SCIENCE 8 REVIEWER Q3

Earth's Land and Water Distribution

Overall Distribution of Earth's Surface

- **71%** of Earth's surface is covered by **water**
- **29%** of Earth's surface is **land**

Land Distribution

Continents

- Land is unevenly distributed across the globe.
- The **Northern Hemisphere** contains about **70% of the world's landmass.**
- The **Southern Hemisphere** is dominated by water and is often called the **"water hemisphere."**

Land Use

- Land distribution also involves **ownership and usage**.
- It affects **development**, **agriculture**, **settlement**, and **land rights policies**.

Water Distribution

Types of Water on Earth

- **Oceans (Saltwater):** ~**96.5%** of all Earth's water
- **Freshwater:** ~**3%** of all Earth's water

Freshwater Breakdown

- **Ice Caps & Glaciers:** ~**68.7%** of freshwater (mostly inaccessible)
- **Groundwater:** ~**30.1%** of freshwater (major source for human use)
- **Surface Water & Other:** ~**1.2%**
  - Lakes
  - Rivers
  - Soil moisture
  - Atmosphere (water vapor)

Accessible Freshwater

- Only a **tiny fraction** of freshwater is easily accessible.
- **Groundwater** is the most significant usable source.

- **Lakes** contain most surface freshwater.
- **Rivers**, though small in volume, are crucial for human needs.

Key Concepts

Abundance vs. Availability

- Earth has abundant water, but most is **saltwater or frozen**.
- Freshwater is **limited and precious**.

Uneven Distribution

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Key Concepts

Abundance vs. Availability

- Earth has abundant water, but most is **saltwater or frozen**.
- Freshwater is **limited and precious**.

Uneven Distribution

- Both **land and usable water** are unevenly distributed.
- This affects **climate**, **ecosystems**, and **human water access**.

Hydrologic Cycle

- Water continuously moves through:
  - Evaporation
  - Condensation
  - Precipitation
- The **total amount of water** on Earth remains relatively constant.

Layers of the Earth

The Earth is composed of **four main layers**, arranged from the **outermost to the innermost**:

1. Crust

- The **outermost layer** where humans live
- **Thinnest** layer of the Earth
- Made of **solid rock**
- Includes the **continents** and the **ocean floor**

2. Mantle

- Located **beneath the crust**
- The **thickest** layer of the Earth
- Composed of **hot, semi-molten rock (magma)**
- Responsible for **tectonic plate movement**

3. Outer Core

- A **liquid** layer
- Composed mainly of **iron and nickel**
- Generates the **Earth's magnetic field**

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- A **liquid** layer
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- Generates the **Earth's magnetic field**

4. Inner Core

- The **innermost layer** of the Earth
- **Solid** due to extremely high pressure
- **Very hot** and made of **iron and nickel**

CONTINENTAL AND OCEANIC CRUST

CRUST – EARTH'S OUTER LAYER

Continental Crust

- **Definition:** Thick, less dense outer layer forming **continents and continental shelves**. Made of **granitic rocks** (rich in aluminum and silica, called *sial*).
- **Key Characteristics:**
  - **Composition:** Granitoid rocks (granite); rich in **K, Na, Ca, Si, Al**
  - **Thickness:** ~10 km on shelves to **70 km under mountains**; much thicker than oceanic crust
  - **Density:** Lower (~2.7 g/cm^3), allowing it to **float higher on the mantle**
  - **Age:** Generally **much older**, with stable cores called **cratons**
  - **Formation:** Formed through **volcanism, erosion, metamorphism, and collisions** at convergent plate boundaries (subduction zones), creating mountains (**orogeny**)
  - **Location:** Forms all **landmasses** and shallow continental shelves
- **Notes:** Constantly reshaped by **plate tectonics**; more complex than oceanic crust.

