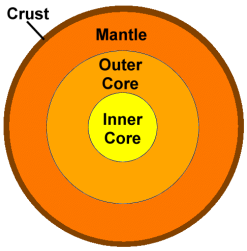
SHAKE IT UP (LEVEL 2)

Description	Learners will begin by learning the earth's composition and the different layers that make up the earth.
Leading Question	How would you keep your community safe if there was an Earthquake?
Total Time Required	5 hours total over 5 days
Resources Required	Pens – Paper, Boiled Egg, Plastic covers of containers, A large tub Cardboard, Scissors, Styrofoam, Glue,2 desks or tables, 1 coin, Pencil or Marker A stack of heavy books, A ruler, A piece of cardboard, 3 rubber bands, and paper/ Preferred: A World Map
Subjects	Science, Art and Design, Literacy
Learning Outcomes	By the end of this project, learners will be able to: 1. Discuss how tectonic plates and the various layers of the Earth are related to earthquakes and graphical features. 2. Explore ways in which they can develop earthquake-resistant structures 3. Identify any risks or dangerous areas and items within their homes and Develop earthquake preparedness protocols for their homes.
Previous Learning	Basic knowledge of the world map
Self-guided/ Supervised activity	High

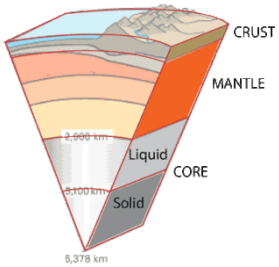
DAY 1

Today you will begin by learning the earth's composition and the different layers that make up the earth.

Time	Activity and Description
25 minutes	• It may seem like the Earth is made up of one big solid rock, but it's really made up of several parts. Some of them are constantly moving! • You can think of the Earth as being made up of several layers, sort of like an onion. See the picture below to see the four main layers of the earth: the crust, mantle, outer core, and inner core.



Obtained from: https://www.ducksters.com/science/composition_of_the_earth.php



Obtained from: https://www.usgs.gov/natural-hazards/earthquake-hazards/science/science-earthquakes?qt-science_center_objects=0#qt-science_center_objects

- **1st layer - Crust:** The crust is the thin outer layer of the Earth where we live. The crust varies from around 5 km thick (in the ocean floor) to around 70 km thick (on land where we live called the continental crust). This is where we live, on pieces called plates.
- **2nd layer - Mantle:** The next layer of the Earth is called the mantle. The mantle is much thicker than the crust at almost 3000 km deep.
- **3rd Layer – Core:**
  - **Outer Core:** The Earth's outer core is made up of iron and nickel and is very hot (4400 to 5000+ degrees C). This is so hot that the iron and nickel metals are liquid!
  - **Inner Core:** The Earth's inner core is made up of iron and nickel, just like the outer core, however, the inner core is different. The inner core is so deep within the earth that it's under immense pressure. So much pressure that, even though it is so hot, it is solid.

10 minutes	**<u>Layers of the Earth Activity:</u>** ● With the help of your parents, boil an egg. ● Step 1: With the boiled egg, begin by peeling the shell of the egg off. Think about the shell like the first layer of the earth. What is the first layer of the earth? *(Answer: The Crust).*  ● Step 2: The next layer of the egg is the white of the egg. It is the middle layer. Think about the white of the egg as the second layer of the earth. What is the second layer of the earth? *(Answer: The mantle)*  ● Step 3: The only portion of the egg remaining is the layer at the center of the egg. Think of this layer as the last two layers of the earth combined. What is the last (inward) layer of the earth? *(Answer: The core)* 
10 minutes	**<u>Reflection:</u>** Thinking about the activities today, can you tell us: ● Two things you have learned from today

	• One thing you found interesting • One thing that you still have a question about Parents/educators will ensure to respond to your questions where possible.

