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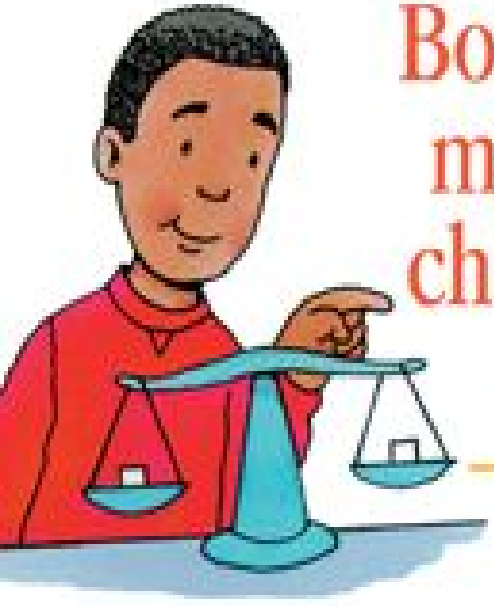
THE EVERYTHING® KIDS' SCIENCE EXPERIMENTS BOOK

Boil ice, float water, measure gravity—challenge the world around you!



Tom Robinson

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Note: All activities in this book should be performed with adult supervision. Likewise, common sense and care are essential to the conduct of any and all activities, whether described in this book or otherwise. Without limitation, no one should EVER look directly at the sun, as blindness could result. Parents or guardians should supervise children. Neither the author nor the publisher assumes any responsibility for any injuries or damages arising from any activities or outings.

DEDICATION

For Matt and Megan

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INTRODUCTION

What does it take to be a great scientist? Think of the most famous scientists you know — Isaac Newton, Louis Pasteur, Albert Einstein, Thomas Edison, Pierre and Marie Curie, Stephen Hawking, and so on. What do all these people have in common? Well, for one thing, they — re all very smart. In some cases they even taught themselves most of what they knew about their particular subject. In fact, Sir Isaac Newton had to invent a new branch of mathematics (calculus) just to solve the problems he was trying to do in physics. There is something else they all had in common that set them apart from the other smart people of their time — their ability to ask questions.

Just having a good brain isn't always enough. To be a great scientist, you need to be able to look at a problem that hundreds, maybe even thousands, of people have already looked at and been unable to solve, and ask the question in a new way. Then you take that question and come up with a new way to answer it. That is what made Newton and the others so famous. They coupled intelligence with a curiosity that said, "I want to know the answer to this." After coming up with the right questions, they discovered ways of answering those questions and ultimately became famous for their discoveries.

Cool Quotes

The important thing is not to stop questioning.
— Albert Einstein

Could you be the next Thomas Edison and invent something the world has waited for, or the next Isaac Newton and answer a question no one has been able to answer? Absolutely! To do it requires something all kids have naturally and many grownups wish they still had — curiosity.

This book will help you to tap into that curiosity by introducing you to five major areas of science — Biology, Chemistry, Physics, the Earth and Sky, and the Human Body. You will be presented with several questions that will help you to begin thinking like a scientist. Perhaps you've asked some of these questions before; for example, why is the sky blue? Some of them will probably be new to you.

Since asking the right question is only the first step toward being a great scientist, this book will also guide you in completing the second step: the experiment. Following each question there will be an experiment that will help you discover for yourself some of the mystery and magic of science. There are three different types of experiments offered in this book — simple activities you can do

quickly, larger and more complex experiments, and science fair projects.

THE SCIENTIFIC METHOD

First, let's take a look at the starting point for all scientific experiments: the Scientific Method. It was made famous by an Italian man named Galileo in the sixteenth century. It is simple and will help you ask and answer many of the questions you have about science. There are five parts to the Scientific Method:

1. Observe some activity in the world around you.
2. Make up a possible explanation for that activity, called a hypothesis.
3. Use your hypothesis to make predictions about the activity.
4. Test those predictions.
5. Come to a conclusion about your hypothesis and its ability to predict the activity.

