

CRIME SCENE

Earth Science



ROCKS



CSI EARTH SCIENCE

Rocks

IDEAL UNIT:	Rocks and Minerals	TIME RANGE:	30-45 Minutes	SUPPLIES:	Pencil & Paper
TOPICS OF FOCUS:					
<ul style="list-style-type: none">- What is a Rock?- Igneous, Sedimentary, Metamorphic Rocks- Rock Classifications- Processes that Change Rocks- The Rock Cycle- Job of a Geologist					

General Procedures

*A.) As an optional hook, you can provide or read students the letter from Officer Osborn. These are relatively the same for each CSI activity and introduce the criminal and world region it takes place.

B.) Provide groups (ideally 2-3), the possible suspects, 6 crime scene puzzles and worksheet to use to record their findings. You may choose to laminate the criminals or crime scenes for easier reuse. They also work well printed as a packet.

C.) Students will work to solve the crime. A vandal has gone and tried to rewrite science. Generally, it takes between 30-45 minutes to complete. You can drop hints or provide assistance to help groups that are behind the pace. There are some situations that utilize close reading and others that focus on fact-based practice. Previewing which crime scenes might be the most challenging so you can be prepared to help small groups or the whole class is a good idea.

The errors are designed to be either around central information of the topic or a clear gross exaggeration. They are written such that no additional research should be needed, but allowing students to use technology is an option.

D.) At the end of each scene, students will receive a clue that will substitute into the "Cryptic Text Message". This provides an element of self-checking because if the Cryptic Text does not lead to a criminal, they know they need to recheck their work. In the end, students will determine which suspect should be arrested. *The gender, race and ethnicity of the guilty "suspect" is intentionally varied across the entire CSI series.*

*E.) There is an emphasis on "evidence" since this is an investigation. Using evidence to discern fact from fiction is a critical element of science. This means detailed work and the ability to argue their logic. You may like for students to create a portfolio of evidence proving that they have arrested the right person and will demonstrate their understanding of their historical content present in the problem.

*F.) Some teachers enjoy having their students present and defend their evidence to the class in a brief oral presentation.

*Optional Extensions

THE EVIDENCE

INVESTIGATOR: _____



1.	CLUE
2.	CLUE
3.	CLUE
4.	CLUE
5.	CLUE
6.	CLUE
CRYPTIC TEXT MESSAGE	
SUSPECT	

CSI: Rocks



Detectives,

We can count down the minutes until the Scientormentors deploy their world-conquering device. For their last crime spree, an associate by the name of “The Stonecold Rock” has traveled to some of the world’s most well-known rock formations. Based on our intel, we believe The Stonecold Rock is a high-ranking member of the evil genius terrorist group. Investigators suspect that the world-conquering device intends to vaporize science everywhere!

The Scientormentors use codes to communicate with each other. To claim their work, they send copies of their altered science to their teammates. When complete, they send a cryptic text message to their teammates to boast. The text message when unscrambled correctly will reveal The Stonecold Rock’s secret passcode. So far there are six suspects that police have questioned.



It is hoped that someone with keen awareness of rocks can use knowledge of primary sources and reliable secondary sources to fact check the scenes.

Your job is to bring The Stonecold Rock to justice and save science. You need to be prepared to state your case and demonstrate your understanding of the following topics that The Stonecold Rock is known to use in the notes:

- Definition of a Rock
- Igneous, Sedimentary, and Metamorphic Rocks
- Rock Classifications
- Processes that Change Rocks
- Rock Cycle
- Job of the Geologists

In your investigation, be sure to explain all of your thoughts. We need to have clear evidence that supports your conclusions. This is not a time to be sloppy. The slightest illegible footnote could result in a not guilty verdict.


Good luck to you, gumshoe,
Officer Osborn



THE SUSPECTS

Who is The Stonecold Rock?



