KINDERGARTEN SCIENCE EXPLORATIONS TO DO AT HOME

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K.ESS.1 Weather changes are long-term and short-term.

Outside option: Make a weather station out of household materials. Include something that can show which direction the wind is blowing like a piece of cloth or a homemade wind vane. Use a container with markings to collect rain. If you don't have a thermometer, just tell the temperature with words like very cold, cold, cool, warm, hot, very hot. Track the weather every day, recording it in a journal, on a chart or on a wall calendar. What are some ways the weather changes from day to day and from one season to the next?

Inside option: Make weather observations at a window. Choose a way to tell how hard the wind is blowing. Is it sunny, cloudy, storming? Draw a picture of the clouds you see. Are they white and puffy? Flat and gray? Black and scary? Listen out your window for animal noises (birds, insects). Do they change with different weather? Look for "pictures" in the clouds. Make up a story about your cloud picture. Have a parent write it down if you need help. Illustrate your story.

K.ESS.2 The moon, sun and stars can be observed at different times of the day or night.

Outside option: Track the moon daily. Draw the shape of the moon and write what time you can saw it. Is the moon only out at night? Look for the moon at various times. What times can you see a full moon? Try to figure out when it rises and sets. What times can you see a crescent moon? Does it rise and set at different times than a full moon? Does the moon seem to move across the sky like the sun does? Find the moon, then check on it again an hour later to see how its position has changed.

Inside option: Make a series of drawings with your house and the sun. Show where the sun is compared to your house in the early morning, late morning, early afternoon and evening. You could do the same project for the moon.

K.PS.1 Objects and materials can be sorted and described by their properties.

Outside option: Practice measuring things in your yard or at the park. Compare the sizes of trees by wrapping a string around each trunk and putting a mark on the string for the diameter of the trunk (or cutting the string to length).

Inside option: Practice sorting household objects (toys or foods). Put them in order from heaviest to lightest, from longest to shortest, sort them by color or texture. Measure the size of objects by counting how many paperclips (or other object) long each is.

K.PS.2 Some objects and materials can be made to vibrate to produce sound.

Outside option: Make a wind chime garden. Design one or more devices that can make sound when the wind blows. Use materials you have around the house. Hang them where the wind can blow on them. Which materials make the loudest sounds? What do you observe about your materials when they are making sounds? Do they vibrate? What makes them start vibrating?

Inside option: Explore the sounds you can make with a plastic bottle. What happens when you blow across it? Does it change if you have water in the bottle? Does the amount of water make a difference in how it sounds? Try tapping a glass with water in it. What changes if you add more water? What if the glass is empty?

K.LS.1 Living things have specific characteristics and traits.

Outside option: Take the living organism challenge. Find as many living things as you can in your yard, field or park. Make a list by writing them down (a parent or older sibling can help) or by taking a picture of each. Call a friend on the phone and compare your lists. Who has the most? Do you have any your friend doesn't? Keep adding to your list.

Inside option: Look through your books and magazines to find pictures of living things. Are the living things characters in the story or just part of the background of the illustrations? Practice counting the number of living things in each picture. Which book has pictures of the greatest variety of living things? Which of the living things are real and which are imaginary?

K.LS.2 Living things have physical traits and behaviors that influence their survival

Outside option: Choose a living organism to observe. Try to identify the purpose of as many parts of the living thing as you can. Observe the behavior of the plant or animal. If it's an animal, where does it go? How does it get food? Where does it rest? How does it move? For a plant, see if it bends toward light or if parts of the plant open, close or move at different times of day. Some easy animals to watch include ants, squirrels and birds. If you have a wet area, this also can provide things to observe. You could attract animals to observe by providing a food source.

Inside option: Interview a grandparent or other relative by phone. Ask him or her to explain the purpose of each part of a familiar living organism (a pet, a tree). Write a list of each part and what it does. Ask why each part's shape or location is best for helping the organism survive.

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- Prevent burns and fires when heating materials. If using a hot plate or flame, make sure to have adult supervision.
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    - Use tempered glass such as Pyrex™ when heating substances.
    - Never leave a room while a hot plate or burner is on.
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- Use alcohol thermometers instead of traditional mercury thermometers.
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GRADE 1 SCIENCE EXPLORATIONS TO DO AT HOME

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1.ESS.1 The sun is the principal source of energy

Outside option: On a sunny day, place containers of water in several outdoor locations, some in the sun, some shaded, some partially shaded. Try placing some on blacktop or concrete, some on grassy areas and some on bare soil or rocks. Make sure they have equal amounts of water. After several hours, check the temperature. No thermometer? Don't worry! Just touch the water with your finger to find the containers in which the water is warmer. Is there a pattern for which ones warmed up the most? Why do you think those containers of water got the warmest? Set them all together in the shade. Which cooled down the fastest? What do you think would happen if you used one with twice as much water? Would it heat slower? Faster? The same? Try it and see.

Inside option: Design a safe shelter for an ice cube. You will be protecting it from melting under a light bulb. Use supplies you find around the house (craft supplies, pantry items, toys). Put an ice cube under a lamp or other light source. Time how long until it melts. Next, place an ice cube (same size) in your shelter. Time to see if your shelter slows the melting. Try to improve your shelter so that it keeps the ice even longer. Draw a diagram of your best design and label the parts.

1.ESS.2 Water on Earth is present in many forms

Outside option: Visit a nearby water location (pond, river, puddle, wetland, lake). Make observations of the water. What color is it? Is it moving? What direction? Does it make noise? Are there things living in the water? Is the water making any changes to the land around it, such as washing away the bank, moving rocks or soil?

Another idea is to watch water during a rain storm. Where does the water go after it rains in your neighborhood? Look for water running off houses and driveways. Where does that go? Write a story about the journey of a raindrop as it falls from a cloud and travels to the ocean. Draw illustrations for your story.

Inside option: Compare solid water (ice) to liquid water. Look at shape, color, temperature. What is the same? What is different? Look at an ice cube before and after crushing. What do you notice? Explore freezing and melting water using your freezer. Do different amounts of water freeze in the same amount of time? Try placing ice cubes in different locations and compare the time it takes them to melt. Why does ice melt faster in some places?

1.PS.1 Properties of objects and materials can change

Outside option: Investigate which solid materials melt when left in the sunshine. Some ideas to try: metal, brick, crayons, ice, candles, chocolate, plastic, clay, marshmallows, hard candy, etc. For anything that melts, describe how the substance changed. Was there a color change? Shape change? Texture change? Record your observations with drawings or words. Get a parent or older sibling to help. Be sure to melt objects in safe locations where they will not damage outdoor objects. **Caution: Handle hot objects with care.**

Inside option: Think of as many ways as you can to change an object such as a piece of paper, ice cube or lump of clay. What are ways to change its shape, color, size or temperature? When you make your changes, notice whether the amount changes (do you still have all the clay, water or paper). If some is missing, where do you think it went? Count how many ways you found to change the object. Call a friend and challenge them to find more.

1.PS.2 Objects can be moved in a variety of ways, such as straight, zigzag, circular and back and forth.

Outside option: Explore how outdoor toys move. Use backyard toys such as bikes, wagons, swings, slides, balls, cars, jump ropes and hoops to investigate motion. What makes the toy or the user speed up? Slow down? Change direction? What sort of push or pull starts or stops the toy? Think of other motions to test such as, "Do all things go down a sliding board (ramp) at the same speed?"

Inside option: Design a maze for a marble or ping pong ball to roll through. You can use paper, cardboard or any materials you have at home. Try to make a place in the maze where the ball goes straight, a place where it moves in a circle and a place where it zigzags. Explain your maze to a family member. Tell him or her what makes the ball do each type of motion.

1.LS.1 Living things have basic needs that are met by obtaining materials from the physical environment.

Outside option: Make observations of how animals get supplies from the environment. Quietly watch animals to see what they eat, where they get water and where they rest/sleep. How are they using their surroundings to help them stay safe? Set up a feeding station. It could be for birds, squirrels, ants, bees or butterflies. Try different foods to see which foods attract which animals.

Inside option: Grow an indoor plant and observe it as it grows. Try starting with food such as a piece of a potato (be sure it has an "eye"), an avocado pit suspended in a cup of water (stick some toothpicks in it to hold it up), a fresh bean or the seed from a fruit. What does your plant need to survive? Find the best location to grow a healthy plant. Keep records of how you care for your plant. Record the date and how much water your give it. Measure its height. Add pictures or drawings to show what the plant looks like each time you care for it.

