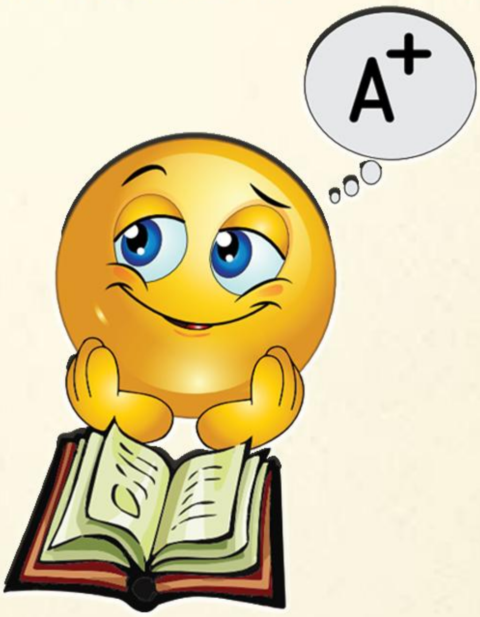
Grade 7 Science
Final Review - Term 3



مراجعة العلوم النهائية
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Lesson 1: Moving Continents

Have you ever looked at a map and noticed how South America and Africa seem to fit together like puzzle pieces?

- **Alfred Wegener and Continental Drift:**
  - Hundreds of years ago, people noticed the puzzle-like fit of the continents.
  - In 1912, a German scientist named Alfred Wegener came up with a big idea called **continental drift**.
  - His idea was that all the continents were once joined together in a huge supercontinent called **Pangaea**.
  - Over millions of years, Pangaea slowly broke apart, and the continents "drifted" to where they are today.
- **Evidence for Continental Drift:** Wegener needed strong proof to convince other scientists. Here's what he found:

1. **Matching Coastlines:** The shapes of continents like South America and Africa fit together, especially if you include their continental shelves (the shallow underwater parts of the continents).
2. **Matching Rocks and Mountains:**
   - Scientists found similar types of rocks and mountain ranges on continents that are now far apart, like on the western coast of Africa and the eastern coast of South America.

- It's like if you had a big drawing and tore it up, then put the pieces back together – the lines on the drawing would match up.
- Volcanic rocks from hundreds of millions of years ago are identical in chemistry and age on these separated continents, suggesting they formed together.

3. **Ancient Climate Clues (Glaciers and Coal):**
   - **Glacial Grooves:** Deep scratches in rocks made by ancient glaciers were found in places like South America, Africa, India, and Australia. This is surprising for warm places like Africa today, meaning they must have been much closer to the South Pole in the past.
   - **Coal Deposits:** Coal forms from plants that grow in warm, wet swampy areas. Finding coal in Antarctica, which is now very cold, shows that Antarctica must have been closer to the equator a long time ago.

4. **Fossil Evidence:**
   - Fossils of the same ancient plants and animals were found on continents now separated by vast oceans.
   - For example, fossils of a plant called *Glossopteris* were found on South America, Africa, India, Australia, and Antarctica. These continents are too far apart and have very different climates today for the same plant to have grown naturally in all of them at the same time.
   - Fossils of reptiles like *Mesosaurus* (a coastal reptile) and *Cynognathus* and *Lystrosaurus*

(land reptiles) were found on continents now separated by huge oceans. These animals couldn't have swum across entire oceans, so the landmasses must have been connected.

- **Why was Wegener's idea not accepted at first?** Even with all his evidence, scientists were skeptical. The main reason was that Wegener couldn't explain *how* the continents moved. He knew *that* they moved, but not the *mechanism*.

Important Terms to Remember

- **Pangaea:** The single supercontinent that existed about 250 million years ago when all the continents were joined.
- **Continental Drift Hypothesis:** Wegener's idea that continents have moved over Earth's surface.
- **Fossils:** The preserved remains or traces of ancient organisms, often found in rocks.

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Lesson 2: Development of a Theory

Scientists continued to explore the Earth, especially the mysterious ocean floor. New discoveries helped explain how continents "drift."

