



SCIENCE

Student Book

► **3rd Grade | Unit 8**

.....

SCIENCE 308

ROCKS AND THEIR CHANGE

Introduction | **3**

1. How Rocks Are Formed **4**

By Heat | **6**

By Pressure | **15**

Self Test 1 | **25**

2. How Rocks Are Changed **27**

By Water | **28**

By Wind | **30**

By Heat and Cold | **31**

By Plants | **34**

Self Test 2 | **42**

3. How Rocks Are Used **44**

For Buildings | **45**

For Enjoyment | **51**

Self Test 3 | **56**

LIFEPAC Test | **Pull-out**

Author:

Merton B. Osborn, Ed.D.

Editor-in-chief:

Richard W. Wheeler, M.A.Ed.

Editor:

Joyce Davis

Consulting Editor:

Harold Wengert, Ed.D.

Revision Editor:

Alan Christopherson, M.S.

Media Credits:

Page 3: © Danish Khan, iStock, Thinkstock; **4:** © IPGGutenbergUKLtd, iStock, Thinkstock; **7:** © Dorling Kindersley, Thinkstock; **11:** © Dtamarack, iStock, Thinkstock; **12:** © Andrea Danti, Hemera, Thinkstock; **15:** © Medioimages, Photodisc, Thinkstock; **17:** © Scott_Walton, iStock, Thinkstock; **20:** © PhilipSmith1000, iStock, Thinkstock; © Givaga, iStock, Thinkstock; **27:** © Mike Watson Images, moodboard, Thinkstock; **29:** © tonda, iStock, Thinkstock; **30, 32:** © moodboard, Thinkstock; **37:** © ManuelGonzalezOlaecheaFranco, iStock, Thinkstock; **39:** © SteveCollender, iStock, Thinkstock; **40:** © rudi_suardi, iStock, Thinkstock; **44:** © SLP_London, iStock, Thinkstock; **45:** © septemberlegs, iStock, Thinkstock; **46:** © TiSanti, iStock, Thinkstock; **47:** © Katty_King, iStock, Thinkstock; **48:** © MarcelC, iStock, Thinkstock; **49:** © walencienne, iStock, Thinkstock; **50:** © Jorge Villalba, iStock, Thinkstock; **52:** © Tatiana Gladskikh, iStock, Thinkstock; **54:** © Jeffrey Hamilton, Digital Vision, Thinkstock.



**804 N. 2nd Ave. E.
Rock Rapids, IA 51246-1759**

© MCMXCVI by Alpha Omega Publications, Inc. All rights reserved.
LIFEPAC is a registered trademark of Alpha Omega Publications, Inc.

All trademarks and/or service marks referenced in this material are the property of their respective owners.
Alpha Omega Publications, Inc. makes no claim of ownership to any trademarks and/or service marks other than their own and their affiliates, and makes no claim of affiliation to any companies whose trademarks may be listed in this material, other than their own.

ROCKS AND THEIR CHANGE

God created the earth. He made many different kinds of rocks. We can learn so much about rocks that some people spend most of their lives studying about them. These people are called geologists. A geologist is a person who studies all about rocks. Geologists know how rocks are formed and how they change. In this LIFEPAK®, you will learn how rocks are formed, how they can change, and how they are used.

Many people who are not geologists study rocks because they enjoy them. They are called rock hounds. Perhaps you will become a geologist or a rock hound some day. Whether you gather rocks or just read about them in books, this LIFEPAK will help you know more about the earth—God’s great creation.

Objectives

Read these objectives. The objectives tell you what you will be able to do when you have finished this LIFEPAK.

1. You will be able to tell how rocks are formed.
2. You will be able to tell how rocks are changed.
3. You will be able to name three different kinds of rocks and give examples of each kind.
4. You will be able to tell how rocks are used.
5. You will be able to tell what precious stones are.

1. HOW ROCKS ARE FORMED

When God made the world, He caused much of it to be made up of rock. Rocks form the **core** of our mountains. Rocks lie under the ocean floor. Rock is underneath all land.

