YOUNG einsteins

science club

THE EDGERTON EXPLORIT CENTER
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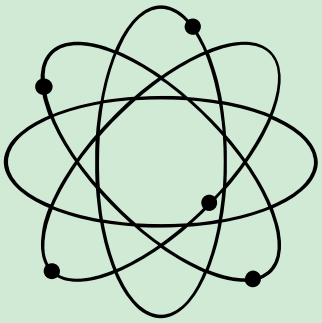

What is Science?

What is Science?

The word “science” probably brings to mind many different pictures: a fat textbook, white lab coats and microscopes, an astronomer peering through a telescope, a naturalist in the rainforest, Einstein’s equations scribbled on a chalkboard, the launch of the space shuttle, bubbling beakers .... All of those images reflect some aspect of science. But none of them provides a full picture because science has so many facets:

1. Science is both a body of knowledge and a process. In school, science may sometimes seem like a collection of isolated and static facts listed in a textbook, but that’s only a small part of the story. Just as importantly, science is also a process of discovery that allows us to link isolated facts into coherent and comprehensive understandings of the natural world.

2. Science is exciting. Science is a way of discovering what’s in the universe and how those things work today, how they worked in the past, and how they are likely to work in the future. Scientists are motivated by the thrill of seeing or figuring out something that no one has before.

3. Science is useful. The knowledge generated by science is powerful and reliable. It can be used to develop new technologies, treat diseases, and deal with many other sorts of problems.

4. Science is ongoing. Science is continually refining and expanding our knowledge of the universe, and as it does, it leads to new questions for future investigation. Science will never be “finished.”

5. Science is a global human endeavor. People all over the world participate in the process of science. And you can too!

Types of Science:

Physics	the branch of science concerned with the nature and properties of matter and energy. The subject matter of physics, distinguished from that of chemistry and biology, includes mechanics, heat, light and other radiation, sound, electricity, magnetism, and the structure of atoms.
Chemistry	the branch of science that deals with the identification of the substances of which matter is composed; the investigation of their properties and the ways in which they interact, combine, and change; and the use of these processes to form new substances
Mathematics	the abstract science of number, quantity, and space. Mathematics may be studied in its own right (pure mathematics), or as it is applied to other disciplines such as physics and engineering (applied mathematics).
Astronomy	Astronomy is a natural science that studies celestial objects and the phenomena that occur in space. Astronomers use math, physics, and chemistry to explain the origin and evolution of these objects, which include planets, stars, moons, galaxies, asteroids, and more.
Biology	Biology is the scientific study of life. It is a natural science with a broad scope but has several unifying themes that tie it together as a single, coherent field. For instance, all organisms are made up of cells that process hereditary information encoded in genes, which can be transmitted to future generations.
Engineering	Engineering is a scientific field that uses scientific understanding of the natural world to create things that solve problems and achieve practical goals. This can include designing, inventing, and building roads, bridges, cars, planes, machines, tools, processes, and computers.
Botany	Botany, also called plant science, plant biology or phytology, is the science of plant life and a branch of biology. A botanist, plant scientist or phytologist is a scientist who specialises in this field.
Geology	The word geology means 'Study of the Earth'. Also known as geoscience or earth science, Geology is the primary Earth science and looks at how the earth formed, its structure and composition, and the types of processes acting on it.

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INTRODUCING EVERYONE

getting to know our class

HANDS UP FOR SCIENCE

An activity designed to get to know one another

Levels: K through 5th
Time: 20 to 25 minutes

OBJECTIVES

To help us learn more about the friends around you, we are creating a mural together that says,
“Hands Up for Science!” “Reach for the STARS!”
Each Student will be creating a one-of-a-kind hand that is designed by you and shows a little bit about who you are!

PREPARATION

It’s best to do this activity at least once before teaching the students to 1) ensure you know how the experiment works, and 2) to have a few examples of what the project will look like.

ACTIVITY

1. Outline the hand and part of the arm with a pencil first (outline non-dominant hand) and then trace over the pencil with a Sharpie marker. Demonstrate how to do this.

2. Cut out the hand outline.

3. Use markers to decorate a one-of-a-kind hand.

4. The child needs to include their first name on the front of their hand.

5. Kids may design the hand how they want, include things about themselves, or simply decorate it.

6. When completed, kids may glue their hands to the mural. Add on stars.

7. Display in a prominent place in your classroom.

MATERIALS:

EACH STUDENT NEEDS:

- Mural Paper/Roll Paper with the words “Hands Up For Science” “Reach for the Stars” on it.
- Paper for kids to trace their hands and forearms on Or print use a preprinted handprint template (included below).
- Washable Markers
- Scissors
- Painter’s Tape to affix mural to the wall
- Glue sticks or Rubber Cement to attach hands to mural
- Star cut outs - write areas of science study on each star

REFLECTION

Things to do after the activity

Display mural in a prominent place for kids to enjoy.

Show a finished hand outline that you have designed and cut out. Talk about what things you like that you included on your hand, favorite colors you used, etc. Then brainstorm things the students could include on the hand outline....circles, stars, hearts, swirls, diamonds. Favorite sport, activity, food, season, etc.

WOULD YOU RATHER

A team-building activity designed to get to know each other

Levels: K through 5th
Time: 5 to 10 minutes

OBJECTIVES

Start a dialogue with the reminder that we are all different and that is what makes life and friends so fun and interesting! Today we are going to discover some fun things about our class—
We will discover we all have different interests and talents.
We will discover that we may like different things — and that is GREAT! It would be a boring world if everyone was the same and thought the same and liked the same things!!

MATERIALS:

EACH STUDENT NEEDS:

- Nothing! You don't need anything in order to play!

PREPARATION

Watch this video on why scientists need to be a good teammate:
The Power of Teamwork

Before you play, create a list of fun (and appropriate) would you rather questions. The more you come up with, the more you'll get to know your group!

REFLECTION:

1. How does getting to know your group/team/class make you a better scientist?
2. Share something you learned about another group member!

ACTIVITY

Have kids stand in a single file line facing the "question asker" who is standing at the front of the room.
When each question is asked, kids will step either right or left out of line to indicate their preference. Have them look around to see their peer's responses. All volunteers and helpers can be in the line as well indicating their preferences! preference for each question---have kids either step right or left out of the line. All volunteers and helpers need to be in the line too showing their preferences.

WOULD YOU RATHER QUESTIONS

- Would you rather ride an elephant or a camel?
- Would you rather be able to fly or breathe underwater?
- Would you rather swim with dolphins or swim with turtles?
- Would you rather be an amazing dancer or an amazing singer?
- Would you rather eat at McDonald's or eat at SpongeBob's restaurant?
- Would you rather be invisible or be able to fly?
- Would you rather own a horse or a bear?
- Would you rather be able to drive a car or fly a plane?

STRING WEB ACTIVITY

A get-to-know-you activity designed to show how we are all connected!

Levels: K through 5th
Time: 10 to 15 minutes

OBJECTIVES

This activity helps students think about their existing networks and the connections that are all around them. Was there ever a point in the activity when it seemed like someone wouldn't find something in common? Probably not! You can always find ways to connect with others, even over trivial things.

MATERIALS:

YOU WILL NEED

- Ball of Yarn

PREPARATION

Watch this video on how this activity is played:
String Web Activity

It's best to do this experiment at least once before teaching the students to 1) ensure you know how the experiment works, and 2) to have a few examples of what the project will look like.

ACTIVITY

1. Gather the students in an open space in your room andhave them sit in a circle.
2. Start with the ball of yarn in your hands and 1. Say your name and 2. Share something about yourself.
3. Hold the end of the yarn in one hand and with the other hand toss the ball of yarn to a student.
4. That student catches the ball of yarn and answers the same two questions before holding on to the yarn and tossing it to another friend.
5. Continue on until everyone has had a turn.
6. If time allows, go through another round asking "favorite sport," "favorite snack," favorite animal," etc.

REFLECTION

Questions to ask after the activity

Was there ever a point in the activity when it seemed like someone wouldn't find something in common?

How many times were you holding onto the string? The more strings you're holding, the more times you spoke up and made an effort to make a connection, and the more connections you've made, the stronger your network.

What happens if you let go of one of your strings? An important part of building a network is maintaining it.

Look around at the web you've created. You're all connected to each other, maybe in ways you did not expect. Even if your string isn't directly connected to someone, you're connected to someone else who is connected to that person; that's how networks function - you use your network to make the connections that you can't make directly on your own.

PHYSICS

Activities to Understand Physics

What is Physics?

Getting to understand Physics deeper

Academic Curriculum

Physics is one of the major branches of science. People who work in physics are called physicists. Physicists study matter and the forces (pushes or pulls) that act on it. (Matter is what makes up all physical objects.) Physicists also study many different forms of energy. The objects that physicists study range in size from the tiny building blocks of matter to huge groups of stars.

Additional Information

Physicists plan and conduct experiments and studies to test theories and discover properties of matter and energy. They may also study the interactions of matter and energy, such as theoretical physicists and astronomers who study the nature of time or the origin of the universe

Physics explains how the world around us works. Many of our modern technologies are based off of scientific discoveries made in the science of physics. Engineers use physics to help design airplanes, cars, buildings, and electronics such as computers and cell phones.

Types of Physics

Astrophysics	Astrophysics is a science that employs the methods and principles of physics and chemistry in the study of astronomical objects and phenomena.
Geophysics	Geophysics is a subject of natural science concerned with the physical processes and physical properties of the Earth and its surrounding space environment, and the use of quantitative methods for their analysis.
Molecular physics	Molecular physics is the study of the physical properties of molecules and molecular dynamics. The field overlaps significantly with physical chemistry, chemical physics, and quantum chemistry. It is often considered as a sub-field of atomic, molecular, and optical physics.
Quantum physics	Quantum mechanics is a fundamental theory that describes the behavior of nature at and below the scale of atoms. It is the foundation of all quantum physics, which includes quantum chemistry, quantum field theory, quantum technology, and quantum information science.
Biophysics	Biophysics is an interdisciplinary science that applies approaches and methods traditionally used in physics to study biological phenomena. Biophysics covers all scales of biological organization, from molecular to organismic and populations.
Mathematical physics	Mathematical physics refers to the development of mathematical methods for application to problems in physics.
Optics	Optics is the branch of physics that studies the behaviour and properties of light, including its interactions with matter and the construction of instruments that use or detect it. Optics usually describes the behaviour of visible, ultraviolet, and infrared light.
Computational physics	Computational physics is the study and implementation of numerical analysis to solve problems in physics. Historically, computational physics was the first application of modern computers in science, and is now a subset of computational science.

BALANCING CRAFT STICK

A S.T.E.A.M. activity designed to explore the topics of the center of gravity

Levels: K through 5th
Time: 35 to 45 minutes

OBJECTIVES

Imagine you have a toy that can balance perfectly on your finger. The spot where it balances without tipping over is called the center of gravity. It's the point where all the weight of the toy is evenly spread out. If you put your finger right under that spot, the toy won't fall because it's perfectly balanced.
Everything has a center of gravity – people, toys, even cars! It's just the point where all the weight is perfectly balanced. So, if you were holding a book or a toy and found the spot where it doesn't tip over, you're finding its center of gravity!

MATERIALS:

EACH STUDENT NEEDS:

- Jumbo Craft Sticks
- Pipe Cleaners
- 2 Clothespins (that clip)
- Permanent Markers
- Googly Eyes
- Cupcake Liners
- Construction Paper

PREPARATION

Watch these videos on the explanation of gravity and the center of gravity:

1. Gravity
2. Center of Gravity

Feel free to watch these videos with the students before or after their activity as well!

Watch this video on how this activity is made: Self Balancing Toy (this project is a a bit different than the one in the video, but watching it will give you a better sense of what we're doing!)

It's best to do this experiment at least once before teaching the students to 1) ensure you know how the experiment works, and 2) to have a few examples of what the project will look like.

ACTIVITY

Talk about the center of gravity. In simple terms, the center of gravity is the point where the weight of an object is even on all sides. Give each student a craft stick and try to balance it on the table or their finger...it doesn't work well. Then show how lowering the center of gravity with a pipe cleaner and clothespins will balance on your finger. Show your completed project.
Kids will decorate a craft stick with markers to create a character of their choice. (brainstorm ideas before beginning -these could be people, robots, animals, etc.)
Demonstrate/explain how to create a balancing toy:

VOCABULARY

Words to know for this experiment:

Gravity: an invisible force that pulls objects toward each other. Earth's gravity keeps you on the ground and makes things fall.

