# Earth Science Reviewer

MIDTERMS 1ST SEM

**IMPORTANCE:**

Helps predict natural hazards, mange natural resources, understand climate change, and sustain life on the planet.

## WHAT IS SCIENCE?

The study of Earth, its structure, history, processes, and place in the solarsystem.

## Major Branches of Earth Science

### GEOLOGY

- study of Earth

two areas:
Physical - study of the materials that make up Earth,, its shape and processes.
Historical - deals with the history , timeline, and events happened on the Earth.

### OCEANOGRAPHY

- studies the composition and movements of seawater, coastal proceses, seafloor topography, and marine life.

### METEOROLOGY

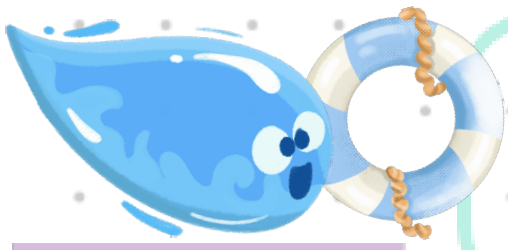
- studies the atmosphere and the process that produce weather and climate.

### ASTRONOMY

- studies the universe that is useful in probing the origins of our environment.

The four branches complement each other because they stusy different parts of the same interconnected Earth system, The changes in one part affects the other (e.g. ocean currents shape weather patterns, while gological events impact atmospheric composition

# Earth's Four Major Systems

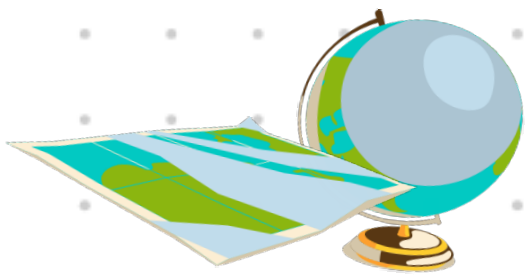


## HYDROSPHERE

- made up all the water on Earth.
- essential for living organism that is why its distribution are major factos that affect ife on Earth.

## ATMOSPHERE

- A life sustaining, thin, gaseous envelope that surround the Earth.
- provides air to breath, produce weather and cliimate, and protects life from the sun's intense heart and radiation.



## GEOSPHERE

- lies beneath the Earth's surface.
- divided into three parts: the core, mantle, and crust

## BIOSPHERE

- includes all life on Earth.
- It is concentrated in a zone that extends from the ocean floor upward into the atmosphere.

# Scientific Inquiry

- The process scientists used to investigate the natural word by making objservations, collecting evidence, testing ideas, and developing explanations.
-This is the standard for explaining our natural world. It helps scientiststo understand everything from animal behavior to forces that shape our planet.

NOTES

## STEPS

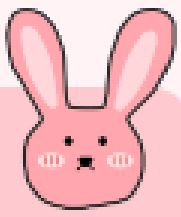
1. Collection of scientific facts through observation and measurement
2. Developing hypotheses
3. Experiment, testing the hypotheses
4. Acceptance, modification, or rejection of hypothesis based on extensive testing

# ORIGIN OF THE UNIVERSE

## Misconceptions

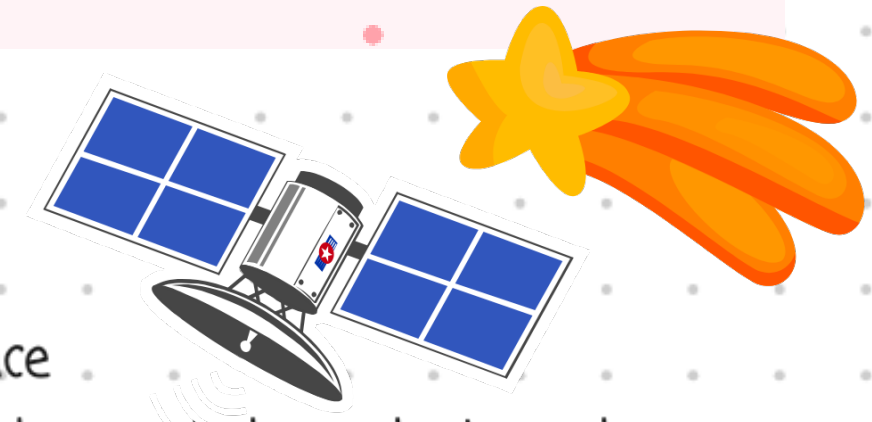
- there were no explotion, there was expansion

