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SCIENCE AND MATH IN THE KITCHEN AND GARDEN

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SCIENCE AND MATH fields often overlap and connect, many experiments fit into multiple early learning foundations that lead to further discovery, extensions, and enrichment. Always have some idea of the next steps children can take based on their interests and the materials at hand.

We have so many facts at our fingertips on smartphones and computers, that education is no longer about memorizing facts. The **process of the scientific method** involves hypothesizing (guessing), making predictions, thinking logically, experimenting to test our hypothesis, observing the results, and then troubleshooting, changing variables, and trying again. Children who learn how to explore, evaluate information, integrate, think critically, work together, and solve problems have the potential to become future innovators. They become resilient to change.

Adults can't just assume children already know something. **Always start with the basics – from the simplest form - and build from there.**

GUIDING THE JOURNEY TO DISCOVERY...

- Provide **age-appropriate tools** for children to use: ruler, scale, magnifying glass, measuring cups, tweezers, gloves, funnels, sifters, buckets, aprons, clear containers for observing, recording implements, a camera, a thermometer, Petri dish, lab coats, gardening tools, etc.
- Encourage **children to make discoveries on their own**: to predict, question, ponder, use their senses, and experiment repeatedly in different ways.
- Ask **open-ended questions** that present an alternative to the actions children take to guide them in their decision-making process or through their next steps. *"What would happen if you...?"*
- Give children **plenty of time** to process open-ended questions and respond with thoughts and actions.
- **Read stories and display reference books** with pictures that support interests, actions, and experiments.
- **Sing songs, act-out stories**, engage children in finger plays, chants, arts & crafts, and **play games** that relate to the concepts they're exploring.
- Help children **make connections to real life** as often as possible. Don't just read a book. Invite speakers. Visit a factory, community garden, or a commercial kitchen. Watch a documentary on the subject.

PROVIDING INSTRUCTIONAL SUPPORT

Ask open-ended questions, questions that cannot be answered with one word, such as yes, no, 5, or yellow. If a child answers with one word, follow up with, "How?" or "Why?"

- "How did you decide to...?" "Why did you...?"
- "What if you...?" "Tell me about...?"
- "How else could you...?" "Why do you think...?"
- "How are they alike/different?" "How can you tell...?"
- "What might happen if...?" "How do you/did you...?"

Discover how children arrive at their conclusions by asking for explanations. Avoid teaching and preaching.

- Use whole sentences - not fragments.
- Use a variety of words in simple phrasing.
- Phrase and re-phrase questions until children understand the question.
- Build on what children say by affirming, encouraging (rather than praising), and then fishing with more open-ended questions. Guide them to the next level of learning when play stalls.
- Do not BOMBARD children with questions. Asking one question may be enough for the entire day. The goal is to get them thinking beyond what they are doing - beyond what they already know and into the next experiment or solution.
- Give children time to explore further and answer the question you ask.

EMBED SCIENTIFIC AND MATH CONCEPTS throughout each day using terms and expressions that give children more exposure to scientific and mathematical language. Do your homework. Prepare a word wall, use flashcards, and display signs at science stations with related terms and a written purpose to help teachers and staff remember content.



EXAMPLES OF EARTH SCIENCE IN THE KITCHEN AND GARDEN

All fields of natural science related to the planet Earth – geography, geology, and ecology. Earth science helps preschoolers explore the Earth, rocks, soil, water, weather, air, and natural changes in the environment. The kitchen and garden provide hands-on opportunities to investigate where materials come from, how water moves, how weather affects the garden, and how Earth's natural processes shape the world around us.

- Explore different soils - Compare garden soil, potting mix, sand, mud, bark, and clay-rich soil. Observe color, texture, and how each feels.
- Make a soil-settling jar - Shake different soils and water in sealed clear jars with adult supervision. Watch particles settle into layers over time.