Center of Gravity: the point where the weight is even on all sides. For an evenly shaped object, like a ball or ruler, the center of gravity would be at the middle of the object.

Balance: The state of having weight spread equally so that you don't fall. For example, a dancer keeping their balance while standing on one toe.

ACTIVITY

1. Color the bottom 1/3 of the stick a solid color for the pants. The pipe cleaner will become the character's legs, so there is no need to draw those on.

2. Draw on a shirt and face. For the shirt you can draw on arms, this is the easiest version. Or, use a small piece of pipe cleaner to make arms later.

4. Draw a face. If wanted you can even glue on tiny googly eyes.

5. Once the craft stick is decorated, it's time to turn it into a balancing person toy.

6. Start by bending your pipe cleaner in half to find its center. Then open it back up.

7. Wrap the middle portion of the pipe cleaner around your craft stick, approximately 1 inch from the end of the craft stick. Twist it tightly so it stays on.

8. It's important that you leave an even amount of pipe cleaner on both sides of the craft stick when you are finished. If needed, you can use scissors to trim off any extra that may happen on one side.

9. Once the pipe cleaner is attached, clip a clothespin to each end.

10. Now try to balance your craft stick person.

11. Place its end on your fingertip or someone else's fingertip.

12. It may take you a few minutes to get the stick person to balance. You may have to slide the pipe cleaner closer to the end of the craft stick or bend the pipe cleaner legs some to get it to work.

ADD ON TO THIS CRAFT:

Extensions to continue this experiment:

Can you get this experiment to work using different materials?

1. Try substituting the craft stick with an unsharpened pencil. Can you get it to balance on the pencil tip?
2. What happens if you replace the clothespins with metal washers?

QUESTIONS TO ASK

Before, after, or during the project

1. What is the center of gravity? Can you explain it in your own words?
2. Where else have you seen the center of gravity work?
    a. Hint: Tightrope walkers, balance beam, a seesaw at a park...
3. Why do tightrope walkers sometimes use long poles? How do you think the pole helps them stay balanced?
4. What happens to the center of gravity if you add weight to one side of an object? Can you show me with a toy or a book?
5. Can you show me how to balance a book on your hand? Where is the center of gravity of the book?

These questions encourage kids to think critically and apply the concept of the center of gravity to real-life situations and simple experiments.

PAPER PLATE MAGNET MAZE

A S.T.E.A.M. activity designed to explore magnets & matter

Levels: K through 5th
Time: 35 to 45 minutes

OBJECTIVES

Add the challenge of a maze to the magical appeal of magnets and you have a fun STEM activity that will have your inquisitive little scientists begging for more. It's a good thing these paper plate mazes are easy to adapt for multiple levels, since magnets seem to attract no matter the kids' ages!

PREPARATION

Watch these videos on the explanation of magnets & poles:
Magnets

Watch this video on how this activity is made:
Magnet Maze

It's best to do this experiment at least once before teaching the students to 1) ensure you know how the experiment works, and 2) to have a few examples of what the project will look like.

MATERIALS:

EACH STUDENT NEEDS:

- Paper Plates (10 3/8 inch plain paper plates)
- Chopsticks
- Strong Magnets (any strong 18 mm button magnets will do)
- Glue (tacky glue or hot glue) and Glue Sticks
- Markers/colored pencils
- Scissors
- White Cardstock
- Magnet Maze Template (click link - print the maze, bunny/space shuttle on card stock)

WHAT IS HAPPENING?

Matter (anything that has mass and takes up space) is made of tiny particles called atoms. Atoms have negatively charged electrons that spin around them and this tiny movement of an electron around its nucleus is enough to create a small magnetic field.

If an element has paired electrons that spin in opposite directions, their magnetic field cancels each other out. If an element, such as iron, has unpaired electrons that spin in the same direction, they have no opposing magnetic fields to cancel their own magnetic fields and they create the invisible force called magnetism.

Magnetic fields are dipolar, meaning they have two poles. The two ends of a magnet are called the north and south poles. As my kids learned when the two magnet wands
wouldn't stick together, matching poles repel while opposite poles attract.

The poles are the parts where the magnets are strongest. Around these poles is an area known as a magnetic field. For another object to be drawn to the magnet, it has to be
within its magnetic field. And that is how a magnet can exert control over another object without even touching it!

VOCABULARY

Words to know for this experiment

Matter: anything that has mass and takes up space

Element: a pure substance that is made up of one type of atom and cannot be broken down into simpler substances

Magnet: rocks or metals that create an invisible field around themselves. This field attracts other magnets and certain metals. A magnetic field is concentrated around the ends of magnets. These ends are called poles

Atoms: the smallest particles of matter that have the properties of a chemical element, such as hydrogen, oxygen, or gold

ACTIVITY

1. Carefully cut out the maze and graphics. (Encourage your students to create their own maze characters and themes. Ex - Rabbit getting a bunch of carrots, rocket going to the moon, football player going to a goalpost, dog finding its bone, snowman getting to its hat.)

2. Use a glue stick to attach the maze to the paper plate.

3. Glue or draw the graphic in the center of each maze.

4. To make the magnet wand use tacky glue/cool temp glue to attach a magnet to the end of a wooden chopstick.

5. Place a small blob of glue onto the magnet, then lay the chopstick on top of the glue.

6. Create the object to run through the maze. set about making the magnet graphic.

7. Before gluing the magnet to the cut out characters with tacky glue/ hot glue, make sure the side that would be facing the plate was of the opposite polarity than the magnet wand. (ie - make sure your wand and object on your magnet will attract and stick together, not repel each other).

QUESTIONS:

Use these questions to test the students knowledge of the activity:

1. What is a magnet?

2. What types of materials do magnets attract?

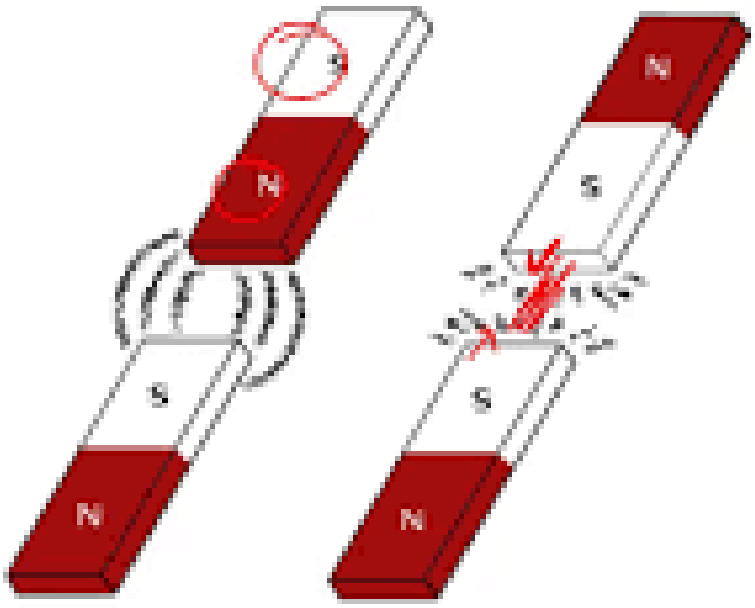
3. What are the two ends of a magnet called?

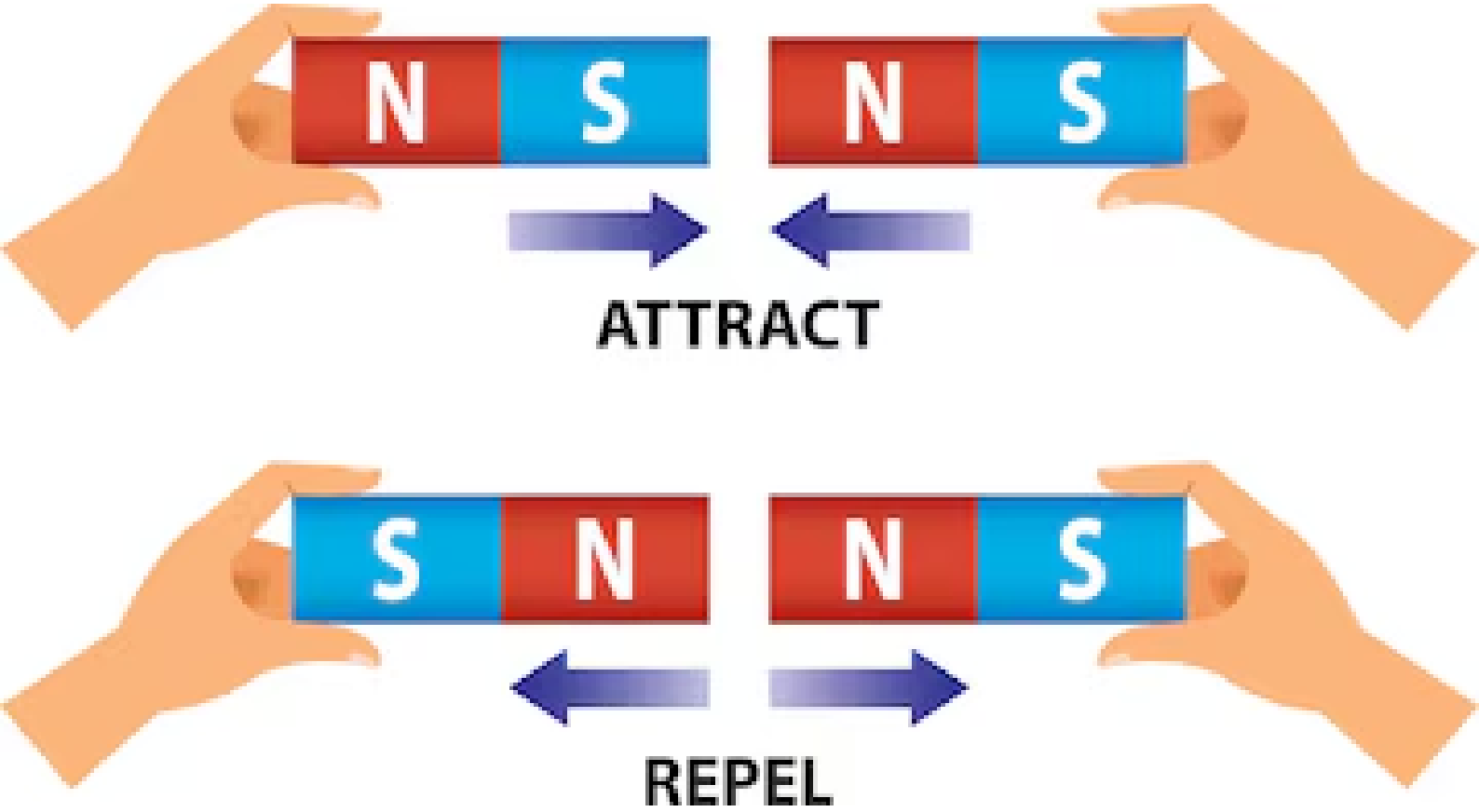
4. What happens when you put the north pole of one magnet near the south pole of another magnet?

5. What happens when you put the north pole of one magnet near the north pole of another magnet?

The Poles of a Magnet

- All magnets have two poles – a negative and a positive pole, also known as a north pole and a south pole.
- Like poles repel, and opposite poles attract.
- The area around a magnet that's affected by its magnetic energy is its magnetic field.





SQUARE & STRAWS

A fun activity used to explore the development of fine motor skills

Levels: K through 5th
Time: ~10 Minutes

OBJECTIVES

Straws can be used for a variety of fun and educational activities. Straw activities allow younger children to explore their creativity while developing their fine motor skills. They are also terrific for sorting, counting, and increasing hand-eye coordination.

PREPARATION

Watch these videos on fine motor development for kids:
Fine Motor Skills

It's best to do this experiment at least once before teaching the students to 1) ensure you know how the experiment works, and 2) to have a few examples of what the project will look like.

MATERIALS:

EACH STUDENT NEEDS:

- 1 bendy straw for each student
- 4 colors of construction paper cut into 1 ½' squares (20 small squares of four different colors/group)
- Baggies for colored squares
- Paper plate or bowl for each student

ACTIVITY

1. Cut one-inch squares of different colored construction paper. Spread the paper squares on a table and have each player use a silicone straw to pick up their assigned color squares. The player that collects the most squares in a certain period wins!