- **Mapping the Ocean Floor:**
  - In the late 1940s, a new tool called an **echo sounder** was developed. It uses sound waves to map the bottom of the ocean.
  - Scientists discovered that the ocean floor is *not* flat! It has mountains, valleys, and deep trenches.

- **Mid-ocean ridges:** These are huge underwater mountain ranges, like the one in the middle of the Atlantic Ocean. They are longer than any mountain range on land.
- **Ocean trenches:** These are very deep, underwater valleys on the seafloor, like the Mariana Trench (the deepest place on Earth).
- **Marie Tharp** was a scientist who helped create the first detailed maps of the seafloor and was the first to identify the mid-ocean ridge.

- **Stripes on the Seafloor (Age of the Crust):**
  - Scientists found a surprising pattern when they looked at the age of the rocks on the ocean floor.
  - The **youngest rocks** are always found along the mid-ocean ridges.
  - As you move *away* from the mid-ocean ridges, the rocks become **progressively older** in symmetrical bands on both sides.
  - This pattern suggests that new crust is being formed at the ridges and then moving outward.

- **Seafloor Spreading: The Missing Piece!**
  - In the 1960s, scientists proposed the idea of **seafloor spreading** to explain these observations.
  - **How it works:**
    - Hot, molten rock called **magma** rises from deep within the Earth at the mid-ocean ridges.
    - This magma erupts onto the surface as **lava**, cools, and forms new oceanic crust.

        - This new crust then spreads out, pushing the older crust away from the ridge like a conveyor belt.
        - As the older oceanic crust moves away, it eventually sinks back into the Earth at **ocean trenches**.
    - This process finally explained *how* continents move! Continents don't plow through the ocean floor; instead, they are carried along as the seafloor itself spreads.
- **Theory of Plate Tectonics:**
    - The ideas of continental drift and seafloor spreading combined to form a more complete and powerful theory called **plate tectonics**.
    - This theory states that Earth's surface is made up of huge, rigid pieces of rock called **plates**.
    - These plates are constantly moving and interacting with each other, causing earthquakes, volcanoes, and the formation of mountains and ocean features.

Key Takeaways for Your Exam:

- **Continental Drift Hypothesis:** Pangaea broke apart, and continents moved.
- **Evidence for Continental Drift:** Matching coastlines, similar rocks/mountains, ancient climate clues (glaciers, coal), and identical fossils on different continents.
- **Seafloor Spreading:** New crust forms at mid-ocean ridges and moves away, while old crust sinks at ocean trenches. This is the *mechanism* for continent movement.

- **Plate Tectonics Theory:** Earth's surface is made of moving plates, explaining continental drift and many Earth features.

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Lesson 3 : Earth's Moving Plates: Shaping Our World

Have you ever wondered why some parts of the Earth have huge mountains, while others are flat? Or why there are volcanoes and earthquakes in certain places? It all comes down to Earth's giant puzzle pieces called **tectonic plates**!

What are Tectonic Plates? Imagine the Earth's outer layer, called the crust, is broken into many large pieces, like a cracked eggshell. These pieces are the tectonic plates, and they are always moving, though very, very slowly, over millions of years. This movement causes many of the big features we see on Earth.

Where Plates Meet: Plate Boundaries

The most exciting things happen where these plates meet. We call these meeting points **plate boundaries**. There are three main types of plate boundaries, and each creates different features:

1. **Convergent Boundary (Plates Collide!):**
    - **What happens:** Two plates push *towards* each other and crash!
    - **What it creates:**
        - **Mountains:** When continental plates collide, the land gets squeezed and crumpled upwards, forming huge mountains like the Himalayas (where the Indian and Eurasian plates meet). The Andes Mountains in South America formed when an oceanic plate (Nazca Plate) crashed into a continental plate (South American Plate).