Oceanic Crust

- **Definition:** Thin, dense, **mafic layer** beneath the oceans, made of **basalt and gabbro** (*sima*). Continuously formed and recycled.
- **Key Characteristics:**
  - **Composition:** Mafic igneous rocks (basalt on top, gabbro below); rich in **Fe and Mg**
  - **Thickness:** ~5–10 km
  - **Density:** Higher (~3.0 g/cm^3), causing it to **sit lower than continental crust**
  - **Age:** Very young, rarely more than **200 million years**; constantly recycled
- **Formation & Destruction:**
  - **Creation:** At **mid-ocean ridges** (divergent boundaries) where magma rises, cools, and solidifies
  - **Recycling:** Subducted back into the mantle at **subduction zones**, forming **deep ocean trenches**

- **Structure (from top to bottom):**

1. **Sediments:** Thin layer of marine sediments
2. **Pillow Lavas:** Basalt flows from underwater eruptions
3. **Sheeted Dikes:** Vertical basalt intrusions, remnants of magma conduits
4. **Gabbro:** Coarse-grained intrusive rock from the magma chamber

TYPHOONS AND EARTHQUAKES

What is a Typhoon?

A **typhoon** is a powerful **tropical cyclone** that forms over **warm ocean waters** in the **Northwestern Pacific Ocean**. It brings **strong winds**, **heavy rainfall**, and **storm surges** that can cause widespread damage.

Other Names of Tropical Cyclones

- **Typhoon** – Northwestern Pacific (including the Philippines)
- **Hurricane** – Atlantic Ocean and Northeastern Pacific
- **Cyclone** – Indian Ocean and South Pacific

All refer to the same type of weather system but are named differently depending on location.

Conditions Needed for Typhoon Formation

Typhoons develop when the following conditions are present:

- Warm ocean water (**at least 26.5°C**)
- Moist air
- Low air pressure
- Little to no wind shear
- Coriolis effect (Earth's rotation)

Parts of a Typhoon

- **Eye** – Calm center with light winds
- **Eyewall** – Surrounds the eye; strongest winds and heaviest rainfall
- **Rainbands** – Spiral bands of clouds that bring rain and thunderstorms

Stages of Typhoon Development

- **Tropical Disturbance** – Cluster of clouds and thunderstorms
- **Tropical Depression** – Wind speed up to **61 km/h**
- **Tropical Storm** – Wind speed **62–117 km/h**; system is given a name

- **Typhoon** – Wind speed **118 km/h or higher**

Common Typhoon Categories (PAGASA – Philippines)

Based on **maximum sustained wind speed**:

- **Tropical Depression (TD):** Up to **62 km/h** (33 knots)

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Common Typhoon Categories (PAGASA – Philippines)

Based on **maximum sustained wind speed**:

- **Tropical Depression (TD):** Up to **62 km/h** (33 knots)
- **Tropical Storm (TS): 62–88 km/h** (34–47 knots)
- **Severe Tropical Storm (STS): 89–117 km/h** (48–63 knots)
- **Typhoon (TY): 118–184 km/h** (64–99 knots)
- **Super Typhoon (STY): 185 km/h and above** (100+ knots)

Typhoon Signal Warning System (Philippines – PAGASA)

- **Signal #1:** 39–61 km/h winds (light damage)
- **Signal #2:** 62–88 km/h winds (moderate damage)
- **Signal #3:** 89–117 km/h winds (heavy damage)
- **Signal #4:** 118–184 km/h winds (very heavy damage)
- **Signal #5:** Over 185 km/h winds (extreme damage)

Effects of Typhoons

Primary Effects

- Strong winds
- Heavy rainfall
- Storm surge

Secondary Effects

- Flooding
- Landslides
- Power outages
- Crop and property damage

Why the Philippines is Prone to Typhoons

- Located near the **equator** and **warm Pacific waters**
- Lies along the **typhoon belt**
- Experiences around **20 typhoons each year**

Typhoon Safety Measures

Before a Typhoon

- Monitor weather updates from **PAGASA**

- Secure homes and prepare emergency kits

During a Typhoon

- Monitor weather updates from **PAGASA**

- Secure homes and prepare emergency kits

During a Typhoon

- Stay indoors
- Avoid flooded areas
- Follow evacuation orders

After a Typhoon

- Watch out for damaged electrical lines
- Avoid floodwaters
- Check for injuries and property damage

Quick Summary

Typhoons are intense tropical cyclones that form over warm oceans. They frequently affect the **Philippines**, causing strong winds, heavy rainfall, flooding, and storm surges. Proper **monitoring and preparedness** are essential to reduce damage and loss of life.

