

CH. 8 and 10

Plate Tectonics and Reshaping
Earth's Surface

Vocabulary

- Crust: outermost solid layer of Earth. The part we live on
- Mantle: part below the crust, contains most of Earth's mass.
- Core: innermost layer of Earth.
- Lithosphere: Earth's crust and upper mantle make up this part

Vocabulary

- Continental Drift: theory the continents drifted apart in the past and continue to do so
- Plate Tectonics: theory that explains how the lithosphere is broken into moving plates that float on a layer of partly melted rock
- Plate Boundary: area where 2 plates meet
- Fault: at a fracture boundary where plates slide past each other. It is a break in the Earth's crust

Vocabulary

- Sediment: solid particles moved from one place to another
- Weathering: process of breaking down rock into smaller pieces
- Mechanical Weathering: weathering when water and ice break down rock. Minerals that make up rock do not change
- Chemical Weathering: weathering where the minerals that make up the rock change.

Vocabulary

- Erosion: process by which soil and sediments are transferred from one location to another
- Deposition: adding sediments to a new place after being carried from another. the shape and direction of a river's flow changes

Ch. 8 Plate Tectonics

Ch. 8.1 What are Earth's layers made of?

Earth's Variety

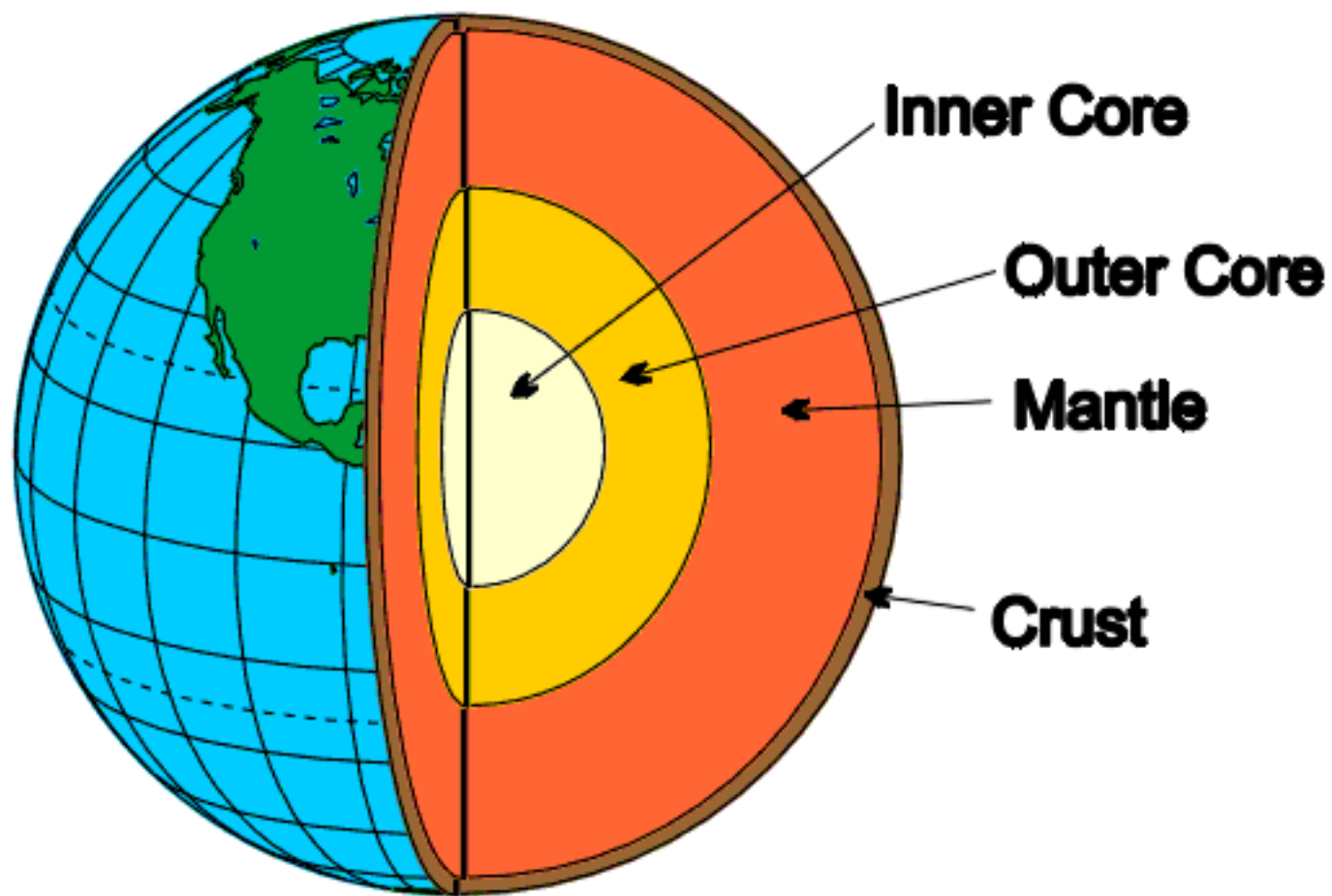
- Earth has a variety of surface features
- Mountains, valleys, plains, volcanoes, canyons, and flatlands, are a few
- Under the ocean, you can find trenches and ridges

