



Site Survey: Four Teams, Eleven Lessons

DRIVING QUESTION

What is the ground under this campus actually made of, and what had to happen for it to end up here?

YOUR CHALLENGE

Build it. Make it work. Teach it. Your team is the class expert on three lessons, and your build is how you teach them.

THE PROJECT

The phenomenon

There is no bedrock to stand on here. Everything under this campus arrived from somewhere else, as atoms, minerals, and rock fragments that were melted, squeezed, weathered, carried, and dropped. To read your own ground you need all of Module 1: maps, matter, minerals, and rocks. No one team can learn it all in time, so each team becomes the expert on one part and teaches it.

THE PROJECT

How it works

- Your group forms on your Scholar Dashboard and picks one focus.
- Each focus covers three Module 1 lessons.
- Each teammate leads one of your three lessons.
- In a group of four, the fourth teammate is the Verifier.
- Your team builds something that works.
- It is not a poster.
- It has to do something you can test.
- Your team keeps one shared group note in Note Studio.
- Everyone types in it at the same time.
- You photograph your build.
- When Dr. Ijezie approves the photos, they appear on the Module 1 page.
- On teach-back day your team teaches its three lessons with the build.
- Everyone learns all eleven lessons.
- Each of you turns in the group note to the Assessment Center, like notes homework.

TEAMS

Four teams, four focuses

Three teams of three and one team of four. Every focus is part of the same driving question: what is the ground under this campus made of, and how did it get here?

TEAM	FOCUS QUESTION
Team 1 • Map Makers Earth science, maps, and remote sensing	How do Earth scientists describe where things are on Earth and what the land is shaped like?
Team 2 • Matter Lab Atoms, bonds, and states of matter	What is water made of, why does it mix with so much, and how can we clean it?
Team 3 • Mineral Bench What minerals are and how to identify them	How can you prove what mineral you are holding?
Team 4 • Rock Cycle Workshop Igneous, sedimentary, and metamorphic rocks	How can one rock become another, and what clues does each rock keep?

TEAMS

Form your group

Groups form on your Scholar Dashboard. First come, first served: once a group takes a focus, no other group can take it.

1. Talk with your partners first and agree on the focus you want, plus a backup.
2. When Dr. Ijezie opens group forming, a pop-up appears on your Scholar Dashboard.
3. Your dashboard shows the opening time before then.
4. One person signs in to the Scholar Dashboard with their alias and PIN.
5. That person adds each partner by typing at least 3 letters of their alias.
6. Then they pick the group's focus and press Create group.
7. Taken focuses are crossed out.
8. Groups are 3 people.
9. One group in the class can have 4.
10. Everyone in the group now sees the group and focus on their own dashboard.
11. To change a group, talk to Dr. Ijezie.

Team roles

EVERY TEAM

Lead Investigator

- Runs the lab investigation and the build tests, and records every setting and reading.
- Keeps the team on schedule and checks each day's checkpoint in the group note.
- Leads one of your three lessons.

Hands the raw readings to the Data Analyst by the end of Day 2.

EVERY TEAM

Data Analyst

- Does the team's calculation and checks it with the self-check.
- Builds the data table in the group note, with units on every number.
- Leads one of your three lessons.

Hands a checked table and one finished calculation to the Communicator by the end of Day 3.

EVERY TEAM

Science Communicator

- Leads the build and takes the build photos for approval.
- Plans the teach-back so every lesson gets equal time.
- Leads one of your three lessons.

Uploads at least two approved-quality photos by the test day.

ONLY THE TEAM OF FOUR

Verifier

- Repeats every test and calculation on their own and settles differences.
- Checks every number in the group note against its source.
- Helps each lesson lead and builds the strongest argument against the team's claim before teach-back.

Turns in a one-page verification log with the team's products. In a team of three, the Analyst writes the uncertainty statement and the Lead writes the counter-argument.

What every team makes

- **Working build** (Presented in class · Day 4).
 1. The thing your team builds.

2. It must pass its 'It works when' tests at least twice.
- **Build photos** (Group note · Day 4).
 1. At least two clear photos of the build only (no faces or people), uploaded in your group note.
 2. Approved photos appear on the Module 1 page.
 - **Group note** (Note Studio → Assessment Center · Day 7).
 1. Your shared Note Studio group note: your three lessons, build plan, test data, results, teach-back plan, and each teammate's own contribution and reflection.
 2. Each of you turns in your copy like notes homework.
 - **Teach-back lesson** (Presented in class · Day 7).
 1. A ten-minute lesson: show the build working, then each lesson lead teaches their lesson with it and asks one check question.

