Name _____ Date _____ Class _____ MS ESS 1-4

Enrich

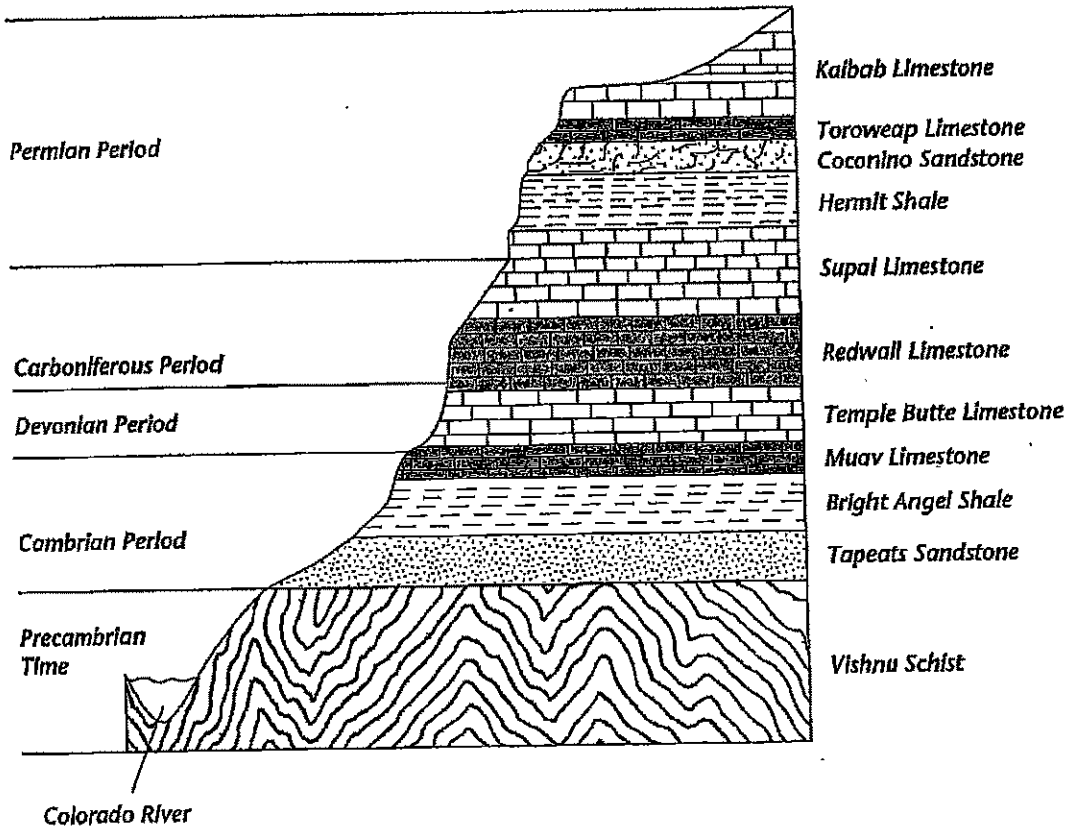
The Geologic Time Scale

You can refer to the picture on page 111.

The figure below shows how old the layers of the Grand Canyon are. Answer the questions that follow on a separate sheet of paper.

A Young Canyon Made of Old Layers

As the Colorado River cut down through Earth's crust to form the Grand Canyon, it exposed layer after layer of sedimentary rock.



1. Did any of the rock in this part of the Grand Canyon form before the Paleozoic Era began? Explain.
2. During which period did the Redwall limestone form?
3. During which period did the Bright Angel shale form?
4. During which period did the Coconino sandstone form?
5. Did any of the rock that forms the Grand Canyon form during the Mesozoic Era? Explain.
6. What periods of the Paleozoic Era are not represented by rock of the Grand Canyon? How might you account for such gaps?

COPYRIGHT © BY PEARSON EDUCATION INC., OR ITS AFFILIATES. ALL RIGHTS RESERVED.

Place the outside corner, the corner away from the dotted line, in the corner of your copy machine to copy onto letter-size paper.

Chapter 7: Slow Changes Summary
Input Page/Notes

Chapter 7: Slow Changes Summary

Recall:
- **Weathering** is the **breakdown** of rock into pieces called sediment. Weathering can also cause minerals to disintegrates or dissolve.
- **Erosion** is **movement** of weathered material from one location to another. Erosion causes the "wearing away" of the rock.
- **Deposition** is the **buildup** of material in an area. The materials is added to (deposited) to a land mass or landform.

Weathering, Erosion and Deposition Work Together
- These three process are the main forces/processes behind landform formation and landscape type.
- These process work together to shape the landscape of land. Without weathering, erosion and deposition, land would look flat and plain.
- Weathering, erosion and deposition slowly change Earth's surface.
- Weathering, erosion and deposition are not the only processes that change Earth's surface. Tectonic plate movement creates new land, mountains and deep valleys as well. Catastrophic events such as landslides and volcanic eruptions also change Earth's landscape.
- Weathering, erosion and deposition ultimately lead to the formation of new rock (specifically, sedimentary rock). When sediment is deposited in a new location, it is compacted and cemented together over time to form new rock.

The Importance of Natural Forces in Slow Change
- Water and wind are the most important natural forces behind these processes. Water and wind BOTH weather (breakdown) and erode (move) rock. When water contains substances, such as carbon dioxide or salt, it can disintegrate or dissolve rock.
- Gravity is the driving force in moving and depositing weathered material. Without gravity, water would not flow and sediment in the wind would never fall to Earth's surface.

