ANGELA RUSS –AYON

MY SHADOW MOVES WITH ME
SIMPLIFYING SCIENCE

AbridgeClub.com

P: 562-421-1836

STEAM is based on the idea of educating students in five specific disciplines — science, technology, engineering, art, and mathematics, embracing teaching skills and subjects in a way that resembles real life. Since these fields overlap and connect, many experiments fit into multiple categories that lead to further discovery, extensions, and enrichment. Always have some idea of the next steps children can take based on the materials at hand.

We have so many facts at our fingertips on smartphones and computers, that education is no longer about memorizing facts.

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

THE SCIENTIFIC METHOD

Just because you talk about something scientific does not mean you are following the **process of the scientific method,** which involves:

- **Observation:** This is the first step, where you observe a phenomenon in the natural world using your senses. It could be something you notice or a question you have about the world around you.
- **Question:** Based on your observations, formulate a clear and concise question that you want to answer through your investigation.
  - *"What happens when you mix colors?"*
  - *"How is a shadow made?"*
  - *"Why is ice kept in the freezer?"*
- **Hypothesis:** Propose a tentative explanation to answer your question about what was observed. It is a statement that can be tested through experimentation or observation. It is often based on existing knowledge or observations and serves as a starting point for further investigation. The hypothesis should be testable and based on current knowledge.
  - *"When colors are mixed, a new color will be the result."*
  - *"Light makes my shadow."*
  - *"Ice melts when it is left out of the freezer."*
- **Prediction:** Develop predictions from your hypothesis. "What will happen?" Predictions should be specific and measurable, helping you design experiments to test the hypothesis.
  - *"If I mix all the paint colors together, I'll get rainbow-colored paint."*
  - *"My shadow will change when I move."*
  - *"If I leave this ice cube outside in the sun, it will turn into water."*
- **Experimentation:** Design and conduct experiments to test your hypothesis. Ensure that your experiments are controlled and that you have the proper age-appropriate materials and clear steps to follow.
- **Data Collection:** Record observations and accurate data during your experiments. Journal!
- Analysis: Analyze the data you've collected to determine whether it supports or contradicts your hypothesis.
- **Conclusion:** Based on your analysis, draw conclusions about whether your hypothesis is supported or not. If the data does not support your hypothesis, consider revising it and repeating the process.
- **Communication:** Share findings with classmates, friends, or family members.

Adults will submit their conclusions and findings for peer review, and once it passes their scrutiny, publish the results to share the knowledge.

Scientists may not follow the steps of the method in order. They may revisit and revise steps as they gather more information and gain a better understanding of what has taken place.

Young children may combine a hypothesis and prediction in the same step. They learn how to explore, evaluate information, integrate, think critically, work together, and problem-solve. They have the potential to become future innovators. They can become resilient to change.

GUIDING THE JOURNEY TO SCIENTIFIC DISCOVERY…

- Provide **age-appropriate tools** for children to use: ruler, scale, magnifying glass, measuring cups, tweezers, funnels, sifters, buckets, aprons, clear containers for observing, recording implements, a camera, a thermometer, Petri dish, lab coats, gloves, gardening tools, etc.
- Encourage **children** to **make discoveries on their own**: to use their senses, observe, predict, question, ponder, 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. Often, they don't know what else they can do.
- Give children **plenty of time** to process open-ended questions and respond with critical thinking, actions, and words.
- **Read stories** and **display reference books** with pictures that support interests, actions, and experiments.
- **Sing songs**, **act-out** sequences, 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.

PROVIDING INSTRUCTIONAL SUPPORT

Ask open-ended questions, questions that cannot be answered with one word, such as yes, no, five, 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.

The magnet is attracted to metal paper clips.

