Learning Activities

Grade 6 - 8

Suggested Learning Activities for Grade 6 students during the COVID-19 school closure.

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While Seattle Public Schools endeavors to only post documents optimized for accessibility, due to the nature and complexity of some documents, an accessible version of the document may not be available. In these limited circumstances, the District will provide equally effective alternate access.

Due to the COVID-19 closure, teachers were asked to provide packets of home activities. This is not intended to take the place of regular classroom instruction but will help supplement student learning and provide opportunities for student learning while they are absent from school. Assignments are not required or graded. Because of the unprecedented nature of this health crisis and the District’s swift closure, some home activities may not be accessible.

If you have difficulty accessing the material or have any questions, please contact Claudine Berry cvberry@seattleschools.org.
Advanced Learning Summer Projects

6th – 8th grade

Suggested projects for 6th-8th grade students to work on during the summer.

The Advanced Learning department is committed to making these projects accessible and usable to all people, regardless of ability or technology. These STEM projects represent a curated list of popular projects that are adapted for use by 6th-8th grade students at home. These projects have also been adapted to only use common household items. These projects are not required nor will be graded. Students can engage in whichever projects interest them.

Please note the following information:

**Family Member Participation Highly Encouraged**
We encourage family members to work on these projects together with their student as much as possible. To support this collaboration, you will also notice that every project contains a section that involves the student reflecting on their learning with a family member.

**Definitions and Vocabulary Building Activities**
The bolded words are defined in a glossary at the back of the packet. As your student reads through the projects, we encourage you to ask them about the bolded words and encourage them to reference the glossary as needed. Also, to engage your student more deeply in building their STEM vocabulary, we have included directions for using a graphic organizer to further explore the definitions and uses of these words.

**Information about Referring your Student for Advanced Learning Services**
The final page of these materials contains information about how to refer your student for Advanced Learning services.

For questions about these materials, please email advlearn@seattleschools.org or call the Advanced Learning department at 206-252-0130.

Name: ________________________________________________________________
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Space Lander Challenge

Materials
- 1 piece of stiff paper or cardboard (approximately 4 x 5 in/10 x 13 cm)
- 1 small paper or plastic cup
- 3 index cards (3 x 5 in/8 x 13 cm)
- 2 regular marshmallows
- 10 miniature marshmallows
- 3 rubber bands
- 8 plastic straws
- scissors
- tape
- [optional] notebook or lined paper for written reflection

The Challenge
Design and build a shock-absorbing system that will protect two “Astronauts” when they land. To do this you will follow the engineering design process to:
1. design and build a shock-absorbing system out of paper, straws, and mini-marshmallows.
2. attach the shock absorber to a cardboard platform.
3. improve the design based on testing results.
What is a Space Lander?
A lander is a spacecraft which descends toward and comes to rest on the surface of an astronomical body, like the Moon. A lander makes a soft landing to protect the astronauts inside or to protect equipment, like a rover or a probe.

The picture on the right is a drawing of a space lander like the one launched by NASA in 2018 called the InSight. It contained equipment that can collect seismic data about Mars. NASA engineers designed it to safely land on the surface of Mars by giving it a few key pieces. First, it has shock-absorbing legs. Second, it has vertical engines that kick in right after the lander is dropped from a space capsule 1 mile above Mars’ surface.

We have yet to send astronauts to Mars, but several organizations are currently working on it. What will the engineers of these landers have to do to keep these astronauts safe while they land on the surface of Mars?

Why is Landing on a Moon or a Planet so Challenging?
Landing on the Moon is tricky. Since a spacecraft can go as fast as 18,000 miles per hour on its way to the Moon, it needs to slow down to land gently. If there are astronauts onboard, the lander also needs to keep them safe.

Similarly, spacecraft on their way to Mars may be traveling as fast as 13,000 miles per hour when they reach the Red Planet. They then need to slow down to land safely on the surface. Future missions to Mars will also need to safely land astronauts on the surface.