Your Note Studio group note

Open Note Studio and choose **ESS Group Project**. Your team types in one shared note at the same time, and nobody can erase a teammate's section.

Build plan and materials

- Sketch description.
- Materials list.
- Who brings what.

What this lesson teaches (one per lesson)

- Two to four key ideas.
- Vocabulary.
- One example.
- The lesson lead writes this; teammates add.

Build log and test data

- Every try:
- Date.
- What you changed.
- Results with units.

What our build shows and what it leaves out

- Claim.
- Evidence from your tests.
- One limit of the build.

Teach-back plan and check questions

- Who teaches what.
- In what order.
- One check question per lesson with the answer.

What I did (each scholar, only you type here)

- Your own work on each day.
- Only you type here.

My reflection (each scholar, only you type here)

- What you learned from another team.
- One thing you would change.

Turn in your copy

Photos: at least two of the build only, no faces or people. Dr. Ijezie approves them before they appear on the Module 1 page. On teach-back day:

1. Each of you presses Update my turn-in copy.
2. Turn it in on the Assessment Center.

THE PLAN

Seven days, seven checkpoints

Dr. Ijezie posts the dates on the course calendar.

DAY	WHAT HAPPENS	CHECKPOINT
Day 1	Form up and plan. Know your three lessons and plan the build. • Form your group on the Scholar Dashboard. • Pick your focus. • Open your group note in Note Studio. • Choose who leads each lesson. • Read your three lesson decks. • In the note, write two key ideas from each. • Sketch the build. • List the materials.	Group note: lesson leads chosen, two key ideas per lesson, build sketch and materials list.
Day 2	Learn deeply. Become the expert on your lesson. • Each lesson lead fills in their lesson section: key ideas, vocabulary, one example. • Run your team's lab investigation. • Record every reading. • Gather materials.	Every lesson section filled in; lab readings recorded with units.
Day 3	Build. Build the thing and make it run once. • Build it. • Follow your build steps. • Try it once. • Write what happened and what you will fix. • Take progress photos (build only, no faces).	Build log in the group note; first try recorded.

DAY	WHAT HAPPENS	CHECKPOINT
Day 4	Test and photograph. Prove it works. • Run every 'It works when' test at least twice. • Record results with units. • Upload at least two photos of the finished build in the group note. • Do your team's calculation. • Check it.	Test data complete; two photos uploaded for approval.
Day 5	Improve and plan the lesson. Fix what failed and plan how to teach. • Fix one thing that did not work. • Test again. • Plan the ten-minute teach-back: two minutes of demo, then each lesson lead teaches with the build. • Write one check question per lesson, with an answer key.	Teach-back plan and three check questions in the group note.
Day 6	Rehearse. Practise until it runs smoothly. • Rehearse with another team. • They give one strength, one question, one fix. • Every teammate practises every part, not only their own lesson. • Each of you writes your own contribution and reflection in the group note.	Rehearsal feedback written; every teammate's contribution filled in.
Day 7	Teach-back day. Teach your lessons and learn all the others. • Each team teaches for ten minutes with its build. • Everyone takes learning notes. • Everyone answers every check question. • Press 'Update my turn-in copy' in the group note. • Turn it in to the Assessment Center. • Last-day partner review in the Assessment Center.	Teach-back given; learning notes; group note turned in; partner review done.

Map Makers

FOCUS QUESTION

How do Earth scientists describe where things are on Earth and what the land is shaped like?

Every other team needs a map. Your team teaches what Earth science studies, how maps show position and shape, and how scientists see Earth from far away.

Your lessons

1. What Is Earth Science?

Publisher lesson: your textbook pages. Dr. Ijezie shares the pages in class.

2. Understanding Maps

Publisher lesson: your textbook pages. Dr. Ijezie shares the pages in class.

3. Remote Sensing

Publisher lesson: your textbook pages. Dr. Ijezie shares the pages in class.

Big ideas you will use

- Earth science has branches: geology, oceanography, meteorology, astronomy, and environmental science. Earth works as connected systems.
- Latitude and longitude give an exact position. Map scale links map distance to real distance.
- Contour lines join points at the same height. Close lines mean steep ground.
- Remote sensing measures Earth from far away, for example with satellites.

BUILD IT

Landform in a box, with a map that works

Build a model landform and its topographic map. Classmates must use only your map to find places on the model.

Materials

- A clear plastic tub with a lid
- Modeling clay (a hill with a steep side and a gentle side)
- A ruler and a dry-erase marker
- A cup of water (colour it with food colouring)
- Graph paper for the grid and the map

Your model must show

1. Contour lines drawn at an even contour interval (for example every 1 cm of height).
2. A coordinate grid with labelled rows and columns, like latitude and longitude.
3. A scale bar and a legend.

