



WEATHERING, EROSION & DEPOSITION MODULE

LESSON 1: AGENTS OF CHANGE



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Lesson 1 – AGENTS OF CHANGE

ACKNOWLEDGEMENTS

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The following lesson and associated materials are part of the Integrating Chemistry and Earth science (ICE) Urban Heat Island Module. The Module brings together important concepts from Earth science and chemistry to help students build an understanding of why urban areas have higher temperatures both during the day and at night, than their rural counterparts.

ICE Partners

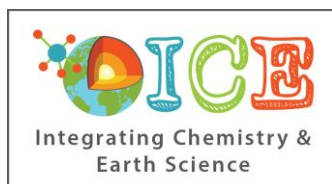


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Lesson 1: Agents of Change

Driving Question: *What can move/change mountains?*

Summary: Students will learn about the basics of weathering, erosion and deposition. They will have the opportunity to debate and defend claims as teams, describe cause and effect relationships, and examine models while classifying phenomena.

Activity Description:

- **Opening Activity:** Engage students' prior knowledge and interest by getting them out of their seats to playing 4 Corners. Have them vote with their feet on what agent they think caused the land feature shown on the PowerPoint slides.
 - Play Agents of Change 4 Corners with your students to see if they can identify what agents cause different land features.
 - Post the *Agents of Change 4 Corners Signs C* "Friction", "Heating/Cooling" "Chemical Reactions", and "Gravity".
 - Alternative signs – simplified concepts - *Agents of Change 4 corners signs B* "Gravity," "Water," "Wind," "Ice".
 - Show the slides in the *Agents of Change PowerPoint*.
 - The notes section of each slide has the agents most impacting the landscape.
 - Students move to the sign that they think is the most likely agent of change in the picture.
 - Have each group discuss their reasoning and have a spokesperson explain their evidence and reasoning to the rest of the class.

Questioning prompt: How does [friction/heating-cooling/chemical reaction/gravity/water/wind/ice/etc.] affect the Earth's surface (such as a cliff or large rock)?

- **Weathering, Erosion and Deposition Mini-lesson:** Challenge student ideas about weathering erosion and deposition processes.

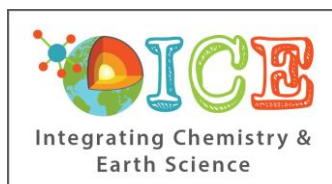
- *Weathering, Erosion, and Deposition PowerPoint*

- **Sorting Activity:** To solidify student understanding, students will work in groups to identify and sort examples of each process.

- Complete the Weathering, Erosion, or Deposition Sort activity.
 - This is a group/partner activity.
 - Prior to class you may want to make reusable cards on cardstock.
 - Scaffolded Versions: *Weathering, Erosion, or Deposition Sort Cards V2*

- **Expansion Activity:** Preparing for lesson eight, students will set up the Expansion Activity so that it can be frozen overnight.

- Have students read and set up the expansion activity *Brr...It's Cold in Here* in preparation for lesson



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eight.

- **Teacher Notes:** The water in the syringes needs to freeze overnight to measure expansion. You may want to add food coloring to the water to make it easier to see.
- Students record the initial volume in the syringe and save the data for tomorrow.

Homework: Doing a photo treasure hunt, have students find evidence of “Agents of Change” in the area between school and home. Have them look for evidence of the most dramatic or powerful agent they can find. The weathering can be of human-made or natural materials. Have them take a picture and either send it to the teacher or bring it into class.

EL Support: Purposefully choose one or more of the following options based upon student needs or formative assessment data to have students process and engage with content.

- Pair students that share a home language
- Provide native language support: bilingual dictionary, cognates, L1 partner
- Modify classwork, assessments, homework (true/false, reduced responses)

Differentiated Instruction: Purposefully choose one or more of the following options based upon student needs or formative assessment data to have students process and engage with content.

- For the Four-Corners activity: a possible “in seat” protocol would be to have students sit in groups and give them the 4 signs. Have each group discuss the image, come to a consensus, then hold up the sign that they agree upon. Afterwards have each group share their reasoning as above.

For the mini-lesson content, the teacher could prepare a Flipped Classroom format and record the content for the students to watch the night before, or as review after class.