Why did the young scientist bring art supplies to science class?

She wanted to draw some conclusions!

Scientists have used this method for hundreds of years to understand their world. Now it's your turn!

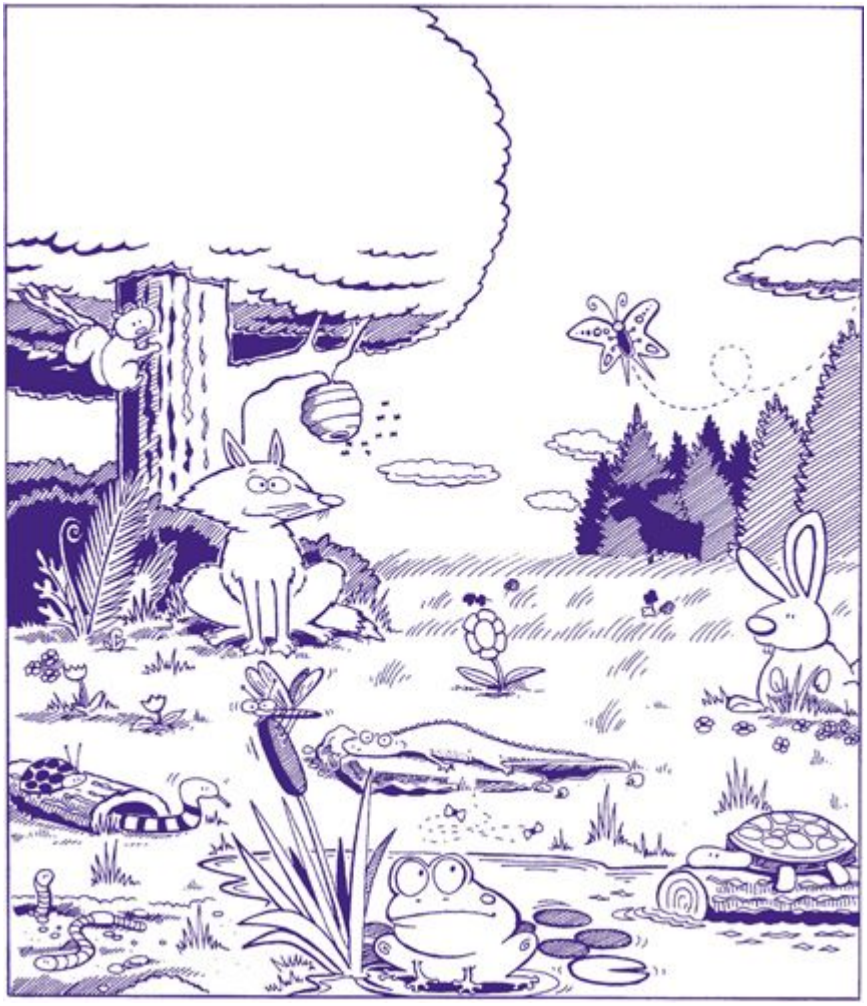
The fun of this book lies in the fact that you can start reading just about anywhere and follow the idea as far as you like. And if this book doesn't take the idea as far as you would like to go, use your imagination and keep exploring the idea. You are invited to join this exciting journey into the world of experimental science. Welcome aboard — let's begin the journey!

Quote Fall

Can you figure out where to put each of the scrambled letters? They all fit in spaces under their own column. When you correctly fill in the grid, you will have a quote from the brilliant scientist Albert Einstein. His theories and experiments led to an entirely new way of thinking about time, space, matter, energy, and gravity!

(All puzzle answers are located at the end of the book.)

BIOLOGY



Life. We all have it. The world around us is full of it, from the birds in the air to the fish in the sea and all the land animals in between. But how does life really work? If you can answer that question, you will gain insight into one of the most widely studied topics in the natural world.

