What's Included?

Unit Planning

- NGSS and APES Standards document
- Unit Pacing Guide for 50 min classes
- Differentiation ideas for honors students and virtual students ***Digital links for virtual learning found here**
- Honors assignment list

Notes

- Unit 2 PowerPoint (39 slides)
  - Minerals & Mining
  - Soil Composition & Conservation
- Cornell Notes Pages (4 pgs)
- Doodle Notes Pages (2 pgs)
  - Guide to Using Doodle Notes
  - Doodle Note Keys & Examples
- Web-quest (6 pgs) *Can be used as an alternative to notes

Activities

- Mineral Identification Lab (3 pgs)
- Mineral Social Media Profile Activity (3 pgs)
- Types of Rocks Jigsaw Activity (7 pgs + 32 slides)
- Edible Mining Simulation (6 pgs)
- Mining Impact Research (3 pgs)
- Soil Analysis Lab (5 pgs)
- Global Soil Profiles Research* (3 pgs)
- Soil Erosion STEM Activity (8 pgs)
- Answer Keys for all activities

Extensions

- Digging Deeper: The Mining Process (2 pgs)
- Dimensional Analysis: Coal Mining* (3 pgs)
- Digging Deeper: The Smell of Soil (1 pg)
- Digging Deeper: Porosity v. Permeability (1 pg)
- Digging Deeper: Saving the Soil (1 pg)
- Data Analysis: Soil Erosion* (1 pg)
- Answer Keys for all Extensions

*Honors Options

Student Pages

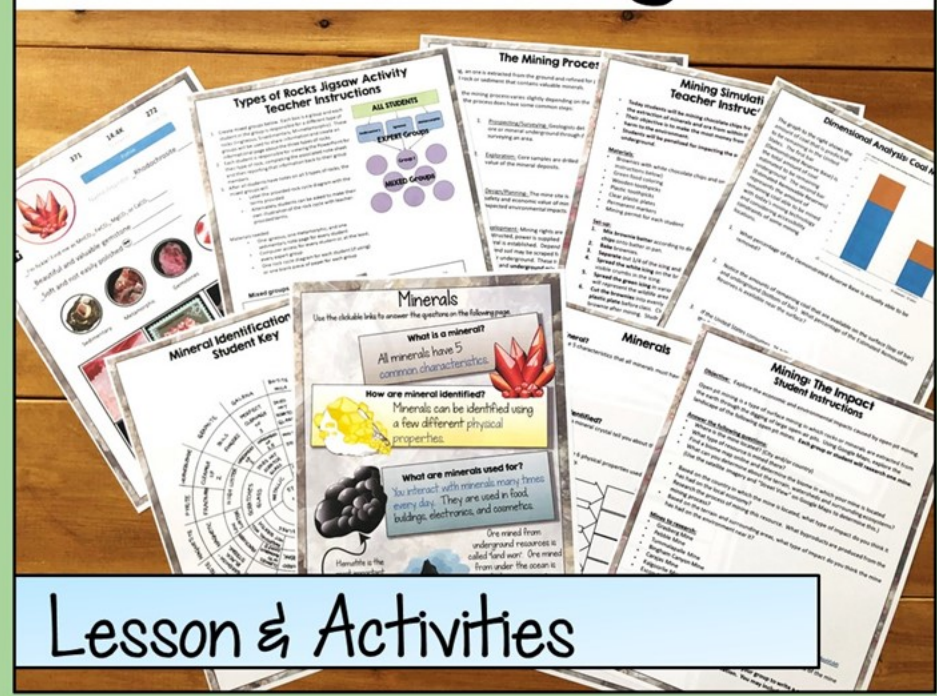
- This folder contains duplicate copies of every student page. They are in order according to the pacing guide for QUICK PHOTOCOPYING if you are using the pacing guide as is.

Review and Assessment

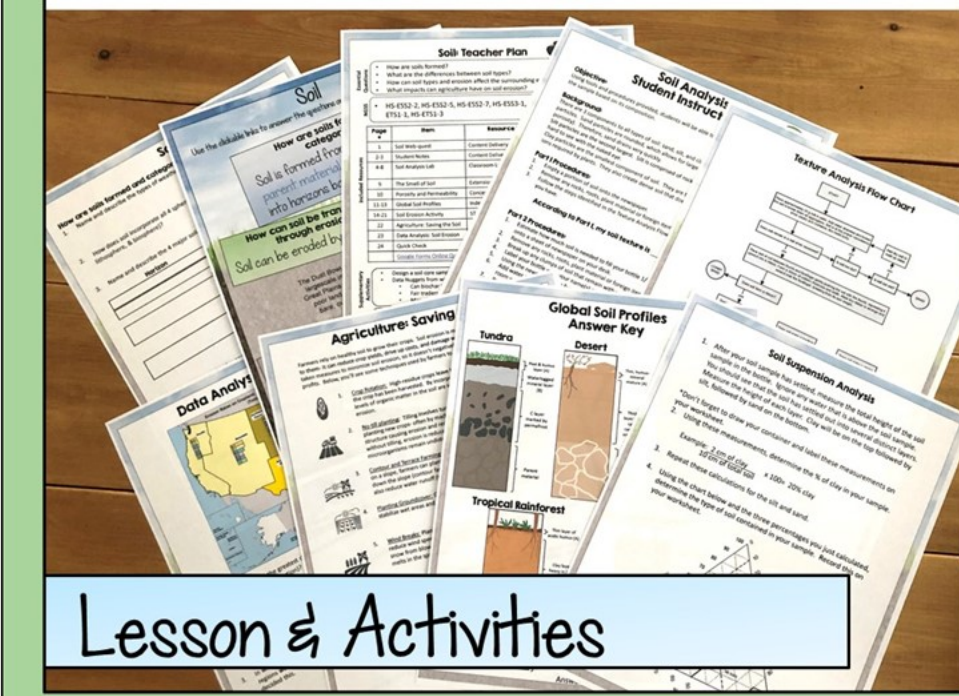
- Quick Check: Effects of Soil Erosion (1 pg)
- Minerals, Rocks, & Mining Quiz through Google Forms
- Soil Composition & Erosion Quiz through Google Forms
- Editable Task Card Review (26 cards) with answer sheet
- Minerals, Rocks, & Soil Test (paper)- both Honors and Regular versions with answer sheets

Includes the following individual lessons which were previously available separately in my store:

Rocks, Minerals, & Mining



Soil Composition & Erosion

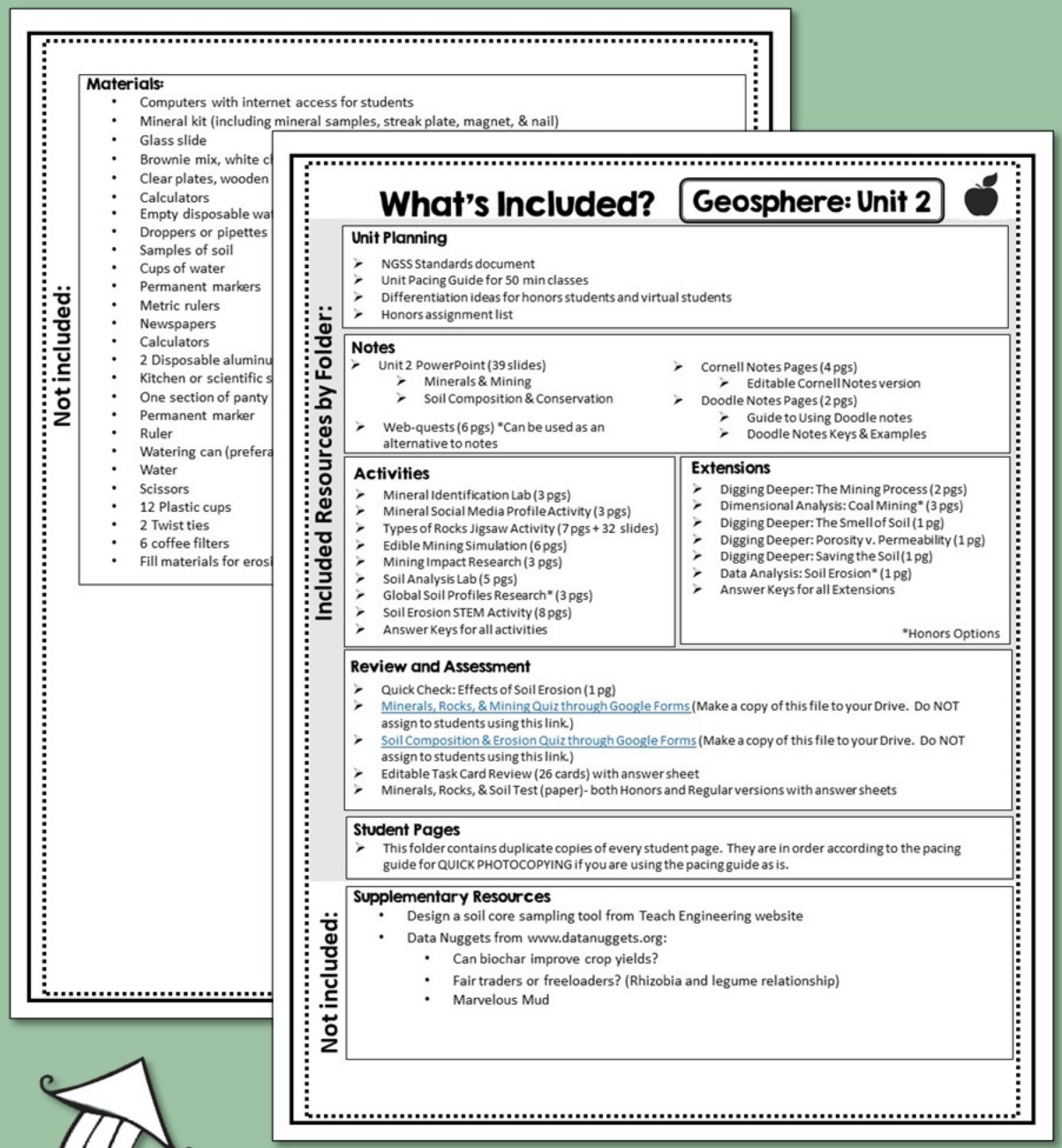


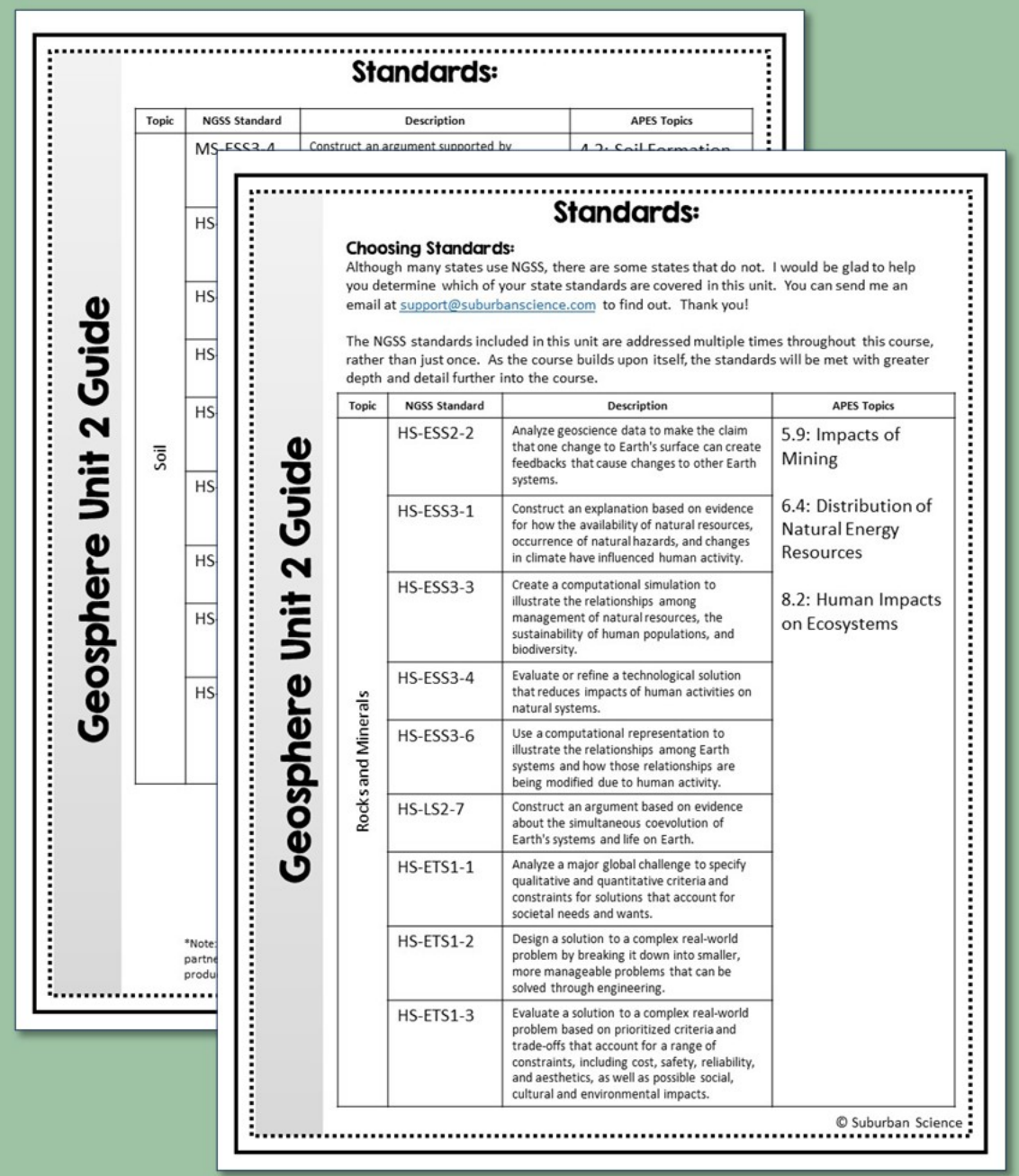
If you've already purchased either of these individual lessons, please contact me at support@suburbanscience.com for a discount on this unit.

Unit Planning

NGSS and APES Standards Document

If you have specific state standards, contact me by email (support@suburbanscience.com) and I'll help you figure out which ones are covered!





Unit Overview Page

plus

Supplementary Resource Ideas

and **Materials Lists**

Editable Pacing Guides

Geosphere Unit 2 Pacing Guide

50 min classes

	Day	Instruct	Assess	Homework
Rocks & Minerals	1	• Unit 2 PPT (Sections 1 & 2) • **Cornell Notes** (Minerals & Mining) (Option 2: Use Minerals web-quest instead of PPT & Cornell Notes. Find web-quest links in "Differentiation Guide" within the "Unit Planning" folder or use PDF from Notes folder.)	• Informal questioning during PPT • Cornell notes summary	
	2	• Complete **Mineral Identification Lab**. Each student (or group) will need one **Student Page** and each group will need one **Student Key**. Materials: mineral kit (see teacher instructions on lab for details), glass slide	• Informal questioning while students work on lab • Informal check of accuracy of specimen identification when finished.	
	3	• Students research and create **Mineral Profile** (copy both research & profile page). Provide example, if necessary. Materials: computers or devices with internet access, colored pencils or markers • Read and complete **Rocks: An Overview**.	• Informal check of student progress during research • Informal check of understanding based on accuracy of mineral profile page	<u>All</u>: Finish Mineral Profile if necessary
	4	• Divide students into groups and complete **Types of Rocks Jigsaw Activity.** Also copy **Types of Rocks Jigsaw Notes.** Materials: computers or devices with internet access, colored pencils or markers	• Informal check of progress and participation during group work • Informal check of note pages completion	
	5	• Finish activity from yesterday in groups by completing the **Rock Cycle Diagram** (coloring optional). Check answers as a class. • As a class, read over **Digging Deeper: The Mining Process**.	• Informal check of student understanding from accuracy of Rock Cycle Diagram.	

Coincide with NGSS document in Unit Planning Folder

*__Bold items__ must be photocopied.

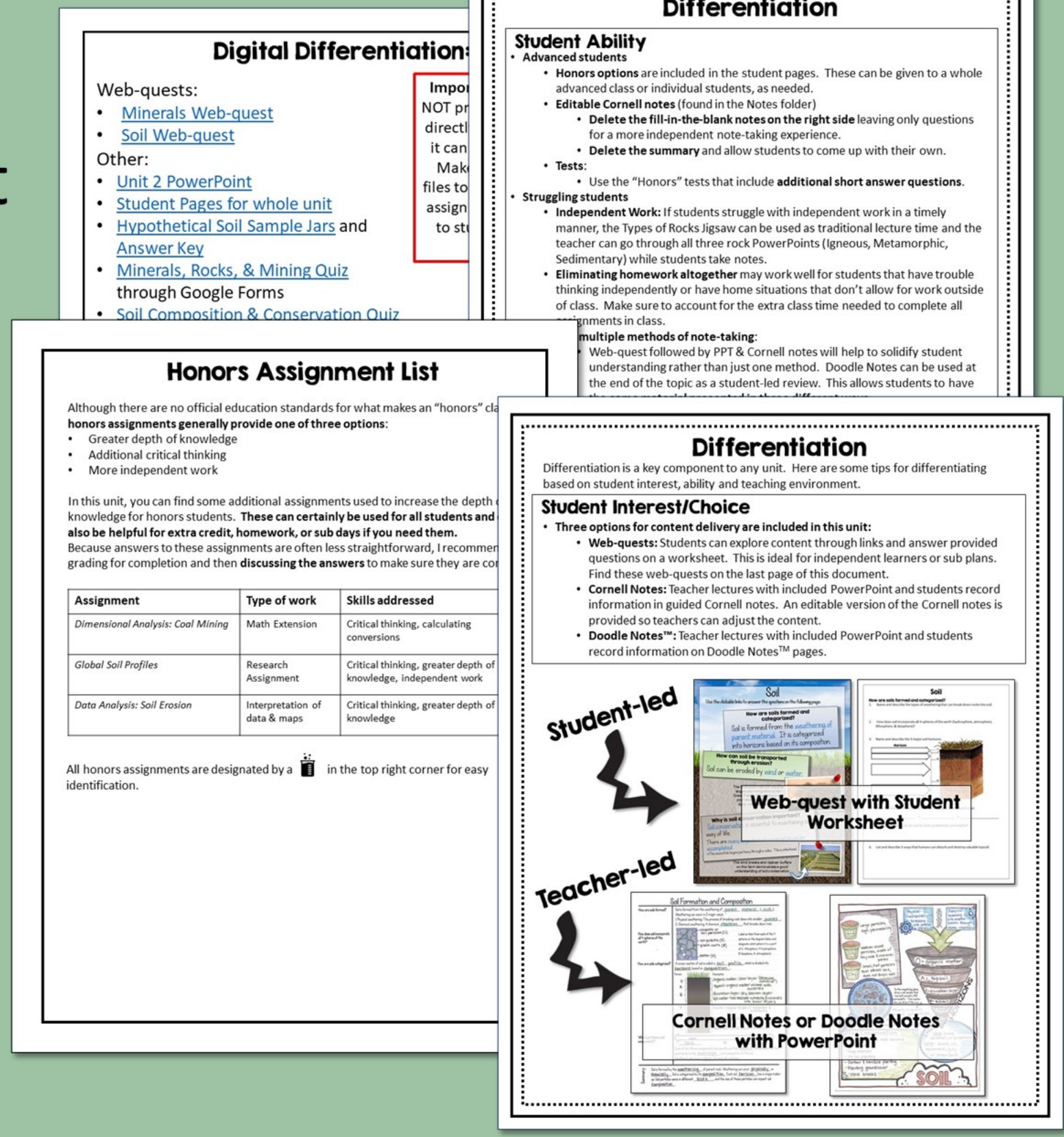
This icon is found on the top right corner of Honors pages for easy identification.

The daily topics coincide with the previous standards document.

Lesson planning is now quick and easy!

