3.4 Notes: Metamorphic Rocks Form as Existing Rocks Change

Think About…

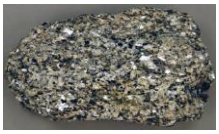
- How does a rock change into another kind of rock?

Heat and Pressure Change Rocks

Shale

Slate

Phyllite



Schist

Gneiss

- When you cook popcorn, you use heat to increase the _____ within small, hard kernels until they explode into a fluffy snack.
- Popcorn is just one example of how the form of things can dramatically change from heat and pressure-even things like rocks!
- _____ is the process in which an existing rock is changed by heat or pressure-or both.
- The original rock is called the _____ rock.
- The _____ rock is a metamorphic rock.
- Example: Shale is a parent rock that can become the metamorphic rocks slate, phyllite, schist, and _____.
- Igneous, sedimentary, and even other _____ rocks can all be parent rocks for metamorphic rocks.
- During metamorphism, rocks undergo many _____.
- Pressure causes a rock's _____ to flatten out in one direction.
- Rocks do NOT melt when they undergo metamorphism, though they experience very high _____.
- Melting ALWAYS produces igneous rock!
- Heat and pressure break the _____ that join atoms in minerals.
- _____ is when the atoms join together differently as new bonds form.
- Recrystallization can result in:
    - Crystals growing _____
    - New minerals forming

Metamorphic Changes Occur Over Large and Small Areas

- The types of metamorphic changes that occur depend on the types of _____ rocks and the conditions of temperature and pressure.

Change Over Large Areas

- When both high temperature and pressure are present, metamorphic changes can occur over very large areas.
- _____ metamorphic changes occur over large areas.
- When large blocks of rock press together and push up mountain ranges, metamorphism can occur in areas _____ of kilometers wide and tens of kilometers deep.
- The deeper below the surface the rocks are, the greater the metamorphic changes that occur in them.
    - Example: Shale near the surface becomes _____, while shale deep in Earth becomes Gneiss.

Change Over Small Areas

- When only one condition (high heat or high pressure) is present, changes tend to occur over smaller areas.
- Lava or magma may heat rock it comes into contact _____ melting it.
- The high heat causes _____ and small areas of metamorphic rock are formed.
- The rocks are experiencing heat but not pressure.

- Metamorphic rock can also be formed by high _____ alone.
- For example, rocks moving and grinding past one another during earthquakes can experience enough pressure to undergo metamorphism.

Most Metamorphic Rocks Develop Bands of Minerals

- _____ is an arrangement of minerals in flat or wavy parallel bands.
- Slate can be split into thin sheets along the _____ between its flat bands of minerals.

Foliated Rocks

- Foliation develops when rocks are under _____.
- Rock that consists almost entirely of one type of mineral does not show foliation.
- At _____ levels of metamorphism, the bands are extremely thin.
- With higher pressure and temperature, the rock will look _____.
- At even higher levels of metamorphism, the rock tends to separate into light and dark _____.

Nonfoliated Rocks

- Metamorphic rocks that do not show foliation are called _____ rocks.
- One reason a metamorphic rock may be nonfoliated is because it is made up of one type of _____.
    - Example: Marble is made from limestone, which is made mostly of calcite.
- Another reason a rock lacks foliation can be because it has not undergone extremely high _____.
    - Example: Hornfels forms from rocks being heated by lava or magma without _____.

Review

____1. Which kind of rock forms by recrystallization?

A. Intrusive igneous
B. Extrusive igneous
C. Sedimentary
D. Metamorphic

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- Popcorn is just one example of how the form of things can dramatically change from heat and pressure-even things like rocks!
- *Metamorphism* is the process in which an existing rock is changed by heat or pressure-or both.
- The original rock is called the parent rock.
- The resulting rock is a metamorphic rock.
- Example: Shale is a parent rock that can become the metamorphic rocks slate, phyllite, schist, and gneiss.
- Igneous, sedimentary, and even other metamorphic rocks can all be parent rocks for metamorphic rocks.
- During metamorphism, rocks undergo many changes.
- Pressure causes a rock's minerals to flatten out in one direction.
- Rocks do NOT melt when they undergo metamorphism, though they experience very high temperatures.
- Melting ALWAYS produces igneous rock!
- Heat and pressure break the bonds that join atoms in minerals.
- *Recrystallization* is when the atoms join together differently as new bonds form.
- Recrystallization can result in:
    - Crystals growing larger
    - New minerals forming

Metamorphic Changes Occur Over Large and Small Areas

- The types of metamorphic changes that occur depend on the types of parent rocks and the conditions of temperature and pressure.

Change Over Large Areas

- When both high temperature and pressure are present, metamorphic changes can occur over very large areas.
- Most metamorphic changes occur over large areas.
- When large blocks of rock press together and push up mountain ranges, metamorphism can occur in areas hundreds of kilometers wide and tens of kilometers deep.
- The deeper below the surface the rocks are, the greater the metamorphic changes that occur in them.
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Most Metamorphic Rocks Develop Bands of Minerals

- *Foliation* is an arrangement of minerals in flat or wavy parallel bands.
- Slate can be split into thin sheets along the boundaries between its flat bands of minerals.

Foliated Rocks

- Foliation develops when rocks are under pressure.
- Rock that consists almost entirely of one type of mineral does not show foliation.
- At low levels of metamorphism, the bands are extremely thin.
- With higher pressure and temperature, the rock will look shiny.
- At even higher levels of metamorphism, the rock tends to separate into light and dark bands.

Nonfoliated Rocks

- Metamorphic rocks that do not show foliation are called nonfoliated rocks.
- One reason a metamorphic rock may be nonfoliated is because it is made up of one type of mineral.
    - Example: Marble is made from limestone, which is made mostly of calcite.
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Review

____1. Which kind of rock forms by recrystallization?

3. Intrusive igneous
4. Extrusive igneous
5. Sedimentary
6. Metamorphic