1.LS.2 Living things survive only in environments that meet their needs

Outside option: Be a spring detective. Watch your yard, a field or a forest during spring. Look for changes that are happening as the weather gets warmer. What plants are growing that were not there in the winter? How are trees changing? Do all trees have the same changes? What animals, including insects, can you now find that were not around during the winter? Be sure to check in the soil too. Have animals changed their behaviors? Look for bird nests. Where are birds nesting? What are they using to make their nests? Think of other signs of spring.

Inside option: Make a picture book of the four seasons. Draw pictures of each season. In your pictures, include plants and animals that are out during that season. What are they doing? How do they look? Is fur thicker, leaves missing or have they changed color? Are they hibernating? Put a person in each picture. How is the person dressed? Have a family member help you write a story to go along with your pictures. Read your story to someone at home. Be sure to explain how the plants and animals are changing with the seasons.

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2.ESS.1 The atmosphere is primarily made up of air.

Outside option: Use household items to design a device that can measure/indicate the speed of the wind. Your device needs to be safe to use and sturdy enough to stand up to the wind. What shape will you use? Think about how the device will move or change to show different wind speeds. Think about what materials are best for your design. Set up your device in an open area. Record the wind speed each day and your observations of the weather each day. Do you see any patterns? When it is windy, is there a certain type of weather? Does the wind change before or after storms? Compare the wind speed in different areas. What patterns do you see? Which areas have the fastest winds? Open areas? Hilly areas? Near buildings? Why do you think these areas are windier?

Inside option: Prove to your parents that air takes up space. Use balloons, baggies, straws or other household items to design a way to show that air takes up space. Show your family. Were they convinced? Write about your best proof. Tell what you did and explain why your demonstration proves that air takes up space.

2.ESS.2 Water is present in the atmosphere.

Outside option: Go outside right after a rain. Look for all the places water can be found. Be sure to look on the ground, on plants and on man-made objects. Make a list. Observe the water over the next several hours. Is it still there? Does if flow away? Disappear without flowing? Try your own investigations with water you pour in various locations? Make predictions about what happened to the water that disappeared. Share your ideas with a family member. Do they agree? Do they have other ideas?

Inside option: Explore why we need coasters under our drinks. What happens when you leave an icy drink sitting out in a warm room? Does the same thing happen with a warm drink? Set up an investigation with different temperatures of water (ice water, cool water, room temperature water, warm water). Which glass has the most changes? If there is water on the outside of the glass, where did it come from? Try a cold sealed beverage. Does it collect water? Describe your thoughts about where the water came from and how it got on your drink. Try to find a way to prove the water is not coming from inside the drink.

2.ESS.3 Long- and short-term weather changes occur due to changes in energy.

Outside option: On a windy day, explore wind chill. Stand in a windy location and in a sheltered location. Does one feel cooler? Hang a wet cloth in a windy and a sheltered location. Be sure they are the same material, size and dampness so you will have a fair test. Compare the drying times. What are other ways you can compare the windy location to the sheltered location?

Inside option: Watch and listen closely during a thunderstorm. Look for evidence of energy in the storm. Talk to a family member about how these things involve energy. Energy could include sound, light and movement. Some sights to look for include falling rain, blowing leaves, lightning and thunder. Write a thunderstorm book or make a poster showing the energy evidence you observed.

2.PS.1 Forces change the motion of an object.

Outside option: Try kicking a ball with different forces (small kick, medium kick, hard kick). What are your results? What happens if you kick two different balls with the same force. Do they travel the same distance? What determines how far a ball travels when you kick it? Is it the size of the ball? The weight of the ball? See if you can find a combination that makes a ball travel the furthest. Describe the type of ball used and the amount of force from the kick. What combination makes the ball travel the shortest distance? Throwing or batting a ball also would work for these tests.

Inside option: Use refrigerator magnets to investigate the types of materials that are attracted. List the things that are attracted to the magnet and the things that are not. Is there a general rule for the things on each list? Compare the strength of two magnets by seeing how close each needs to be to attract a paper clip or other small object. Find which one can hold the heaviest paper to the refrigerator.

Rub an inflated balloon on your hair and use it to explore static electricity. Does it stick to a wall? What objects can the balloon stick to? For how long? Try shuffling your feet along carpet to get a static charge on your body. Does the weather make a difference in how easy it is to make static electricity? Try your tests on a dry day and a rainy day. Is there a difference?

2.LS.1 Living things cause changes on Earth.

Outside option: Become a change detective. Go on a walk around your yard, park or neighborhood looking for changes that plants and animals have made to the area. Look for changes caused by trees, weeds, humans, ants, moles, beavers, farm animals, woodpeckers, dogs and other living things. When you get home, make a map of the area. Mark the changes you found on your map.

Inside option: Search your book collection for pictures or descriptions of living things affecting their environments. Make a list of the changes your found. Next, make a list of the ways you, your family, your pets and your livestock affect the environment.

2.LS.2 All organisms alive today result from their ancestors, some of which may be extinct. Not all kinds of organisms that lived in the past are represented by living organisms today.

Outside option: Choose a living thing in your outdoor area. Observe it carefully, listing all the things the plant or animal requires to stay alive. What changes to the environment would cause the organism to need to adapt, migrate or die? Think about changes in temperature, sunlight, water supply, food sources, predators, nesting sites, etc.

Inside option: Choose an extinct animal. Look at a picture of it or think about the characteristics you know about the animal. List all the characteristics the extinct animal has that are similar animals you know today. Think about the structures (body parts) of the animal. Are the legs and feet similar to anything today? The head? What about teeth? Did it move like anything that is alive today? Are there any characteristics the extinct animal had that animals no longer have?

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3.ESS.1 Earth's nonliving resources have specific properties.

Outside option: Dig up soil from several different locations in your yard or local area. Design a way to see which soil allows water to pass through most quickly. Carefully record your observations. Determine whether there is a certain type of soil that water passes through most easily.

Inside option: Learn about the Grand Canyon or another famous rock formation. Watch a documentary about the area. Call a neighbor or relative who has visited the feature and have him or her tell you about the rocks he or she saw. Does that person know how the rock formation formed? What was most impressive about it? If you have internet, research online to find the types of rocks exposed in the feature. What sort of environment was present when the rocks formed? Research how the feature formed. Was rock eroded? Did a glacier move rock? Look up videos online and take a virtual field trip to your rock feature.

3.ESS.2 Earth's resources can be used for energy.

Outside option: Construct a windmill out of materials found around the house and yard. Design a way for your windmill to perform work, such as move an object. You may want a parent or older sibling to help. Be sure you have a parent's permission. Write a paragraph explaining how your windmill works.

Inside option: Ask an adult to help you investigate the sources of energy in your home. Find out how the electricity in your area is produced. Do you use natural gas to heat or cook? What about propane? Charcoal? Wood? Sunlight coming through windows and skylights? Determine whether each of the sources of energy used in your house is renewable or nonrenewable? Think about the pros and cons of each and their environmental impact.

3.ESS.3 Some of Earth's resources are limited.

Outside option: Observe the local area for sources of pollution. Are fields being fertilized or lawns being treated with chemicals? Has trash fallen out of trash cans or dumpsters? Is there evidence of fluids that have dripped from cars, trucks or tractors? Are there industries in the area emitting chemicals into the air or dumping waste water? Is there runoff from construction sites? Do you see evidence of trash in local streams? Choose one local problem and develop a plan that would decrease the pollution.

Inside option: Conduct an audit of water use in your home. Track how many times the toilet is flushed, how long the shower runs, how many baths are taken, how long sinks are running to brush teeth and other activities, how much water is used for cooking, washing dishes, watering plants/gardens, filling swimming pools and other activities. Design a way to measure how much is used in each case. For example, time how long it takes for the sink or shower to run one gallon of water. Use your research to determine the easiest way for your family to conserve water resources.

3.PS.1 All objects and substances in the natural world are composed of matter.

Outside option: Design a way to keep a chocolate bar from melting in a hot car. Test your design on a sunny day. Think of a way to improve your design. Retest. Continue until you have your best solution. Keep a design journal with labeled sketches of each model, along with measurements and notes from each trial.

Inside option: Design a device to measure the mass of objects using a nontraditional unit such as number of paperclips. Use your balance to measure the mass of several objects.

3.PS.2 Matter exists in different states, each of which has different properties.

