The Same but Different

Can two different rocks with different names have the same mineral composition? The answer is yes. There are six major kinds of igneous rocks: granite, diorite, gabbro, rhyolite, andesite, and basalt. Geologists usually group these six kinds of igneous rocks in pairs, because each pair generally contains the same minerals. Study the table below to see which igneous rocks are the same but different.

<table>
<thead>
<tr>
<th>Common Igneous Rocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intrusive rocks (Coarse-grained)</td>
</tr>
<tr>
<td>Extrusive rocks (Fine-grained)</td>
</tr>
<tr>
<td>Minerals</td>
</tr>
<tr>
<td>Color</td>
</tr>
</tbody>
</table>

→ → → → → → Silica content of rock decreases → → → → → →

→ → → → → → Rock color becomes darker → → → → → →

Answer the following questions on a separate sheet of paper.

1. Which of the six major kinds of rock are intrusive and which are extrusive?

2. Compare granite with rhyolite. How are they similar? How are they different?

3. Compare the mineral composition of diorite with the mineral composition of andesite.

4. In what way is gabbro different from basalt? What can you infer from this about how these two kinds of igneous rocks form?

5. How is granite like gabbro? How is granite different from basalt?

6. Which rock has more silica in it, granite or basalt?

7. Is a rock with more silica in it likely to be lighter or darker than a rock with less silica in it?
The Formation of Coal

Coal is an organic sedimentary rock. One of its properties is that it burns. Coal provides energy for industries and for the production of electricity. This rock has been extremely important to the industrial development of the United States.

Much of the country's best coal is found in Pennsylvania, Ohio, West Virginia, Kentucky, Tennessee, and Alabama. The formation of this large coalfield began about 300 million years ago during a time geologists call the Carboniferous Period. During that period, vast tropical swamp forests covered much of North America. When these ancient trees died, they fell into the swamp water, which was low in oxygen. Instead of rotting—as they would in an oxygen-rich environment—the dead vegetation accumulated. The sequence of pictures below tells the rest of the story of how this accumulated plant matter became coal.

1. What is coal?
2. When did the coal deposits of the eastern United States begin to form? What were environmental conditions like at that time?
3. What is peat?
4. What process caused the peat to become coal?
5. A type of coal called anthracite is classified by geologists as a metamorphic rock. It is much harder than sedimentary coal. **Describe how you think anthracite forms.**

Underline the answer in the passage above - put question after next line.
Different Soils for Different Climates

Scientists classify soils into different types based mostly on the climate of a region. Study the cross sections of the following soil types, and then answer the questions below.

1. How far beneath the surface does each cross section of soil show?
2. In a northern forest soil, what is above the topsoil and how does it form?
3. Compare and contrast the topsoil of the three types of soil.
4. Compare and contrast the subsoil of the three types of soil.
5. Which soil develops in the wettest climate? The driest?
Weathering and Soil Formation  •  Enrich

Why Are Many Rocks Round?

Maybe you have noticed that many of the rocks you see are rounded. This is true for the small stones near a riverbank and for the large boulders in a field or forest. Sometimes you do see rocks with jagged edges, such as in a rockfall at the bottom of a cliff. These rocks' jagged edges are a sign that they have broken off from a larger block of rock fairly recently. The reason for this difference in shape is that over time, weathering tends to make rocks round. Study the figures below to find out why.

A. Ice wedging has broken off a piece from a larger block of rock. When weathering breaks rocks apart, the pieces have jagged edges and sharp corners.

B. Weathering continues to act on the rock, affecting every part of the rock’s surface. The most rapid weathering, though, occurs at the sharp edges and corners. This is because these places have a greater amount of surface area than the more rounded places have.

C. The shape of a rock that has the least amount of surface area for its volume is a rounded shape. Therefore, weathering eventually rounds off the jagged edges and sharp corners of the rock.

D. Weathering continues to affect the rock. Now, instead of changing shape, the rock gets smaller because weathering is affecting its entire surface fairly equally.

Answer the following questions

1. How would you describe the shape of a rock that has just broken off of a larger block of rock?

2. What is the process that changes the shape of rocks?

3. What part of a rock does weathering attack most rapidly?

4. Why does a rock tend to become rounded?

5. After a rock is rounded, how does weathering affect it?
Rocks From Reefs

♦ Understanding Main Ideas

Fill in the blanks in the flowchart below.