In this part of your LIFEPAC, you will take a field trip with Look-It-Up Club and learn what **geologists** know about the ways rocks are formed. You will learn how heat and **pressure** have helped to form the rocks that we see all around us.

Vocabulary

Study these new words. Learning the meanings of these words is a good study habit and will improve your understanding of this LIFEPAC.

basalt (bə sôlt'). Hard rock left by a volcano.

boulder (bôl' dər). A large, rounded rock.

college (kôl' ĭj). A school of higher learning.

core (kôr). The hot center of the earth.

crumble (krŭm' bəl). Break into very small pieces.

crust (krŭst). A hard, outside covering.

crystal (krĭs' təl). An evenly shaped clear mineral.

dissolve (dĭ zôlv'). Break up; change into a liquid.

erupt (ĭ rūpt'). Burst forth; blow up.

feldspar (fēld' spär'). A common mineral on the earth's surface.

geologist (jē ôl' ə jĭst). A person who studies rocks.

gneiss (nīs). Metamorphic rock.

granite (grăn' ĭt). Hard, igneous rock.

igneous (ĩg' nē əs). Formed by great heat and pressure.

lava (lä' və). Melted rock flowing from a volcano.

limestone (līm' stōn). A sedimentary rock.

liquid (lĩk' wĩd). Something not a solid or a gas, but like water; it flows.

magma (măg' mə). Hot, liquid rock under the earth.

mantle (măn' təl). The part of earth just beneath the crust.

metamorphic (mět' ə mōr' fĩk). Having to do with change of form.

mineral (mĩn' ər əl). A thing that is not a plant or an animal.

pressure (prěsh' ər). To press with a lot of weight and force.

quartz (kwōrts). A glassy mineral.

sedimentary (sěd' ə mēn' tər ē). Rock formed from things that have settled to the bottom of the sea over a long time.

volcano (vōl kă' nō). An opening in the earth through which steam and lava pour.

Note: All vocabulary words in this LIFEPAK appear in **boldface** print the first time they are used. If you are unsure of the meaning when you are reading, study the definitions given.

Pronunciation Key: hat, āge, cāre, fār; let, ēqual, tērm; it, ĩce; hot, ōpen, ôrder; oil; out; cup, pũt, rũle; child; long; thin; /ʦh/ for then; /zh/ for measure; /u/ or /ə/ represents /a/ in about, /e/ in taken, /i/ in pencil, /o/ in lemon, and /u/ in circus.

Special Words

Hawaii

Mauna Loa

Ask your teacher to say these words with you.



Teacher check:

Initials _____

Date _____

By Heat

Rick's father called the Look-It-Up Club to order. The club had six members: ten-year-old Rick, his younger sister Mary, their two cousins Jack and Debbie, and Father and Mother who acted as teachers.

"I have a surprise for our club tonight," Father said.

"What is it?" Everyone wanted to know.

"Tomorrow is Saturday, and I do not have to teach at the college. So, we are going on a field trip."

"Great!" shouted Rick.

"Sounds like great fun!" Debbie exclaimed.

"Where are we going?" Jack asked.

"To the mountains," Father replied. "I asked my friend, Mr. Scott, if we could visit his farm to look for rocks."

The others grew excited. Mother offered to pack a lunch, and Mary said she would help.

Saturday was warm and sunny. The six club members reached Mr. Scott's farm after a long half-hour hike up the side of Mount Tusk. While the others were catching their breath, Rick picked up a chunk of grayish rock.



"What did you find, Rick?" Jack asked. "Some gold?"

"No," Rick smiled. "I'm afraid not. I don't know what it is exactly."

Father came over and took a look.

"You've found a piece of **granite** rock," he said. "Granite is a very, very hard rock. It's what we call an **igneous** rock."

"What does igneous mean?" they all hollered at once.

Father sat down on a **boulder**. "Let me explain," he said.

"You already know that some rocks are very, very small. When you pick up a handful of sand at the seashore, you are looking at tiny grains of rock. Some rocks are very, very large such as this boulder I'm sitting on. This mountain we climbed this morning is really a huge rock. Only the top of it is above the ground. The rest is far below."

"In deep places of the earth," Father continued, "there is a very thick, hot **liquid**. This hot liquid is called **magma**. Magma is melted rock. This magma moves around under the top layer, or **crust**, of the earth. If there are cracks in the crust, the magma fills them up. Rock that is formed in this way is called igneous rock."





Write the answer in the blank with a word from the list.

God	granite	crust
magma	hard	rocks
lunch	hike	igneous
geologists	hounds	soft

- 1.1 Scientists who study about rocks are called _____.
- 1.2 When magma cools in cracks of the earth's crust, it makes _____ rock.
- 1.3 People who collect rocks for fun are called rock _____.
- 1.4 Igneous rocks are _____.
- 1.5 The Look-it-Up Club went on a a. _____ to find b. _____.
- 1.6 _____ created rocks.
- 1.7 Granite rocks are _____.
- 1.8 Sand at the seashore is really very tiny grains of _____.
- 1.9 A thick, hot liquid found far below the earth is called _____.
- 1.10 Magma moves around under the _____ of the earth.

"Is our whole earth a ball of rock?" Jack wanted to know.

"In a way, yes," Father replied. "But that is a long story. Let's eat lunch while I tell it to you," Father said with a smile.

Everyone was eager for that. Mother was already unpacking the lunch. She and Mary were placing it on the ground on top of a red and white tablecloth. The children were hungry from their long hike up the mountainside. They didn't need a second invitation to gather around the "table." Father thanked God for the food that He had provided, and the happy club members all said a loud "Amen."

"In a way, it is true that the earth is a huge ball of rock," Father began in between bites of chicken sandwich. "I suppose you have all wondered what you would find if you could dig far down to the center of the earth. No one has ever been able to do this. Scientists believe that the very center of the

earth is made up of a very, very hot core. This core is larger than the moon and has a liquid layer around a solid rock layer. Around that is another layer called the **mantle**.

The mantle is not quite so hot and is made of rock. The top layer of the earth is called the crust and is only about twenty miles (32 kilometers) deep at its thickest part. The crust is made of soil and rocks. The soil on the top of the earth is mostly broken-down rock mixed with dead plants and animals."



| The layers of the earth

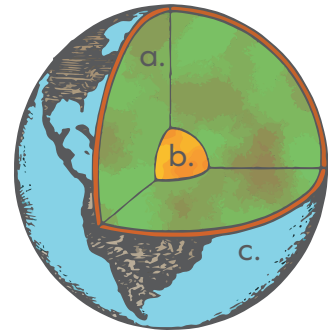


Put one of these words on a line to label the parts of the earth.

mantle

core

crust



- 1.11 a. _____
b. _____
c. _____



Write these words from the list to complete the sentences.

(One word is used more than once.)

animals
top layer
rock

middle
soil

rock
plants

center
liquid

- 1.12 The core is at the a. _____ of the earth and has a
b. _____ layer and a solid
c. _____ layer.
- 1.13 The mantle is in the a. _____ of the earth and is
mostly b. _____.
- 1.14 The crust is the a. _____ of the earth and is
made of b. _____ and
c. _____.
- 1.15 The soil on the crust of the earth is made of broken-down
a. _____ and dead
b. _____ and c. _____.

"The rock that Rick found lying on the ground was once hot magma," Father said. "This magma was moving around under the crust of earth. When there was a crack in the crust, the magma moved in to fill it. Then, the magma began to cool and harden. As it cooled, the rocks around it and above it were pushing against it."

"It was being squeezed tighter and tighter together. After many years, the hot magma became cooler and cooler. The pressure of the rocks made it harder and harder. The hot magma had become granite rock. Rocks made from magma are called igneous rocks."

"Does magma always cool under the ground?" Jack wanted to know.

"No," Father answered. "Sometimes when the magma is mixed with gas and is under a lot of pressure, it comes up fast and bursts out of the earth. When it reaches the earth's surface, the magma flows over the ground and is called **lava**. It cools and becomes rock faster than when it is under the surface."



| Lava flow from Mauna Loa on the Big Island of Hawaii

"Oh, we've seen lava haven't we, Debbie?" Jack exclaimed. "Remember when Mom and Dad took us to Hawaii? We went to see the **volcano** called Mauna Loa on the Big Island."

"Yes," Debbie replied, "I remember. The whole island was covered with lava rock. Dad told us that red hot lava had shot out of the volcano and had flowed down the mountain toward the ocean."

"Years ago when I was in the army, some of us went to see a volcano while it was **erupting**," Father said. "The magma from under the earth's crust shot out the top of the mountain and began flowing toward a little village near the coast. People were running everywhere. Magma that reaches the surface of the earth is called lava. Lava on the surface hardens

more quickly than the magma underground. It takes a long, long time for magma to harden underground into granite, but lava hardens in a few years sometimes into a rock called **basalt**. I will show you a piece of basalt I brought back from that village. You will see many spaces and holes the bubbles of gas made as the magma cooled. They still show."

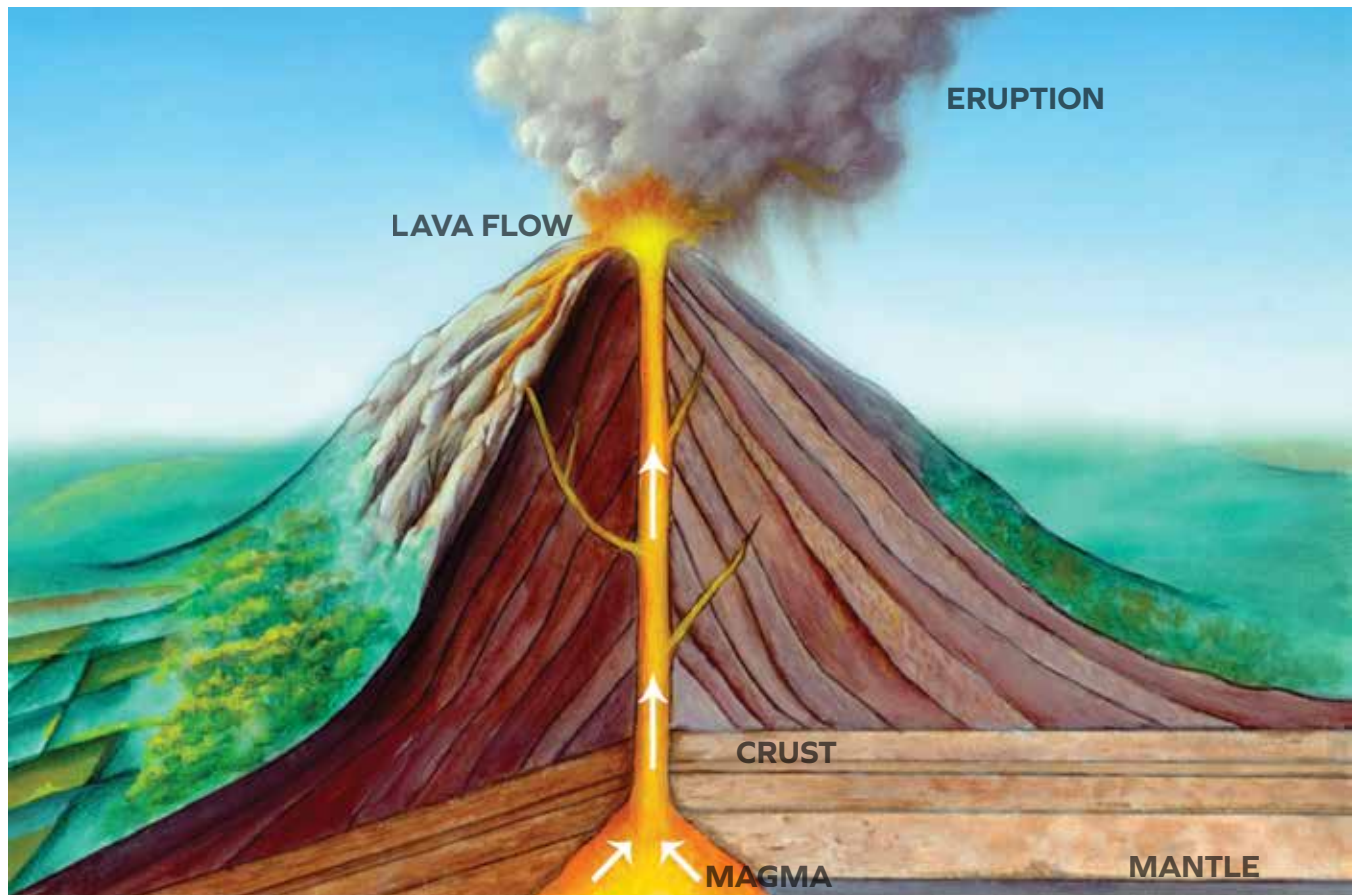
"Did the lava reach the village?" Debbie asked.