<div>NAME</div> <div>Enrique</div> <div>OCCUPATION</div> <div>Pro Ping Pong Player</div> <div>PREFERRED PASSCODE CATEGORY</div> <div>Sports</div> <div></div>	<div>NAME</div> <div>Tripiti</div> <div>OCCUPATION</div> <div>Pet Store Owner</div> <div>PREFERRED PASSCODE CATEGORY</div> <div>Animals</div> <div></div>
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Scene #1 Stone Forest -- Yunnan, China



While it is unclear how it was done, The Stonecold Rock stole a helicopter and took the tallest limestone formation at the site.



Do you smell what The Stonecold Rock is cookin'? The Stonecold Rock taunts you in third person, so sit back, relax and watch The Stonecold Rock do the job of spreading fake news.

FOR THOSE ABOUT TO ROCK...

Incorrect rock facts have been added to the list.
Cross out the ones that are wrong.

WHAT IS A ROCK?

- A rock is naturally formed.
- A rock is non-living Earth material.
- Anything that is hard is made of rock.
- Most all rocks are made out of one or more minerals.
- Rocks are collections of mineral grains that are held together in a firm, solid mass.
- A few rocks are made of materials that do not fit the definition of minerals like obsidian, coal and amber.
- Rocks are named for the combinations of minerals they are made of, their textures, and the ways the minerals came together.
- Ores are rocks that include minerals that have important elements such as metals like gold and silver.
- Obsidian is an ore mined out of Wakanda. Metal is extracted and smelted into vibranium. It was originally brought to Earth on a meteorite.
- Some rocks are predominantly composed of just one mineral, but most are mixtures of many minerals.
- The Earth's crust is made up of rock.
- Rocks have been used by humans for millions of years as tools and weapons, as well as in construction.
- Humans have learned how to build new rocks.

How many incorrect facts have been added?

3 ↓ R	2 ↓ O	1 ↓ C	0 ↓ K
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Scene #2 Wave Rock -- Hyden, Australia



The Stonecold Rock snuck in at night and skateboarded on Wave Rock. A section of granite was jackhammered out of the beautiful curve.



The Stonecold Rock is the most electrifying criminal in science-focused world takeovers today.

IGNEOUS VS.
SEDIMENTARY VS.
METAMORPHIC

The characteristics of the different rock types have been scattered. *List them correctly with the appropriate group. Which one category has the most?*

Igneous	Sedimentary	Metamorphic

CHARACTERISTICS

May be mafic, felsic, or intermediate.	Begin as igneous, sedimentary, or metamorphic rock.	Formed by great heat and pressure.
Formed by years and years of sediment compacting together and becoming hard.	May have large crystals.	Only 5% of the Earth’s crust.
Causes a change that can be physical, chemical, or both.	Created when magma cools below Earth’s surface or lava cools at the surface.	The process is considered either “contact” or “regional”.
May contain evidence of past life.	The rate of cooling determines the texture of the rock.	Has wavy bands or layers.

Which rock type has the most characteristics?

Igneous ↓ I, G	Sedimentary ↓ S, E	Metamorphic ↓ M, E
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Scene #3 Valley of the Moon -- San Juan Province, Argentina

Last night, The Stonecold Rock stole construction equipment and took a gigantic rock formation that resembles the Sphinx.



The Stonecold Rock says, "It doesn't matter what its name is!" If you can't tell the difference all by yourself, you don't deserve to know which is which!

A ROCK'N MIX-UP

The Stonecold Rock has erased a rock! We have 7 rocks and 8 descriptions. They have been mixed up and one has been deleted. *Draw lines to connect the rock with their description and determine which is missing.*



Basalt



Granite



Limestone



Marble



Sandstone



Shale



Slate

A hard sedimentary rock, composed mainly of calcium carbonate or dolomite. It often includes the skeletal fragments of marine organisms such as coral and mollusks. It can be used in construction and to make cement.

A smooth, soft sedimentary rock that formed from consolidated mud or clay. It can be split easily into fragile slabs.

A mafic extrusive, dark colored, igneous rock formed from the rapid cooling of magnesium-rich and iron-rich lava. 90% of volcanic rocks on Earth.