Outside option: Make a water cycle model to show water evaporating and condensing. Place a clear container or bowl over a smaller container that is filled with water. Place it in the sun. Make observations throughout the day. Sketch or take pictures to document changes in this system. What evidence do you have that water is evaporating or condensing?

Inside option: Make sure an adult approves the solids and liquids you choose for this investigation. Investigate melting and freezing for various household liquids. Freeze common kitchen liquids such as dish soap, syrup, cooking oil, etc. Which ones freeze in your home freezer? If one doesn't freeze, research how cold it would need to get to become a solid. Investigate solids to see which ones melt. Some suggestions to try are butter, chocolate, sugar, marshmallows, bacon grease, candles, crayons, glass and metal. You can think of others. **Be sure to get adult help if you are using a flame or heat source.** Do some solids melt at lower temperatures than others? For things that don't melt, look up how hot they would need to get to melt. For each of your substances, compare the solid form with the liquid form. How was the solid form the same as the liquid form? How were they different?

3.PS.3 Heat, electrical energy, light, sound and magnetic energy are forms of energy.

Outside option: Design a device that uses energy from the sun to cook a hotdog. Test your design. Draw a sketch of your design. Explain the purpose of each part of your hotdog cooker. You may want to get adult help.

Inside option: Get containers of cold and warm water. Squirt a small drop of food coloring in each one and watch what happens. Write a paragraph describing the differences between the cold and warm water.

3.LS.1 Offspring resemble their parents and each other.

Outside option: Watch for animals or evidence of animals in your environment. You may need to check very carefully. Try to discover ways humans are changing the behaviors of animals. Are animals living in human-constructed locations (sidewalk cracks, under decks), eating food provided by humans (bird feeder, trash can, compost) or behaving differently than they would in the wild? Keep a journal of animals and their behaviors. Make observations over several weeks. Has anything changed? Predict why and explain your reasoning.

Inside option: Examine the people in your household. Make a list of the traits that are shared by every human. Which traits vary from human to human? Choose another species, such as a dog or other pet. List the traits all dogs have in common and the traits that change from dog to dog.

3.LS.2 Individuals of the same kind of organism differ in their inherited traits. These differences give some individuals an advantage in surviving and/or reproducing.

Outside option: Observe a group of plants or animals of the same kind (squirrels, earthworms, dogs, dandelions, pine trees). What characteristics (physical traits and behaviors) do all in the group have in common? What things vary from individual to individual? What is the function of each part of the organism? Try to determine how the different characteristics help the organism survive in its environment.

Inside option: Investigate the role of teeth. Look in a mirror and examine the teeth in your mouth. Are they all the same? Record your observations and ideas about why some teeth look different. Next experiment with food. Try eating a variety of foods (meat, vegetables, sandwiches, pudding). Decide on a good way to organize your data. Pay careful attention to how you chew each food. Which foods need which teeth? What does the tooth do to the food (tear it, grind it, mash it)? Look for relationships between the shape (structure) of teeth and type of food they help chew.

Extra idea: If you or anyone in your house loses a baby tooth, have a parent wash it thoroughly and then examine its structure. Which types of food needed this tooth?

3.LS.3 Plants and animals have life cycles that are part of their adaptations for survival in their natural environments.

Outside option: Investigate the life cycle of a dandelion or other plant. Begin with seeds from the dandelion. They appear after the yellow flower is gone; the gray ball of fluff you like to blow on is the seeds. Plant the seeds. You might want to sprout some in a baggie with wet paper towels too so that you can see how they first start to develop. Make observations each day. When do they first start to come out of the soil? What parts of the plant form first? Take photos or make sketches of the plant as it develops. How long does it take to develop a flower? What happens to the flower as the seeds are developing. How long does it take for a dandelion to reproduce? Can the same plant reproduce more than once? If you took pictures, use them to make a time lapse video.

Inside option: Make a life cycle flip book. Draw a series of about 20 pictures on small pieces of paper or index cards. It should show the life cycle of a plant or animal. Make the pictures start with a seed or birth of the organism. Show each stage the organism goes through. Be sure to vary the size of the pictures as the organism gets bigger. Place them in order and attach one edge of the papers. Now you can flip through your book and watch the organism grow and develop.

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GRADE 4 SCIENCE EXPLORATIONS TO DO AT HOME

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4.ESS.1 Earth's surface has specific characteristics and landforms that can be identified.

Outside option: Examine the yard or a nearby field, stream or forest for examples of erosion, weathering and/or deposition. Take pictures with a device, if possible. Look up similar images and information about these processes if the internet is available. Write a paragraph or multi-paragraph description that includes details about the site. Include your hypothesis for how the feature formed and why it occurred where it did. What evidence from your pictures supports your claim?

Inside option: Build a model of a landform (hill, mountain, mountain range, island) in a waterproof tub or container using household supplies (clay, toys, kitty litter, craft or pantry items) or natural materials (dirt, sand and grass). Pour water over the model to investigate how water moves and settles around the landform. Record your findings using drawings or a video taken with a device. Describe the ways your model is similar to, and different from, the real landform.

4.ESS.2 The surface of Earth changes due to weathering.

Outside option: Examine driveways, sidewalks and buildings for cracks in cement, bricks, stone and other building materials. Document the things you find with pictures or drawings. For each site, try to determine what caused the material to weather (breakdown). Common causes are wind, water, freeze-thaw cycles and plant growth.

Inside option: Fill a container with water to a certain mark. Freeze it and see what happens to the size of the ice cube. Explore how freezing and thawing affects materials. Use an ice cube tray or plastic container to repeatedly freeze and thaw various wet materials such as rocks, pieces of cement or chunks of wood. Take before and after pictures. Write descriptions of the changes.

4.ESS.3 The surface of Earth changes due to erosion and deposition.

Outside option: Pour or squirt water on various types of Earth materials (sand, soils, rocks, gravel). Determine which materials are easiest to erode (move). Experiment with the effect of changing the amount of water or the height you pour it from. Make a graph or chart showing your findings.

Inside option: The outside option can be done small scale in a container or bathtub. If you can't get outside to find materials, items around the house (clay, baking soda, pencil shavings, kitty litter) could be tested to see which erode most easily.

4.PS.1 When objects break into smaller pieces, dissolve, or change state, the total amount of matter is conserved.

Outside option: Place a large clod of dirt, piece of clay or another breakable object into a container on your bathroom scale. Record the weight. Break the object into small pieces, being careful to keep all of it in the container. What happens to the weight? What happens to the space (volume) that it takes up in the container?

Inside option: Think of ways to demonstrate that mass (the amount of material) stays the same during changes. Two ideas to get you started could be to dissolve salt in water and then try to get it back to salt or use Legos to demonstrate different shapes you build still use the same Legos. Try to think of other demonstrations of the conservation of mass.

4.PS.2 Energy can be transferred from one location to another or can be transformed from one form to another.

Outside option: On a sunny day, place equal-sized ice cubes in various locations. Time how long it takes each to melt. Create a graph or other visual summarizing the results. Write a description of what you discovered, including your explanation for why they melted at different rates.

Inside option: Choose a household object that runs on electricity, such as a lamp. Have an adult help you list all the energy changes that took place to make the bulb light. Find out how the electricity in your location is produced. Was it from coal? Wind? Sunlight? Nuclear sources? See if you can trace the energy lighting your light bulb all the way back to the sun.

4.LS.1 Changes in an organism's environment are sometimes beneficial to its survival and sometimes harmful.

Outside option: Look for evidence that an environment has changed. Is there evidence that plant species are changing? Is erosion present in the area? How is this affecting plants or animals at the erosion site?

Inside option: Research the history of Ohio's environment for your location. Were their glaciers? When? Was your area covered by water? Have local rivers shifted course? Were there forests that have been cleared for fields or construction? Create a timeline of the environment for your county. The timeline also supports social studies grade 4, standard 1.

4.LS.2 Fossils can be compared to one another and to present-day organisms according to their similarities and differences.

Outside option: Look carefully at rocks in your environment to check for fossil evidence. Sources of rocks could be stream beds, gravel parking lots or driveways, road cuts, plowed fields and landscaping. If you find fossils in your local area, describe how they look similar to or different from plants and animals that live here now.

Inside option: Think about the area where you live. What are the current seasonal weather conditions? What would happen if there was a sudden shift and it was significantly warmer or colder all the time? What if it rained constantly, everything flooded and the water levels did not recede? How would the change impact the living things in the environment? Which organisms could survive? What traits would help them survive?

