Table of Contents

Introduction and Organization

Every year states give a science test to elementary school students. The purpose of the test is to find out what students know and what students can do in science. Students can learn science in various ways, but the method with the highest success rate is achieved by actively involving students in doing science experiments.

Elementary Science with Classroom Experiments focuses on science learning by actively engaging students in experiments. Four or five experiments support each science topic, with a total of fifty experiments in this book. Hands-on activities help students better understand and retain the concepts behind science learning standards.

All the experiments follow the framework of the scientific method by first asking a question. In general, each experiment follows the same format.

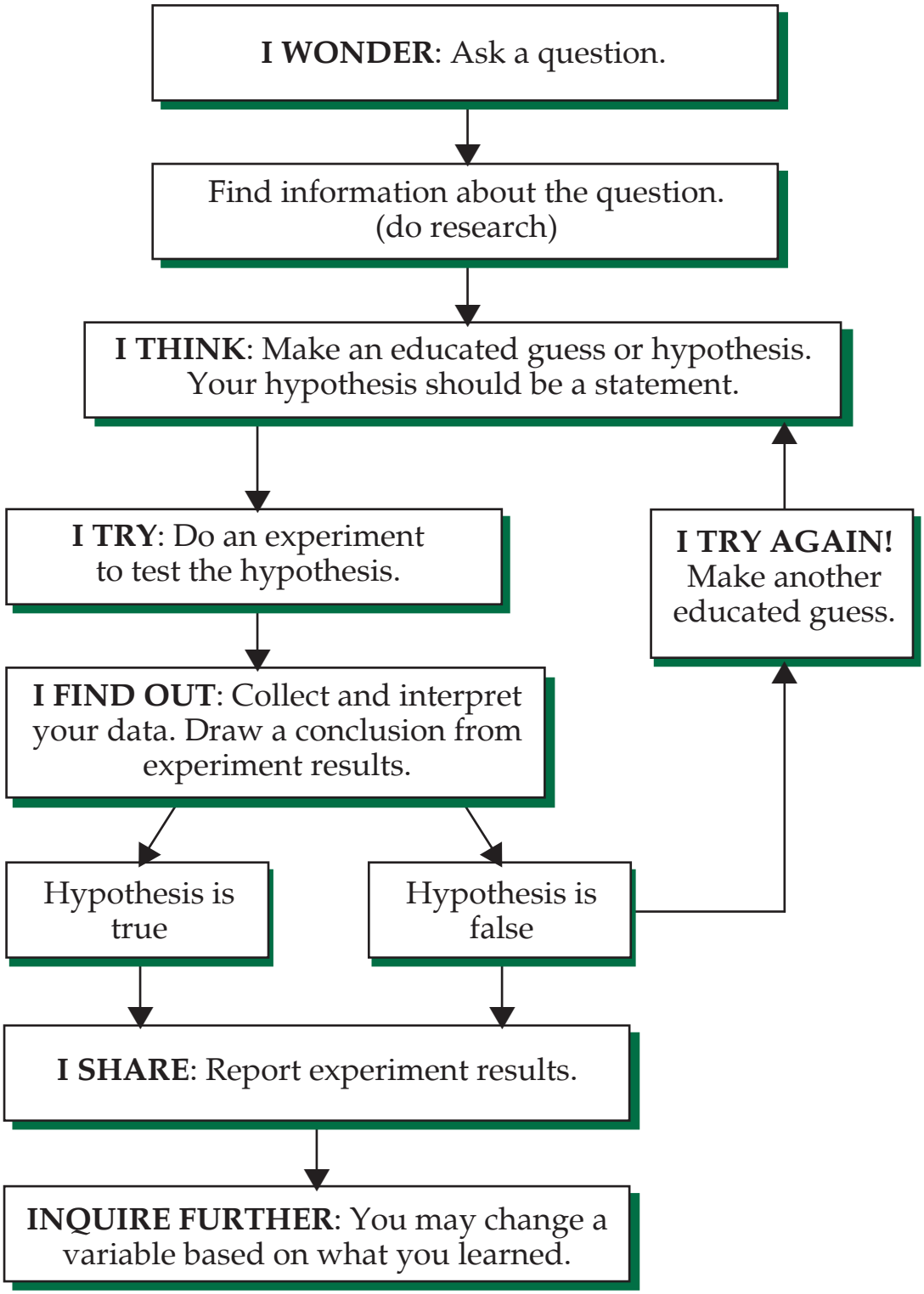
- Question
- Materials
- Hypothesis
- Experiment
- Results
- Discussion
- Review

Materials needed for experiments can be purchased from local stores or scientific companies. A Supply Resources list where special experimental materials are available is on page 218. Do all the experiments under adult supervision.