"No, not that time," Father said. "But years later, that volcano erupted again and killed every living thing around. Most of the people were able to get away before the flow reached them, though. They had to really move fast."

"It would be fun to watch a volcano erupt," said Mary.

"Yes, if you could stay away from the lava flow," they all added.

"We have talked enough for now," Father said. "Let's look for more rocks before we start for home."



| When a volcano erupts, hot magma from under the earth's crust shoots out of the mountain and flows down the side as lava.



Write the correct word from the list on the line.

basalt
blow

liquid
magma

pressure
heat

lava
volcano

- 1.16** When lava flows from a volcano, it is a very hot _____ .
- 1.17** Mauna Loa is a _____ on the Big Island of Hawaii.
- 1.18** The hot liquid that forms both granite and lava is called _____ .
- 1.19** The magma that flows from volcanoes to the surface of the earth sometimes forms a rock called _____ .
- 1.20** Erupt means to _____ up.
- 1.21** Magma that flows from a volcano is called _____ .
- 1.22** What two forces help form granite?
- a. _____
- b. _____



Write *true* or *false*.

- 1.23** _____ Heat and pressure help form granite.
- 1.24** _____ The center of the earth is very hot.
- 1.25** _____ The center of the earth is called the crust.
- 1.26** _____ Soil is mostly rock and water.
- 1.27** _____ Granite comes from hot magma which has cooled.
- 1.28** _____ It takes only a few years for magma to cool.
- 1.29** _____ The core of the earth is larger than the moon.
- 1.30** _____ Granite is called igneous rock.

1.31 _____ The part of the earth just under the soil is called the mantle.



Draw a picture of a volcano and color it.

1.32 Show the mountain, the eruption, the hot magma, and flowing lava.



Teacher check:

Initials _____ Date _____

By Pressure

That evening, the family sat around the fireplace talking about their trip to the mountain.

"What did you find, Jack?" asked Father.

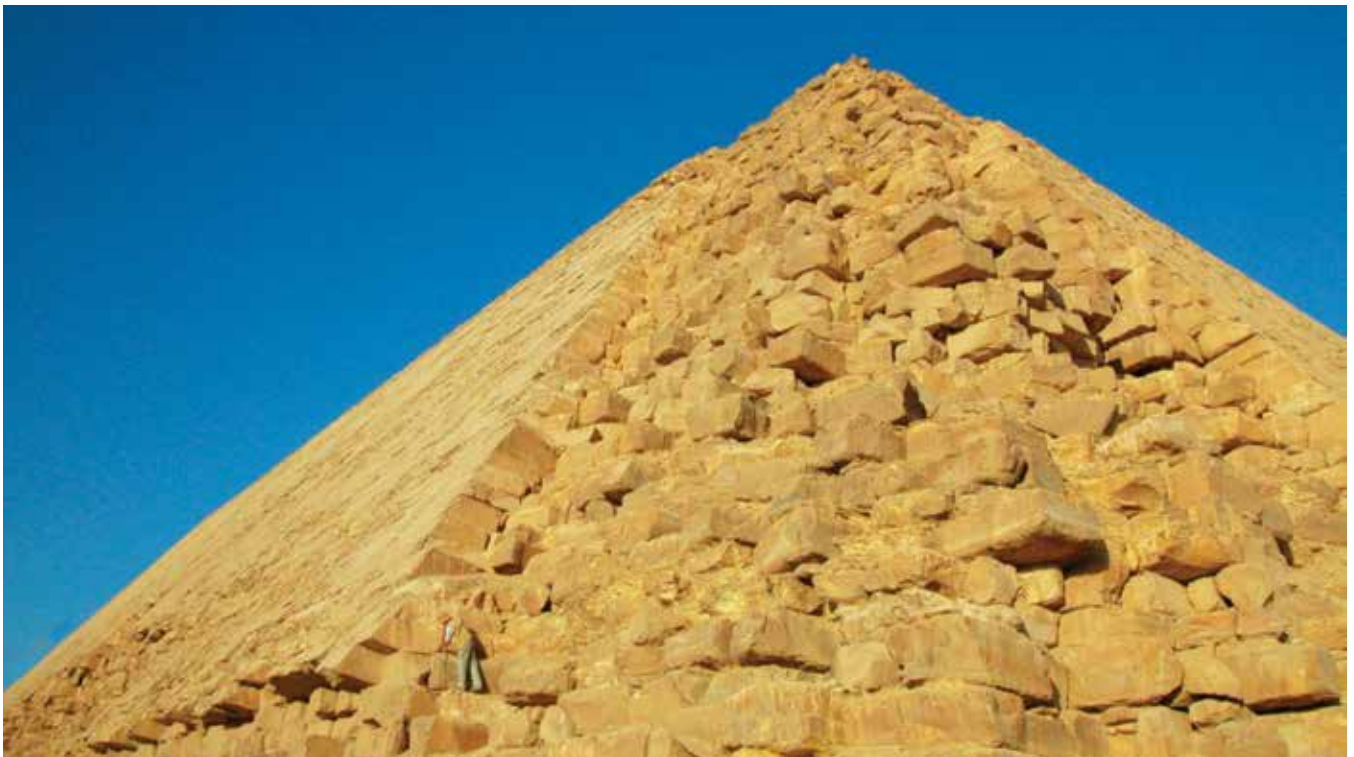
"I don't know what it is," Jack replied, holding up a gray rock for everyone to see.

"I tried to write on another stone with it, and it left white marks."

"It is probably a piece of **limestone**," Father said. "Will it crumble?"

"No, it doesn't **crumble**," answered Jack.

"Then it's not sandstone," said Father. "Sandstone is made of sand and crumbles very easily. We can soon tell if it is limestone if Mother will get us some vinegar from the kitchen (vinegar contains acid)."



| The pyramids in Egypt are made of limestone.

TEST FOR LIMESTONE



You will need these things:

a piece of limestone
some vinegar
a large nail
an eyedropper



Follow these directions. Check the boxes as you do each step.

- ☐ 1. Scrape the stone to loosen some of the grains.
- ☐ 2. Gather the grains into a small pile on the top of the stone.
- ☐ 3. Use an eyedropper and drop some vinegar on the grains.
- ☐ 4. Watch what happens.
- ☐ 5. Listen carefully.



Answer these questions.

1.33 What happened in step 4 of the experiment?

1.34 What happened in step 5?

1.35 What did you use to make the grains of rock bubble?



Teacher check:

Initials _____ Date _____

Father explained that limestone is the only rock that will fizz when vinegar is dropped on it.

"Seawater has a lot of lime in it," he told the club. "Grains of lime settle to the bottom of the sea. These grains pile up in layers. After many years, the layers become pressed together more and more. They become very hard. Limestone rock is formed in this way."

"Flowing water also helps form limestone. The flowing water carries **minerals** in the soil to the sea. The minerals settle to the bottom and pile up on layers. The minerals make limestone. Wherever you find beds of limestone on dry land, you know that water was once there."

"Now we have learned about two different kinds of rocks," Father continued.

"You remember igneous rocks were formed deep beneath the earth by heat and pressure. Granite is an igneous rock. **Sedimentary** rocks, such as limestone, were formed when minerals were washed from the soil and carried to the sea. These minerals settled to the bottom and hardened into rock. Chalk is a type of limestone. So are the beautiful forms of rock that are found in caves."

Sediment is things that settle to the bottom of a liquid. Sedimentary is a word made from the root word of sediment. This experiment will show you how soil, stones, and sand mixed together in water make sediment.



| Layers of sedimentary rock

LAYERS OF SEDIMENT



Do this experiment at home.

You will need these things:

a plastic jar with a cover
small pebbles
coarse sand
soil
water

Follow these directions. Check the boxes as you do each step.

- ☐ 1. Mix the pebbles, coarse sand, and soil together.
- ☐ 2. Fill the jar about one-half full.
- ☐ 3. Cover the mixture with water.
- ☐ 4. Put the cover on the jar and shake the jar for a few minutes.
- ☐ 5. Place the jar on a table and watch what happens.
- ☐ 6. Look at the layers of pebbles, soil, and sand. These layers are layers of sediment. If they could be pressed together and hardened, you would have a sedimentary rock.



Draw a picture of what happened.

1.36

Label the drawing: pebbles, soil, and sand.



Teacher check:

Initials _____ Date _____



Answer *yes* or *no* to each question.

1.37

- a. _____ Is limestone an igneous rock?
- b. _____ Does flowing water help form limestone?
- c. _____ Are igneous rocks formed by pressure and heat?
- d. _____ Are sedimentary rocks formed from vinegar and water?
- e. _____ Is sediment matter that has settled to the bottom of a liquid?
- f. _____ Does sea water have lime in it?
- g. _____ Did the pebbles come to the top when you did the experiment?

"What did you find today, Mary?" asked Father.

"I think it's granite, but it doesn't sparkle," she said, holding up a gray chunk.

"Mary, you have a **metamorphic** rock here called **gneiss**," Father explained.

"What's a metamorphic rock?" Rick wanted to know.

"Well, let's look at that granite rock of yours again first, Rick," said Father.

"Most rocks are made of tiny **crystals** called minerals. Different kinds of rocks are made of different kinds of minerals. This piece of granite has three kinds of crystals," Father explained. "If you look closely you will see tiny **quartz** crystals."

"Are they the ones that shine in the sun like glass?" Rick asked.

"Yes," Father answered. "Granite also has crystals of **feldspar** and mica. The mica crystals give the granite a 'salt-and-pepper' look."

"It's fun when you know what is on the inside of a rock," Mary said. "But what's a crystal?"

"That's a good question, Mary," her father said. "Let's go into the kitchen and answer that."

Here is the experiment the club tried at home. Ask your parents or your teacher to do this experiment at home or at school.



| Gneiss



| Granite

MAKE SOME CRYSTALS

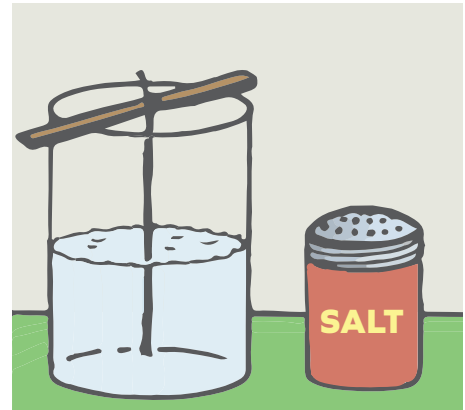


You will need these things:

glass jar
magnifying glass
a string
table salt
a small, flat stick
tablespoon
some warm water

Follow these directions. Check the boxes as you do each step.

- ☐ 1. Pour some warm water into the jar until it is about half full.
- ☐ 2. Put three tablespoons of salt into the water.
- ☐ 3. Stir the water and salt until the salt **dissolves**.
- ☐ 4. Tie the string on the stick and place the string in the water.
- ☐ 5. Let the jar stand for several days.
- ☐ 6. After several days, take the string out of the jar and examine it. If possible, use a magnifying glass. You will be looking at salt crystals.





Write the word in the blank to tell what you discovered.

1.38 Each salt crystal has _____ square sides.

- a. five
- b. six
- c. four
- d. one

1.39 A cube has six squares sides. The salt crystals were

- _____ .
- a. cubes
 - b. circles
 - c. triangles
 - d. none of these

1.40 The crystals formed on the string from the salt

- _____ .
- a. string
 - b. water
 - c. glass
 - d. none of these

1.41 Water is a _____ .

- a. solid
- b. liquid
- c. rock
- d. none of these

1.42 If a rock is made of crystals, it was probably once a

- _____ .
- a. stone
 - b. liquid
 - c. rock
 - d. none of these



"Granite is made up of three kinds of crystals or minerals—quartz, feldspar and mica. These crystals are mixed together," said Father. "This piece of gneiss rock Mary found has the same minerals in it. Notice that it is not speckled like granite. It has dark and light streaks in it. In granite, the minerals are all mixed together. In this piece of gneiss, they sorted themselves out. Feldspar is in one band. Quartz is in another. Mica is in a third band. Gneiss is called a metamorphic rock. That word means 'changed.' Metamorphic rocks have been squeezed and pushed together deep in the earth. Then, heat and pressure cause the crystals to change places. They line themselves up differently because of the great pressure."

"The rocks are not always broken into pieces from the pressure," continued Father. "Hard coal is a metamorphic rock. It is usually found deep within the earth. Men dig tunnels called mines to bring it out."



Fill in the circle before the right answer.

- 1.43** Metamorphic rock means _____ rock.
☐ soft ☐ changed
- 1.44** Gneiss is made from _____.
☐ granite ☐ lava
- 1.45** Gneiss is a _____ rock.
☐ metamorphic ☐ sedimentary
- 1.46** A metamorphic rock mined deep within the earth is _____ coal.
☐ soft ☐ hard
- 1.47** Metamorphic rocks are made by _____.
☐ heat and pressure ☐ layers in water



Teacher check:

Initials _____ Date _____



For this Self Test, study what you have read and done. The Self Test will check what you remember.

SELF TEST 1

Each answer = 1 point

Fill in the circle before the right answer.

- 1.01** Granite rocks are _____.
☐ hard ☐ soft
- 1.02** Rocks were created by _____.
☐ God ☐ man
- 1.03** Before going somewhere to hunt rocks, a person _____ ask the owner of the land if it is all right.
☐ should not ☐ should
- 1.04** A large stone is called a _____.
☐ crystal ☐ boulder
- 1.05** Sand is really a very tiny grain of _____.
☐ rock ☐ magma
- 1.06** Scientists who study rocks are called _____.
☐ rock hounds ☐ geologists
- 1.07** The top layer of the earth is sometimes called the _____.
☐ core ☐ crust
- 1.08** Rocks that are formed under the surface of the earth by heat and pressure are _____.
☐ igneous rocks ☐ crystal rocks
- 1.09** Most rocks are made up of tiny crystals called _____.
☐ mantles ☐ minerals
- 1.010** Mauna Loa is a(n) _____ in Hawaii.
☐ island ☐ volcano

Draw a line from the beginning of the sentence to the end.

- | | | | |
|--------------|--------------|---|-----------------------------------|
| 1.011 | A rock hound | ● | means changed. |
| 1.012 | Metamorphic | ● | helps form rock. |
| 1.013 | Pressure | ● | is a hard rock formed from magma. |
| 1.014 | Granite | ● | is a rock formed from a volcano. |
| 1.015 | Basalt | ● | studies rocks for fun. |

Write *yes* on the line if the sentence is correct. Write *no* on the line if the sentence is not correct.

- 1.016** _____ Heat helps form rocks.
- 1.017** _____ The center of the earth is called a cube.
- 1.018** _____ All crystals have eight square sides.
- 1.019** _____ Granite and basalt are igneous rocks.
- 1.020** _____ The core of the earth is larger than the moon.
- 1.021** _____ Limestone is a metamorphic rock.
- 1.022** _____ Coal is a sedimentary rock.

Write two examples of the three kinds of rocks formed by heat and pressure. Choose the examples from the box.

granite	coal	lava	basalt
limestone	gneiss	sandstone	

- 1.023** Igneous _____
- 1.024** Sedimentary _____
- 1.025** Metamorphic _____



Teacher check:

Score _____

Initials _____

Date _____