- **Volcanoes:** When an oceanic plate crashes into and slides *under* another plate (a process called **subduction**), the melting rock can rise to the surface, forming volcanoes. This is why you see many volcanoes along the west coast of South America and in places like the Cascades in North America.
- **Ocean Trenches:** When one plate slides under another, it creates a deep ditch in the ocean floor called an ocean trench.
- **Earthquakes:** The immense pressure and friction at these boundaries can cause powerful earthquakes.

2. **Divergent Boundary (Plates Pull Apart!):**
   - **What happens:** Two plates pull *away* from each other.
   - **What it creates:**
     - **Mid-Ocean Ridges:** In the ocean, as plates pull apart, molten rock (magma) rises from deep inside the Earth, creating underwater mountain ranges called mid-ocean ridges. Most volcanic activity on Earth happens here, but these eruptions are usually gentle and non-explosive, forming "pillow lava."
     - **Fault-Block Mountains:** On land, when plates pull apart, the crust stretches and breaks into large blocks. Some blocks drop down, and others tilt up, forming jagged mountains with flat valleys in between. The Basin and Range Province in the western United States is an example.
3. **Transform Boundary (Plates Slide Past Each Other!):**
   - **What happens:** Two plates slide *horizontally* past each other.
   - **What it creates:**

- **Earthquakes:** The plates can get stuck and then suddenly slip, releasing a lot of energy as an earthquake. The San Andreas Fault in California is a famous example.

Why is South America "Lopsided"?

Now you can understand why the west coast of South America has mountains (like the Andes) and many volcanoes and earthquakes, while the east coast is flatter. This is because the Nazca Plate (an oceanic plate) is crashing into and sliding *under* the South American Plate along its west coast. This creates the tall Andes Mountains, volcanoes, and frequent earthquakes. The east coast is not at an active plate boundary, so it experiences less dramatic changes.

Volcanoes: Mountains of Fire

- A **volcano** is an opening in Earth's crust where molten rock (magma) flows out.
- Volcanic eruptions can be slow lava flows or sudden, explosive blasts.
- They can form new crust and change the landscape very quickly.
- **Volcanic Arcs:** Curved lines of volcanoes often form where an oceanic plate subducts under another plate (either oceanic or continental).
- **Hot Spots:** Not all volcanoes are at plate boundaries! Some, called **hot spot volcanoes**, form in the middle of a plate over a "mantle plume" (a rising column of hot magma). As the plate moves over the stationary hot spot, a chain of volcanoes forms, like the Hawaiian Islands. The oldest islands are farthest from the hot spot.

Earthquakes: When the Ground Shakes

- An **earthquake** is the sudden shaking of the ground caused by the breaking and movement of rocks along a crack (a **fault**) in Earth's crust.

- They happen when stress builds up along plate boundaries and is suddenly released.
- Earthquakes can cause:
  - **Faults:** Visible cracks in the ground where movement has occurred.
  - **Landslides:** Rapid downhill movement of soil and rocks, triggered by the shaking.
  - **Tsunamis:** Giant ocean waves caused by underwater earthquakes that displace a large volume of water.

Mountains Don't Last Forever

Even the tallest mountains are constantly being changed by:

- **Weathering:** The breaking down of rocks into smaller pieces (like from wind, water, or ice).
- **Erosion:** The moving of weathered rock pieces from one place to another (like by rivers, glaciers, or wind).
  - This is why older mountain ranges, like the Appalachians, are shorter and smoother than younger ones, like the Rocky Mountains, because they have been worn down over a much longer time.

Beyond Plate Tectonics: Impact Craters

While plate tectonics is responsible for many of Earth's big features, not everything is. **Impact craters**, for example, are large circular holes formed when meteoroids from space crash into Earth's surface. These are rapid, catastrophic changes, but like mountains, they are also slowly changed by weathering and erosion over time.

Key Takeaways for Your Exam:

- Earth's surface is always changing due to **tectonic plate movement**.
- Understand the three types of **plate boundaries** (convergent, divergent, transform) and what features they create (mountains, volcanoes, trenches, ridges, faults, earthquakes).
- Remember that changes from plate tectonics can be **slow (millions of years)**, like mountain building, or **rapid (seconds)**, like earthquakes and volcanic eruptions.
- **Weathering and erosion** are constant processes that wear down Earth's features over time.