Build steps

1. Shape a hill with one steep side and one gentle side inside the tub.
2. Add water to 1 cm deep.
3. From above, trace the waterline on the lid with the marker.
4. Add another 1 cm and trace again.
5. Repeat to the top.
6. Copy the traced lines onto graph paper with a grid, a scale bar, and a legend.
7. Mark three secret points on the model (peak, steepest slope, gentlest slope) and write their grid coordinates.

It works when

- A classmate who has never seen the model finds all three points using only your map and coordinates.
- Your contour lines are closest together on the steep side.
- Your scale bar gives a real distance that matches a ruler measurement on the model within 1 cm.

Test it: Run the classmate test twice with two different classmates. Record how many of the three points each one found and how long it took.

Safety: Keep water in the tub. Wipe spills right away.

The Rock Cycle Forge: Investigation 4, Why the third axis exists

1. Open Cross-Section.
2. Under Heat source in the block, press Emplace a pluton.
3. Set both Sample along strike and Section plane along strike to 0 km.
4. Use Depth of the sample and Position across the section to move the sample into the heated halo around the pluton (the aureole).
5. Record the Pluton · contact heating reading.
6. Slide only Section plane along strike to 25 km.
7. Leave Sample along strike alone.
8. Record what the figure shows and what the readout says.
9. Explain why the figure and the readout are both correct.
10. Then explain why one slice can never tell you the size of the body that heated the rock.
11. Read the depth ruler and record the depth of the Moho.

Calculate: Map scale and slope

1. Your map uses a scale of 1 cm = 50 m and a contour interval of 10 m.
2. Two points are 4 cm apart on the map and five contour lines apart.
3. Find the real distance, the height difference, and the slope as $\text{rise} \div \text{run}$.

Self-check: $4 \text{ cm} \times 50 \text{ m} = 200 \text{ m}$; $5 \times 10 \text{ m} = 50 \text{ m}$ of rise; $\text{slope} = 50 \div 200 = 0.25$.

Real data

- **The clay near the surface** · USGS, State Geologic Map Compilation: Beaumont Formation, areas predominantly clay. USGS lists this unit as unconsolidated (loose) clay and silt, mixed and in layers, with beds and lenses of fine sand. It was laid down in flood basins, coastal lakes, and old stream channels on a delta plain. It is 5 to 10 m thick at its north edge and thickens to the south to more than 100 m.
<https://mrdata.usgs.gov/geology/state/sgmc-unit.php?unit=TXQbc%3B0> · Read on 2026-09-23.
- **The layers deeper down** · Texas Water Development Board, Gulf Coast Aquifer. TWDB says the aquifer includes the Jasper, Evangeline, and Chicot aquifers, made of patchy beds of sand, silt, clay, and gravel. The thickness of the fresh-water-filled part averages about 1,000 feet.
<https://www.twdb.texas.gov/groundwater/aquifer/majors/gulf-coast.asp> · Read on 2026-09-23.
- **How deep is the water under campus?** · Texas Water Development Board, Groundwater Data Viewer. Find the well nearest campus. Record its depth, its most recent water-level measurement, and the date of that measurement. Use it for the bottom of your site profile.
<https://www3.twdb.texas.gov/apps/WaterDataInteractive/GroundwaterDataViewer> · Look this up yourself. Record the date you read it.

A choice people make

1. Choosing what a map shows and what it leaves out.

Two options to compare

- A topographic map with contour lines
- A satellite image of the same place

Your map hotspot

1. Mark the steepest slope on your map and your model.

Trap to avoid

A map is a model: it always leaves something out.

TEACH IT

Show your build working, then teach:

1. Earth science studies connected systems: rock, water, air, and life.
2. Coordinates and scale let anyone find a place and a distance.
3. Contour lines show height; close lines mean steep ground; satellites let us map Earth from above.

Check question: On a topographic map, how can you tell where the ground is steepest?

Texas standards

- **ESS.1D** Use appropriate tools such as a drawing compass, magnetic compass, bar magnets, topographical and geological maps, satellite imagery and other remote sensing data, Geographic Information Systems (GIS), Global Positioning System (GPS), hand lenses, and fossil and rock sample kits. §112.49(c)(1)(D) *You use topographic maps, satellite images, and remote sensing as tools.*
- **ESS.9A** Interpret Earth surface features using a variety of methods such as satellite imagery, aerial photography, and topographic and geologic maps using appropriate technologies. §112.49(c)(9)(A) *You interpret surface features using topographic maps and satellite images.*
- **ESS.1G** Develop and use models to represent phenomena, systems, processes, or solutions to engineering problems. §112.49(c)(1)(G) *You build a model landform and a map of it.*
- **6.10A** Differentiate between the biosphere, hydrosphere, atmosphere, and geosphere and identify components of each system. §112.26(b)(10)(A) *Grade 6–8 foundation.*

Word bank: latitude · longitude · map scale · contour line · contour interval · remote sensing

Matter Lab

FOCUS QUESTION

What is water made of, why does it mix with so much, and how can we clean it?