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GRADE 5 SCIENCE EXPLORATIONS TO DO AT HOME

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5.ESS.1 The solar system includes the sun and all celestial bodies that orbit the sun. Each planet in the solar system has unique characteristics.

Outside option: Explore the force that makes planets orbit the sun and makes moons orbit planets by tying a string or rope to a soft object. Swing the object in a circle above your head. What keeps the object moving in a circle? What happens when you let go? Describe how this is similar to planets and moons. Think of another way to model the cause of circular motion.

Inside option: Make a model of the solar system using dough or household materials. Attach labels with information about each of the celestial objects. Does your model include the sun, planets, moons, comets, asteroids and other solar system objects? List ways you could improve on your model to make it a more accurate representation of the solar system.

5.ESS.2 The sun is one of many stars that exist in the universe.

Outside option: Measure an object using your hand(s). Place it on the ground, fence or table. Walk a few feet away and use your hand to measure it (hold up your thumb and first finger to match the top and bottom). Walk further away and measure again. Repeat at several distances. What happens to the "height"? Did the height of the object really change? Make a graph (scatterplot) of the height vs. distance. What conclusions can you make from your graph?

Inside option: Create a book for younger children explaining why the sun looks so much larger than the other stars. Illustrate your book. If you don't know why the sun looks so large, ask a teacher or a family member. You also can use your science book or other resources.

5.ESS.3 Most of the cycles and patterns of motion between the Earth and sun are predictable.

Outside option: On a sunny day, place a stick in the ground (or observe a pole or other object that is already there). Each hour, record where the shadow ends with a stick in the ground or mark with chalk. Be sure to label the times. What patterns do you see as the day goes by? Try checking the shadow at a certain time each day or each week. How does the shadow change as a month passes?

Inside option: From a window, watch the night sky. Take a picture or make a sketch of what you see. Return in an hour and see how your picture has changed. Check each hour until bedtime. If you wake up before dawn, check to see if things have changed. Be sure to look out the same window each time. This also can be done outside, making sure to use the same location and direction.

5.PS.1 The amount of change in movement of an object is based on the mass of the object and the amount of force exerted.

Outside option: Design an investigation to see how changing the mass of a sled, wagon or other toy affects how easy it will be to push or pull the toy. Think about how you can change the mass (what objects or material you can add) and how you will measure or describe how hard it is to push or pull. Describe some things you need to keep the same to conduct a fair test.

Have a dog? Play a game of tug-of-war with your dog and a rope toy. **Note:** Only do this if you have a dog that likes tug-of-war. Identify times when the forces on the rope are balanced and when they are unbalanced. What evidence (movement, direction) shows the force was balanced? Unbalanced?

Inside option: Use something such as a ruler to flick an object across an open floor space or down a hallway. Record how far the object travels when you pull the ruler back different amounts. Think about the best way to organize your data. Is there a pattern? How do things change if you slide it on different surfaces (carpet, tile, wood)?

5.PS.2 Light and sound are forms of energy that behave in predictable ways.

Outside option: Take various objects outside and explore whether light can pass through them. If you leave the objects in the sun, what happens to their temperatures? Do all the objects heat up at the same rate? Look for patterns in which objects warm the fastest. Does the material it is made of make a difference? Does color make a difference? Summarize what you observe.

Inside option: Use household objects to make a homemade musical instrument. Observe the motion of different parts of your instrument as it is played. Explore ways to change the pitch of your instrument. What changes make a difference in the pitch?

5.LS.1 Organisms perform a variety of roles in an ecosystem.

Outside option: Go on an ecosystem scavenger hunt. Look in your backyard or neighborhood to find examples or evidence of producers, consumers, decomposers, mutualism, commensalism, parasitism, predator-prey, invasive species, herbivores, carnivores and omnivores. Take a photograph or make a drawing of each item that you find. Could you find them all? What other ecosystem components can you identify?

Inside option: Print or draw pictures representing a variety of plants, animals and other organisms found in your neighborhood. Watch out the window for ideas of things you may have forgotten or never noticed. If you have internet or other resources, look up information about the organisms. Organize the pictures into a food web.

5.LS.2 All of the processes that take place within organisms require energy.

Outside option: Carefully observe your yard or an outdoor area. Which plants grow in the sun? Which prefer shade? What are the first signs of spring? What time of year do plants under large trees grow best? What about those in open areas? What are some characteristics of plants that prefer shade? What birds and other animals are out and about? Does that change from month to month? What differences do you observe between daytime and evening?

Inside option: Think about a change that has happened to a local ecosystem. Has there been new construction or demolition nearby? Was a farm field abandoned? A yard landscaped? Logging in a nearby forest? If you have access to Google Earth or other online tools, you can look at before and after images of ecosystems in other parts of the world. Choose one ecosystem and write about it; describing changes observed, causes of the changes, positive and negative consequences of the changes and what could have been done to prevent the changes. If applicable, tell how the ecosystem could be improved or restored?

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6.ESS.1 Minerals have specific, quantifiable properties.

Outside option: Collect rocks from the yard, field or natural area. Test the rocks to see if they leave marks when scratched on tile, whether they break easily and whether they are attracted to a magnet. Organize a way to record your results. In your data table, describe the shape and size of the crystals, if any are visible. Is the rock shiny or dull? If you can, use the data you collect, along with online resources or your textbook to try to determine what mineral(s) make up each rock.

Inside option: Research the characteristics and formation of various minerals. Your textbook should have information. Choose one and write a narrative story or illustrate a cartoon strip describing how the mineral formed.

6.ESS.2 Igneous, metamorphic and sedimentary rocks have unique characteristics that can be used for identification and/or classification.

Outside option: Gather a variety of rocks from the yard, field or natural area. Determine a way to sort them. Write a description for each category. Use an online guide or your science textbook to try to identify the rocks. Which are sedimentary? Igneous? Metamorphic? How was your method of classification similar to or different from the igneous, metamorphic, sedimentary classification system geologists use?

Inside option: Design an informational pamphlet explaining igneous, metamorphic and sedimentary rocks. Include information about locations where each is common in Ohio and how each is formed.

6.ESS.3 Igneous, metamorphic and sedimentary rocks form in different ways.

Outside option: If there is an exposed rock surface (road cut, cliff) nearby, examine the layers to see what types of rock appear. Is there a coal layer? Sedimentary rock? What do these types of layers indicate about the past environment in your part of Ohio?

Inside option: Use shavings from crayons to model the processes in the formation of igneous, metamorphic and sedimentary rocks. Think about the ways these rocks form and how you can put your crayon shavings through similar processes. Be sure to check with an adult about any heat sources you plan to use. Describe the appearance of the individual shavings in the "rocks." Identify ways your model "rocks" are similar and different from real igneous, metamorphic and sedimentary rocks.

6.ESS.4 Soil is unconsolidated material that contains organic matter and weathered rock.

Outside option: Dig a hole and look inside to see the layers of soil. What do you see in the top layer that isn't found deeper? How do colors or textures change? Is there evidence of living organisms? In which layers? Draw a diagram showing your findings. Repeat in a different location. Are the soil horizons (layers) the same in both locations? If not, what could explain the differences? Be sure to pack dirt back into your holes for safety when you have finished.

Inside option: Read about the dust bowl. You can find books to download (*Out of the Dust*) or online articles. How did agricultural practices contribute to the dust bowl? What natural causes contributed? How were people's lives affected?

6.ESS.5 Rocks, minerals and soils have common and practical uses.

Outside option: Play geology sleuth, look inside and outside your home for examples of ways humans use Earth materials. Identify as many places as you can that rocks, soil or minerals are used.

Inside option: Make a list of ways that rocks, minerals and soils are used by people. Be sure to think about construction, energy, transportation, agriculture, jewelry, dyes and technology. If resources are available, research which type of Earth material is most appropriate for each use. Create a project (poster, slide deck, video) that showcases the many ways we depend on Earth materials for human activities.

6.PS.1 Matter is made up of small particles called atoms.

Outside option: Find the volume of irregular objects. Put a container large enough to fit your objects on top of a tray with edges or a larger pan. Fill the container exactly to the top with water. Carefully, to avoid splashing, put one of your objects into the water. If it sinks, great. If it floats, push it gently with your finger until it is just under the water, then let go. You can now measure how much water flowed out of your container. Use a measuring cup or spoon to see how much volume your object displaced. Test your other objects. Display the volumes on a column graph. Be sure to title and label the graph.