Lesson Summary:

Students should have an idea of the following: Weathering is a process that breaks down rocks. Erosion is a process that moves broken material. Deposition is the process that drops moved material in other locations.

Water, gravity, and chemical processes are among the factors which are responsible for the processes.

Questions students should be asking include How can water break rocks? and How do chemicals change rocks?

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Weathering, Erosion, or Deposition?

Based on the free activity by Laura Chandler:

(<https://www.teacherspayteachers.com/FreeDownload/Weathering-and-Erosion-Sorting-Activity-Free-354192>)

Instructions:

- Print and cut out the sorting cards.
- Students will sort the cards into 3 stacks based on the process being described: Weathering, Erosion, or Deposition.
- Once sorted, teacher may choose to check the stacks before students move on to the writing portion.
- For each stack students will choose 1 card and, in CER format, explain why they classified the card as they did.

CER Rubric:

	Claim <i>A statement or conclusion that answers the original question/problem.</i>	Evidence <i>Scientific data that supports the claim. The data needs to be appropriate and sufficient to support the claim.</i>	Reasoning <i>A justification that connects the evidence to the claim. It shows why the data counts as evidence by using appropriate and sufficient scientific principles.</i>	Language and Vocabulary	Focus and Organization
4	<ul style="list-style-type: none"> • All aspects of level 3 and is written in a way that engages the reader. 	<ul style="list-style-type: none"> • All aspects of level 3, correctly identifies the sources and is written in a way that engages the reader. 	<ul style="list-style-type: none"> • All aspects of level 3 and is written in a way that engages the reader. 	<ul style="list-style-type: none"> • Response clearly and effectively expresses ideas using precise, scientifically appropriate descriptions and vocabulary. 	<ul style="list-style-type: none"> • Focus only on question at hand • Logical progression of ideas • Clearly stated and focused claim that is strongly maintained
3	<ul style="list-style-type: none"> • Makes an accurate and complete claim and includes points from the question in the writing. 	<ul style="list-style-type: none"> • Provides all or most of the expected pieces of evidence from the sources used in an appropriate manner. 	<ul style="list-style-type: none"> • Provides reasoning components for all or most of the evidence and explains how the evidence supports the claim. 	<ul style="list-style-type: none"> • Response adequately expresses ideas and scientifically appropriate descriptions and vocabulary, but they are more general than specific 	<ul style="list-style-type: none"> • Focus mainly on question at hand, some loosely connected material present • Logical progression of ideas • Clearly stated and focused claim that is adequately maintained

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2	<ul style="list-style-type: none"> Makes an accurate and complete claim. 	<ul style="list-style-type: none"> Provides some of the expected pieces of evidence from the sources used (e.g. data like numbers, observations, etc.) in an appropriate manner. 	<ul style="list-style-type: none"> Provides reasoning components for some of the evidence and explains how the evidence supports the claim. 	<ul style="list-style-type: none"> Response inconsistently and sometimes inappropriately expresses ideas or scientific descriptions and vocabulary 	<ul style="list-style-type: none"> Focus not consistent on question at hand Progression of ideas not entirely logical Have a claim, but it's not entirely clear or maintained
1	<ul style="list-style-type: none"> Makes an accurate but vague or incomplete claim. 	<ul style="list-style-type: none"> Makes a general statement regarding evidence, but does not include specific details. 	<ul style="list-style-type: none"> Repeats evidence and links it to the claim, but does not explain how the evidence supports the claim. 	<ul style="list-style-type: none"> Scientific language and vocabulary are not precise or appropriate 	<ul style="list-style-type: none"> Focus not at all consistent Progression of ideas not logical Have an unclear claim that is not maintained
0	<ul style="list-style-type: none"> Does not make a claim, or makes an inaccurate claim. 	<ul style="list-style-type: none"> Does not provide evidence, or only provides inappropriate evidence or vague evidence, like "the data shows me it is true." 	<ul style="list-style-type: none"> Does not provide reasoning, or only provides inappropriate reasoning. 	<ul style="list-style-type: none"> Not understandable 	<ul style="list-style-type: none"> No clear focus or organization.