What is an Earthquake?

An **earthquake** is the sudden shaking of the Earth caused by the **release of energy** from within the Earth, usually due to **movement along faults** in the Earth's crust.

Causes of Earthquakes

Tectonic Earthquakes (Most Common)

- Caused by the **movement of tectonic plates**
- Stress builds up along **faults** until it is suddenly released

Volcanic Earthquakes

- Caused by **magma movement** beneath volcanoes
- Often occur **before or during volcanic eruptions**

Human-Induced Earthquakes

Caused by human activities such as:

- Mining
- Reservoir-induced pressure (large dams)
- Underground explosions

Faults

A **fault** is a crack in the Earth's crust where rocks move past each other.

Types of Faults

Caused by human activities such as:

- Mining
- Reservoir-induced pressure (large dams)
- Underground explosions

Faults

A **fault** is a crack in the Earth's crust where rocks move past each other.

Types of Faults

- **Normal Fault** – caused by **tension** (pulling apart)
- **Reverse Fault** – caused by **compression** (pushing together)
- **Strike-Slip Fault** – caused by **shearing** (sliding past each other)

Focus and Epicenter

- **Focus (Hypocenter)** – the point **inside the Earth** where the earthquake starts
- **Epicenter** – the point on the **Earth's surface directly above** the focus

Seismic Waves

Seismic waves are energy waves produced by earthquakes.

Body Waves (travel through the Earth)

P Waves (Primary Waves)

- Fastest seismic waves
- Travel through **solids, liquids, and gases**

S Waves (Secondary Waves)

- Slower than P waves
- Travel **only through solids**

Surface Waves (travel along Earth's surface)

- Cause the **most damage**
- Move the ground **side-to-side and up-and-down**

Measuring Earthquakes

Magnitude

- Measures the **energy released** by an earthquake
- Common scale: **Moment Magnitude Scale (Mw)**

Intensity

- Measures the **effects and damage** of an earthquake

- Scale used: **Modified Mercalli Intensity Scale (MMI)**

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Instruments Used

- **Seismograph** – detects and records seismic waves
- **Seismogram** – the record produced by a seismograph

Effects of Earthquakes

Primary Effects

- Ground shaking
- Surface rupture

Secondary Effects

- Landslides
- Liquefaction
- Tsunamis
- Fires and building collapse

Earthquake-Prone Areas

- Most earthquakes occur along **plate boundaries**
- The **majority of Earth's volcanoes and earthquakes** take place along the **Pacific Ring of Fire**

Major Earthquake Zones

- **Pacific Ring of Fire**
- **Mid-Atlantic Ridge**
- **Alpine-Himalayan Belt**

Earthquakes in the Philippines

- The Philippines is earthquake-prone because it lies along the **Pacific Ring of Fire**
- Major fault system: **Philippine Fault Zone**
- The country experiences **frequent seismic activity**

Earthquake Safety

Before an Earthquake

- Secure heavy objects
- Prepare an emergency kit

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During an Earthquake

- **Drop, Cover, and Hold On**
- Stay away from windows and heavy objects

After an Earthquake

- Check for injuries
- Be alert for aftershocks
- Follow official instructions

Quick Summary

Earthquakes result from the **sudden release of energy** due to **plate movements**. They produce **seismic waves**, are measured by **magnitude and intensity**, and can cause serious damage—especially in **plate boundary regions** such as the **Pacific Ring of Fire** and the **Philippines**.

TIDES

What are Tides?