Inside option: See how many elements from the periodic table you can identify in your home. Be sure to read labels on products to see if you find any there. Researching online to find the uses of various elements may help you find more. Be sure to check with a parent before examining any products that may be harmful (cleaning supplies, workshop chemicals, medications).

6.PS.2 Changes of state are explained by a model of matter composed of particles that are in motion.

Outside option: Take ice cubes outside on a sunny day. Design an investigation about changes of state using your ice cubes and heat from the sun. Describe the question you are trying to answer and how you plan to set up the investigation. Conduct your tests and record your observations. Think about the best way to organize and analyze your data. What did you discover? Write a conclusion describing how evidence from your tests supports your claim.

Inside option: Be sure to get adult permission. Heat a pan of water on a stove burner. Time how long it takes to reach a certain temperature or to boil. You will have to decide on an observation to use to determine it has reached that point (thermometer, bubbling, steam). Empty and cool the pan. Repeat using twice as much water. Write an explanation for your observations.

6.PS.3 There are two categories of energy: kinetic and potential.

Outside option: Explore the relationship between height and gravitational potential energy by dropping a rock onto a pile of sand or loose dirt and comparing the size of the craters it makes. Want more fun? Drop water balloons from various heights and measure the size of the splash zone. No balloons? Baggies might work. Be sure to control for variables such as the amount of water you use. Don't worry if you don't have a ruler. You can measure with any object. Record your findings and describe the relationship you found.

Inside option: Set up a ramp using anything around the house. Mark a starting line and release an object to roll or slide down the ramp. Measure how far it travels. Change the height of your ramp and repeat the test. Look for a relationship between the height and distance traveled.

6.PS.4 An object's motion can be described by its speed and the direction in which it is moving.

Outside option: Fill a baggie with water and make a tiny hole in the bag (so it can drip slowly). Walk at a steady pace along a sidewalk or driveway. Examine the pattern in the drips. Try this again walking slower or faster and then running. What changes? Try it again starting from a standstill and slowly going faster and faster. What pattern do you see now? Use your observations to write a paragraph describing your personal definition of the word "speed."

Inside option: Design a drip cart out of household materials. Your cart should be able to slowly drip a substance (washable paint, food coloring, syrup, water). It needs to be able to roll or slide and drip on the space beneath it. Pull your drip cart at a slow, steady pace across paper (tape together notebook paper, newspaper or junk mail). Examine the pattern in the drips. Try this again pulling slower or faster. What changes? Try it again starting from a standstill and then slowly pulling faster and faster. What pattern do you see now? Use your observations to write a paragraph describing your personal definition of the word "speed." Water also could be dripped directly on a tile floor. Water-based paint or syrup could be dripped in a bathtub. Be careful not to drip anything that could stain directly on a surface.

6.LS.1 Cells are the fundamental unit of life.

Outside option: Construct a cell model out of materials you find in the local environment. Consider the structure and function of the cell organelle when choosing the materials to represent each. Take a video of yourself explaining each organelle.

Inside option: Are viruses alive? Research to come up with an answer. Justify your answer with evidence from reliable sources.

6.LS.2 All cells come from pre-existing cells.

Outside option: Sprout seeds to observe the stages a plant goes through as it reproduces. Open the sprouting seeds at different stages and observe the changes. Notes, sketches and photographs are all good record-keeping methods. Once plants begin to grow, observe similarities and differences between the seedlings and later the mature plants.

Inside option: Research how viruses, such as coronaviruses, reproduce. Compare this to mitosis, which happens in plants and animals.

6.LS.3 Cells carry on specific functions that sustain life.

Outside option: Explore the functions of leaves. Experiment with leaves on a plant by exposing them to a variety of conditions and recording observations of each leaf over time. Be sure to organize your data carefully so you can identify what happened to each leaf day by day. Some suggestions to try are coating the leaf with different substances, enclosing the leaf in a baggie, breathing on it, shining extra light on it, exposing it to light 24 hours a day or shielding it from the sun with a paper bag. You can think of others. Record changes to each leaf each day and record anything you see happening inside the coverings. What can you conclude from your investigations? Support your claims with evidence from your tests.

Inside option: Get a parent's permission to make bread to investigate how yeast reacts under various conditions. Vary the temperature, amount of sugar or type of flour. You can even split your bread recipe into fractions (good math practice) and make rolls so you can test several conditions in smaller batches. Compare the density of the bread that results to see which conditions are best for yeast. Hint — active yeast makes fluffy bread! Be sure to keep accurate records of the conditions you use. If you don't have a favorite bread recipe, use the one below, no bread machine needed, just bake in any greased pan.

Basic bread recipe: (the basic recipe can be your control)

Scald 1 cup of milk. Dissolve ½ cup of sugar and 1 tablespoon of salt in the warm milk. Let this cool. Dissolve 1 packet of yeast in one cup of warm water. When the milk has cooled, add the yeast water to it. Mix in 3 cups of flour. Add 6 tablespoons of melted butter. Add three more cups of flour. Knead it all together and leave it to rise in a greased bowl. When it has doubled in size, shape it into loaves, rolls or braids. Let it rise again. Bake at 350° for about 20 minutes.

6.LS.4 Living systems at all levels of organization demonstrate the complementary nature of structure and function.

Outside option: Choose a flowering plant to examine. Make a careful scientific drawing of the plant. Annotate each part with a description of the function it performs. Which parts are organs? What different types of tissues can you find in your plant? Does your plant exhibit symmetry? Choose another plant. In what ways is the second plant different? Try to identify some characteristics that all plants have in common.

Inside option: Choose two fruits or vegetables. Examine each. What part of the plant did the items come from? Is the fruit or vegetable symmetrical? Carefully sketch each item. Label your sketches telling whether each part is a tissue or an organ and describing its function.

SAFETY DURING AT HOME SCIENCE EXPLORATIONS

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- Keep area cleared of materials that could provide a tripping hazard (for example, equipment placed in walkways).
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- Clean up spills immediately to prevent the possibility of slipping or falling.
- Tie back long hair, and secure loose clothing and dangling jewelry.
- Prevent burns and fires when heating materials. If using a hot plate or flame, make sure to have adult supervision.
    - Make sure there are no combustible materials nearby.
    - Use tempered glass such as Pyrex™ when heating substances.
    - Never leave a room while a hot plate or burner is on.
    - Before handling a hot plate or burner, make sure it is unplugged and cool.
    - If using a flame, use tea candles that are short and wide and hard to knock over with normal use.
    - Never leave the room while a flame is lit.
- Use alcohol thermometers instead of traditional mercury thermometers.
- Do not use thermometers as a stirring rod. Stir with kitchen utensils or paint stirrers.
- Always label containers so the contents are identified.
- Never attach homemade devices to your home's electrical sockets.
- Clean up your area after conducting a science activity.

Resources for Safety in the Science Classroom

National Science Teaching Association: https://www.nsta.org/safety/

GRADE 7 SCIENCE EXPLORATIONS TO DO AT HOME

One of the three core principals of *Each Child, Our Future*, Ohio's strategic plan for education, is partnerships. The plan recognizes the collaboration between teachers and parents as the most important partnership. This document provides activities for students to complete in a home environment, allowing parents to be more closely involved in each child's mastery of science concepts. The investigations are written for a home setting using limited resources and are specifically targeted to each of *Ohio's Learning Standards for Science*.

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It is important to build a strong foundation in science in the early elementary years so students are prepared for understanding more complex material in the intermediate and middle grades. It is equally important to continue students' science instruction by offering more advanced courses at the high school level. This allows students to be better prepared to compete for admission to college or other postsecondary programs, as well as for increasingly technical jobs. Advanced science courses in high schools also help produce a more scientifically literate public.

7.ESS.1 The hydrologic cycle illustrates the changing states of water as it moves through the lithosphere, biosphere, hydrosphere and atmosphere.

Outside option: Look around your neighborhood to identify water flow and drainage patterns, including storm sewers. Identify regions where surface water and runoff or acid rain could impact ground or surface water. Design solutions for reducing runoff in those regions.

Inside option: Build a model to represent a section of Earth's surface that includes topography and components representing soil, rock and groundwater. Use it to investigate water pathways. How do these pathways impact the land? Use picture or drawings along with written descriptions of your findings.