TRY THIS WATER COLORS

Humans and other animals are very complex creatures. So let's first consider plants. Plants seem to be simple examples of the way life works. You plant them in the ground, water them, and let the sun shine on them. Pretty soon, they grow, they bloom, and then they die. But inside a plant, there are processes happening that we don't see — processes unlike anything else we encounter. Let's begin to understand these processes with what everyone knows is the most important resource a plant can get: water.

QUESTION

How does water get from the ground to the leaves of a plant?

MATERIALS

4 full glasses of water at room temperature Red, blue, green, and yellow food coloring 3 white carnations from a florist Sharp knife

PROCEDURE

1. Mix one color into each of your four glasses. The stronger the color of the water, the more effective the experiment will be.
2. Place your first carnation into the glass of your choice. You may need to trim the stem if it's too long.
3. Place your second carnation into another glass.
4. Take your final carnation and, with an adult's help, slice the stem lengthwise so that it looks like two smaller stems, both of which remain attached to the flower.

5. Place one half of the stem into your third glass of colored water and the other half into the fourth and final glass.
6. Place the flowers out of the sunlight and wait a day or so. Then look at each of the flowers.

WHAT'S HAPPENING

Through a process called **capillary action**, water travels up through the stems of plants until it reaches the outermost parts of the flowers. You saw this when the flower of each carnation turned the color of the water it was sitting in. Even more interesting is that the split stem produced a flower with *both* colors in it. You could easily repeat this experiment with other flowers and other colors to see if they behave in the same way. Celery stalks with the leaves on also work well in this experiment.

capillary action: the process that allows water and other nutrients to move up from the ground to all parts of a plant.

FOLLOW-UP

When you water the plants in your yard, should you water the leaves or the ground around the bottom of the plant?[1]

(The answers to all Follow-Up Questions are at the end of the book. The number of the superscript marks the answer in the back.)

Why did the silly scientist keep his shirt on when he took a bath? Because the label said “Wash and Wear.”

Science Online

ZooNet is a good starting point for information about animals, zoos, and more. Visit *www.zoonet.org* .

TRY THIS FALLING LEAVES

Some trees stay green the whole year round while others lose their leaves in the fall and winter and grow new leaves in the spring. If you've ever seen trees lose their leaves in the fall, you may have noticed that the leaves turn from green to yellow, red, or orange before eventually falling to the ground.

QUESTION

Where do the leaves get their colors?

MATERIALS

4–5 spinach leaves
1 drinking glass
Spoon
Nail polish remover — ask a parent for help in getting this
Coffee filter

Scissors
Tape
Pencil

PROCEDURE

1. Tear the leaves into small pieces.
2. Place the pieces into the bottom of the glass and mash them together with a spoon.
3. Add several teaspoons of nail polish remover to the leaf mush. Wait until the leaves settle at the bottom of the nail polish remover. If the remover does not cover all the leaves, add enough so that they are totally covered.
4. Cut a rectangle from the coffee filter. It should be slightly narrower than the glass.
5. Tape the rectangle to the pencil and, when the leaves are settled, place the pencil across the top of the glass so that the coffee filter rests in the nail polish remover without touching the leaves.
6. Let the glass sit for several hours.

Cool Quotes

Autumn is a second spring when every leaf is a flower.
— Albert Camus, French novelist

WHAT'S HAPPENING

You should see many colors work their way up the coffee filter. The green you see comes from the chemical that makes leaves green — **chlorophyll**. But you should also see other colors, like red, yellow, and orange. These come from different chemicals that are also found in green leaves.

During the spring and summer, **photosynthesis** produces so much chlorophyll you can see only the green color in the leaves. But as the days get shorter, less chlorophyll is produced and the green fades away so that you can finally see the other colors. When the green is gone, the leaf is not far from falling to the ground.

FOLLOW-UP

When fall comes, watch the leaves change color. Can you tell what causes this to occur?[2]

chlorophyll: the chemical in plants that makes their leaves green.

photosynthesis: the process by which plants turn sunlight and water into chlorophyll.