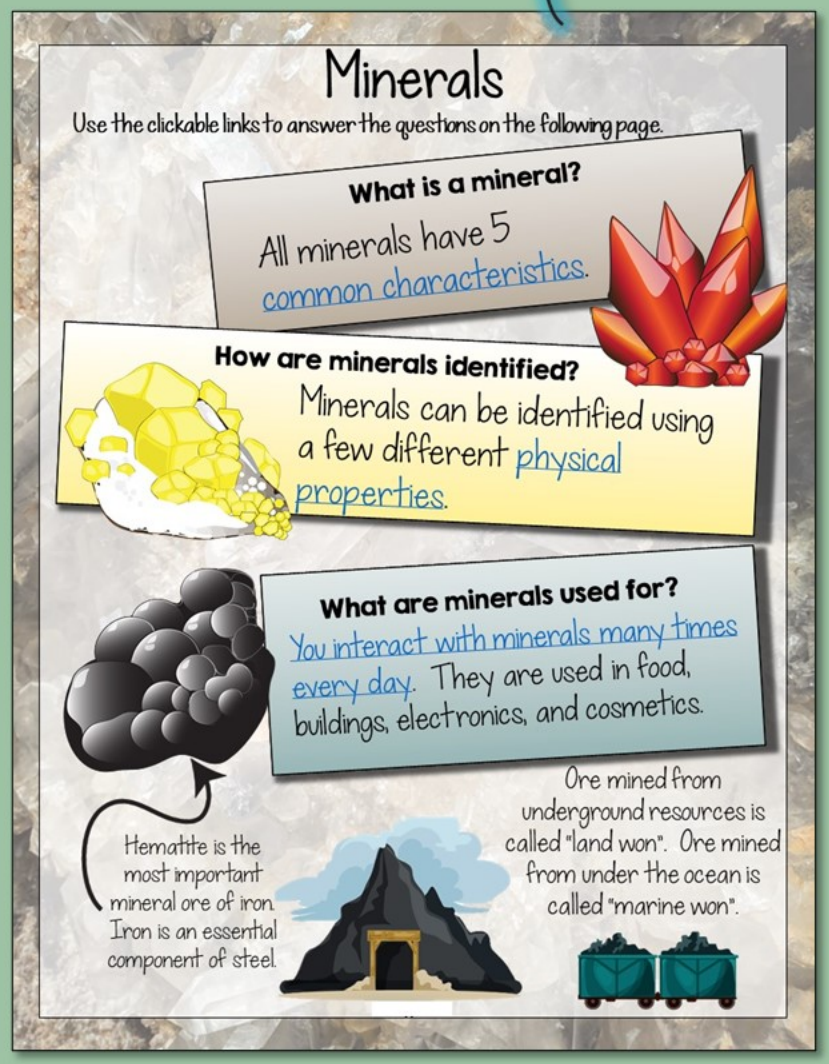
Differentiation Ideas for:

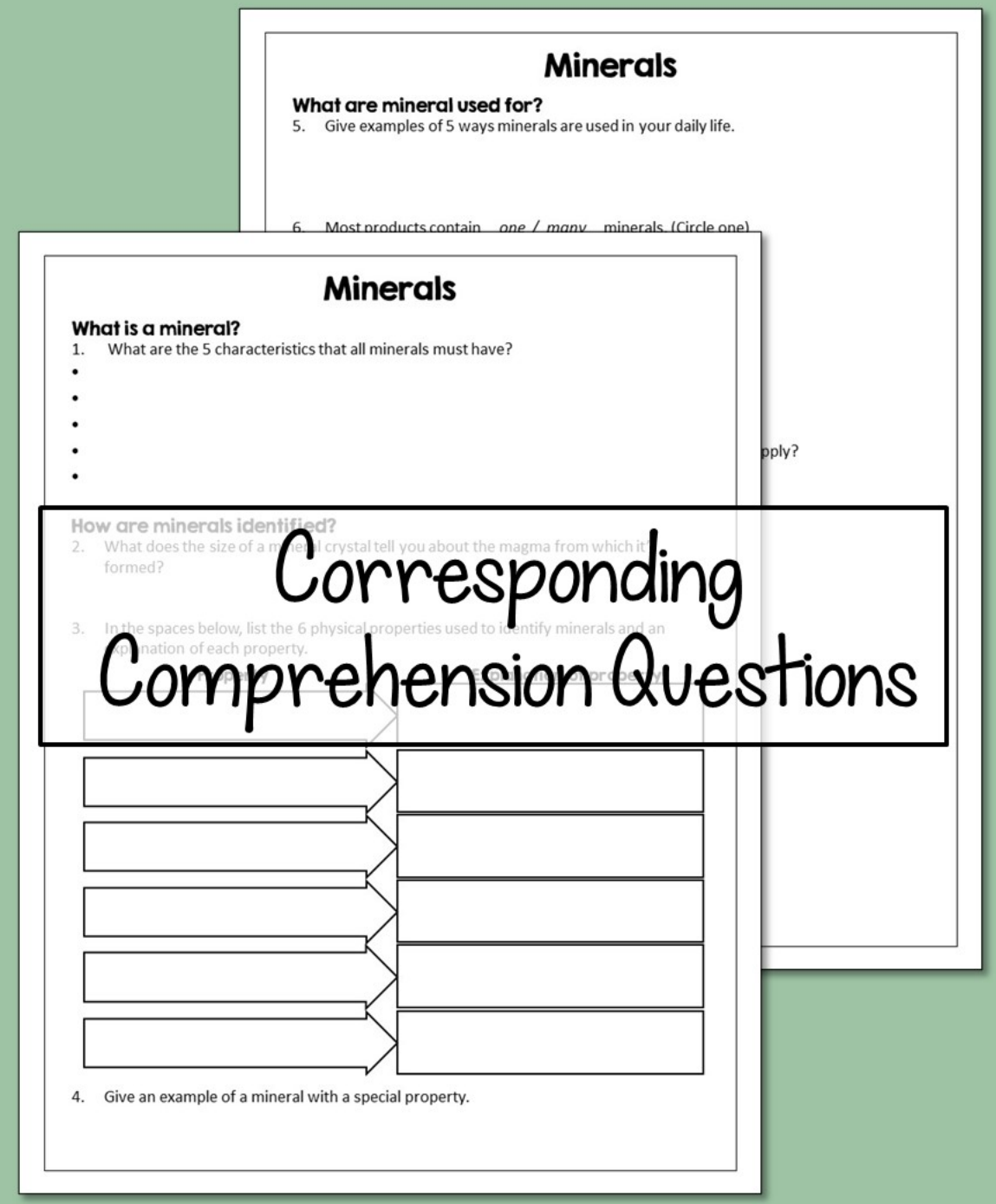
- Student Interest
- Student Ability
- Teaching Pace
- Teaching Environment (Virtual, in-class, or hybrid)



Content Delivery Option I: Student Webquest

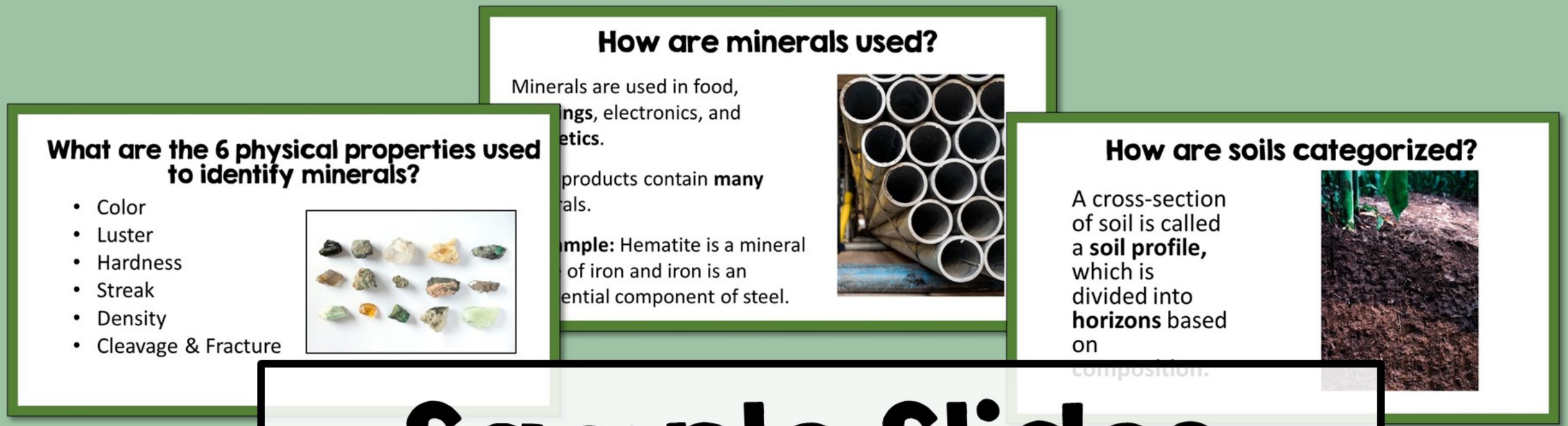
Live video links for independent learning on any device!



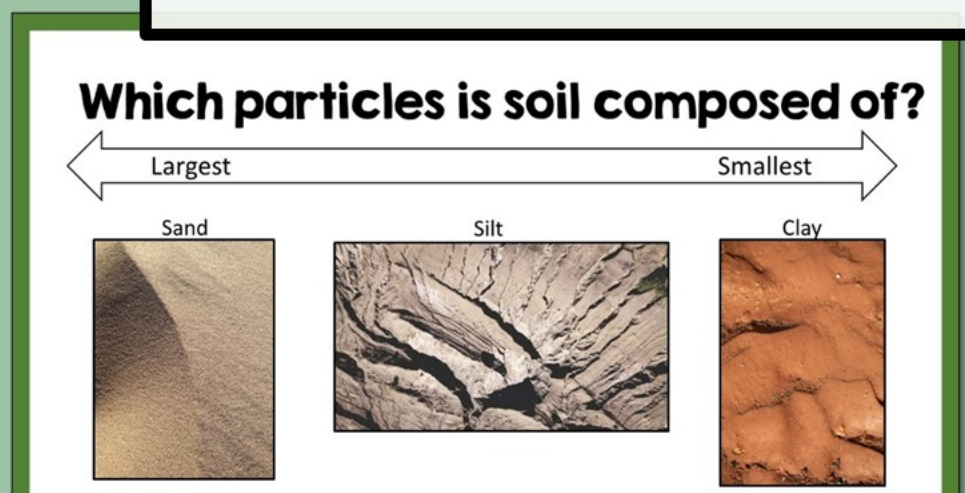


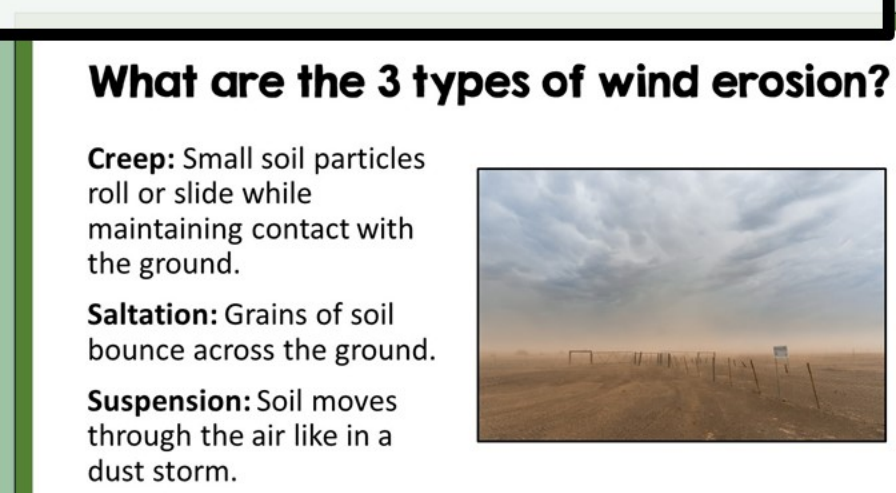
Content Delivery Option 2: PowerPoint Presentation