7.ESS.2 Thermal-energy transfers in the ocean and the atmosphere contribute to the formation of currents, which influence global climate patterns.

Outside option: Investigate local wind patterns. Design a device to show wind direction (a simple wind vane, wind sock or flag will work). Place it in an open area. For several days or weeks, record the direction the wind blows each time it is windy. Wind direction normally is recorded as the direction the wind comes from, so air moving from west to east is called a west wind. When storms arrive, record their direction. Do the dark skies first appear in the north, south, east or west? How does this compare with the general wind directions you observe on clearer days? Try to make a general statement about the direction of global winds in Ohio.

Hint: Can't find north at your house? If you don't have a compass, phone or GPS, you can locate east by the general area where the sun rises.

Inside option: Investigate the effects of density on ocean currents. Combine water with different salinities (concentrations of salt) or different temperatures and observe currents in the water. Use cold and hot water. Add food coloring to the cold water. When you combine the waters, watch how the food coloring moves. Which is more dense, warm water or cold water? What makes you think so? Do the same experiment with different salinities. You can change salinity by dissolving various amounts of regular table salt in tap water. Use plain tap water for fresh water and combine it with salt water. Again, use food coloring in one of your samples so you can observe the motion of invisible water molecules. Try combining different salinities of salt water. Does dissolving additional salt make water more dense or less dense? What overall conclusion can you make about the effect of density on the movement of water. How does this relate to oceans?

7.ESS.3 The atmosphere has different properties at different elevations and contains a mixture of gases that cycle through the lithosphere, biosphere, hydrosphere and atmosphere.

Outside option: Each day make and record observations on the air quality outside. Is it foggy or clear? Are pollen, smoke or unusual odors present in the air? What human activities can you identify that may be affecting air quality? If an air quality report is available (found in daily weather reports), compare your observations to the air quality report. Based on your comparisons, decide if air quality issues are always observable by sight. Justify your conclusion with evidence from the reports and your personal observations.

Inside option: Investigate the effects COVID-19 responses have had on Earth's atmosphere. Review news stories that discuss changes in pollution or air quality as a result of people staying home due to COVID-19. What do the areas experiencing changes in air quality have in common? Predict how the changes impact the type and abundance of gases in the atmosphere? Identify which human behaviors have changed to cause these changes to the atmosphere. What are the short- and long-term effects? Brainstorm possible ways to maintain positive changes as business and travel returns to normal levels.

7.ESS.4 The relative patterns of motion and positions of Earth, moon and sun cause solar and lunar eclipses, tides and phases of the moon.

Outside option: Observe and record the different phases of the moon during a lunar cycle. Take pictures or draw and label the phases. Track it again over the next month. What do you notice about the appearance of the moon over the course of the month? Does it change from month to month?

Inside option: Create a model of a lunar eclipse. Use two balls of different sizes for the Earth and moon and a flashlight, cell phone or lamp to represent the sun. Where do you need to position the ball representing the moon and the ball representing Earth to prevent light from the flashlight reaching the moon? Why is the moon not visible if sunlight cannot reach it? Record your model with a picture or diagram. Can you change the model to represent a solar eclipse? Use your model to explore possible reasons we do not have eclipses every time the moon orbits Earth. What can you predict about the orbital path of the moon compared to the plane of the solar system?

7.ESS.5 The relative positions of Earth and the sun cause patterns we call seasons.

Outside option: Record the location of sunrise and sunset once each week. Be sure to check from the same location each day. Observe and record what object (house, tree, pole, barn) the sun rises and sets directly above. How quickly does the location shift? In what direction (north, south, east, west) does it shift? Does this shift continue in the same direction all year? Investigate changes before and after the winter (Dec. 21 or 22) or summer (June 20, 21 or 22) solstice if possible. What changes at the solstice? Relate your observations of sunrise and sunset to seasonal changes in Ohio. Predict whether the sunrise and sunset locations would be the same for observers at other locations on the Earth.

Inside option: Investigate the amount of light energy on different portions of Earth. You will need a piece of grid paper and a light source (flashlight, cell phone, light bulb). If you do not have graph paper, make grid paper by drawing vertical lines on notebook paper or putting grid lines on plain paper. You may need to tape more than one sheet of paper together depending on the angles and distances you choose. Shine your light straight down onto the paper from directly above. Draw a circle around the lighted area. Count the number of squares in the lighted area. Decide on a method to deal with any partially lit squares. Next, hold the light so it shines on the paper at an angle (be sure to keep it the same distance away). Circle the lit area and count the squares. Try several angles. Organize your data and look for a relationship between the angle of the light and the number of squares lighted. If the same light is spread over more squares how does that affect how well the area could be heated by the light energy? If you have a thermometer, test the heating from a light at different angles. How do these results compare with your prior experience with temperatures on a sunny day? How does the noon temperature (sun high in the sky) compare with the early morning or evening temperatures (sun at a low angle)? Try shining your light on a round surface (ball). What do you observe about light on curved surfaces? Relate this to temperatures near Earth's equator and near the poles.

7.PS.1 Elements can be organized by properties.

Outside option: Take a walk around your yard, farm or neighborhood and identify items you find that are composed of various elements. Using photos, drawings or item names, categorize your items as metals, metalloids or nonmetals. Which category has the most representatives?

Inside option: Investigate the composition of kitchen items. Compare the uses for items made from metals with those made from nonmetals. What properties of metal make it a good choice for the metal kitchen utensils, appliances or surfaces? What properties of nonmetals are helpful for the items made from nonmetals? Are there any kitchen items made from metalloids? What properties are beneficial in these items? How would you categorize the items in your kitchen according to the elements you think comprise them? What are the major differences in the purposes of the item and their composition? Summarize your findings.

7.PS.2 Matter can be separated or changed, but in a closed system, the number and types of atoms remains constant.

Outside option: What examples of mixtures and solutions can be found around the outside of your home?

Inside option: Compare the characteristics of different types of mixtures. Examine solutions (salt or sugar dissolved in water), suspensions (chalk or flour mixed with water) and colloids (milk, mayonnaise, gelatin). Can you see particles within the fluid? Can you see through the mixture? What happens to a light that is shined through the mixture?

7.PS.3 Energy can be transformed or transferred but is never lost.

Outside Option: Use everyday materials to design and construct a machine that performs a simple task in many steps. Test the machine as each additional component is added. Redesign to solve problems encountered during the testing and to reduce the loss of energy to the surrounding environment. Record any problems encountered, as well as the changes made to the machine to overcome these problems.

Inside Option: Look at a mechanical can opener and trace the flow of energy that is required to open the can. If available, compare that to an electric can opener or other kitchen device.

7.PS.4 Energy can be transferred through a variety of ways.

Outside option: Design a solar cooker and compare the cook times for multiple items (such as hotdogs or marshmallows) on a sunny day. Record the composition of each item and how that affects the cook time.

Inside option: Using action figures and toy cars, design a system with usable seatbelts. With your designed setup, explore and explain how seat belts work to keep you safe. Include in your explanation how energy is transferred through the system.

7.LS.1 Energy flows and matter is transferred continuously from one organism to another and between organisms and their physical environments.

Outside option: Living things die, decay and provide nutrients to the next generation. Nature recycles organic material. Composting is one way to show how this happens. Use a bin or make a pile of yard waste and kitchen scraps such as skins from fruits and vegetables (do not include meats). Worms can accelerate the decay process. If you want the process to happen more quickly, make sure the pile gets moisture and is stirred or turned periodically. What do you notice about the pile? Record your observations. After the appropriate amount of time, use your composted material in a local garden.

Inside option: Look at your breakfast and think about the origin of one item (for example, eggs). Think about where it came from and where it got its energy. Trace the energy flow back to its original source. Do the same for your other food items. What do all the foods have in common? Think about what your body is going to do with the food. Trace your meal through your body, identifying how your body processes and uses the breakfast.

7.LS.2 In any particular biome, the number, growth and survival of organisms and populations depend on biotic and abiotic factors.

Outside option: Observe secondary succession in the temperate forest biome. Return a small patch of land to bare soil or fill a container with soil and place it outdoors. Watch the bare patch throughout the summer. What types of organisms are the first to inhabit the bare patch? Which plants grow first? What animals visit? How does this change throughout the summer? Predict what will happen to your bare patch if it is left unattended for an extended period of time. Ohio is a temperate deciduous forest biome, yet much of Ohio is no longer forested. Explain the events that changed Ohio's landscape over the past 200 years. Make predictions about changes to the biome if the human population of Ohio increases or decreases.