Coral animals absorb the element 1. ____________ from ocean water. ➔

Corals change the element into calcite to form protective 2. ____________

➔ When corals die, new 3. ____________ build on top of the dead corals’ shells, creating a structure. ➔ Over thousands of years, 4. ____________ grow outward toward the ocean.

Answer the following questions in the spaces provided.

5. What conditions are present in the water just south of Florida that explain why coral reefs can be found there?

   The water is ____________

6. Explain why almost all growth in a coral reef occurs within 40 meters of the water’s surface.

   Below 40 meters

7. Describe each of the three types of coral reefs. (Where it forms)

   1. ____________
   2. ____________
   3. ____________

8. What explains how limestone that began as coral can be found on continents?

   ____________ has raised ancient sea floors above

♦ Building Vocabulary

Fill in the blank to complete each statement.

9. A ring-shaped coral island found far from land is called

   a(n) ____________

10. A structure formed when the shells of coral animals grow together is

    a(n) ____________

   Inside Earth
Changing From One Reef to Another

In the South Pacific and Indian oceans, there are many atolls. These circular islands usually form a ring around a central lagoon, a shallow body of water cut off from the ocean. How do these atolls form? The nineteenth-century English biologist Charles Darwin was the first to propose that atolls began as fringing reefs around a volcanic island. Few scientists believed his theory at first. But modern scientists have drilled through the reefs of atolls and discovered that underneath are hundreds of meters of volcanic rock. Examine the series of pictures below to see how an atoll forms.

1. What is an atoll?
2. How does an atoll originally form?
3. Why does a volcanic island sink?
4. What happens to the fringing reef as the island sinks?
5. What is at the center of an atoll?
Rocks - Review and Reinforce

Metamorphic Rocks

Understanding Main Ideas
Fill in the blanks in the flowchart below.

Collisions between Earth’s plates push rock down toward the heat of Earth’s 1. __________. ⇒ As the rock is buried deeper in the crust, 2. __________ also increases on the rock. ⇒ The rock is squeezed so tightly that the 3: __________ of the rock change, creating metamorphic rock.

Answer the following questions in the spaces provided.

4. Describe a situation in which heat can change rock to metamorphic rock.
   pockets of m________ rising through Earth’s c________ can provide h________ that can produce m________ rock

5. What characteristic do geologists use to classify metamorphic rocks?
   a________ of grains that make up rocks

6. Describe how quartzite forms.
   weakly c________ quartz particles in s________ recrystallize because h________ + p________ deep beneath the surface

7. Explain what characteristics make marble a useful metamorphic rock.
   f________, even g________ cut into thin s________

Building Vocabulary
Classify each of the following metamorphic rocks by writing either Foliated or Nonfoliated in the blank beside it.

8. marble
9. slate
10. gneiss

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The Metamorphic Rocks

Tremendous pressure and high temperatures can change any rock into metamorphic rock. This process often occurs near plate boundaries. There, pressure builds as one plate collides with another. In addition, hot magma flows upward into rock near these boundaries. Such intense conditions change one kind of rock into another, such as shale, a sedimentary rock, into slate, a metamorphic rock. But what happens if the pressure and temperature continue to increase after shale becomes slate? Look at Figure 1 below. Increasing pressure and temperature change the slate into schist, and the schist changes into gneiss.

![Figure 1](image)

Gneiss and schist are the most common metamorphic rocks. Gneiss is a foliated rock usually composed of quartz and feldspar. Schist is also foliated, but its mineral composition varies. The terms gneiss and schist actually describe certain textures of metamorphic rock. That's why both shale and granite can change into gneiss, and both granite and basalt can change into schist. Figure 2 shows common metamorphic rocks to the right. The rocks on the left are igneous and sedimentary rocks. The arrows represent the pressure and temperatures that cause the formation of metamorphic rocks.

![Figure 2](image)

Answer the following questions:
1. What causes shale to change into slate?
2. What happens to the slate if these conditions increase? turns into
3. What are gneiss and schist?
4. How do tremendous pressures and high temperatures affect limestone?
5. How does metamorphism affect basalt?
6. What rocks can change into schist?
7. How does increased metamorphism affect schist?

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Teaching Resources