- Sort and compare rocks - Examine clean rocks and pebbles. Sort them by color, size, shape, smoothness, and roughness. How will the rocks in the soil change how the plants grow?
- What happens when rain falls on soil? - Pour equal amounts of water onto bare soil and soil covered with leaves. Observe how water flows and whether soil washes away.
- Where did the water go? - Observe a small puddle or shallow dish of water over time. Compare sunny and shady locations.
- Make a model rain cloud - Place shaving cream on water in a clear cup and slowly add colored water with a dropper until it passes through to show how clouds fill with water before it rains.
- Collect and measure rain using a rain gauge in the garden and compare how much rain falls on different days.
- Observe daily weather - Record whether the day is sunny, cloudy, rainy, or windy. Compare how the garden looks and responds under different conditions.
- Air, Wind, and Weather - Place pinwheels, ribbons, a windsock, or lightweight streamers in different garden locations to observe moving air. Blow through a straw to move a cotton ball, a paper leaf, ping pong ball, or another lightweight object across a table.



- Trace the shadow of small plants or leaves in the morning and again later in the day. Compare the positions and lengths.
- With an adult, compare the temperatures of soil or surfaces in the sun and shade using a thermometer.
- Pour water slowly over a small mound of soil and observe where the water travels and where the soil collects.
- Toss a bucket of water against a pile of sand or soil to demonstrate how destructive weather can affect a garden or farm: tornadoes, hurricanes, floods, earthquakes, tsunamis.

- Compare soil before and after watering. Notice changes in color, firmness, clumping, and texture.
- Compare fresh leaves, partly decomposed leaves, brittle leaves, different colors, and finished compost. Discuss how dead plant material breaks down and contributes organic matter to soil.
- Wash vegetables from the garden - Observe soil on freshly harvested carrots or potatoes and watch how water carries it away.



- Build a simple water filter model - Pour muddy water, oils, and other liquids through a coffee filter or layers of clean sand and gravel. Compare the water before and after.
- Explore frozen water - Freeze water in different containers, then observe the ice melting. Connect freezing and melting to snow, ice, and Earth's cold environments.
- Start a recycling program.

EXAMPLES OF LIFE SCIENCE

IN THE KITCHEN AND GARDEN

The study of life, living things, and organisms, i.e.:

• Plants, Seeds, and Growing

- Plant seeds and grow an edible garden.
- Grow a bean in a clear plastic bag or container to observe roots, sprouts, and leaves developing.
- Grow root vegetables in clear containers of water.
- Dissect beans, peas, or sunflower seeds to discover the tiny plant inside.
- Regrow vegetables from their scraps, such as celery bases, lettuce stems, onion bulbs, or carrot tops.



- Grow celery in colored water to observe how water travels up the stalk.

- Compare roots, stems, leaves, flowers, and seeds.
- Examine and compare leaves, flowers, bark, and other plant parts.
- Observe how plants change as they grow.
- Explore how plants grow in different types of soil.
- Investigate how plants respond to sunlight and water.
- Examine flowers and leaves, including their petals, shapes, symmetry, and scents.
- Smell and compare edible herbs, such as mint, rosemary, and basil. Use them in food. See how the flavor changes.
- Press flowers and make leaf rubbings to explore plant structures.
- Investigate how seeds travel by wind, water, or animals.
- Match leaves to their plants or trees.

• **Fruits, Vegetables, and Food**

- Examine and compare fruits and vegetables, such as pumpkins, oranges, carrots, beets, and potatoes.
- Use the senses to examine and compare fake and real fruit and vegetables.
- Dry fruits.
- Explore the parts of plants we eat: roots, stems, leaves, flowers, fruits, and seeds.
- Shuck corn and examine its kernels, husks, and silk.
- Open fruits and vegetables to observe their insides, seeds, and textures.
- Investigate and observe how seeds from fruits and vegetables can grow into new plants
- Compare the colors, shapes, sizes, scents, and textures of different foods.
- Taste safe, edible fruits, vegetables, flowers, and herbs grown in the garden.
- Explore how fruits and vegetables grow (bushes, trees, underground, above ground, vines, etc) and where they come from.
- Observe how cut fruits and vegetables change over time.
- Explore how food changes as it ripens, then decays. Use the parts we typically don't eat such as banana peels, apple cores, or other food scraps.
- Compare fresh, dried, and decomposing leaves or plant materials.
- Discover how people use plants to make foods, such as bread, cornmeal, and vegetable oils.
- Explore how plants provide food for people and animals.