© Stephanie Elkowitz

Slow Changes to Earth

What is ***erosion***?

-
  - What term best describes ***erosion***?
    -

What is ***weathering***?

-
  - What term best describes ***weathering***?
    -

What is ***deposition***?

-
  - What term best describes ***deposition***?
    -

(Which process comes first?) → ***(Which process comes second?)*** → ***(Which process comes third?)***

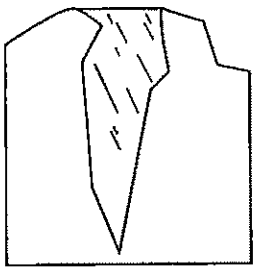
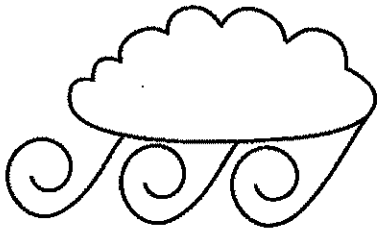
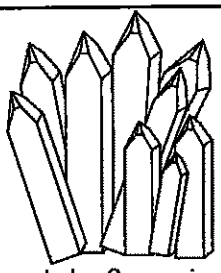
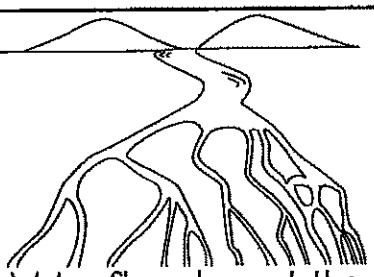
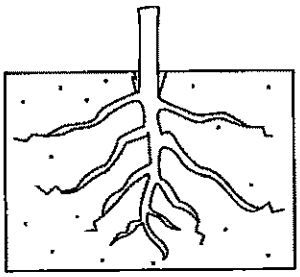
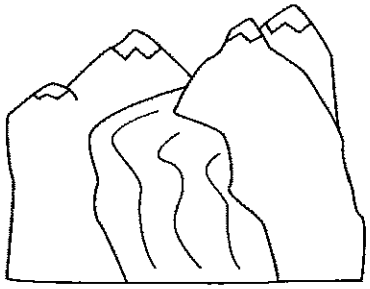
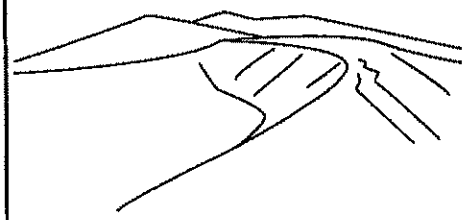
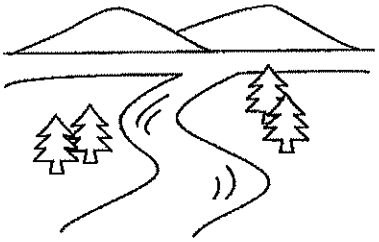
● Chapter 7: Slow Changes Summary
INB Activity #2

Directions: Cut out the table and cards. Sort and glue the cards in the correct spots on the table. Glue the table into your notebook.

WEATHERING	EROSION	DEPOSITION

© Stephanie Elkowitz

● Chapter 7: Slow Changes Summary
INB Activity #2 cont.

 Water freezes, expands and breaks apart rock	 Rain falls and wears away rock. If acidic, the rain can disintegrate rock	 Wind carries broken rock pieces and sediment from one location to another
 Salt crystals form in rocks and cause it to break apart or disintegrate.	 Water flow slows at the mouth of a river. Sediment is deposited and a delta forms.	 Tree roots wedge into rock and break it apart
 Glaciers carry sediments as they move downhill	 Waves carry and move sediments along coastlines	 Sand dunes form when wind stops blowing and sand is deposited
 Flowing water in rivers carries sediments downstream		

© Stephanie Elkowitz

Chapter 12: Rapid Changes to Earth
Input Page/Notes

Chapter 12: Rapid Changes to Earth

Weathering, erosion and deposition cause slow changes to Earth. These processes are gradual and take many years – sometimes millions of years – to change Earth's landscape.

Rapid Changes to Earth
- Some events/processes that occur on Earth can dramatically and quickly change Earth's surface. These events are punctuated and usually catastrophic.
- Rapid changes to Earth usually occur unexpectedly and they are often associated with the destruction of land. If this land is inhabited by humans, humans can be negatively affected.

Rapid Changes to Earth's Surface

There are several events and natural processes that can rapidly change Earth's surface. These changes can occur in as short as seconds.

1. **Volcanic Eruption.** A volcanic eruption is a rupture of molten rock (called magma) onto Earth's surface. The magma flows on Earth's surface (called lava). When the lava cools, it forms new rock. This rock becomes new land. In this way, volcanic eruptions create new land in a very short amount of time. This new land can expand islands or change the landscape of an area.
2. **Landslide.** A landslide is the movement of rock, debris and/or a large mass of land down the edge of a mountain. Landslides can occur when slopes become too steep. They can also occur during torrential rains or earthquakes. These events weaken rock on the edge of a mountain, causing it to collapse. Landslides are dangerous because large amounts of land are destroyed in a very short amount of time.
3. **Tsunami.** A tsunami is a large sea wave or series of waves that resembles a rapidly rising tide. Tsunamis can cause massive destruction in coastal regions. Specifically, they can destroy beaches. Tsunamis are most often caused by earthquakes that originate in the ocean.
4. **Earthquakes.** An earthquake is shaking of Earth's surface. It is most often caused by grinding of tectonic plates (large slabs of Earth's crust that move towards each other, away from each other or past each other). An earthquake can cause rapid changes to Earth because the shaking of Earth can cause landslides and/or tsunamis.