- *"What other objects are attracted to a magnet? Why?"*
- *"How can you sort the objects, so you know which ones are attracted to the magnet?"*
- *"How can you use the magnet to fish for things?"*
- *"How can you move an object using a magnet?"*
- *"What if you moved the magnet under the paper?"*
- *"What would happen if you painted by moving the magnet around?"*

The goal is to get children thinking beyond what they are doing - beyond what they already know - and into the next activity, experiment, or discovery. Give them plenty of time to answer the question you ask.

EMBED SCIENTIFIC CONCEPTS throughout each day using terms and expressions that give children more exposure to the language of STEM. Describe actions using **STEM terminology.** Do your homework. Prepare a word wall, use flashcards and display signs at science stations with related terms and a written purpose to help everyone remember content.

EARTH SCIENCE

All fields of natural science related to the planet Earth – geography, geology, ecology i.e.:

- Day and night: Moon, night sky, stars, sun, sunrise, sunset.
- Effects of the sun on different objects and people
- Shadow changing, chasing, measuring, tracing.
- Weather: sunny, rain, snow, hail, wind, ice, shade
- Clouds and formations
- Terrain: mountains, valleys, desert, grass, plants, flat lands
- Dirt and soil exploration and discovery: mud, compost, sand, clay
- Solids vs liquids (sand is a solid)
- Water: oceans, lakes, rivers / flow on ramps, pouring, mixing, condensation, evaporation, freezing

- Changing seasons: temperature changes, cause and effect
- Rocks: sedimentary, metamorphic, igneous
- Observation of rocks: shapes, color, crystals, streaks, hardness, cleavage and cracks, luster
- Colors of the rainbow
- Destructive weather: tornadoes, hurricanes, floods, earthquakes, tsunamis
- Taking care of the Earth: litter, recycling, conservation
- Fossils
- Gravity

LIFE SCIENCE

A natural science - The study of life, living things and organisms, i.e.:

- Living things
- The human body / 5 senses / use & purpose of body parts / motor skills / balance / heart rate / perspiration /mindfulness
- Animals: wild versus tame / farm / pets
- Health / nutrition / germs / diseases / clean body & teeth / Purpose of doctors and dentists
- Lifecycles of animals, insects, plants
- Eggs and birth
- Parent and baby animals
- Comparing leaves / pinecones / trees / bark / flowers
- Growing root vegetables in clear glass with water
- Plant a seed or an edible garden
- Examine fruits & veggies
- Flowers: water, sun, xylem, petals, symmetry, scent, etc.
- Earthworm, mealworm, and other insect observation
- Collecting ants / observing an ant farm
- Collecting caterpillars / observing change to a butterfly
- Spider webs and ways of hunting
- Fish and sea creature observation
- Characteristics of animals and insects
  - Movement of animals and insects: feet, fins, skin, wings, etc.
  - Animal and insect sounds / habitats / features (hair, fur, feathers, skin, scales, etc.)
  - Location of habitats: underground, in trees, in water, around coral reefs, etc.
  - Food sources and hierarchy of animals and insects (survival of the fittest)
  - Sleep and movement patterns: day, no sleep, nocturnal, etc.
  - Survival skills: hiding, camouflage, webs, etc.
- Human use of animal and plant products
- Metamorphosis and physical changes over time

PHYSICAL SCIENCE

A natural science – the study of nonliving materials; explains and predicts nature's phenomena - physics, chemistry, astronomy, math & statistics, i.e.:

- Ways to measure time: timer, routine, sundial, clock, hourglass
- Force and motion
- Cause and effect
- Weight and balance
- Magnetic attraction (WARNING!)
- Temperature changes
- Ice freezing and melting
- Liquid vs solid
- Water absorption
- Water flow
- Sink or float
- Archways and bridges
- Magnification
- Simple machines
- Gravity
- Static electricity
- Battery electricity
- Classifying / Sorting

Thank you for listening
and welcome to the CLUB!

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QUICK AND FUN EXPERIMENTS

Always begin with the questions "WHY?" and "HOW?" and invite children to answer the question.