Everything under campus is matter. Your team teaches atoms and ions, how matter combines, and how matter changes state, using water as the example the decks use.

Your lessons

1. Matter — Atoms, Elements, and Ions

Slides: storage.googleapis.com/drijezie-lesson-resources/.../M01-T02-L01 - Matter - Atoms, Elements, and Ions.pdf

2. Combining Matter — Bonds, Reactions, and Solutions

Slides: storage.googleapis.com/drijezie-lesson-resources/.../M01-T02-L02 - Combining Matter - Bonds, Reactions, and Solutions.pdf

3. States of Matter — Particles, Energy, and Phase Change

Slides: storage.googleapis.com/drijezie-lesson-resources/.../M01-T02-L03 - States of Matter - Particles, Energy, and Phase Change.pdf

Also read: Matter and Change Module Launch & Investigation. Its anchor question, how to find and remove harmful substances from drinking water, is your build.

Big ideas you will use

- An element is set by its number of protons. Ions form when atoms gain or lose electrons.
- Atoms join by ionic, covalent, or metallic bonds. Water is polar, so it dissolves many things.
- A mixture can be separated by physical means, such as filtering or evaporating.
- Phase changes absorb or release energy. Evaporation and condensation drive the water cycle.

BUILD IT

Water-cleaning station

Build a two-stage station that turns dirty water into clearer water: a layered filter, then a solar still that uses evaporation and condensation.

Materials

- Two clear plastic bottles (cut one in half to make a funnel)
- Gravel, sand, and a coffee filter or cotton
- Activated charcoal (from a pet store) if available
- A large bowl, a small cup, plastic wrap, and a small pebble
- Muddy water with a pinch of salt
- Red cabbage juice or pH strips to test before and after

Your model must show

1. The filter removes particles (a physical separation of a mixture).
2. The solar still separates water from dissolved salt by a phase change.
3. A before-and-after test with a number: pH or clarity.

Build steps

1. Layer the funnel bottle: cotton or filter, charcoal, sand, gravel.
2. Pour muddy water through.
3. Put the filtered water in the bowl, set the empty cup in the middle, cover with plastic wrap, and put a pebble on top over the cup.
4. Leave it in sunlight.
5. Test the water before, after the filter, and after the still.

It works when

- The filtered water is clearer than the dirty water (you can read print through it that you could not read before).
- The still collects water in the cup. Let one drop from the cup and one drop from the bowl dry on a dark plate: the cup's drop leaves less white salt behind. Never taste lab water.
- You explain which step was a physical change and which was a phase change.

Test it: Run the filter twice and the still once for a full class period. Record volumes in mL, clarity, and pH at each stage.

Safety: Never drink or taste the water. Wear goggles. Wash hands after handling charcoal.

The Rock Cycle Forge: Investigation 1, Two rocks, one magma

1. On The Forge, choose Granite — igneous, felsic under New sample.
2. Then press Melt it.
3. Press Cool it slowly.
4. It sets the Cooling time slider to 50,000 years.
5. Record the Crystal size from the readout.
6. Press Melt it again.
7. Then press Erupt & quench.
8. It cools the same melt in about 5 hours.
9. Record what the Crystal size row says now.
10. Open The Hand Lens.
11. Look at Granite, Basalt, and Obsidian at $\times 10$.
12. Record which one shows no crystals.
13. Write the argument in one sentence: cooling time, not the kind of magma or its temperature, set the grain size.
14. Glass has no grains at all.

Calculate: Mass percent in a formula

1. Find the mass percent of hydrogen in water, H_2O ($\text{H} = 1.008$, $\text{O} = 16.00$), and of oxygen in quartz, SiO_2 ($\text{Si} = 28.09$, $\text{O} = 16.00$).

Self-check: H in water: $2.016 \div 18.016 = 11.2\%$. O in quartz: $32.00 \div 60.09 = 53.3\%$. Each set of percents in a formula adds to 100%.

A choice people make

1. Deciding how to clean drinking water.

Two options to compare

- Filtering through sand and charcoal
- Evaporation and condensation (distillation)

Your map hotspot

1. Mark where the salt stays behind in your still.

Trap to avoid

Clear water is not always clean water: dissolved salt cannot be seen.