© Stephanie Elkowitz

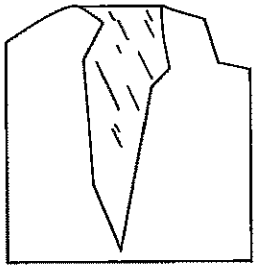
Chapter 12: Rapid Changes to Earth
INB Activity

Directions: Cut out the table and cards. Sort the cards as examples of rapid and slow changes to Earth.

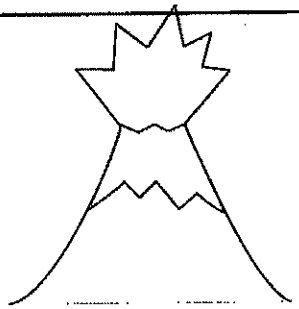
Rapid Change	Slow Change

© Stephanie Elkowitz

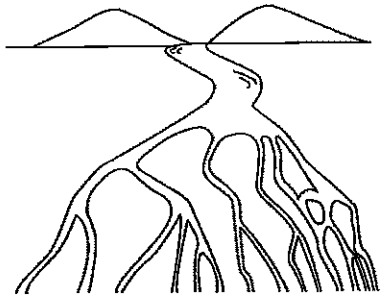
● Chapter 12: Rapid Changes to Earth
INB Activity cont.



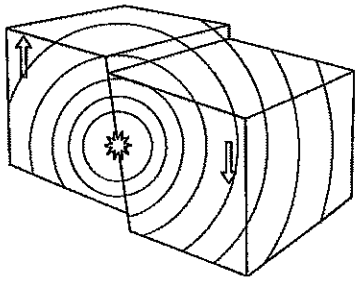
Weathering



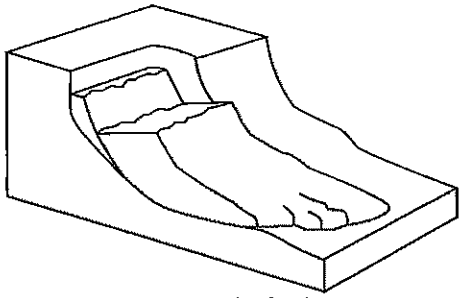
Volcanic Eruption



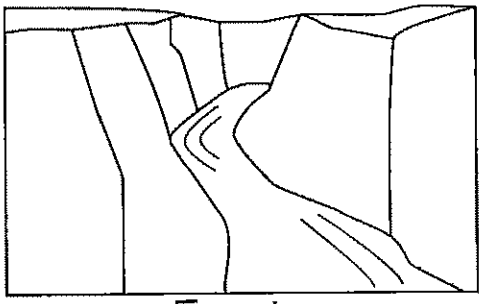
Deposition



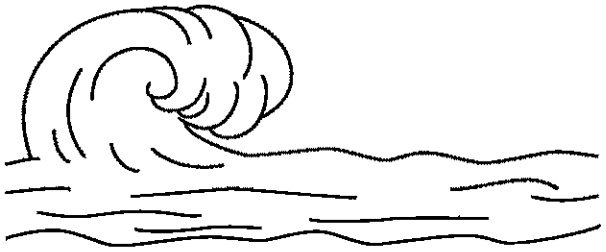
Earthquake



Landslide



Erosion



Tsunami

© Stephanie Elkowitz

MS-ESS2-2

Chapter 2: Types of Plate Boundaries
Input Page/Notes Version 2

Chapter 2: Types of Plate Boundaries

Summary of Plate Movement
Tectonic plates can move toward each other, move away from each other or slide past each other. The type of movement that occurs at the boundary between tectonic plates determines the type of plate boundary that exists between them. There are 3 types of plate boundaries:

Convergent Boundary
- Two tectonic plates move towards each other at a convergent boundary
- A convergent boundary is also called a destructive plate boundary because one plate is slowly destroyed at the boundary
- At a convergent boundary, the denser plate subducts or moves below the less dense plate. The subducted plate melts and becomes part of the mantle
- There are 3 types of convergent plate boundaries:
  1. **Oceanic–oceanic convergence**: This occurs where two plates made of oceanic crust converge. One plate subducts under the other, forming a trench. The subducted plate melts and becomes part of the mantle. Often, underwater volcanoes form near the boundary in the other plate. Ex. The Mariana trench is formed by an oceanic–oceanic convergence.
  2. **Oceanic–continental convergence**: This occurs where an oceanic plate converges with a continental plate. The oceanic plate subducts under the continental plate because it's denser. A trench forms at the boundary. Often, mountains or volcanoes form on the continental plate near the boundary. Ex. Andes mountains are formed by oceanic–continental convergence.
  3. **Continental–continental: convergence**: This occurs where two continental plates converge. One plate subducts, melts and becomes part of the mantle. A mountain range forms in the other plate where crust is "squashed" together. Ex. The Himalayan mountains are formed by continental–continental convergence

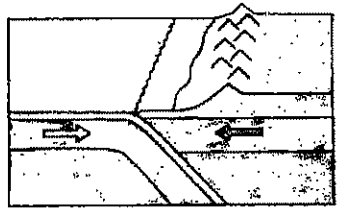
Divergent Boundary
- Two tectonic plates move away from each other at a divergent boundary.
- A divergent boundary is also called a constructive boundary because new crust or lithosphere is created at the boundary.
- As the plate move apart, molten rock from within Earth moves upward and fills the space between the plates. The molten rock cools and forms new crust.

