

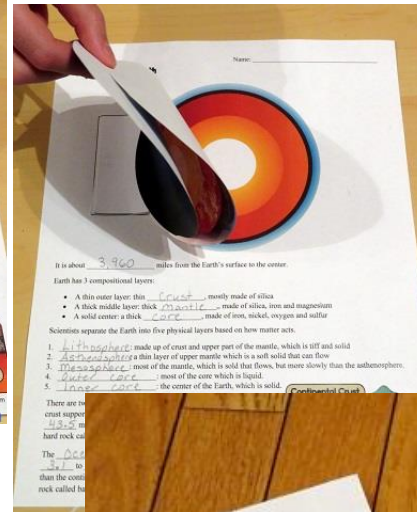
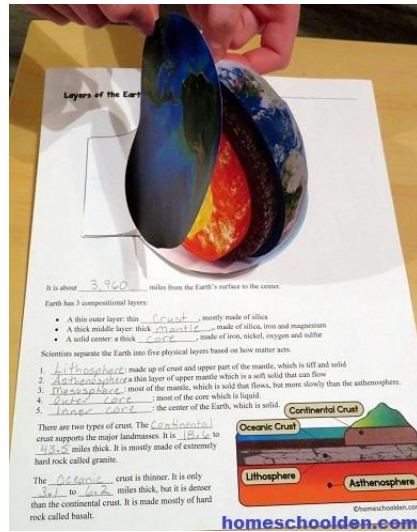