39 **editable**, fully-animated slides



Sample Slides

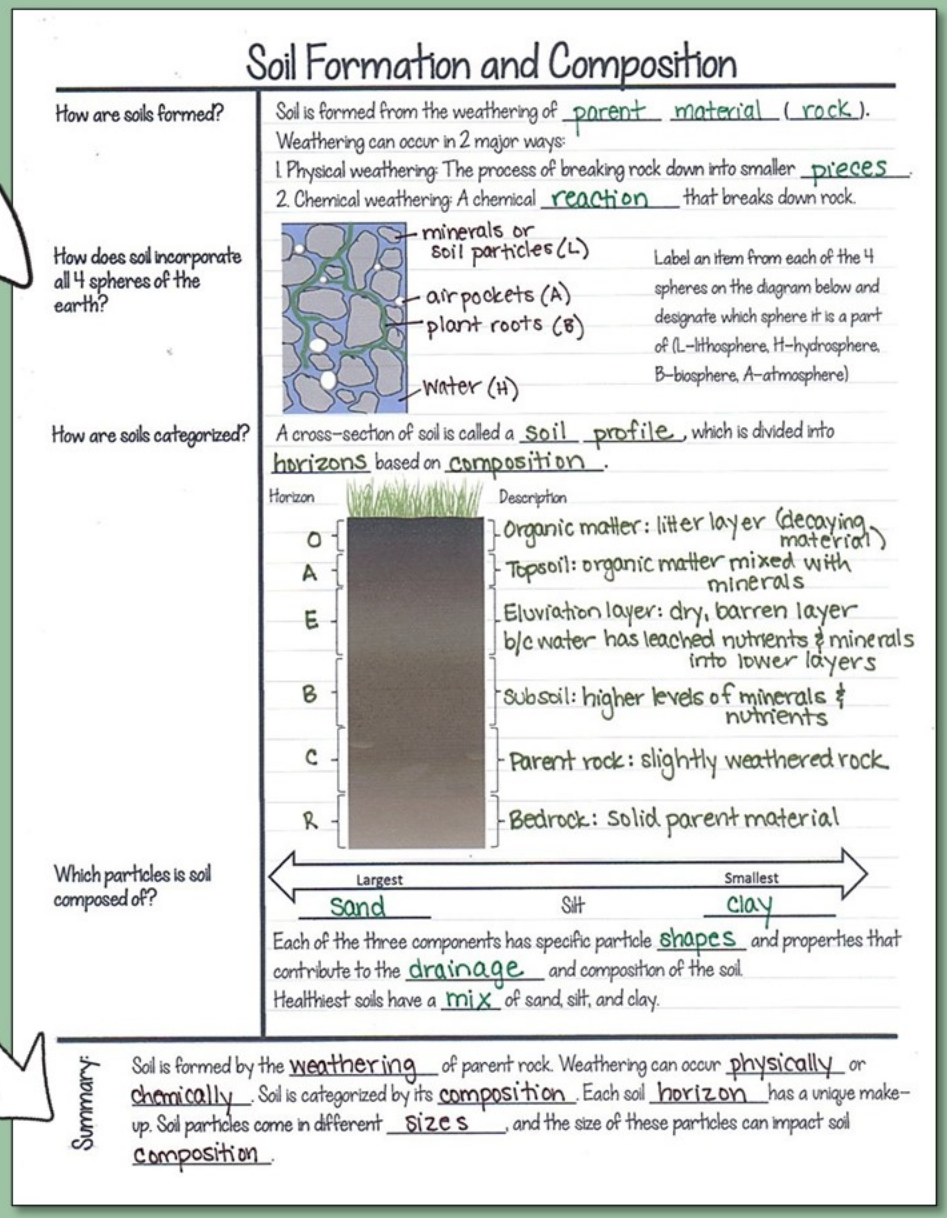


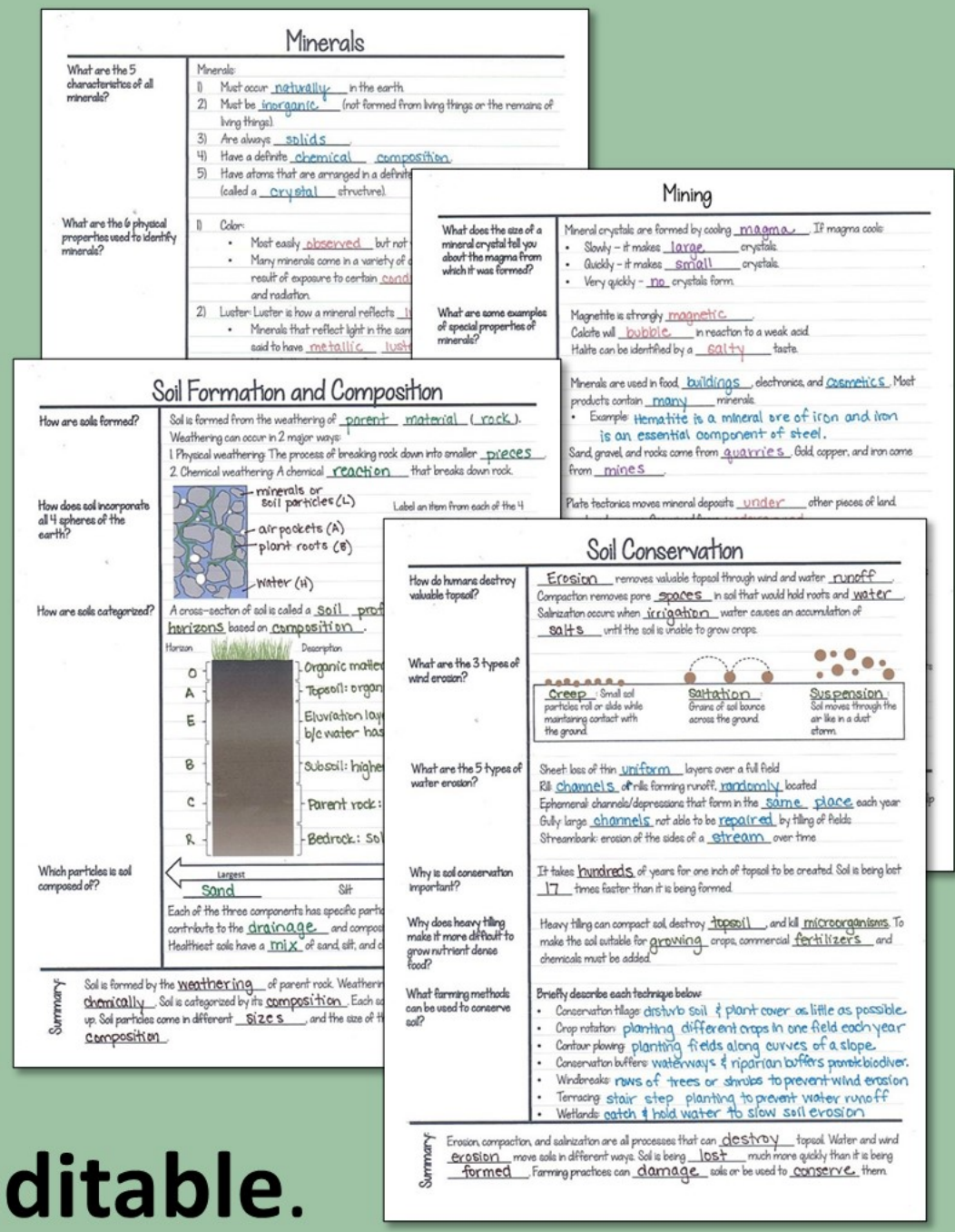


4 pages of Cornell Notes

Big concept questions

Content summary for each page



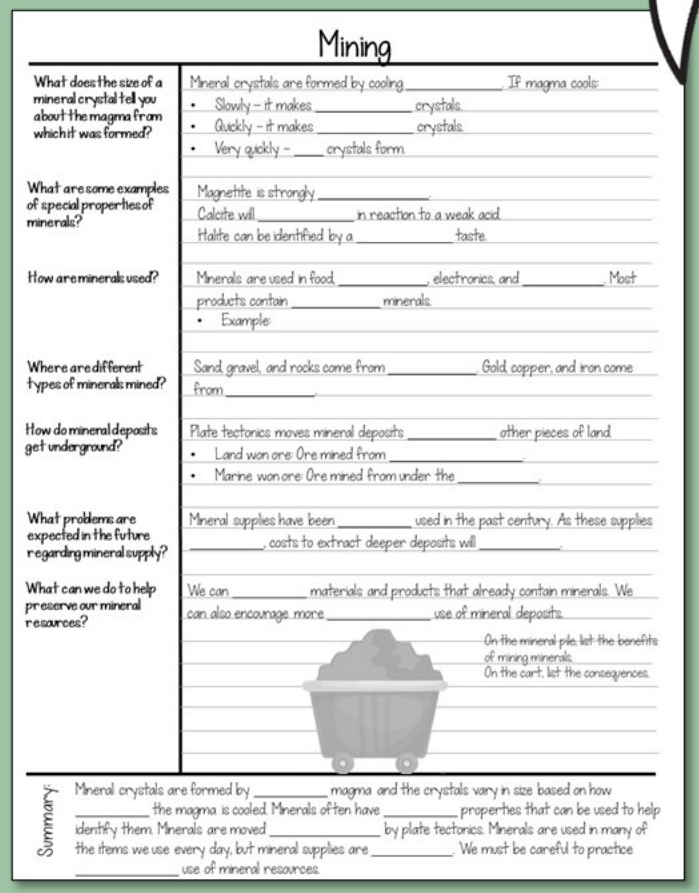


Each page is **editable**.

Add and delete text, questions, and summaries to meet the needs of your students.

Every student page also comes in a digital version on Google Slides

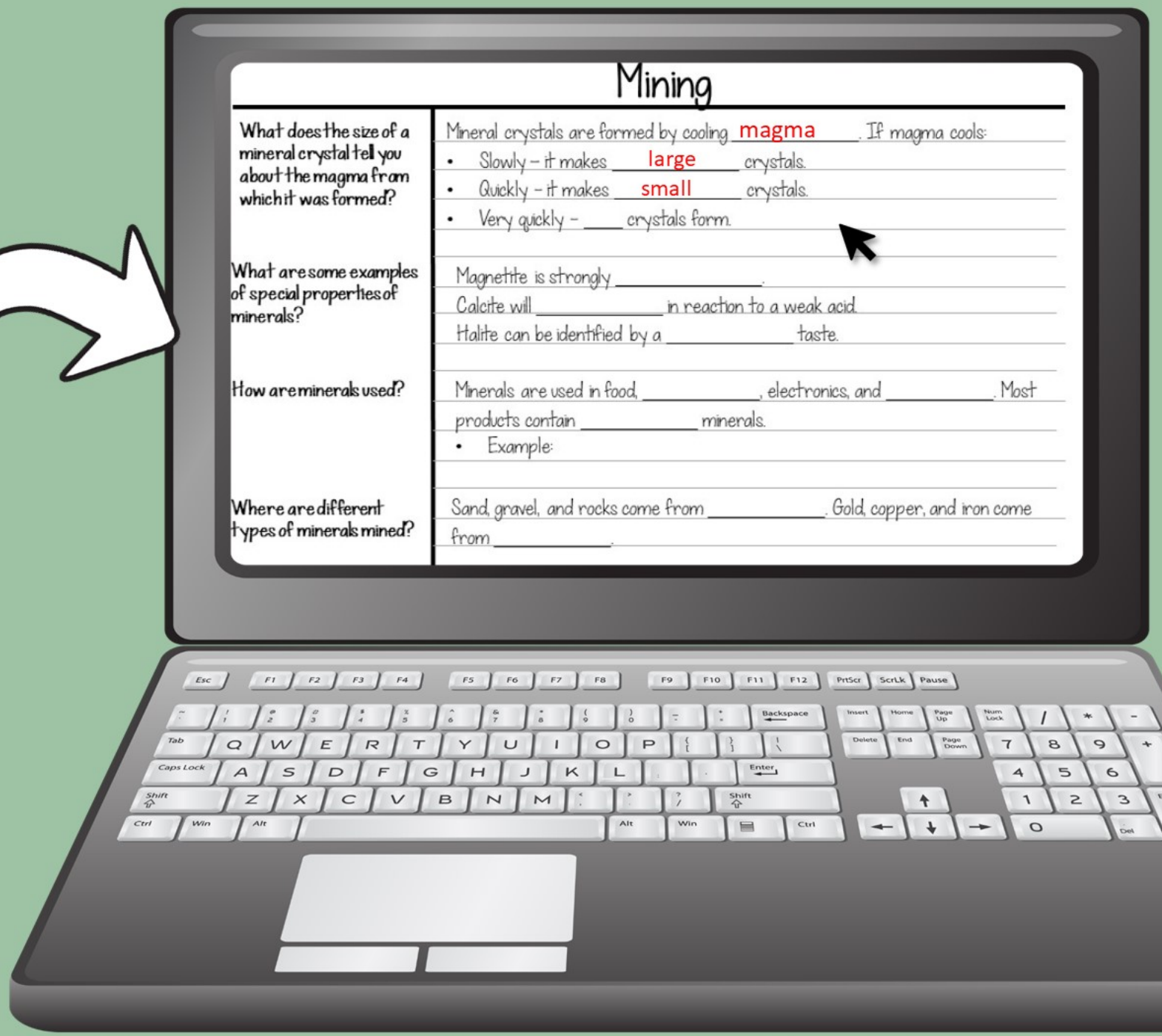
Virtual, hybrid, or absent students can stay right on track!



Mining

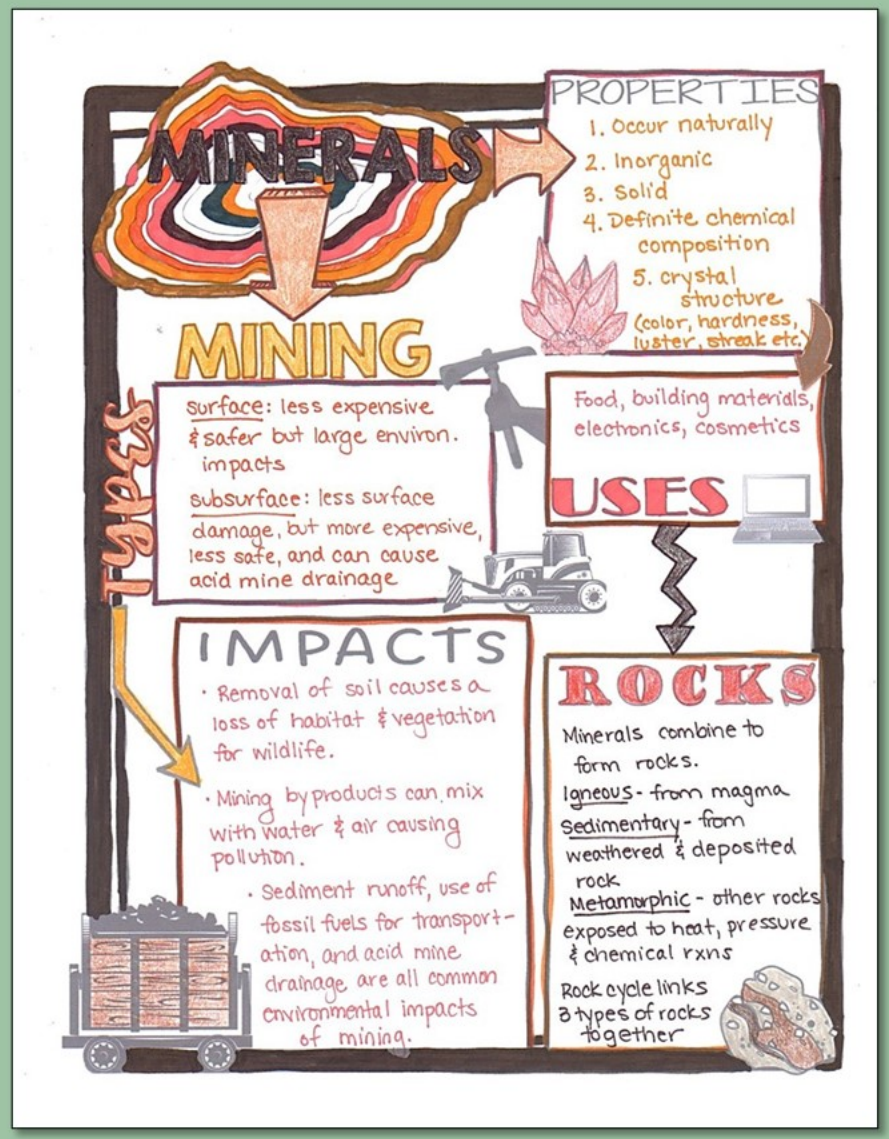
What does the size of a mineral crystal tell you about the magma from which it was formed?	Mineral crystals are formed by cooling _____. If magma cools: • Slowly – it makes _____ crystals. • Quickly – it makes _____ crystals. • Very quickly – ____ crystals form.
What are some examples of special properties of minerals?	Magnetite is strongly _____. Calcite will _____ in reaction to a weak acid. Halite can be identified by a _____ taste.
How are minerals used?	Minerals are used in food, _____, electronics, and _____. Most products contain _____ minerals. • Example:
Where are different types of minerals mined?	Sand, gravel, and rocks come from _____. Gold, copper, and iron come from _____.
How do mineral deposits get underground?	Plate tectonics moves mineral deposits _____ other pieces of land. • Land won ore: Ore mined from _____. • Marine won ore: Ore mined from under the _____.
What problems are expected in the future regarding mineral supply?	Mineral supplies have been _____ used in the past century. As these supplies _____, costs to extract deeper deposits will _____.
What can we do to help preserve our mineral resources?	We can _____ materials and products that already contain minerals. We can also encourage more _____ use of mineral deposits. On the mineral pile, list the benefits of mining minerals. On the cart, list the consequences.

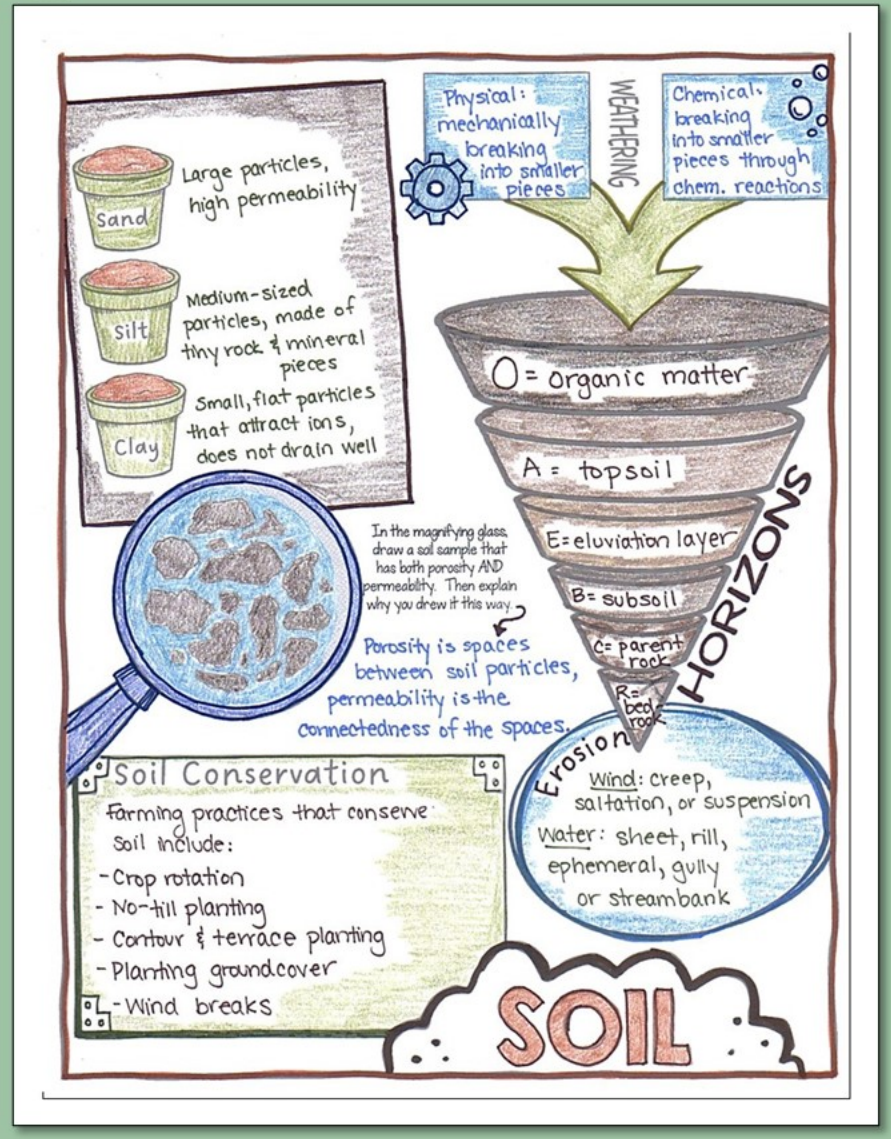
Summary: Mineral crystals are formed by _____ magma and the crystals vary in size based on how _____ the magma is cooled. Minerals often have _____ properties that can be used to help identify them. Minerals are moved _____ by plate tectonics. Minerals are used in many of the items we use every day, but mineral supplies are _____. We must be careful to practice _____ use of mineral resources.



Can be used in Google Classroom, Microsoft OneDrive or many other platforms!

2 pages of Doodle Notes for Summarizing & Review



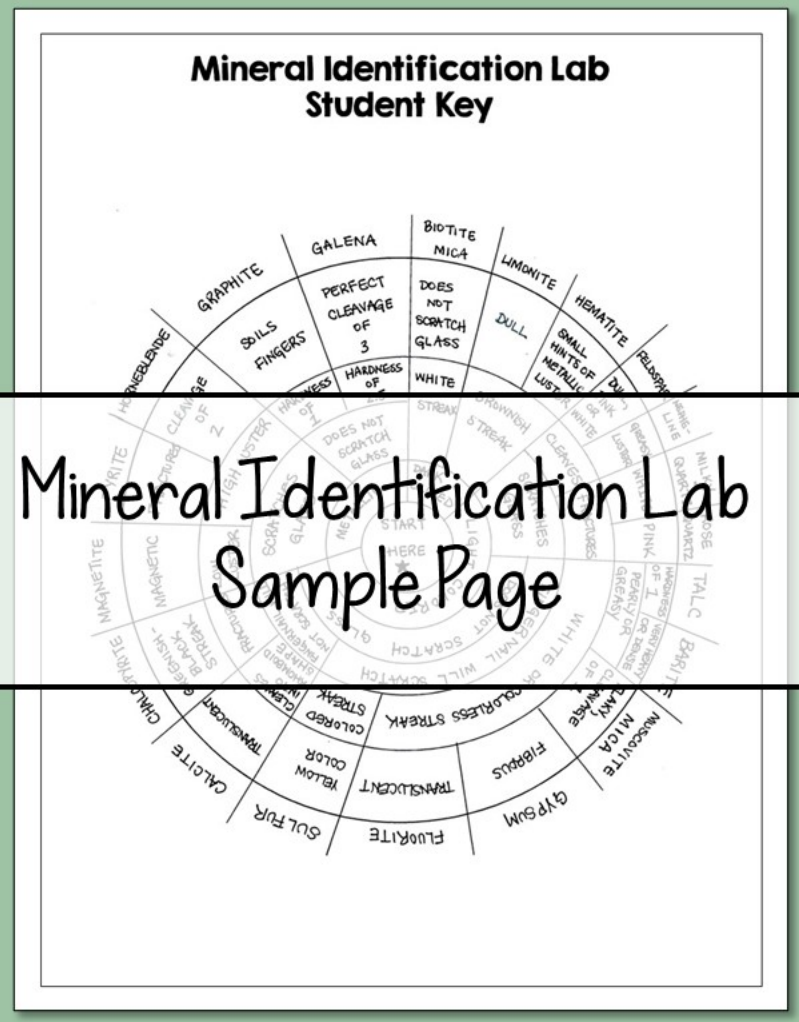


Doodle Notes™ increase student focus and memory- and they're great fun!

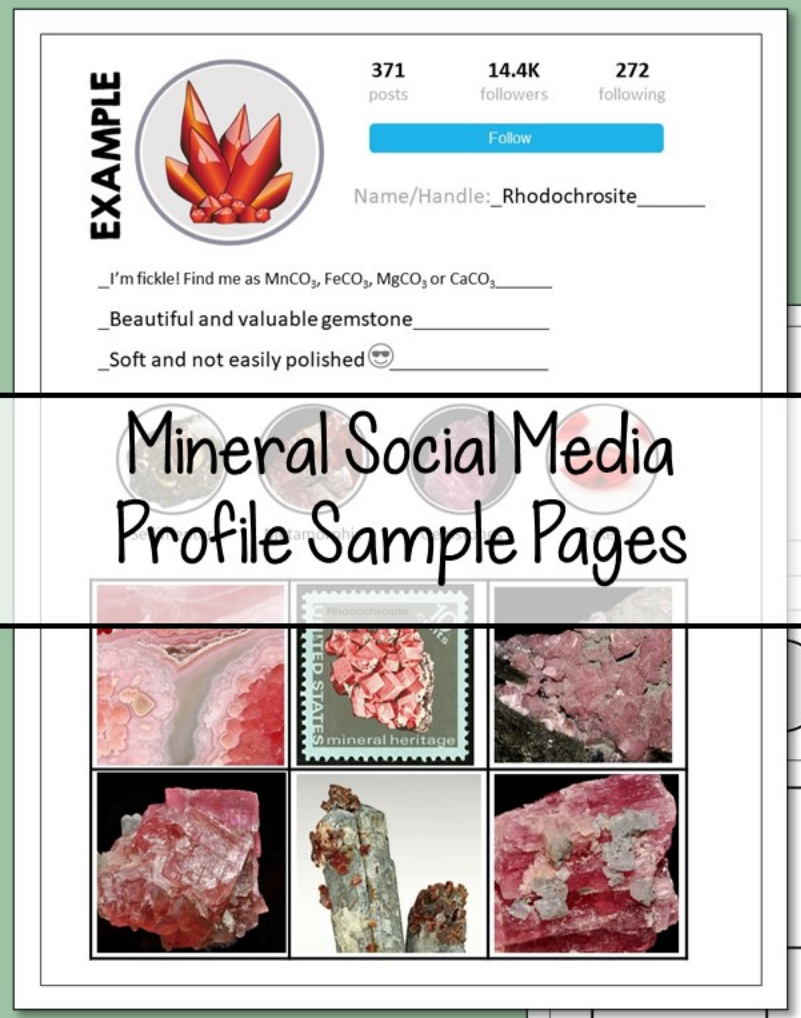
A guide for using them in your classroom is included.

Includes 8 Activities

- Mineral Identification Lab
- Mineral Social Media Profile
- Type of Rocks Jigsaw Activity
- Edible Mining Simulation
- Soil Analysis Lab
- Global Soil Profiles Research
- Mining Impact Research
- Soil Erosion STEM Activity



Mineral Identification Lab Sample Page



Mineral Social Media Profile Sample Pages

Rocks Jigsaw Activity Sample Pages

Edible Mining Simulation Sample Pages

Mining Impact Research Activity Sample Page

Types of Rocks Jigsaw Activity Teacher Instructions

1. Create mixed groups below. Each box is a group and each student in the group is responsible for a different type of rocks (I=igneous, S=sedimentary, M=metamorphic). These groups will be used to share information and create an informational page about the rock cycle.
2. Each student is responsible for viewing the PowerPoint for their type of rock, completing the associated note-sheet and then reporting that information back to their group members.
3. After all students have notes on all 3 types mixed groups will
   - Label the provided rock cycle diagr terms provided
   - Alternately, students can be asked own illustration of the rock cycle w provided terms.

ALL STUDENTS

Sedimentary | Igneous | Metamorphic

EXPERT Groups

Materials needed:

- One igneous, one metamorphic, a sedimentary note page for every s
- Computer access for eve every expert group
- One rock cycle diagram f or one blank piece of paper for eac

Mixed groups:

_____ (I)	
_____ (S)	
_____ (M)	
_____ (I)	
_____ (S)	
_____ (M)	
_____ (I)	
_____ (S)	
_____ (M)	

Types of Rocks Jigsaw Notes Igneous Rocks

Igneous rocks are formed from: the cooling & hardening of magma

Plutonic: form underground

Volcanic: form on surface when

3 types of igneous rock

Felsic:
- High % of silica (SiO_2)
- Low Fe & Mg
- Mostly light-colored minerals
ex: granite

Mafic:
- High % of Mg & Fe
- Darker, heavier minerals
- Hotter, thinner, more fluid
ex: basalt

Intermediate:
Composition between felsic & mafic compositions
ex: andesite

Ultra Mafic:
>90% mafic minerals, very low in silica

What determines the size of crystals in an igneous rock?
Determined by how fast the magma hardens.

Fine grained:
- Made of interlocking crystals that are very small b/c the magma cooled quickly after reaching surface
ex: basalt

Coarse grained:
- Crystals are roughly same size & big b/c magma cooled within crust (slowly)
ex: gabbro

4 types of TEXTURES

Glassy:
- Shiny, glassy, polished
- magma hardened so fast that crystals couldn't develop
ex: obsidian

Mining Simulation Teacher Instructions

- **Today students will be mining chocolate chips from inside brownies to simulate the extraction of minerals and ore from within the earth.**
- **…m mineral extraction with minimal**
- **…urface of the brownie as well as**
- **…ontainer prepared vanilla icing (see**
- **…4 cup white chocolate**
- **…with food coloring.**
- **…in layer. Be careful not to make any**
- **…es throughout the white icing. This will try to avoid when mining.**
- **…s. Put each brownie on a clear …d to see cracks on the bottom of the …t their piece of land.**

…een icing= wildlife areas;
…ditional penalty for disturbance

Mining Simulation: Student Worksheet

Pre-lab:

1. How did you decide which brownie to select?

Draw a topographic map of the surface of your brownie before excavation:

Draw a topographic map of the surface of your brownie after excavation:

Lab:

Now mine as many white chocolate chips from your brownie as possible. You have mining expenses, so be careful not to spend more than you might earn.

Expenses:
Tools: _____
Salary: _____
Penalties:

Income:
Chocolate Chips: _____

Total Profit: _____

…t is moved to get to a resource is called **overburden**.
…ie represented the overburden?

…e to extract your chocolate chips? How might these …ining?

Mining: The Impact Student Instructions

Objective: Explore the economic and environmental impacts caused by open pit mining.

Open pit mining is a type of surface mining in which rocks or minerals are extracted from the earth through the digging of large open-air pits. Using Google Maps, explore the landscape of the following open pit mines. **Each group or student will research one mine.**

Answer the following questions:

- Where is the mine located? (City and/or country)
- What type of resource is mined there?
- Find a biome map online and determine the biome in which your mine is located
- What can you determine about the terrain, watersheds and surrounding ecosystems? (Use the satellite imagery and "Street View" on Google Maps to determine this.)
- Research the process of mining this resource. What byproducts are produced from the mining process?
- …has had on the local economy?
- …has had on the environment near it?

Mines to research:

- Grasberg Mine
- Pebble Mine
- Tummalapalle Mine
- Bingham Canyon Mine
- Carajas Mine
- Kalgoorlie Mine
- Escondida Mine

Watch this video about mine reclamation: https://www.youtube.com/watch?v=uYw06osVLMI

What types of reclamation would help to reduce the environmental impacts of the mine you researched?

After you are finished researching, collaborate with your group to write a one-page summary of your research about the mine location. You may include a picture of the site if you teacher allows.

Soil Analysis Student Instructions

Objective:
Using the tools and procedures provided, students will be able to determine the type of soil in the sample based on its composition.

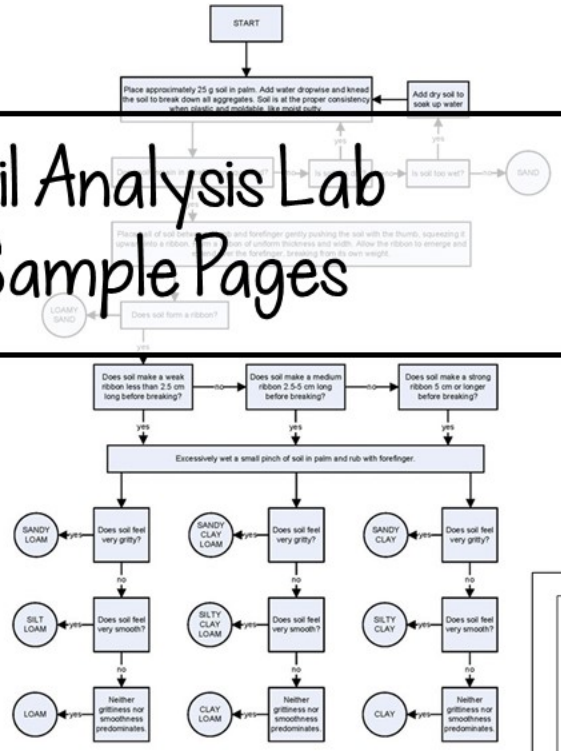
Background:
There are 3 components to all type
particles. Sand particles are round
porosity). Therefore, sand drains v
Silt particles are the second largest
hard to see with the naked eye.
Clay particles are the smallest com
ions required by plants. They also

Part I Procedures:
2. Remove any rocks, roots, plan
3. Follow the steps identified in
you have.

According to Part I, r

Part 2 Procedures:
1. Estimate how much soil is nee
onto a sheet of newspaper or
2. Remove any rocks, roots, plan
3. Break up any clumps of soil th
4. Label your bottle with your na
5. Using the newspaper as a fun
6. Add water to the bottle until i
room when shaking.
7. Put the lid on your container t
8. Shake the container gently un
suspended in the water. Don'
it to settle!
9. Let the container settle for at
10. Complete the soil suspension

Texture Analysis Flow Chart



Global Soil Profiles

Objective:
Learn about the soil profile for a biome from the list below. Draw the soil profile, label any visible horizons, and explain how the soil profile relates to the vegetation of that biome.

Possible biomes:
- Desert
- Tundra
- Tropical Rainforest
- Grassland
- Temperate Forest

profile in this box.

Global Soil Profiles Grading Rubric

	Score	
	Soil profile is not correct or not detailed	Soil profile is not correct nor detailed
	Soil profile has fewer than 3 horizons labeled	Soil profile has only 1 horizon correctly labeled.
	anation of soil shows a partial rstanding of soil water flow and w vegetation racts with the horizons.	Explanation of soil profile shows little understanding of soil types, water flow and how vegetation interacts with the horizons.
	3-4 grammar, punctuation & spelling mistakes	5+ grammar, punctuation & spelling mistakes

Soil Erosion Activity Teacher Instruction

Lab Overview:
Throughout this lab, students will be causing erosion in an area
a disposable baking pan. After determining the rate of erosion
control, students will create an erosion control barrier using pa
types of materials. Students will test materials to determine w
the best erosion control by containing sediment flow without s
water flow.

No erosion control

Modifications:
If you are using an electronic g or bal ce you can have st
exact with their measurement
of the plastic cup and subtrac
water weight.

Extensions:
Students can make a bar graph of their results

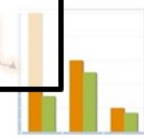
Students can measure additional variables such as time of wat
cost of barrier materials, etc.

Picture of actual erosion control barr

Part 2: Erosion control

Erosion is often controlled through the use of a sediment barrier like the one in the picture below. They can be filled with any number of materials, based on the location, cost, and goal of the developer using it. You will create a model of this barrier using the pantyhose provided.

1. First, choose one material to fill the pantyhose. Write this material down in the second row of your data table.
2. Close the end of the pantyhose with a twist tie and lay it on the marker line in the pan. Make sure that you have filled the panty hose with enough material that it
3. Repeat steps 4-6 [illegible] this time [illegible] your plastic cup with the material you
4. Continue running this experiment using different materials or combinations of materials inside the pantyhose at least 4 more times, completing the data table as you
5. [illegible] weights in a double bar graph.
6. Answer the discussion questions after finishing the activity.



Soil Analysis Lab
Sample Pages

Global Soil Profiles Research
Activity
Sample Pages

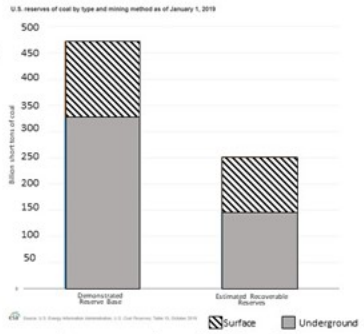
Soil Erosion STEM Lab
Sample Pages

6 Extension Pages

Math skills check! (great for standardized test prep)

Dimensional Analysis: Coal Mining

The graph to the right shows the amount of coal that is predicted to be remaining in the United States. The first bar (Demonstrated Reserve Base) is the total amount of coal estimated to be remaining underground. The second bar (Estimated Recoverable Reserves) represents the amount of remaining coal able to be mined with today's mining technology and considering accessibility constraints of some mining locations.



1. What percentage of the Demonstrated Reserve Base is actually able to be removed?

2. Notice the amounts of remaining coal that are available on the surface and underground. What percentage of the Estimated Recoverable Reserves is available near the surface?

3. If the United States consumes .76 billion short tons of coal per year, how long will the E

4. Nam

Digging Deeper: The Mining Process

In mining, an ore is extracted from the ground and refined for practical use. An ore is simply a natural rock or sediment that contains valuable minerals.

Although the mining process varies slightly depending on the type of mineral being extracted, the process does have some common steps:

1. Prospecting/Surveying- Geologists determine the availability of an ore or mineral underground through digging or electronically surveying an area.

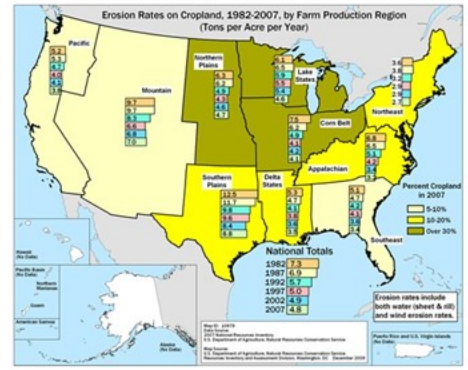
2. Exploration- Core samples are drilled to examine the size and value of the mineral deposits.

3. Design/Planning- The mine site is evaluated to determine the safety and economic value of mine construction, as well as the expected environmental impacts.

4. Development- Mining rights are purchased, roads are constructed, power is supplied and the path to extract the mineral is established. Depending on the location of the deposit, rock and soil may be scraped from the surface or may be dug from deeper underground. These two methods are known as **surface mining** and **subsurface (underground) mining.**

5. Production- This is the actual process of excavation. It also involves the extraction of the valuable materials (minerals or

Data Analysis: Soil Erosion



1. Which region had the greatest decrease in soil erosion from 1982 to 2007? What was the decrease (in % reduction)?

2. Which region do you think had the greatest impact on the National Totals between 1982 and 2007? Why?

3. In which regions would you expect water to be the primary source of erosion? In which regions would you expect wind to be the primary source of erosion? Explain how you decided th

Provide 3 r

Digging Deeper: Saving the Soil

Farmers rely on healthy soil to grow their crops. Soil erosion is more than just an inconvenience to them- it can reduce crop yields, drive up costs, and damage water quality. Many farmers have taken measures to minimize soil erosion, so it doesn't negatively affect their operations and profits. Below, you'll see some techniques used by farmers to prevent soil erosion in their fields.

1. Crop Rotation: High-residue crops leave behind a lot of plant material after the crop has been harvested. By incorporating these crops on a regular cycle, levels of organic matter in the soil are improved and less soil is exposed for erosion.

2. No-till planting: Tilling involves turning over the top layer of soil before planting new crops- often by machinery. This loosens plant roots and soil structure causing erosion and reducing soil porosity. By planting new seeds without tilling, erosion is reduced, and beneficial nutrients and microorganisms remain undisturbed.

3. Contour and Terrace Farming: Slopes increase water erosion. When planting on a slope, f ers can plant horizontally around hills rather than up and down the sl e (contour farmi). Cutting flat step-like fields into a hill can also reduce ater runoff (te ce ming).

4. Planting Gro dcover: Gr stabilize wet reas and bir so

5. Wind Brea : Planting a row or two of larger trees or shrubs between fields can reduce win speeds and decrease soil erosion from wind. They can also k snow from owing away, allowing for a natural water source as the snow melts in th springtime.

Critical Thinking: Choose ne of the techniques above. Explain what cost **it may have for the farm** and 2 ways the farmer will benefit from the **technique.**

Digging Deeper: The Smell of Soil

Streptomyces is a bacterial genus including over 500 species. It is a primary cause of organic decomposition within topsoil. *Streptomyces* is filamentous and produces spores, making it similar in structure to fungi. As a spore germinates, it grows a mycelium which serves as a food source for aerial hyphae. To protect the nutrients of the dying mycelium, the bacteria produces antibiotics within the soil. These antibiotics have become the source of many well-known antibiotics that are used to treat human bacterial infections today.

In addition to antibiotics, *Streptomyces* produce a secondary metabolite known as **geosmin**, which gives soil its characteristic smell. Although we may enjoy the smell of earth in our yard, the smell is apparently less welcome in our food and water supply. Humans are able to detect extremely small amounts (only 5 parts per trillion!) of geosmin. Even low concentrations within fish and drinking water cause consumers to complain and the quality to be reduced. Freshwater aquaculture companies regularly test for geosmin levels to prevent the loss of profits.

Camels have a pretty good sense of smell for geosmin, too. Wild Bactrian camels of the Gobi desert are reputed to be able to find water up to 50 miles away. Scientists now believe that the camels can d t the smell of *Streptom* within damp ground, leading them to a s ible water source.

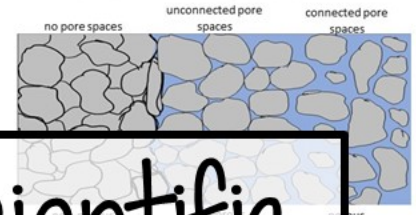
2. Botanists have also disco d geosmins in some t s of flowers that are pollinated by H ht the pound produce geosmin. It is a highly coveted discovery for factories that manufacture antibiotics from *Streptomyces*. How will this discovery help those companies?

Fun Fact:
The smell of rain is called "petrichor". It is thought to be caused by geosmin mixed with an oil produced by plants during dry periods.

Digging Deeper: Porosity v. Permeability

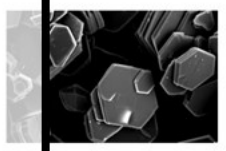
Groundwater is water that is found underground. Sometimes when discussing groundwater, we think of large rivers and lakes of water under our feet. Although some groundwater exists in areas like this, most of it is found in the small spaces between particles of rocks and soil.

Porosity and permeability are related properties of any rock or sediment. Both describe the openings within a rock or rock layer. **Porosity** is the rock's ability to hold fluid based on the amount of open space within the rock. **Permeability** is a measure of how easily fluid can flow within a rock or rock layer. A rock with many internal spaces may be porous, but those spaces must be connected in order for the rock to also be permeable.



Discussion Questions:

1. Although clay is the smallest of the soil particles, it is also quite flat (see photo). These flat sheets can hold water because of their large surface area.
ow at and knowing that clay soils are some of the nting water flow, what can you determine rosity and permeability of clay soils?



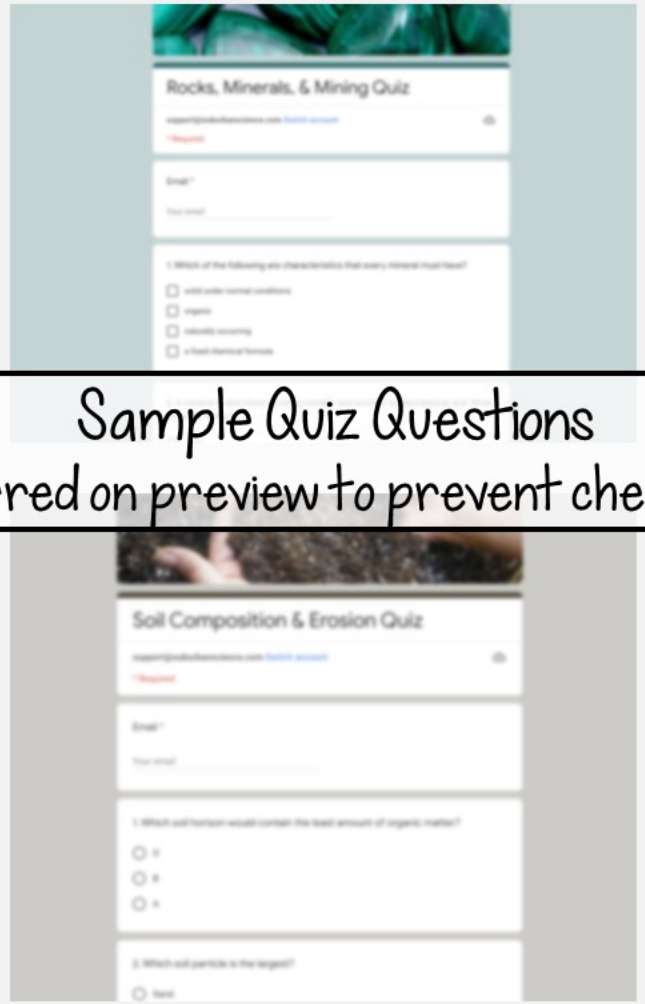
2. You've decided to dig a shallow hole to obtain groundwater because the area has high porosity. Why would you also want the soil in that location to have LOW permeability?

3. Some individuals in areas with high clay soils are known to spread sand in their yards. What property would they expect to be improved by this?

Greater depth of knowledge, scientific literacy, & critical thinking

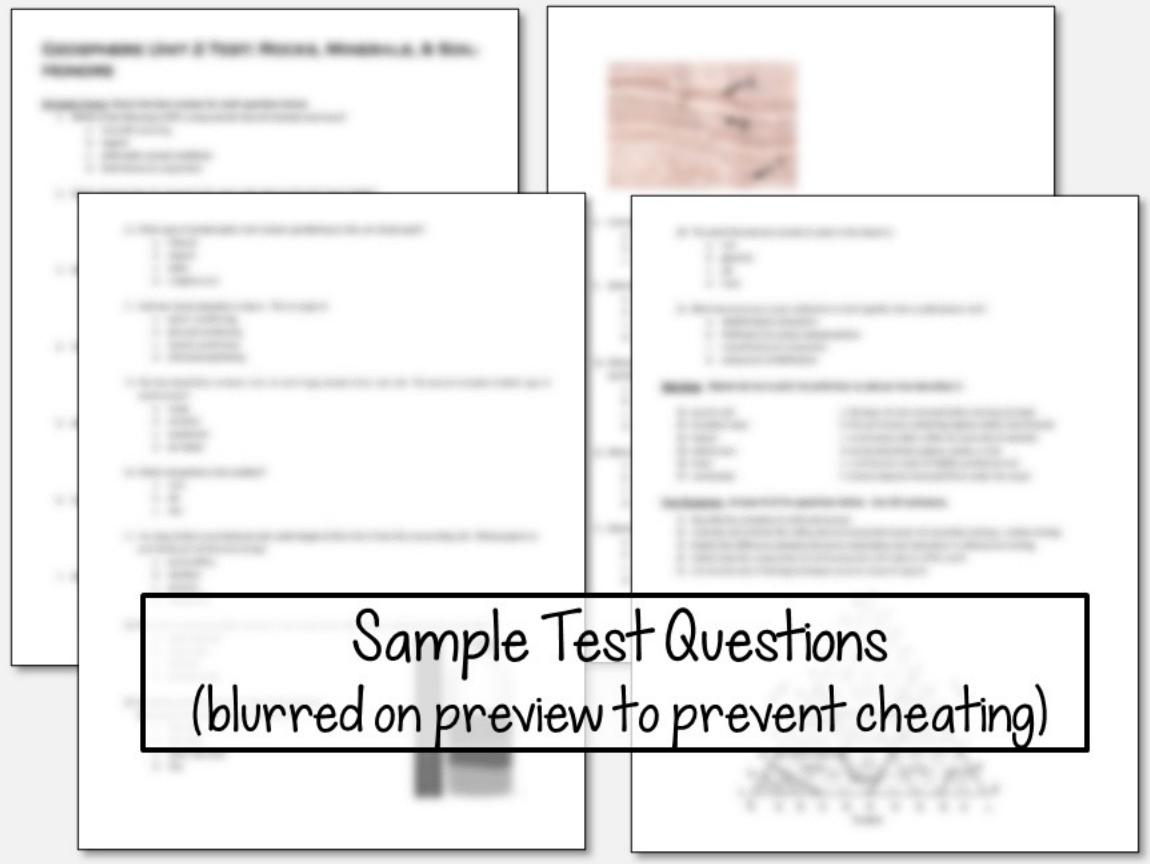
Assessment

Editable Online Quiz through Google Forms



Sample Quiz Questions
(blurred on preview to prevent cheating)

- 25 multi-part questions
- Fully editable
- Answer key included for automatic grading



Sample Test Questions
(blurred on preview to prevent cheating)

- 21 multiple-choice questions
- 6 matching questions
- 5 free response questions
- Both Honors & Regular versions included with answer keys

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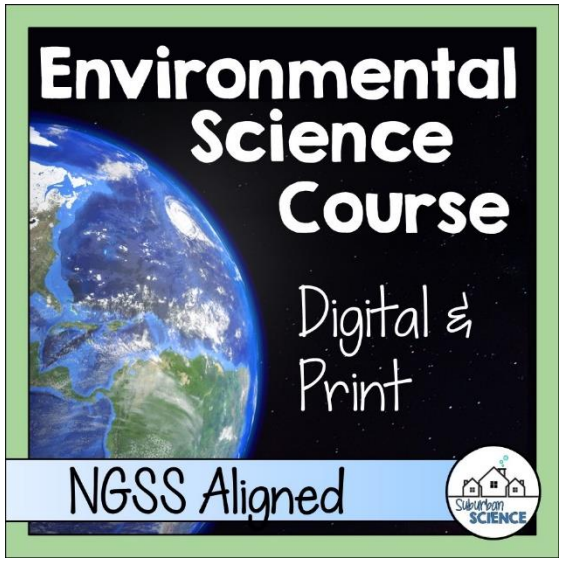

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Sincerely,
Anne from Suburban Science