Transform Boundary
- Two tectonic plates slide past each other at a transform boundary.
- A transform boundary is also called a conservative plate boundary because crust is neither created nor destroyed at this boundary (crust is conserved).
- Transform boundaries are often found between two convergent, two divergent or a convergent and divergent boundary.
- The San Andreas Fault is one of the most well-known transform boundaries.

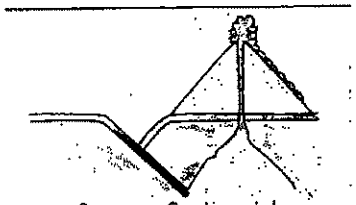
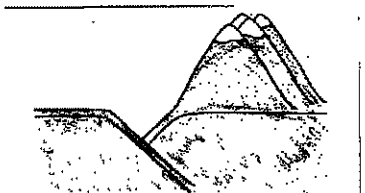
© Stephanie Elkowitz

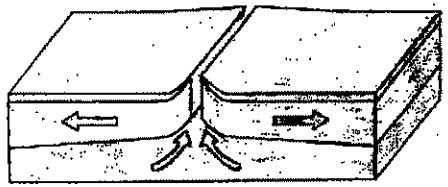
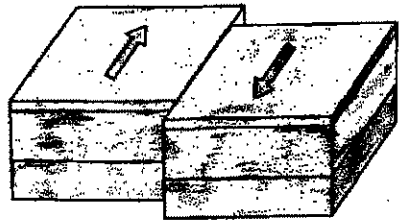
Name: _____ Period: _____

Types of Plate Boundaries

Type of Plate Boundary	What happens at the boundary	What the boundary creates
 Convergent		

Convergent Boundaries

 Oceanic–Oceanic Convergence		
 Oceanic–Continental Convergence		
 Continental–Continental Convergence		

Type of Plate Boundary	What happens at the boundary	What the boundary creates
 Divergent		
 Transform		

MS-ESS2-3

Chapter 7: Evidence for Pangaea
Input Page/Notes

Chapter 7: Evidence for Pangaea

Alfred Wegener developed his Theory of Continental Drift based on important pieces of evidence. **Evidence** is pieces of information or facts that help prove something to be true. Wegener had 3 major types of evidence to prove his theory:

1. Landform Evidence
   - Mountains and other landforms on separate continents seem to be continuous. The only way the landforms could be continuous is if the continents were once combined together as Pangaea.
   - The mountain ranges in North America are made of the same rock found in European mountain ranges.
   - Mountain ranges in Africa and South America "line up" and appear to be continuous. Also, the east coast of South America complements the west coast of Africa. The continents seem to fit together like puzzle pieces.

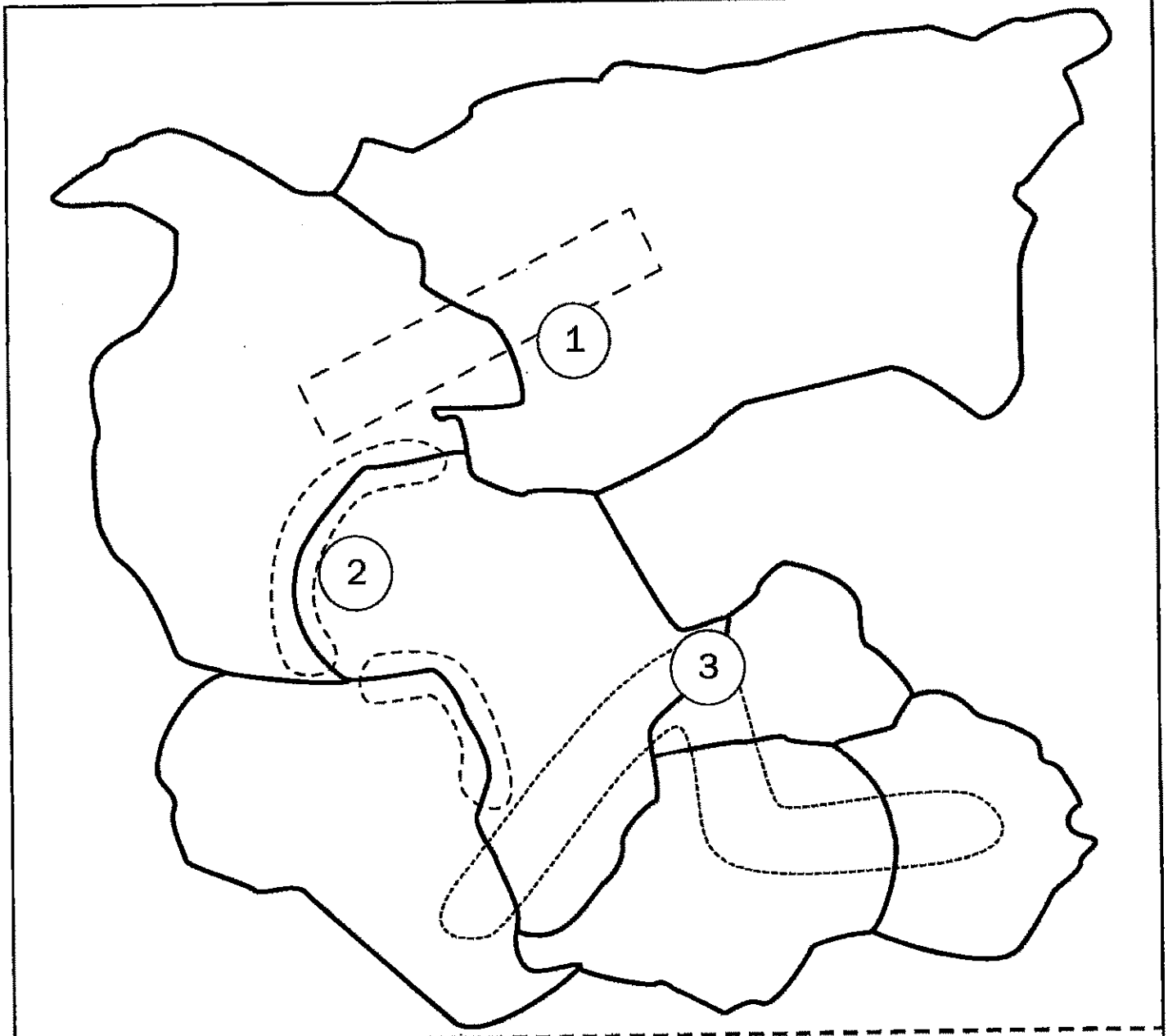
2. Geology Evidence
   - Rocks, minerals and natural resources on separate continents are consistent with each other and are found in locations that suggest the continents were once joined together.
   - There are matching geologic trends along the east coast of South America and west coast of Africa. Rock composition and formations found along the coasts are the same.
   - Coal deposits in North America (specifically Pennsylvania) match up with coal deposits across Europe. The deposits are made of coal with a similar composition and date back to the same time period.
   - Glacial sediment from the same glacier was deposited across South America, Africa, India, Antarctica and Australia.