• **Soil, Composting, and Decomposition**

- Explore and compare different types of garden soil.
- Compost fruit and vegetable scraps and observe how they break down.
- Investigate how compost can help nourish garden plants.
- Observe small garden organisms, such as pill bugs and other decomposers, in their natural habitats.

• **Garden Animals, Insects, and Pollination**

- Observe earthworms, snails, slugs, caterpillars, pill bugs, and other insects. Discover how they move in soil.
- Create a see-through worm bin or ant farm and observe worms and ants move in their environment.
- Observe the transformation of caterpillars into butterflies.
- Observe bees visiting flowers from a safe distance. Explore how they and other pollinators help plants produce fruits and seeds.
- Observe birds visiting a garden and discover what they eat.
- Investigate which garden creatures eat plants, seeds, or other small organisms.
- Compare the features of garden insects, such as wings, legs, antennae, and body shapes.
- Explore how animals and insects find food and shelter in a garden.
- Observe how garden creatures change as they grow.

• **Plant Products and Food Changes**

- Make simple dishes for taste tests using fruits, vegetables, and herbs.
- Compare fresh, frozen, dried, and cooked fruits or vegetables.
- Compare the different ways food can be prepared: fresh, dried, steamed, boiled, baked, fried, etc.
- Explore how people preserve foods by drying, refrigerating, or freezing them.
- Observe how heat changes the color, texture, smell, and appearance of foods.
- Explore how seeds, grains, and nuts differ in size, shape, and texture. Sort them.
- Investigate how water moves into or out of plant materials.
- Observe how the skin of fruits such as apples and oranges protects the fruit from changing color over time.
- Investigate how plants provide ingredients for everyday foods.
- Explore how butter is made from cream.
- Observe how yeast helps bread dough rise.

• **Kitchen and Garden Observation Tools**

Most tools can be incorporated into any of the activities above.

- Use magnifying glasses to examine seeds, roots, leaves, flowers, insects, and soil.
- Use clear jars, containers, or baggies to observe germination and root growth.
- Use droppers, measuring cups, and small pitchers to water plants and investigate their needs.
- Photograph plants over several days/weeks to document changes.
- Journal and raw pictures of observations, such as a seed before and after sprouting.
- Sort and compare seeds, leaves, fruits, and vegetables by size, shape, color, or texture.

EXAMPLES OF PHYSICAL SCIENCE

IN THE KITCHEN & GARDEN

A natural science – the study of nonliving materials; explains and predicts nature's phenomena - physics, chemistry, astronomy, math, and statistics. Physical science helps preschoolers explore matter, motion, force, energy, light, sound, cause and effect, magnetism, absorption, temperature, and the properties of materials through hands-on discovery. The kitchen and garden offer everyday opportunities to observe, predict, experiment, and investigate cause and effect.