Earth's Layers

- Earth has many different layers
- Above the surface is the atmosphere
- The gases in the atmosphere allow us to live
- The outermost solid layer is the crust
 - Part we live on
 - Thickness varies
 - Part covered by ocean is 6-11 kilometers thick
 - Dry land is about 35-40km thick

Earth's Layers

- Just below the crust is the mantle
 - Contains most of Earth's mass
 - Outer part is solid rock
 - Inner part is so hot that the rock can flow slowly over time
- The innermost layer is the core
 - More compact than the mantle
 - Temperature is thought to be about 7,000 C which is as hot as the sun
 - Outer core is so hot it is a liquid
 - Inner core is solid



Earth's Plates

- Earth's crust and the upper part of the mantle are called the lithosphere
- The lithosphere is not a continuous layer
- It is broken into pieces called tectonic plates
- They are all different shapes and sizes
- The plates fit together like a puzzle
- Many of the plates are made of continental crust and oceanic crust
- Earth's plates rest on a soft solid. They float on top of the lower part of the mantle



Ch. 8.2 How do Earth's plates help create landforms?

Continental Drift

- In the early 1600s, scientists began to notice the coastlines of some continents looked like they could fit together
- In 1912 Alfred Wegener suggested that 225 million years ago the continents were all joined together in Pangea (all Earth)
- He introduced the theory of continental drift
 - Continents drifted apart in the past and continue to do so

Continental Drift

- The shape of the continents wasn't the only evidence
- Plant and animal fossils found on the eastern coast of South America matched those found along the western coast of Africa
- Wegener felt this was impossible unless the species once lived side-by-side
- Matching rocks along both coasts also helped back up Wegener's ideas
- But because they couldn't find a force strong enough to move the continents, most people did not believe his idea



225 million years ago



150 million years ago



100 million years ago



Earth today

The Spreading Ocean Bottom

- There wasn't much more evidence that supported Wegener's theory
- Later, better methods to map the ocean floor were discovered
- Data was collected that showed long, deep ocean trenches and a chain of mountains along the floor of the Atlantic Ocean
 - Now called the Mid-Atlantic Ridge

The Spreading Ocean Bottom

- In 1960 an explanation for the trenches and ridges was made
- Was suggested that new crust forms at ocean ridges
- Magma, which is molten rock, pushes up through Earth's crust
- When magma cools, it forms new crust
- More magma comes up and pushes newly formed crust and old crust aside
- Process is known as seafloor spreading

The Spreading Ocean Bottom

- Magma rises to fill gaps caused from plate movement
- Plate movement is caused from temperature differences
- When a liquid is heated, its particles move faster and spread apart
- Hot liquid weigh less and float above cooler liquids
- When it rises to the top, it cools, and more hot liquid can rise above
- This process is called convection
- The mantle is not a liquid, but its rocks are so hot they float slowly