TEACH IT

Show your build working, then teach:

1. An element is defined by its protons; ions have gained or lost electrons.
2. Water is polar, so it dissolves many substances; mixtures can be separated physically.
3. Phase changes absorb or release energy, which is how the solar still separates water.

Check question: In the solar still, why is the water in the cup less salty than the water in the bowl?

Texas standards

- **ESS.1G** Develop and use models to represent phenomena, systems, processes, or solutions to engineering problems. §112.49(c)(1)(G) *You build a working model of how matter separates.*
- **ESS.11F** Explain how the transfer of thermal energy among the hydrosphere, lithosphere, and atmosphere influences weather. §112.49(c)(11)(F) *You explain how thermal energy moves water between states.*
- **ESS.9D** Evaluate how weather and human activity affect the location, quality, and supply of available freshwater resources. §112.49(c)(9)(D) *You evaluate how people can improve the quality of freshwater.*
- **7.6C** Distinguish between physical and chemical changes in matter. §112.27(b)(6)(C) *Grade 6–8 foundation.*

Word bank: atom · ion · covalent bond · ionic bond · solution · phase change

Mineral Bench

FOCUS QUESTION

How can you prove what mineral you are holding?

Rocks are made of minerals. Your team teaches what makes something a mineral, how to identify minerals with tests, and why mineral types matter as resources.

Your lessons

1. Minerals — Module Launch & Crystal Investigation

Slides: storage.googleapis.com/drijezie-lesson-resources/.../M01-T03-LAUNCH - Minerals - Module Launch and Crystal Investigation.pdf

2. What Is a Mineral?

Slides: storage.googleapis.com/drijezie-lesson-resources/.../M01-T03-L01 - What Is a Mineral.pdf

3. Types of Minerals — Chemistry, Structure, and Resources

Slides: storage.googleapis.com/drijezie-lesson-resources/.../M01-T03-L02 - Types of Minerals - Chemistry, Structure, and Resources.pdf

Big ideas you will use

- A mineral is naturally formed, solid, inorganic, has a definite chemical make-up, and has an orderly crystal structure.
- Colour is the least reliable property. Streak, hardness, luster, cleavage, and density are better.
- Silicates are the most common group. Their structures range from single tetrahedra to frameworks.
- Some minerals are ores or gems, and mining them has costs and trade-offs.

BUILD IT

Mineral ID station with a working key

Build a testing station and a step-by-step identification key. Classmates use it to identify mystery minerals on their own.

Materials

- An unglazed tile (streak plate), a steel nail, a glass plate, a copper coin
- A magnet and vinegar in a dropper bottle
- A graduated cylinder, water, and a kitchen scale for density
- Four or more labelled mystery samples (for example quartz, calcite, magnetite or hematite, halite)
- Salt or alum and hot tap water to grow crystals

Your model must show

1. At least five tests: streak, hardness, magnetism, fizz, and density.
2. A yes/no key that ends in one mineral name for every sample.
3. Grown crystals that show a regular shape.

Build steps

1. Set up one test per spot, each with a short instruction card.
2. Test every known sample and record the results in a table.
3. Write the key: each step asks one yes/no question that splits the samples.
4. Grow salt or alum crystals from a saturated solution for your teach-back.

It works when

- Two classmates each identify all mystery samples correctly using only your station and key.
- Your density for quartz is within 0.1 g/cm^3 of 2.65 g/cm^3 .
- Every step in your key uses a test, not colour alone.

Test it: Run the classmate test twice. Record each classmate's answers and time, and fix any step in the key that sent someone the wrong way.

Safety: Goggles for vinegar and the nail. Adults handle hot water. Wash hands after handling samples.

The Rock Cycle Forge: Reading rocks at three magnifications

1. Open The Hand Lens.
2. On the Specimen bench, choose Granite.
3. Look at it at $\times 1$, then $\times 10$, then $\times 40$ under Magnification.
4. Record what you can see at each.
5. Choose Basalt, Obsidian, and Sandstone.
6. At $\times 10$, record which show grains you can see and which show tiny grains or glass.
7. Choose Slate, Schist, and Gneiss.
8. Drag the rock (or use the arrow keys) to turn it.
9. Record whether the banding looks like lines (edge-on) or a shiny surface (face-on).
10. Pick one specimen and press Forge this in the simulator.
11. Record the steps the Forge takes to make it.