3. Fossil Evidence
   - There are similar fossils dating to the same time period found on separate continents. *Fossil evidence is considered to be the strongest evidence for Pangaea.*
   - Fossils of the same plants and animals living at the same time were found in South America, Africa, India and Australia.
   - Fossils of an ancient freshwater reptile known as *Mesosaurus* were found in both Brazil and South Africa in the same rock layers.
   - Fossils of an ancient land reptile known as *Lystrosaurus* were found in Africa, India and Antarctica in the same rock layers.

© Stephanie Elkowitz

■ Chapter 7: Evidence for Pangaea
INB Activity

Directions: Cut out the organizer. Cut along the solid lines. Fold along the dotted line. Describe the three different forms of evidence for the existence of Pangaea.



1. LANDFORM EVIDENCE	2. GEOLOGY EVIDENCE	3. FOSSIL EVIDENCE

© Stephanie Elkowitz

Chapter 12: Earthquake & Volcano Map
Input Page/Notes

Chapter 12: Earthquake & Volcano Map

Earth is an Active Planet
- Earth is an active planet. The surface of Earth is covered with a thin layer of rock called lithosphere. The lithosphere is not continuous - it is broken into large slabs called tectonic plates. Tectonic plates are constantly moving and interacting.
- The movement and interaction of tectonic plates creates disturbances in Earth's crust.

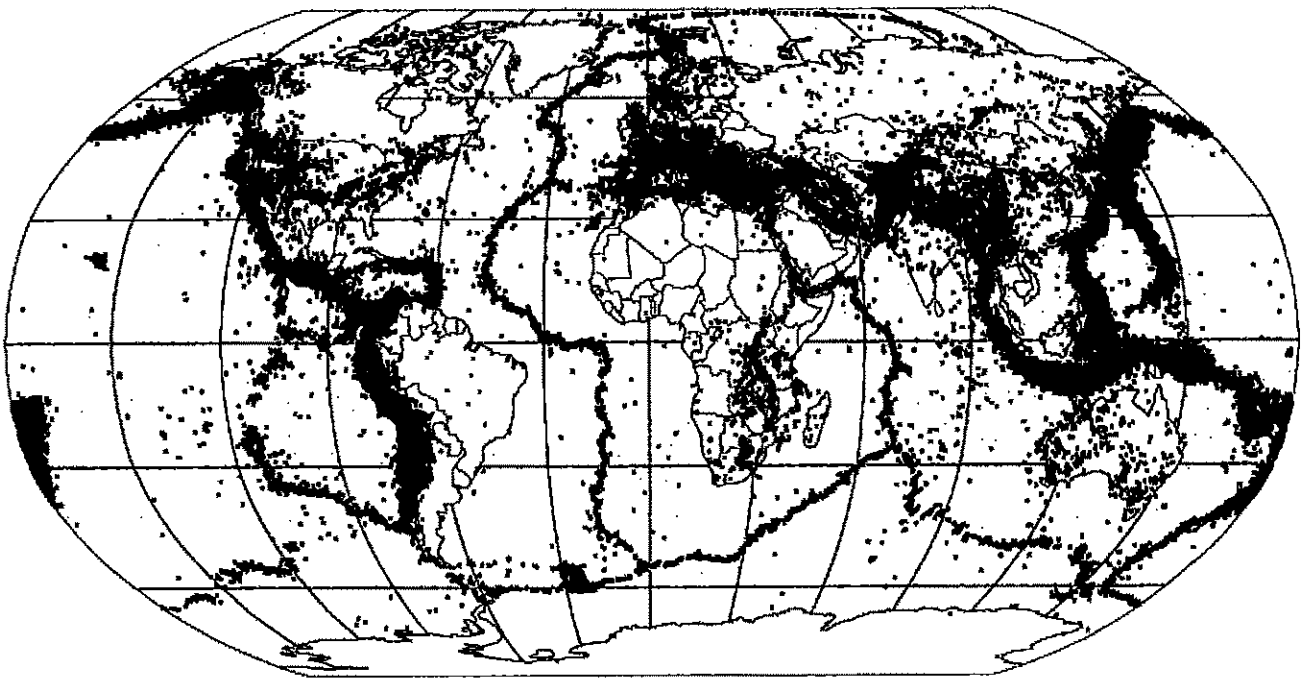
Earthquakes and Volcanic Eruptions
- Earthquakes and volcanoes are associated with disturbances in Earth's crust. Most often, they are associated with fractures or faults in Earth crust. Faults are found at the boundary between tectonic plates.
- At faults, plates move toward, away from or past each other. This movement causes plates to rub or grind each other. The rubbing and grinding creates a buildup of energy. This energy is released during an earthquake. Waves of energy move through Earth's crust during an earthquake, causing earth to move and shake.
- Hot, molten rock (magma) can escape Earth's interior at faults. Faults provide fractures through which magma rises and pushes through. At the surface, the magma erupts through the fractures. The escape of magma through the fracture produces volcanoes.