A sedimentary rock consisting of sand or quartz grains cemented together. It is typically red, yellow, or brown in color.

A type of felsic intrusive igneous rock that is composed of mostly two minerals: quartz and feldspar. It is lighter in color and its grains can be seen by the naked eye.

A hard, dark, glasslike volcanic rock formed by very rapid solidification of lava. It does not contain minerals or form crystals.

A hard, crystalline metamorphic form of limestone. It is typically white with streaks of color. It is often polished and is used in sculpture and architecture.

A fine-grained gray, green, or bluish rock formed by the metamorphosis of clay or shale. It is easily split into smooth, flat pieces and is often used in roofs.

Which rock has been deleted?

Amber



S

Obsidian



T

Gabbro



O

Quartzite



N

Gneiss



E

Scene #4 Chocolate Hills -- Bohol, Philippines



The Stonecold Rock caused problems in Southeast Asia. One of the famed limestone mounds was taken, but it is not clear how it will be used in the time machine.

You think you are getting close? The Stonecold Rock says, "Just bring it!" Pay close attention because your science is about to be rewritten!

PRESSURE IS ON

The Stonecold Rock has erased key elements about the processes that change rocks! We have a list of possible words from each sentence. *Fill in the blanks with the correct words. The leftovers reveal the first clue.*



1. As _____ cools, _____ occurs, which forms igneous rocks. Crystals grow larger if the magma cools _____, as it does if it remains deep within the Earth. If the magma cools _____, they will be very small.
2. Rocks are broken down by _____, which may be caused by wind, water, plants or animals. Once water, wind or glaciers move this sediment from one place to another, it is called _____. When the sediments are eventually deposited somewhere, this is known as _____.
3. If a rock is exposed to extreme heat and/or pressure within the Earth's crust, it undergoes _____. This may change a rock's mineral _____ or texture.

WORD BANK

Cross out the words in the bank that belong in the sentences.

crystallization = 1	slowly = 2	composition = 3	core = 4
magma = 5	metamorphism = 6	sedimentation = 7	weathering = 8
luster = 9	quickly = 10	metal = 11	erosion = 12

Add the numbers next to the leftover words in the bank. Identify the letter that your total points to.

7 ↓ E	19 ↓ R	21 ↓ O	24 ↓ D	28 ↓ E
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Scene #5 Great Blue Hole -- Coast of Belize