Calculate: Density, mass percent, and particle size

1. Sample A has a mass of 132.6 g.
2. It raises the water in a cylinder from 20.0 mL to 70.0 mL.
3. Sample B has a mass of 227.4 g.
4. It raises the water from 15.0 mL to 45.0 mL.
5. Find each density in g/cm^3 ($1 \text{ mL} = 1 \text{ cm}^3$).
6. Name each one from the table: quartz 2.65, halite 2.17, fluorite 3.18, corundum 4.02, pyrite 5.02, galena 7.58.
7. Next, find the percent of silicon by mass in quartz, SiO_2 ($\text{Si} = 28.09$, $\text{O} = 16.00$).
8. Last, the $\times 40$ view in The Hand Lens is 1.5 mm wide.
9. How many particles 5 micrometres wide would fit across it?
10. ($1 \text{ mm} = 1,000$ micrometres.) That is the particle size in the TDLR swelling test.

Self-check: Density $\times$ volume must give back the mass. Each density must match only one mineral in the table.

Real data

- **The Mohs hardness scale** · USGS, Gemstones: Mineral Gemstones. USGS lists the ten Mohs minerals: talc 1, gypsum 2, calcite 3, fluorite 4, apatite 5, feldspar 6, quartz 7, topaz 8, sapphire 9, diamond 10. F. Mohs made the scale in 1822. Use it for the hardness column of your bench table.
<https://pubs.usgs.gov/gip/gemstones/mineral.html> · Read on 2026-09-23.
- **How common silicon is** · USGS National Minerals Information Center, Silicon Statistics and Information. USGS says silicon combines with oxygen and other elements to form silicates, and that silicon in the form of silicates makes up more than 25% of Earth's crust. Compare this with your percent of silicon in quartz.
<https://www.usgs.gov/centers/national-minerals-information-center/silicon-statistics-and-information> · Read on 2026-09-23.

A choice people make

1. Mining minerals we use every day.

Two options to compare

- Mining new ore
- Recycling the metals and minerals in used devices

Your map hotspot

1. Mark where each test sits on your station.

Trap to avoid

Colour can fool you: the same mineral comes in many colours.

TEACH IT

Show your build working, then teach:

1. A mineral meets five criteria; glass and coal do not.
2. Test properties such as streak and hardness identify a mineral better than colour.
3. Mineral groups, especially silicates, build Earth's rocks and our resources.

Check question: Why is streak a better clue than colour for identifying a mineral?

Texas standards

- **ESS.1D** Use appropriate tools such as a drawing compass, magnetic compass, bar magnets, topographical and geological maps, satellite imagery and other remote sensing data, Geographic Information Systems (GIS), Global Positioning System (GPS), hand lenses, and fossil and rock sample kits. §112.49(c)(1)(D) *You use tools such as a streak plate, a scale, and a hand lens.*
- **ESS.2C** Use mathematical calculations to assess quantitative relationships in data. §112.49(c)(2)(C) *You calculate density from mass and volume.*
- **ESS.12E** Predict how human use of Texas's naturally occurring resources such as fossil fuels, minerals, soil, solar energy, and wind energy directly and indirectly changes the cycling of matter and energy through Earth's systems. §112.49(c)(12)(E) *You connect mineral types to how people use Texas resources.*
- **6.6B** Investigate the physical properties of matter to distinguish between pure substances, homogeneous mixtures (solutions), and heterogeneous mixtures. §112.26(b)(6)(B) *Grade 6–8 foundation.*

Word bank: mineral · crystal · streak · hardness · density · silicate

Rock Cycle Workshop

FOCUS QUESTION

How can one rock become another, and what clues does each rock keep?

Minerals make rocks, and rocks keep changing. Your team teaches how each rock type forms and shows the changes working in front of the class.

Your lessons

1. Igneous Rocks — From Melting to Crystallization

Slides: storage.googleapis.com/drijezie-lesson-resources/.../M01-T04-L01 - Igneous Rocks - From Melting to Crystallization.pdf

2. Sedimentary Rocks — From Sediment to Stone

Slides: storage.googleapis.com/drijezie-lesson-resources/.../M01-T04-L02 - Sedimentary Rocks - From Sediment to Stone.pdf

3. Metamorphic Rocks — Transformation Without Melting

Slides: storage.googleapis.com/drijezie-lesson-resources/.../M01-T04-L03 - Metamorphic Rocks - Transformation Without Melting.pdf

Big ideas you will use

- Igneous rock forms when melted rock cools. Slow cooling makes big crystals; fast cooling makes small crystals or glass.
- Sedimentary rock forms when sediment is laid down, compacted, and cemented. Layers and fossils are clues.
- Metamorphic rock forms when heat and pressure change a rock without melting it. Pressure lines minerals up into bands (foliation).
- The rock cycle is a network: any rock can become any other.

BUILD IT

Rock-cycle demonstration bench

Build three working stations that make each rock type's key process happen in front of the class.

Materials

- Igneous: salt or alum solution in two cups, one cooled in a fridge and one at room temperature, and a hand lens
- Sedimentary: a tall clear bottle with water and mixed gravel, sand, and soil; sand plus white glue in a paper cup
- Metamorphic: several colours of modeling clay mixed with small flat flakes (glitter or paper bits) and two books to press it
- A ruler and a timer

Your model must show

1. Cooling rate changes crystal size (igneous).
2. Sediment settles in graded layers and can be cemented into a solid (sedimentary).
3. Pressure lines up flat flakes into bands without melting (metamorphic).

Build steps

1. Igneous: split a warm saturated solution into two cups; cool one fast and one slowly; compare crystal sizes after a day.
2. Sedimentary: shake the bottle and time how the layers settle; make 'sandstone' by mixing sand and glue and letting it dry.
3. Metamorphic: roll clay with flakes into a ball, then press it flat under the books; cut it and look at the flakes.
4. Label each station with its lesson and the rock it models.

It works when

- The slowly cooled cup has bigger crystals than the fast-cooled cup.
- The bottle settles into layers with the biggest grains at the bottom, and the glued sand holds together.
- The pressed clay shows flakes lined up in bands that the unpressed ball does not show.

Test it: Run each station twice. Record crystal sizes in mm, settling times in seconds, layer thicknesses in mm, and a photo of each result.

Safety: Adults handle hot water. Keep glue off skin. Wipe spills right away.

The Rock Cycle Forge: Investigation 3, The cycle is a network

1. On The Forge, choose Granite — igneous, felsic under New sample.
2. Reach metamorphic the long way: Weather & erode, then Bury & cement, then Bury & squeeze.
3. Choose Granite — igneous, felsic under New sample again. (Reset sample only moves the rock back to the surface. It does not change the rock type.)
4. Reach metamorphic the direct way: press Bury & squeeze once.
5. Compare the two paths on The P–T Map and the arrows lit on the network.
6. Use the network to name a process chain from loose sediment to magma.
7. Check its length against the shortest-path rule in the Practice Blueprint on the module page.
8. In Field Challenges, finish Demolition crew: turn coarse igneous rock into sedimentary rock with no melting.

Calculate: Pressure from depth: $P = \rho \times g \times h$

1. Find the pressure at 5, 10, 20, and 30 km below the surface for crust with density $\rho = 2,800 \text{ kg/m}^3$ and $g = 9.8 \text{ m/s}^2$.
2. Change each depth to metres first.
3. Give each answer in megapascals (1 MPa = 1,000,000 Pa) and in kilobars (100 MPa = 1 kbar).
4. Compare your answers with the pressure the Forge shows.

Self-check: Pressure divided by depth is the same every time: about 27.4 MPa, or 0.274 kbar, per kilometre.

Real data

- **Texas metamorphic rock: the Llano region** · Bureau of Economic Geology, The University of Texas at Austin: Precambrian Rocks of the Southeastern Llano Region, Texas. The Bureau reports that rocks in Central Texas went through one episode of regional metamorphism about 1,050 million years ago. The Valley Spring Gneiss is mostly quartz-feldspar gneiss. The Packsaddle Schist includes marble and mica schist. The Llano Supergroup, which holds both, is more than 28,000 ft (8,400 m) thick.

<https://www.beg.utexas.edu/publications/precambrian-rocks-southeastern-llano-region-texas> · Read on 2026-09-23.

A choice people make

1. Using rock as a building resource.

Two options to compare

- Quarrying new stone
- Reusing crushed concrete and stone

Your map hotspot

1. Mark where each rock type would form in a cross-section of Texas.

Trap to avoid

Metamorphism is not melting: the rock stays solid.

TEACH IT

Show your build working, then teach:

1. Cooling rate sets crystal size in igneous rock.
2. Sediment is deposited, compacted, and cemented into sedimentary rock, in layers.
3. Heat and pressure change rock without melting it; pressure makes bands.

Check question: Why does a slowly cooled rock like granite have bigger crystals than basalt?

Texas standards

- **ESS.8A** Evaluate heat transfer through Earth's systems by convection and conduction and include its role in plate tectonics and volcanism. §112.49(c)(8)(A) *You explain how rocks form and change through Earth processes.*
- **ESS.9C** Model the processes of mass wasting, erosion, and deposition by water, wind, ice, glaciation, gravity, and volcanism in constantly reshaping Earth's surface. §112.49(c)(9)(C) *You model erosion and deposition that make sedimentary layers.*
- **ESS.16** Develop and use models to represent phenomena, systems, processes, or solutions to engineering problems. §112.49(c)(1)(G) *You build working models of three rock-forming processes.*
- **6.10C** Describe how metamorphic, igneous, and sedimentary rocks form and change through geologic processes in the rock cycle. §112.26(b)(10)(C) *Grade 6–8 foundation.*

Word bank: igneous · sedimentary · metamorphic · crystal size · compaction · foliation

Day 7: teach, learn, decide

Teach-back day. Every team teaches its three lessons, so everyone leaves knowing all eleven.

ABOUT 40 MINUTES

Teach-back lessons

Each team teaches for ten minutes: two minutes showing the build working, then each lesson lead teaches their lesson with the build and asks one check question. Every visitor writes an answer.

ABOUT 7 MINUTES

Council

Mixed groups answer the driving question using evidence from all four teams.

ABOUT 8 MINUTES

On your own

Exit ticket, then turn in your group note and do the partner review.

Your learning notes, for every team's lesson

- Team and lessons
- What the build showed
- Key idea from each lesson
- My answers to their check questions
- A question I still have

SCORING

The rubric

One rubric for every ESS team project. Your team is scored together on the first four rows; the last row is scored for you alone. Read it before you start and check your work against it before teach-back day.

STRAND	4 • EXEMPLARY	3 • PROFICIENT	2 • DEVELOPING	1 • BEGINNING
Lesson science Content accuracy across all your lessons • 25% • team	Every lesson is correct and complete, uses the right vocabulary, and connects to the other lessons and the driving question.	Every lesson is correct, with key ideas and vocabulary.	One lesson has errors or gaps, or the ideas are listed without explanation.	Lessons are missing or mostly wrong.
The build works Function, testing, and photos • 25% • team	The build passes every 'It works when' test at least twice, the results have units, one fix improved it, and clear approved photos show it.	The build passes its tests, with recorded results and photos.	The build works only partly, or the tests are not recorded.	The build does not work or was not tested.
Teaching the class Teach-back and check questions • 20% • team	Each lesson lead teaches clearly with the build; most classmates answer the check questions correctly; timing is right.	Every lesson is taught with the build, and check questions are asked.	Some lessons are rushed or taught without the build.	The lesson is missing or unclear.
Group note Note Studio group note and evidence • 20% • team	Every section is complete, data has units and sources, the claim matches the evidence, and it names one limit of the build.	Every section is complete, with data and a claim.	Some sections are thin or missing.	The note is mostly empty.
My contribution Individual work, partner and teacher ratings • 10% • each scholar	You led your lesson well, did your role on time, and made a teammate's work better. Your contribution section, partner ratings, and teacher rating agree.	You led your lesson and did your role on time.	Your part was late or only partly done.	Little evidence of your part.

The first four rows are scored for the team. My contribution, your learning notes, and your exit ticket are scored for you alone.

ON YOUR OWN

Exit ticket

1. Pick a lesson another team taught. Explain its main idea in two or three sentences.
2. Name one test from another team's build and what it proved.
3. Name the part of your team's work you did yourself, and one thing you would rebuild.

Sentence starters

- *Our team claims that ____ because ____.*
- *We observed _____. From that we infer _____.*
- *The evidence that supports this is _____, which shows _____.*
- *In the Forge, when we changed _____, the _____ changed from _____ to _____.*
- *The data came from _____, and we read it on _____.*
- *One limit of our model is _____.*
- *Explanation _____ fits the evidence better, because _____.*
- *I agree with _____ because _____. I would add _____.*
- *I have a different idea. The evidence _____ suggests _____.*
- *Can you explain how _____ connects to _____?*

Supports you can use

- Every packet has a word bank. Look up any word in the Ascent Lexicon.
- You may draft in the language you think in best and then write the final version in English.
- Use the sentence starters above in your claim, your lesson, and the council.
- The teach-back lesson can be split between teammates, and it can use the slide's pictures and numbers as notes.
- Ask your teacher for a printed packet, a larger-print copy, or extra time on any checkpoint.

STANDARDS

Standards for the whole project

These are selected connections to the Texas standards for Earth Systems Science (19 TAC §112.49), not a claim that this project fully covers each one. No engineering-design (HS-ETS) standard is claimed.

- **ESS.3B** Communicate explanations and solutions individually and collaboratively in a variety of settings and formats. §112.49(c)(3)(B) *Every team teaches its lessons to the class and explains its build.*
- **ESS.3C** Engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence. §112.49(c)(3)(C) *The council argues from evidence across all four teams.*

SOURCES

Where the numbers come from

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13. USDA Natural Resources Conservation Service. Web Soil Survey. <https://websoilsurvey.nrcs.usda.gov/app/> (live data)