In this project you will build a model of a space lander (with little marshmallow astronauts!) using only the materials suggested. You will see that the directions are intentionally not specific, as it will be up to you to design a space lander that can keep your marshmallow astronauts safe. To be successful at your design, you will need to do multiple trial runs to learn what is and what is not working. A good design will come from learning from these “crash landings.” You will then need to redesign your space lander based on what you notice from these landings.
Procedure

Brainstorm & Design:
Think about how to build a spacecraft that can absorb the shock of a landing.

- What kind of shock absorber can you make from these materials that can help soften a landing? If the landing is too hard, your model space lander may break apart.
- How will you make sure the lander does not tip over as it falls through the air?

Build
1. First, design a shock-absorbing system. Think springs and cushions. For example, you can fold an index card into a spring (see illustration).
2. Then, put your spacecraft together. Attach the shock absorbers to the cardboard platform.
3. Finally, add a cabin for the astronauts. Tape the cup to the platform. Put two astronauts (the large marshmallows) in it. (NOTE: The cup must stay open—no lids!)

Test, Evaluate, & Redesign
Ready to test? Drop your lander from a height of one foot. If the “astronauts” bounce out, figure out ways to improve your design. Study any problems and redesign. For example, if your spacecraft:

- tips over as it falls through the air—Make sure it’s level when you release it. Also check that the cup is centered on the cardboard. Finally, check that the weight is evenly distributed.
- bounces the astronauts out of the cup—Add soft pads or change the number or position of the shock absorbers. Also, make the springs less springy so they don’t bounce the astronauts out.

Reflect on your Learning
Write down the answers to these questions in a notebook, on a piece of lined paper. Share and discuss your answers with an adult family member.

- What forces affected your lander as it fell?
• After testing, what changes did you make to your lander?
• Engineers’ early ideas rarely work out perfectly. How does testing help them improve a design?
• The moon is covered in a thick layer of fine dust. How might this be an advantage? A disadvantage?
• What was challenging about designing a lander that can land safely?
• If your first drop was not successful, what adjustments did you make to your lander to make it successful?
• What questions do you still have about space landers, mars, or space exploration?
• What are ways you can learn more about these topics?

Extensions
If you would like to continue this project even further, consider the following extensions to increase your engineering skills and deepen your learning.

Engineering Competition
With one or more family members and/or friends, organize an engineering competition to see who can design the most effective space lander.

The goal should be to see who can design a space lander that can be dropped from the highest point without the marshmallows falling out.

Make sure every person (or team) has the same building materials and the same amount of them. Make sure everyone is given the same amount of time to build their lander. For example, set the timer on a phone or smart speaker to 10 minutes.

drop their landers from two feet. Eliminate all landers that bounce out their “astronauts.” Next, raise the height to three feet. Continue in this fashion until a winner emerges. You can also increase the challenge by adding a third marshmallow “astronaut” to each cup.
Balloon Car Challenge

Materials
This is a creative engineering and design project, so you may not have all of the materials listed below. The materials you may use is also not limited to the list! Just make sure you ask an adult for help before using expensive, fragile, or dangerous materials. Think of this list as suggestions:

- Open floor space
- Tape measure
- Wheels (round objects like CD/DVDs and bottle caps, etc.)
- Axles (wooden skewers, pencils, straws, etc.)
- Frame/body (plastic bottles, cardboard boxes, popsicle sticks, paper plates, etc.)
- Straws
- Balloons
- Rubber bands
- Tape
- Scissors
- Notebook or lined paper
- Other assorted classroom/office supplies (paper clips, binder clips, zip ties, etc.)

Key Concepts
You are probably familiar with buses and cars, but have you ever wondered how they work? Cars and buses are types of vehicles with 4 or more wheels turning on 2 or more axles, with the vehicle itself propelled by an engine. A full-size car and car engine take an enormous amount of time, materials, and experience with engineering to completely build, but with a few items from around your house, you can learn about the physics of motion.

In this project, you will design and build a balloon-powered car. The car will be propelled forward by air escaping from the balloon and it can be built using a variety of different materials, including those in the list above.
You should engineer your design around the balloon. When you fill the balloon with carbon dioxide from your lungs and trap it closed with your fingers on the open end of the balloon, the gas molecules moving around inside the balloon put pressure outward from the inside on the balloon’s surface. This outward pressure is potential energy waiting to be converted into kinetic energy.