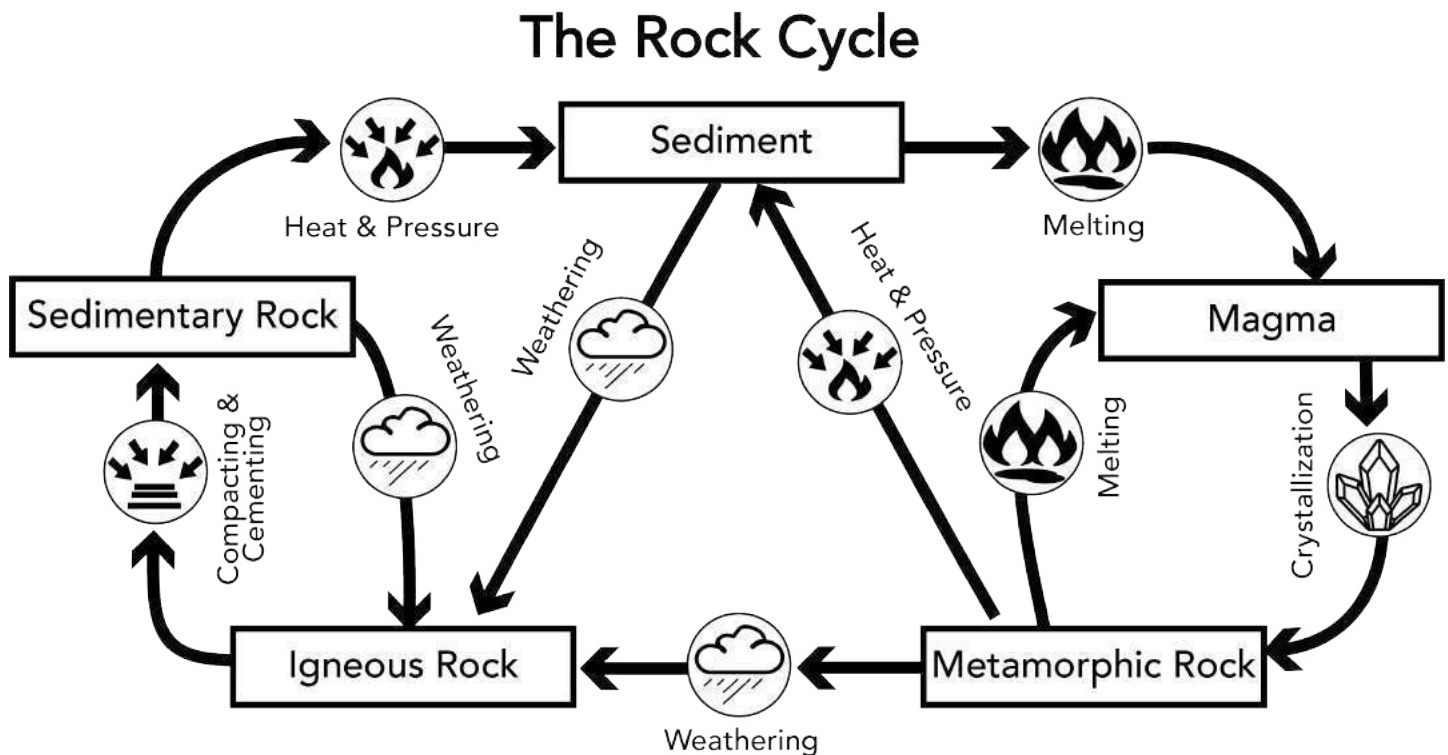
The Stonecold Rock commandeered a fishing boat and used scuba gear to explore the famous sinkhole. It is believed five endangered hammerhead sharks were taken away.



The Stonecold Rock says they will “lay the smackdown” on anyone who stands in the way of rewriting science. Before you know it, instead of learning about the Rock Cycle, you will be learning about the “Stonecold Rock Cycle.”

ROCK AROUND THE CLOCK

The model of the Rock Cycle below has been changed. The circular icons are in the right place and the arrows point in the right direction, but some of the five rectangular labels are incorrect. *Cross out the false information and correct it.*



How many labels are incorrect?

0	1	2	3	4
↓	↓	↓	↓	↓
P	H	A	S	E

Scene #6 Uluru -- Northern Territory, Australia



The Stonecold Rock scaled the sandstone monolith and chipped away five tons of rock. It is believed The Stonecold Rock escaped with a fleet of stolen dump trucks.



Finally... The Stonecold Rock has come to the end of the crime spree. Remember, The Stonecold Rock is doing all of this for the millions (and millions) of rocks around the world today. Geologists everywhere can learn and listen to The Stonecold Rock from here on out. He'll keep the science straight.

LEAVE NO STONE UNTURNED...

In the overview of the career of a geologist, items have been changed. *Circle the mistakes.* How many sections have at least one mistake?

- The overall goal of a geologist's work is to understand the history of geography. If we
- i. can better understand Earth's history, then we will be better at foreseeing how events and processes might impact the future.
 - ii. There are different specializations that a geologist may have. For example, a geologist may study and map rock formations, collect rock samples and fossils, or measure the physical properties of the earth like the movement of tectonic plates.
 - iii. If a city were interested in building a bridge, dam, road or tunnel, a geologist could help determine if it can be structurally safe and help minimize the cost. In most cases, they would walk close to the rock and "Ask Siri" to tell them about it. Siri will tell them everything about the type of rock it is, how thick it is, how old it is, and what it wrote as its most recent Facebook status update.
 - iv. Geologists may work for natural resource companies, environmental companies or government agencies. Many geologists do work in the field at least part of the time. Others spend their time in labs, classrooms or offices. Most play bass in a heavy metal band. All geologists prepare reports, do calculations and use computers.