Proof of Continental Drift

- Seafloor spreading helped support Wegener's idea but it wasn't enough proof
- In the early 1960s scientists were studying the magnetism of rocks near the Mid-Ocean Ridge
- In some places the magnetism faced north, in other places south
- Found alternating rows of north/south patterns spreading out from the Mid-Ocean Ridge
- Earth's magnetism flips about every half million years'
- When rocks form from cooling lava, the particular magnetic pattern is frozen into the rocks
- Evidence that alternating pattern of the rock has been slowly spreading out as new crust is formed

Ch. 8.3 How do scientists explain Earth's features?

Theory of Plate Tectonics

- Scientists use the theory of plate tectonics to explain why Earth's features appear as they do
- This theory states that Earth's lithosphere is broken into about 20 moving plates
- Continents and ocean floor are the surfaces of the plates
- Plates are always moving in a continuous process in different directions

Theory of Plate Tectonics

- Scientists use GPS satellites in space to determine the distance between points on different plates
- They know from data that the North American plate and the Eurasian plate are moving about 2cm a year away from each other
- Mountains may form where plates move together, volcanoes when plates move apart

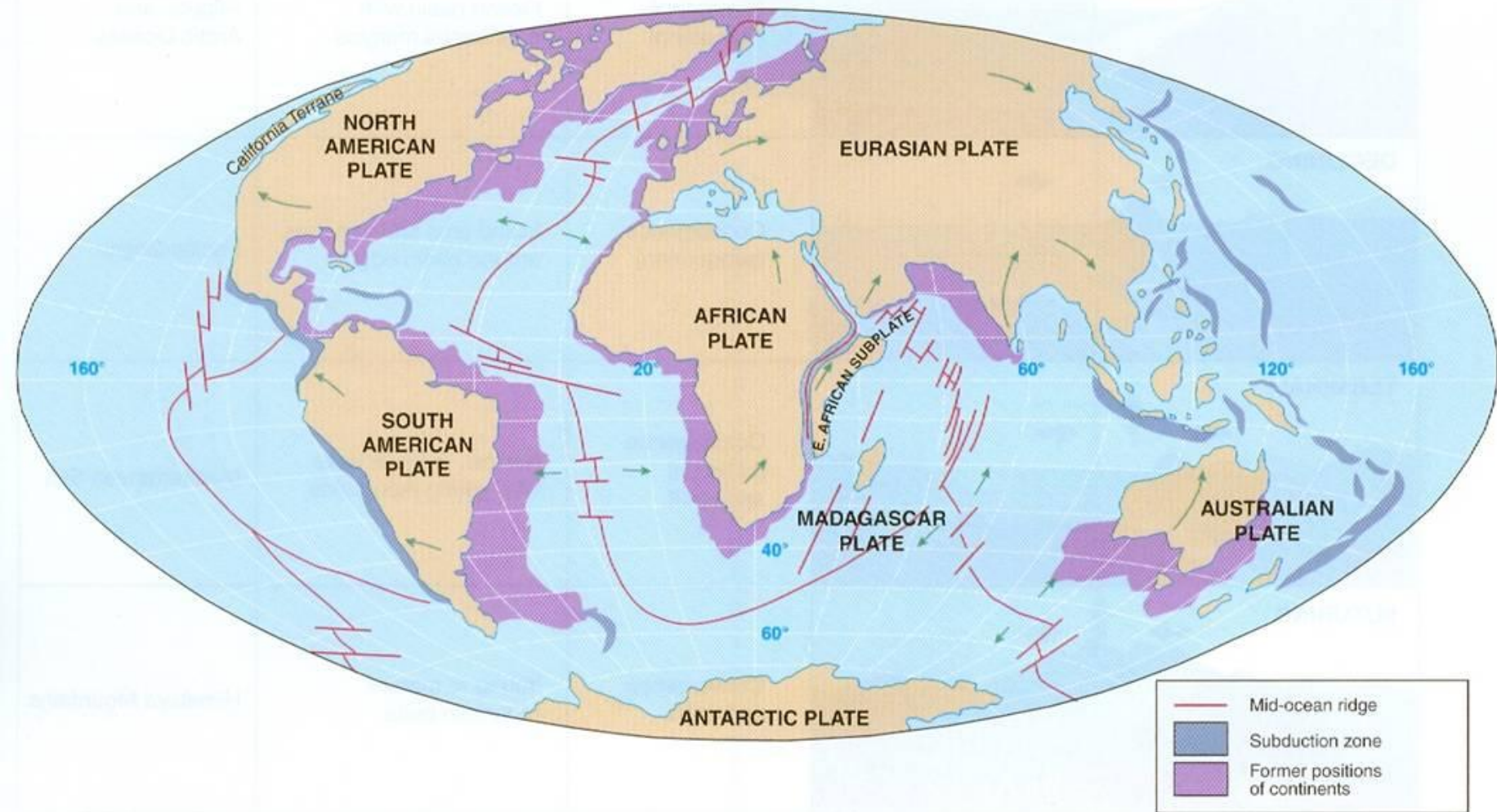