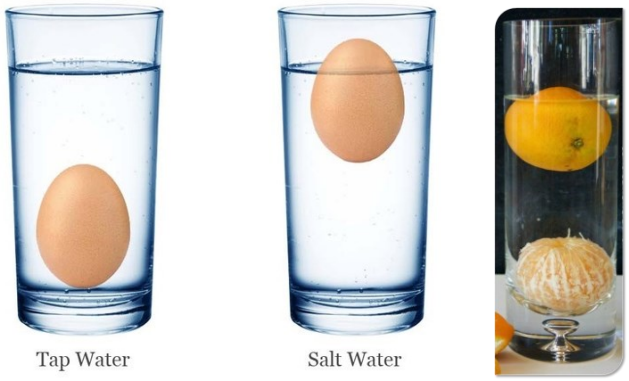
○ **SCIENCE: Unbreakable Baggie**

"Why can you stick sharp pencils through a plastic baggie of water without it leaking?"

Plastic storage bags are made of polymer called low-density polyethylene. It is flexible and moves out of the way of the pencil, forming a seal around the edge of the sharp pencil.

Extensions:

- ○ Use a plastic grocery bag or a water balloon.
- ○ Puncture with a toothpick, metal skewer, or stick pin.



○ **SCIENCE & MATH: Egg Sink or Float**

"Why does an egg sink?"

"How can you make an egg float?

An egg is denser (closely compacted) than water, so it sinks. But when enough salt is dissolved in the water, the water becomes denser, and the egg will float.

Extensions:

- ○ Adding baking soda to the water
- ○ Adding corn starch to the water
- ○ Adding flour to the water
- ○ Measure the depths.
- ○ Testing different things: orange with peel and one without

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○ **SCIENCE: Bending Light**

"Why does a pencil bend when it is placed in a glass of water?"

When light traveling through the air hits water, some of the light is reflected off the water. The rest of the light passes through the water, but it bends (or refracts) as it enters the water.

Refraction occurs when light travels from one medium to another (i.e., air to water, water to air). The same thing happens when light hits glass or any other transparent material.

Extensions:

- ○ Replace the pencil with a clear straw and other objects.
- ○ Shine a laser light through the water (supervision)

○ **SCIENCE: Chemical Reactions**
"Why does baking soda and vinegar fizzle when combined?"

When baking soda is mixed with vinegar there is a chemical reaction. The acid breaks down baking soda, releasing carbon dioxide gas which causes the fizz.

Extensions:
- ○ Add food coloring.
- ○ Freeze the baking soda and water mixture. Drop vinegar on the ice.
- ○ Secure a balloon on top of a water bottle. The gas will inflate the balloon.
- ○ Seal the mixture in a baggie.

○ **SCIENCE & MATH: Baking Bread**
How do you bake bread?
Why does the dough rise?

Measure and mix basic bread ingredients: flour, yeast, water, salt. When the yeast digests the sugar, carbon dioxide is released (fermentation). It is trapped as tiny pockets of air within the dough. This causes it to rise. During baking the carbon dioxide expands and causes the bread to rise further.

Extensions:
- ○ Try to bake bread in the freezer.
- ○ Note how the consistency changes as you add ingredients:
- ○ Change the amount of ingredients. Leave some out, add new, and then compare how the dough rises, cooks, and tastes.

○ **SCIENCE & MATH: Fresh vs. Decay**
Why does a sliced pumpkin rot faster than a whole pumpkin?

Like all fresh foods, pumpkins will eventually rot and decompose. Pumpkins rot when exposed to air, through the process of oxidation, and when they lose moisture, so these vegetables slowly begin to decay once cut from the stem. Warm weather and extremely low temperatures can also make a rotting pumpkin worse. Mark calendar days with photos of the decaying process.