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Lesson 4 : How Earth's Surface Changes

Our Earth is always changing! Mountains get worn down, canyons get deeper, and even beaches can disappear. These changes happen because of three main processes: **weathering, erosion, and deposition.** Think of it like a never-ending cycle!

1. Weathering: Breaking Rocks Apart

Weathering is like the "breaking down" process. It's when rocks and other materials on Earth's surface are broken into smaller pieces. There are two main types:

- **Physical Weathering:** This is when rocks are broken down mechanically without changing what they're made of.
    - **Examples:**
        - Rocks hitting against each other, like in a river or a shaking cup (remember the granola "rocks" lab!).

        - Water freezing in cracks and pushing rocks apart.
        - Plant roots growing into cracks and prying rocks open.
        - Animals digging and burrowing.

- **Chemical Weathering:** This is when rocks are broken down by chemical reactions, changing what they're made of.
    - **Examples:**
        - Water dissolves minerals in rocks (like how caves are formed when acidic rainwater dissolves limestone over thousands of years).
        - Acid rain reacts with rocks.

2. Erosion: Moving the Broken Pieces

Erosion is the "moving" process. It's when weathered material (now called **sediment**) is carried away from one place to another. Think of it as a delivery service for rocks!

- **Agents of Erosion:**
    - **Water:** This is a huge one! Rivers, streams, and even ocean waves are constantly eroding the land.
        - **How it works:** Faster water has more energy and can carry bigger and more sediment. Slower water carries less.
        - **Examples:** Rivers carving out V-shaped valleys, waves carrying sand away from beaches.
    - **Wind:** Strong winds can pick up and carry loose sediment.

        - **How it works:** Wind can move tiny dust particles very far, but it needs to be stronger to move larger sand grains.
        - **Examples:** Forming sand dunes in deserts, "sandblasting" and smoothing out rocks.
    - **Ice (Glaciers):** Glaciers are giant, slow-moving rivers of ice.
        - **How it works:** As glaciers move, they scrape and pick up rocks and other debris, acting like a giant bulldozer.
        - **Examples:** Carving out deep valleys and lakebeds, leaving behind scratches on rocks.

3. Deposition: Laying the Pieces Down

Deposition is the "dropping off" process. It's when eroded sediment is laid down or settles in a new location. This usually happens when the agent of erosion (water, wind, or ice) loses energy.

- **Examples:**
    - Rivers depositing sand and mud when they slow down, forming deltas at their mouths.
    - Wind dropping sand to form dunes.
    - Glaciers melting and leaving behind a jumble of rocks and sediment (called till).

The Grand Canyon: A Perfect Example

The Grand Canyon is an amazing example of all these processes working together over millions of years!

- **Uplift:** Tectonic plates pushed the land up.
- **Erosion:** The Colorado River, flowing faster because of the steeper slope, cut deeply into the rock layers.

- **Weathering:** The canyon walls continue to weather and erode today, with softer rocks wearing away more easily.
- **Deposition:** Before the canyon formed, layers of sand and shells were deposited and eventually turned into the colorful rock layers we see today.

Uniformitarianism: Understanding Earth's Past

Uniformitarianism is a big idea in geology. It means that the same natural processes we see happening on Earth today (like weathering, erosion, and deposition) are the same ones that happened in the past. This helps scientists understand how Earth's surface has changed over millions of years, even though sometimes big, sudden events (like huge volcanic eruptions) can also cause rapid changes.

By understanding weathering, erosion, and deposition, you can see how Earth's surface is constantly being shaped, slowly and surely, all around us!

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Lesson 5 : What are Rocks?

- A **rock** is a naturally occurring solid material made up of different things, like minerals, smaller pieces of other rocks, or even glass and tiny bits of plants or animals.
- The small pieces that make up a rock are called **grains**.
- Most rocks are made of **minerals**. A mineral is a natural, non-living solid with a specific chemical makeup and a clear arrangement of its tiny parts (atoms).

