GRADE 8 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*.

The resources listed in this document are provided to enhance planning, instruction and learning about science. They are not mandatory. Local districts are responsible for establishing the local curriculum and identifying appropriate instructional resources. The at-home projects are intended to provide activities that can be used by teachers to assign as homework or share with parents to supplement classroom instruction. Teachers should feel free to adapt the activities to align with the local curriculum. The projects are designed with the intent that technology is not necessary; although in many cases, the activities could be extended with additional components. When possible, data can be shared in small groups or with the entire class, analyzed and discussed to deepen understandings that students uncover during these activities.

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.

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.