Extensions:
- ○ Keep one in the refrigerator and one out.
- ○ Carved pumpkin vs. uncarved. - Mold spores and bacteria float in the air. When they land on the exposed pumpkin, they start to eat the pumpkin and grow.
- ○ Examine the decay with a magnifying glass.

○ **TECHNOLOGY: Static Electricity**

Why does the spoon charged with static electricity pick up more pepper than salt?

When you rub a plastic spoon against a dish cloth, wool fabric, or hair, you manually move electrons from one material to another, causing static electricity (a charge imbalance). Wool more easily sheds electrons than cotton. When the spoon is charged full of electrons, it can attract small objects. Pepper is lighter than salt, so it is attracted first and sticks longer.

NOTE: Cultural differences in hair.

Extensions:

- Rub a balloon on your hair to see what happens to your hair. (**Cultural warning:** rubbing a balloon on hair may not cause static electricity for some people of color because of the presence of moisturizers and creams in their hair)
- Rub a plastic pen on wool and try to pick up small pieces of paper or glitter.
- Rub a balloon on wool or your hair. Hold it to the wall and see if it sticks.
- Rub a balloon on wool or hair. Hold it near a thin stream of water under a faucet and watch the water bend.

○ **ENGINEERING: Straw Plane**

"Which paper plane flies the farthest?

Fold a paper plane or build a plane out of a straw and two strips of paper. Planes fly using the physics of aerodynamics and flight. Air moves through both the straw and the paper circle which enables the plane to lift and fly.

Extensions:

- Measure how far the planes fly.
- Fly the plane toward a target.
- Redesign the plane.
- Change the length or type of straw.
- Modify the length of the paper strips.
- Make the strips out of different materials. (Paper plate, trimmed paper cup, tissue paper, copy paper, file folder)
- Add paper wings.
- Add weight, like paperclips.

○ **SCIENCE & MATH: Absorption, Color, Weight**

What happens when you pour water onto a sponge?

Liquid absorption is when something takes in another substance. Materials that are thicker and contain more cellulose absorb more water. The fibers in tissues and paper towels are made of cellulose molecules (tiny sugar molecules chained together). Water molecules rush into the cellulose fibers when cellulose and water meet.

Extensions:

- Compare different brands of the same material (paper towels & napkins).
- Compare various materials: napkins, paper towels, dishcloths (cotton), etc.
- Weigh different objects.

- **SCIENCE & MATH: POPCORN MATH - CONSERVATION**

Does the weight of popcorn change after the corn is popped?

The law of conservation of mass states that mass is neither created nor destroyed in a chemical reaction. No matter how the materials change chemically in a closed system, the weight will remain the same.

Extensions:

- Open the bag and weigh it again.
- Conduct a kernel vs. popped corn sink or float test.

INTERESTING STEM ACTIVITIES:

- Use the senses to examine and compare fake and real fruit and vegetables.
- 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.
- Dry fruits.
- Take the temperature of different solids/liquids or foods before eating it.
- Use beets, blueberries, etc. to dye fabric.
- Measure objects and journal results using a ruler, tape measure, and non-standard means such as string or paper strips.
- Construct 2D and 3D shapes and designs with paper towel rolls, toothpicks, Popsicle sticks, cups, recycled materials, etc.
- Practice folding napkins into different shapes before dining.
- Make a puzzle out of a cereal box, sponge, coloring book covers, etc.