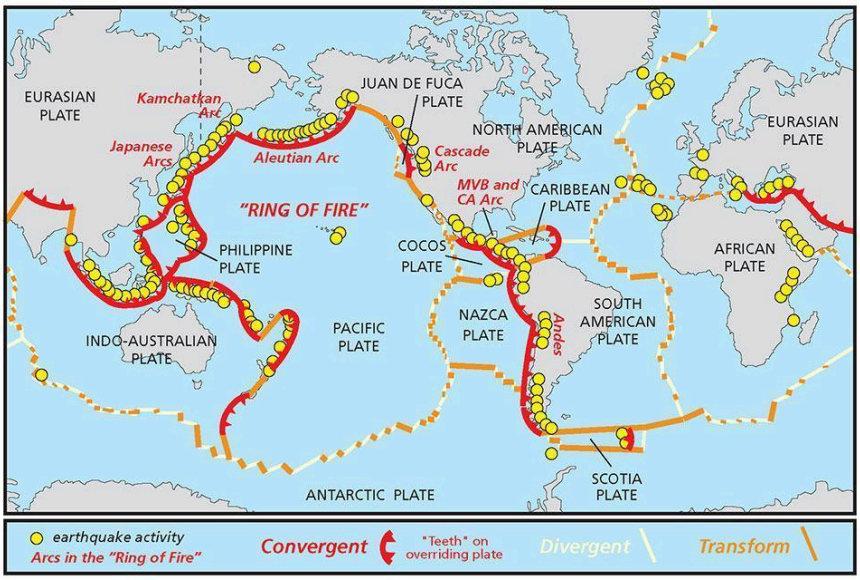
Day 2

Today you will learn about how the outer crust of the earth can be like a puzzle.

Time	Activity and Description
25 minutes	• Draw and design your own map of the Earth as a jigsaw puzzle with 15 pieces on a piece of paper or Cardboard (representing the 15 plates). Draw or trace one below or your own imagination of the various continents.  • Paint over your world map with blue representing the oceans and label the ones that you know.
10 minutes	• The jigsaw puzzle pieces drawn above represent the tectonic plates of the earth. A tectonic plate is a massive, irregularly shaped slab of solid rock, generally composed of both continental and oceanic surface. The tectonic plates are a combination of the crust and the outer mantle. • Come up with wanderings based on what you've learned. Some possible questions include: - What is the largest tectonic plate? - What is the smallest tectonic plate? - On what tectonic plate is your country and home found?

Day 3

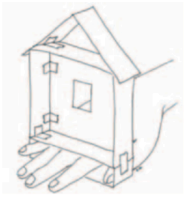
Today you will begin to understand that the earth's surface is always moving and different ways that these pieces move and form earthquakes and mountains.

Time	Activity and Description
15 minutes	● Step on the ground. Do you think the ground beneath our feet is moving? Can you feel it move? Let's learn about it! ● Even though we can not feel it, tectonic plates move less than 3 inches (about 17 cm) per year. These plates slide over each other to cause friction that in most cases creates Earthquakes and mountains.
	● Look at the map below and share what you see at the descriptive level, without any interpretation (e.g. "I see some yellow dots along some lines'', "I see some pieces of the image that are colored in blue"), think (e.g. "I think the yellow dots might be indicating something about the plates''), and wonder (e.g. "Why are the no dots in the east coast of North America?") in relation to the map.  ● The map shows places where the earthquakes have occured (yellow dots). - What do you notice about the distribution of earthquakes? - Do you see any patterns? - Can you think of a possible explanation for the patterns you see?
15 minutes	**<u>Earthquake exercise:</u>** ● Hold up both your hands touching at the fingertips as shown in step 1. Each of your hands represents a different tectonic plate. Then push your hands

	together from their wrists as shown in step 2 and observe how your fingers move upward to form a mountain as shown in step 3 (see images below for clarification). This is representative of two plates colliding with each other – this is how the Himalayas and other mountains were formed when plates crashed against each other **Step 1:**  ***Step 2:***  ***Step 3:*** 
15 minutes	*Literacy extension and check for understanding:* ● Identify a mountain in your country or region or continent. Using the information learned today, can you write a short paragraph explaining how the mountain was formed?

Day 4

Today you will try to create structures that are Earthquake resistant.

Time	Activity and Description
10 minutes	● Have you ever experienced an earthquake? If yes, what did it feel like? If not, you can interview your parents or an adult at home if they have ever experienced an earthquake and ask them to explain to you what it feels like. ● Some earthquakes are small, while others could be big and could destroy a house or an entire village.
10 minutes	● Hypothesize, check online, or ask your parents/an adult at home about the danger and destruction a big earthquake can cause to a building or a place with weak structures. ● First, write your hypothesis on whether shorter or taller buildings are more Earthquake resistant. Prompt: Have you ever climbed a tree? Or observed a tree shaking? When it is windy, what part of the tree shakes more? *Hint: All buildings shake at the same frequency as the shaking of the Earth, but the movement is magnified as the building gets taller.* ● Make your own shake-tables to learn about strong and weak buildings through experimentation. Build a paper house from 3-cm wide strips of paper, scissors, and tape, as shown in the figure. 
10 minutes	● Insert your hands into the base of the building and slide the building back and forth to see how the paper house sways and even collapses. ● Using extra sheets or paper, experiment with methods of strengthening their building by cutting out and taping paper walls, paper X shaped braces, or interior columns to their building. ● Older students can try building houses of two or three stories to determine how height affects a building in an earthquake or cyclone
40 minutes	● Use Styrofoam (thermocol) as a base and construct a tower of any materials available at home such as paper or plastic cups ● Design two towers: - The first tower will be deeply embedded into the base and have a broader base. You can use toothpicks, pins etc. to secure the tower into the base.

	- The second tower will not be as embedded into the base and has a narrower base Experiment with different types of towers
10 minutes	● Try and shake the Styrofoam base to test which of the towers will not fall during an Earthquake. **<u>Critique and revision:</u>** ● Present and test the various structures developed to your parents or family members for feedback and suggestions for improvement. The parents or family members provide feedback using the following format: ● Praise: What did you like about the learner's work? ● Question: Any questions or clarifications you have about the work? ● Suggestions: In what areas does the learner need to improve their work?
10 minutes	● Reflect on what makes towers more resistant and write this down. Consult the internet or your parents or an adult in your family if they are not sure of the responses. Some of the answers may include: - Reinforced walls - Stronger and deeper building foundation - Light roof

DAY 5

Today you will think of ways to react in an earthquake.

Time	Activity and Description
10 minutes	● Imagine a violent shaking of the ground for a prolonged period of time; what do you need to do to make your house safe? Check on the internet or ask your parents/adult in case they are not sure what to do in case of an earthquake.
15 minutes	● Identify the potential dangers around you in times of an Earthquake. Imagine a violent shaking of the ground for a prolonged period of time, what would be hazards in their home? ● What are the household items that are loosely attached and can fall easily? E.g. loose furniture etc. What are the items that can cause injury? E.g. hanging lights, windows etc.? What items have wheels and might move and hurt individuals?

20 minutes

- Make a list of the items in your home and decide how to make your home safer. Draw three columns: 1) Household item, 2) Danger posed, 3) If an earthquake occurs: move, relocate, attach, anchor, replace, remove, fasten, secure, tie down, eliminate and change

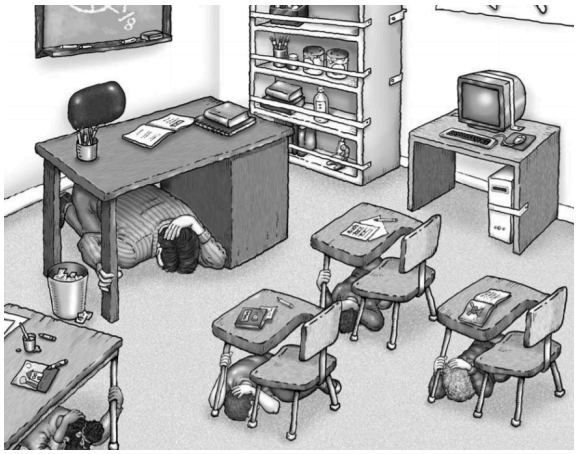
No	Household Item	Hazard Posed	If an Earthquake occurs
1	Heavy Books on the Shelf	Heavy items can be displaced and can fall	Move the heavier items to the lower shelf
2	Hanging Glass Chandelier	Glass can be injurious	Secure the light and move bed or table from under this light
3	Lose Chest of Drawers	Not attached to the wall and can fall	Attaching the cabinet to the wall

25 minutes

- Make a plan for your family with suggested changes to ensure they are aware of the hazards.
- Create a plan for evacuation or staying safely at home during an earthquake
- Given that earthquakes can last as long as 2-3 minutes and be followed by aftershocks or smaller earthquakes, what would you consider the correct safety protocol to be?