2. Kids get into groups of 3 or 4 and sit around a small table or on the floor in a circle. Each student has a bendy straw. Each student in the group should have a baggie of different colored paper squares. Each kid places their paper squares in the center of the circle and mixes the colors around.

3. On 'go' each student uses their straw and only their straw to "suck" and collects only their paper squares and places them on their plate.

4. Play for 1 minute. Kids count the squares they collected. The highest number collected wins. Keep track of the highest on the whiteboard.

5. Remix all paper squares and play several rounds as time allows..

QUESTIONS TO ASK

Before, After, or During the Activity

1. What was the most difficult part about this activity?
2. What did you succeed at? What was something you needed to work on?
3. How can this activity help with your development?
4. What other activities can you think of that would help with your development?
5. Why would older kids be better at this activity than younger kids?

SNOWMAN AIR CANNONS

A S.T.E.A.M. activity designed to explore the topics of air pressure

Levels: K through 5th
Time: ~30 minutes

OBJECTIVES

This activity is designed to get students thinking about what happens when air moves. Sometimes it isn't easy to think about air and what it does because it is invisible. The air cannon is a way to 'see' air as it moves objects within its 'blast zone'.

PREPARATION

Watch these videos on the explanation of gravity and the center of gravity: Airzooka Air Cannon: Arbor Scientific

Watch this video on how this activity is made:
Airzooka Air Cannon
Votex Cannons

It's best to do this experiment at least once before teaching the students to 1) ensure you know how the experiment works, and 2) to have a few examples of what the project will look like.

MATERIALS:

EACH STUDENT NEEDS:

- White paper cup
- Balloons
- Scissors
- Markers
- Marshmallows
- pom poms
- Measuring tape or ruler
- Masking tape
- Containers to use as targets

ACTIVITY

Get the class's attention by showing a real air cannon(Airzooka) or showing the following video that demonstrates how it works.
Rapid compression of a focused pocket of air creates a burst of compressed air that can be fired at distracted students to focus their attention.

AIR PRESSURE

How this experiment works

Air pressure, also known as atmospheric pressure, is the force exerted on a surface by the weight of air. Even though it is invisible to our eyes, the air surrounding us puts about 14.7 pounds per square inch of pressure on everything on the surface of Earth. That's much pressure!

Although you can't see it, your cup is filled with air. When you apply a force to the air molecules by pulling back the balloon and letting it snap back, the air molecules are pushed towards the opening. This movement sets o˜ a quick chain reaction of collisions with other air molecules and the sides of the cup. The only way for the air molecules to escape is through the opening at the bottom of the cup. The quick escape of these air molecules forms a stream of air that ˛ows straight out of the cannon.

1. Carefully poke a hole in the bottom of the paper cup with scissors and cut out the entire bottom

2. Tie the balloon

3. Cut the bottom of the balloon off, leaving the knotted end.

4. Stretch the balloon over the bottom of the cup. This is your shooting end and can become the hat of the snowman!

5. Use masking tape to secure the balloon to the cup

6. Use markers to decorate the cup. Snowmen are fun, but the kids can be encouraged to turn their cannon into anything they would like!

7. Put a marshmallow or pompom into the cannon, pull back the balloon knot and let it go! This might take a few practice tries.

Challenges for kids to try with their cannons:
1. Use an open area of your classroom/center and lay out a 25' measuring tape. See how far kids can launch their marshmallow/pompom.
2. Set up plastic containers and give each a point amount. Kids try to shoot their ammo into the targets to receive points.
3. Set up Styrofoam cups into pyramids and see if the kids can use their cannons to knock them down.

EXTENSIONS TO THIS CRAFT

1. What might happen if you used a different-sized cup? Could you cut a 2-liter bottle to make a larger cannon?

2. Could you try another stretchy material to take the place of the balloon?

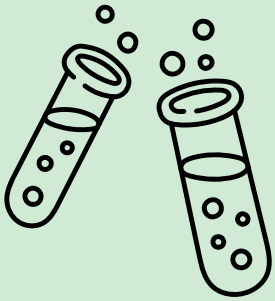
3. Does it change the experiment if you make the hole a different shape? What if you place it in a different spot?

4. Experiment with your air cannon to see what changes allow you to shoot air the furthest.

5. Have a target competition with a friend.

CHEMISTRY

Activities to Explore Chemistry



What is Chemistry?

Getting to understand Chemistry deeper

What is Chemistry?

Chemistry is one of the major branches of science. People who work in chemistry are called chemists. Chemists study the substances that make up matter—everything that takes up space in the universe. They also study the changes that take place when substances are combined. These changes are called chemical reactions.
In addition, chemists create new substances. They have made plastics, fibers, building materials, medicines, and many other substances that are useful in everyday life.

What do Chemists do?

People who work in chemistry are called chemists. Chemists study the substances that make up matter—everything that takes up space in the universe. They also study the changes that take place when substances are combined. These changes are called chemical reactions.

Types of Chemistry

Inorganic chemistry	Inorganic chemistry deals with synthesis and behavior of inorganic and organometallic compounds. This field covers chemical compounds that are not carbon-based, which are the subjects of organic chemistry.
Organic chemistry	Organic chemistry is a subdiscipline within chemistry involving the scientific study of the structure, properties, and reactions of organic compounds and organic materials, i.e., matter in its various forms that contain carbon atoms. Study of structure determines their structural formula.
Biochemistry	Biochemistry or biological chemistry is the study of chemical processes within and relating to living organisms. A sub-discipline of both chemistry and biology, biochemistry may be divided into three fields: structural biology, enzymology, and metabolism
Environmental chemistry	Environmental chemistry is the scientific study of the chemical and biochemical phenomena that occur in natural places. It should not be confused with green chemistry, which seeks to reduce potential pollution at its source.
Forensic chemistry	Forensic chemistry is the application of chemistry and its subfield, forensic toxicology, in a legal setting. A forensic chemist can assist in the identification of unknown materials found at a crime scene. Specialists in this field have a wide array of methods and instruments to help identify unknown substances.
Medicinal chemistry	Medicinal or pharmaceutical chemistry is a scientific discipline at the intersection of chemistry and pharmacy involved with designing and developing pharmaceutical drugs. Medicinal chemistry involves the identification, synthesis and development of new chemical entities suitable for therapeutic use.
Geochemistry	Geochemistry is an in-depth study of Earth Systems and Environmental Sciences. Geochemistry is important to understand the mineral, weathering agents, and other environmental aspects. Earth is composed to various chemicals and geochemistry is the study of all those chemical processes
Industrial Chemistry	Industrial Chemistry is important to manufacture new products. Raw products are dissolved, heated, filtering and various other techniques to form a new product. Examples of industrial chemistry are petrochemicals – ethylene, propylene, benzene, styrene, Ceramic products – silica brick, frit, etc.

CANDLE EXTINGUISHER

A S.T.E.A.M. activity designed to explore chemical reactions

Levels: K through 5th
Time: 10 to 15 minutes

OBJECTIVES

Get ready to be amazed with this activity! In this activity, students will observe “magic” when an empty cup is able to extinguish a lit candle. Through a chemical reaction, students will be able to observe as the chemical properties of baking soda and vinegar change to form new substances and a gas. Students will be able to compare the physical properties of air and carbon dioxide as the reaction occurs and the candle is extinguished.

MATERIALS:

EACH STUDENT NEEDS:

- Candle
- Lighter
- 2 cups
- 1 tsp. baking soda
- 1 tbsp. white vinegar

PREPARATION

Watch these videos on the explanation of the science behind this experiment:
Fire Extinguisher | Experiment for Kids

It’s best to do this experiment at least once before teaching the students to 1) ensure you know how the experiment works, and 2) to have a few examples of what the project will look like.

BACKGROUND INFO

A chemical reaction is a process in which substances undergo a chemical change to form a different substance. Mixing baking soda and vinegar will create a chemical reaction because one is an acid and the other a base. Baking soda is a basic compound called sodium bicarbonate while vinegar is a diluted solution that contains acetic acid (95% water, 5% acetic acid). There are five signs that indicate a chemical reaction has occurred: odor, energy change, gas bubbles, precipitate formation, and color change. When any of these changes occur, the reaction is irreversible and cannot be undone.

VOCABULARY

words to know for this experiment:

Chemicals: a substance with a specific composition and properties that can be used to identify it. Chemicals can be found in nature, like water, or they can be manufactured, like chlorine. They can interact with other substances and change form

Chemistry: the study of matter, which is anything that has mass and takes up space. It includes the study of matter's composition, structure, and properties, as well as how it changes.

React: to change or behave in a particular way as a result of or in response to something

Substances: a pure form of matter. In other words, a substance is matter than contains only one type of atom or molecule. Pure substances can be further divided into two sub-categories: elements and compounds

Property: the characteristics and qualities of a substance that describe and identify it. Properties can be physical or chemical, and they can be observed, measured, or tested

The reaction occurs once the vinegar is added to the baking soda. In this reaction, evidence of a chemical reaction is the formation of carbon dioxide gas and gas bubbles.

There are two separate types of reactions taking place when mixing baking soda and vinegar. The first is called an acid-base reaction. When the two substances are mixed, hydrogen ions in the vinegar react with the sodium and bicarbonate ions in the baking soda. This initial reaction results in two new chemicals: carbonic acid and sodium acetate.

A decomposition reaction is the second reaction that occurs. The first reaction created carbonic acid which immediately begins to decompose into water and releases carbon dioxide gas (CO_2). The CO_2 rises to the top of the mixture and creates the bubbles that are a hallmark of the baking soda and vinegar reaction. Oxygen is required for a flame to burn. The carbon dioxide gas produced in this reaction is more dense than normal air, and it sinks to the bottom of the cup. When poured over a flame, the carbon dioxide will push out the surrounding oxygen molecules and extinguish the flame. As the carbon dioxide is colorless, it gives the appearance of an empty cup extinguishing the flame.

ACTIVITY

1. To begin this activity, first light the candle and put it to the side.

2. Measure 1 teaspoon of baking soda into an empty cup.

3. Add 1 tablespoon of white vinegar to the baking soda. This will undergo a chemical reaction and will release carbon dioxide gas.

4. Pour only the air from the cup with the baking soda and white vinegar into an empty cup.

5. Pour your “empty” cup (with CO_2) over the lit candle.

6. The candle will extinguish.

SAFETY TIPS

Keep these tips in mind as you prepare for this experiment:

- Fire safety should be taken very seriously. Make sure your child is supervised at all times.
- Due to the chemicals in the fire extinguisher and the open flame, it may not be safe for young children to participate in the experiment. But they can still watch the magic of science happen!
- Carbon dioxide is colorless and odorless. You will not be able to see it come out of the container, but you will definitely notice what it does!

ASK THESE QUESTIONS:

Questions for After the Lab

1. Has a reaction occurred? How can you tell?
Yes, a reaction has occurred. A sign a chemical reaction has occurred is the formation of gas, which can be seen in the form of bubbles. Once the vinegar is added to the baking soda, carbon dioxide is released as a product. The bubbling is the release of CO_2.

2. What is being poured out of the “empty” cup? Why does this pour out differently than air?
Carbon dioxide is being poured out of the seemingly empty cup. Carbon dioxide is a colorless, odorless gas that forms as a product of the chemical reaction that occurs between vinegar and baking soda. Carbon dioxide is heavier than normal air. When the reaction occurs and the “air” is poured from one cup to the other, it is the CO_2 being poured. Although the CO_2 is colorless like air, it is much heavier and can put out the flame of the candle when poured over it.

ELEPHANT TOOTHPASTE

Levels: K through 5th
Time: 20 to 30 minutes

OBJECTIVES

In this activity, students will observe a chemical change by combining a yeast mixture with hydrogen peroxide and dish soap. The resulting foam ("elephant's toothpaste") demonstrates a chemical reaction that can "explode" in student engagement!

MATERIALS:

EACH STUDENT NEEDS:

- Large bowl
- Clear bottle
- 1 packet of dry yeast
- 4 tbsp. warm water
- 4 oz. 20-volume hydrogen peroxide
- Dish-washing liquid
- Food coloring

PREPARATION

Watch these videos for the explanation of the science behind this experiment and how this experiment is made:
Elephant Toothpaste

It's best to do this experiment at least once before teaching the students to 1) ensure you know how the experiment works, and 2) to have a few examples of what the project will look like.