Science is exciting. Let *Elementary Science with Classroom Experiments* guide you through an interesting journey while you learn important science concepts.

The Scientific Method Overview

The scientific method is a process used to explore observations, answer questions and solve problems. The order of the steps or number of steps used may vary.



Science Safety Rules

Scientists work carefully when doing experiments. You also have to be careful working as a scientist. Please read the following rules and keep them in mind as you perform each experiment.

1. **Read and follow all directions carefully.**

2. **Clean spills up right away.**

3. **Never taste or smell substances unless your teacher directs you to do so.**

4. **Handle sharp items carefully.**

5. **Use chemicals carefully.**

6. **Dispose of chemicals safely, when experiments are completed.**

7. **Put all materials away after completing each experiment.**

8. **Wear safety goggles when needed.**

9. **Wash your hands after every experiment.**

Process Skills for Science Inquiry

Observe
Use one or more of your senses to gather information. See, hear, touch, smell, and taste. (Don't taste or smell without permission.)

Classify
Group objects according to their properties.

Communicate
Share information about what you learn using pictures, graphs, diagrams, and reports.

Estimate and Measure
Make a guess about an object's properties, then describe it with numbers.

Infer or Explain
Draw a conclusion based on your learning experience.

Predict
Form an idea about what will happen. Make a guess.

Make a Model
Make a representation to explain ideas, objects, or events.

Formulate Questions and Hypotheses
Think of a statement you can test to solve a problem.

Collect and Interpret Data
Gather observation and measurement information and display using graphs and charts. Use the information to solve problems.

Identify and Control Variables
Decide which one factor in the experiment you need to test. Change one factor that may affect the outcome of an event while holding other factors the same or constant.

Experiment
Design and do an investigation to test a hypothesis or solve a problem.

Vocabulary You Need to Know

absorbent (pg. 44): a substance able to take in and make part of itself

acid (pg. 88): **1**. a substance usually with a sour taste **2**. reacts with bases to form chemical salt **3**. neutralizes alkalis

acid rain (pg. 204): rain containing acid substances from air pollution causing damage to the environment

alkaline (pg. 88): having the properties of forming chemical salt when combined with acids

artery (pg. 184): a blood vessel that carries blood away from the heart

axis (pg. 144): an imaginary straight line through the center of the Earth, around which the Earth rotates

barometer (pg. 140): an instrument used to measure air pressure, and is used to forecast changes in weather

base (pg. 88): a substance that reacts with an acid to form chemical salt (see acid)

behavior (pg. 12): the way a living thing acts

bias (pg. 80): a favoring of one way of feeling or acting over another

Big Bang (pg. 168): the theory that the universe started when matter exploded, about 20 billion years ago

biodegradable (pg. 36): capable of breaking down naturally

carrying capacity (pg. 48): the number of organisms an environment can support with its food, water, air supply, and living space

circulatory (pg. 184): going around in a circle, such as blood flowing through the body

conductor (pg. 104): a material which energy (heat, sound, electricity) can flow through

copper (pg. 96): yellow-red metal used in making coins and conductors

crustacean (pg. 76): a group of animals with a hard shell and jointed legs, such as a lobster

density (pg. 108): a property of matter; the amount of matter in a specified volume or area

dependent variable (pg. 17): the observed result of an independent variable being changed: in an experiment, the intake of vitamin C (independent variable) can influence the dependent variable of life expectancy

diameter (pg. 120): a straight line that runs through the center of a circle and meets the circumference

distilled water (pg. 68): pure water (water is boiled to steam, and allowed to cool, condensing back to liquid form; this removes all minerals)

dominant (pg. 56): a trait that has control over effect (see recessive)

egg (pg. 48): the first stage of the life cycle

electromagnet (pg. 116): a magnet made by an electric current flowing through a wire around a metal core

environment (pg. 68): all the things that surround an organism such as air, water, and other organisms

fossil fuels (pg. 192): materials (coal, oil) formed from remains of organisms millions of years ago, that are burned to produce energy

friction (pg. 124): the force that slows or stops the motion of an object, when that object rubs against another object

fruit fly culture (pg. 48): a food medium used to raise small insects

function (pg. 60): natural action or purpose

galaxy (pg. 168): a large system of planets, stars, gas, and dust that make up the universe

gender (pg. 80): a male (boy) or female (girl)

gravitational energy (pg. 19): the energy exerted by the pull of gravity

gravity (pg. 124): the natural force that pulls objects toward the center of the Earth; gravity differs on different planets

hardness (pg. 136): a property of matter that is firm, stiff, and not easily broken

heredity (pg. 56): the passing on of traits or qualities from parent to child

horizon (pg. 152): line where the sky and earth or sea appear to meet

hypothesis (pg. 8): an educated guess

independent variable (pg. 17): the factor being changed in an experiment: in an experiment, the independent variable of vitamin C intake can influence life expectancy (dependent variable)

indicator (pg. 88): substance which shows chemical changes, by changing color

inertia (pg. 124): the tendency of a moving object to stay in motion, or a resting object to stay at rest

inherited (pg. 56): passed to offspring from one's mother or father

iris (pg. 56): colored part of the eye that controls the amount of light that enters it

larva (pg. 48): a worm-like young in an insect's life cycle; *plural* larve

life cycle (pg. 51): the stages of an organism's life

magnet (pg. 116): a substance that pulls iron, steel, and certain other metals to it

magnetic force (pg. 19): the pull or push of a magnet

mechanical energy (pg. 19): the energy an object has because it is moving

neutral (pg. 90): in chemistry, neither an acid nor a base

Newton's 1st Law of Motion (pg. 124): the tendency of an object to resist any change in its state of motion, sometimes called the law of inertia

oscillate (pg. 128): to move back and forth

oscillation (pg. 128): a series of regular movements back and forth

particles (pg. 132): matter made up of small pieces

pendulum (pg. 128): an object hung from a fixed point that swings freely back and forth, under the force of gravity

pitch (pg. 101): the highness or lowness of a sound

pollution (pg. 192): process that fouls or uncleans the air, land, or water

pore space (pg. 132): air space between soil particles

potential energy (pg. 19): the energy an object has because of its position

predator (pg. 72): an animal that hunts and kills other animals for food

prey (pg. 72): an animal that predators hunt

primary colors (pg. 20): the three main colors (red, yellow, and blue) used to produce a variety of other colors

property (pg. 88): a special quality belonging to a thing

pupa (pg. 48): the middle stage in the insect life cycle, between larva and adult; *plural* pupae

recessive (pg. 56): describing a trait that is being covered or hidden (see dominant)

recycling (pg. 188): using a material over and over again

response (pg. 12): a resulting behavior or action caused by a stimulus

secondary colors (pg. 20): colors produced by mixing two primary colors of the same amounts: for example, red and yellow create orange.

seismograph (pg. 148): an instrument that records earth movements such as earthquakes

simulation (pg. 63): an imitation to give the effect of

solar energy (pg. 200): light and heat from the sun

solution (pg. 92): a mixture in which one substance spreads evenly in another substance

stimulus (pg. 12): something that causes a reaction in an organism; *plural* stimuli

structural adaptation (pg. 84): a change of an organism's coloring or body parts, so it can exist in its environment

structure (pg. 60): the way something is built or formed

taxis (pg. 76): a behavioral response by an organism to a stimulus

tectonics (pg. 148): the science of movements of the Earths' plates

trait (pg. 56): a special feature or quality of one's character

variable (pg. 11): something that can change such as time or temperature

variation (pg. 56): different forms, positions, state or quality of something

vibration (pg. 100): rapid back and forth movement

vial (pg. 172): a small container that is usually made of glass or plastic

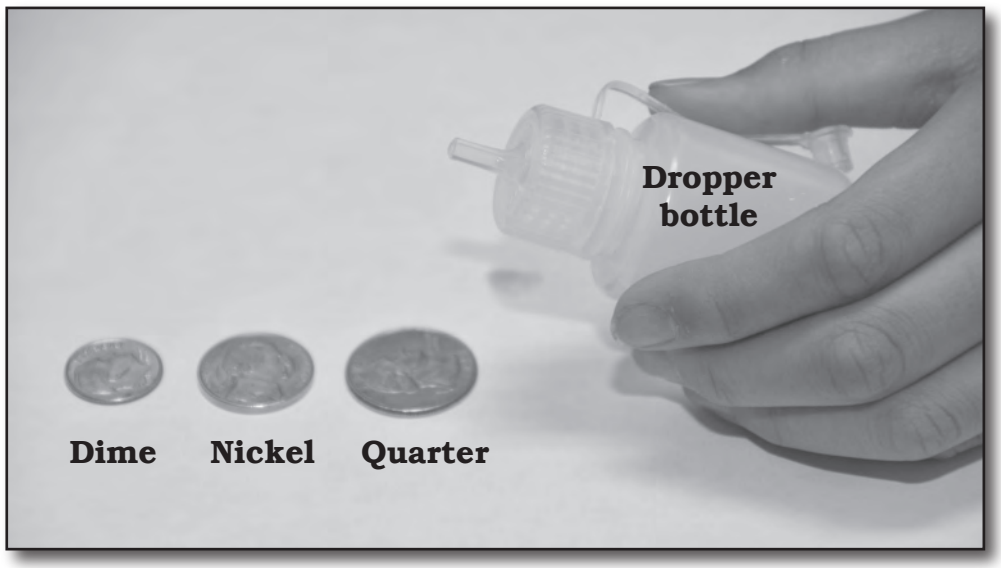
water holding capacity (pg. 24): the amount of water a substance such as soil can hold

watt (pg. 195): a unit of measuring how much electricity is being used

EXPERIMENT #1

Question: **How many water drops will a coin hold when placed flat on a surface?**

Materials: • three coins (a dime, a nickel, a quarter) • towel or paper towels
• a water dropping device (medicine dropper or soda straw)



Hypothesis: Coin surfaces of different sizes will hold different amounts of water.

Experiment:

1. Place a dime, head side up, on a flat surface such as a tabletop. Estimate how many drops the dime will hold.
2. Carefully drop water on the coin from a fixed height – one drop at a time.
3. Count the water drops until the last drop spills over.
4. Dry coin and table. Repeat steps 1-3, two times. Make sure water is dropped from the same height. Write down the results.
5. Find the average of the three trials. Write down the results.
6. Place a nickel, head side up, on a flat surface. Estimate how many drops the nickel will hold.
7. Repeat steps 2 through 5.
8. Place a quarter, head side up, on a flat surface. Estimate how many drops the quarter will hold.
9. Repeat steps 2 through 5.

Results: Complete the data table on the next page with the number of water drops recorded in the experiment. Be sure to include your estimate of how many water drops each coin will hold.

	Your Estimate	Trial 1	Trial 2	Trial 3	Average
Dime					
Nickel					
Quarter					

To find the average, add the 3 trial numbers. Divide that number by the amount of trials (3). The answer is the average.

Discussion:

a. What is the difference between your estimate and the average of the *dime* experiment?

_____

_____

_____

_____

b. What is the difference between your estimate and the average of the *nickel* experiment?

_____

_____

_____

_____

c. What is the difference between your estimate and the average of the *quarter* experiment?

_____

_____

_____

_____

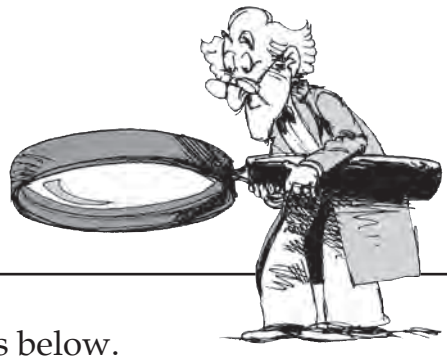
d. How is the difference between your estimate and average different, as you go from the *dime* and *nickel* experiments to the *quarter* experiment?

Why?

What is the difference in water drops?

e. Describe the water drop shape on the coin surface as seen from the side.

f. What shapes the water drop on the coin surface? Hint: It is a force.



Review: Read each question and circle the answers below.

1. What is the sequence of doing an experiment?

a. Ask a question – make a hypothesis – do an experiment – write the results.
b. Write the results – do an experiment – make a hypothesis – ask a question.
c. Do an experiment – ask a question – write the results – make a hypothesis.
d. Make a hypothesis – write the results – ask a question – do an experiment.

2. What are the variables you can change in the experiment to make the results different?

a. The height of the water drop.
b. The age of the coin.
c. Placing the coin tail side up.
d. All of the above.

3. What factor or variable changes in the experiment?

a. The size of the water drops.
b. The surface size of the coins (dime, nickel, quarter).
c. The height of the water drop.
d. How the coin is placed.