FIGURE 2.32 The world as it may look 50 million years from now. Purple shadows indicate the present-day positions of continents and tan shading indicates positions of the continents in 50 million years. Green arrows indicate direction of plate motion.

Plate Boundaries

- Plate boundaries are where two plates meet
- There are 3 types of boundaries
 - Spreading boundaries: plates move away from one another
 - Fracture boundaries: plates slide past each other. The break in the crust is called a fault. Earthquakes can occur here
 - Colliding boundaries: plates push against each other. When plates carry continents into each other, mountains can form. Other times volcanoes, ocean trenches or earthquakes.

Ch. 8.4 What causes earthquakes and volcanoes?

Earthquakes

- Plate movement takes place very slowly
- You can't see it or feel it
- Jagged edges in the lithosphere sometimes stop movement
- Pressure builds up until it becomes too strong
- Rocks lurch forward and Earth's crust shakes
- Earthquakes cause damage when pressure builds up along a fault line
- The underground point where an earthquake occurs is called the focus
- The point on Earth's surface directly above the focus is called the epicenter
- Energy is carried out by waves. Waves spread out from the focus and the epicenter

Earthquake Magnitude

- The strength of an earthquake is given as its magnitude
- The number shows the total number of energy released
- The Richter Scale is an example of a system used
- Each increase of 1 on the scale indicates about 31 times more energy released
- Magnitude doesn't always indicate how much damage will be done

