



Project **REACH** CALABARZON



EARTH AND LIFE SCIENCE



Ate Stella Speaker

LESSON 1:

Different Hypotheses on the

Origin of the Universe

ORIGIN OF THE UNIVERSE

**APPROXIMATELY 14 BILLION YEARS
AGO, NOTHING EXISTED**

BLACK VOID OF SPACE

**ALL MATTER AND ENERGY
COMPRESSED IN A SPACE ABOUT A
POINT OF A NEEDLE**

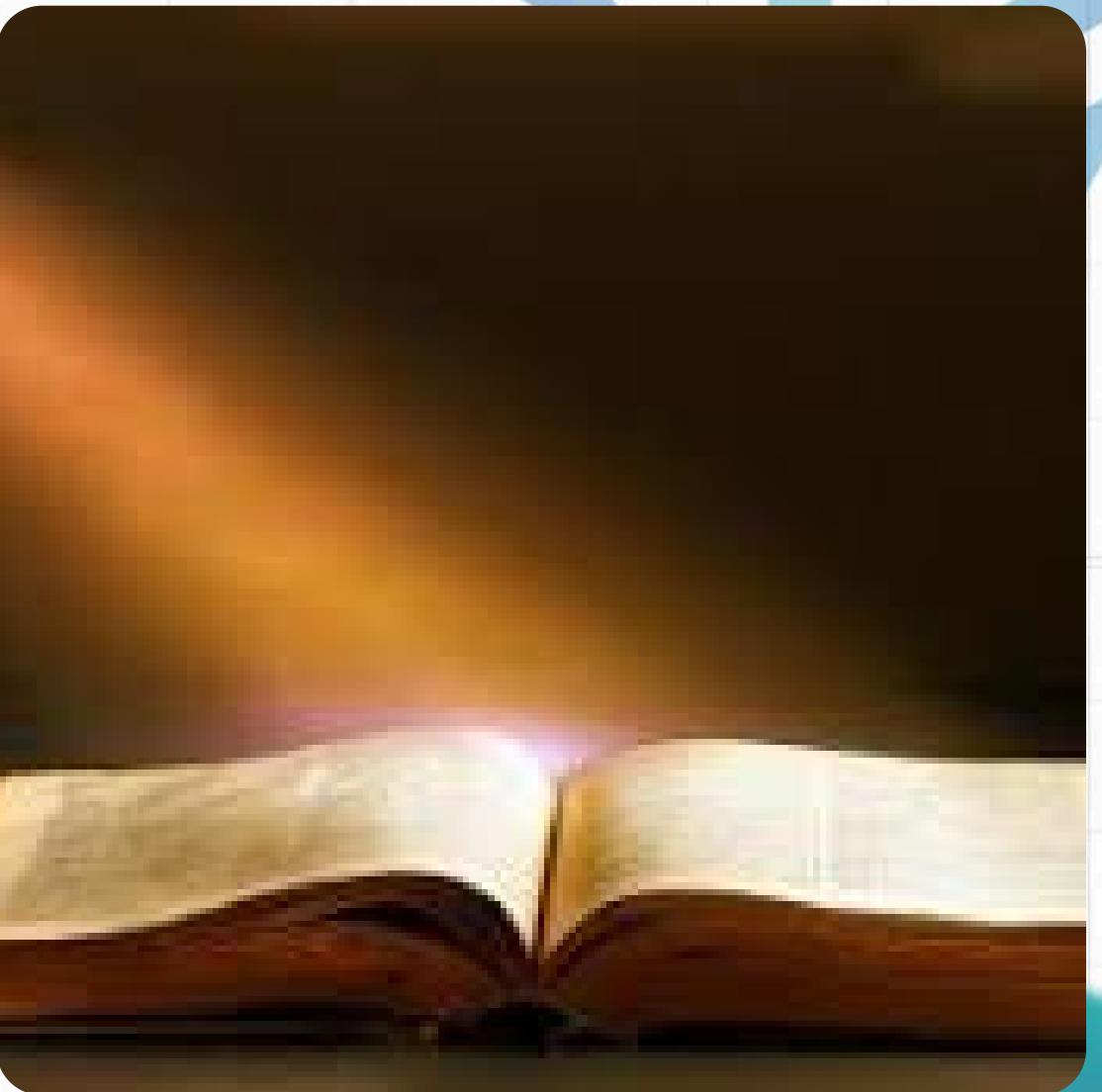


DIFFERENT THEORIES

- CREATIONISM
- BIG BANG THEORY
- STEADY-STATE UNIVERSE
- ETERNAL INFLATION
- OSCILLATING UNIVERSE
- PLASMA UNIVERSE

CREATIONISM

- BIBLICAL THEORY
- THERE IS A "CREATOR"
- GENESIS 1:1, "IN THE BEGINNING, GOD CREATED THE HEAVENS AND THE EARTH"



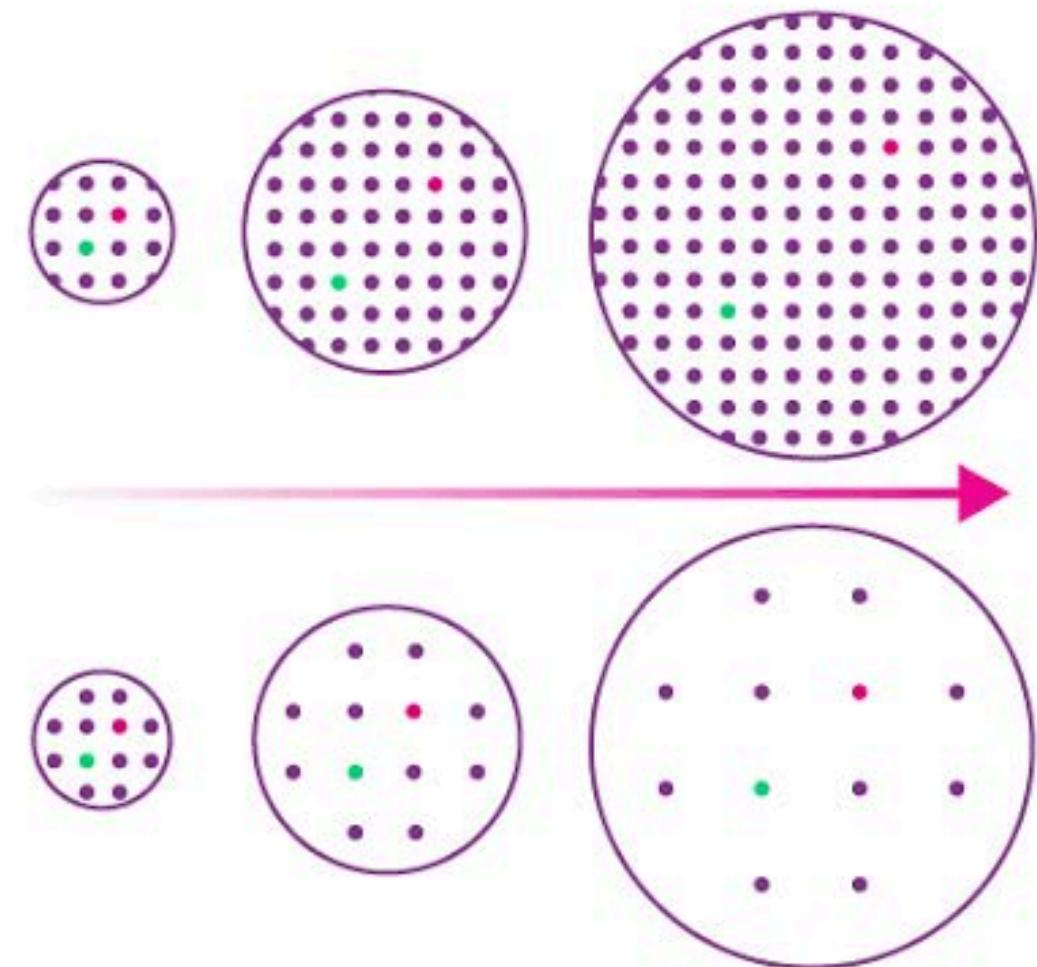
BIG BANG THEORY

- GEORGE LEMAITRE, 1920S
- RANDOM FLUNCTUATION OF A SUBATOMIC PARTICLE THAT EXPLODED
- CREATED THE UNIVERSE WITH AN IMAGINABLE HUGE SIZE



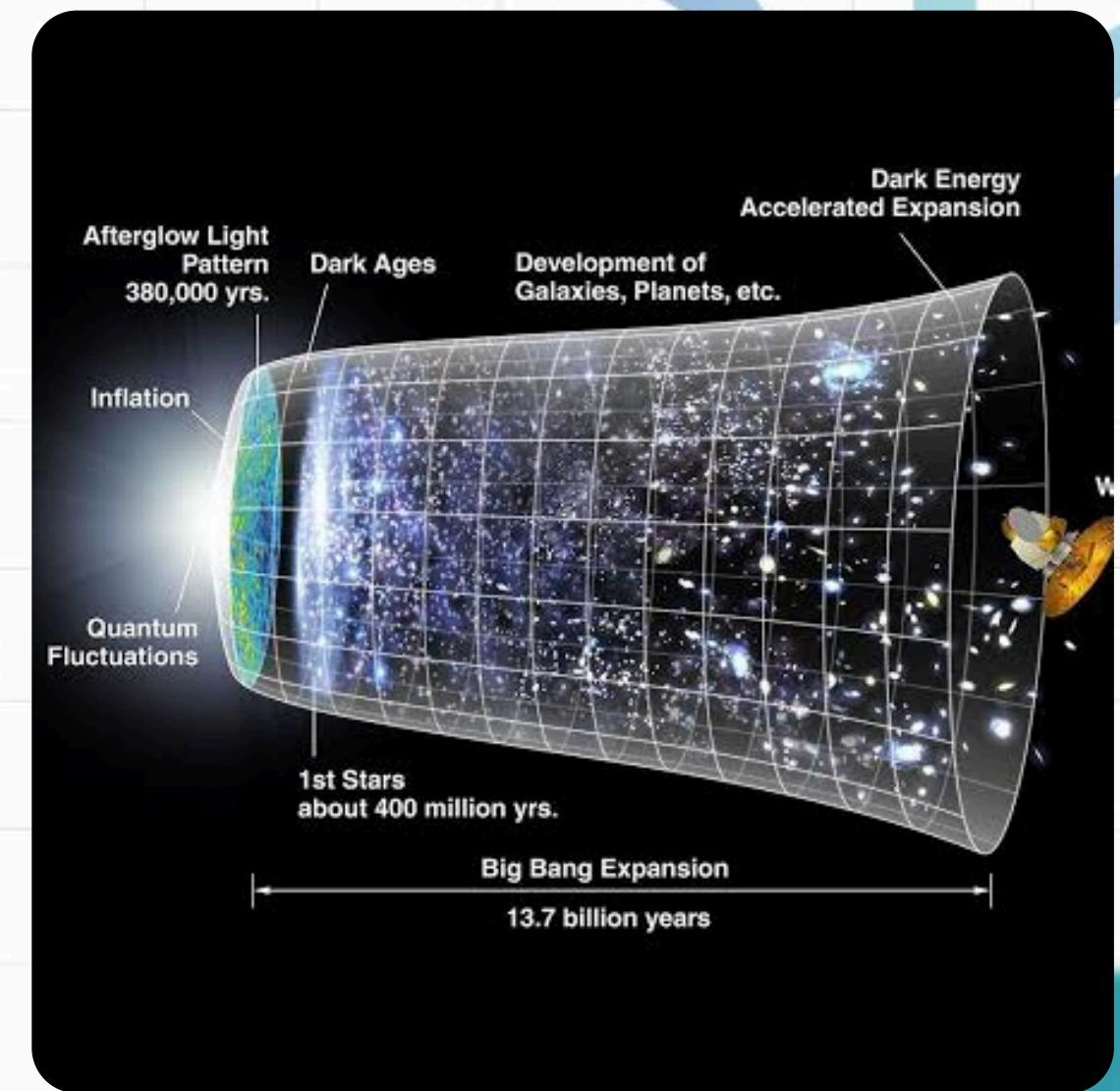
STEADY-STATE THEORY

- FRED HOYLE, 1940S
- THE UNIVERSE IS NOT ONLY UNIFORM IN SPACE BUT IS ALSO UNCHANGING IN TIME
- DENSITY OF MATTER IS CONSTANT OVER TIME; MATTER IS CONTINUOUSLY AND SPONTANEOUSLY CREATED



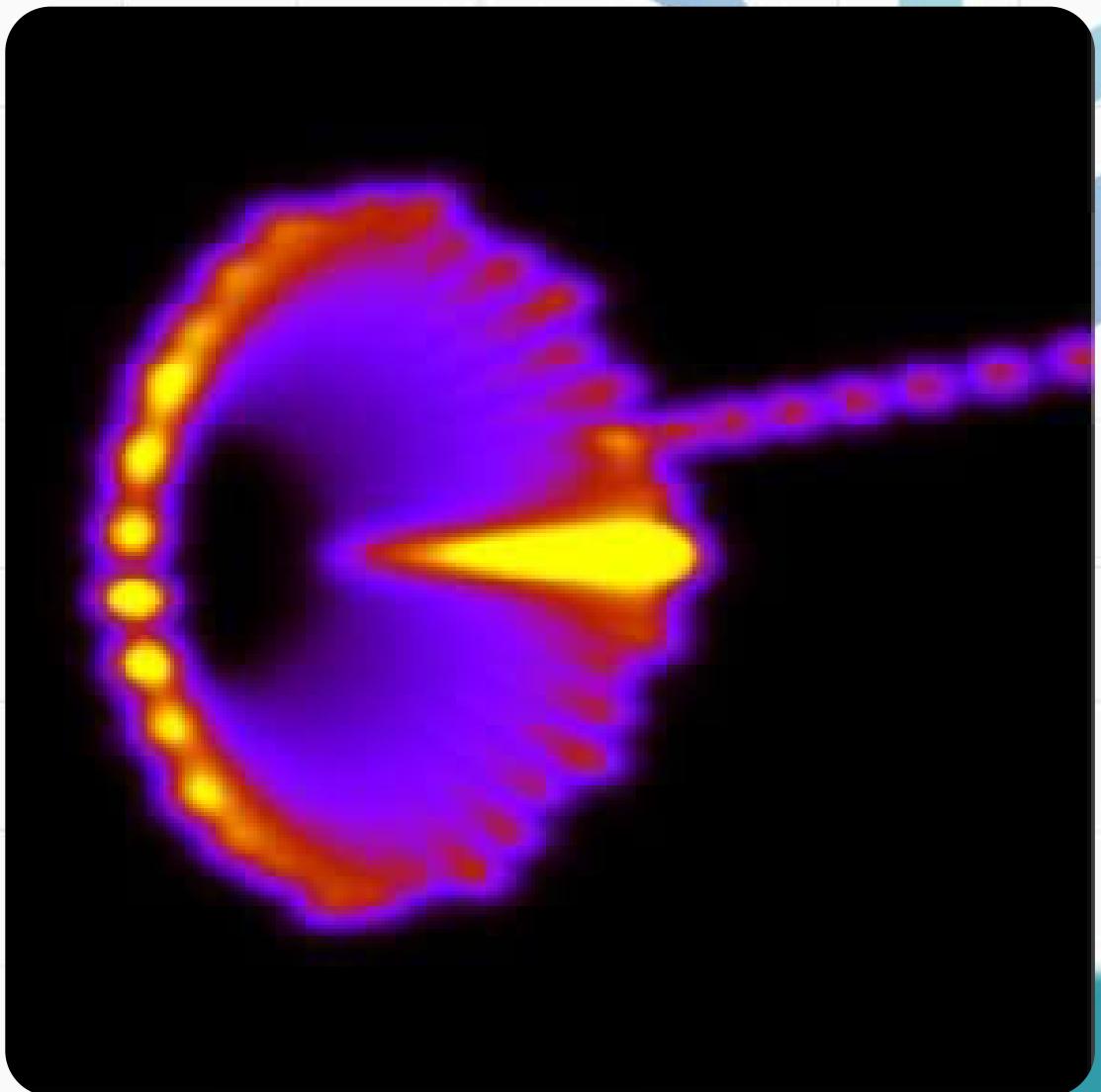
ETERNAL INFLATION

- HAPPENED AFTER BIG BANG
- RAPID EXPANSION OF THE UNIVERSE CALLED "INFLATION"
- HAS BEEN GOING ON AND NEVER STOPPED EXPANDING



OSCILLATING UNIVERSE

- A CYCLIC MODEL
- AN ENDLESS OCCURENCES OF EXPLOSIONS OR BIG BANG
- FOLLOWED BY CONTRACTION (BIG CRUNCHES) OF THE UNIVERSE TO REPEAT THE CYCLE



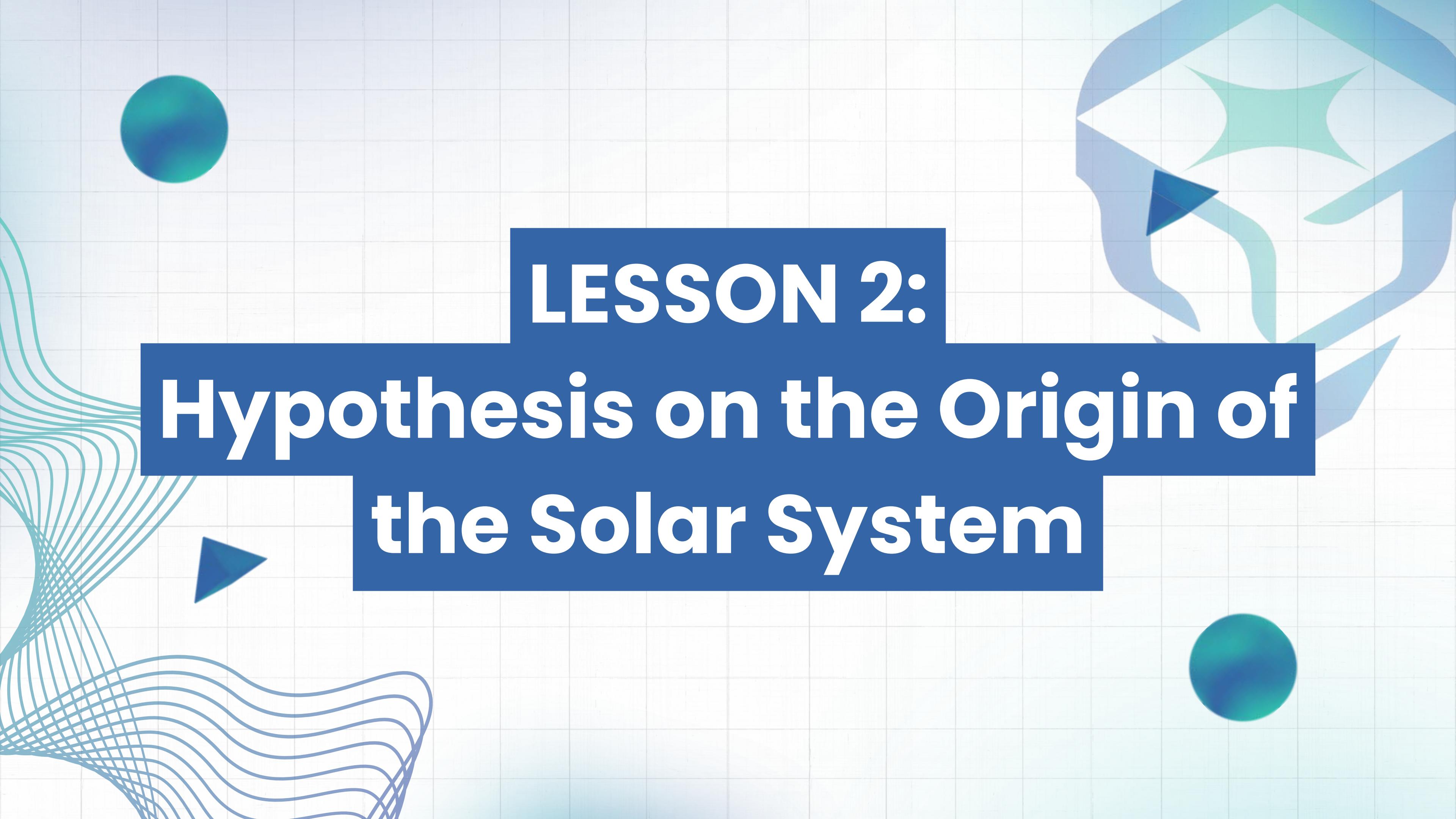
PLASMA UNIVERSE

- HANNES ALFVEN
- 99% OF THE UNIVERSE IS MADE UP OF PLASMA
- BIG BANG NEVER HAPPENED;
UNIVERSE IS A CRISSCROSS OF ELECTRIC CURRENT AND MAGNETIC FIELD



SUMMARY

SHORT QUIZ



LESSON 2:

Hypothesis on the Origin of

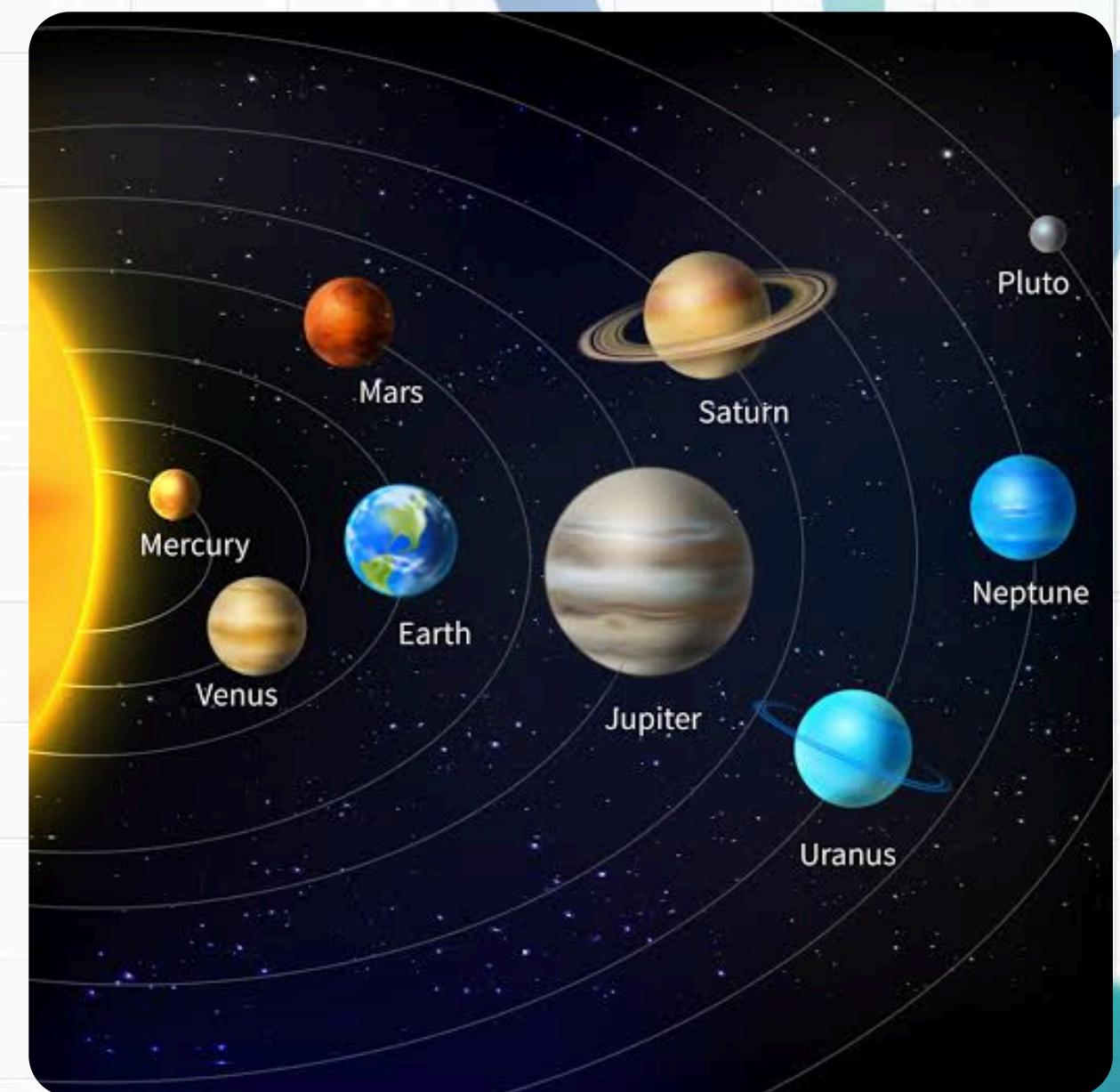
the Solar System

ORIGIN OF THE SOLAR SYSTEM

APPROXIMATELY 4.6 BILLION
YEARS AGO THE UNIVERSE WAS
FORMED

CATASTROPHIC OR UNNATURAL
EVENTS

NATURAL AND CONTINUOUS
PROCESSES

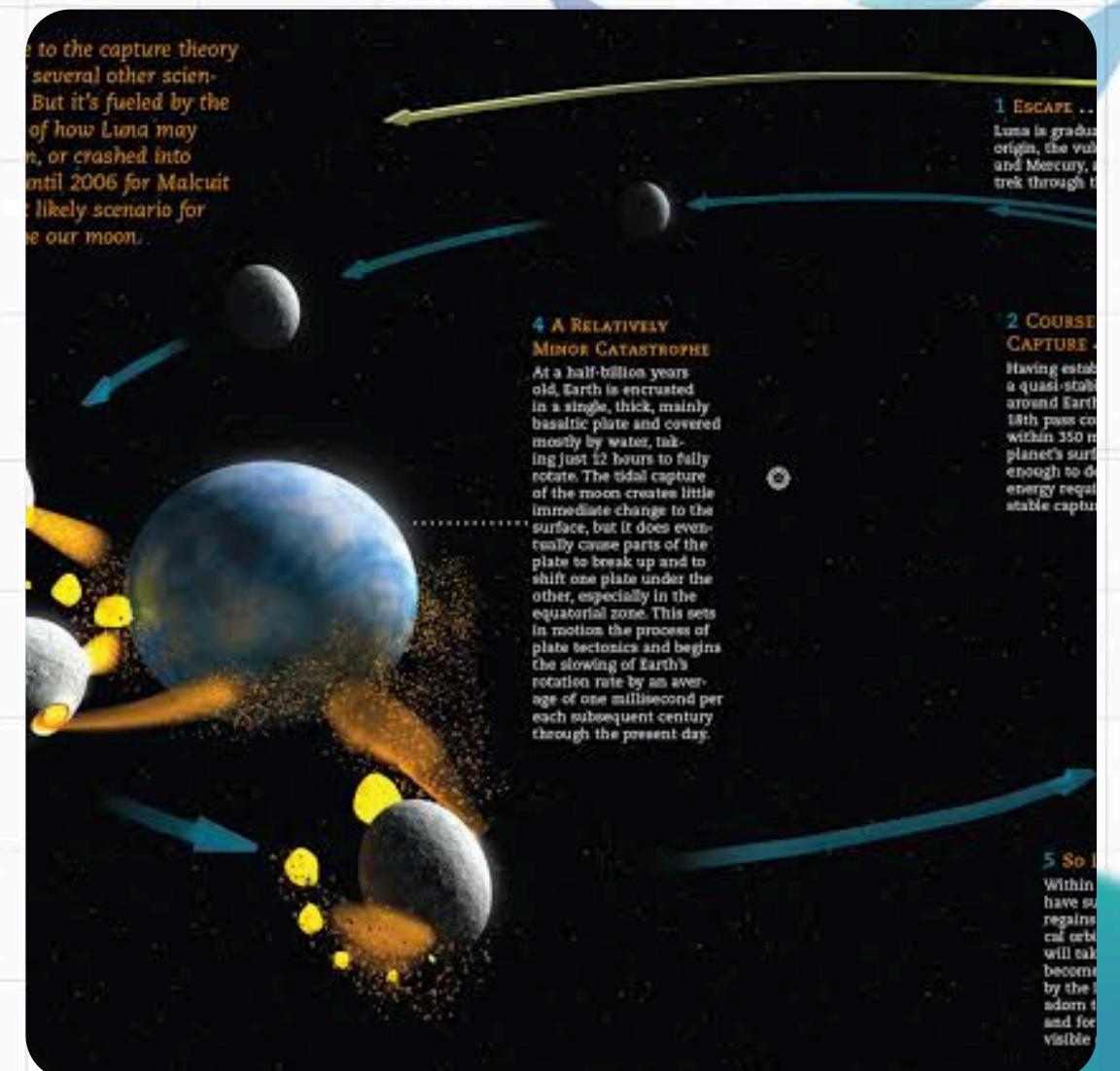


CATASTROPHIC OR UNNATURAL EVENTS

- **RANDOM CAPTURE HYPOTHESIS**
- **FISSION THEORY**
- **COLLISION THEORY**
- **ENCOUNTER HYPOTHESIS**

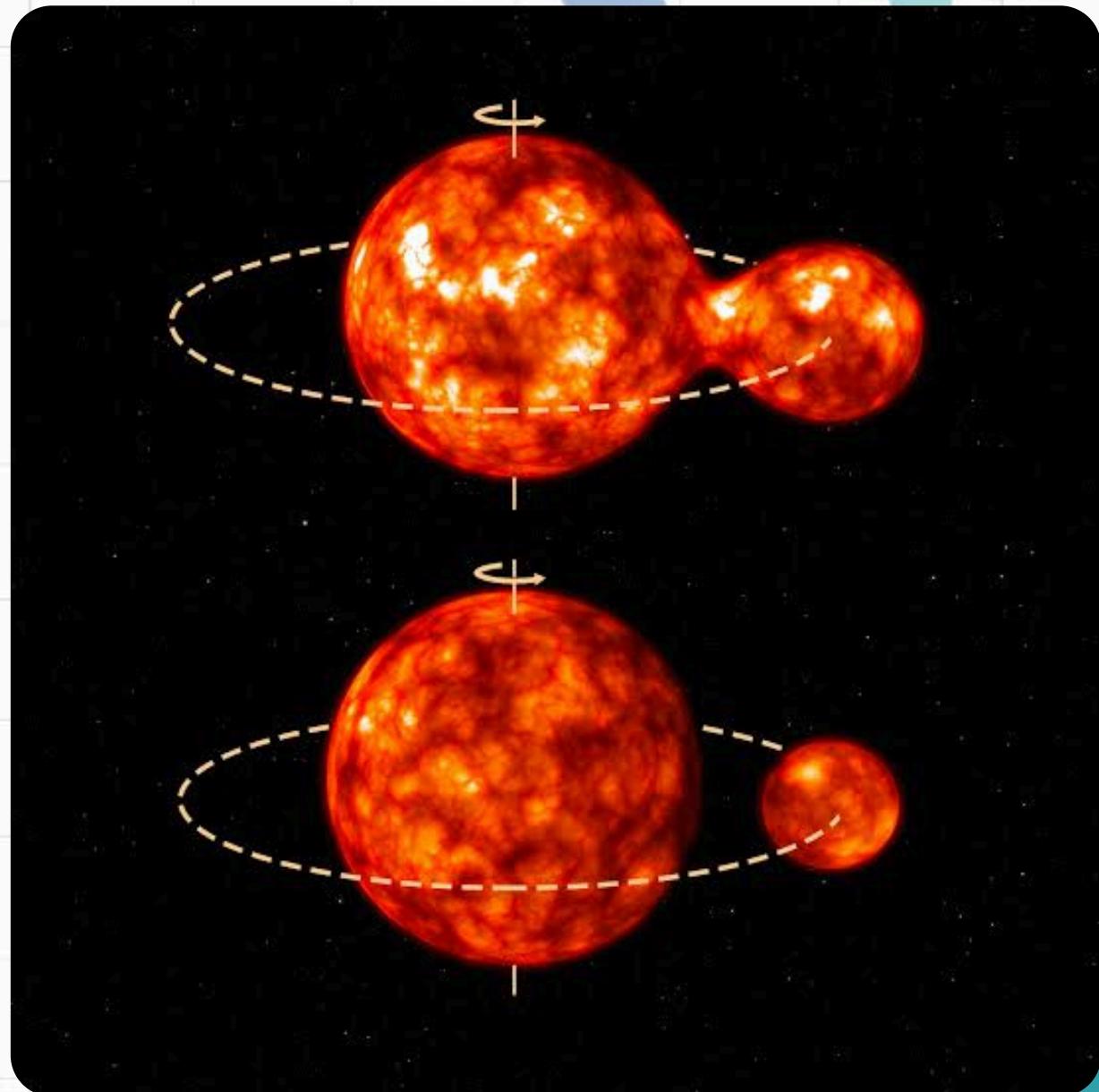
RANDOM CAPTURE HYPOTHESIS

- THE SUN'S GRAVITY "CAPTURES" FLYING OR NEARBY PLANETS THAT WERE FORMED INDEPENDENTLY
- THESE PLANETS WOULD LATER BE DIFFERENTIATED TO BECOME THE PRESENT-DAY PLANETS



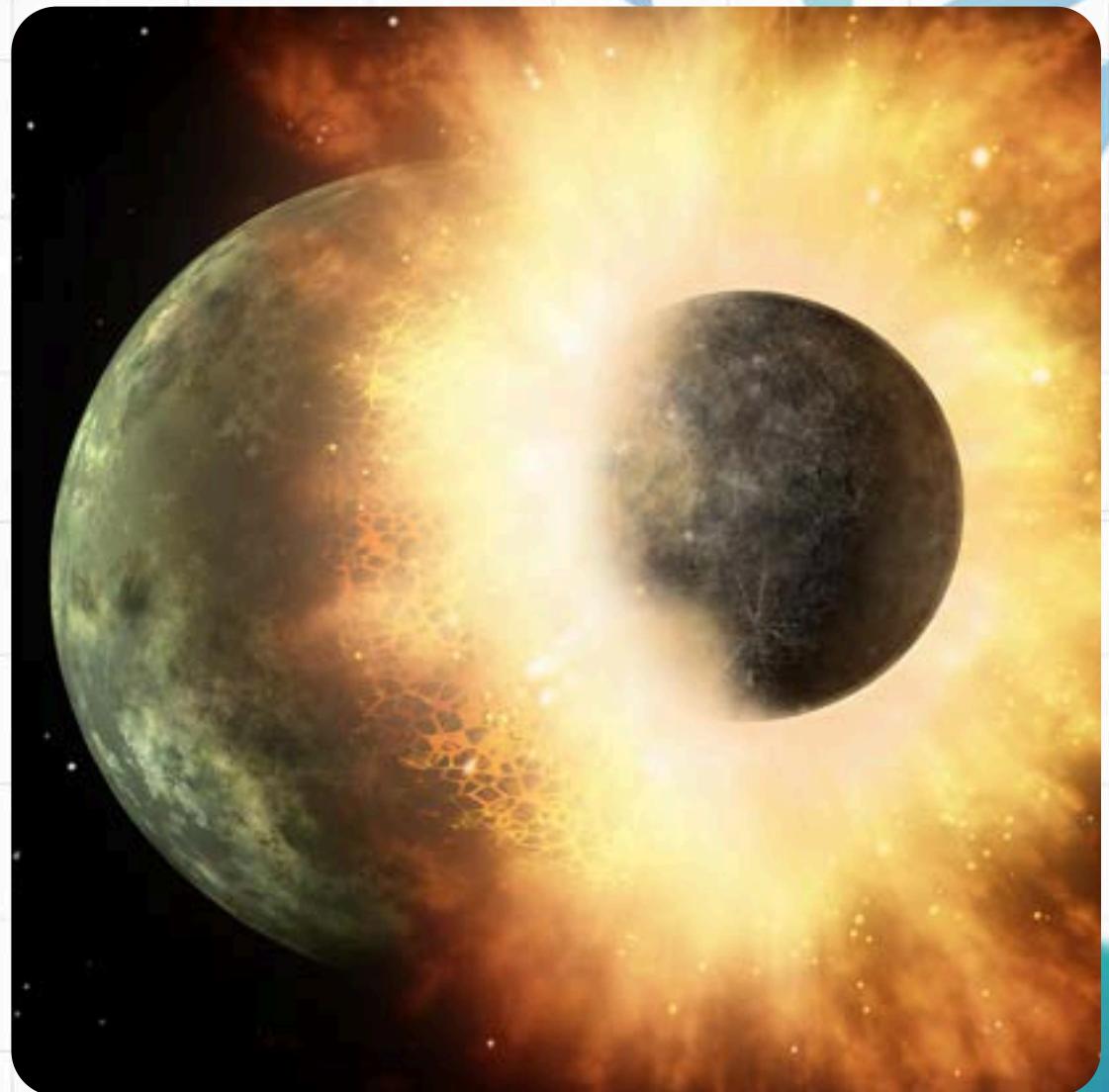
FISSION THEORY

- PLANETS AND OTHER OBJECTS IN THE SOLAR SYSTEM ARE PRODUCTS OF THE SUN'S EXPLOSION
- MOONS OR SATELLITES CAME FROM THE PLANETS



COLLISION THEORY

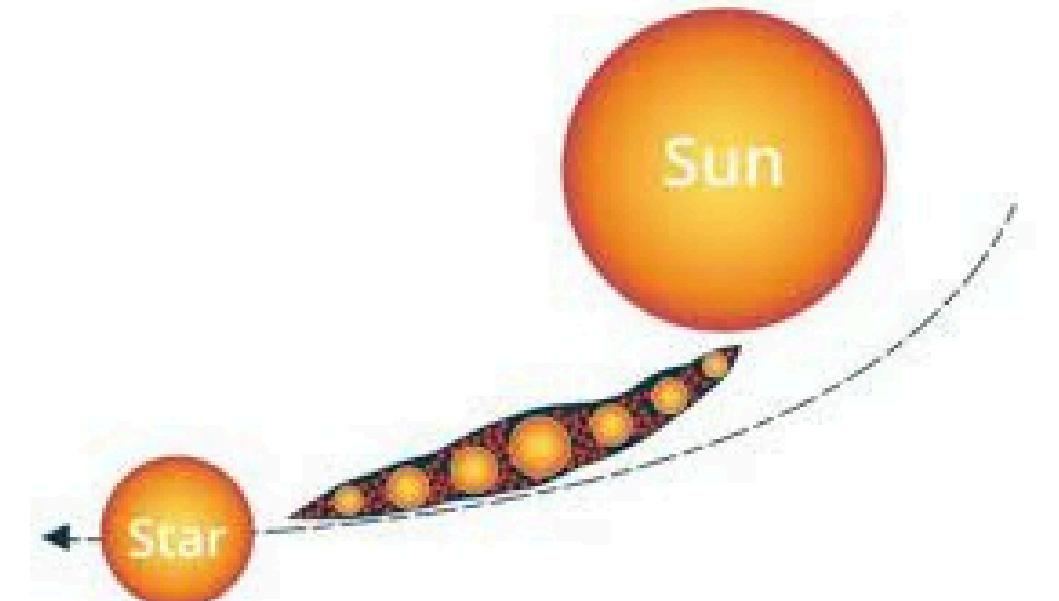
- PLANETS, STARS, AND OTHER OBJECTS COLLIDED
- THE PRODUCTS OF THE COLLISION ARE NOW THE PLANETS AND OTHER OBJECTS IN THE SOLAR SYSTEM



ENCOUNTER HYPOTHESIS

- WHEN A STAR PASSES CLOSE TO THE SUN, SEVERAL MATERIALS FROM THAT STAR AND THE SUN WERE REMOVED
- LUMPS WERE FORMED AND BECAME PLANETS

Material is ejected from the sun during an encounter with another celestial object. This celestial object could have been another star. The encounter theory has two main branches, including the planetesimal theory and the tidal theory.



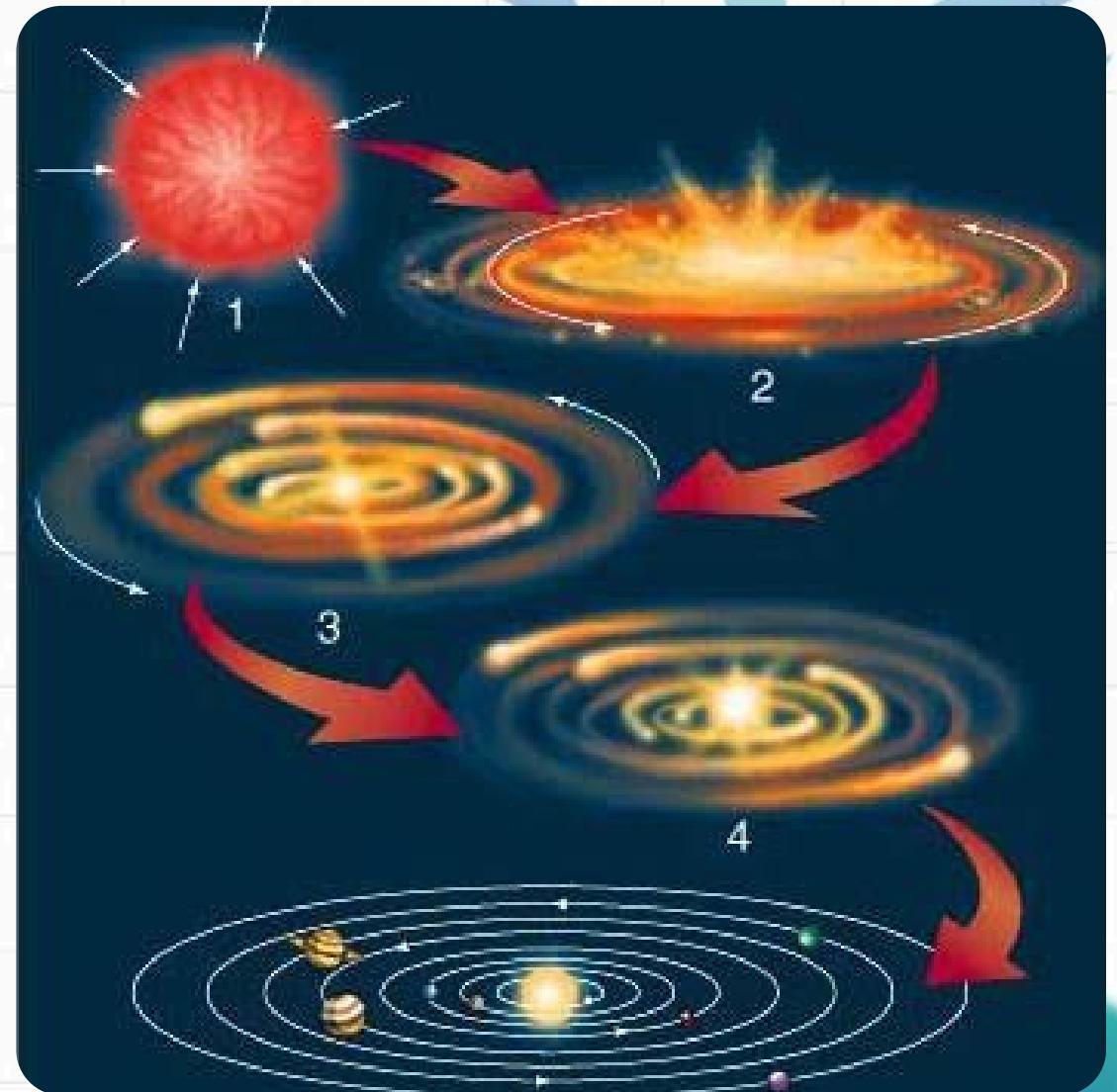
The encounter theory proposes that the planets formed from the material ejected from the sun during an encounter with another star.

NATURAL AND CONTINUOUS PROCESS

- NEBULAR HYPOTHESIS
- SOLAR NEBULAR DISC MODEL
- THE PROTOPLANET HYPOTHESIS

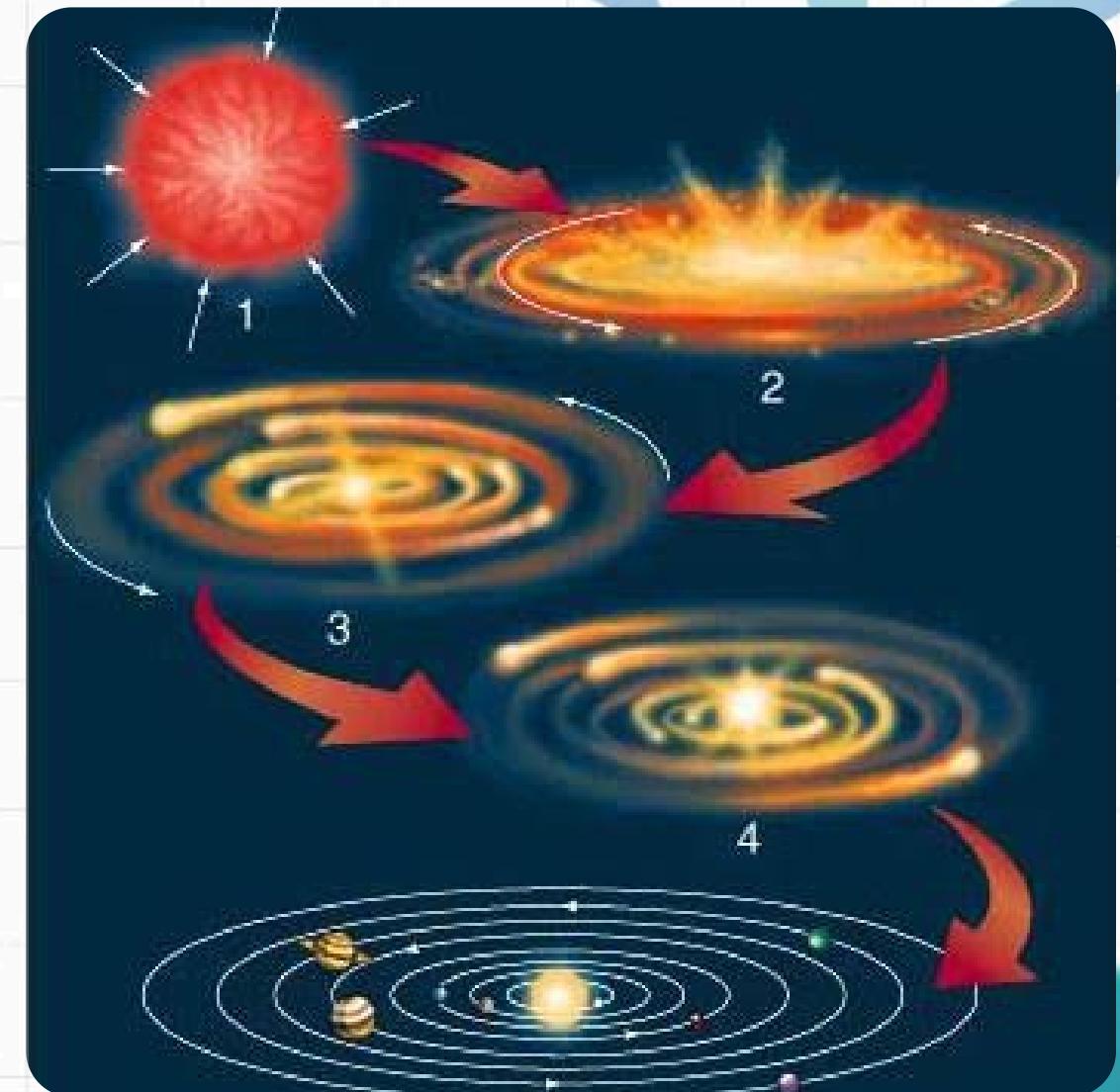
NEBULAR HYPOTHESIS

- NEBULA – A LARGE CLOUD OF DIRT AND GASSES
- THE NEBULA COLLAPSED DUE TO GRAVITATIONAL FORCE OF THE NEBULA AND THE PRESSURE EXERTED BY THE GASSES
- AS IT COLLAPSEE, THE NEBULA ROTATED AND FLATTENED AT THE POLES



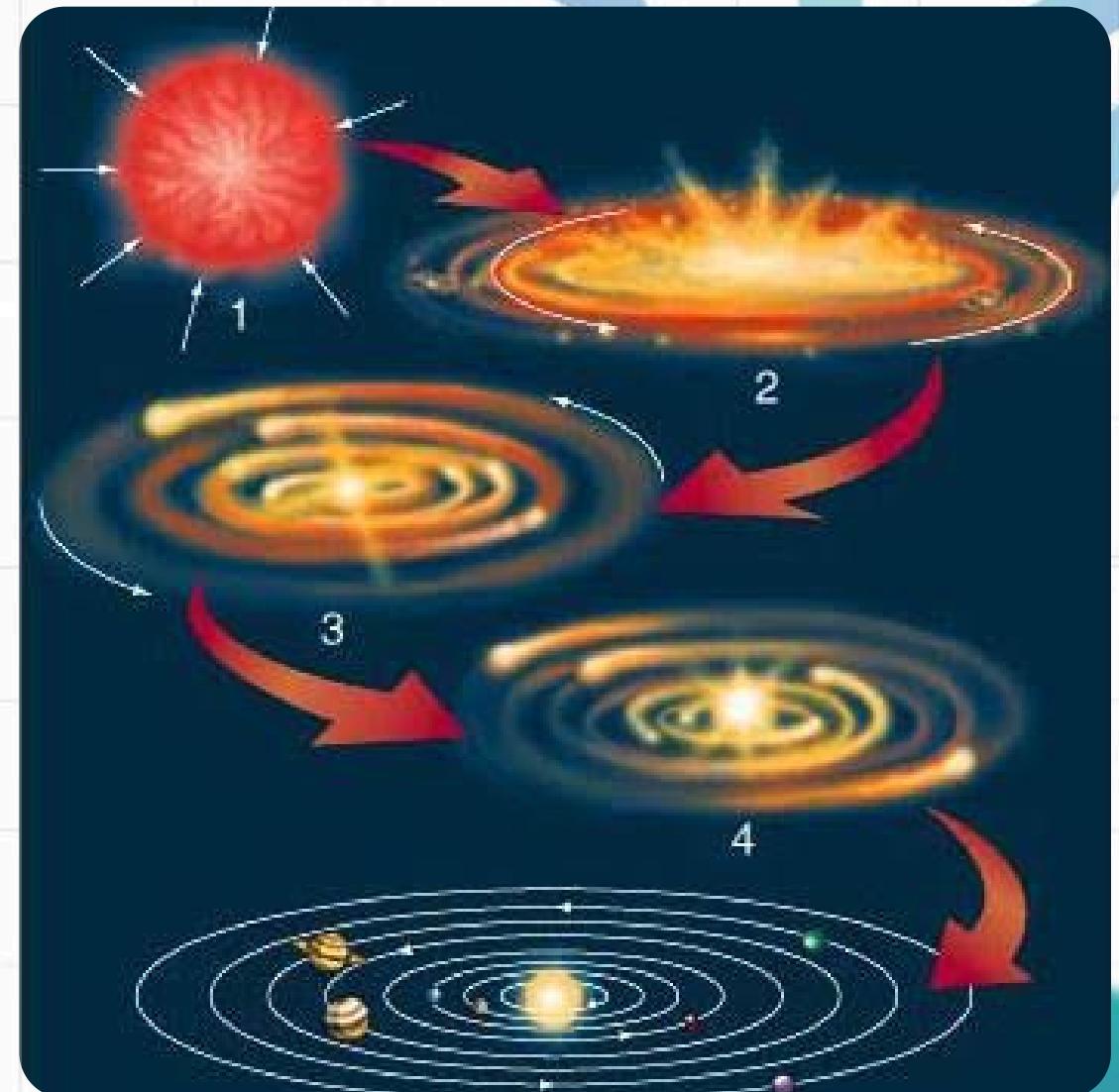
NEBULAR HYPOTHESIS

- PARTICLES AND GASES ACCRETED TO FORMED PROTOPLANETS
- THESE PROTOPLANETS BECAME THE PRECURSORS TO THE PRESENT-DAY PLANETS
- EXPLAINS WHY PLANETS REVOLVE AROUND THE SUN IN THE SAME MANNER



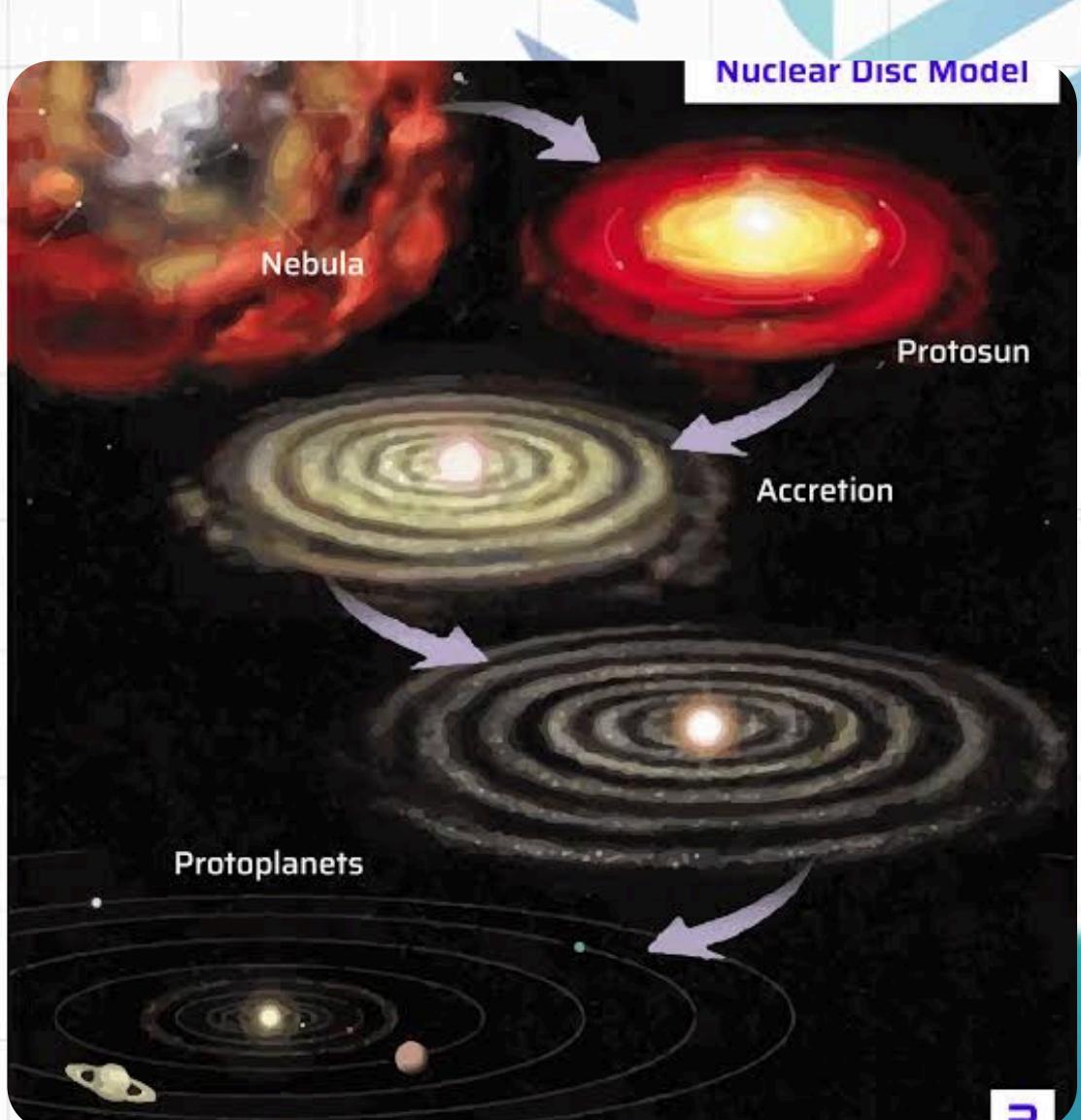
NEBULAR HYPOTHESIS

- ALL PLANETS AND MOST OF ITS SATELLITES REVOLVE AROUND THE SUN IN THE SAME DIRECTION. THIS SUPPORTS THE IDEA OF A ROTATING DISC AS AN ORIGIN OF SOLAR SYSTEM.
- THE OUTER PLANETS ARE MORE DENSE AND HAVE MORE HYDROGEN, UNLIKE INNER PLANETS THAT ARE LESS DENSE AND HAVE MORE HELIUM. OUTER PLANETS ARE ALSO MORE MASSIVE.



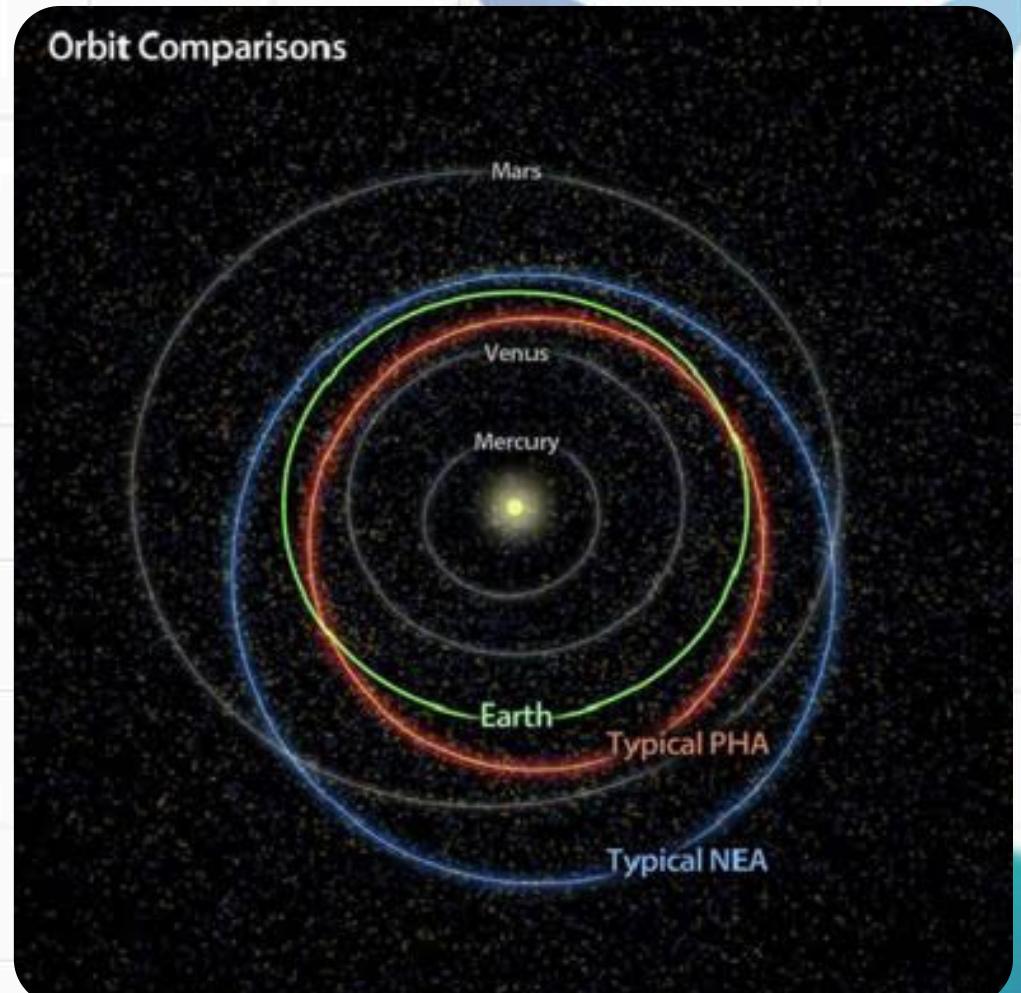
SOLAR NEBULAR DISC MODEL

- STARS ARE FORMED AFTER GIANT MOLECULAR CLOUDS WHICH RESULTED TO THE COALESCCE OF CLUMPS
- PLANETS WERE THEN FORMED AS A PRODUCT OF STAR FORMATION



THE PROTOPLANET HYPOTHESIS

- INFUSED MOST OF THE TENETS OF THE PROTOPLANET HYPOTHESIS
- SUPPORTED BY MODERN KNOWLEDGE ABOUT FLUID DYNAMICS, CHEMISTRY, AND ASTRONOMY



SUMMARY

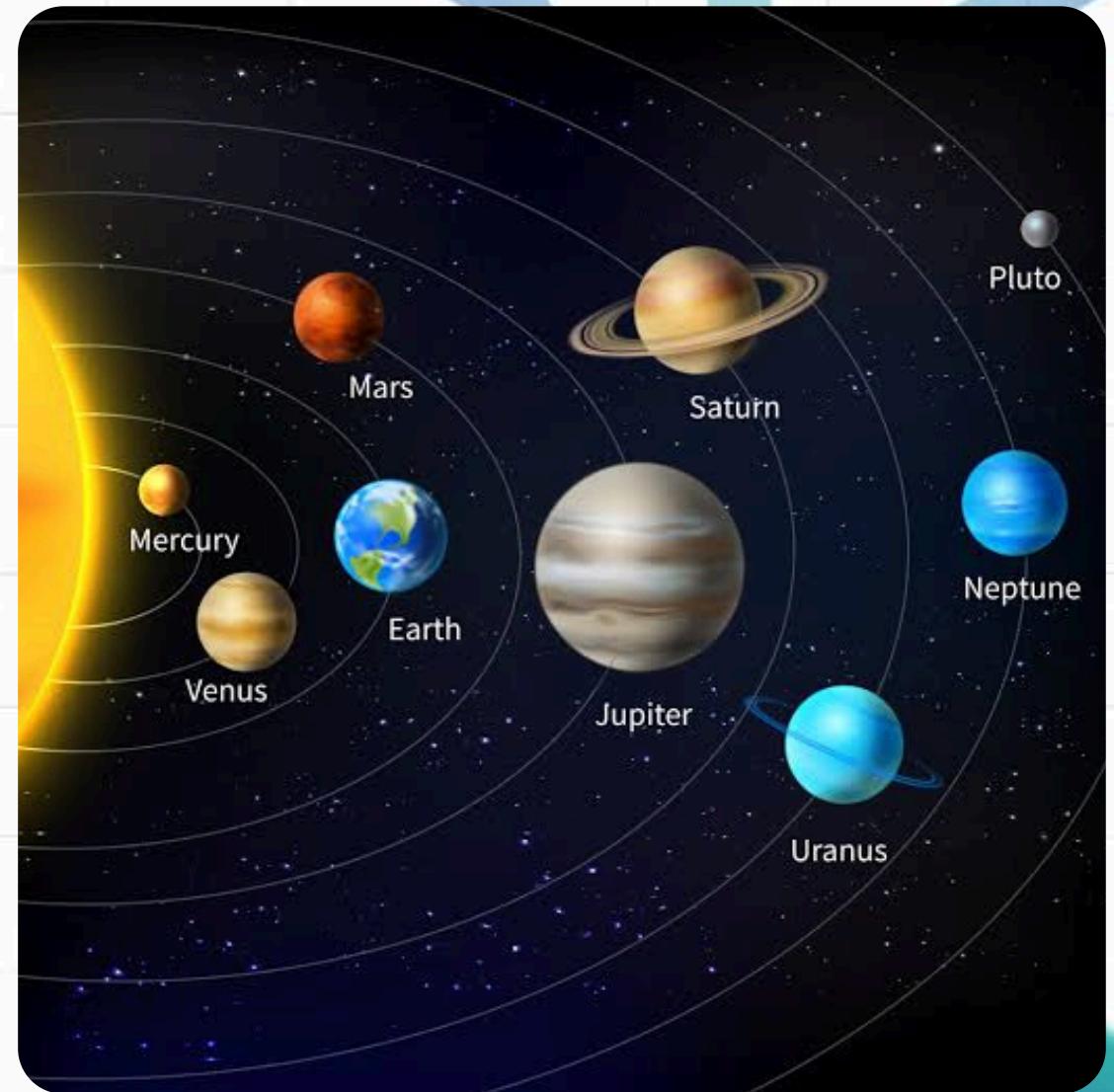
SHORT QUIZ

LESSON 3:

Recognizing the Unique Characteristics of the Earth

SOLAR SYSTEM

- COMPOSED OF SEVERAL PLANETS, ASTEROIDS, COMETS, SATELLITES, AND THE SUN
- EARTH IS THE ONLY PLANET WHERE LIFE EXISTS



UNIQUE CHARACTERISTICS OF THE EARTH

- **ATMOSPHERE**
- **WATER**
- **LOCATION IN THE SOLAR SYSTEM**
- **PLATE TECTONICS**
- **MAGNETISM**
- **LIFE FORMS**

ATMOSPHERE

- UNIQUE IN COMPOSITION AND STRUCTURE
- CONDUCIVE FOR LIFE EXISTENCE
- WITH OXYGEN AND CARBON DIOXIDE

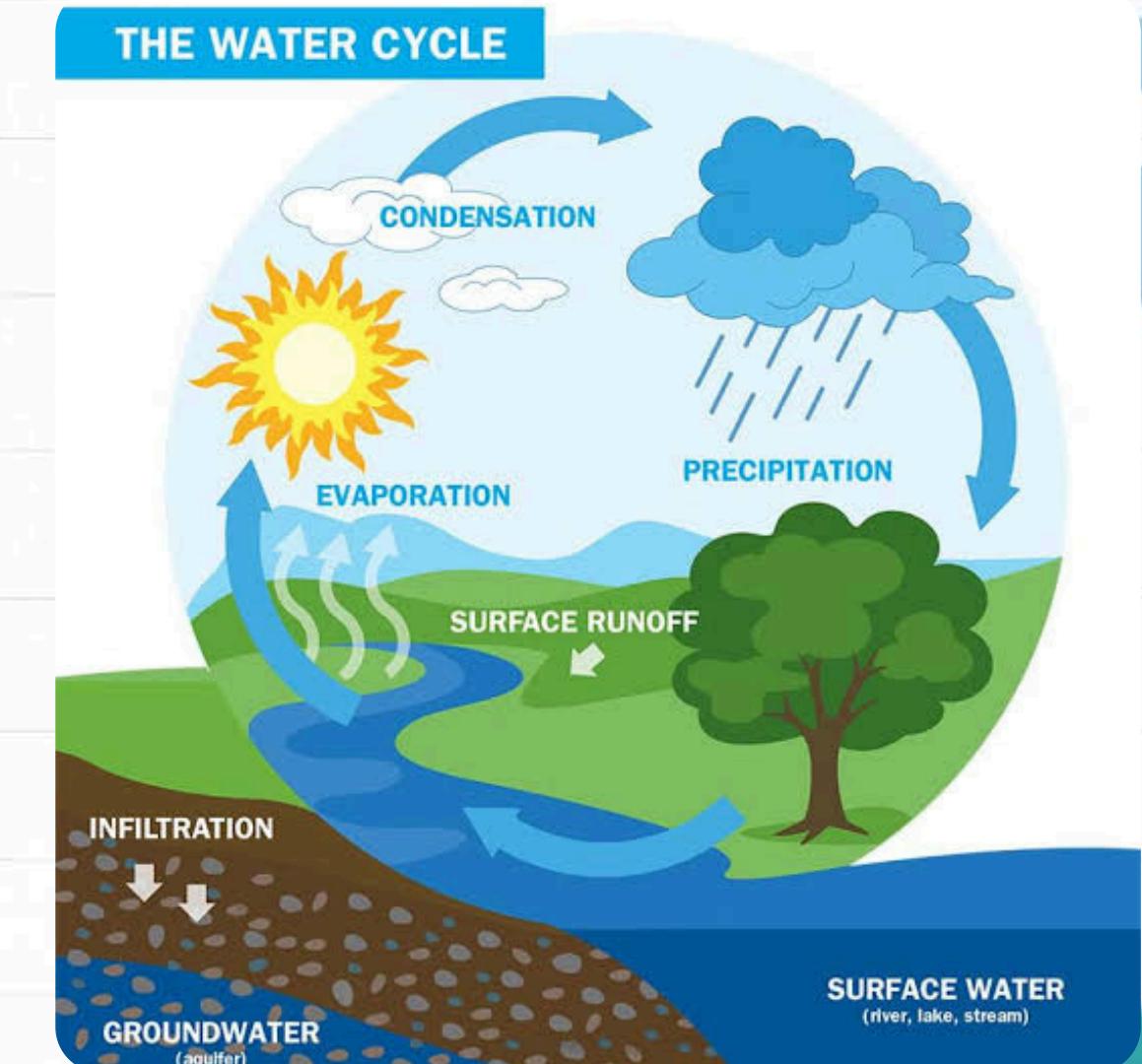


ATMOSPHERE

- IT HAS AN OZONE LAYER (PROTECTS THE EARTH FROM UV RADIATION, METEOROIDS, AND ASTEROIDS)
- PROTECTS THE EARTH FROM METEOROIDS AND ASTEROIDS

WATER

- THE PRESENCE OF WATER IS UNIQUE TO EARTH
- ALLOWS LIFE TO EXIST
- WATER IS RENEWABLE AND IT FLOWS IN A NATURAL CYCLE



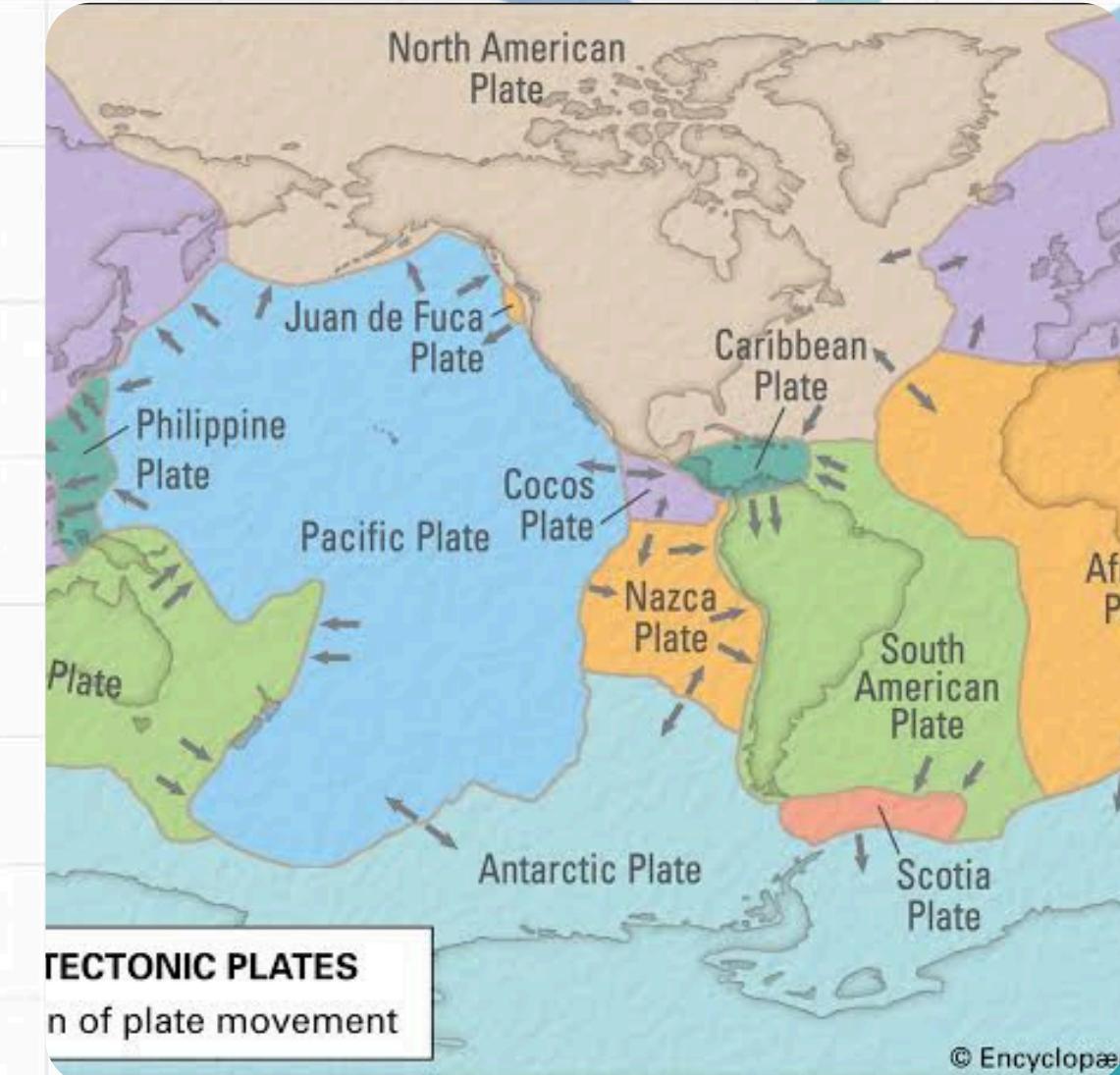
LOCATION

- LOCATES IN THE HABITABLE ZONE OR GOLDILOCKS ZONE
- THE DISTANCE OF THE PLANET FROM THE SUN CAN DEFINE ITS PHYSICAL CHARACTERISTICS



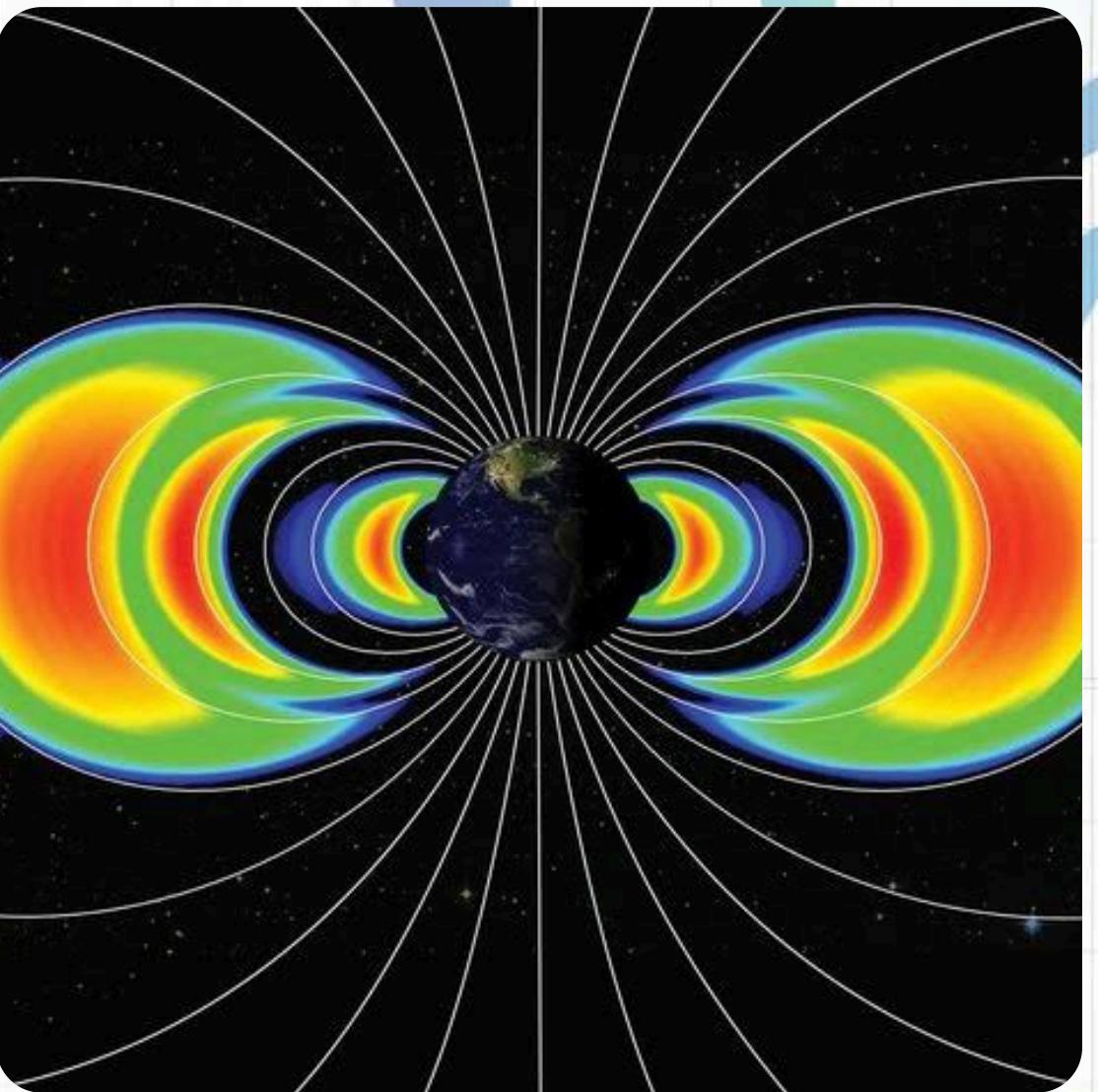
PLATE TECTONICS

- ALLOWS THE RENEWAL, OR FORMATION DISAPPEARANCE OF LAND FORMS
- ALLOWS OCCURENCE OF VOLCANIC ERUPTIONS AND EARTHQUAKES



MAGNETISM

- THE EARTH'S MAGNETIC FIELD PROVIDES PROTECTION AGAINST SOLAR WINDS THAT COULD BREAK THE OZONE LAYER AND SCORCH THE EARTH. THIS IS IMPORTANT IN ENSURING THE SURVIVAL OF LIFE'S EXISTENCE



LIFE FORMS

- EARTH IS THE ONLY PLACE WHERE LIFE FORMS EXIST
- SIX DIFFERENT TYPES; BACTERIA, ARCHAEA, FUNGI, PROTISTS, PLANTS, AND ANIMALS



SUMMARY

LESSON 4:

The Four Subsystems of the

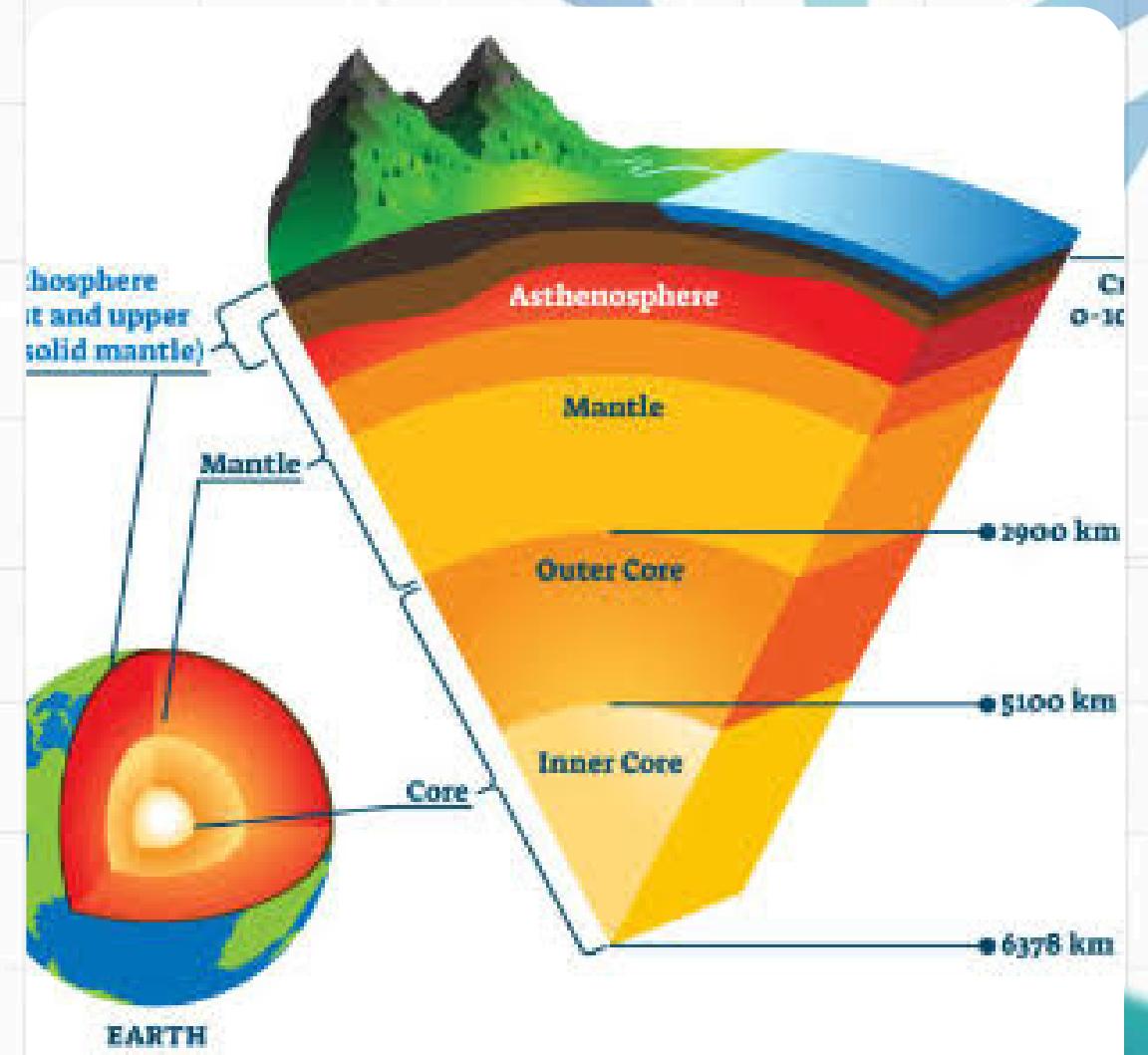
Earth

SUBSYSTEMS OF THE EARTH

- GEOSPHERE
- ATMOSPHERE
- HYDROSPHERE
- BIOSPHERE

GEOSPHERE

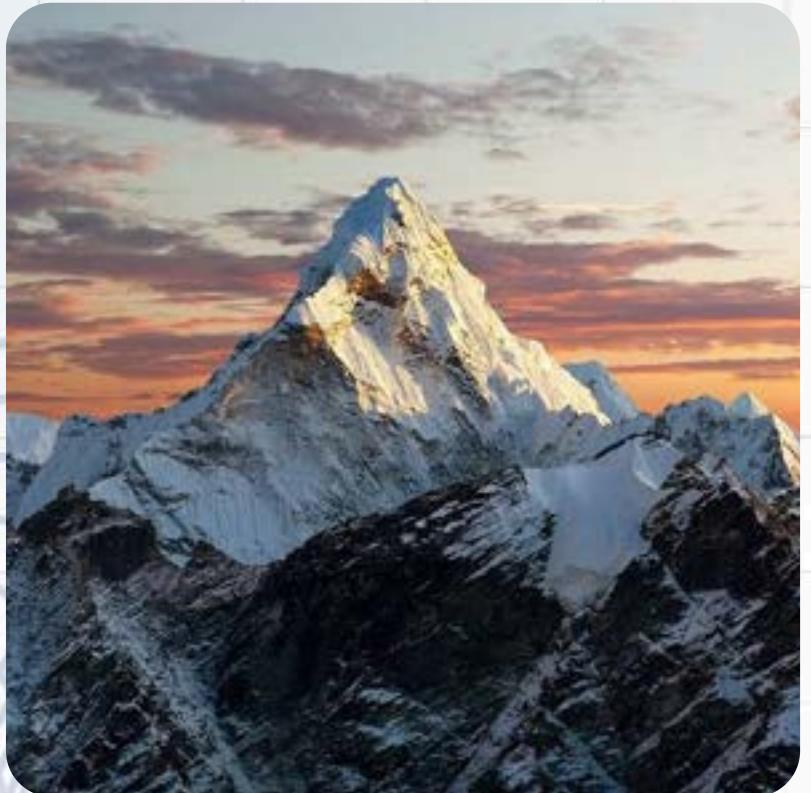
- SOLID PORTION OF THE EARTH
- LANDFORMS, LANDMASSES,
PLATES, ROCKS AND
MINERALS, AND LAYERS



LANDFORMS

- MOUNTAINS
- VOLCANOES
- ISLANDS AND ARCHIPELAGOS
- CANYONS
- PENINSULA
- HILLS
- PLATEAUS
- VALLEYS
- PLAINS

LANDFORMS



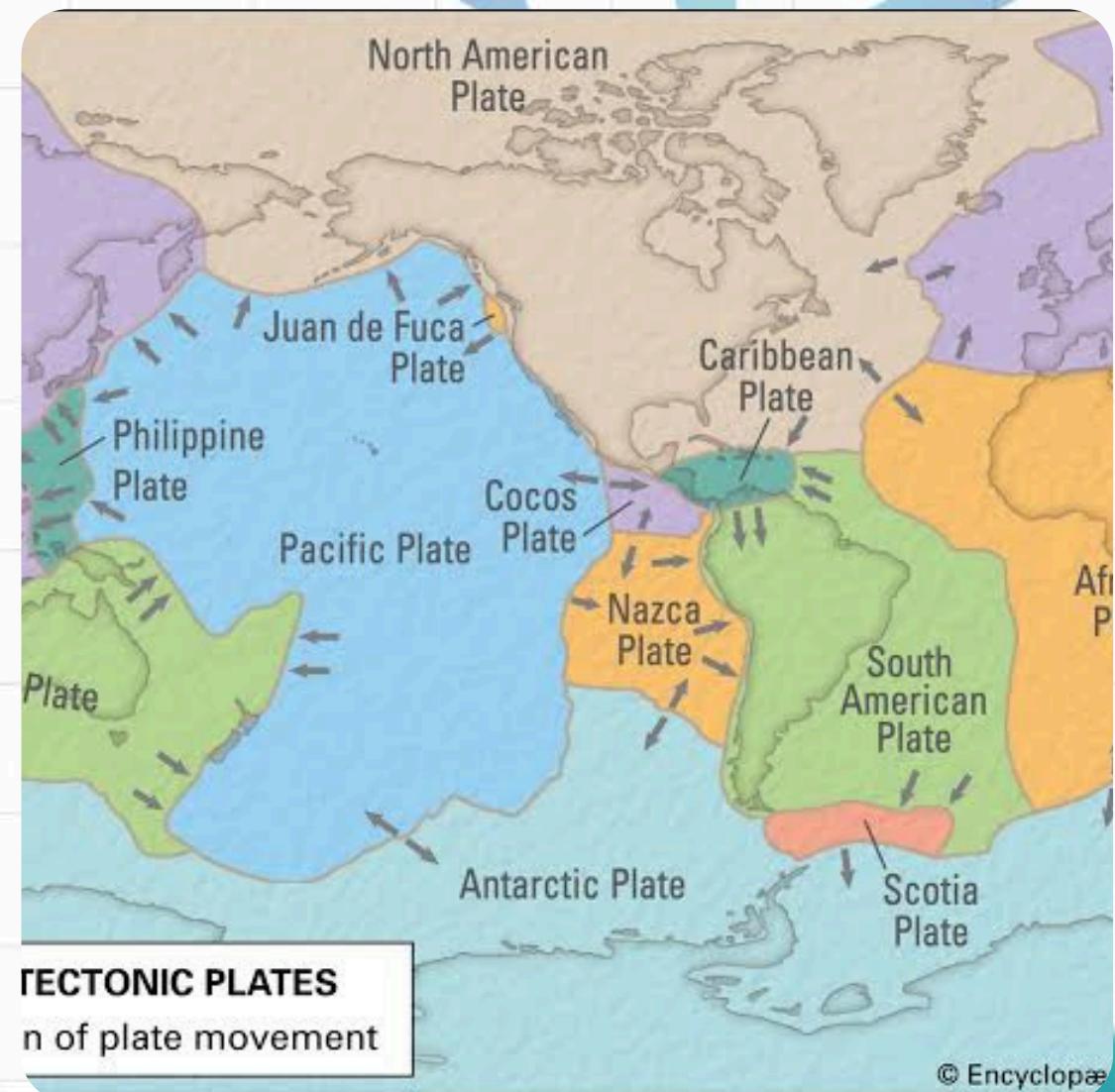
LANDMASSES

- EARTH IS COMPOSED OF SEVERAL LANDMASSES CALLED CONTINENTS
- CONTINENRAL DRIFT THEORY BY ALFRED WEGENER



PLATES

- EARTH'S SURFACE IS COMPOSED OF PLATES
- PLATES MOVE DUE TO PLATE TECTONICS
- PLATES INTERACT WITH EACH OTHER

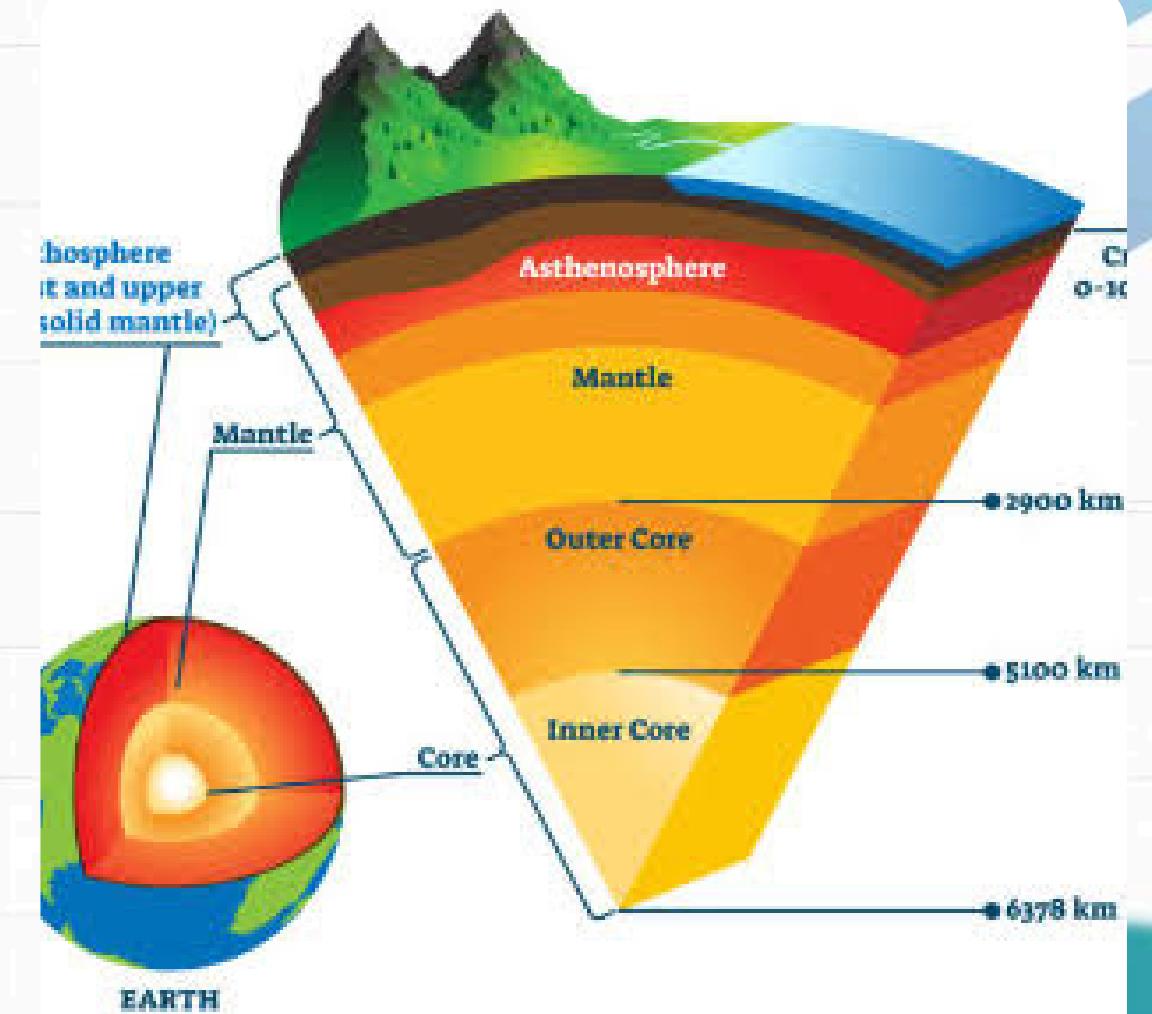


ROCKS AND MINERALS

- ROCKS ARE SOLID AGGREGATES OF MATERIALS**
- MINERALS ARE NATURALLY OCCURING SUBSTANCES FORMED IN THE EARTH**

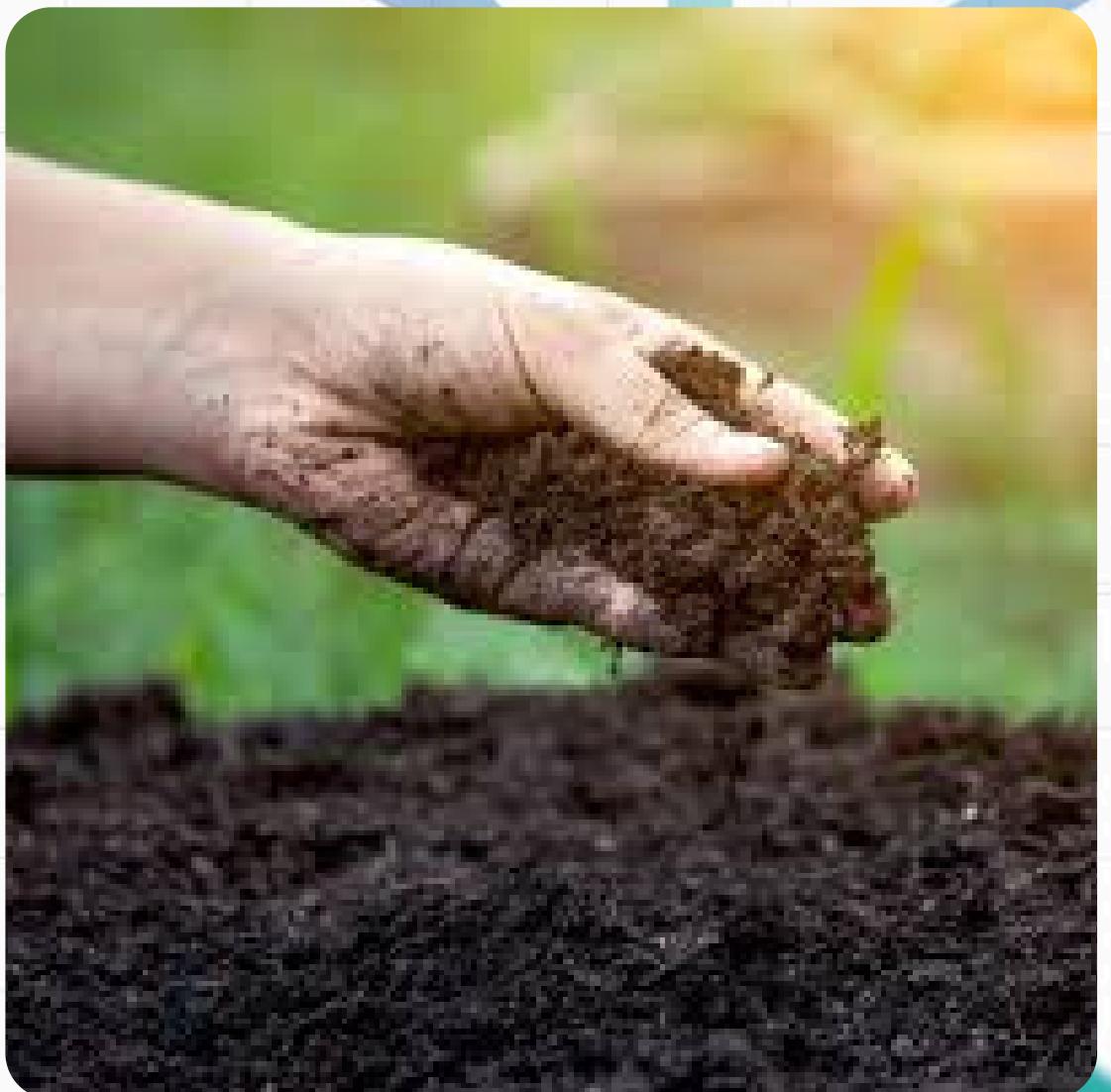
LAYERS

- CRUST – OUTERMOST LAYER
- MANTLE – INNER LAYER
- CORE – INNER AND OUTER CORE



SOIL

- **TOPMOST LAYER OF THE CRUST**
- **HAS ORGANIC MATTER, LIVING ORGANISMS, ROCKS, AND MINERALS**
- **IMPORTANT MEDIUM FOR LIFE EXISTENCE, BIOGEOCHEMICAL CYCLES, AND NATURAL PHENOMENA**

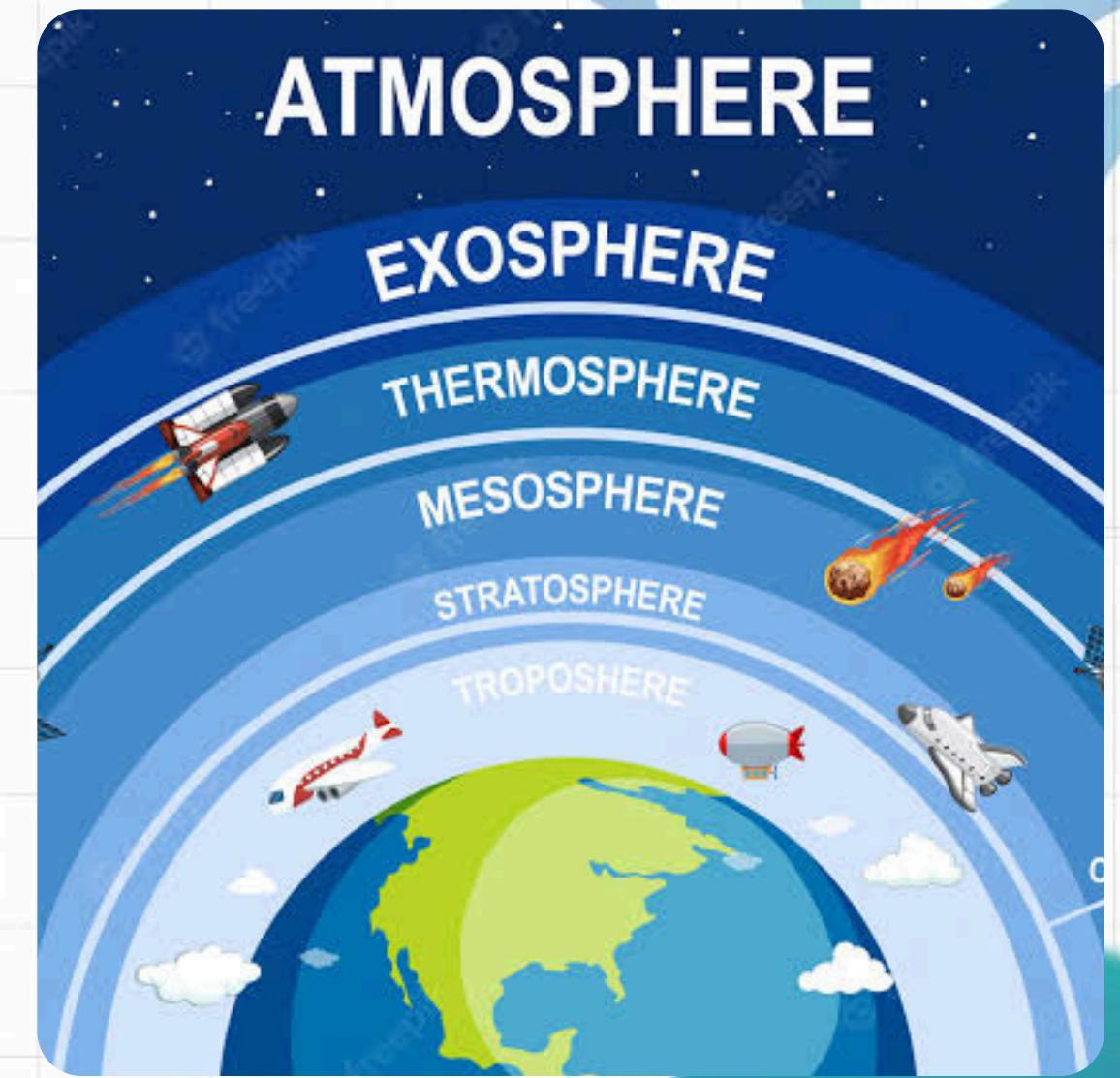


ATMOSPHERE

- BLANKET OF GASES THAT COVER THE EARTH
- INTERACTS WITH THE EARTH'S SURFACE AND OUTER SPACE

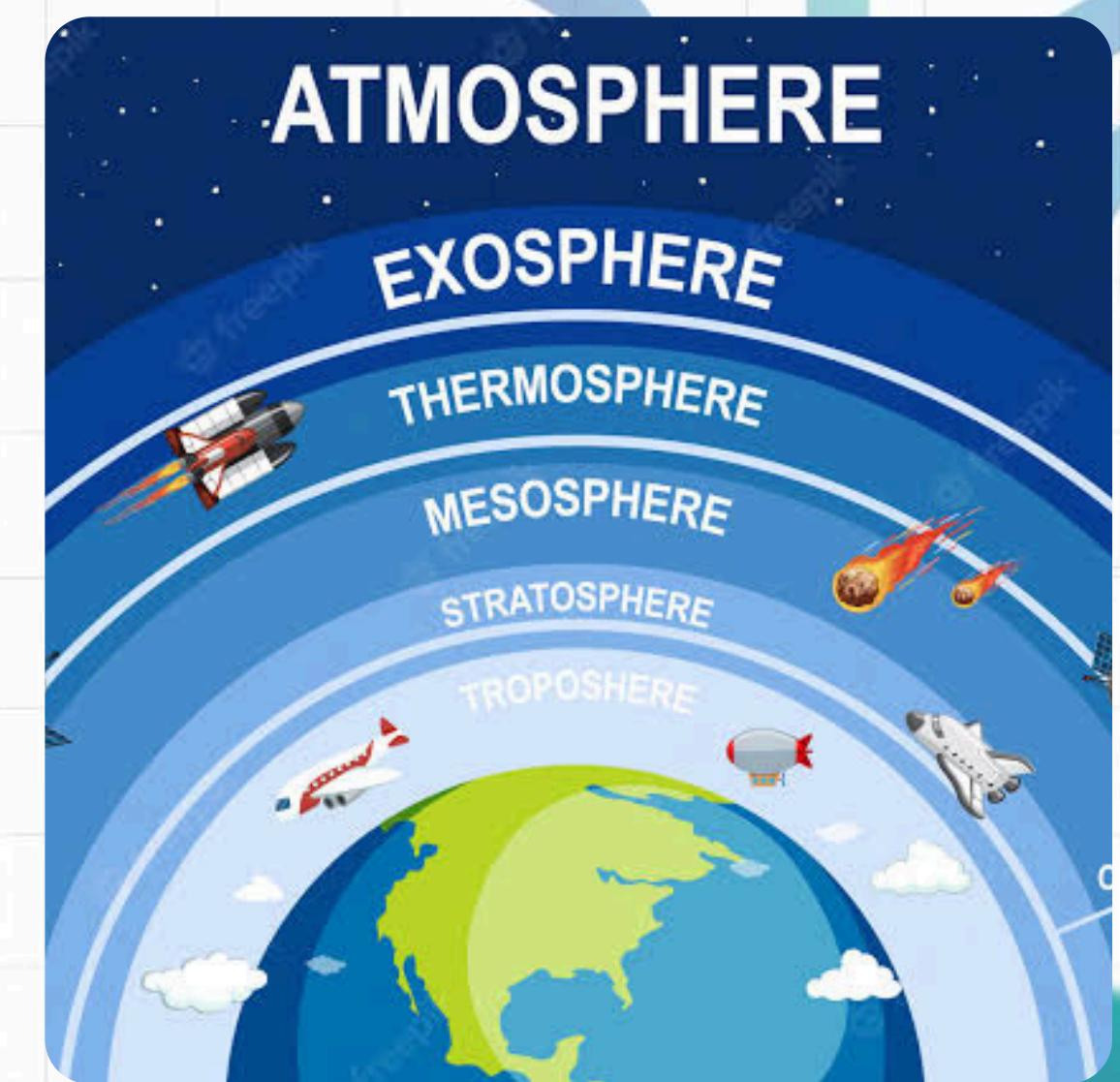
ATMOSPHERE

- COMPOSED OF NITROGEN (78%), OXYGEN (21%), AND OTHERS (1%)
- LAYERS (TROPOSPHERE, STRATOSPHERE, MESOSPHERE, THERMOSPHERE)