Inside option: Select two biomes (for example, desert and temperate forest) and compare the living and nonliving features in each. How are they the same? How are they different? Record your reflections. What if one nonliving feature, such as rainfall, was altered significantly for an extended amount of time. How would that biome change?

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GRADE 8 SCIENCE EXPLORATIONS TO DO AT HOME

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8.ESS.1 The composition and properties of Earth's interior are identified by the behavior of seismic waves.

Outside option: Find a small body of still water such as a pond, puddle or wading pool. Drop small rocks into the water and observe the waves produced. In which direction do the waves move? What happens to the size of each wave as it travels? Craft an explanation for any changes in size. Does the wave reach all the pool edges at the same time? If not, what determines where it arrives first? What happens if you use larger rocks? Place a barrier (board, stick) in the puddle. What happens to the waves when they encounter the barrier?

Inside option: Use a spring toy (Slinky®) to model types of seismic waves. Attach one end to an object or have a family member hold it in place. Hold the other end and stretch the spring. Slide your end from left to right across the floor, watching the wave produced. Describe the movement of each part of the spring. You may want to tie a ribbon to one spot in the middle of the spring to make it easier to track. How does the ribbon (single spot on the wave) move? Is it in the same direction as the wave movement along the spring or is it perpendicular to the wave? What happens to the wave when it reaches the far end of the spring? What other observations can you make? Next, stop moving it from side to side and make observations when you push in and pull back on your end of the stretched spring. How do the coils move? Do they compress and stretch? Describe the motion of the ribbon. Determine which spring motion corresponds to primary earthquake waves and which corresponds to secondary earthquake waves. Think about the waves on your spring and the properties of liquids and solids. Propose a reason why S-waves are unable to travel through liquids.

8.ESS.2 Earth's lithosphere consists of major and minor tectonic plates that move relative to each other.

Outside option: Model the three main types of plate boundaries using household materials. One suggestion, given here, is to use graham crackers, paper and frosting. Feel free to develop your own models. **Divergent:** Coat wax paper (plate, cardboard) with a ½ inch of frosting (clay, peanut butter, thick mud). Lay two graham crackers beside one another on top of the frosting. Gently push straight down on the crackers as you slowly move them apart about an inch. Describe what happens to the frosting. In your model, what did the frosting represent? What did the graham crackers represent? **Convergent: 1.** Slide a sheet of paper and a graham cracker toward each other on a hard surface. When they meet, which one can slide under the other? What process does this represent? Where on Earth can we find this process in action? In this model, what does the paper represent? What does the graham cracker represent? **2.** Dip the edge of two graham crackers into water briefly. Push the wet edges into each other. Observe what happens to the moist parts of the crackers. What real tectonic process does this represent? What land feature is formed by the moist cracker? **Transform:** Break a graham cracker into its two rectangles. Place the rough (torn) edges tightly together and slide the crackers along each other. Observe what happens.

Inside option: Be sure you have permission to use the stove. Place a flat pan (9" X 12" baking dish) of cold water on the stove top with one end of the pan on a hot burner. The other end should rest off the stove or on an unlit part of the stove top. Allow the water to heat for a short time then look for evidence of convection currents. Drop a droplet of food coloring or other dye into the cold end. Observe its movement. Try it at the hot end. Place objects that float on the top surface of the water. Small pieces of paper or cardboard will work. Watch their movements. Does the water at the surface of the pan move in a certain direction? Do the papers collide, separate, keep their spacing or do a combination? Think of other ways to see the invisible movement of the water particles. Write a description explaining how this model relates to the movement of materials in Earth's asthenosphere. Which parts of the model accurately depict the real Earth? What are drawbacks to the model? Can you think of a more accurate way to model these processes?

8.ESS.3 A combination of constructive and destructive geologic processes formed Earth's surface.

Outside option: Observe a nearby stream. Does the stream have meanders (curves)? Can you find clues about why the stream curves? Look for places that the stream is eroding the streambank. Find locations where rocks and dirt are being deposited (building up). You can test for erosion and deposition by placing a pile of dirt/leaves/sticks into a shallow part of the stream. Does it quickly wash away or does more material build up onto the pile? Float sticks down your stream. Watch where they travel. Where do the sticks move quickly, slow down or stop? Is there a pattern for where erosion or deposition happen? Think about the relationship between curves and slopes (steepness) and where material is eroded or deposited. If possible, compare your stream to another stream. What are the similarities and differences between the streams? Predict reasons for the differences.

Inside option: Make a topographic map. Construct a hill using layers of cardboard stacked on top of each other with each layer smaller than the one below. Make one side of your hill steep and the other side slope gradually. Make it consist of five to 10 layers of stacked cardboard. Convert your "hill" into a topographic map. On a piece of paper, trace around the largest (bottom) layer of your hill. Slide that layer out and trace the next layer. Continue until you have transferred all the layers to your paper map. Each line on your map represents a certain height on your hill. Which part of the map represents the top of the hill? How are the lines spaced where there is a steep slope? How is a gentle slope different? Try making a different landform (cliff, valley between two hills). Transfer your new landform to a topographic map. How is the second map different from your first one?

8.ESS.4 Evidence of the dynamic changes of Earth's surface through time is found in the geologic record.

Outside option: Make a geologic history timeline. Below, the periods of geologic history are listed with their start dates (in millions of years ago). Use them to create a scale model of the timeline. You can create the model in your yard, a field or along a driveway or sidewalk. Use chalk to write on surfaces or use sticks or flags to mark a soil area. You also could make your model out of string or yarn with tape labels for the beginning of each period or with signs along a fence row. Choose an appropriate scale factor for the area you are using. Use ratios to determine how long each segment needs to be. Once your model is ready, think about it carefully. Which time period is the longest? Is there a pattern to the length of the periods or are they random? What percentage of the geologic record has living things? Where on your timeline do mammals become prevalent? What was one thing that surprised you about the model? If possible, take a video of yourself describing your project and what you have learned.

Time Period/Era	Start date (MYA)	Major event(s) or life forms (approximate dates in MYA)
Precambrian	4,600	Earth forms (4600); oldest rocks (3950); first bacteria (3500)
Cambrian	2500	Oxygen-rich atmosphere (1500); soft-bodied animals (700)
Ordovician	543	First fish (505); mass extinction ends period
Silurian	500	Appalachian Mountains formed (450); early land plants
Devonian	439	First amphibians (370); start of supercontinent Pangaea (360)
Carboniferous	409	First reptiles
Permian	354	Mass extinction ends period
Triassic	290	First dinosaurs; first mammals; Pangaea breaks up (225)
Jurassic	251	First birds; Atlantic Ocean begins forming
Cretaceous	206	Flowering plants appear; Mass extinction ends period
Tertiary	144	Rocky Mountains form (60); First horses (37)
Quaternary	5	Earliest humans (2); Ohio's major ice age (1.6); Hawaii (big island) begins forming (0.7)

Inside option: Collect data from three models of radioactive decay to create graphs and determine half-lives. Toss 100 coins. Remove the coins that come up heads. Count the remaining (tails) coins and record. Toss only the remaining (tails) coins. Remove those that come up heads. Record the number of tails. Continue this process until no coins remain. Graph your data placing the number of coins remaining on the y-axis and the trial number on the x-axis. On your graph, indicate the point where only half (50) of the coins remain. Do the same for ¼ (25), 1/8 (12.5), 1/16 (6.25) and 1/32 (3.125). What is the average number of tosses it takes for half of the coins to be lost? This number is the half-life for the coins. Next, repeat for something with a different probability of "decaying." You can create your own models but here are two ideas. Get 100 toothpicks (other objects will work). Draw parallel lines on large sheet of paper (tape several together). The lines should be spaced apart the length of three toothpicks. Drop the toothpicks from a certain height (you choose) onto the paper. Remove any toothpicks that touch a line. Count the remaining toothpicks. Drop the remaining toothpicks to see how many "decay." Continue, each time removing the ones that touch a line until you have no toothpicks. Graph the results from this model. A third idea is to use number cubes (dice). Roll a die 100 times (if you have multiple dice you can do them in sets). Count how many times the roll is NOT a one. Record this number. For your next trial, only roll the dice that many times. For example, if you rolled a one 12 times and something other than a one 88 times, then on the next data collection you would roll only 88 times. Continue until you have no rolls left. Graph the data for this model. Compare your three graphs. Which had the longest half-life (the most turns before 50% of it was gone). Use each graph to estimate the age (in turns) of a pile of objects with 37 remaining. Is it different for the three models? Explain how these models relate to the reason geologists would use different radioactive elements on different age rocks?

