**Volcanoes and Earthquakes**

**Volcanoes**

* The term *volcano* comes from the name of the Roman god of fire, *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*.
* There are different types of volcanoes.
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Eruptions like we see in the movies
	+ Slowly flowing \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ eruptions

So why are some volcanoes more "explosive" than others?

* + **The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ inside the magma is one of the things that determines how violent an eruption will be.**

The more dissolved gas, the more explosive!

**The VISCOSITY of Magma HIGH (honey) LOW (water)**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ measures the thickness of a fluid

* + **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ magma slows down the escape of gases and may also block a volcano’s main vent.**
	+ **When it finally breaks through it is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**

**Pyroclastic Flows**

Explosive volcanoes can release tiny pieces of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

In super explosive eruptions glass and gases can combine to form dense, super heated cloud that travels down hill at high speeds= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**The 3 types of Volcanoes**

The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ produces 3 distinct types of volcanoes:

* 1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* **Composite Volcanoes**
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_ shaped, steep
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ eruptions
	+ build up of layers of ash and lava
	+ thick magma traps gas then explosively erupts
	+ found near \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ form \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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* **Shield Volcanoes**
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ volcanoes
	+ gentle slopes
	+ form over \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ usually occurs in thinner oceanic crust but some in

 continental crust

* + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ means less explosive, tend to flow easily
	+ Examples: Hawaiian Island Chain
* **Rift Eruptions**
	+ occur when magma erupts through long \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ not particularly violent
	+ create lava curtains
	+ release \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ amounts of \_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Why can Volcanoes be so Dangerous???**

* + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and debris (pyroclastic flows)
	+ Volcanic \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Landslides and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (mudflows)
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or deposits

**Earthquakes**

**Where do earthquakes occur?**

\_\_\_\_\_\_\_\_\_\_\_\_ occur at plate boundaries where the edges of the plates are in contact with each other

**What is an Earthquake?**

* An earthquake is the shaking of the ground caused by a sudden \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ at or under Earth's surface.
* They occur at \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ types of Boundaries
* Most of the time \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ prevents plates from moving but eventually the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ becomes \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ than the friction and the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* The movement occurs along a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Describing an Earthquake**

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = The point at which the \_\_\_\_\_\_\_\_\_\_\_ movement occurs ( where the rocks first move)
	+ This usually occurs many kilometers below
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = The point at Earth’s surface \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the earthquake’s \_\_\_\_\_\_\_\_\_\_\_\_

**Seismology**

* When an Earthquake occurs it releases its \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the form of WAVES.
	+ These are called: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Seismology is the study of Earthquakes and the energy waves that it releases
* There are 3 different types of waves:
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |
| --- | --- | --- |
| **Seismic Wave** | **Description** | **Ground Motion** |
| P – Wave | * **P**rimary wave (1st to arrive)
* travels through solid, liquid and gas
 |  |
| S – Wave | * **S**econdary wave (2nd to arrive)
* travels through **s**olid only
* greater damage
 |  |
| L – Wave | * **L**ove wave (**l**ast to arrive)
* roll along Earth’s surface
 |  |

**Types of Waves on a Seismograph**

* It is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of

the P-waves and the S-waves that tells scientists how far

 they are from the epicenter of the earthquake!



* Only \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ can travel through the Earth’s liquid outer

 core!

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ penetrate the Outer Liquid Core

**How do we Measure Earthquakes???**

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = measures ground movement
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = a recording of the ground movement
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = size of earthquake based on size of waves

**S-P Interval**

* The amount of time between when the P-waves first arrive

and the S-waves arrive

* + Allows us to calculate \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**The Richter Scale**

1. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ measures the amount \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ using a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	* each whole number increase on the magnitude scale = a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the size of waves
	* magnitude 2.0 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	* magnitude 6.0 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	* magnitude 8.0 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	* difference in wave size from magnitude 2.0 to 6.0 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ bigger (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)

**Practice!**

1. Which of the following best describes shield volcanoes?
2. Tall, cone-shaped volcanoes, often found underwater, that form over thin spots in the lithosphere called hot spots
3. Wide volcanoes, often found underwater, that form over thin spots in the lithosphere called hot spots
4. Wide volcanoes, formed by repeated eruptions of thick lava and ash
5. Tall, cone-shaped volcanoes formed by repeated eruptions of thick lava and ash
6. Where is a shield volcano most likely to occur?
	1. in a mountain range
	2. at a spreading ridge
	3. over a hot spot
	4. under a subduction zone
7. Where is a composite volcano most likely to occur?
	1. in a mountain range
	2. at a spreading ridge
	3. over a hot spot
	4. over a subduction zone
8. Where is a rift volcano most likely to occur?
	1. in a mountain range
	2. at a spreading centre
	3. over a hot spot
	4. under a subduction zone
9. Which type of volcano is most likely to have the most explosive and violent eruptions?
	1. Composite volcano
	2. Shield volcano
	3. Rift volcano
	4. All types of volcanoes are equally likely to be explosive and violent.
10. A magnitude 6.6 earthquake occurred on November 2, 2004, 560 km west of Tofino. The actual earthquake originated at a depth of 10 km.

Which of the following statements is correct?
11. The focus of the earthquake was 10 km below the ocean surface
12. The focus of the earthquake was 560 km west of Tofino, on the ocean's surface
13. The epicentre of the earthquake was 560 km west of Tofino, on the ocean's surface
14. The epicentre of the earthquake was 10 km below the ocean surface
15. Which is the correct order for the following volcanoes?



* 1. rift, shield, composite
	2. shield, composite, rift
	3. rift, composite, shield
	4. composite, shield, rift
1. A large earthquake occurs 100 km away from where you are playing soccer one evening. You would feel the P-waves about 17 seconds after the earthquake occurred, followed by the S-waves 13 seconds later. Finally, the L-waves would arrive, causing the earth to move more than the other two types of waves.

Which of the following statements is true?
2. The L-waves, arriving last, do the most damage because they move through the body of Earth by squeezing and stretching like a spring
3. The L-waves, arriving last, do the most damage because they move along the surface like ocean waves
4. The S-waves are slower and do less damage than P-waves, since they are smaller waves than P-waves
5. The P-waves, arriving first, do the most damage because they move along the surface like ocean waves
6. If a large earthquake occurs in Australia, which type of earthquake wave can be measured in British Columbia, all the way on the other side of the planet?
7. S-waves, since they travel through the molten centre of Earth
8. L-waves, since they travel along Earth's surface
9. P-waves, since they stretch and compress like a spring
10. P-waves, since they stretch and compress like a spring and can travel through all types of materials
11. What instrument records the ground shaking caused by earthquakes?
	1. Magnetometer
	2. Barometer
	3. Seismograph
	4. Seismometer