The Three Main Types of Rocks

There are three big groups of rocks, and they form in different ways:

1. **Igneous Rocks**
2. **Sedimentary Rocks**

3. **Metamorphic Rocks**

How Igneous Rocks Form

- **Igneous rocks** form from melted rock material.
- When melted rock is *inside* Earth, it's called **magma**.
- When melted rock comes *out* onto Earth's surface (like from a volcano), it's called **lava**.
- As magma or lava cools, tiny mineral crystals start to grow. This process is called **crystallization**.
- **Extrusive igneous rocks** form when lava cools *quickly* on Earth's surface. Because they cool fast, their crystals are very small or don't form at all (like obsidian, which looks like glass). Geologists call this a **fine-grained** texture.
- **Intrusive igneous rocks** form when magma cools *slowly inside* Earth. Because they cool slowly, their crystals have more time to grow and become larger (like diorite or granite). Geologists call this a **coarse-grained** texture.

What Happens to Rocks at Earth's Surface?

- **Weathering** is when rocks are broken down into smaller pieces or dissolved by water.
  - **Physical weathering** breaks rocks into smaller pieces without changing what they're made of (like cracking due to temperature changes).
  - **Chemical weathering** changes the actual makeup of the rock through chemical reactions (like rust forming on a rock).

- **Erosion** is when those broken-down rock pieces (called **sediment**) are moved to a new location by forces like wind, water, or glaciers.
- **Deposition** is when eroded sediment settles down in a new place, often in layers. This happens when the wind or water carrying the sediment slows down. The heaviest sediments settle first.

How Sedimentary Rocks Form

- **Sedimentary rocks** form from layers of sediment that get stuck together.
- **Lithification** is the process where sediment turns into rock. It involves two main steps:
  - **Compaction:** As more and more layers of sediment pile up, their weight squishes out the water and air between the grains, making the layers thinner and denser.
  - **Cementation:** Minerals dissolved in water act like "glue" and crystallize between the sediment grains, holding them together.
- There are different kinds of sedimentary rocks:
  - **Clastic sedimentary rocks** are made from broken pieces of other rocks and minerals (like sandstone, made from sand grains).
  - **Chemical sedimentary rocks** form when minerals crystallize directly out of water as the water evaporates (like rock salt).
  - **Biochemical sedimentary rocks** form from the remains of living organisms (like limestone, made from shells, or coal, made from dead plants).

How Metamorphic Rocks Form

- **Metamorphic rocks** form when existing rocks (igneous, sedimentary, or even other metamorphic rocks) are changed by intense **heat**, **pressure**, or hot chemical fluids, *without melting*.
- The high temperatures come from Earth's internal heat (deep underground or near magma).
- The high pressures come from being deeply buried or from the squeezing forces where Earth's tectonic plates collide.
- During metamorphism, the minerals in the rock can change into new minerals, and the texture (how the grains are arranged) of the rock can also change.

The Rock Cycle

- The **rock cycle** is a continuous process where rocks are constantly changing from one type to another.
- It shows how igneous, sedimentary, and metamorphic rocks are all connected and can transform over vast periods of time.
- The energy that drives the rock cycle comes from two main sources:
  - **The Sun:** Powers processes like weathering, erosion, and deposition (through wind and water movement).
  - **Earth's internal heat:** Powers processes like melting, crystallization, and the heat and pressure that form metamorphic rocks, as well as the uplift of rocks to the surface.

Uplift is a process where rocks that were deep underground come up to the Earth's surface.

Melting is a common process between igneous and metamorphic rocks (metamorphic rocks can melt to form magma, which then cools to form igneous rocks).

- Any type of rock can eventually become any other type of rock or even sediment, magma, or lava, as it moves through the rock cycle. For example, sandstone (sedimentary) can be buried deep and become metamorphic rock, then uplifted, weathered into sediment, and eventually form new sedimentary rock.

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Lesson 6 : Earthquakes

Earthquakes are a natural part of our Earth's activity. They happen when the ground **shakes** suddenly. Let's break down the important ideas:

What Causes Earthquakes?