For those outside the home:
i) Where do you think is the correct outdoor location? How would you stay away from potential hazards such as buildings and power lines? *(Answer: Please move to open land and spaces with no danger)*
ii) Given a potential aftershock or damage at home, when do you think is the right time to return to your home? *(Answer: Please do stay outdoors and only re-enter home only after secured by authorities)*
For those who are inside the home,

i) Would it be possible to evacuate the building during a quake of that length? *(Answer: No, because there is not enough time)*
ii) What would be some of the hazards along the way if we tried to leave the building during a quake? *(Answer: objects falling, windows breaking)*
iii) When should you evacuate given the potential for an aftershock? *(Answer: you should seek cover until at least a full minute has passed without shaking)*
iv) Where in your home should you be located to be safe from household items falling or injuring you? *(Answer: Away from windows and other lose or precarious items)*

	v) What is the best position to stay safe from injury? How will you protect your eyes, face and critical organs of heart and lungs? *(Answer: Crouch bending your heads to your knees and put both hands on the back of your neck)* vi) What can be used in your home as a shield to prevent injuries from shattered glass and debris? *(Answer: Under a table and desk or using coats or thick blankets as a shield from glass or debris)* 
15 minutes	**<u>Critique and revision:</u>** Present your understanding of earthquakes and your emergency preparedness plan with your families and get their feedback and suggestions for improvement. The parents or family members provide feedback using the following format: ● Praise: What did you like about the learner's work? ● Question: Any questions or clarifications you have about the work? ● Suggestions: In what areas does the learner need to improve their work? **<u>Reflection:</u>** Thinking about the activities from the entire week, can you tell us: - Three things you have learned from all the week's activities - Two things you found interesting - One thing that you still have a question about

Additional enrichment activities:	EARTHQUAKE MEASUREMENT ● Learners will reflect on the fact that the land they stand on is moving and how slowly it moves that they cannot feel it.

	• Learners will measure the impact of earthquakes by designing their own Seismograph instruments. Seismographs are instruments used to record the motion of the ground during an earthquake. • Step 1: Place the tables or desks side by side. Stack the books on top of the piece of cardboard on one desk. • Step 2: Insert the ruler or any long thin stick between two books near the top of the stack. The ruler should stick out over the adjacent desk. • Step 3: Hang the pencil or marker from the end of the ruler using three rubber bands and the coin if needed for extra weight. The marker or pencil should touch a piece of paper placed under it on the adjacent desk when the cardboard is moved. • The first desk represents the place where the earthquake is occurring. • A family member can make the earthquake occur by shaking the cardboard back and forth towards the second desk. The pen will move as this earthquake occurs. The second desk represents the recording station. Learners can record the earthquake by slowly pulling the paper underneath the marker while the cardboard is being shaken. • This record that the seismograph creates is called a seismogram. • Learners should simulate 3 to 5 earthquakes and then make a hypothesis on reading the seismogram. Hint: The tallest wave represents the Earthquake with the maximum intensity (or magnitude)
Modifications for Simplification	• Learners can pair up or work in groups. • Reduce the challenges based on the learners' participation and involvement in the process.

ASSESSMENT CRITERIA

By the end of the project, most of the learners were able to:

- ☐ Discuss tectonic plates and their movement and how that creates earthquakes.
- ☐ Design building structures that are Earthquake resistant.
- ☐ Design maps and jigsaw puzzles.
- ☐ Identify risks and dangers at home during an earthquake.
- ☐ Prepare emergency preparedness plans.