Tides are the regular **rise and fall of sea levels** caused mainly by the **gravitational pull of the Moon**, and to a lesser extent, the **Sun**, on the Earth.

Causes of Tides

Moon's Gravitational Pull

- The **primary cause** of tides
- Pulls ocean water toward the side of Earth facing the Moon
- Creates a **high tide**

Inertia (Centrifugal Force)

- Causes a **second high tide** on the opposite side of the Earth
- Occurs because the **Earth and Moon rotate around a common center of mass**

Sun's Gravitational Pull

- Also affects tides, but **less than the Moon** due to greater distance
- Can **strengthen or weaken tides** depending on alignment with the Moon

Types of Tides (Based on Water Level)

Sun's Gravitational Pull

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- Can **strengthen or weaken tides** depending on alignment with the Moon

Types of Tides (Based on Water Level)

- **High Tide** – When sea level is at its highest
- **Low Tide** – When sea level is at its lowest

Most coastal areas experience **two high tides and two low tides each day**.

Spring Tide and Neap Tide

Spring Tide

- Occurs during **new moon** and **full moon**
- **Sun, Moon, and Earth are aligned**
- Produces **very high high tides** and **very low low tides**

Neap Tide

- Occurs during **first quarter** and **last quarter** moon phases
- **Sun and Moon pull at right angles**
- Produces **lower high tides** and **higher low tides**

Types of Tides (Based on Frequency)

- **Semidiurnal Tide** – Two high tides and two low tides daily (most common)
- **Diurnal Tide** – One high tide and one low tide daily
- **Mixed Tide** – Two unequal high tides and two unequal low tides daily

Factors Affecting Tides

- Shape of the **coastline**
- **Depth** of the ocean
- **Earth's rotation**
- Position of the **Moon and Sun**

Importance of Tides

- Helps **navigation** for ships and boats
- Affects **fishing activities**
- Distributes **nutrients** in coastal ecosystems
- Influences **coastal erosion** and sediment movement

Tides in the Philippines

- The Philippines experiences mostly **semidiurnal tides**
- Tides affect **fishing, ports, and coastal communities**
- Strong tides can increase the risk of **coastal flooding**, especially during storms

Difference Between Tides and Waves

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Difference Between Tides and Waves

- **Tides** – Caused by **gravity**; long-term rise and fall of sea level
- **Waves** – Caused by **wind**; short-term movement of water on the surface

Quick Summary

Tides are caused mainly by the **Moon's gravitational pull**, with help from the **Sun**. They occur regularly, influence marine life and human activities, and are important for **navigation, fishing, and coastal processes**, especially in countries like the **Philippines**.

VOLCANOES

Types of Volcanoes

Shield Volcano

- **Shape:** Broad, wide, and gently sloping
- **Lava Viscosity:** Low (runny and thin)
- **Lava Type:** Basaltic (low silica)
- **Gas Content:** Low
- **Eruption Type:** Effusive and quiet

Composite Volcano (Stratovolcano)

- **Shape:** Tall, steep, and symmetrical cone
- **Structure:** Made of **alternating layers of lava and ash**
- **Lava Viscosity:** High (thick)
- **Lava Type:** Andesitic to rhyolitic
- **Gas Content:** High
- **Eruption Type:** Powerful and explosive; sometimes effusive

Cinder Cone Volcano

- **Shape:** Small, steep-sided cone
- **Structure:** Built from **ash, cinders, and rocks** with a **bowl-shaped crater**
- **Lava Viscosity:** Low to moderate
- **Lava Type:** Basaltic
- **Gas Content:** High
- **Eruption Type:** Explosive

Types of Magma

Basaltic Magma

- **Viscosity:** Low
- **Temperature: 1000°C – 1200°C**
- **Gas Content: 1–3%**
- **Silica Content:** About **50%**

Andesitic Magma

- **Viscosity:** Intermediate
- **Temperature: 900°C – 1000°C**
- **Gas Content: 3–4%**
- **Silica Content:** About **60%**