How many of the four sections contain errors?

1 ↓ C	2 ↓ R	3 ↓ U	4 ↓ S	0 ↓ T
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CRYPTIC TEXT MESSAGE

Try to unscramble before it's too late.

I can be beat, but it's not likely.




The Stonecold Rock



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- ~~Humans have learned how to build new rocks.~~

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3 ↓	2 ↓	1 ↓	0 ↓
R	O	C	K

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IGNEOUS VS. SEDIMENTARY VS. METAMORPHIC

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The rate of cooling determines the texture of the rock.	Only 5% of the earth's crust.	Has wavy bands or layers.
May have large crystals.	May contain evidence of past life.	Causes a change that can be physical, chemical, or both.
May be mafic, felsic, or intermediate		The process is considered either "contact" or "regional".
		Begin as igneous, sedimentary, or metamorphic rock.

CHARACTERISTICS

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Granite



Limestone



Marble



Sandstone



Shale



Slate

A hard sedimentary rock, composed mainly of calcium carbonate or dolomite. It often includes the skeletal fragments of marine organisms such as coral and mollusks. It can be used in construction and to make cement. **LIMESTONE**

A smooth, soft sedimentary rock that formed from consolidated mud or clay. It can be split easily into fragile slabs. **SHALE**

A mafic extrusive, dark colored, igneous rock formed from the rapid cooling of magnesium-rich and iron-rich lava. 90% of volcanic rocks on Earth. **BASALT**

A sedimentary rock consisting of sand or quartz grains cemented together. It is typically red, yellow, or brown in color. **SANDSTONE**

A type of felsic intrusive igneous rock that is composed of mostly two minerals: quartz and feldspar. It is lighter in color and its grains can be seen by the naked eye. **GRANITE**

A hard, dark, glasslike volcanic rock formed by very rapid solidification of lava. It does not contain minerals or form crystals. **OBSIDIAN**

A hard, crystalline metamorphic form of limestone. It is typically white with streaks of color. It is often polished and is used in sculpture and architecture. **MARBLE**

A fine-grained gray, green, or bluish rock formed by the metamorphosis of clay or shale. It is easily split into smooth, flat pieces and is often used in roofs. **SLATE**

Which rock has been deleted?

Amber ↓ S	Obsidian ↓ T	Gabbro ↓ O	Quartzite ↓ N	Gneiss ↓ E
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Scene #4 Chocolate Hills-- Bohol, Philippines

The Stonecold Rock caused problems in Southeast Asia. One of the famed limestone mounds was taken, but it is not clear how it will be used in the time machine.



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1. As **MAGMA** cools, **CRYSTALLIZATION** occurs, which forms igneous rocks. Crystals grow larger if the magma cools **SLOWLY**, as it does if it remains deep within the Earth. If the magma cools **QUICKLY**, they will be very small.
2. Rocks are broken down by **WEATHERING**, which may be caused by wind, water, plants or animals. Once water, wind or glaciers move this sediment from one place to another, it is called **EROSION**. When the sediments are eventually deposited somewhere, this is known as **SEDIMENTATION**.
3. If a rock is exposed to extreme heat and/or pressure within the Earth's crust, it undergoes **METAMORPHISM**. This may change a rock's mineral **COMPOSITION** or texture.

WORD BANK

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Scene #5 Great Blue Hole -- Coast of Belize