When you release the pressure and allow the gas to escape by releasing your grip on the open end of the balloon, the moving gas creates pressure differences in the air behind your car, propelling it forward. Your task will be to make sure the balloon stays attached to your car and faces it in one direction.

You can maximize the conversion to kinetic energy by making sure the wheels of your car are hindered by friction as minimally as possible. Make sure they turn smoothly!

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**Procedure**

**Before you start building your car, complete the design step below.**

1. **Design**
   
   In the space below (or on a separate piece of paper), draw sketches of some ideas for your balloon car before you start building it. Label the materials you will use to keep track of what you have or what you need. You might come back to this page to modify your sketch or make a new one as you test and redesign your car.

2. **Build your car.**
   
   This is YOUR design, so be creative! But if you need a few tips, consider these:
   
   a. Keep your materials organized and neat
b. Most cars use 2 axles reaching from one side of the car to the other and on opposite ends, with 1 wheel attached to each axle at the center.

c. Position your balloon with the open end facing the back of the car so that it can roll forward on the wheels.

3. Test your car.
   a. Make START and FINISH lines. You can ask a friend or family member to help you time with a stopwatch, or you can just see how far the car can go.
   b. Fill your balloon with air, keep the air trapped, and position your car at the START line.
   c. Release the air and watch the car until it comes to a stop.
   d. Record how far the car traveled in your notebook or on lined paper, or you can modify it for timed rounds. The important thing to note is engineers need to record measurements and then redesign to improve on those measurements.
   e. Note any problems with your car. For example, do the wheels wobble? Does it drift off to one side? You can fix these problems and return to testing.

Reflect on your Learning
Write down the answers to these questions in a notebook, on a piece of lined paper. Share and discuss your answers with an adult family member.

- What problems did you encounter when designing and building your car? How did you overcome these challenges?
- If you had more time, how would you further modify or improve your designs? Would you use any materials not currently available at home?
- The cars in this project store potential energy in inflated balloons. How do real cars store energy? How is this energy converted to kinetic energy?

Extensions
If you would like to continue this project even further, consider the following extensions to increase your engineering skills and deepen your learning.

Balloon Rocket!
Use what you learned about physics from your balloon car to aim for the stars and build a balloon rocket! A rocket is another type of vehicle designed to overcome gravity instead of friction. Can you re-engineer your balloon car and take it to space?

Uses of Potential and Kinetic Energy in the Wild
While out and about on a walk in your neighborhood, on a trip to the store in a car, or driving with your family somewhere this summer, look for things showing potential and kinetic energies to help
your brain understand it more. It might be the potential energy in a huge container being loaded onto a ship by a crane, or it might be the kinetic energy in a frisbee sailing through the air.

Use your observations to talk with friends or family about what you have noticed. Ask about careers like the ones suggested below to understand the important connection between the school/home STEM projects and STEM job opportunities in the real world.

- **Automotive Engineer**: Real cars are complicated machines with many different sub-systems inside them, ranging from passenger safety features like seatbelts and airbags, to comfort features like the heating and air conditioning systems, and of course the engine and all the parts that make the car move! Automotive engineers are involved in designing all the different parts that go into building a complete car.

- **CAD Technician**: In this project you drew a sketch of your design before you started building your car. Computer Aided Design (CAD) technicians create computer drawings and three-dimensional models of cars during the design process and when the final designs are sent off to the factory for manufacturing.
Windmill Challenge

Materials

- fan (a medium size or box fan would work great)
- straws
- popsicle sticks
- sheets of different kinds and weights of paper
- masking tape
- paperclips
- index cards
- paper plates/cups
- water bottle
- string
- add other miscellaneous items to inspire creativity like rubber bands, binder clips, glue etc.

The Challenge:

Design and build a working windmill that produces the most power (spins the fastest). You will use the Engineering Design Process to complete this challenge.

The engineering design process is a series of steps that guides engineering teams as we solve problems. The design process is iterative, meaning that we repeat the steps as many times as needed, making improvements along the way as we learn from failure and uncover new design possibilities to arrive at great solutions. The steps are:

- Define the Problem
- Plan Solutions/Brainstorm
- Make a Model/Build
Background

A windmill uses sails or blades to convert energy from the wind into rotational energy. Early windmills were developed in Persia to grind grain between 500 – 900 AD. The design of these windmills was different from the ones you see today. These were called vertical axis windmills since the main axis stood upright. From Persia, windmills spread throughout Asia and China.

Windmills were developed in Europe around 1300 AD. European windmills had a horizontal axis. These windmills were used to mill grain and/or pump water. During the 19th century, small scale windmills became common on American farms to pump water and irrigate the crops. Between 1850 and 1970 over 6 million windmills were installed in the US.

The windmills usually seen today are wind turbines that generate electricity as the blades turn. When the blades turn the main axis, it powers a generator that produces electricity. The more the blades turn, the more electricity is produced.

Wind is a renewable resource. This means wind can be used repeatedly without running out. In addition to being renewable, wind energy is a form of clean energy since it does not pollute or harm the environment. Since wind energy is a clean renewable source of electricity, there has been a lot of growth in the industry. In the past decade, the amount of energy produced by wind has tripled. Significant growth of wind power is also happening in other countries including China and countries in Europe.
Procedure

1. **Brainstorm**: You can use the brainstorming worksheet below to create 2 prototype designs and then build both or choose your best design and have a family member or friend design and build their own. The important part is to plan your design!

2. **Build**: Use the materials to build your windmill. If you need some ideas to get started, consider these:
   - A windmill’s sails or blades need to catch the wind like a kite, so face all your windmill’s blades in the same direction and at a slight angle rather than flat.
   - A windmill’s wheel needs to turn on an axle like on a car. Reduce friction as much as possible so that your windmill’s wheel turns smoothly!
   - The more wind your windmill can access, the better! So build it tall, but take care that it is stable and can stand on its own.

3. **Test**: Test your windmill to see how fast you can get it to spin. Evaluate how well it works by using the fan as wind.

4. **Redesign**: Redesign as needed.

Observations & Reflection Questions

When the windmill turns, it transfers the kinetic energy in the wind into the blades and the wheel on which they are attached so that it turns on the axle. Depending on how many redesigns you needed, would you say that your windmill’s speed was slow, medium, or fast? How similar was your design to the actual windmill you built? Did you use all the items you planned to use?

Now consider windmills that people use to grind grain or produce electricity. Some windmills use a gear or pulley system to change the direction of the kinetic energy so that it can be harnessed by grinding stones or an electrical generator. How would you change your design to meet this real-world need? Would you need to change any of your materials?

Reflect on your Learning

Write down the answers to these questions in a notebook, on a piece of lined paper. Share and discuss your answers with an adult family member.

- What problems did you encounter when designing and building your windmill? How did you overcome these challenges?
- If you had more time, how would you further modify or improve your designs? Would you use any materials not currently available at home?
• What questions do you have about potential and kinetic energy? How can you find answers to these questions?

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**Extensions**

If you would like to continue this project even further, consider the following extensions to increase your engineering skills and deepen your learning.

**Clean Energy in the Wild**

While out and about on a walk in your neighborhood, on a trip to the store in a car, or driving with your family somewhere this summer, look for things which represent clean energy and/or renewable resources. You might see solar panels or, if you happen to be traveling through central Washington, wind turbines. How do you think these machines harness solar power or wind or other elements of nature in similar or different ways than the windmill you created?
PROTOTYPE #1
CREATE A PROTOTYPE OF A WINDMILL

Instructions: Using the materials provided design a windmill that will spin fast. Draw your idea below.

Briefly explain your prototype and how you will create a windmill with the materials you have chosen:

___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________
PROTOTYPE #2
CREATE A PROTOTYPE OF A WINDMILL

Instructions: Using the materials provided design a windmill that will spin fast. Draw your idea below.

Briefly explain your prototype and how you will create a windmill with the materials you have chosen.

___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________
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The Science of Stealth: How Do Planes Avoid RADAR Detection?

Materials

- Recycled cardboard (enough to cut a 2 foot strip from)
- Masking tape
- Flashlight
- Black construction paper, 8½ x 11 inches (approximately 5 sheets, but get extra for errors for further experimentation) FOR AS MANY PLANES AS YOU WANT TO TEST
- Pencil
- Ruler or protractor
- A notebook or lined paper for writing/drawing observations
- Optional: scissors
- Optional: an object to prop up the flashlight, such as a book

What is RADAR and how does it work?

RADAR, an acronym for Radio Detection And Ranging, is a detection system that uses radio waves to determine the size, shape, location, and movement of an object. A transmitter emits radio waves into the air and then a receiver listens for the “bounce-back” of those same waves reflecting off an object (see Figure 1).

This is the same way many animals, including bats and whales, navigate through their environment using sound waves. Scientists use RADAR in a variety of fields, such as to track weather and navigate ships in the open ocean. The most advanced aircraft in the world’s militaries are designed to avoid RADAR detection.

We can make a model of an aircraft designed to avoid RADAR detection by simulating radio waves with something we can see and measure at home: light and shadows.

In this experiment, we will build stealth aircraft out of paper and then test their abilities to avoid detection with a homemade RADAR.
Directions
This is a complicated project. To help stay organized here is a quick checklist of the items you will need to create or set up to gather data about your stealth aircraft.

- Two or more paper airplanes made with black construction paper. Each airplane should have a different design.
- White paper (one large piece, or multiple white printer paper-zed pieces of paper taped together) placed up on the wall.
- A cardboard stand to place your airplanes on.

1. In a dark room, use the masking tape to secure the large white paper to the wall, preferably at a low height a few inches off the ground. This will serve as a background to draw on.
2. Using the black construction paper, you may follow the directions in the image below to make a paper airplane, or you can design your own. It is recommended to make many planes of different
designs. You can use scissors if necessary. And most importantly, make sure to name each of your aircraft!

1. Fold the paper in half **vertically**.
2. Unfold the paper and fold each of the top corners into the center line.
3. Fold the top edges into the center line.
4. Fold the plane in half toward you.
5. Fold the wings down, matching the top edges up with the bottom edge of the body.

Follow these directions for how to create a paper airplane. These images match the steps in directions above.

3. Using a narrow (approximately 3 inches wide and 12 inches long) strip of paper, make a stand to hold your paper aircraft. You can do this by folding the paper in half and then folding each half outward on each side, forming an upside-down T shape and securing with masking tape on the floor so it doesn’t move or fall over. It should be able to stand on its own. *note: if you have cardboard or cardstock available, this can be used instead of paper to make a more stable stand.*

4. Use the masking tape to secure T shaped stand on the floor about 6 inches away from the wall. You can also use books to weigh the stand legs down instead of taping the floor.

5. Balance the aircraft on its folded crease on the stand. In other words, the paper airplane will be upside down on the stand. You can also secure it with tape and make another stand for more aircraft. Make sure the rear of the aircraft is at least 3 inches away from the wall. When you place
your aircraft on the stand, the craft should be facing away from the wall, with the nose pointed out as though it’s about to fly straight away!

6. Using the flashlight, shine the light directly at the nose of the aircraft. It helps to use a solid object to prop up the flashlight, such as a book, so that you don’t have to hold it and so that it holds the light in the same place and at the same distance for every plane in every experiment. ADJUST FLASHLIGHT SO THE SHADOW APPEARS ON THE. KEEP IT HERE.

7. Using the pencil, carefully trace the aircraft’s shadows, which should be projected onto the white paper behind the aircraft on the wall. Work slowly and make sure you capture the entire outline of the entire shadow.

8. When you are done outlining the shadow, remove the white paper from the wall.

9. Inspect the shape of the shadow you just traced on the white paper and label it with the name of your aircraft. Using the ruler, divide the irregular shadow shape into different regular shapes, such as triangles and rectangles (see Figure 1 for an example).

![Figure 1](image)

10. Using the ruler again, measure the length of each side of the regular shapes you just made. Record these measurements and the shapes in the shadows in a lab notebook or scrap piece of paper.

11. Using the formulas for Area (see Figure 2 on the next page), calculate the Area of each regular shadow shape and record the results in the appropriate units². When you have each regular shape Area calculated, add all the areas together to find the total area of the entire shadow of the aircraft. Record the result in your lab notebook or scrap piece of paper.
12. Repeat the procedure for each aircraft you made and compare the recorded shadow areas for all crafts.

**Observations**

Unlike radio waves, microwaves, or sound waves, the light from the flashlight is a type of particle wave that we can see. In a full RADAR system, the waves reflecting off the target object would be received and measured by high-tech (and expensive) sensors and computers.

In our model, the shadows reflected on the white paper background represent transmitted waves that would be reflected off the target object and then received and measured by the RADAR system, producing a “signature” or measurement indicating the presence of an object. In fact, the light waves ARE reflected off the aircraft, and their reflection is interpreted by your brain through your eyes as color!
Reflect on your Learning
Write down the answers to these questions in a notebook, on a piece of lined paper. Share and discuss your answers with an adult family member.

- What types of aircraft design produces the smallest RADAR “signature?” How do you know which signature is the smallest?
- As a scientist, what recommendations would you make to design airplanes that needed to avoid detection by RADAR?
- What potential flaws in your measurements did you notice, and what would you change about this experiment?

Extensions
If you would like to continue this project even further, consider the following extensions to deepen your learning.

Echo Location
What would happen to your measurements if you changed the distance of the flashlight from the aircraft? What about the distance of the aircraft to the wall? When you move the pieces in your experiment, what would you be moving if this were a full-size RADAR system with a real aircraft?

Move it Along
How would you simulate the aircraft moving through the air? Could you calculate a theoretical “speed” or “velocity” of the aircraft?
Self-Inflating Balloons

*Note: We highly recommend you do this project outside! It can get messy.*

**Materials**

- 3 balloons (12-inch balloons work great)
- 3 water bottles or other similar containers
- 1 cup vinegar
- baking soda (approx. 1/4 cup)
- 1 teaspoon
- 1 marker
- 1 funnel (or a folded sheet of paper)
- Notebook or lined paper

**Challenge**

Can you blow up balloons without using any breath? Your challenge will be to blow up 3 balloons with different amounts of baking soda and describe the differences you see!

**Inflating a Balloon with a Chemical Reaction?**

When the vinegar and baking soda combine there is a reaction between an acid and a base. Vinegar is the acid and baking soda is the base. This reaction between the two causes a gas called carbon dioxide to bubble and foam. This gas having nowhere else to go, expands the balloon making the self-inflating balloon happen.

**Procedures**

1. With your marker, write a ‘1’ on one balloon, a ‘2’ on another, and ‘3’ on the last one. This will be the amount of teaspoons of baking soda you will put into them.

2. Fill the water bottles (or other similar containers) halfway with vinegar.

3. Give the balloons a good stretching, like you would if you were about to blow them up.

4. Use the funnel to put the baking soda inside the balloons. Put 1 teaspoon of baking soda in balloon marked a ‘1’, 2 teaspoons in the one marked with a ‘2’, and 3 teaspoons in the one marked with a ‘3’. Gently shake the balloon until all the baking soda goes to the bottom.

5. One at a time, put the balloons on the opening of the water bottles. It is important you do not let any of the baking soda get into the water bottle (at least not yet!). To do this successfully, carefully stretch the opening of the balloons until they are completely over the opening of a
water bottle. If it’s not a tight fit, your balloons are probably too big, and you should use smaller ones instead.

6. Make the following predictions:
   a. Will your balloons be the same size or different at the end?
   b. Do you think they will get to their largest size at the same time?

7. Lift each balloon and allow the baking soda to fall to the bottom of the bottle. Record as many observations as possible here.

8. Once each balloon is attached to the water bottles, lift the balloon labeled ‘1’ so that the baking soda falls into the vinegar. You might have to give it a gentle shake to make sure it all goes in. Watch the balloon inflate! Note what you observe in your notebook or on lined paper.

9. Repeat this one at a time for the balloon labeled ‘2’, and the balloon labeled ‘3.’ Observe the ways in which these balloons inflate in a different way than the first one and each other. Note these observations in your notebook or on lined paper.

10. Were your predictions correct? Note what you were right about and what was different in your notebook or on lined paper.

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Extensions
If you would like to continue this project even further, consider the following extensions to increase your STEM skills and deepen your learning.

Experimenting with Amounts
You have already done this project using very specific amounts of baking soda and vinegar. What if you changed these amounts? What if you added even more baking soda? What if you added more or less vinegar? Observe what happens and note this in your notebook or on your lined paper.

Make sure you do this outside! As you can imagine, this has potential to get a little messy.

Calculating the Volume of a Balloon
Balloons take on a shape that is very similar to a sphere. One way to measure the size of a balloon is by finding its volume. The volume of a sphere is found with the equation below:

\[
V = \frac{4}{3} \pi r^3
\]
Please calculate the volume of the following balloons (let’s assume they are spherical in shape).

1. Find the volume when the radius is 5cm.
2. Find the volume when the radius is 10cm.
3. Consider problem 1 and 2 above, when the radius gets doubled, does the volume also double? Explain your answer to this in your notebook or on your lined paper.
4. Find the volume if the diameter 40cm.
5. Challenge: If the volume of the balloon (sphere) is 325cm$^3$, what is the radius?
Glossary

Here are all the definitions to the bolded words in the text. If there is a word you are not sure about, check the definition below. If you want to make sure you fully understand the word, use the graphic organizer after the glossary to practice using the word and defining it.

Astronomical/astronomy: the branch of science which deals with celestial objects, space, and the physical universe as a whole.

Design: a plan or drawing produced to show the look and function or workings of a building, garment, or other object before it is built or made.

Detection: the action or process of identifying the presence of something concealed.

Energy: the property of matter and radiation which is manifest as a capacity to perform work (such as causing motion or the interaction of molecules).

Engine: a machine with moving parts that converts power into motion.

Engineering: the branch of science and technology concerned with the design, building, and use of engines, machines, and structures.

Friction: the resistance that one surface or object encounters when moving over another.

Gas: a substance or matter in a state in which it will expand freely to fill the whole of a container, having no fixed shape (unlike a solid) and no fixed volume (unlike a liquid).

Gravity: the force that attracts a body toward the center of the earth, or toward any other physical body having mass.

Iterative: the repetition of a process or utterance.

Kinetic energy: energy which a body possesses by virtue of being in motion.

Molecules: a group of atoms bonded together, representing the smallest fundamental unit of a chemical compound that can take part in a chemical reaction.

Motion: the action or process of moving or being moved.

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.

Potential energy: the energy possessed by a body by virtue of its position relative to others, stresses within itself, electric charge, and other factors.

Pressure: continuous physical force exerted on or against an object by something in contact with it.
Propelled/propulsion: the action of driving or pushing forward.

Radio waves: an electromagnetic wave used for long-distance communication.

Receiver: in radio communications, an electronic device that receives radio waves and converts the information carried by them to a usable form.

Renewable resource: a natural resource which will replenish to replace the portion depleted by usage and consumption, either through natural reproduction or other recurring processes in a finite amount of time in a human time scale.

Rotational energy: kinetic energy relating to a circular movement about an axis or center.

Shock-absorbing: a mechanical or hydraulic device designed to convert the kinetic energy of a shock impact into another form of energy (typically heat) which is then dissipated.

Spacecraft: a vehicle used for traveling in space.

Transmitter: equipment used to generate and transmit electromagnetic waves carrying messages or signals, especially those of radio or television.

Wave: periodic disturbance of the particles of a substance.

Wind: the perceptible natural movement of the air, especially in the form of a current of air blowing from a particular direction.

Windmill: a building with sails or vanes that turn in the wind and generate power to grind grain into flour.
Building Vocabulary

While doing these STEM projects, it is important to continue building your scientific and mathematic vocabulary by exploring the glossary words with the graphic organizer below. It can help you understand complex concepts in a way that is easy to visualize.