BACKGROUND INFO

Background Information: A chemical reaction is a process in which substances undergo a chemical change to form a different substance. In this reaction, the hydrogen peroxide is catalyzed by the yeast to release the oxygen molecules. The foam is oxygen-filled bubbles that result from the hydrogen peroxide being broken down into water (H2O) and oxygen (O2).

This reaction uses yeast as a catalyst. A catalyst is a substance that increases the rate of a chemical reaction. In this case, the yeast helps to separate the oxygen from the hydrogen peroxide. In this reaction, the bottle will feel warm to the touch because it is an exothermic reaction. This means that the chemical reaction releases heat as it occurs. The opposite also demonstrates a chemical reaction. An endothermic reaction would feel cool to the touch.

VOCABULARY

Words to Know for this Experiment

Chemistry: the study of matter, which is anything that has mass and takes up space

Chemicals: a substance with a specific composition and properties that can be used to identify it

Demonstration: an activity that shows how something works or how it is made

Reaction: a process in which one or more substances are converted to one or more different substances

Properties: describe how a substance behaves during a chemical reaction

Substance: a unique form of matter that has a constant chemical composition and characteristic properties

ACTIVITY

1. Fill a large clear bottle with 4 ounces of 20-Volume Hydrogen Peroxide. Then, place the bottle inside a large clear bowl.

2. Add a squirt of dish-washing liquid to the bottle containing the hydrogen peroxide.

3. Add a few drops of food coloring to the bottle.

4. In a separate container, mix a packet of yeast with 3-4 tablespoons of warm water. Mix thoroughly for a few minutes; the yeast needs time to dissolve and to also to become activated.

5. Pour the yeast/water mixture into the bottle and watch the foam as it rises over the
top of the bottle and out into the bowl!

REFLECTION:

Questions for after the Experiment

1. How is the final substance different from its starting ingredients? What are some signs that show it is different?

The starting ingredients (hydrogen peroxide, yeast, water, and dish soap) are separate ingredients that can be identified. The final substance is unable to be separated into distinct parts. The physical appearance, texture, and color are all signs that the final substance is different from its starting ingredients.

2. Has a chemical or physical change taken place here? How do you know?

A chemical change has taken place. One way that we know that is because bubbles are formed. These bubbles indicate that the hydrogen peroxide has been broken apart into water and oxygen. Another reason we know that a chemical change has occurred is because there is a change in temperature. Endothermic and exothermic reactions are indicators of a chemical change.

3. How does this reaction occur?

This reaction occurs when the yeast acts as a catalyst to separate the oxygen from the hydrogen peroxide. The foam is a result of oxygen-filled bubbles from the hydrogen peroxide being broken into water (H_2O) and oxygen (O_2).

4. Is the reaction endothermic or exothermic? How do you know?

The reaction is exothermic. We know this because the bottle will feel warm to the touch when the chemical reaction occurs.

SLIME

Levels: K through 5th
Time: 15 to 20 minutes

OBJECTIVES

Slime is a non-Newtonian fluid that has properties of both solids and liquids, and its science involves chemistry. Slime is made of polymers, which are long chains of molecules that can slide past each other like a liquid. When borax is added to glue, the borate ions from the borax solution link the polymer molecules together, preventing them from moving as easily. This causes the glue to change from a liquid to a rubbery substance that we call slime.

PREPARATION

Watch these videos of an explanation of the science behind slime:
Science behind Slime

It's best to do this experiment at least once before teaching the students to 1) ensure you know how the experiment works, and 2) to have a few examples of what the project will look like.

MATERIALS:

EACH STUDENT NEEDS:

- 18oz Solo Cup
- 3oz Dixie Cup
- 3.5 oz of Glue
- Water
- Borax Solution (mix one cup of borax laundry detergent to one gallon of HOT water)
- Food Coloring
- Glitter (optional)

ACTIVITY

1. Fill two dixie cups full of water and pour it into the red solo cup
2. Add your color
    a. Only put 1-2 drops of food coloring into your water
3. Add the glue. Make sure to scrap the sides of the container to ensure you get almost all of the glue.
4. If you want to add glitter, do it now and continue stirring
5. Mix up the glue and the water well.
6. Add the cup of borax and QUICKLY start stirring.
    a. The borax will immediately start hardening, so you need to start stirring right away!
7. Put your slime in the Ziplock bag and enjoy!

TIPS

Be sure not to get slime on the carpet, in your hair, or on your clothes.
Vinegar is the best way to get slime off your clothes

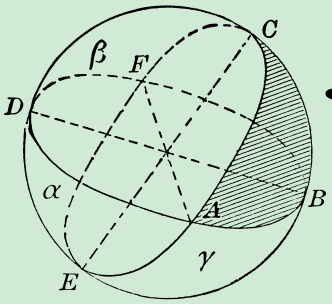
REFLECTION

What did you notice happening when you added the borax to the glue and water mixture, and how did it change the texture of the slime?

How did you decide on the colors and any additional elements, like glitter, for your slime, and what effect did they have?

MATHMATICS

Activities to Explore Mathematics



What is Mathematics?

Getting to understand Math deeper

What is Mathematics?

Mathematics is the science and study of quality, structure, space, and change. Mathematicians seek out patterns, formulate new conjectures, and establish truth by rigorous deduction from appropriately chosen axioms and definitions.

Today, mathematics is used throughout the world as an essential tool in many fields, including natural science, engineering, medicine, and the social sciences. Applied mathematics, the branch of mathematics concerned with application of mathematical knowledge to other fields, inspires and makes use of new mathematical discoveries and sometimes leads to the development of entirely new disciplines. Mathematicians also engage in pure mathematics, or mathematics for its own sake, without having any application in mind, although practical applications for what began as pure mathematics are often discovered later.

What does a Mathematician Do?

Mathematicians use their knowledge of mathematics to solve problems in many fields, including business, engineering, and the sciences. They use mathematical theories, computational techniques, algorithms, and computer technology to Develop mathematical principles, Create models, Solve problems, and Communicate

Types of Math

Algebra	Algebra is the branch of mathematics that studies certain abstract systems, known as algebraic structures, and the manipulation of statements within those systems.
Geometry	Geometry is a branch of mathematics concerned with properties of space such as the distance, shape, size, and relative position of figures. Geometry is, along with arithmetic, one of the oldest branches of mathematics. A mathematician who works in the field of geometry is called a geometer
Calculus	Calculus is the mathematical study of continuous change, in the same way that geometry is the study of shape, and algebra is the study of generalizations of arithmetic operations.
Statistics	Statistics is the discipline that concerns the collection, organization, analysis, interpretation, and presentation of data. In applying statistics to a scientific, industrial, or social problem, it is conventional to begin with a statistical population or a statistical model to be studied.
Trigonometry	Trigonometry is a branch of mathematics concerned with relationships between angles and side lengths of triangles. In particular, the trigonometric functions relate the angles of a right triangle with ratios of its side lengths.
Topology	Topology is the branch of mathematics concerned with the properties of a geometric object that are preserved under continuous deformations, such as stretching, twisting, crumpling, and bending; that is, without closing holes, opening holes, tearing, gluing, or passing through itself.
Game theory	Game theory is the study of mathematical models of strategic interactions. It has applications in many fields of social science, and is used extensively in economics, logic, systems science and computer science.
Arithmetic	Arithmetic is an elementary branch of mathematics that studies numerical operations like addition, subtraction, multiplication, and division. In a wider sense, it also includes exponentiation, extraction of roots, and taking logarithms.

DICE GAMES

Levels: K through 5th
Time: 35 to 45 minutes

OBJECTIVES

Dice games can be fun and engaging, and they can help to motivate students to participate and learn. Dice introduce an element of randomness to classroom activities, which can help to level the playing field and make things more fair for all students.
Here are some fun dice games to play with the students!

PREPARATION

Run through each dice game before the students play in order to make sure you understand each game well!

MATERIALS:

EACH STUDENT NEEDS:

- Dice (The number varies on the game)
- other materials are noted with the game!

DICE GAMES & DEVELOPMENT

Dice games can be a valuable tool in the learning and development of children for several reasons:

1. Math Skills Development

Counting: Rolling dice helps children practice counting the dots and adding numbers, reinforcing basic math skills.

2. Cognitive Skills

Strategic Thinking: Many dice games require planning and decision-making, which helps develop critical thinking and problem-solving skills.
Pattern Recognition: Identifying patterns or sequences in dice rolls can enhance a child's ability to recognize and predict outcomes.

3. Social and Emotional Development

Turn-Taking: Dice games often involve taking turns, which helps children learn patience and the importance of waiting for their turn.
Cooperation: Many dice games are played in groups, fostering teamwork, communication, and social interaction.

4. Fine Motor Skills

Rolling Dice: The physical act of rolling dice and picking them up helps develop hand-eye coordination and fine motor skills.

5. Language and Communication

Following Directions: Understanding and following the rules of dice games helps improve listening skills and comprehension.

Beat That

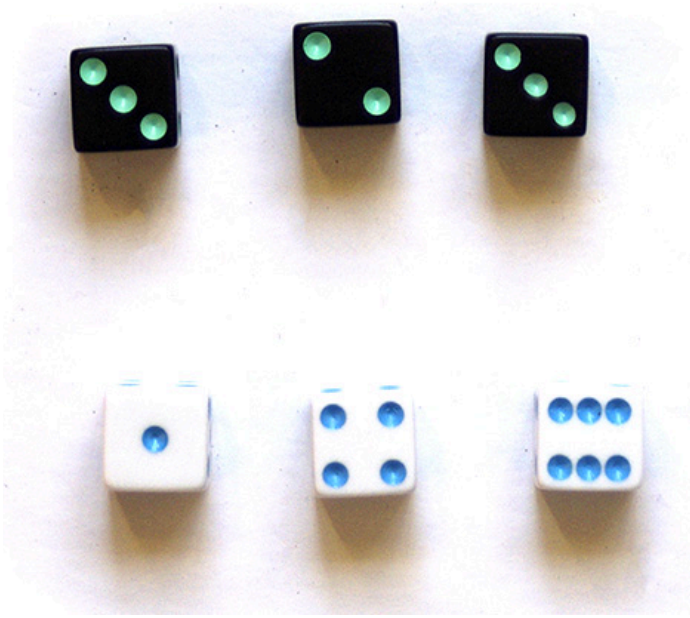
GAME #1: BEAT THAT!

Beat That is an easy dice game for all ages of players and takes only minutes. This is a very versatile game with many variations of play. It makes a great, fast game that players of all ages can participate in and it makes great math practice too (but we don't have to tell the kids).

Number of Players: 2-4 in each group

Total Dice Needed: 2 for each player, 5 die for older kids

Object of the Game: Be the player to get the highest score for the most rounds.



HOW TO PLAY

1. Decide how many rounds you will play (5-10 rounds is good)

2. Each player takes a turn rolling the dice
    a. If playing with older kids, you can increase to 5 dice

3. Once the dice have been rolled, the player must calculate the highest possible number he or she can form from the numbers rolled.
For example, if the player throws a 5 and a 2, his or her highest score would be 52. If a player throws a 2, 4, or 6, the highest score would be 642

4. The player who scores the highest combination wins the round and gets a point on the point sheet
    a. If 2 or more players have the same score, they roll again to decide who the winner of that round is

5. The player with the most wins once the set number of rounds have been played is the winner

VARIATIONS OF THE GAME

More or Less Dice:
To make the game easier for kids who are just starting to add you can play with just two dice. Or if they are working on number recognition, then one dice can work.

20 Sides:
To make it more interesting, and more additional practice, you could play with a 20-sided dice. If you don't have more than one 20-sided, keep track of rolls on paper.

Don't Beat That:
This fun variation plays the same way with a twist. The second player is trying not to beat the score, therefore rolling a lesser number. it works with all the other variations too.

GAME #2: PIG

Pig is a simple dice game first described in print by John Scarne in 1945. Players take turns to roll a single dice as many times as they wish, adding all roll results to a running total, but losing their gained score for the turn if they roll a 1.

As with many games of folk origin, Pig is played with many rule variations, including the use of two dice instead of one. Commercial variants of two-dice Pig include Pass the Pigs, Pig Dice, and Skunk.[3] Pig is commonly used by mathematics teachers to teach probability concepts.