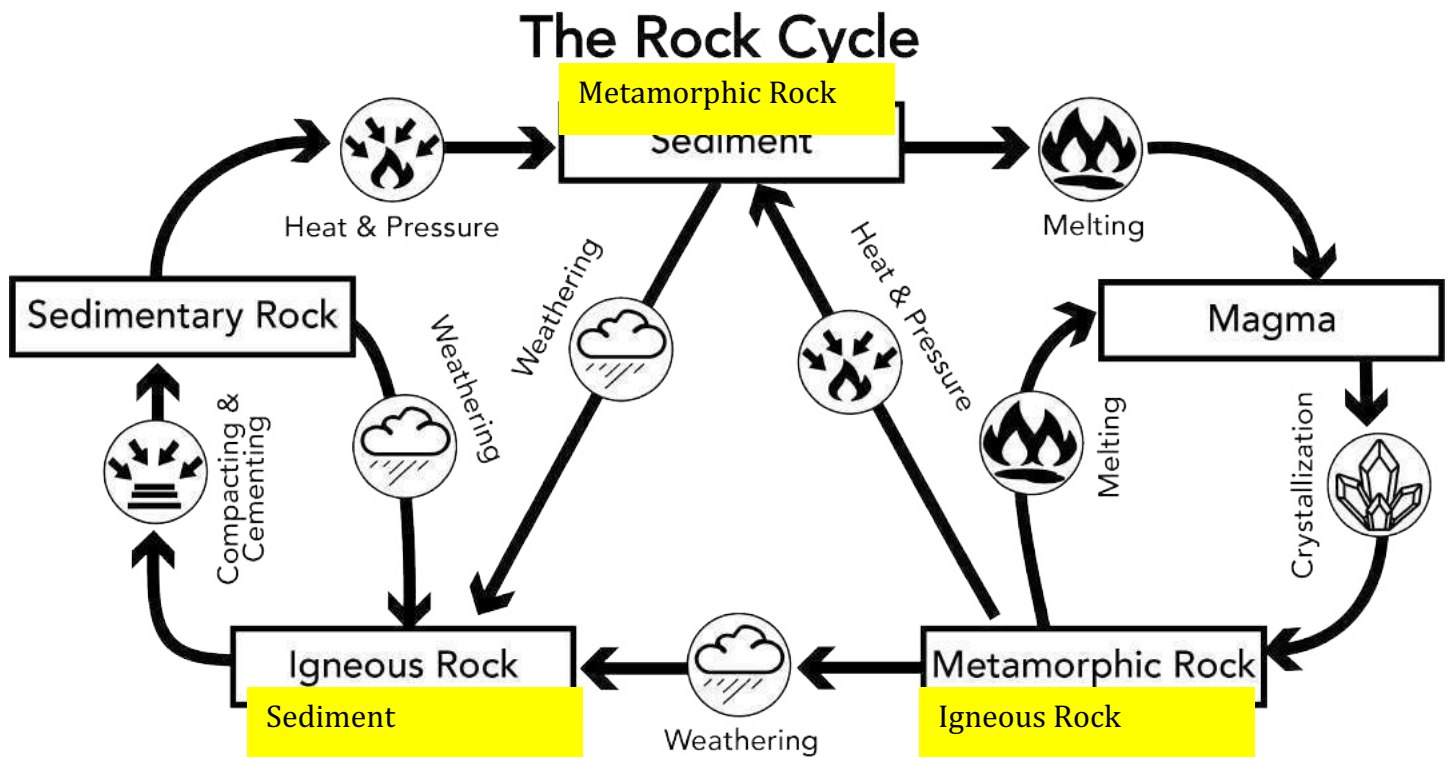
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CRYPTIC TEXT MESSAGE

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I can be beat, but it's not likely

D-R-U-M-S-E-T

The Stonecold Rock

CSI: EARTH SCIENCE

Rocks Rubric



Skills & Understandings		Exemplary	Proficient	Developing
I can articulate the definition of a rock.				
I can identify the differences and unique traits of igneous, sedimentary, metamorphic rocks.				
I can identify and match common rocks with their descriptions.				
I can articulate the processes that can change rocks from one type to another.				
I can demonstrate knowledge of the rock cycle and create an accurate model.				
I can articulate what a geologist might do in their career.				
Science Processes		Exemplary	Proficient	Developing
Close Reading	<i>accurately reads information to draw conclusions</i>			
	<i>can thoughtfully and critically analyze text</i>			
21 st Century Skills	<i>can obtain, evaluate and communicate scientific information</i>			
	<i>utilizes facts to prove what is clearly false and confirm what is true</i>			

COMMENTS: