* is defined as "anything that occupies **space**." A block of wood is matter because it occupies space. When you drive a nail into wood, the nail pushes the wood aside because they are both matter and cannot occupy the same space. The drivers of cars colliding on the freeway soon learn that autos are made of matter and cannot occupy the same space.

The amount of matter in an object is defined as **mass**. The more mass in matter, the harder it is to move it. Mass is measured with a balance and is usually given in metric units of grams or kilograms.

If you are alert, you should be wondering how **weight** differs from mass. The words *weight* and *mass* are practically the same and interchangeable in common usage. But for the precise needs of physicists, they are vastly different.



Mass equals 72 kilograms
Weight equals 72 kilograms
ON EARTH

Mass equals 72 kilograms
Weight equals 12 kilograms
ON THE MOON

Mass is defined as "the amount of matter and never changes." A 72-kilogram astronaut has a mass of 72 kilograms on Earth, in space and on the moon. However, he may weigh 72 kilograms on Earth, 0 kilograms in space and only 12 kilograms on the moon. This is because weight is defined as "the pull of gravity on an object." Weight is a measure of the force of gravitational attraction and is measured with a spring scale or balance. The weight of an object depends on both the amount of mass (which never changes) and the pulling force of gravity (which may change from place to place). On the moon, our 72-kilogram astronaut weighs only 12 kilograms because the gravitational pull of the moon is only one sixth of the Earth's gravitational pull.

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What's the Matter?

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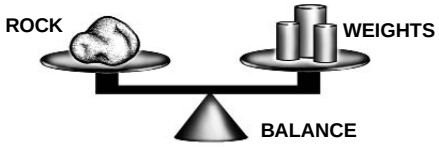
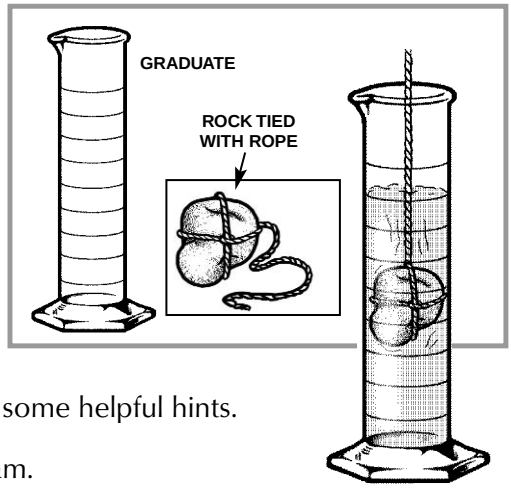
You can find the density of any object by dividing its **weight** by its **volume**. Suppose you wanted to find the density of a rock. Weigh it using a balance or spring scale. Find the rock's volume using a graduate.

Example: A rock weighs 80 grams.
Its volume is 16 milliliters.

$$\text{DENSITY} = \frac{\text{WEIGHT}}{\text{VOLUME}} = \frac{80}{16} = 5$$





Newton wants you to measure the density of some convenient objects. Here are some helpful hints.

1. Round off the weight to the nearest gram.
2. Dry the objects off before weighing them.
3. Use the largest sample of each object that can fit inside your graduate.
4. Obtain volume by filling the graduate to a convenient level, submerging the objects and recording the *difference* in volume.
5. Tie a string to the object to lower it **safely**.
6. Use rocks, metal, wood, candles, plastic or anything convenient.
7. Fill out the Density Data Table below.

DENSITY DATA TABLE

Material Tested	Weight in grams to nearest gram	Volume in milliliters to nearest milliliter	Density = Mass ÷ Volume Round off to one decimal place
1			
2			
3			
4			
5			
6			