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

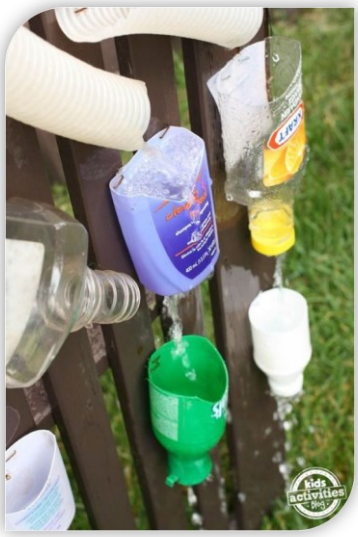
- Examine how ice freezes and melts under different conditions.
- Freeze food and objects in the ice. Use tools to chisel and drip warm water over the ice.
- Spoon sugar on a slice of cucumber to see how sugar absorbs moisture.
- Use a sifter/strainer to see what passes through and what doesn't.
- Pour water & other liquids through coffee filters.
- Transfer water from a container to containers of different sizes.
- Demonstrate and use simple machines (kitchen tools): pick up with spatulas, transfer objects with tongs, strain ingredients, etc.
- Conduct water experiments by mixing it with oil, solids (sugar, baking soda, salt), liquids (vinegar, corn syrup, dish soap), food coloring, etc.
- Experience chemical reactions with vinegar and baking soda.
- Make a sensory bin using water, beans, bottle caps, rice, etc.
- Dip coffee filters or press paper towels into food coloring.

- Discover how a salad spinner, blender, whisk, mixer, toaster, works.
- 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.
- Test absorption on paper towels, sponges, napkins, and dish cloths, foil, baggies, Saran wrap, etc.
- Test wet and dry weight loads on paper towels or napkins.
- Rub wax/crayon on an egg before painting/dying.
- Use egg cartons for sorting and number games.
- Compare different colors and types of eggs: chicken, quail, etc.
- Make home-made Playdoh from a recipe.
- Bake bread from scratch.
- Use weekly food ads to make a food pyramid, go on a healthy food hunt, or sort by color/food group.
- Identify different sounds using items in containers (plastic eggs) or utensils against a metal bowl, etc.
- Make a paper plate wind spinner, puzzle, or use the plate to weave string.

- Make a parachute out of a coffee filter and pipe cleaner or string.
- Blow and pop bubbles using dish soap.
- Wind: blow cotton balls or ping pong balls using straws or condiment bottles, etc.
- Design a windsock for the garden.

- Scavenger hunt in the kitchen and garden by giving verbal or visual clues.
- Make patterns out of Skittles and then pour water on the plate.

- Stuff thin metal lids or playing cards into plastic containers with slits cut into the holes.
- Thread spaghetti, straws, chopsticks, or flowers through a colander.
- Thread chopsticks or spaghetti with Cheerios, beads, buttons, etc.
- Lace and weave shoelaces, string, or strips of paper through holes punched into paper towel rolls, paper plates, cereal boxes, oven grates, etc.
- Sort different shapes and colors of pasta or beans.
- Stamp paint with cookie cutters, mashers, or the end of paper towel rolls.
- Use cookie cutters to cut shapes into sandwiches and other food.
- Press and mold foil over different objects.
- Build a system of ramps out of paper towel rolls or recycled plastic food bottles.

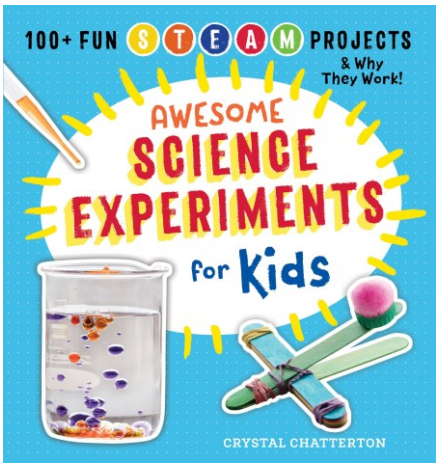


- Use shelf liners, dishcloths, paper towels, and other textures on the surface of the ramps to test friction.
- Use cups to sort items, make number or letter match games, and counting games.
- Grow lettuce or celery from a stem sitting in water.