# Layers of the Earth Activity

## Interactive Flapbook - Notebook Page

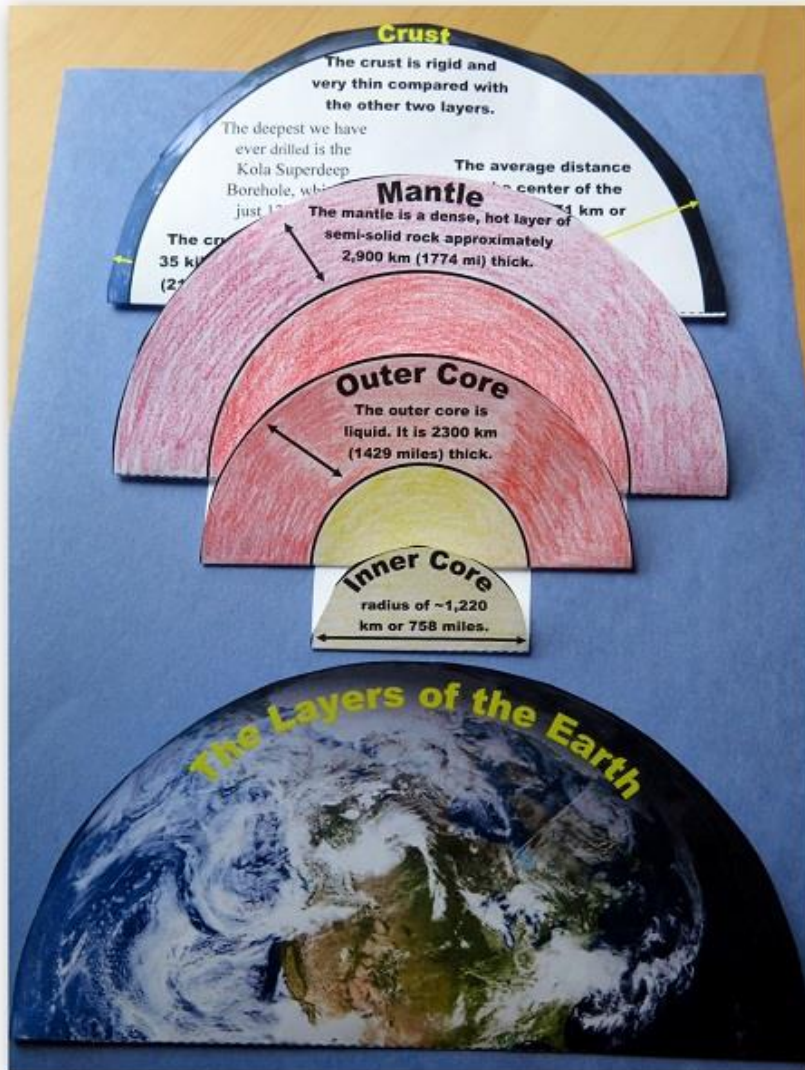
In color or black & white



# 2<sup>nd</sup> Option: Layers of the Earth Activity

## Interactive Notebook Pieces

### Layers of the Earth - Interactive Notebook Activity



# Hands-On Activities Earth Science Unit



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Map makers of the 1500s noticed how South America and Africa almost fit together.

## Plate Tectonics

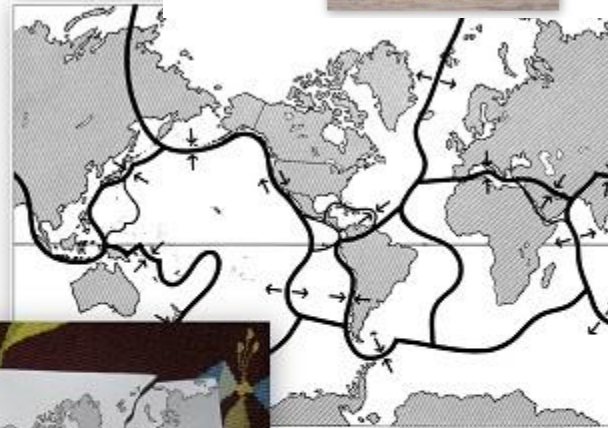


## Plate Tectonics

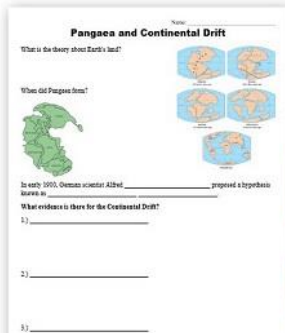


Introducing the idea of convection currents

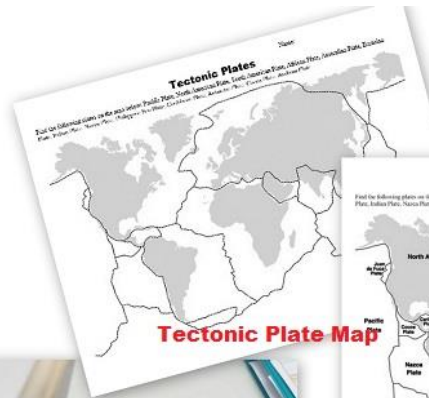
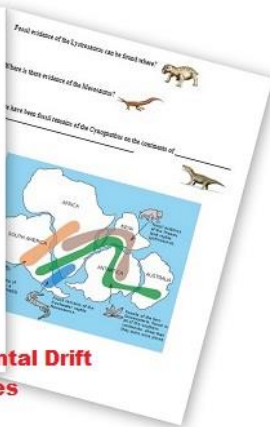
## Plate Tectonics Puzzle



