Co-Teaching Lesson Plan

Teacher 1: Mrs. Amanda Simon **Teacher 2**: **Mrs. Chandra Smith**

Co-Teaching Approach(es): Place an **X** or a ✓ on the line in front of each approach outlined in the lesson.

___ Parallel Teaching	___ Team Teaching	X Station Teaching
___ One Teach,One Observe	___ One Teach,One Assist	X Alternative Teaching

Subject: Earth Science	Topic/Lesson: Weathering of Limestone	Date: October

Standard(s): ES.7 The student will investigate and understand geologic processes, including plate tectonics. Key concepts include

a) geologic processes and their resulting features.

ES.8 The student will investigate and understand how freshwater resources are influenced by geologic processes and the activities of humans. Key concepts include

b) development of karst topography.

Lesson Outcomes: Students will identify examples of both mechanical and chemical weathering (the processes by which rocks are broken down by the actions of water, air, chemicals, and organisms) and its by-products, including sediments and soil and its products. Students will observe the effects of temperature on chemical weathering rates and observe the effects of physical weathering on chemical weathering rates by increasing surface area for chemical reactions.

Materials Needed: For each small group:

- Goggles and other safety equipment
- 500-ml plastic beaker or plastic cup
- Chalk, or calcium carbonate tablets
- Stopwatch
- Weathering of Limestone handout (attached)
- Hot water
- Room-temperature water
- Ice water
- Various concentrations of hydrochloric acid
- Four mortars and pestles

Vocabulary: ***acidity, calcite, chemical weathering, hydrolysis, limestone, physical weathering (mechanical weathering)***

Lesson Component	Teacher 1	Teacher 2
Anticipatory Set *Co-Teaching Approach:*	1. Introduce the concept that *physical weathering* (the disintegration of rock material into smaller particles) and *chemical weathering* (the decomposition of rock material by chemical reactions) work together to transform rocks and minerals into soil and to dissolve minerals in solution. Tell students that the following activity will demonstrate that physical and chemical weathering can occur separately or in tandem and will reveal that physical weathering can accelerate chemical weathering. 2. Have the students complete the prelesson inquiry activity. This is an activity in which the students will draw a short four segment comic strip and answer some questions.	3. Ask students, "Why do we chew our food?" They may say, "To break it up" "To make it smaller." "To make it easier to digest." Then ask, "Why do we have acid in our stomachs?" They may have difficulty coming up with any reasons besides "to digest the food," but with some prompting, they should realize the acids react with the food to decompose or dissolve the food.
Lesson: Activities/ Procedures *Co-Teaching Approach:*	1. After experimentation is complete, have students discuss results with partners and collaboratively write a conclusion based on their findings. Have partners share their results with the class. 2. Introduce students to available materials, including various temperatures of water and various concentrations of hydrochloric acid. Instruct students to write a	1. Ask students to provide some examples of how rocks can be broken into smaller pieces. Rocks falling or tumbling down cliffs and mountains are obvious examples. Students may have more difficulty providing examples of rocks being chemically dissolved because the process is slow and goes largely unnoticed. Photographs of very old and more recent gravestones and their engravings can provide clear examples of

	procedure to determine how physical weathering could alter the rate of chemical weathering. *(by increasing surface area for chemical reactions)* Approve students' procedures before allowing them to proceed to the experimentation phase.	the effects of chemical weathering on the stones. 2. After experimentation is complete, have students discuss results with partners and collaboratively write a conclusion based on their findings. Have partners share their results with the class.
Guided/Independent Practice *Co-Teaching Approach:*	Have students carry out approved experiments to observe the effects of physical weathering on the rate of chemical weathering. Stations Teaching	
Closure *Co-Teaching Approach:*	Discuss the effect of reducing particle size by physical weathering on the chemical weathering rate. Questions to ask might include the following: Which piece of chalk (or $CaCO_3$ tablet) took the most time to dissolve? Which tablet dissolved in the least amount of time? What does breaking up the tablet into smaller pieces affect? *(the rate of chemical weathering)* Why? Alternate Teaching	Discuss the effect of varying amounts and concentrations of acid on chemical weathering rates. Questions to ask might include the following: Which solution dissolved the tablet in the least amount of time? Which solution dissolved the tablet in the greatest amount of time? Why does acidity affect the chemical reaction rate?
Formative Assessment Strategies	o You visit a car junkyard and notice that every car there is rusting away. What type of weathering is most responsible for transforming shiny new cars into rusty old ones in a junkyard? o On a field trip to Shenandoah National	o If limestone is easily weathered, what does this mean for structures that utilize limestone as a building material? o If a home is built with limestone bricks and nonlimestone bearing mortar to hold the home together, what does this mean for the weathering

Co-Teaching Approach:	Park, you observe a tree growing out of a crack in a large boulder. How does the growth of the tree affect this boulder? What kind of weathering does the tree cause? o On the same boulder, you observe lichen growing on the rock surface. Lichen obtains nutrients from the rock. How does the weathering caused by the growth of the lichen differ from the weathering caused by the growth of the tree? Alternate Teaching	rates of the two materials? o Looking specifically at our nation's capitol, why would so many of the monuments and buildings be constructed of limestone if it will eventually weather away?
Homework	• Make a list of 5 examples of chemical weathering in your neighborhood. • Complete a Comparison Table comparing physical and chemical weathering.	• Make a list of 5 examples of chemical weathering in your neighborhood. • Complete a Comparison Table comparing physical and chemical weathering.
Specially Designed Instruction and Accommodations, Modifications for Specific Students	• Use of timer • Flexible grouping • Small group instruction	• Pictorial or video procedural steps • Use of technology to share results

Notes:

Related SOL ES.1 The student will plan and conduct investigations in which
a) volume, area, mass, elapsed time, direction, temperature, pressure, distance, density, and changes in elevation/depth are calculated utilizing the most appropriate tools;
e) variables are manipulated with repeated trials; and
f) current applications are used to reinforce Earth science concepts.

ES.2 The student will demonstrate an understanding of the nature of science and scientific reasoning and logic. Key concepts include

a) science explains and predicts the interactions and dynamics of complex Earth systems;
b) evidence is required to evaluate hypotheses and explanations;
c) observation and logic are essential for reaching a conclusion.

Students will draw on prior knowledge of scientific method. Make sure to relate current lab to prior lab activities to activate prior knowledge. Assign jobs at each lab station so that students have structured activities to complete in the time allotted.