- Smell and examine fresh and dry spices.
- Mix food coloring in whip cream, water, shaving cream, oil, etc.
- How to pickle to prevent spoilage.
- How to make jelly or jam.
- Use beets, blueberries, tea, etc. to dye fabric.
- Test which utensils respond to magnets. (WARNING!)
- Measure time using a timer, sundial, routines, clock, or hourglass.
- Water, Liquids, and Flow - Pour, fill, and measure - Use cups, pitchers, funnels, and containers of different shapes. Explore how water flows and how much each container holds.
- Float or sink? Predict whether corks, leaves, stones, spoons, and other safe objects will float or sink in water.
- Watch ice melt - Compare ice in different locations, such as a shaded garden spot and a warmer indoor area.
- Freeze different liquids: water, oil, vinegar, juice. Use interesting molds to put the liquids in. Refreeze what melts.
- Compare how quickly ice melts or food thaws when kept cold in insulated and uninsulated containers.
- Make frozen fruit pops: Observe how liquid mixtures become solid in a freezer and melt again when removed.
- Explore temperature: Compare objects that have been kept in a cool place and a warm place, using touch only when safe and comfortable.
- Mix colored water - Use droppers to combine colored water and discover how new colors appear.
- Which materials absorb water? Compare sponges, paper towels, cloth, foil, and plastic to discover which materials soak up water. Add food coloring to see what happens.
- Force, Motion, and Gravity – explore how things moved when poured, rolled, from a tilted pan, etc.
- Push and pull garden tools - an empty wagon, then one carrying lightweight items. Compare the effort needed.
- What falls fastest? Drop a leaf, a stick, and a rock from the same height. Observe how their shapes affect falling.
- Move objects through water - Use a spoon, a gentle water pour, or a hand fan to move floating objects and suds across a basin.
- Make garden shadows. Trace the shadows of leaves, flowers, pots, or garden tools at different times of day.
- Explore shade and sunlight. How do they affect how plants grow? How do they affect the temperature in the garden? How do the shadows of the plants change at different times of the day?
- Compare wet and dry soil - Feel and observe damp and dry soil. Notice differences in texture, clumping, and how easily each can be moved.
- Explore evaporation - Put equal amounts of water in shallow dishes in sunny and shaded locations. Check them later and compare what remains.
- Compare wooden, metal, plastic, and silicone utensils. Describe their texture, flexibility, hardness, and weight.
- Compare sand, soil, and gravel - Examine how materials feel, pour, pile up, and change when water is added.
- Make a fizzing/gas/chemical change or reaction - With adult supervision, combine baking soda and vinegar in a tray and observe the bubbles and foam.
- Mix flour and water - Observe how dry flour changes when water is added, then compare the texture as the mixture is stirred and kneaded.
- Conduct water experiments by mixing it with oil, solids (sugar, baking soda, salt), liquids (vinegar, corn syrup, dish soap), food coloring, etc.
- Sound and Vibration - Make sounds by gently tapping metal bowls, wooden spoons, and plastic containers. Compare the sounds each material makes.
- Listen to water-filled glasses - With adult help, gently tap sturdy glasses containing different amounts of water and compare their sounds.
- Listen to the garden - Observe wind chimes or leaves rustling and investigate what makes the sounds begin and stop.
- See what dissolve and what doesn't? Stir sugar, salt, sand, and flour into separate cups of water and compare what happens.
- Watch steam: Observe an adult demonstrate steam from hot water from a safe distance. Understand that steam can burn the skin.
- Build a bridge or archway over growing vegetables.
- Spoon sugar on a slice of cucumber to see how sugar absorbs moisture.
- Use a sifter/strainer to see what passes through and what doesn't.
- Demonstrate and use simple machines (kitchen tools): pick up with spatulas, transfer objects with tongs, strain ingredients, etc.
- Discover how a salad spinner, blender, whisk, mixer, toaster, and other kitchen tools work.
- Build bridges, enclosures, or towers out of Popsicle sticks, plastic utensils, cups, paper plates, etc.
- Make a catapult out of Popsicle sticks, rubber bands, and plastic spoons/bottle caps.
- Dip coffee filters or press paper towels into food coloring.
- Discover how a salad spinner, blender, whisk, mixer, toaster, works.
- Rub wax/crayon on an egg before painting/dying.
- Build a system of ramps out of paper towel rolls or recycled plastic food bottles.
- Make a parachute out of a coffee filter and pipe cleaner or string.
- Blow and pop bubbles using dish soap.

- Use shelf liners, dishcloths, paper towels, and other textures on the surface of the ramps to test friction.

MATH ACTIVITIES

IN THE KITCHEN AND GARDEN

Math and science foundations often overlap, as children use counting, measuring, sorting, comparing, and recognizing patterns to explore, investigate, and make sense of the world around them.

- Compare and match measuring spoons and cups. Explore which ones hold more or fewer, put them in order by size, and discover how smaller amounts combine to fill larger measures.



- Transfer water from a container to containers of different sizes.
- Create patterns with fruit and vegetable pieces. Arrange snack pieces in patterns such as apple–grape–apple–grape, then invite children to predict what comes next before they eat.
- Explore fractions when sharing food. Cut a sandwich, tortilla, or piece of fruit into two equal parts, then four parts. Compare equal and unequal portions.
- Play a kitchen estimation game. Ask children to estimate how many beans fit in a cup, how many crackers are on a plate, or how many grapes are in a bowl. Count afterward to check their estimates.
- Build and compare towers with food containers. Stack clean yogurt cups, small boxes, or cans, then count the pieces, compare tower heights, and investigate which structures are taller, shorter, or more stable.
- Seek and find large shapes or numbers hidden in the garden or kitchen.