Patterns to Earthquake Epicenters and Volcanic Eruptions
- Earthquakes and volcanic eruptions have been observed for thousands of years. Scientists began accurately recording and mapping the location where earthquakes originate and volcanoes erupt during the mid 1800's.
- The recording and mapping of earthquake epicenters and volcanic eruptions helps scientists map the boundaries between tectonic plates. It also helps scientists predict where future earthquakes and volcanic eruptions might take place.

 © Stephanie Elkowitz

■ Chapter 12: Earthquake & Volcano Map
INB Activity Version 2

Directions: Cut out the worksheet. Answer the questions using the map, which represents earthquake and volcano activity between 1963 and 1998. *Each dot represents an epicenter or eruption.* Use your plate tectonics map to help you.



Map that represents Earthquakes & Volcanic Eruptions from 1963 to 1998

1. Where do earthquakes and volcanic eruptions most commonly occur?

2. Is there a pattern to where earthquakes occur and volcanoes erupt?

3. Why do earthquakes/eruptions most often occur near plate boundaries?

4. Are there any clusters of earthquakes or volcanic eruptions that are not near a plate boundary? Explain.

© Stephanie Elkowitz

Chapter II: Nutrient Cycling
Input Page/Notes

Chapter 11: Nutrient Cycling

What is nutrient cycling?
- Nutrients and other substances important to living things are constantly cycling in the environment. Cycling of nutrients is important because if they are stagnate, living things could not survive.
- Water, oxygen (O_2) and carbon dioxide (CO_2) are essential to living things. They cycle between living things as well as between living things and nonliving parts of the environment.

Water Cycling
- Water is important to all living things. Plants need water to make food, to transport substances inside them and to maintain their structure. Animals need water to transport substances inside them, to digest food and for many reactions that keep an animal alive.
- Water cycles between plants and animals as well as through the atmosphere (the air), hydrosphere (bodies of water) and geosphere (the ground):
  - Animals take in water from lakes, rivers and streams. They excrete (release) excess water, which collects in nonliving parts of the environment (such as lakes, rivers or soil).
  - Plants takes in water in the soil. They use this water for photosynthesis. They lose some water through tiny openings in their leaves. This water evaporates and becomes part of nonliving parts of the environment (such as the atmosphere).
  - Water in the air (water vapor), in the ground (the geosphere) and in bodies of water (the hydrosphere) cycle around Earth through the water cycle. In the water cycle, water evaporates, condenses, precipitates and collects on different parts of Earth.

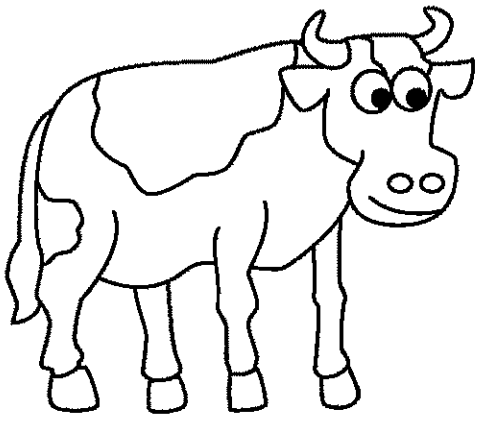
Oxygen Cycling
- Oxygen is essential to animals. Animals cannot live without oxygen.
- Plants produce oxygen as a byproduct of photosynthesis. When plants make food, they produce some oxygen as well. They release oxygen into the environment. Animals take in oxygen and use it to help break down food and make energy.

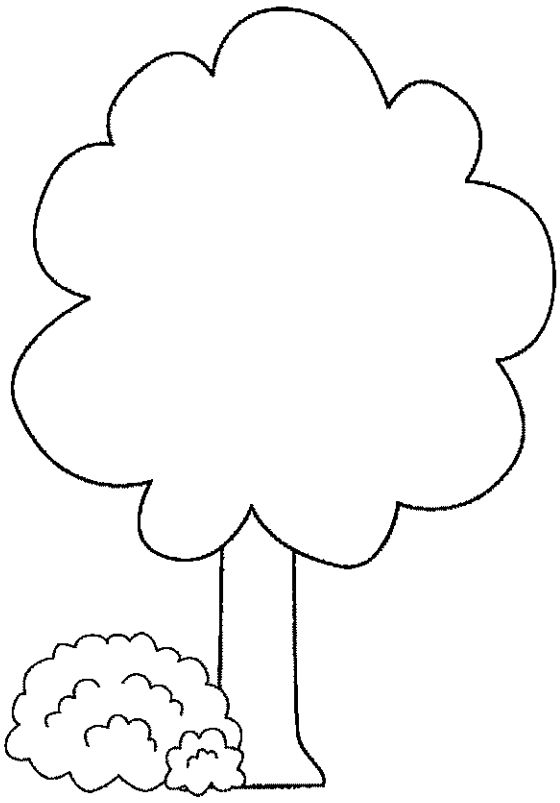
Carbon Dioxide Cycling
- Plants require carbon dioxide to perform photosynthesis. Without carbon dioxide, plants cannot make their own food.
- Animals produce carbon dioxide when they extract energy from food (in the process of cellular respiration). They release carbon dioxide into the environment. Plants take in the carbon dioxide and use it to perform photosynthesis.