You should first define the vocabulary word and apply your knowledge by generating examples and non-examples, giving characteristics, and/or drawing a picture. Here is a blank example:

<table>
<thead>
<tr>
<th>Definition</th>
<th>Facts / Illustration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vocabulary Word</td>
<td></td>
</tr>
<tr>
<td>Examples</td>
<td>Non-examples</td>
</tr>
</tbody>
</table>

On the next page is an example of this graphic organizer when filled out.
Suggestions for Use
If you are doing other Summer Learning activities, you can use some of this vocabulary-building in your everyday routine. For example, you can work on a new vocabulary word every summer school day. Here are some suggestions for how they can do this vocabulary work:

- If you have recently worked on one of these STEM projects, pick a relevant word from that project to dive into with the graphic organizer. This can be a word you had questions about or a word you think you could benefit from more thoroughly understanding.

- Get a printed copy of the graphic organizer OR get a notebook or piece of lined paper and draw the graphic organizer on it. Make sure to label each section (definition, examples, facts/illustration, and non-examples).
2020-21 Advanced Learning Referral Window

OPEN: August 28th - October 1st, 2020

Will your student benefit from receiving Advanced Learning Services? Here are three ways to refer them for evaluation.

1. You may refer your student through the Source. *New to the Source? Please go to www.seattleschools.org. The Source is located in the “Student Family Portals.” Click “Set Up” to set up your Source account.*
2. You may contact your school office to arrange for support in filling out the online referral on the Source.
3. You may fill out a translated paper form and mail it to the Advanced Learning Department at Seattle Public Schools no later than October 1st, 2020. Please contact your school office to obtain this form and arrange for support with this process.

¿Se beneficiará su estudiante de recibir servicios de aprendizaje avanzado? (Spanish)
Aqui hay tres formas de referirlos para evaluación.

2. Puede comunicarse con la oficina de su escuela para solicitar ayuda para completar la referencia en línea en la Fuente.
3. Puede completar un formulario en papel traducido y enviarlo por correo al Departamento de Aprendizaje Avanzado de las Escuelas Públicas de Seattle a más tardar el 1 de octubre de 2020. Comuníquese con la oficina de su escuela para obtener este formulario y coordinar su apoyo con este proceso.

你的学生能从接受高级学习服务中受益吗? (Chinese)
以下是推荐他们进行评估的三种方法。

1. 你可以通过 the source 来推荐你的学生。从未使用过 the source？请访问 www.seattleschools.org.
   The Source位于“Student Family Portals”中，请按“Set Up”以设置你的 Source 账户。
2. 你可以联络你的学校办公室，以帮助你在 the source 上填写在线推荐。
3. 你可以填写翻译好的表格，并在 2020 年 10 月 1 日之前将其邮寄至西雅图公立学校的高级学习部门。请联系你的学校办公室获取此表格并安排帮助。

اهلواز waxaa ah sedexaad siyaboob oo loogu gedbiyo qilmaynta

2. Waxaad la xiriiraa kartaa xofiska dugnigaaga si aad iskuu abaaboosha taageerad buuxinta tixrooca tooska ah ee internetka ee Theureau.
3. Waxaad buuxin kartaa fooma wargad ah oo la turjumay oo aad ugu dhirka Clayhta Waxbarashada Sare ee Dugsiyada SeattlePip dhamaan ugu ugu dhammaadaa Oktober 1, 2020.

Tajaajila Barnoota Foya'aa aragchuus isaanitiif dada'imman keessan faajidaa argatanii jiruu? (Oromo)
Qormaataaaf isaan akeekuf karaawwan sadii asii gaadti ibsamaniiiru.

2. Soorsiihaaf akeeka onlaynii irratti gargaarsa aragchuudhaaf biroo mana barumsaa keessanii qunnamuu ni dandeessu.
Học sinh của quý vị sẽ được liên hệ từ việc nhận Dịch Vụ Học Tập Nâng Cao hay không? (Vietnamese)

Dây là ba cách thức để giới thiệu các em để được đánh giá:


2. Quý vị có thể liên hệ với văn phòng nhà trường để sắp xếp sự hỗ trợ cho việc điện thoại giới thiệu trực tiếp trên Source.


Advanced Learning| 206-252-0130 | www.seattleschools.org/advlearning