- Take the temperature of different solids/liquids or foods before eating it.
- Weigh different liquids and foods.
- Measure objects using a ruler, tape measure, and nonstandard means such as string or popsicle sticks, or straws.
- Monitor and measure the growth of plants.
- Construct 2D and 3D shapes and designs with paper towel rolls, toothpicks, popsicle sticks, foil, cups, recycled materials, etc.
- Practice folding foil and napkins into different shapes before dining.
- Count the food on your plate.
- Make puzzles out of a cereal box, sponges, coloring book covers, etc.



- Make a puzzle by tracing everyday kitchen objects on construction paper using a Sharpie.



- Test wet and dry weight loads on paper towels or napkins.
- Use egg cartons for sorting and number games.
- Compare different colors, sizes, and types of eggs: chicken, quail, etc.

- Make home-made Playdoh or simple foods from a recipe. (steps in sequential order)
- Bake bread from scratch.
- Use weekly food ads to make a food pyramid, go on a healthy food hunt, sort by color/food group, or put numbers in order.
- Make a paper plate wind spinner, puzzle, or use the plate to weave through.
- Lace and weave shoelaces, string, or strips of paper through holes punched into paper towel rolls, paper plates, cereal boxes, oven grates, etc.



- Scavenger hunt in the kitchen and garden by giving verbal or visual clues relating to size, length, quantity, and other descriptions.
- Make patterns out of Skittles and then pour warm water on the plate.



- Stuff thin lids, different sizes of bottle caps, or playing cards into plastic containers that have holes or slits of different sizes.
- Thread spaghetti, straws, chopsticks, or flowers through a colander.
- Thread Cheerios, beads, buttons, onto chopsticks or spaghetti with etc.
- Sort different shapes and colors of pasta or beans.
- Paint by stamping with cookie cutters, mashers, or the end of paper towel rolls.
- Use cookie cutters to cut shapes into sandwiches and other food.
- Make a water all and predict where water will go to compare heights, sequencing, and spatial relationships.



- Use cups to sort items, make number/letter match games, and counting games.
- Press, mold, and wrap objects that are different shapes, sizes, measurements.

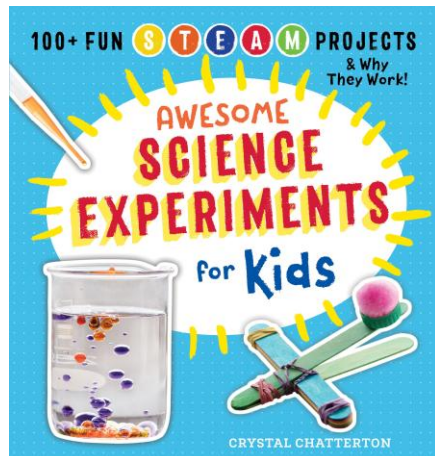


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***Thank you for listening,
and welcome to the CLUB!***

Many of the photo samples are from various early childhood blogs online.

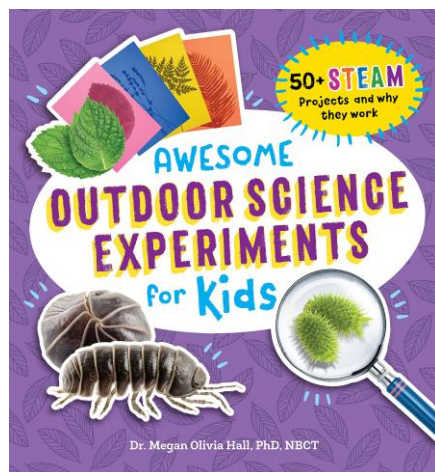
Here are some wonderful books filled with experiments you can try.



Awesome Science Experiments for Kids,
by Crystal Chatterton
ISBN-10: 9781939754660



Awesome Kitchen Science Experiments for Kids,
by Megan Olivia Hall
ISBN-13: 978-1641526210



Awesome Outdoor Science Experiments for Kids,
by Megan Olivia Hall
ISBN-13: 9781648769368

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