- Set a flower or celery in die to see how water travels in plants.
- Dig in and examine dirt with a magnifying glass.
- Start a compost heap.
- Examine insects in the garden.
- Observe the lifecycles of caterpillars/butterflies/moths.
- Build an ant or worm farm in a recycled jar/compost heap.
- Compare and contrast fresh vs dying plants.
- Plant a seed. Monitor and measure growth.
- Experiment with plant growth using sun vs. darkness, dry vs. wet.
- Grow plants using different light sources.
- Examine fruits and vegetables as they decay.
- Harvest crops for meals.

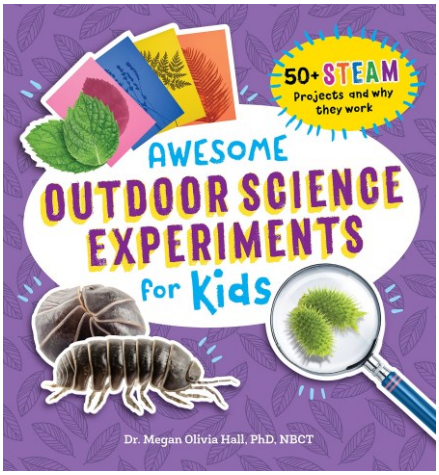
Thank you for listening,
and welcome to the CLUB!

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

Scientific Terms

Courtesy of AbridgeClub.com

A ——————
abdomen
adapt
air
analyze
animal
animate object
antenna
apply
approximation
arthropod
ask
axle

B ——————
balance
bar graph
basic needs
baster
bark
bitter
body parts
bounce
bug viewer

C ——————
capacity
category
cause
characteristics
Chart
climate
compare
complex
conclusion
conduct
connect
construct
contrast
conversion
cloud
Cold
collect
color
compare
curious

D ——————
dark
data
day
decay
decide
describe
different
direction
discover
diversity
document

E ——————
effect
engineering
environment
estimate
evaporation
evidence
examine
example
exhibit
experiment
explain
explore
external
extinct
eyedropper

F ——————
features
findings
function
feet
five senses
flow
flower
float
force
freeze
fruit

G ——————
gas
gear
gloves
graph
green
growth
grouping

H ——————
habitat
hand lens
hard
hatch
head
heart
heat
height
high
how
hypothesize

I ——————
ice
identify
illuminate
inanimate
incline plane
inquire
Interaction
internal
investigate

J ——————
journal

K ——————
knowledge

L ——————
laboratory
leaf
leaves
lever
lifecycle
liquid
lever
length
light
living
loud
low

M ——————
magnify
magnifying glass
mammal
match
mathematics
matter
mass
measure
melt
method
microscope
model
moon
motion
movement

N ——————
number
night
nonliving

O ——————
object
observe
opaque
organism
organization

P ——————
part
pattern
pebble
peel
perspective
pipette
plant
pod
position
predict
process
properties
pull
Pulley
pulp
push

Q ——————
quantify
quantity
question

R ——————
rainbow
ramp
record
reflect
research
result
reverse
revise
recycle
reptile
recourses
river rocks
roll
root
rot
rough

S ——————
safety
same
scale
science
screw
seasons
section
seed
segment
senses shape
seriation
similar
sequence
sink
size
skin
slide
smooth
soft
soil
Sort
specimen
sprout
spring
sort
sound
sour
stars
stem
steps
stone
structure
Study
stump
substance
summer
sun
system

T ——————
tail
temperature
technology
test
theory
timer
topple
tool
transfer
translucent
transparent
tweezers

U ——————
understand
useful

V ——————
variable
variation
vegetable
Venn diagram

W ——————
watch
warm
warning
water
weather
wedge
weight
what
when
where
why
wheel and axle
wind
wing
winter
wonder
wood
worn