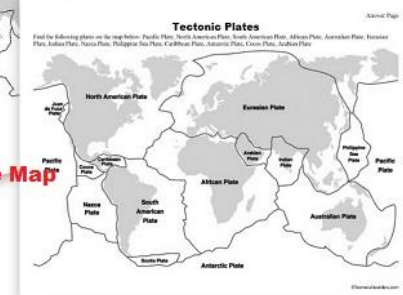
# Pangaea & Plate Movement Activities



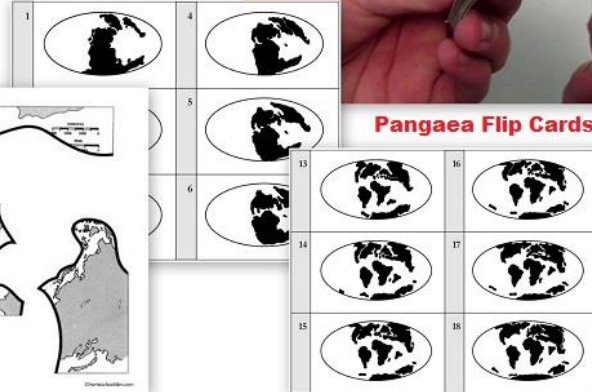
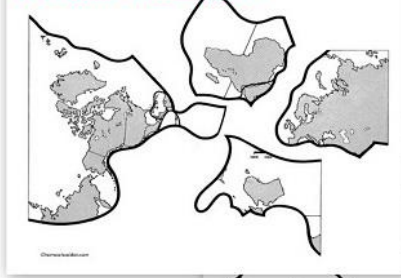
**Pangaea and Continental Drift notebook pages**



**Tectonic Plate Map**



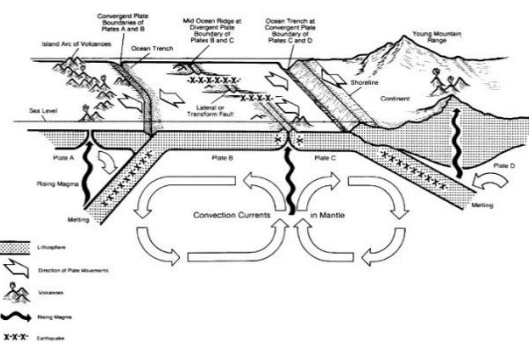
**Tectonic Plate Puzzle**



**Pangaea Flip Cards**



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**Creating a Convection Current Activity**

1. Using a pipette or eye dropper gently squeeze red (dye) water at the bottom of the pan near the heating element. As the water heats up, the red dye will move up and out, away from the heating element.
2. Then gently squeeze some blue (dye) water at the top of the water surface near the bag of ice. The water will sink and then start to move across the bottom of the pan toward the heating element.




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## Plate Boundaries

**Plate Boundaries** Name: \_\_\_\_\_


**Divergent Boundaries**



These are places where two tectonic plates are \_\_\_\_\_ from each other. Most of these are found along the \_\_\_\_\_ valleys.

\_\_\_\_\_ rises through the rift's faults and forms a mid-ocean ridge. New ocean crust is formed.

**Transform Boundaries**



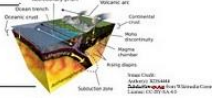
These are places where two tectonic plates \_\_\_\_\_ past each other. In these areas, there are long faults sometimes hundreds of kilometers in length. The fault is probably the best-known example.

**Types of Convergent Boundaries**

At convergent boundaries two tectonic plates are moving \_\_\_\_\_ each other.

When plates collide, the \_\_\_\_\_ plate eventually descends below the other plate. This process is called \_\_\_\_\_.

This diagram shows the process of subduction:







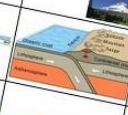

There are three types of convergent boundaries.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

The \_\_\_\_\_ crust is made mostly of minerals that are high in iron and magnesium. These form dense, dark-colored rocks like \_\_\_\_\_.

The \_\_\_\_\_ crust is made mostly of minerals such as feldspar and quartz. These are less dense, lighter colored such as \_\_\_\_\_.

**Types of Convergent Boundaries** Name: \_\_\_\_\_

| Oceanic-Oceanic  | Oceanic-Continental   | Continental-Continental  |
|--|---|--|
|  <p>One oceanic plate is cooler than the other and therefore is denser. It descends into the mantle. As it descends into the mantle, it is melting some of the plate. This molten material, called magma, is less dense and rises to the surface where it erupts. Volcanic island arcs parallel the trench.</p> |  <p>In this case, the oceanic plate is denser than the continental plate and descends into the mantle. This results in a chain of volcanoes along the edge of the continental plate.</p> |  <p>Continents are often called along-arc, the oceanic plate may be completely subducted. The continental crust behind it cannot descend, though, because the continental rocks are less dense and don't sink into the mantle. The edges of the continents collide, becoming crumpled, folded and uplifted.</p> |
|  <p>Island Arc</p>  |  <p>Volcanic Island Arc</p>  |  <p>Mountain Range</p>  |

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## Faults, Earthquakes, Earthquake Waves

**Faults**

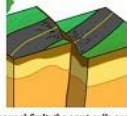
A fault is a crack in the bedrock where neither side is kept together.

The image on the right shows a fault in the limestone. Can you see where that is?


Both sides of a fault are free to move.

There are several different types of faults


A strike-slip fault: rocks slide past each other horizontally. There is little vertical movement.



A normal fault: the crust pulls apart, stretching the crust into a valley.

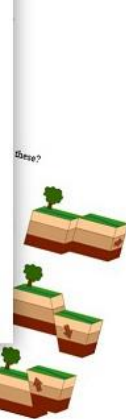


A thrust fault is sometimes also called a reverse fault. Once block of the crust slides on top of the other.



All faults are related to the movement of Earth's tectonic plates. The biggest faults mark the boundary between two plates.

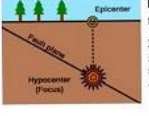
### Faults and Earthquakes Review



**Earthquake Waves**

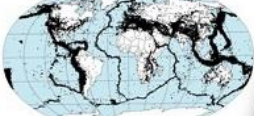
**Earthquake Focus** - Energy is generated at the place where rocks break (or slip). This is called the focus or hypocenter.

Energy moves outward from that point in a series of waves, which are represented in diagrams as concentric circles.



**Epicenter** - If you draw a line straight upward to the surface of the Earth, that is called the epicenter.

The image below shows where over 300,000 earthquakes epicenters were located between 1963 and 1999.



What does that show you?

Earthquakes usually occur on a fault - a fracture on which there is sliding. That fault is usually underground. In the 1940s and 1950s, scientists realized that earthquakes don't happen randomly on the surface of the globe. They cluster in distinct zones or belts - called seismic belts or seismic zones.

Between 1960 and 1968 geologists came up with the idea of the theory of plate tectonics. They found that earthquakes tend to be concentrated along the plate boundaries.

**Earthquake Energy:**

Scientists recognize different kinds of earthquake energy or earthquake waves.

**Body waves**

These occur within the earth, within the solid rock of the planet. They travel through the interior of the earth.

**Surface waves**

These travel along the surface of the earth.

**Hands-On Activity - Earthquake Waves 3**



Energy doesn't just stay where the slip or break occurs. It starts to migrate and move. Let's demonstrate some of these vibrations and show what happens as they move outward:

**Different types of waves:**

Give the students a Slinky. Have them try making P-waves and S-waves as they consider which wave appears to move faster, the P-waves or the S-waves?

To make a P-wave have the kids stretch the Slinky out. Move the left hand straight towards the right, then move it back out. These are similar to P-waves.

**P-wave Primary waves**

Move just one hand straight toward the other quickly (forward and backward).

You can see the waves moving back and forth.

**Body waves**

These are waves that travel through the interior of the Earth.

**P-wave Primary waves**



P-waves are compressional waves. They travel faster than other waves (almost 2x faster than S-waves).

**S-wave Secondary waves**



These are also called shear waves. They displace the ground perpendicular to the direction of the propagation. They only travel through solids. These are slower than P-waves.

**Surface waves**

Surface waves move more slowly than P-waves and S-waves.

**Love waves**

Waves move the ground from side to side in a horizontal plane but at right angles to the direction of propagation.



**Rayleigh waves**

These are also called ground roll. Surface waves travel as ripples with motions that are similar to those of waves on the surface of water. Waves move in an undulatory type motion.

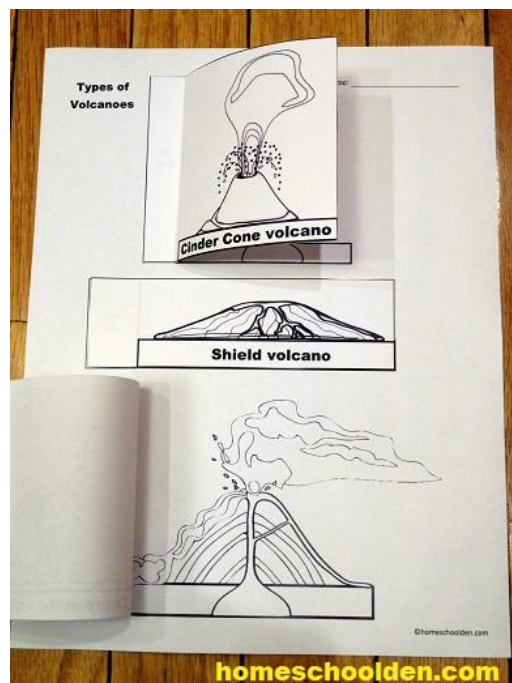


These waves were named after the scientists who discovered them.

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# Volcano Lapbook - Interactive Notebook Pieces