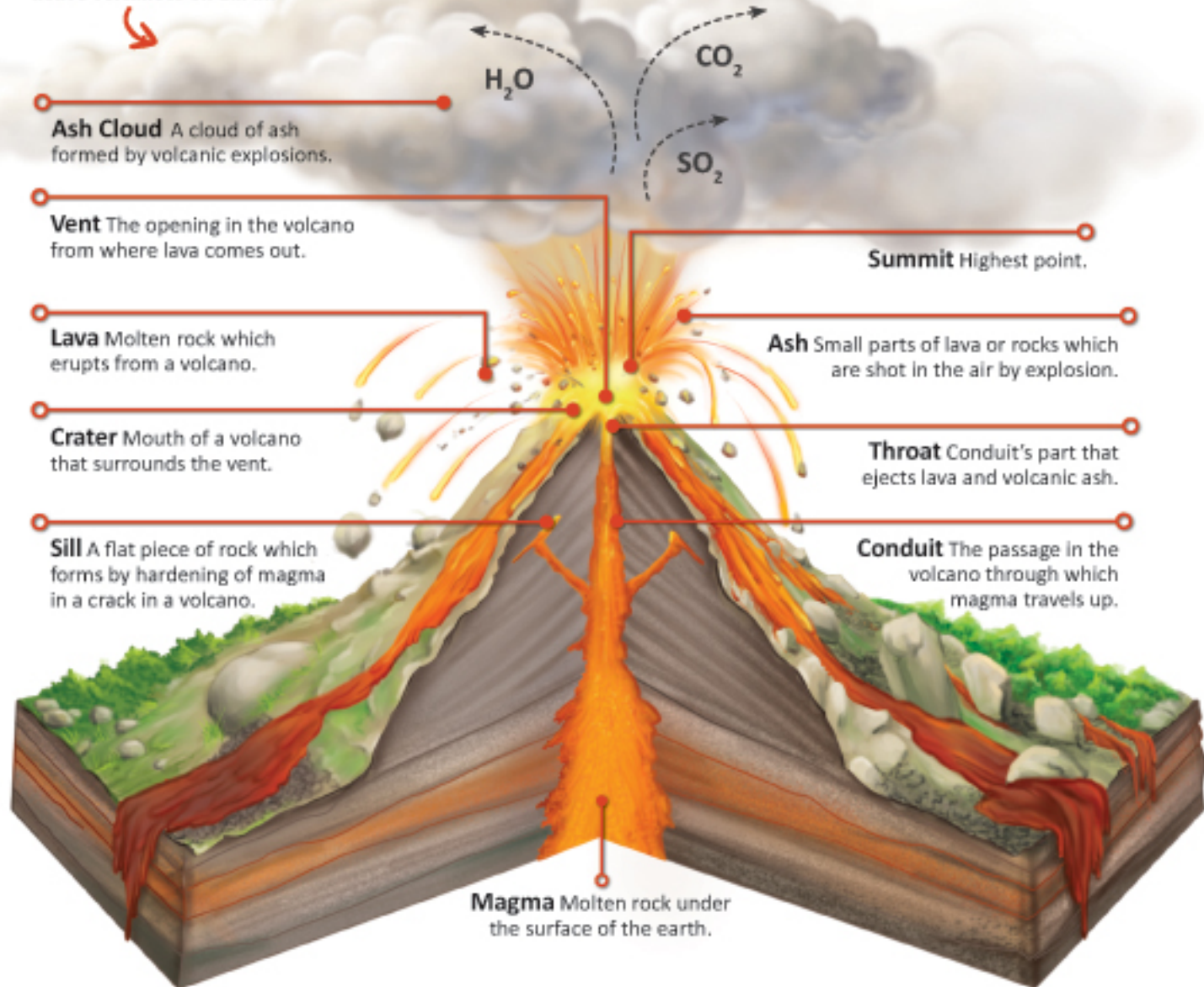
Understanding the Richter Scale:

Richter Magnitude	Feels like KG of TNT	Extra Information
0-1	0.6-20 kilograms of dynamite	We can not feel these
2	600 kilograms of dynamite	Smallest Quake people can normally feel
3	20,000 kilograms of dynamite	People near the epicenter feel this quake
4	60,000 kilograms of dynamite	This will cause damage around the epicenter. It is the same as a small fission bomb
5	20,000,000 kilograms of dynamite	Damage done to weak buildings in the area of the epicenter
6	60,000,000 kilograms of dynamite	Can cause great damage around the epicenter
7	20 billion kilograms of dynamite	Creates enough energy to heat New York city for one year. Can be detected all over the world. Causes serious damage
8	20 billion kilograms of dynamite	Causes death and major destruction. Destroyed San Francisco in 1906
9	20 trillion kilograms of dynamite	Rare, but would causes unbelievable damage!

Volcanoes

- A volcano is an opening in the surface of one of Earth's plates through which magma rises
- They mostly occur near plate boundaries
- Theory of plate tectonics explains why
- When a plate sinks beneath another at a plate boundary, the sinking crust melts into magma
- Pressure builds up from gases trapped in the magma
- If the crust of the overlying plate can no longer withstand the pressure, magma explodes through
- Magma that reaches the surface is called lava

There are as many as 1,500 active volcanoes on Earth.



H_2O

CO_2

SO_2

Ash Cloud A cloud of ash formed by volcanic explosions.

Vent The opening in the volcano from where lava comes out.

Summit Highest point.

Lava Molten rock which erupts from a volcano.

Ash Small parts of lava or rocks which are shot in the air by explosion.