## BIG BANG THEORY



- the cosmological model describing the universe expanding from an extremely hot, dense singularity approx. 13.4 billion years ago.
- Abundance of atom especially Hydrogen 75% and Helium 25%

## Supporting evidence:



a. Cosmic Microwave Background Radiation (CMBR)
- Noise radiation (static) is evenly spread across space
- Law of Conservation of Energy: energy can neither be created nor destryoed; energy remains constant over time

b. Redshift of galaxies (Hubble's Law) indicating universe expansion.
- Hubble observe that majority of the galaxies are moving away from each other
- Farther the distancce, the faster they move

c. Quasars
- super large galactic cores that put out more light than galaxies
- onlyfound 10-15 billio light year away; nothing exists past them

d. Radioactive Decay
- gives the age of items from the decay of raddioactive materials found within the object

e. Stellar Formation and Evoluton
- Satteltes and Telescopesareused to observe the life cycle of stars across the universe

f. Speed of Light and Stellar Distances
- The speed oflight is a universal constant of 300,000 km/s^2


The Solar System is a set made up of the Sun and the eight planets (Mercury, Venus, Earth, Mars, Jupiter, Satur, Uranus, Neptune)

## How did the Solar System Form?

### Collapse

- Gas cloud collapsed from nearby supernova

### Formation of the Sun

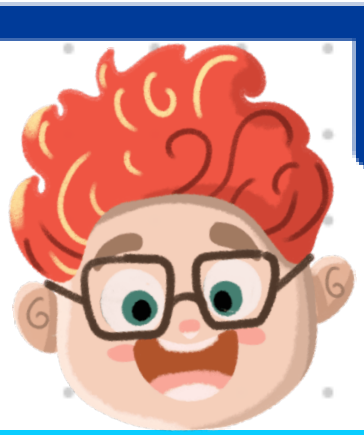
- Gravity fusion birthed the Sun

### Formation of Planets and Large Moons

- Clumping matter formed spherical planets

### Asteroids and Comets

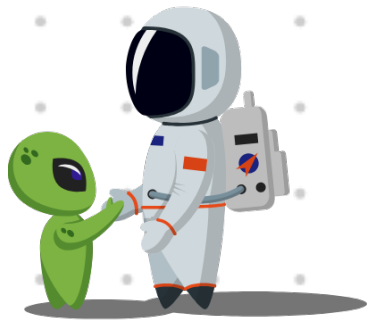
- Remaining matter became steriods and comets



## Main Stages of Planetary Formation

- **Nebular Collapse**

- Gravity causes a massive cloud gas and dust to collapse inward
- as it contracts, it spins faster and flattens forming a protostar



- **Condensation**

- as the spinning disk cools, gaseous materials transition into solid particles
- Metalsand silicat roks solidifies near the hot cene, while ice and lighter gases condense in outer regions

- **Accretion**

- Collision of solid dustand ice grains accumulate into a kilometer-size objectknown as planetesiamls.

- **Protoplanet Growth**

- planetismals violently collide forming protoplanets

- **Differentiation**

- continuos collisions and radioactive decay heat meltsprotolanet. Heavy materials sink foming the core, while lihter silicate float upward forming the crust and mantle.