© Stephanie Elkowitz

● Chapter II: Nutrient Cycling
INB Activity

Directions: Cut out the organizer. Cut along the solid lines and fold along the dotted. Describe how plants and animals contribute to the cycling of water, oxygen and carbon cycle through the environment.





Water Cycling	Oxygen Cycling	Carbon Dioxide Cycling

© Stephanie Elkowitz

Chapter 14: Rock Cycle
Input Page/Notes

Chapter 14: Rock Cycle

Rocks are constantly breaking down and forming new rock. They are cycled in and around Earth in a process known as the **rock cycle**.

The rock cycle is a series of changes and processes that cause rocks to break down and form new rocks. Igneous rock can become sedimentary rock, sedimentary rock can become metamorphic rock and so on.

There are four sets of processes important to the rock cycle:

Melting and Solidification
- Rock (igneous, metamorphic or sedimentary) can be buried deep within Earth. If buried deep enough, extreme heat will cause the rock to melt and form magma. Magma is molten or liquid rock.
- *Note: In diagrams, we often show only igneous and metamorphic rock melting to become magma. Sedimentary rock usually first becomes metamorphic rock before completely melting to become magma.*
- Over time, magma moves up through Earth's crust, cools and solidifies underground. Magma can also rupture through Earth's crust. Lava cools and solidifies on Earth's surface. When magma or lava cools and solidifies it becomes igneous rock.

Weathering and Erosion
- Igneous, metamorphic and igneous rock on Earth's surface is exposed to the natural elements.
- Over time, rock is broken down by wind, water and other natural forces into tiny particles (sediment). This is called weathering.
- Sediment is carried by wind and water from one location to another. The movement of sediment is called erosion.

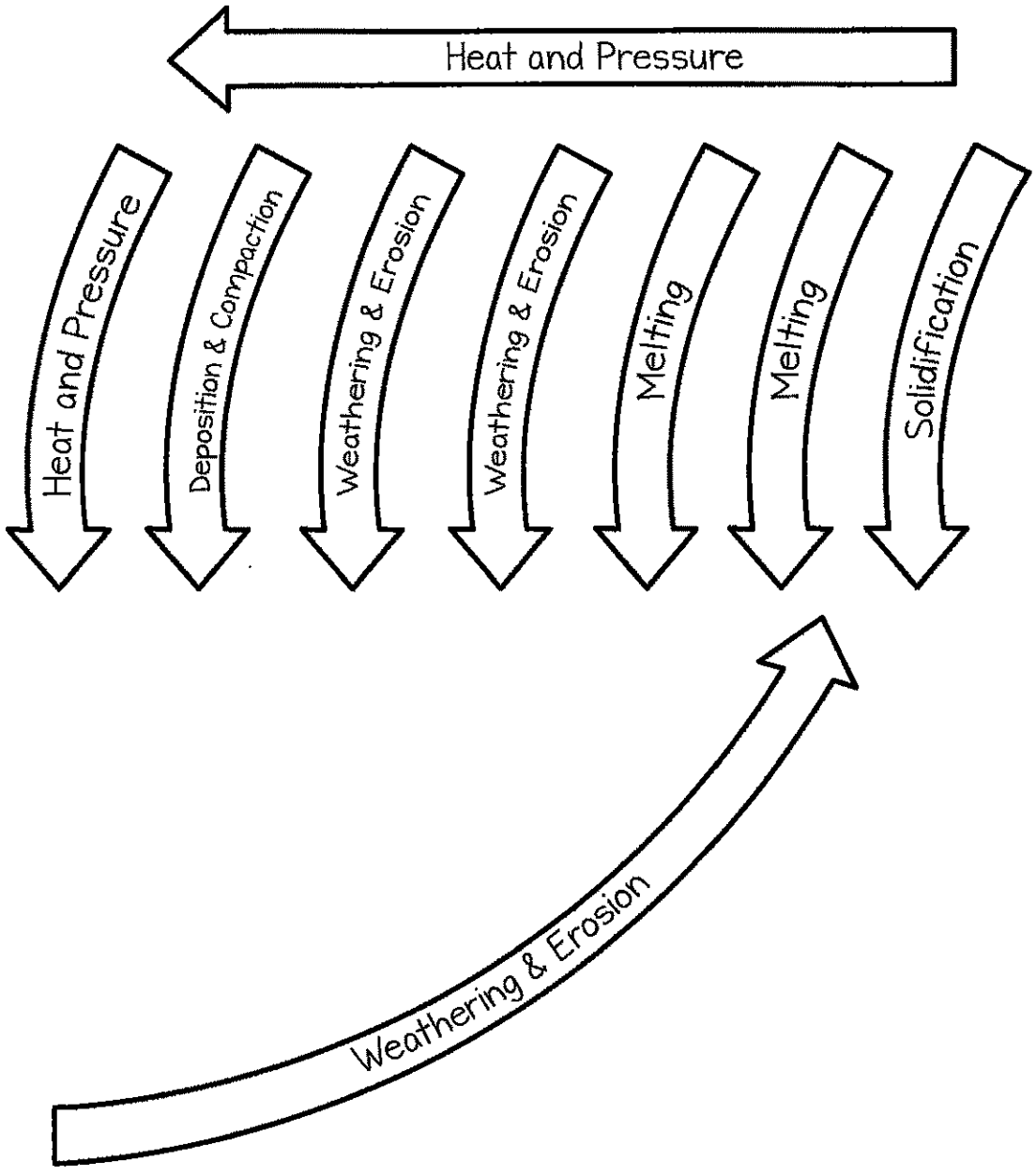
Deposition and Compaction
- Sediment is deposited in a location. Over time, it is compacted and cemented together to form sedimentary rock.