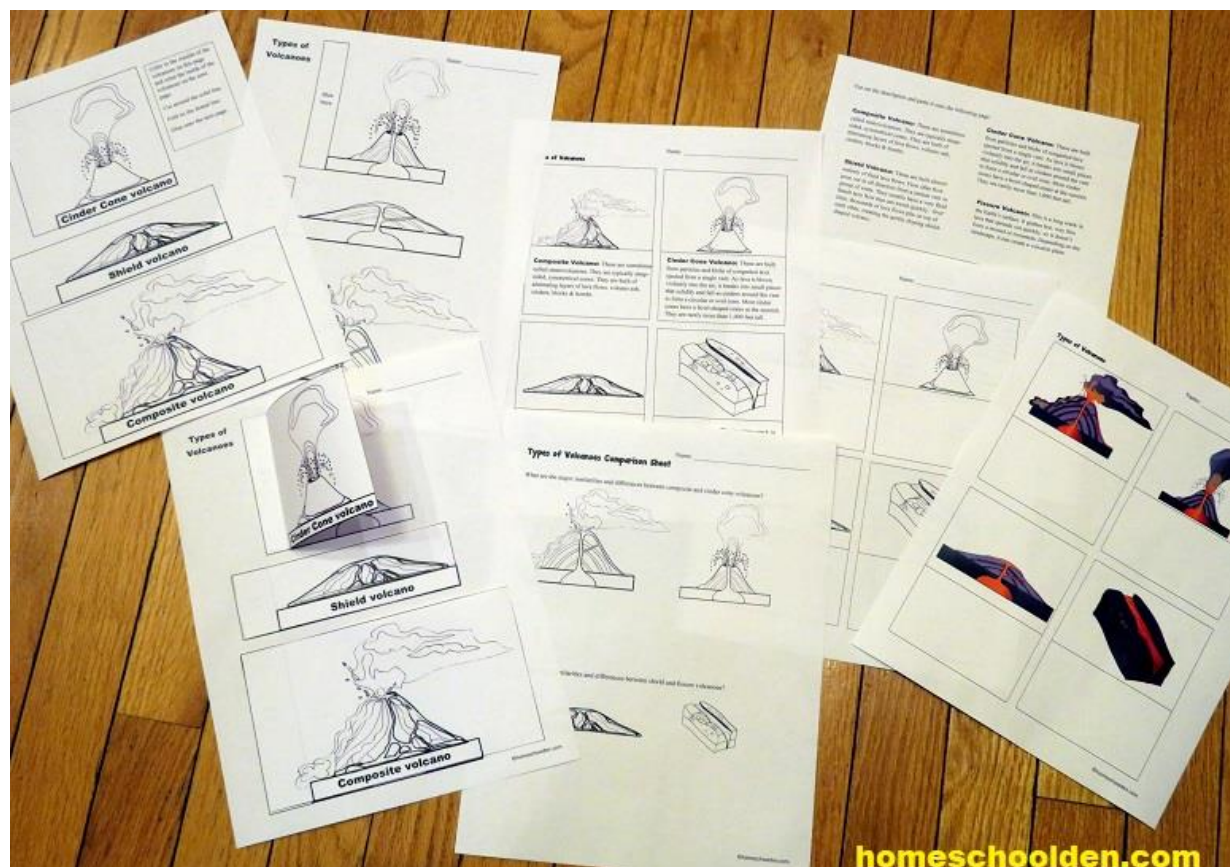




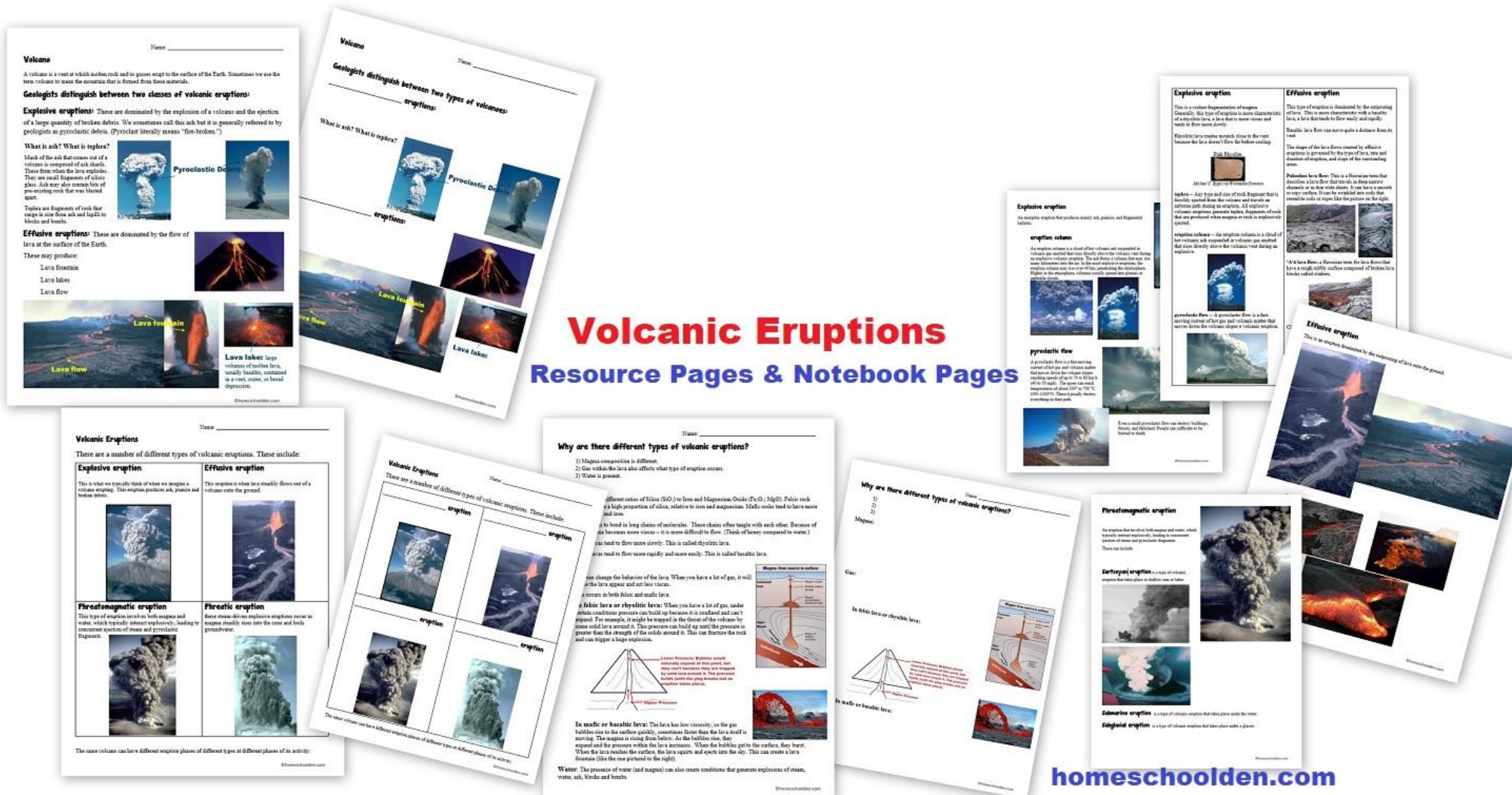
# Types of Volcanoes Activities

## Interactive Flapbook - Notebook Page

### Cut & Paste Activity (with information about Composite, Cinder Cone, Shield and Fissure Volcanoes)



# Resource Pages and Notebook Pages about Volcanic Eruptions:



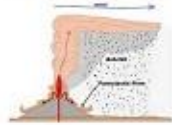
The 4 different types of volcanic eruptions, the different types of lava, why there are different types of volcanic eruptions, etc.