# Why are the Planets Different from one another?

- Distance from the Sun
- Size and Gravity
- Collisions

## NEBULAR HYPOTHESIS

- It said that solar system originatd from a nebula
- widely accepted view

## OBSERVATIONS THAT SUPPORTS THE NEBULAR HYPOTHESIS

Dusk disks: Telescopes spot stellar rings around newborn stars

Active Formation: Orion Nebula shows creation in real time

Exoplanets: Flat disk sysems are common

## MAJOR STEPS IN THE FORMATION OF THE SOLAR SYSTEM

- CLOUD COLLAPSE

Triggers: Supernova

Cause: Gravity overcomes intergas pressure

Effect: Shrinking cloud spins faster

- PROTOPLANETARY DISK

Stability: Metals and silicate endured heat

Properties: High boiling points allowed proximity

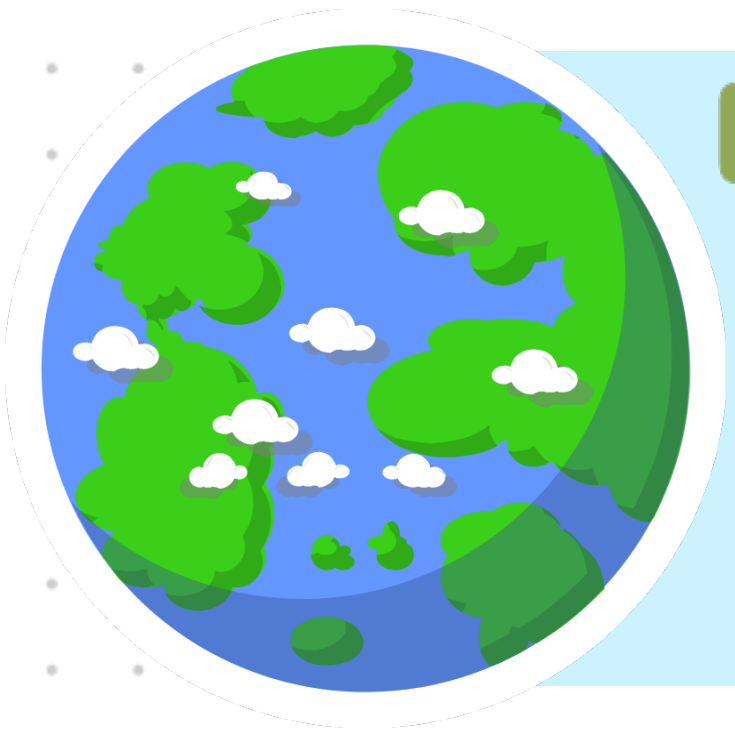
Outcome: Terrestrial Planets

- GROWTH OF PLANETS

Clumping: Dust grains formed initial clumps

Accretion: Clumps accreted into planetesimals

Planets: Colliding planetesimals fused into planets



## EARTH

- The word "Earth" comes from the old english word for "land"
- belongs to the milky way galaxy
- only planet to sustain iife

## Earth's Formation

- Earth formed 4.6 billion years ago
- Solr nebula collapsed under gravity pull
- Rotating cloud flattened into spinning disk
- Center material pulled to for Sun
- Colliding disk particles formed Earth's body

## SECTION BASED ON MAJOR CHANGES ON EARTH

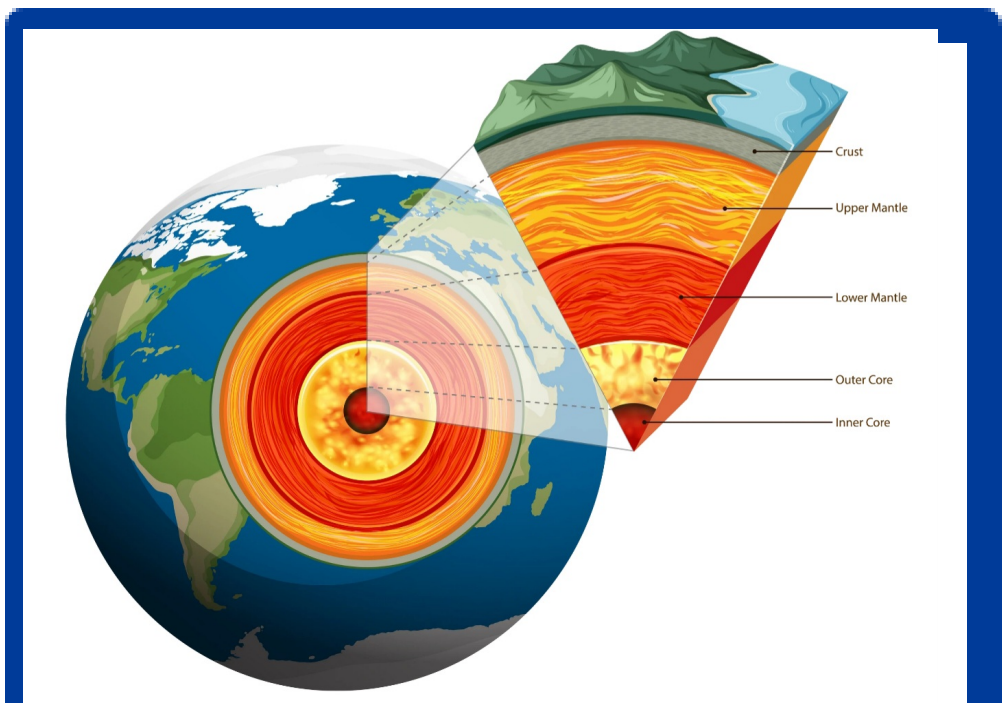
EON- half a billion years or more
ERA- severalhundred million years
PERIOD- one hundred million years
EPOCH- tens of million of years
AGE- milllion year