Rhyolitic Magma

- **Viscosity:** High
- **Temperature: 700°C – 800°C**
- **Gas Content: 4–6%**
- **Silica Content:** About **70%**

Major Volcanic Hazards

Ashfall

- Showering of **volcanic ash and rock fragments** from an eruption
- Can damage crops, buildings, and affect breathing

- **Shape:** Small, steep-sided cone
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Lahar Flow

- **Volcanic mudflow** formed when volcanic debris mixes with **water**
- Often triggered by heavy rain or melting ice

Volcanic Gases

- Includes poisonous gases such as **sulfur dioxide**, which harm the **lungs, eyes, and skin**
- Can form **acid rain**
- **Carbon dioxide (CO_2)** is not poisonous but is **extremely dangerous** because it can displace oxygen

Lava Flow

- Streams of **molten rock** moving from a volcano
- Destroys everything in its path but usually moves slowly

Pyroclastic Flow

- **Extremely hot**, fast-moving currents of **gas, ash, and rock**
- One of the **most deadly volcanic hazards**

MAYON VOLCANO ALERT LEVELS

Source: Philippine Institute of Volcanology and Seismology (**PHIVOLCS**)

ALERT LEVEL 5 – HAZARDOUS ERUPTION ONGOING

- **Meaning:** Hazardous eruption underway
- **Action: Full evacuation** of surrounding areas required
- **Note:** EVACUATE IMMEDIATELY

ALERT LEVEL 4 – HAZARDOUS ERUPTION IMMINENT

- **Meaning:** High likelihood of a **major eruption**
- **Hazards:** Increased lava flow, ashfall, potential pyroclastic flows
- **Action: Evacuation required**

Volcanic Gases

- Includes poisonous gases such as **sulfur dioxide**, which harm the **lungs, eyes, and skin**
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- **Action: Evacuation required**

ALERT LEVEL 3 – INCREASING TENDENCY TOWARDS ERUPTION

- **Meaning:** Relatively high unrest
- **Sign:** Strong signs of magma moving closer to the surface
- **Action:** Evacuation of the **Permanent Danger Zone (PDZ)** recommended

ALERT LEVEL 2 – INCREASING / MODERATE UNREST

- **Meaning:** Probable magma intrusion, may lead to eruption
- **Hazards:** Increased rockfalls, ground deformation
- **Action: PDZ no entry**

ALERT LEVEL 1 – LOW LEVEL OF UNREST

- **Meaning:** Magmatic, tectonic, or hydrothermal disturbance
- **Hazards:** No eruption imminent, but caution advised within the **6 km PDZ**

ALERT LEVEL 0 – QUIET / NO ALERT

- **Meaning:** Quiescent; no eruption foreseen
- **Hazards:** Explosions, rockfalls, landslides may still occur within the **4 km PDZ**

SCIENCE REVIEWER
- 29% Land
- 71% Water

Blue Planet
- The earth's often called by this due to 71% of it is covered by water

Oceanic Crust
- Made mostly of a dark dense rock called basalt

Continental Crust
- Made mostly of a less dense rock called granite

Crust
- Outermost layer of the earth

Mantle
- Made of hot semi-molten rock

Outer core
- Composed mainly of liquid iron and nickel that produces earth's magnetic field

Inner core
- The hottest and densest layer

Eruption Types
- **Hawaiian:** Least explosive type (effusive)
- **Strombolian:** Moderately explosive
- **Vulcanian**: Highly explosive
- **Pelean:** Extremely violent explosions
- **Plinian:** Most violently explosive

Types of Volcano
1. Cinder Cone
2. Composite
3. Shield
4. Lava Domes

26.5/27 Degree Celcius
- Minimum ocean temperature required for a typhoon to form

Three Parts When Cyclone is Formed
1. Eye
2. Eyewall
3. Rainbands

Intertropical Convergence Zone (ITCZ)
Philippine Area of Responsibility (PAR)
Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA)
Department of Science and Technology (DOST)

Nationwide Operational Assessment of Hazards (NOAH)

Typhoon Categories
- Tropical Depression (61 kph)
- Tropical Storm (62-88 kph)
- Severe Tropical Storm (89-117 kph)
- Typhoon (118-184 kph)
- Super Typhoon (185 kph above)

Wave
- Movement of water

Tide

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Wave
- Movement of water

Tide
- The rise or fall of sea level because of gravity
- Two types of tide: Spring and Neap Tide

Terms to Remember:

Active: A volcano that has erupted within the last 600 years or has a documented record of eruption within the last 10,000 years.