Number of Players: 2+

Total Dice Needed: 1

The object of the Game: Be the player to reach 100 points first

REFLECTION:

questions to ask after the activity

1. What did you learn during this game?

2. How did you practice good sportsmanship/being a good teammate during this activity?

HOW TO PLAY

1. Each player takes a turn rolling 1 die over and over again, tallying their points along the way

2. The goal is to get as many points as possible by adding the face value of the die on each roll

3. If a player rolls a 1, their turn is over and they lose all of their points

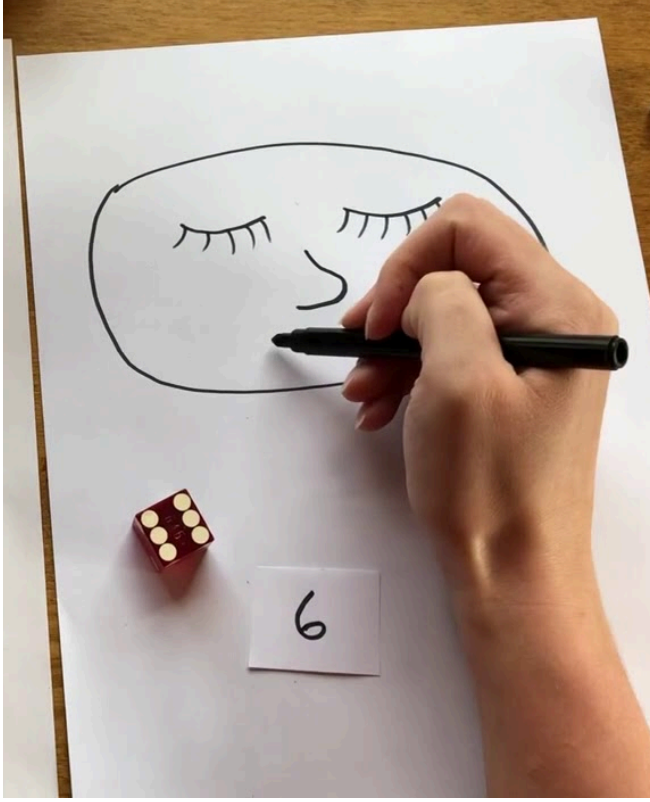
4. Players can continue rolling until they reach 100 points, or they can play it safe and pass the die to the next player and keep their points at any time.

5. Have one person be the scorekeeper on a sheet of paper.

6. Players continue taking turns

7. The player that reaches 100 points first wins

GAME #4: ROLL THE DICE DRAWING GAME



Here is a silly drawing game that is a lot of fun for kids to play.
In this drawing game, you use dice to decide what parts of the drawing you will draw.
We have included a face-drawing game and a landscape-drawing game.
This is a lot of fun and it helps children who might not be able to draw freely and creatively...this will help them draw more freely and creatively. This will also increase silliness.

The next few pages have examples of these drawing games- get creative with these!

Have fun!

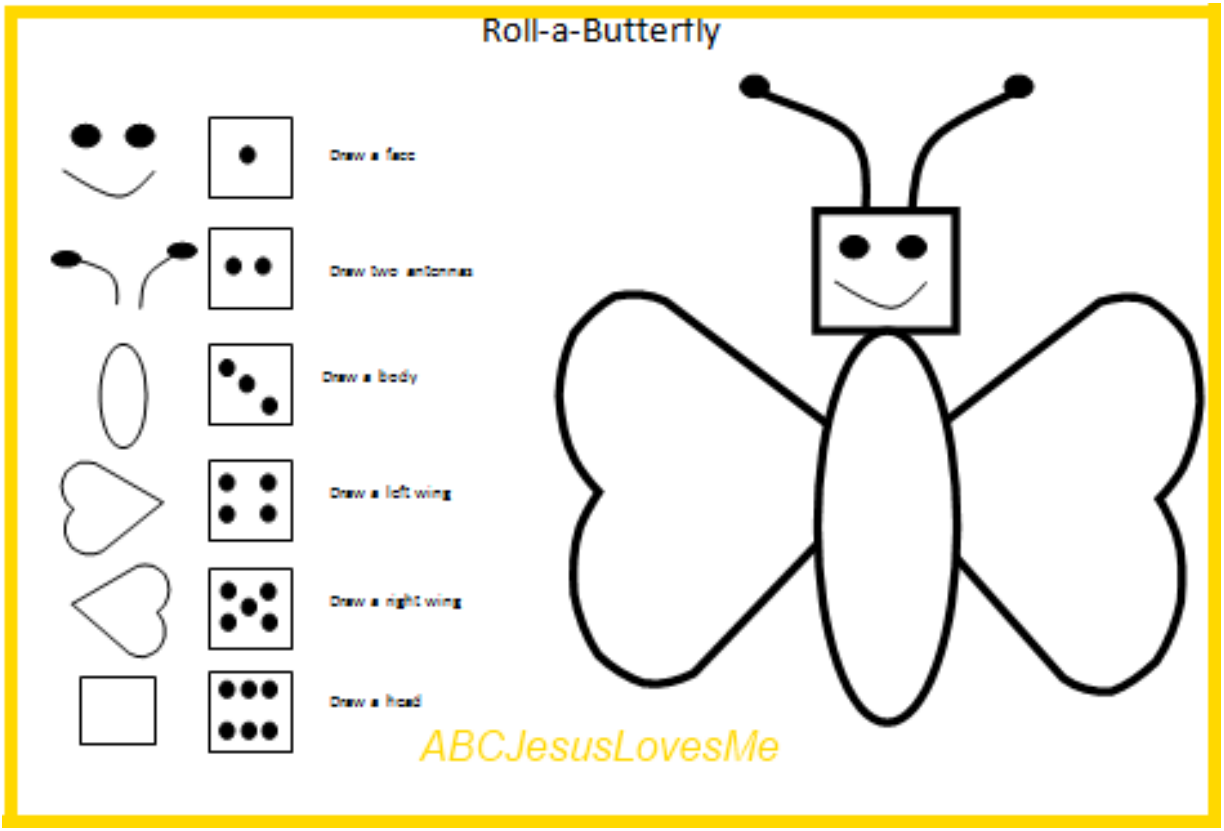
Dice Needed: 1

REFLECTION:

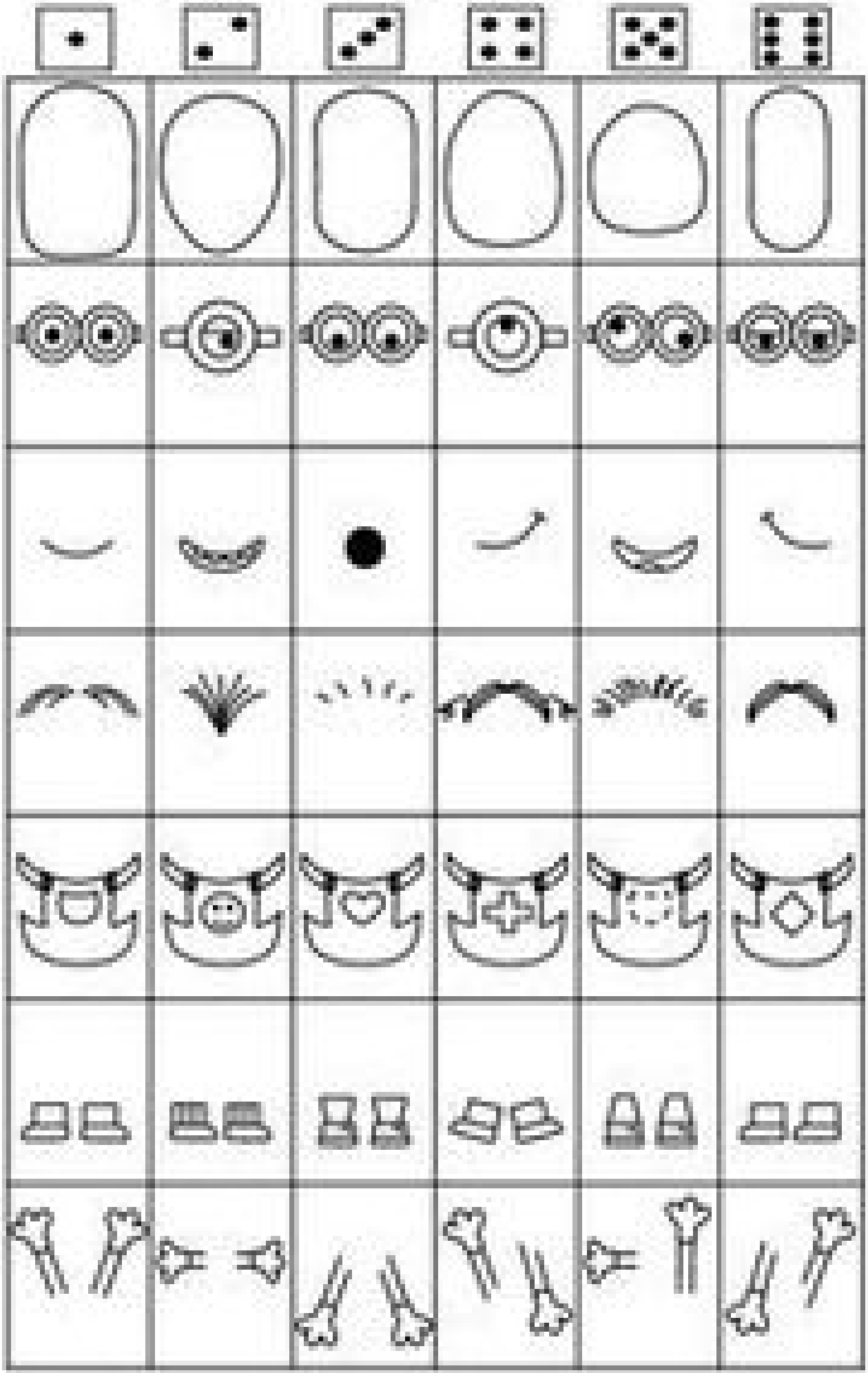
questions to ask after the activity

1. What did you learn during this game?

2. How did you practice good sportsmanship/being a good teammate during this activity?



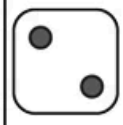
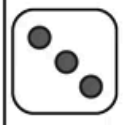
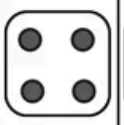
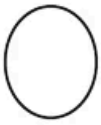
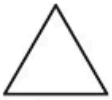
Roll a Minion



ROLL-A-DOODLE GAME

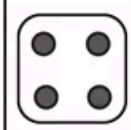
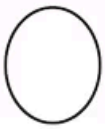
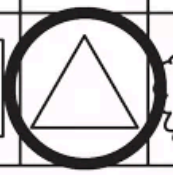
Let this game of chance predict your next drawing!

1. Either find a dice or fold the paper dice template (on the next page).

						
1st Turn Body						
2nd Turn Eyes						

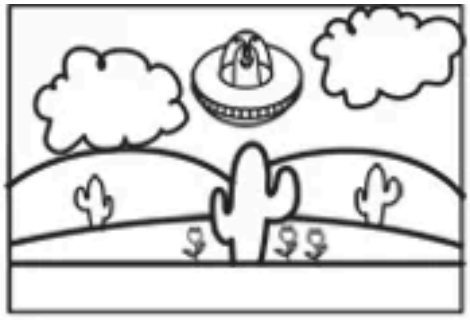
1st Turn

2. Go to the turn that you are on ... so, for example, if you are on your first turn, then go to "1st Turn" on the first column.

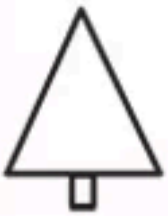
						
1st Turn Body						

3. Roll the dice. Look for the number on the dice and match it to the dice pictured in the first row. If you are on the first turn, and you rolled a 3 on the dice, then you would draw a triangle shape (in the example above).

4. Continue on to "Turn 2" (and then the next turn, etc) until your drawing is done.



ROLL-A-LANDSCAPE

						
1st Turn Air/Sky						
2nd Turn Background						
3rd Turn Foreground						
4th Turn Trees						
5th Turn Flowers						
6th Turn Extras						

ROLL-A-FACE

						
1st Turn Face Shape						
2nd Turn Eyes						
3rd Turn Nose						
4th Turn Mouth						
5th Turn Ears						
6th Turn Hair						

GAME #3: TENZI

Number of Players: 2-4
Total Dice Needed: 10 dice for each player (all in the same color)
Object of the Game: Be the player to get all ten of your dice to show the same color

HOW TO PLAY

1. Each player chooses a set of dice. Players hold all ten dice in their hands. Someone says “Go” and everyone rolls at the same time. Quickly look at your roll and decide which number you are going to go for.
(For example, if you have more 3’s than any other number, that’s what you want to go for.)
2. Put all your dice with that number aside, collect the remaining dice, and quickly roll again. (You do not have to wait for others to roll again. Everyone rolls together only on the first roll.)

3. Keep rolling until all ten of your dice show the same number.

Winning:
The first player to get all ten of their dice to match (ten 3’s, for example) shouts out “TENZI” and wins the game!

REFLECTION:

questions to ask after the activity

1. What did you learn during this game?

2. How did you practice good sportsmanship/being a good teammate during this activity?

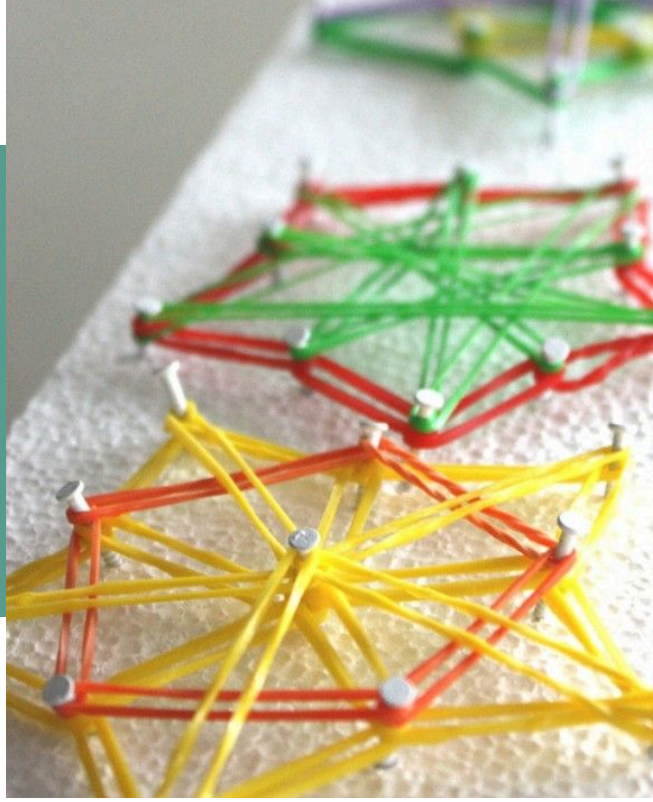
VARIATIONS OF THE GAME

TENZI Tower:
Instead of putting your successfully rolled dice aside, stack them one on top of the other. First player to get all ten of their dice stacked and shout “TENZI” wins!

STYROFOAM GEOBOARD

A S.T.E.A.M. activity designed to explore and understand geometry

Levels: K through 5th
Time: 30 minutes



OBJECTIVES

The objective of the geoboard activity is for kids to create and explore geometric shapes using nails and loom bands on a Styrofoam base. By participating, children learn about shape recognition, symmetry, and pattern creation, while also developing fine motor skills as they manipulate the bands. The activity encourages creativity and experimentation, allowing kids to explore different designs and problem-solving through trial and error. Additionally, it reinforces the concept of geometry in a hands-on, engaging way, making abstract math concepts more tangible.

PREPARATION

Watch this video on an explanation of geometry:
What's the point of Geometry?

Watch this video on how this activity is made:
Styrofoam Geoboard

It's best to do this experiment at least once before teaching the students to 1) ensure you know how the experiment works, and 2) to have a few examples of what the project will look like.

MATERIALS:

EACH STUDENT NEEDS:

- Pieces of thick Styrofoam (1 1/2" or thicker): pre-cut into manageable sizes (5" x5" or similar sizes are easy for small hand to handle.
- Cookie Cutters {any shape}
- Small thin finishing nails (1 inch size)
- Loom rubber bands in all colors.
- Pencils

ACTIVITY

Discuss the word "Geo." Geo- sounds like geometry (write this word on the whiteboard). In Geometry, people study lines, points, and shapes.
Have the kids name some shapes. Draw these on the board. (square, circle, triangle (draw several types of triangles), rectangle, star, heart, etc.)

Have the kids go on a "Shape Hunt" around the room. Call out the name of a shape and point to that shape on the board. Kids walk around the room and stand next to something that is that shape. Repeat this with several other shapes. Have them look at clothing, and shapes in the cabinets, tables, floor, ceiling, etc.

VOCABULARY

Words to know for this experiment

Geometry: a branch of mathematics that studies shapes and figures, including their properties, sizes, angles, and dimensions. It also involves learning how to draw, build, and measure shapes, and compare them.

Shapes: the outline or boundary of an object. Shapes can be classified into different types based on their properties.

ACTIVITY

Demonstrate the activity. Explain that there will be two ways for them to make a geoboard on Styrofoam:

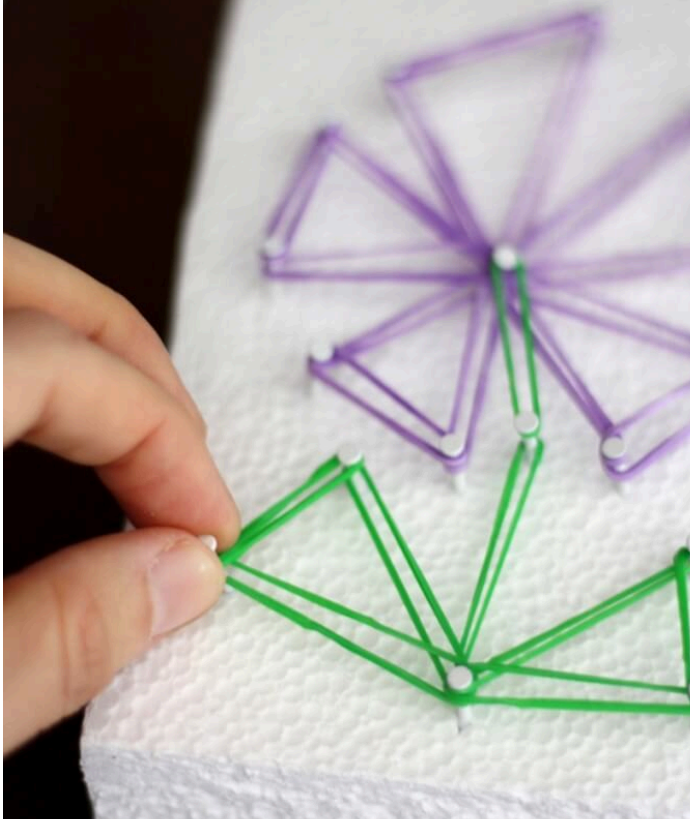
1. Kids may simply experiment and create their own by drawing shapes with a pencil or
2. Use a Cookie Cutter.

Place a cookie cutter of choice on top of the styrofoam. When you have your cookie cutter in the right place, push a nail in at the points of the star. Put one nail at the top of each point, one at the dip of each point and one in the middle of the star. Loom bands only have so much stretch, so depending on the size of the cookie cutter you might need to add extra nails in the middle.

Once your nails are set up, have some geometric shape fun! First you have the outside shape of the geoboard, but then you can create so many shapes within the shape too! Make patterns, Explore symmetry. How many shapes within the shape can you create? Use different colors!

Hints: push the nails in so only about ¼ inch is above the Styrofoam. Reposition the nails if they are too close together or too far apart.
Encourage Trial and Error. It's ok to experiment and redo if something is not working.

Encourage creativity and using various colors of bands. Small areas of the styrofoam may be also used to create other geometric shapes of their choices.



REFLECTION

Questions to ask after the activity

What shapes or patterns did you create on your geoboard, and how did you decide where to place the nails?

Did you use the cookie cutter method, or did you create your own design? What made you choose that approach?

How did you experiment with the loom bands to create different shapes within your main shape, and what did you learn about symmetry during the process?

What challenges did you face while setting up your geoboard, and how did you solve them through trial and error?

How did using different colors of bands affect the patterns you created, and what other creative ideas would you like to try with the geoboard?

OTHER TYPES OF SCIENCE

Biology, Astronomy, & Engineering

What is Biology?

Getting to understand biology deeper

What is Biology?

Biology is a natural science discipline that studies living things. It is a very large and broad field due to the wide variety of life found on Earth, so individual biologists normally focus on specific fields. These fields are either categorized by the scale of life or by the types of organisms studied.

What do Biologists do?

A biologist studies living organisms, including their structure, function, evolution, behavior, interactions with each other and the environment, and the processes that govern their existence. Biologists explore the diversity of life, from the smallest microorganisms to the largest mammals and everything in between. They use a range of techniques, including molecular biology, genetics, biochemistry, ecology, and evolutionary biology, to understand the biological processes that underpin life.

Biologists work in a wide variety of settings, including universities, research institutions, government agencies, private companies, and nonprofit organizations. Some biologists focus on basic research to expand our knowledge of the natural world, while others apply their expertise to address practical problems, such as developing new medicines, protecting endangered species, or managing ecosystems.

Types of Biologists

Marine Biologist	Marine biologists study wildlife, plants, microbes, or other living organisms found in the ocean. Some focus on a particular marine species, while others study the effects of human behavior on the oceans. Marine biologists can work under different job titles, including fish and wildlife biologist, aquatic biologist, or biological technician.
Zoologist	Zoologists are biologists who study wildlife species to learn more about them and their interactions with their habitats. This typically includes studying animal behavior, physical characteristics, and life cycles. Zoologists might also study the effects of human behavior on wildlife species and their ecosystems or habitats.
Microbiologist	Microbiologists research tiny living organisms or microorganisms, such as viruses and bacteria. They also study fungi, algae, and other microorganisms to find out more about how they live and how they interact with their surrounding environments. Some microbiologists conduct research involving certain microorganisms to develop new treatments for diseases, while others study microorganisms to develop products, such as genetically modified crops.
Conservation Biologist	Conservation biologists study the effects of human activities on the environment and seek to find ways to protect vulnerable habitats and plant and animal species. Some of these biologists focus on studying specific endangered animal or plant species, while others spend their time researching ways to conserve an entire ecosystem or natural habitat.
Ecologist	Ecologists are biologists who study the relationships between living organisms and their ecosystem or surrounding environment. Some focus on studying how different species in a particular ecosystem interact, while other ecologists focus on studying the effects of invasive species on native species in an ecosystem.
Botanist	Botanists are biologists who study plants, trying to determine things like how plants interact with their environment, the physiological processes of plant life, or the agricultural uses of plants. Some botanists specialize in plant ecology to find ways to save native species of plants in certain environments or decrease the presence of invasive plant species.
Forensic biologist	Forensic biologists specialize in applying biological knowledge and principles to assist with various criminal and civil investigations. They typically work either directly for law enforcement agencies or for private forensic science laboratories. Their main tasks are analyzing various pieces of evidence collected from investigation scenes and using their expertise to produce an informed conclusion regarding the crime.
Biostatistician	iostatisticians use mathematical and statistical principles in biology by gathering and analyzing various pieces of biological data and using them to draw conclusions related to medicine and agriculture. They use their findings to discover the factors that have a major impact on the health and well-being of people, animals and plants, by discovering what can cause diseases and disorders.

WHY SHARKS DON'T SINK

A S.T.E.A.M. activity designed to understand sharks and buoyancy

Levels: K through 5th
Time: 35 to 45 minutes

OBJECTIVES

This experiment is a great way to show how sharks float without using a swim bladder like most other fish. A swim bladder is a gas filled organ in bony fish that helps them stay afloat. Some types of sharks use their oil filled liver to stay buoyant.

Oil is lighter than water, so it sits on top of it instead of sinking like the water bottle. The oil in the bottle keeps it buoyant, which is how some sharks such as great whites stay afloat.

PREPARATION

Watch these videos on an explanation of the science behind this experiment:
What Happens When Fish and Sharks Stop Swimming?

Watch this video on how this activity is made:
Why Sharks Don't Sink

It's best to do this experiment at least once before teaching the students to 1) ensure you know how the experiment works, and 2) to have a few examples of what the project will look like.

MATERIALS:

EACH STUDENT NEEDS:

- Plastic water bottles
- Vegetable oil
- Large plastic tub
- Water
- Optional: plastic toy shark and black permanent markers

HOW ELSE DO SHARKS FLOAT?

Another reason sharks float is because they are made of cartilage rather than bone. Cartilage is, you guessed it, much lighter than bone.