Crater Mouth of a volcano that surrounds the vent.

Throat Conduit's part that ejects lava and volcanic ash.

Sill A flat piece of rock which forms by hardening of magma in a crack in a volcano.

Conduit The passage in the volcano through which magma travels up.

Magma Molten rock under the surface of the earth.

Predicting Volcanoes and Earthquakes

- Predicting when volcanoes will erupt or earthquakes will occur is a challenge for scientists
- It is easier to predict when a volcano will erupt
- Scientists study maps of past eruptions
- Since volcanoes usually erupt in a pattern, this can help predict the next eruption
- Earthquake predictions are not as easy
- Scientists can find faults, but that isn't always a direct indication
- They use seismographs to listen for tremors

Ch. 10 Reshaping Earth's Surface

Earth's Features

- There are many different types of landforms on Earth
- Water shapes a lot of these landforms
- Landforms can form from gradual or dramatic events

Weathering and Erosion

- Many changes to Earth's surface can only be seen over thousands of years
- Most of these changes are caused by weathering and erosion
- There are 2 types of weathering, mechanical and chemical
- The rocks that break apart are eroded away
- Weathering and erosion are continuously changing Earth's surface

Weathering and Erosion

- Weathering is the process of breaking down rock into smaller pieces
- These pieces are called sediments
- Mechanical Weathering: when forces such as water and ice break down rock. Minerals that make up rock do not change
- Chemical Weathering: Minerals that make up rock change
- When water, oxygen, or chemicals from plants change the make up of the rock
- Erosion: moves the sediments away

Soil Erosion

- Soil can be eroded very quickly
- Plant roots help keep soil intact
- But if nothing is planted, rain and wind can blow the soil away
- EX: the Dust Bowl in the 1930s
- Started an era of soil conservation

Ch. 10.2 How does water affect Earth's features?

Deposition

- The high energy moving water has can break down rock and soil into sediments
- It can also chemically weather rock by dissolving minerals and other materials in the rock
- The sediments that form during weathering are eroded and deposited in another location
- This is called deposition
- In this process the shape and direction of a river's flow change

Minerals in Lakes and Oceans

- As rivers flow to the ocean, they carry sediments and dissolved minerals
- Ocean plants and animals use some of these minerals
- Some settle out of water and form mineral deposits in lakes, along the coast, and on the ocean floor
- One mineral carried by water is salt
- Rivers carry an estimated 4 billion tons of dissolved salts to the oceans
- As a result of thousands of years of ocean water evaporating, the amount of salt has increased

River Systems

- While rivers and streams look like a flat, quiet body of water, they can change quite a bit over time
- A stream begins on land higher than sea level
- It flows because gravity pulls it downward to a lower area
- When many streams flow into each other, a river is formed
- Sediments carried by rivers are deposited in different places

Floodplains

- When rivers flood their banks, sediments are deposited
- Flooding can move huge amounts of sediments to places that normally wouldn't receive them
- A floodplain is the area that is likely to receive the overflow from a flooded river
- Floods can be good for farmers, but can cause a lot of damage to houses

Ch. 10.3 How do waves affect coastal landforms?