Inactive (Dormant): A volcano that has not erupted for a very long time but has the potential to erupt again. Some are "extinct," meaning they are unlikely to ever erupt again because their magma supply is gone.

Longitude: Imaginary vertical lines that measure distance East or West of the Prime Meridian. (Think "Long" lines that meet at the poles).

Latitude: Imaginary horizontal lines that measure distance North or South of the Equator. (Think "Lat is Flat").

Strombolian: A moderate eruption characterized by periodic "bursts" or "burps" of glowing lava fragments (cinders) into the air.

Phreatomagmatic: A violent eruption caused by the interaction of water and new magma. It produces a large amount of fine ash and steam.

Plinian: The most explosive and powerful type of eruption. It creates a massive, continuous column of ash and gas that reaches high into the atmosphere (the stratosphere).

Volcanian: A brief but violent eruption that sends a dark, cauliflower-shaped cloud of ash and gas several kilometers into the sky.

Phreatic: A steam-driven eruption caused when water (groundwater or rain) hits hot rocks. It blasts out ash and steam but no new magma.

F **Lesson 6 : Viscosity & Non-Viscosity**

Viscosity (High Viscosity)
Viscosity is a measure of a fluid's resistance to flow. In simpler terms, it describes how "thick" or "sticky" a liquid is.

Behavior: A high-viscosity liquid moves very slowly. It is difficult to pour or stir.

Volcano Connection: Magma with high viscosity is thick and sticky (like peanut butter or honey). Because it is so thick, it traps gas bubbles inside. When the pressure from these trapped gases builds up too much, it results in a violent, explosive eruption.

Example: Rhyolitic magma (found in Composite volcanoes).

Non-Viscosity (Low Viscosity)
While scientists usually say "low viscosity" rather than "non-viscosity," it refers to a liquid that flows very easily.

Behavior: A low-viscosity liquid is "runny" and thin. It flows quickly and spreads out over large areas

Volcanic Connection: Low-viscosity magma is thin and runny (like water or cooking oil). Gas bubbles can escape easily from this kind of magma, so the eruptions are usually quiet and effusive (lava just flows out smoothly).

Example: Basaltic lava (found in Hawaii's Shield volcanoes).

(Why Viscosity Changes?)
There are two main things that determine if magma will be thick or runny:

- **Silica Content:** This is the most important factor. Silica acts like "glue."

  High Silica = High Viscosity (Thick)
  Low Silica = Low Viscosity (Runny)

- **Temperature:**

Cold Magma: More viscous (thicker, like honey from the fridge).
Hot Magma: Less viscous (runnier, like honey heated in the microwave).

F Lesson 7 : Classifications of Magma

Types of Magma

Basaltic Magma (Mafic)
-A thin, runny magma with low silica content (45–55%) and the highest temperature (1,000–1,250°C), resulting in quiet, flowing eruptions.

Andesitic Magma (Mafic)
-A moderately thick magma with intermediate silica content (55–65%) and moderate temperature (800–1,000°C), leading to both flowing and explosive eruptions.

Rhyolitic Magma (Mafic)
-A very thick, sticky magma with high silica content (65–75%) and the lowest temperature (650–800°C), which traps gases and causes violently explosive eruptions.

The Big 8 Elements that Magma Contains:

Oxygen (O)
Silica (Si)
Aluminum (Al)
Iron (Fe)
Calcium (Ca)
Sodium (Na)
Magnesium (Mg)
Potassium (K)