Now let's talk about those shark fins and tail. The side fins are somewhat like wings while the tail fin generates constant movement pushing the shark forward. The fins lift the shark while the tail moves the shark through the water. However, a shark cannot swim backward!

Note: Different species of shark use different means to stay buoyant.

VOCABULARY

Words to know for this experiment:

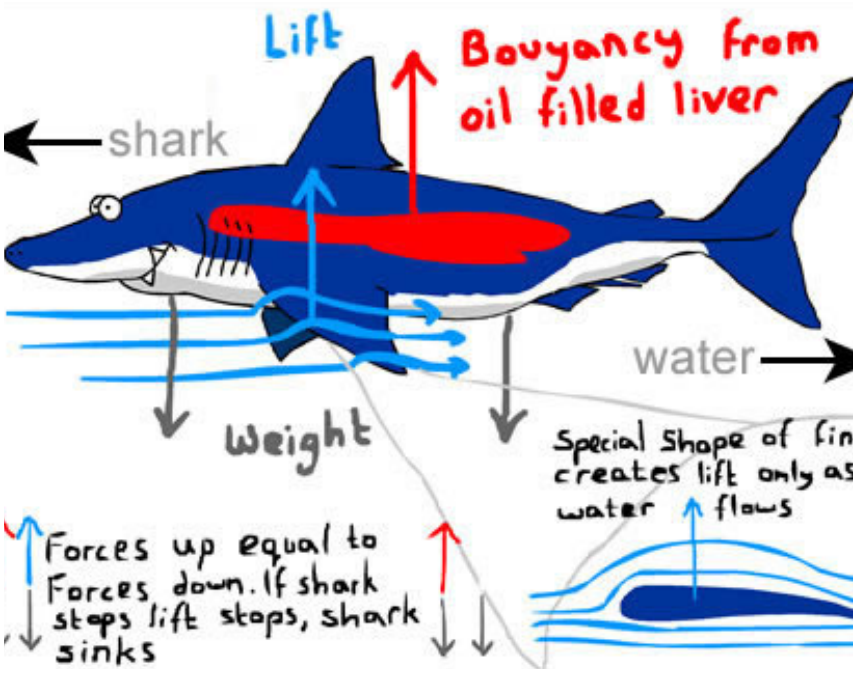
Buoyancy: the ability of an object to float in water or air. It can also be defined as the tendency of an object to rise or float in a fluid, or the power of a fluid to push an object upward.

Swim Bladder: an organ that can fill up or release air, allowing the fish to go up or down in the water. As a fish swims deeper, the pressure on its body increases. The swim bladder helps its body compensate for the pressure changes.

ACTIVITY

1. Take two empty bottles and fill one up with oil, and the other with water. If you are crafty, draw a shark face on each of the bottles to look like two sharks.

2. Put the bottles into the water and observe what happens. The oil bottle should float, while the water bottle sinks.



WHAT TYPE OF SCIENTISTS STUDY SHARKS?

Shark biologists are a type of marine biologist who specialize in studying sharks. They study sharks in the ocean to learn about their biology, including their natural history, physiology, and movement ecology. They also track sharks for data like growth and migration. Shark biologists work to protect and conserve sharks, which are apex predators that help balance the ocean ecosystem by keeping other species in check.

QUESTIONS TO ASK

before, after, or during the experiment:

1. What will the two bottles do once they are in the water?

2. If sharks didn't have their special adaptations, what do you think would happen to them in the ocean?

3. Can you think of any other animals that have special ways to stay afloat?

4. What do you think would happen if a shark didn't have its liver?

5. What did you learn about how sharks are different from other fish?

6. Why is it important for sharks to be able to stay at different depths in the water?

What is Astronomy?

Getting to understand Astronomy deeper

What is Astronomy?

Astronomy is the study of everything in the universe beyond Earth's atmosphere. That includes objects we can see with our naked eyes, like the Sun , the Moon , the planets, and the stars . It also includes objects we can only see with telescopes or other instruments, like faraway galaxies and tiny particles. And it even includes questions about things we can't see at all, like dark matter and dark energy .
What are the big ideas about astronomy?

1. When we look up at the night sky, we see patterns and want to explain them
2. The sky is vast and distances between objects can be very large
3. Everything in space is moving all the time
4. Gravity holds everything together
5. There's much more to light than our eyes can see
6. The universe contains mysterious, invisible stuff
7. It takes a team of people working together to study the universe

What do Astronomers do?

An astronomer studies celestial objects and phenomena in the universe. They explore and investigate various aspects of the cosmos, including stars, planets, galaxies, asteroids, comets, and other celestial bodies. Astronomers seek to understand the nature, composition, behavior, and evolution of these objects, as well as the larger structure and dynamics of the universe.

Astronomers employ a range of tools and methods to conduct their research. They use telescopes, both on the ground and in space, to observe and collect data from distant objects. They analyze the light emitted or reflected by celestial bodies to determine their properties, such as their composition, temperature, distance, and motion. Astronomers also employ computational modeling and simulations to study complex astrophysical processes, such as the formation of galaxies or the behavior of black holes. Through their work, astronomers contribute to expanding our knowledge of the universe and deepening our understanding of its origins and dynamics.

Types of Astronomists

Planetary astronomer	Planetary astronomers research and analyze planets, their atmospheres and other celestial objects within our solar system. They work to understand the formation, evolution and characteristics of these celestial bodies by using data gathered from telescopes and spacecraft.
Galactic astronomer	Galactic astronomers study the structure, composition and dynamics of galaxies and their components, including stars, gas and dark matter. They also investigate the formation and evolution of galaxies over time. Galactic astronomers use telescopes and other observational tools to accumulate data and analyze it to answer fundamental questions about the universe.
Cosmologist	Cosmologists survey the universe's origins, evolution and structure as a whole. They use observations of the cosmic microwave background radiation, the distribution of galaxies and other phenomena to create and critique theories about the nature of the universe. .
Solar astronomer	Solar astronomers look at the sun, its behavior and its effects on the Earth and other planets. They use telescopes and other instruments to observe the sun and analyze its features, such as sunspots, solar flares and coronal mass ejections.
Optical astronomer	Optical astronomers survey celestial objects using visible light and other wavelengths of light that the human eye can detect. They use telescopes and other instruments to gather data points and analyze them to better understand the properties of stars, galaxies, and other celestial objects.
Exoplanet astronomer	Exoplanet astronomers research and analyze planets outside of our solar system. They use various techniques to detect and watch exoplanets, such as the transit and radial velocity methods. Exoplanet astronomers work to understand the properties of these planets, like their size, mass and composition.
Radio astronomer	Radio astronomers examine celestial objects using radio waves. They use radio telescopes and other instruments to seek specific information from the sky and analyze it to understand the properties of space better.
Astrophysicist	Astrophysicists observe the physical properties and behavior of celestial objects, including stars, galaxies and black holes. They use various techniques to analyze the data gathered from telescopes and other instruments to improve models and theories about the universe.

SOLAR SYSTEM BRACELETS

A S.T.E.A.M. activity designed to explore our galaxy & the planets

Levels: K through 5th
Time: 10 to 15 minutes

OBJECTIVES

Constructing a Solar System Bracelet is a GREAT way to introduce students to their study of the solar system.
Although constructing the bracelet makes students more interested in the solar system, like most diagrams and models of the solar system, the bracelet does not accurately depict sizes AND distances. So, it's important to set aside time to help students understand this.

PREPARATION

Watch these videos on the space:
Exploring Our Solar System

Watch this video on how this activity is made:
Solar System Bracelets

It's best to do this experiment at least once before teaching the students to 1) ensure you know how the experiment works, and 2) to have a few examples of what the project will look like.

MATERIALS:

EACH STUDENT NEEDS:

- String
- Solar System Beads: you can order them here

ACTIVITY

As you go through each of the planets, have the students first guess which planet is which, and
then when they guess correctly, have them put the planet on the string.

There are ten beads that look like asteroids and ten gold beads for the students to use to add their own flare to their bracelets! Allow them to put these beads on wherever they would like on the bracelet.

AFTER THIS ACTIVITY:

1. test the student's knowledge of the planets by asking them trivia! Some trivia questions are listed below the activity, but feel free to find more

ABOUT THE PLANETS:

1. Mercury: is the smallest, and the fastest planet. It goes around the sun in 88 days. It also has no moons or rings.

2. Venus: Venus takes 225 days to go around the sun. It is the second brightest object in the night sky.

3. Earth: The Earth is covered with 70% water. It takes 365 orbit the sun and its axis it tilted at 66 degrees

a. Moon: The moon is a natural satellite to the Earth and the brightest object in the night sky. It has no atmosphere and less gravity than earth.

4. Mars: Mars is the second smallest planet and has two moons. Its atmosphere is made of mostly carbon dioxide.

5. Jupiter: Jupiter is the biggest planet in our solar system. It's like a star, but it never got big enough to start burning. Jupiter is covered in swirling cloud stripes. It has big storms like the Great Red Spot, which has been going for hundreds of years.

6. Saturn: Saturn with its unique ring system orbits the sun once every 29 years and has around 82 moons.

7. Uranus: Uranus isn't visible without a telescope. Its axis is 98 degrees, so it rolls on its side around the sun.

8. Neptune: Neptune is the smallest gas planet and takes 165 earth years to orbit the sun. The gases in its atmosphere give it the deep blue color.

9. Pluto: Pluto is a dwarf planet, one of five. At one point, it was known as the ninth planet
of the solar system. It has 5 known moons.

Additional Facts:

10. The Sun: The sun is composed of hydrogen and helium. One million earths, approximately, could fit inside of the sun. It takes roughly eight minutes for light from the sun to reach earth

11. Asteroid Belt: The asteroid belt is located between the orbits of Mars and Jupiter. There are many asteroids, but most are fairly small and spread out inside of a large area. This allows for spacecrafts, pass through it relatively easily.

SOLAR SYSTEM TRIVIA

1. Now that Pluto is no longer included, how many planets are there in the Solar System?
A: 8

2. What is the smallest planet in the Solar System?
A: Mercury

3. What is the largest planet in the Solar System?
A: Jupiter

4. What is the hottest planet in the Solar System?
A: Venus

5. The sixth planet from the Sun features an extensive ring system, what is the name of this planet?
A: Saturn

6. The chemical element uranium was named after what planet?
A: Uranus

7. What planet in the solar system is farthest from the Sun?
A: Neptune

8. What is the second smallest planet in the solar system?
A: Mars

9. What planet is closest in size to Earth?
A: Venus

10. The moon Titan orbits what planet?
A: Saturn

11. What planet is nicknamed the 'Red Planet'?
A: Mars

12. True or false? Neptune is larger than Saturn.
A: False

13. The Galilean moons orbit what planet?
A: Jupiter

14. What planet is closest to the Sun?
A: Mercury

15. What is the seventh planet from the Sun?
A: Uranus

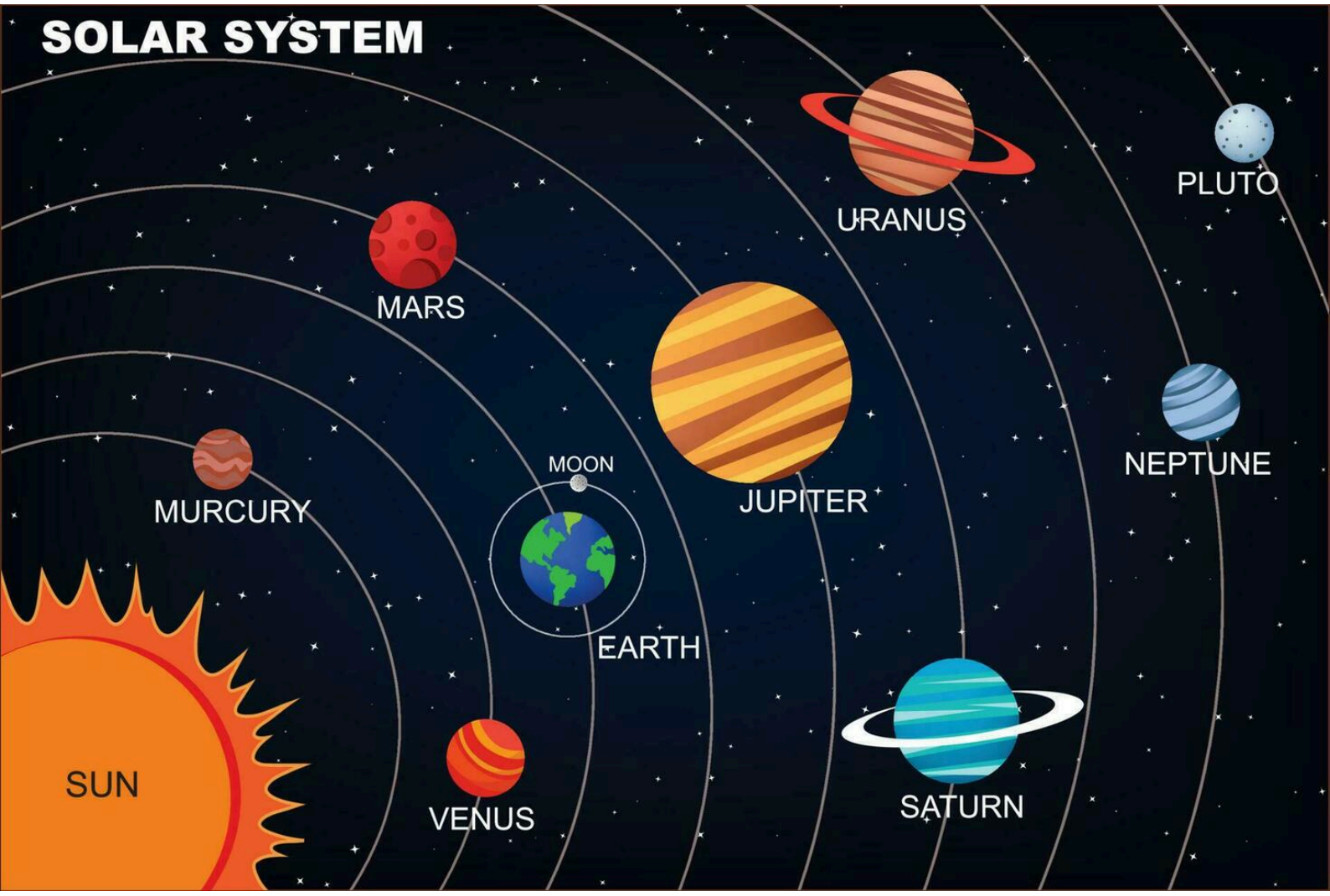
16. True or false? Venus has more atmospheric pressure than Earth?
A: True

17. Triton is the largest moon of what planet?
A: Neptune

18. What is the brightest planet in the night sky?
A: Venus

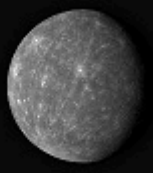
19. What is the third planet from the Sun?
A: Earth

20. Phobos and Deimos are moons of what planet?
A: Mars


SOLAR SYSTEM
URANUS
PLUTO
MARS
JUPITER
NEPTUNE
MOON
MURCURY
EARTH
SUN
VENUS
SATURN

– COOL SPACE FACTS –

THE SUN MAKES UP 99.86% OF THE SOLAR SYSTEMS MASS



MERCURY IS NAMED AFTER THE ROMAN MESSENGER TO THE GODS

VENUS SPINS IN THE OPPOSITE DIRECTION TO MOST PLANETS

THE EARTH IS 149,598,262 KM FROM THE SUN

MARS IS HOME TO OLYMPUS MONS THE SOLAR SYSTEMS TALLEST VOLCANO

JUPITER IS LARGE ENOUGH FOR THE EARTH TO FIT INSIDE 1,000 TIMES

SATURN HAS THE SECOND LARGEST MOON IN THE SOLAR SYSTEM, TITAN

URANUS IS COLDEST PLANET IN THE SOLAR SYSTEM

NEPTUNE ORBITS THE SUN ONCE EVERY 165 YEARS

What is Engineering?

Getting to understand Engineering deeper

What Is Engineering?

Engineers love to figure out how things work and use their knowledge in practical ways; therefore, at their core, engineers are innovative problem solvers. While scientists and inventors create things, it's the engineer that figures out how the creation can be used to solve real-world complications. This can include building electronics, planning buildings or bridges, or even creating robots or spaceships to further human ingenuity.

Engineering has brought us some of the world's most incredible creations, from the majestic pyramids and the iconic Eiffel Tower to the ingenious Roman aqueducts and ancient road systems. Engineers apply math and science to solve problems and overcome challenges, answering the question, "What is an engineer?" in spectacular ways.

What's even more exciting is the variety within the field of engineering. Whether your child's interests lie in exploring space, designing cutting-edge electronics, or shaping the cities of the future, there's a place for them in engineering. No matter what sparks their curiosity, there's an engineering path waiting for them to discover!

What Do Engineers Do?

Engineers come with a wide range of interests, talents, and strengths. Some excel at planning and designing cities or structures, while others are passionate about technology, working on robots, or spacecraft. When it comes to answering the question, "What does an engineer do?" the possibilities are endless!

If you love to problem-solve, there's a place for you in the world of engineering, no matter where your kid's passions lie.

Types of Engineers

In the world of engineering, there are many different types of work. Here are the most common types of engineers:

Civil Engineer	Civil engineers are those who help solve problems with infrastructure. That includes roads, bridges, tunnels, water or sewer systems, etc. They often work with cities, towns, or governments on projects.
Chemical Engineer	Solving challenges that involve food, medication, or chemicals is the role of a chemical engineer. They have a good understanding of various sciences like biology, chemistry, and physics. Chemical engineers apply their knowledge to make products safer and more effective. They often work in labs or offices.
Mechanical Engineer	The main role of a mechanical engineer is to design machines. This can include every type of machine from household appliances to jets. A mechanical engineer uses their abilities to solve problems for people and companies, from making life more comfortable to creating more environmentally friendly machines.
Electrical Engineer	Engineers that work with electrical components like computers and motors fall into the category of electrical engineers. Many industries hire electrical engineers from research facilities to manufacturing plants.
Agricultural Engineer	Food production has become a major industry and engineers also work in this area. Their role is to solve problems with regard to agriculture, which can include plants, animals, and machinery. For example, they can design farm equipment that makes harvesting more efficient.
Aerospace Engineer	For those who are excited about flight or space exploration, aerospace engineering would be an ideal fit. An aerospace engineer designs different parts of aircraft and spaceships. This can include every small component that is essential to making the machine work.
Biomedical Engineer	Making life better for patients and healthcare workers is the goal of a biomedical engineer. They use science and math to solve problems in healthcare. Some examples include pacemakers, artificial limbs, and surgical robots.
Nuclear Engineer	Engineers that develop and design safe ways to work with nuclear equipment are called nuclear engineers. Some of their tasks can include writing instructional materials for nuclear power plants or creating medical imaging devices for use in healthcare. They can also be called upon in emergencies such as a nuclear power plant shutdown.

BALLOON SCULPTURES

A team-building activity used to explore methods of creative thinking and effective communication in groups.

Levels: K through 5th
Time: 30 to 40 minutes

OBJECTIVES

This is an informal lab that does not rely on technical knowledge or skills, so it works especially well when your group consists of participants of different job levels. It's a fun activity that allows the group to work together without thinking about their formal roles within the organization.
You may notice that participants may behave in ways contrary to their job levels or job roles (e.g. someone with lower authority in the office may step up and lead the team or someone who does a more technical job may turn out to be more creative).

PREPARATION

Explore effective ways of communication within teams. Here's some ways teams can effectively work together:
How Teams Communicate
What Makes A Team Great?

It's best to read through this activity at least once before teaching the students to 1) ensure you know how the experiment works, and 2) to have a few examples of what the project will look like.

MATERIALS:

EACH GROUP NEEDS:

- 25 balloons of varying colors and sizes
- Roll of Masking Tape
- Large cardstock for each team to build towers on.

OPTIONAL MATERIALS:

- a tape measurer
- sticky notes
- pen
- electric balloon inflator.

CHALLENGE:

Can your team create the tallest free-standing balloon tower using 25 balloons and masking tape?

Freestanding means – without anyone holding it up or touching it and without the tower leaning against the wall.

How well can the teams work together? This activity tests communication and creative thinking between the participants. While participants are building their towers, observe strengths and weaknesses between the groups and talk about it afterward.

WHAT ARE WE LEARNING?

This lab is going to teach:

Communication: the process of sending and receiving information through verbal and non-verbal methods

Creative Thinking: the ability to develop new and different approaches to a problem or a concept. Essentially, creative thought involves processing existing information and experiences, adopting various perspectives, and figuring out new patterns

ACTIVITY

1. Put kids into 3 teams. (3-4 kids in each group)

2. Determine who can blow up/tie balloons in each group. Adult helpers help with this. Give each team about 10 minutes to blow up balloons. Using a portable electric balloon-inflating machine could help all teams out as well.
(Helpful Hint - have some balloons blown up ahead of time for each group)

3. On “Go” - The team has 10 minutes to build their towers using all 25 balloons and pieces of masking tape. Teams stop building after 10 minutes. (Allow extra time if needed...the process is more important than the time limit). Adult helpers become part of each team to help the process along.

4. Use the remaining time to measure each group’s balloon tower and determine the tallest.

5. On a sticky note - Label each tower with height in inches so kids have a visual of each tower’s height.

Take a photo of each group and their finished tower and celebrate teamwork.

QUESTIONS TO ASK:

1. What did you learn about your team members that you didn’t know before?

2. What communication methods did your team use?

3. Did everyone agree with the idea for the balloon sculpture? If not, did you have to compromise?

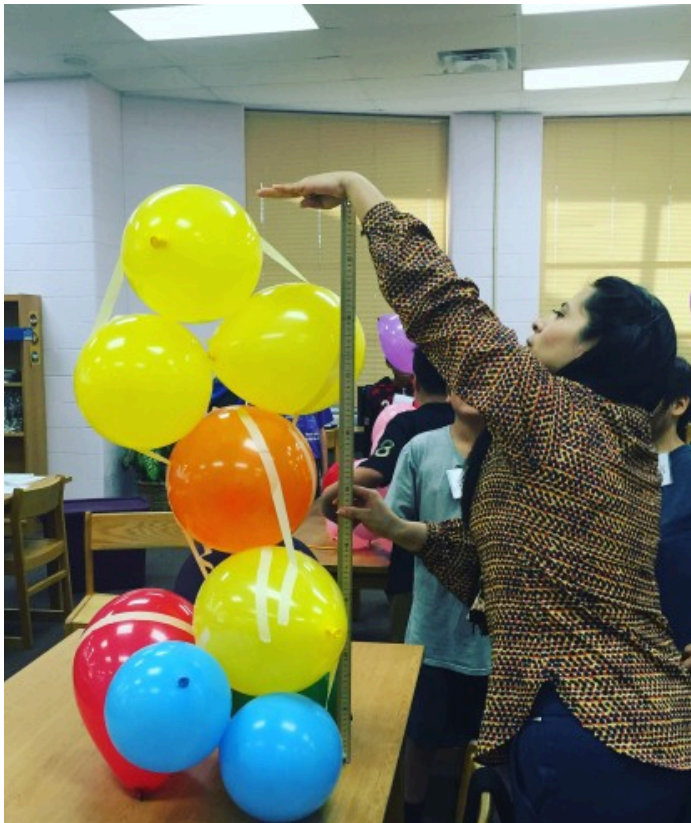
4. How well did you work as a team?

5. Did others in the team listen to your opinion? Did everyone have their input?

6. Did anyone emerge as a leader, and how did having a leader help?

SCIENTISTS & TEAMWORK

Scientists need to have effective teamwork because solving big problems often requires different skills and ideas. When scientists work together, they can share their knowledge, learn from each other, and come up with better solutions. Teamwork also helps them to complete projects faster and avoid mistakes by checking each other's work. By working as a team, scientists can make discoveries that help improve our world



REVIEW

what have we learned?

Review

What have we learned?

Review

Create a dialogue with the students about what they have learned. Ask questions about each activity and lab they have completed and discuss how each activity has helped them become better engineers. Let the students take turns and discuss with an open conversation

Questions

Let the students have an open discussion on what they have learned. If you feel as though you won't need questions to direct the conversation, don't use them! If you have other questions you would like to ask, ask them! This review is completely up to you and the students- let them take the lead on the discussion!

1. What type of science was most interesting to you? Why?
2. Can you think of more types of sciences? (Hint: there are A LOT! Scientists have names for just about any type of science you can think of!)
3. How did these activities prepare you to become a scientist?
4. Did these activities encourage you to become a scientist? Why/Why not?

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