KEY:

Weathering	Erosion	Deposition
1, 5, 7, 11, 13, 14, 16, 19	2, 4, 12*, 15, 18	3, 6, 8, 9, 10, 17, 20
* the focus on 12 is the movement of the sand (thus erosion), but students may focus on the end-point and classify it as Deposition. Use your judgement, based on their evidence and reasoning, to determine if you want to accept it as deposition or erosion.		

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<p>1 Flowing river water pounding against a canyon wall and wearing it down.</p>	<p>2 Rain washing away soil from a hillside.</p>
<p>3 Layers of sediment forming on the bottom of a river.</p>	<p>4 A mudslide flowing down a hill.</p>
<p>5 Rockslide sends tons of granite falling to the bottom of a mountain.</p>	<p>6 Delta forms at the mouth of the Mississippi River.</p>
<p>7 Caves form as acidic rain dissolves away limestone underground.</p>	<p>8 Waves push sand up on the beach.</p>



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<p>9</p> <p>A glacier drops rock to form terminal moraines.</p>	<p>10</p> <p>Flood water piling rocks, trees, cars and other debris against bridge supports.</p>
<p>11</p> <p>Water getting into cracks in the road, freezing, and forming pot-holes.</p>	<p>12</p> <p>Wind blowing sand from one place to another.</p>
<p>13</p> <p>Wind forming an arch by blasting sand against soft stone.</p>	<p>14</p> <p>Glaciers scraping rocks across the earth's surface.</p>
<p>15</p> <p>A fast-moving river carrying mud downstream.</p>	<p>16</p> <p>Rivers smoothing and rounding out rocks by tumbling them across the riverbed.</p>

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<p>17</p> <p>A pond fills with mud and sediment and turns into a marsh</p>	<p>18</p> <p>Ocean waves carve out the soft rock in a cliff to form a natural bridge.</p>
<p>19</p> <p>Tree roots grow into a crack in a bolder and split the rock in half.</p>	<p>20</p> <p>Mineral rich water drips from the roof of a cave forming a stalactite.</p>



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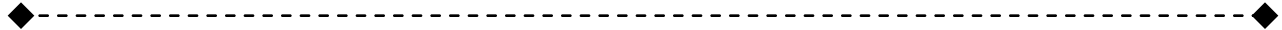
Weathering, Erosion, or Deposition?

Define:

1. Weathering:
2. Erosion:
3. Deposition:

Activity Instructions:

1. With your group discuss each card and then sort the cards into 3 stacks:
 - a. Weathering
 - b. Erosion
 - c. Deposition
2. Choose 1 card from each stack, each member of the group should choose a different card.
3. In CER format write 1 paragraph for each card justifying the classification claim you have made.

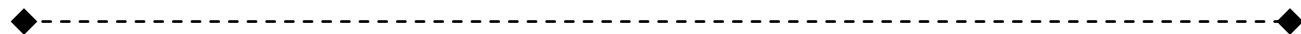


Weathering:

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Erosion:



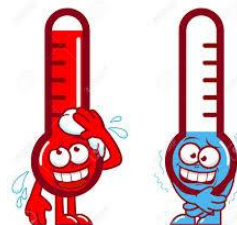
Deposition:

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Brrr... it's Cold in Here!

You will be collecting data, making and supporting a claim on how water is affected by freezing



<p>Materials:</p> <ul style="list-style-type: none">• 10 mL plastic syringe and cap• Blu tac• Food coloring	<p>Instructions:</p> <ol style="list-style-type: none">1. Fill a 10mL syringe with 5mL of cold water2. Seal the end of the syringe with your Blu tac and then place the syringe cap over top for closure3. Measure (mL) the length of the water column4. Place in freezer (overnight)5. Next day: Measure the length of the ice column (mL)6. Calculate the percent expansion as the water turned to ice
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Data Chart: Day 1:

Observations	Volume Measurement (mL)

Day 2:

Observations	Volume Measurement (mL)

$$\frac{\text{Volume Ice} - \text{Volume Water}}{\text{Volume Water}} \times 100$$

Question: Why do water bottles change shape when left in the freezer overnight? (Respond in CER format.)