# Volcano Notebook Pages:

## Volcanic Hazards

### Volcanic Hazards:

Lava flow from basaltic eruptions: Even though they are slow moving, lava flows can bury houses, farm fields, towns, and highways. Lava flow can cause considerable property damage.



**Pyroclastic flow:** This fast-moving current of hot gas and volcanic matter can rush down the mountains at speeds of 100, 200 even 300 km/h! (See the orange cloud in the picture to the left.) The temperature can be extremely hot. These travel so fast, you can't escape from them if you are in their path.



**Lahar:** During some eruptions the ash and pyroclastic debris on a volcano mixes with water or melted snow/ice. This can create flooding conditions, but since it is mixed with ash and pyroclastic debris, it has greater viscosity than pure water. Heavy debris, even boulders, can float and be carried along considerable distances. A lahar can destroy houses, bridges and other structures in its way.

A lahar is usually restricted to valleys.

### Ash:



**Ash Clouds:** Ash clouds can cause disruptions to air travel operations. The map to the left shows the ash cloud that spread from Iceland in April 2010 which disrupted air travel for a period of time.

Why is ash dangerous to airplanes?

Ash gets sucked into the engines. It melts in the jet engines, freezes, and forms a glass coating that blocks the fuel intake and blocks some of the temperature sensors. When it blocks the temperature sensors, it causes the engine to shut down.

**British Airways Flight 38, the Jakarta incident:** This aircraft flew into a cloud of volcanic ash thrown up by the eruption of Mount Gajahung (approximately 180 kilometers (110 mi) south-east of Jakarta, Indonesia). (See the picture of the 1982 eruption to the right.)



This resulted in the failure of all four engines. The reason for the failure was not immediately apparent to the crew or air traffic control.

The aircraft was diverted to Jakarta in the hope that enough engines could be restarted to allow it to land there. The aircraft glided out of the ash cloud, and all engines were restarted (although one failed again soon after). Ash damaged the windscreen as well, so the pilot had to lean out of the side airplane window in order to land the aircraft safely! (See this [Wikipedia](http://en.wikipedia.org/wiki/1982_British_Airways_Flight_38) article for more details.)

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### Given:

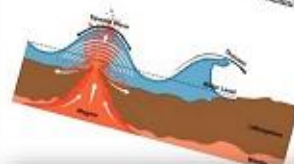
The gas that escapes from a volcano can also be harmful.

**Carbon dioxide:** The gas coming out of our volcano in Cameroon was primarily carbon dioxide. The center of the volcano was filled with water and the CO<sub>2</sub> was dissolved in the cold water. For some reason, the water heated over, releasing a large volume of gas. (Think of a can of soda. When you pop the cap open, pressure is released and gas escapes.) A large cloud of CO<sub>2</sub> was produced in Lake Nyos in Cameroon in 1986 that killed more than 1700 people and countless livestock. A rolled down into two valleys and suffocated people and livestock within 10 miles of the lake.



**Sulfur dioxide:** When this gas enters into solution in the air, it becomes sulfuric acid, which can be very harmful to your lungs if you inhale it. Furthermore, when volcanic acid rain falls to the atmosphere, these rain droplets can reflect the sunlight, so for years after a super eruption the average global temperature can drop.

**Hint:** Large eruptions occur under water or on an island, these can generate tsunamis that devastate coastal areas.



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### Volcanic Hazards:

Lava flow from basaltic eruptions



Lahar:



British Airways Flight 38, the Jakarta incident

Why is ash dangerous to airplanes?



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