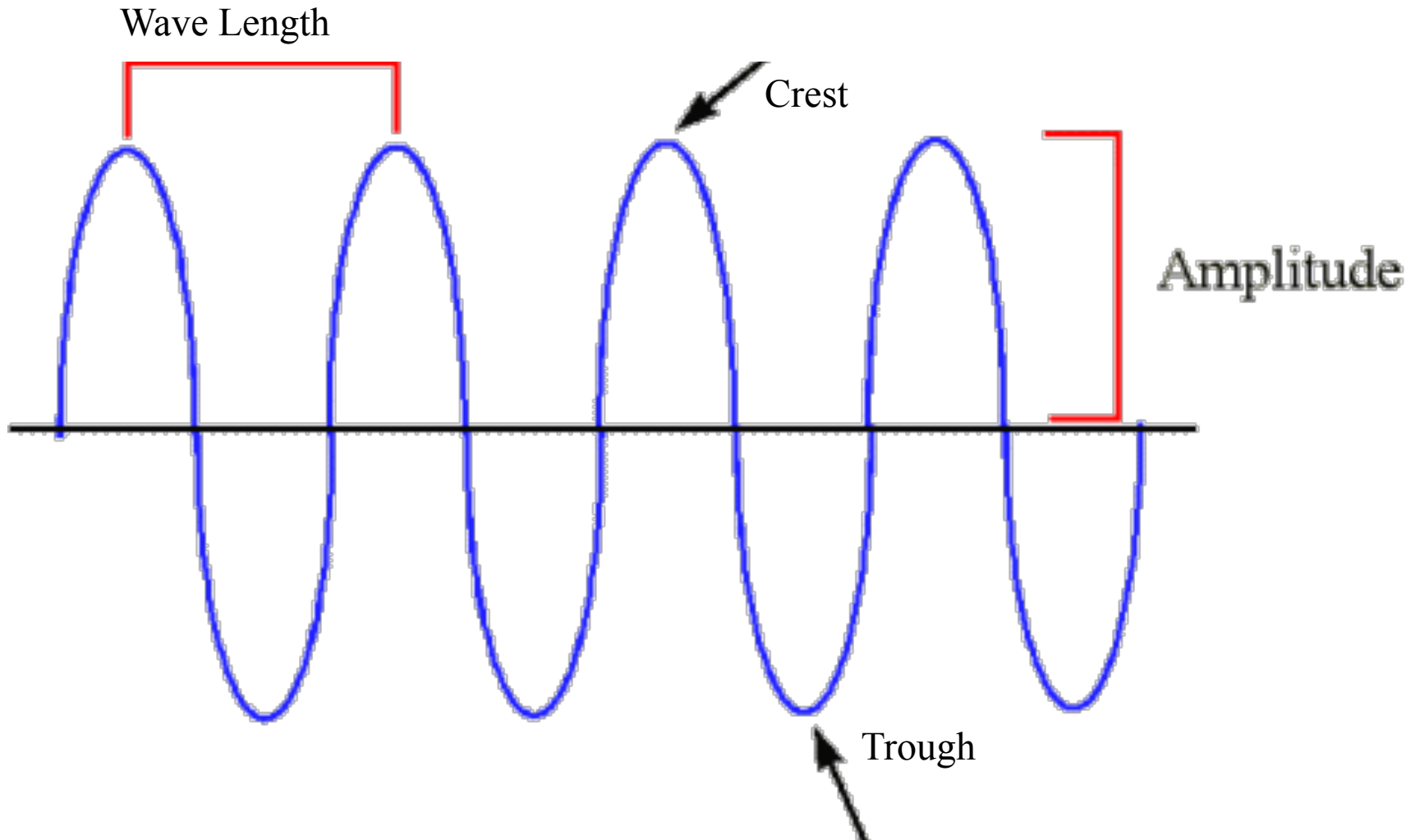
Wave Energy

- When an ocean wave moves, only energy moves forward, the water stays in the same spot
- The water rises and falls in a circular motion
- As the wave moves closer to shore, the shallower ocean floor interferes with the waves movements
- The ocean floor causes the waves to slow down, while the top continues at the same speed

Causes of Waves

- Waves on open water are caused by wind
- The wind blows on the water and transfers energy
- The size of the wave depends on the speed of the wind
- They can also be formed through tectonic activity
- Earthquakes, volcano eruptions, and landslides under water can cause massive waves
- The events can form tsunamis, which are waves that travel at great speeds and reach great heights

Wave Characteristics



- http://www.educade.org/lesson_plans/create-your-own-flip-book-of-earths-surface-with-puzzling-plates-level-1
- <http://www.britannica.com/science/plate-tectonics/Development-of-tectonic-theory>
- <https://www.studyblue.com/notes/n/geol-130-study-guide-2012-13-horton/deck/9721521>
- <http://www.thinkstations.com/homework-help/geography/volcanoes-violent-outbursts.html>