8.PS.1 Objects can experience a force due to an external field such as magnetic, electrostatic or gravitational fields.

Outside option: Investigate gravitational forces. Drop objects of various masses from a certain height and observe the effects. One suggestion is to drop the objects into loose material (sand, kitty litter, flour) and measure the size or depth of the crater formed. Decide how to organize and analyze your data. Make a claim about the relationship between mass and gravitational force. Support your claim with evidence from your investigations. Is the evidence you collected sufficient to prove your claim? If not, what additional evidence is needed? How can you collect the additional evidence?

Inside option: Build an electromagnet. Tightly wrap coils of insulated (it can't be bare) wire around a nail. If you don't have wire handy, an old cord with the ends cut off will work (it contains two or three strands of wire) or dismantle old Christmas lights (use the strand that runs continuously, not the one the light bulb sockets are connected to). Connect the end of the wire to the two ends of a battery (any C, D, AA or AAA will work). When the battery is connected, see if the electromagnet can affect a small metal object like a paperclip. From how far away can the magnet affect the paperclip? Investigate what happens if you wrap more coils of wire around the nail, use a thicker nail or use two batteries end to end. Design your own investigation using the electromagnet. Collect, record and analyze data to draw a conclusion. Defend your conclusion with evidence from your investigation. **Caution: never attach your device to household electricity.**

8.PS.2 Forces can act to change the motion of objects.

Outside option: Ride your bike or skateboard and observe the apparent motion of objects around you. **Be sure to use protective gear and pay attention to hazards in your environment.** How do the fixed objects appear as you pass? Look closely at trees, mailboxes and houses. From your point of view, how do these objects appear to move? Get a sibling or household member to ride with you. Observe them in various situations (riding toward you, riding away from you, riding faster than you or slower than you in either direction). For each situation, describe the apparent motion. If you don't have a bike or skateboard, walking or running also can work. Use your observations to defend or refute the statement "All motion is relative." Include supporting evidence.

Inside option: Practice constructing force diagrams. On a force diagram an arrow shows the direction and relative strength of forces acting on an object. Observe moving objects and for each segment of their motions, draw the appropriate force diagram. Some possible motions to use include: an object dropped from your hands (at rest in your hand, falling, hitting the floor, at rest on the floor); an object tossed into the air (at rest in your hand, moving upward, stopped at the highest point, falling, at rest in your hand); an object rolling down a ramp (at rest at the top, rolling down the ramp, rolling on the floor, at rest after stopping); an object rolling along a table and falling off; and an object twirled in a circle. You can think of other moving objects to include. Analyze your force diagrams. What patterns can you find for how the diagrams look when objects are speeding up, standing still or changing direction. Write a general rule for the relationship between forces and motion.

8.LS.1 Diversity of species, a result of variation of traits, occurs through the process of evolution and extinction over many generations. The fossil records provide evidence that changes have occurred in number and types of species.

Outside option: Conduct a field study on a specific population of plants or animals in a local area. Examine members of that population and record variations in physical characteristics that can be seen (for example, height, coloration, number of flowers). Predict which traits are more beneficial for survival in the population's current environment. Predict what variations may result in higher survival rates should the environment change (became warmer, colder, wetter, windier).

Inside option: Panda bears eat only bamboo. Raccoons eat a wide variety of plants and animals. Make predictions about the relative abilities of panda bears and raccoons to survive environmental changes. Describe changes to the environment that would be likely to affect both species. Which types of changes might affect one species but not the other? Are there environmental changes that probably would have no effect on either species? Describe reasons that being a specialist could be both beneficial and harmful to a species.

8.LS.2 Every organism alive today comes from a long line of ancestors who reproduced successfully every generation.

Outside option: Investigate asexual reproduction in plants. Look for examples of asexual reproduction (for example, grasses and weeds with underground runners). List the types of plants you find reproducing asexually. What evidence makes you predict they are reproducing asexually?

Try to cultivate new plants asexually.

- Use cuttings from plants to root new plants by placing a snip from each plant into water and letting it develop roots. The new plant can then be placed in soil. Try various plants and plant parts.
- Cut up a potato and grow plants from the pieces. Do all the pieces grow a plant? What determines which ones grow? Do the new plants all look alike?
- Try other methods to grow a new plant from an existing plant. Which parts of a plant can develop into a new plant? Does it vary by species of plant? Are the new plants identical to the original plant? Are certain types of plants more likely to be capable of reproducing asexually? Summarize your findings in a display, video or presentation.

Inside option: Write and illustrate a children's book, informational pamphlet or other product explaining the differences between sexual and asexual reproduction. Be sure to include information about the number of parents and how offspring are similar to, or different from, their parent(s) and each other.

8.LS.3 The characteristics of an organism are a result of inherited traits received from parent(s)

Outside option: Investigate whether the seeds of a single fruit are genetically identical. Plant a group of seeds from a single piece of produce (bean, pea, tomato, squash, melon, apple). Observe the plants that grow from the seeds. After listing similarities and differences, make a claim about whether all the seeds contained identical genes. What evidence from your plants supports your claim? What additional investigations would need to be conducted to substantiate your claim? If practical, continue to grow your plants to maturity. When you harvest the resulting fruits, what similarities and differences exist? Does this new evidence support or refute your claim? Enjoy eating your harvest.

Inside option: Choose one human trait that is controlled by dominant and recessive alleles. Some examples are dimples, cleft (dimpled in) chin, left/right handedness, free (dangling) or attached earlobes, being able to roll you tongue into an O shape, having a bent top segment to the pinkie finger, freckles, curly/straight hair, widow's peak (V-shaped hairline on forehead). Create a pedigree for the biological relatives of someone in your household. Use squares for males and circles for females. Choose the blank or filled-in shape to represent each phenotype (observable version of the trait). Observe and interview family members to determine who has which version of the trait. Include parents, grandparents, aunts, uncles, cousins, children and grandchildren. You can use a "?" on your pedigree if the phenotype is unknown for some. Once your pedigree is complete, see if you have enough information to determine which expression of the trait is dominant. Explain why your pedigree is able, or unable, to prove which allele is dominant.

SAFETY DURING AT HOME SCIENCE EXPLORATIONS

The *Science Explorations To Do at Home* are designed to be completed in a home setting and are specifically targeted to each of *Ohio's Learning Standards for Science*. These activities use easy to find, familiar, household items. The projects are intended to be used by parents to supplement instruction in the classroom or teachers may assign them during remote learning, particularly for students who do not have access to online resources. While performing these investigations, please be sure to practice proper safety procedures. Some of these activities should be done with the supervision of an adult.

The following are safety practices that should be employed when doing science explorations at home.

- Obtain parent permission before any exploration.
- Wash your hands with soap and water both before and after completing any science activity.
- Keep all materials used in the science activity away from your mouth, nose and eyes. Do not place your hands on your face when conducting or cleaning after an activity.
- Never taste anything during a science activity.
- Conduct explorations where they can be monitored and remain safe from younger siblings, pets, breakage or contamination.
- Keep area cleared of materials that could provide a tripping hazard (for example, equipment placed in walkways).
- Notify an adult immediately if an injury, spill, broken glass or other accident occurs.
- Clean up spills immediately to prevent the possibility of slipping or falling.
- Tie back long hair, and secure loose clothing and dangling jewelry.
- Prevent burns and fires when heating materials. If using a hot plate or flame, make sure to have adult supervision.
    - Make sure there are no combustible materials nearby.
    - Use tempered glass such as Pyrex™ when heating substances.
    - Never leave a room while a hot plate or burner is on.
    - Before handling a hot plate or burner, make sure it is unplugged and cool.
    - If using a flame, use tea candles that are short and wide and hard to knock over with normal use.
    - Never leave the room while a flame is lit.
- Use alcohol thermometers instead of traditional mercury thermometers.
- Do not use thermometers as a stirring rod. Stir with kitchen utensils or paint stirrers.
- Always label containers so the contents are identified.
- Never attach homemade devices to your home's electrical sockets.
- Clean up your area after conducting a science activity.

Resources for Safety in the Science Classroom

National Science Teaching Association: https://www.nsta.org/safety/