- **Stress Buildup:** Imagine bending a stick slowly. It builds up stress. Similarly, stress builds up in rocks deep inside the Earth.
- **Fault Lines:** Our Earth's crust is broken into huge pieces called tectonic plates. Where these plates meet, there are cracks called **faults**.
- **Release of Energy:** When the stress on rocks along a fault line becomes too much, the rocks suddenly move or "slide" past each other. This sudden movement releases a lot of stored-up **energy**.
- **Seismic Waves:** This released energy travels outwards in all directions as vibrations called **seismic waves**. These waves are what we feel as ground shaking during an earthquake.

- **Where They Happen:** Most earthquakes happen **along plate boundaries**, where these huge tectonic plates interact.

Measuring Earthquakes

Scientists use different scales to measure earthquakes:

- **Magnitude (Strength/Size):** This tells us how much energy an earthquake released.
    - **Moment Magnitude Scale:** This is the most accurate scale for measuring the **energy released** by an earthquake.
    - **Richter Magnitude Scale:** This scale also measures the **strength** of an earthquake.
    - **Important Note on Magnitude:**
        - Each whole number increase on these scales means about **10 times more ground shaking**. So, a magnitude 5 earthquake has 10 times more shaking than a magnitude 4.
        - Each whole number increase also means about **32 times more energy released**. So, a magnitude 5 earthquake releases about 32 times more energy than a magnitude 4.
        - For example, a magnitude 7 earthquake has 100 times more shaking than a magnitude 5 earthquake (10 x 10 = 100). And a magnitude 9 earthquake has 1000 times more ground shaking than a magnitude 6 earthquake (10 x 10 x 10 = 1000).
- **Intensity (Damage):** This tells us how much **damage** an earthquake caused in a specific location.

- **Modified Mercalli Intensity Scale:** This scale **describes the damage** caused by an earthquake and how it's felt by people. It doesn't measure the earthquake's strength directly.

Effects of Earthquakes

Earthquakes can cause a lot of damage and lead to other dangerous events:

- **Ground Shaking:** This is the most direct effect, causing buildings to collapse.
- **Liquefaction:** In areas with wet soil, intense shaking can make the soil lose its strength and act like a liquid, causing buildings to sink or tilt.
- **Landslides:** Earthquakes can loosen rocks and soil on slopes, leading to dangerous **landslides**.
- **Tsunamis:** If an earthquake happens underwater, it can create huge ocean waves called **tsunamis** that travel across the ocean and can cause massive destruction when they hit coastal areas.
- **Pancaking:** This is a type of severe building damage where floors collapse on top of each other, like a stack of pancakes.

Factors Affecting Earthquake Damage

The amount of damage an earthquake causes depends on several things:

- **Magnitude:** Stronger earthquakes (higher magnitude) generally cause more damage.
- **Distance from Epicenter:** The **epicenter** is the point on the Earth's surface directly above where the earthquake started. Damage is usually **more severe closer to the epicenter** and decreases as you get further away.
- **Geology of the Area:** The type of ground beneath buildings matters. Loose, wet soil can lead to liquefaction and more damage compared to solid rock.

- **Building Design and Structure:** Buildings designed to **resist** earthquakes (like those with flexible foundations that sway) are less likely to be severely damaged than older, rigid structures.

Reducing Earthquake Impact

While we can't stop earthquakes from happening, we can reduce their impact:

- **Building Codes:** Engineers design buildings to withstand shaking, especially in earthquake-prone areas.
- **Warning Systems:** While predicting earthquakes perfectly isn't possible yet, warning systems can give a few seconds or minutes of notice, which can be crucial.

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Lesson 7 : Volcanoes and Plate Tectonics

This summary covers the most important ideas about volcanoes and how they are connected to Earth's moving plates. Use it to get ready for your final exam!

1. Earth's Moving Plates and Volcanoes

- **Tectonic Plates:** Imagine Earth's outer layer (the crust) is broken into huge pieces, like a giant puzzle. These pieces are called **tectonic plates**, and they are always slowly moving.
- **Plate Boundaries:** Most volcanoes form where these plates meet. There are two main types of boundaries where volcanoes are common:
    - **Divergent Boundary:** This is where plates are **pulled apart** from each other. Magma (melted rock) from deep inside Earth can rise up in these gaps, forming new crust and volcanoes.

    - **Convergent Boundary:** This is where plates are **crashing into each other**. Often, one plate slides under the other (this is called subduction), and this process can create a lot of pressure and heat, leading to volcanoes.

- **Volcano Belts:** Many volcanoes are found in long chains or "belts" along these plate boundaries. A famous example is the **Ring of Fire**, which circles the Pacific Ocean.

2. Hot Spot Volcanoes

- **What is a Hot Spot?** Not all volcanoes form at plate boundaries. Some form in the middle of a plate, over a special place called a **hot spot**. A hot spot is a very hot plume of magma that rises from deep within Earth's **mantle** (the layer below the crust).

- **How Chains Form:** The hot spot itself usually stays in one place, but the tectonic plate above it keeps moving. As the plate moves, new volcanoes form over the hot spot, while older volcanoes move away. This creates a **chain of volcanoes**, with the oldest ones being farthest from the hot spot and the youngest (and often most active) ones being directly over or nearest to it.

- **Hawaiian Islands Example:** The Hawaiian Islands are a perfect example of a hot spot chain. Kauai Island is the oldest Hawaiian island and is located **farthest away from** the hot spot. This also means its rocks are the oldest, and it's a **dormant** or **extinct** volcano. The ages of the rocks **increase** as you move from the active volcanoes (like those on the Big Island of Hawaii) towards Kauai.

3. Types of Volcanoes

- **Active Volcano:** A volcano that is currently erupting or has erupted recently and is expected to erupt again.

- **Dormant Volcano:** A volcano that hasn't erupted for a very long time but **can erupt in the future**. Kauai Island is an example.
- **Extinct Volcano:** A volcano that is no longer expected to erupt.

4. Volcanic Eruptions: What Happens?

- **Cause:** Volcanic eruptions are mainly caused by the **movement of tectonic plates**, which creates pressure and allows magma to rise.
- **What is Released?** During an eruption, volcanoes release:
  - **Volcanic ash:** Tiny particles of glass and rock that are thrown high into the atmosphere.
  - **Molten rock (lava):** Liquid rock that flows out of the volcano.
  - **Toxic gases:** Harmful gases that can be dangerous to breathe.

5. Volcanic Hazards (Dangers)

Volcanic eruptions can be very dangerous. Here are some of the main hazards:

- **Lava Flow:** Hot, flowing molten rock. It destroys everything in its path, but it usually moves slowly, so people can often get out of the way.
- **Volcanic Ash:** Can cover everything, make it hard to breathe, damage engines, and make roads slippery.
- **Pyroclastic Flow:** This is often the **most severe** and dangerous hazard. It's a fast-moving mixture of **hot gases, ash, and rocks** that rushes down the volcano's slopes at great speed. It's extremely hot and toxic, killing almost everything in its path.
- **Lahars (Mudflows):** When the heat from an eruption melts snow and ice at the top of a volcano, it mixes with volcanic ash, rocks, and mud. This creates a fast-moving, destructive river of mud that flows down the mountain.

- **Landslides:** The ground around a volcano can become unstable and collapse, causing landslides.

6. Predicting Volcanic Eruptions

Scientists work hard to predict eruptions to keep people safe. They use a **hazard assessment program** and look for several signs:

- **Earthquakes:** Small earthquakes often happen as magma moves inside the volcano. Scientists use **seismometers** to detect these.
- **Gas Emissions:** Changes in the types and amounts of gases (like sulfur dioxide) coming out of the volcano can mean magma is rising.
- **Deformation (Bulging):** The volcano's surface might swell or bulge as magma pushes its way up.
- **Past Eruptions:** Studying how a volcano behaved in the past helps scientists understand what it might do in the future.