# Earth as a Dynamic Planet

**Actual Shape:** Oblate Spheroid ( flattened at the poles and buldging at the equator)

**Reason:** Centrifugal forces from the Earth's rotation cause the equator toblge sligtly outward

**Dimensions:** Equatorial diameter ~12,756 km; polar diameter is ~12,714 km




## LAYERS OF THE EARTH

### CRUST

Thin, rocky, outermost shell

types: continental and oceanic

### MANTLE

Upper mantle: Lithosphere and Asthenosphere

Lower Mantle: Hot, rigid material

### INNER

Solid iron-nickel due toimese pressure, despite high temp

### OUTER

Liquid iron-nickel alloy; responsible for Earth's

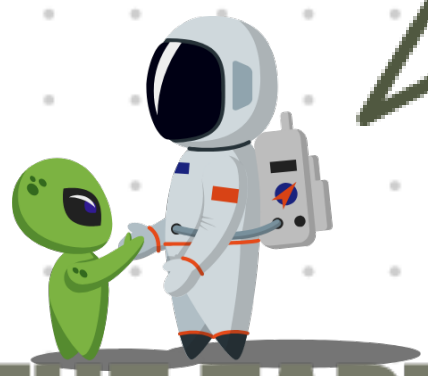
## FACTS OF THE EARTH

- Earth is the fifth largest planet.
- With a total surface area of 197 milio square miles (510 milion square km)

# MOHOROVICIC DISCONTNUITY

- Moho is the boundary between the crust and the mantle.
- Discoverd in 1909 by seismologist Andrija Morovicic

Through:
Seismic Waves, Gavity, Magnetic fields
Lab experiments, Meteorites, Driling, and direct samples



## HOW DO SCIENTISTS STUDY EARTH'S INTERIOR?

# 4 SPHERES OF THE EARTH

## GEOSPHERE

Provides the foundation for landforms, stores resources, and drives processes lie plate tectonics, earthquakes, and volcanism

## HYDROSPHERE

Composed of the ocean, rivers, lakes, glaciers, groundwater, and even ater vapor

## BIOSPHERE

All living organisms, from microbes to humans, interacting with land, water, and air

## ATMOSPHERE

A thin envelope that surounds the earth providing air, protection from solar radiation, reglate climate, and drives weather patterns

***A change in one sphere triggers a cascade of effects across the others through continuous exchanges of matter and energy.***

# Earth's Energy Sources

## External Energy Source

The sun provides most of the energy that powers Earth's suface processes

## Internal Energy Source

Heat inside Earth comes from radioactivedecay and residual heat from Earth's formation

# MINERALS AND ROCKS

## MINERAL

A natualy occuring, inoganic solid with definite chemical compostion and an ordely crystalline structure.

examples:

-Quartz -Gypsum
- Feldspar - Halite
- Mica - Diamond
- Calcite - Gold

| CHARACERISTICS | MEANING |
| --- | --- |
| Naturally occuring | formed by natural geological processes not produced by living organisms |
| Inorganic | |
| Solid | has a define solid form |
| Definite crystalline composition | consists of specific elements in a particular proportion |
| Orderly crystalline structure | atoms are arranged in an oganized, repeating pattern |

Minerals are important natural resources used in many areas of human life.

# COMMON USES

**Construction** - building materials

**Technology** - components of devices

**Electronics** - materials used in electronic equipment

**Agriculture** - nutrients and argicultural materials

**Medicine** - ingredients used in medical

**Jewelry** - gemstones and preciois metals

**Manufacturing** - raw materials used in producing different

# Mineral Identification

## COLOR

- The visible color of a mineral

## LUSTER

- The way mineral's surface reflects light
two general types:
Metallic
Nonmetallic

## STREAK

- The color of a mineral in powdered form; tested by rubbing the mineral against a ceramic plate

## HARDNESS

- A mineral's resistance to being scratched
- tested using material withknown hardness; using Mohs Hardness Scale

## CLEAVAGE

- tendency of a mineral to break along smooth , flat, and repeated planes

## FRACTURE

- The way mineral breaks when it does not follow a regular cleavage plane

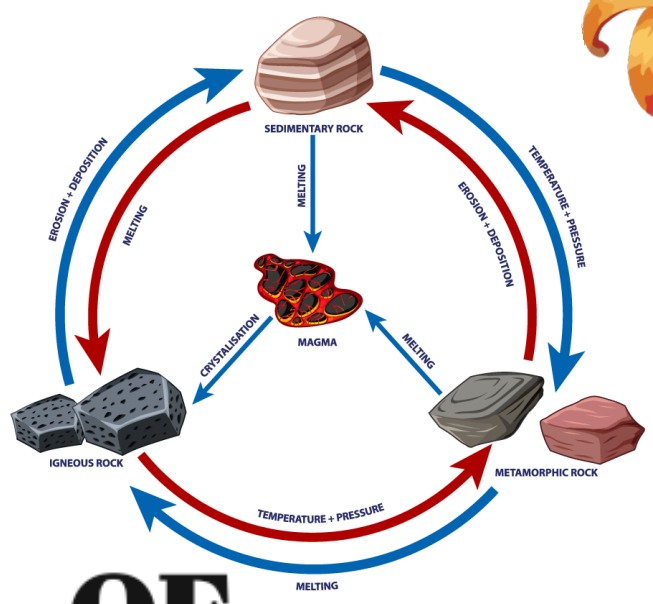
# MINERAL IDENTIFICATION PROCESS

The mineral identification process begins with an unknown mineral. First, the mineral is carefully observed to gather initial information about its appearance and characteristics. Next, its physical properties are tested, such as color, luster, streak, hardness, cleavage, and fracture. The observations and test results are then recorded and compared with mineral identification information or identification cards. Based on the evidence gathered, the mineral can then be identified. Finally, the identification should be explained and supported by evidence from the observations and tests conducted.

## Rocks

- May contains one or several minerals
- Does not necessarily have one uniform chemical composition
- An aggregate of natural minerals

Example:




# TYPES OF ROCKS

## Igneous

- Formed from the cooling and crystallization of magma or lava.

TYPES:

a. Intrusive = forms inside the Earth

b. Extrusive = forms at or near Earth's surface

Ex. Granite, Basalt, Obsidian

## Sedimentary

- through a sequence of processes:

weathering - erosion - transportation - deposition - compaction - cementation

Ex. Sandstone, Shale, Limestone

## Metamorphic

- form when existing rocks are changed by heat and pressure without completely melting.

| Process | What happens? |
|---|---|
| Weathering | Breaks rocks into smaller pieces |
| Erosion | Transports weathered materials |
| Deposition | Sediments settle and accumulate |
| Compaction | Sediments are pressed together |
| Cementation | Sediments are bound together |
| Heat & Pressure | Change existing rocks while remaining solid |
| Melting | Turns rock into molten material/magma |
| Cooling & Crystallization | Magma cools and becomes solid rock |