Heat and Pressure
- Igneous and sedimentary rock can be buried deep within Earth. This rock can change into metamorphic rock due to heat and pressure.
- Old metamorphic rock can also become new metamorphic rock if it exposed and then reburied and exposed to heat and pressure.

 © Stephanie Elkowitz

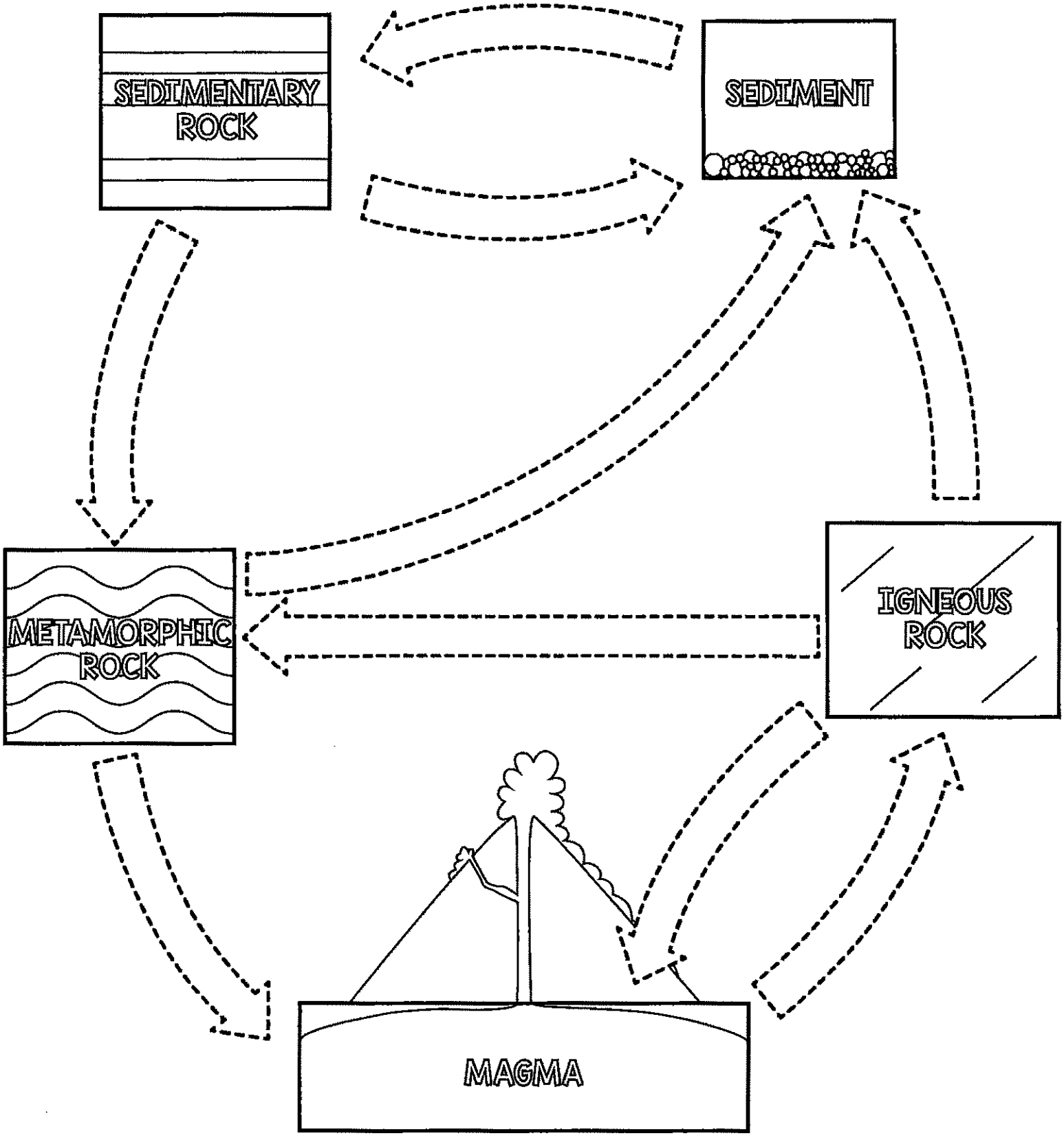
■ Chapter 14: Rock Cycle
INB Activity

Directions: Cut arrows below and the diagram on the next page. Glue the diagram into your notebook. Then glue the arrows in the correct spots on the diagram to show the different processes of the rock cycle.



 © Stephanie Elkowitz

■ Chapter 14: Rock Cycle
INB Activity



© Stephanie Elkowitz