By monitoring these signs, scientists can **alert people to evacuate the area before the eruption**, saving lives.

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Lesson 8 : Severe Weather

Hey students! Getting ready for your science final? This summary will help you review some important points about severe weather, like tornadoes, hurricanes, floods, and droughts. Let's dive in!

1. What is Severe Weather?

Severe weather includes powerful natural events like **storms** and **lightning**. It's important to understand these events so we can stay safe.

- **Not a Weather Hazard:** An **earthquake** is *not* a weather hazard; it's a geological hazard (related to the Earth's ground).

2. Tornadoes: Spinning Columns of Air

A **tornado** is a very fast-spinning column of air that stretches from a cloud all the way down to the ground.

- **Where they happen:** Most tornadoes happen over **land**.
- **How we rate them:** We use the **Enhanced Fujita (EF) Scale** to rate tornadoes. This scale looks at how fast the wind is blowing and how much damage the tornado causes.
    - **EF-0:** Causes lighter damage, like breaking tree branches or destroying chimneys.
    - **EF-5:** Causes extreme, catastrophic damage, like what happened with the Tri-State tornado, which was very deadly and caused a lot of harm.

3. Hurricanes: Powerful Ocean Storms

A **hurricane** is a type of severe weather hazard that forms over the ocean. It has very strong winds, usually faster than 119 kilometers per hour.

- **Where they happen:** Hurricanes form over **oceans**.
- **What they need to form:** They need **ocean water** and **warm, moist air** to develop.
- **What they can cause:**
    - **Flooding:** Hurricanes often bring heavy rain that can lead to widespread flooding.
    - **Storm Surge:** This is when a huge amount of ocean water is pushed onto the land, especially in low coastal areas, causing a lot of damage to buildings.

- **How scientists watch them:** Scientists use special tools like **satellites**, **ocean buoys**, and **ships** to collect data and predict where hurricanes might go.

4. Floods: Too Much Water

Flooding happens when there's too much water, and it covers land that is usually dry.

- **What causes floods?**
  - **Heavy Rain:** Lots of rain in one area can cause flash floods.
  - **Hurricanes, Monsoons, Thunderstorms:** These powerful weather events can bring so much rain that they cause floods.
  - **Snowmelt:** When a lot of snow melts quickly, the water can cause flooding.
- **How cities affect floods:** When we build more cities, we reduce farmlands and forests. These natural areas usually soak up rainwater, so building cities can sometimes make flooding worse.
- **Effects of floods:**
  - Destroying crops, farms, and natural habitats.
  - Damaging cities, roads, and businesses.
- **Good side of floods:** Flooding can actually be good for **wetlands** because it helps them stay healthy.

5. Droughts: Not Enough Water

A **drought** is a long period when there is very little or no rain. This causes the water levels in streams and lakes to drop a lot.

- **What causes droughts?**

- **High-Pressure Systems and Heat Waves:** These weather patterns can stop clouds from forming and bringing rain, leading to dry conditions and high temperatures.
- **No Precipitation:** Simply, a lack of rain or snow for a long time causes a drought.

- **Effects of droughts:**
  - **Drinking Water:** Droughts reduce the amount of safe drinking water available.
  - **Agriculture:** They harm farming by lowering plant growth, reducing harvests, and decreasing food for livestock (farm animals).
  - **Soil:** Droughts can lead to **soil erosion**, where the dry soil is easily blown away by wind or washed away by any small rain.
  - **Wildfires:** Very dry conditions from droughts can also increase the risk of wildfires.

6. Staying Safe and Monitoring Weather

- **Why forecasters monitor weather:** Weather forecasters watch the weather closely to **warn people to be safe** when severe weather is coming.
- **How they predict severe weather:** Meteorologists use tools like **weather balloons** and **radar** to help them predict severe weather events.
- **Your Safety:** It's important to listen to weather warnings and **stay safe** during severe storms. Don't go out to open areas when storms are happening.

TAKE THE QUIZ

Keep reviewing these points, and you'll be well-prepared for your final exam! Good luck!