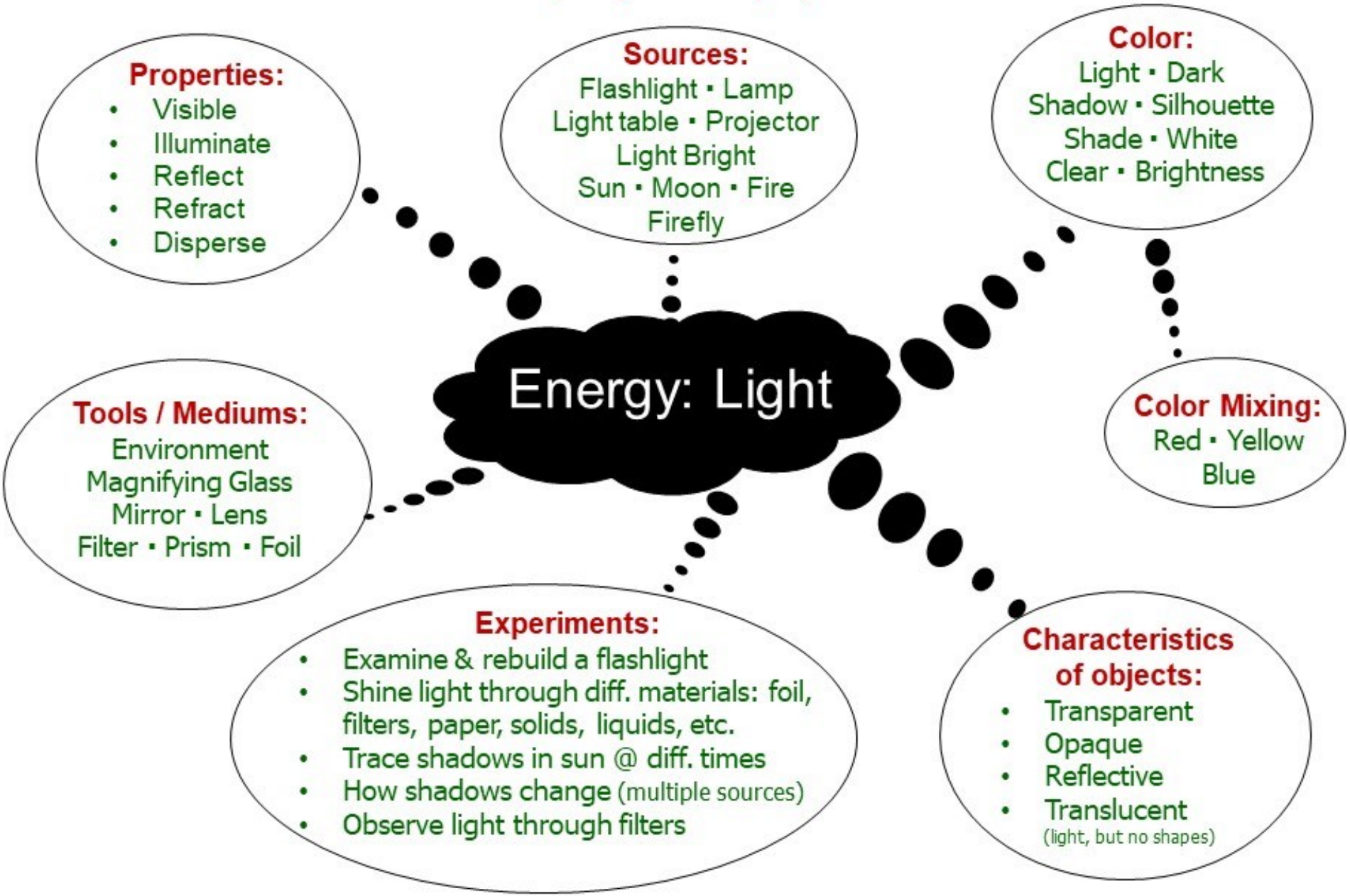
X ——————
x-ray

Y ——————
year
young

Scientific vocabulary list.pub

Sample for Physical Science - Light Curriculum Web

(Stay on a topic)



Curriculum WEB ▪ Connect Subjects/Concepts Across Domains