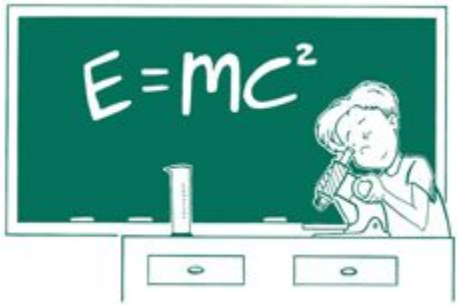
Fun Facts

Chlorophyll absorbs red and blue light and reflects green light back to your eyes.

What do you call a scientist who carries a dictionary in her jeans pocket?

A smarty pants!

KIDS' LAB LESSONS



QUESTIONS Do seeds need light to grow? Do plants need light to grow?

EXPERIMENT OVERVIEW You've already seen what happens to some trees when they don't get enough light — they lose their leaves. But plants and trees are different. In this experiment, you'll get to explore whether or not seeds and plants need light to grow by placing some seeds and plants in the dark while others stay in the light. You will decide whether or not light makes a difference in their growth pattern. This experiment will take a few days since most processes with plants occur very slowly, but the results should be obvious and a little surprising.

SCIENCE CONCEPT Most gardeners believe that light and water are the basic needs of any plant. You'll test that theory by letting some seeds grow in a dark setting while others grow in a light setting. You'll then take two healthy plants and place one in a dark closet for a few days while the other sits in the sunshine. By doing this you will be using one of the most important pieces of the Scientific Method —

testing one change at a time. It's important that you treat the seeds and plants exactly the same except for where they are placed. By doing so, you will know whether light makes a difference.

MATERIALS

2 paper towels
2 small dishes
Pinto beans (available at a grocery store)
Water
2 small, identical, healthy potted plants

PROCEDURE

1. Fold the paper towels so that each fits onto a dish.
2. Place the folded paper towel on a dish and place several beans on each paper towel.
3. Pour just enough water onto the paper towel so that it is damp. Pour out any excess water from the dish.
4. Place one dish of beans in a closet where it will stay dark for several days.
5. Water the potted plants until their soil is just damp and place one of the plants beside the beans in the same dark location.

6. Place the second dish of beans in a well-lit place alongside the second plant.
7. After two days have passed, slightly dampen the two dishes containing the beans and water the potted plants. Make sure that you give each the same amount of water so you keep the experiment fair.
8. After a total of four days have passed, take the beans and plant out of the closet and place each by its sunlit partner.

QUESTIONS FOR THE SCIENTIST

- Which sample of beans grew better — the one in the dark or the one in the light?
- Which sample of potted plant grew better — the one in the dark or the one in the light?
- If you were going to plant seeds, where would you put them — in a light place or in a dark place?
- Think about the amount of light where seeds and plants normally grow. Does this experiment confirm that those locations are the best places for growing?
- Do some seeds require different amounts of light? Experiment with different kinds of seeds and amounts of sunlight to see what factors most affect germination and growth.

Totally Tubular

Can you find your way through all the tiny tubes in this leaf from START to END?

TRY THIS HOLE-Y WALLS

Another amazing talent plants have is the ability to absorb water right through their skin. This process is called osmosis, and you can do an experiment that shows how it works.

QUESTION

Can liquid really pass through walls?

MATERIALS

2 wide glasses or measuring cups
Water
Tincture of iodine (available at a drugstore)
Cornstarch
A small, sealable plastic bag

PROCEDURE

1. Fill both glasses approximately three-quarters full of water.
2. In one glass, mix two teaspoons of iodine with the water.
3. In the other glass, mix one tablespoon of cornstarch with the water, and pour about half of it into the plastic bag.
4. Seal the plastic bag and place it into the iodine mixture. You may need to wash the bag with water to make sure there is no cornstarch on the outside when you place it in the iodine.
5. Allow the bag to sit in the iodine for an hour and observe the changes that occur during that time. Meanwhile, drop a few drops of iodine into the glass with cornstarch in it and observe what happens.