LAYERS OF THE ATMOSPHERE

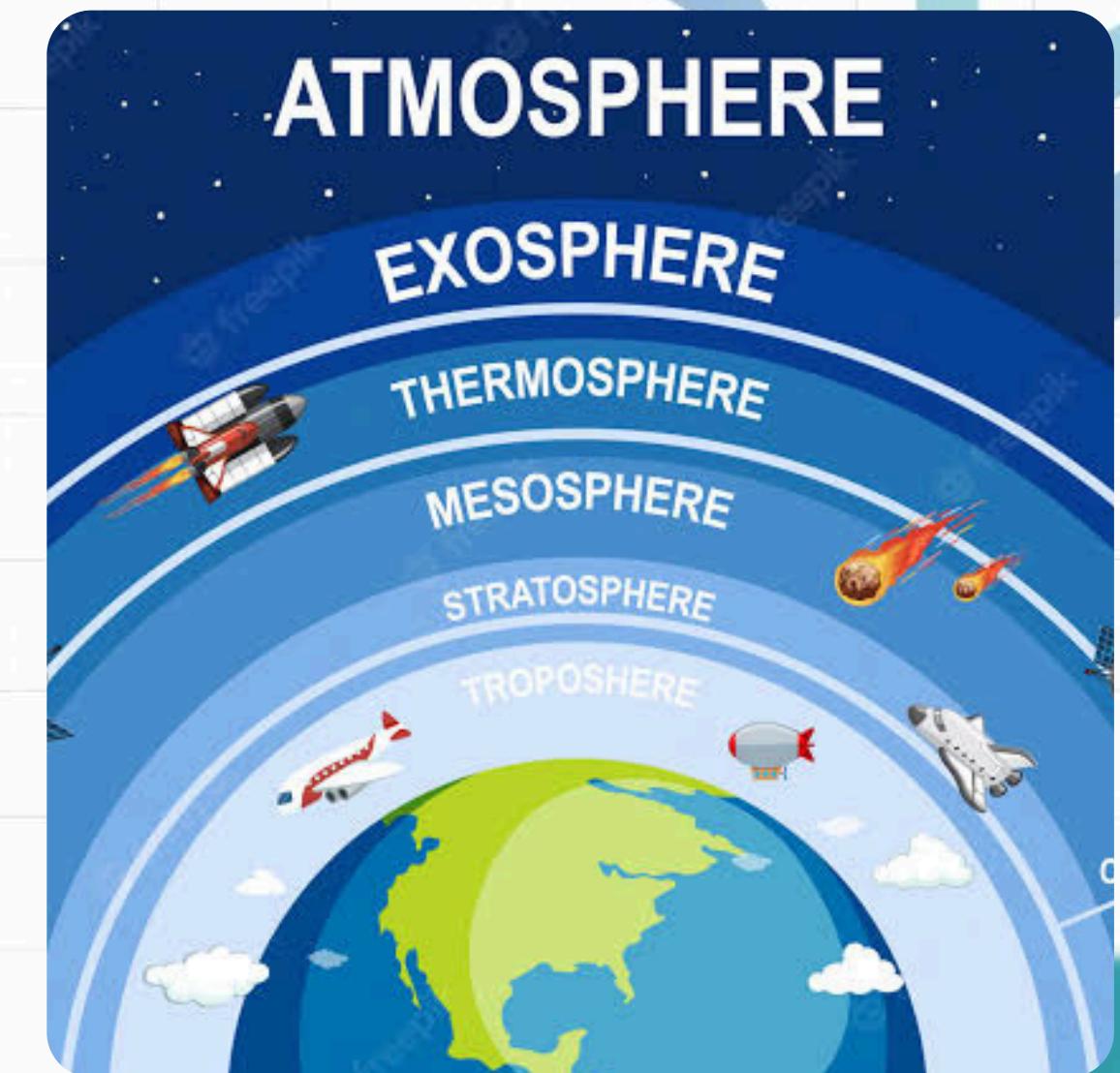
- **TROPOSPHERE**
 1. FIRST LAYER
 2. 75% OF THE EARTH'S ATMOSPHERE
 3. WHERE WEATHER HAPPENS
 4. TROPOPAUSE – TOP OF THE TROPOSPHERE
 5. 15°C TO -57°C



LAYERS OF THE ATMOSPHERE

- **STRATOSPHERE**

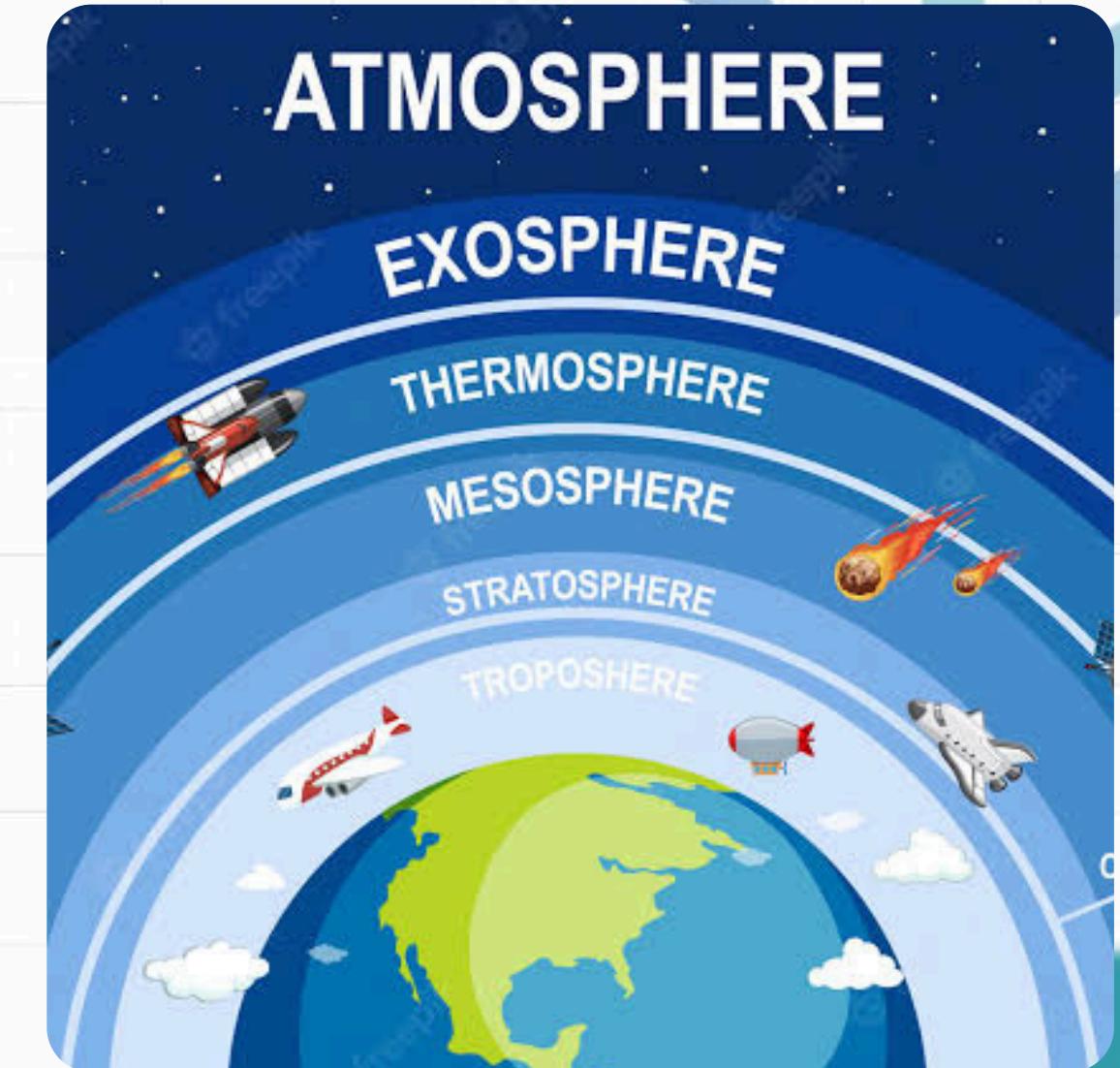
1. LOCATED ABOVE TROPOPAUSE
2. 15–50KM FROM THE EARTH'S SURFACE
3. CONTAINS THE OZONE LAYER
4. STRATOPAUSE – TOP PART OF STRATOSPHERE
5. -57°C TO -5°C



LAYERS OF THE ATMOSPHERE

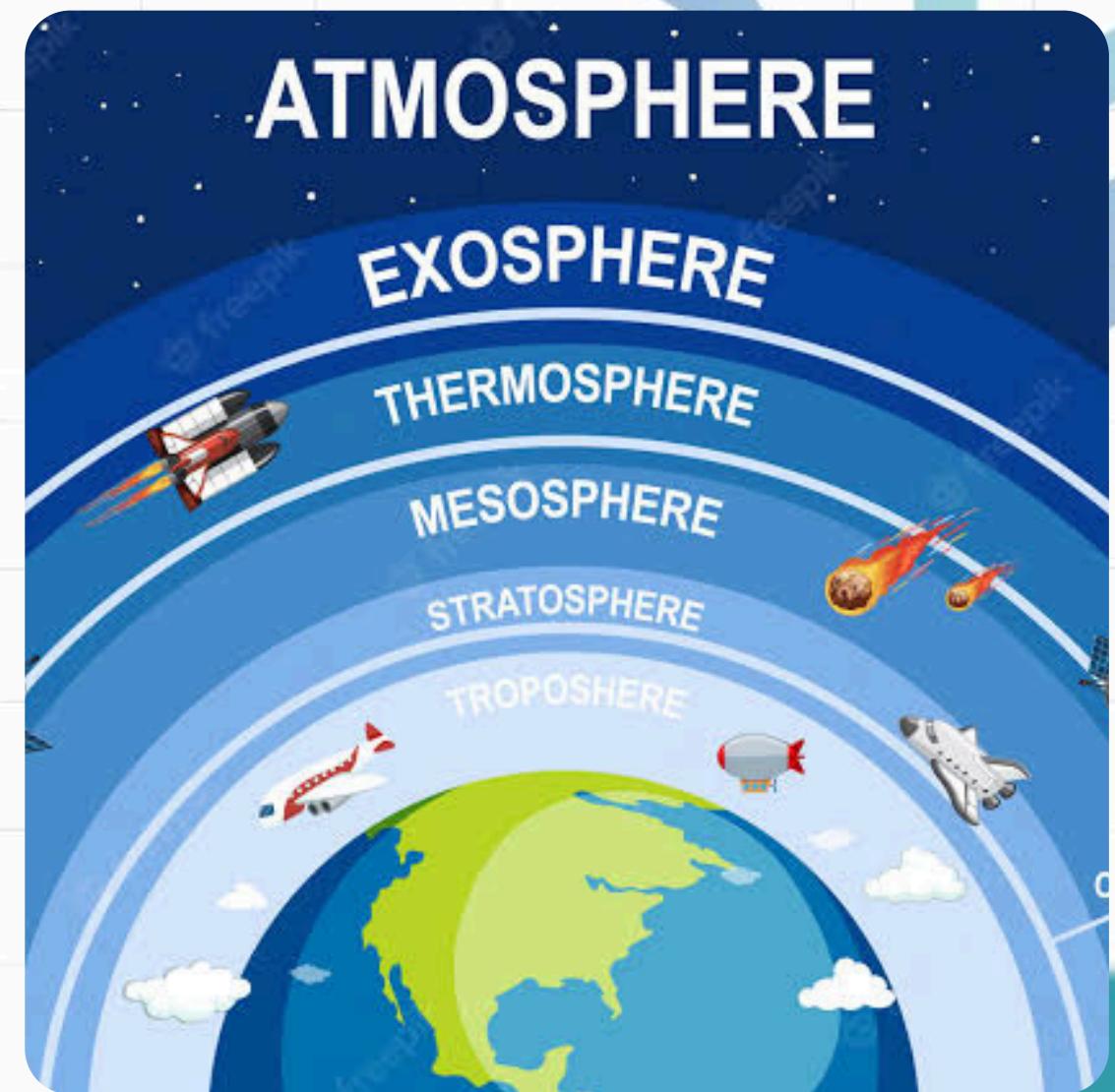
- **MESOSPHERE**

1. LOCATED ABOVE THE STRATOPAUSE
2. 50-80KM AWAY FROM THE EARTH'S SURFACE
3. COLD AND THICK
4. BURNS METEORS AND OTHER OBJECTS ENTERING THE EARTH'S ATMOSPHERE



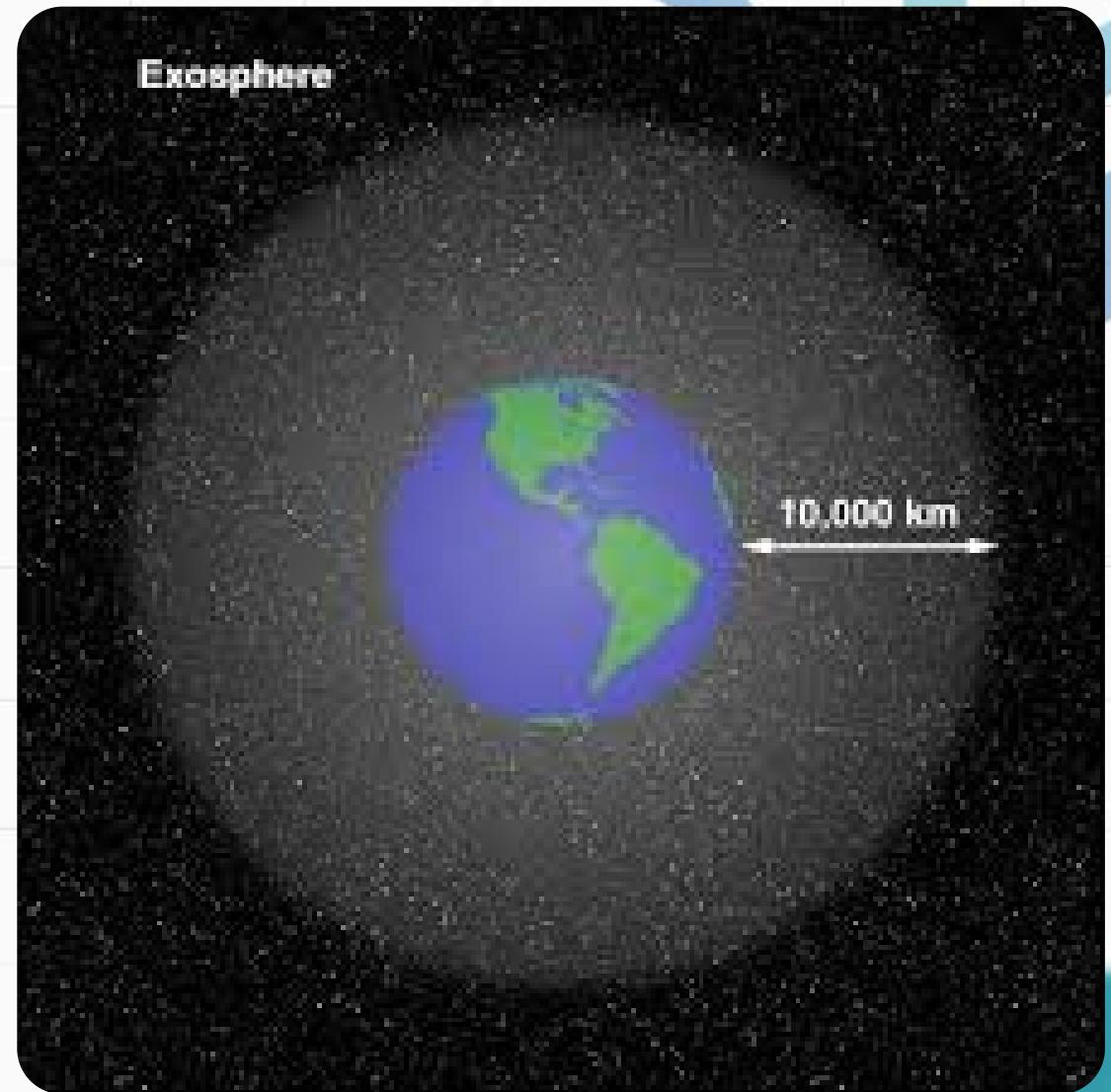
LAYERS OF THE ATMOSPHERE

- **THERMOSPHERE**
 1. LOCATED ABOVE THE MESOPAUSE
 2. 80KM FROM THE EARTH'S SURFACE
 3. GASES ARE ARRANGED HORIZONTALLY BASED ON MASS
 4. 1727°C



LAYERS OF THE ATMOSPHERE

- **EXOSPHERE AND MAGNETOSPHERE**
 1. ABOVE THE THERMOSPHERE
 2. EXOSPHERE – AROUND 500KM FROM THE EARTH'S SURFACE
 3. MAGNETOSPHERE – WITH MOLECULES AND PARTICLES INFLUENCED BY THE MAGNETIC FIELD



IMPORTANCE OF THE ATMOSPHERE

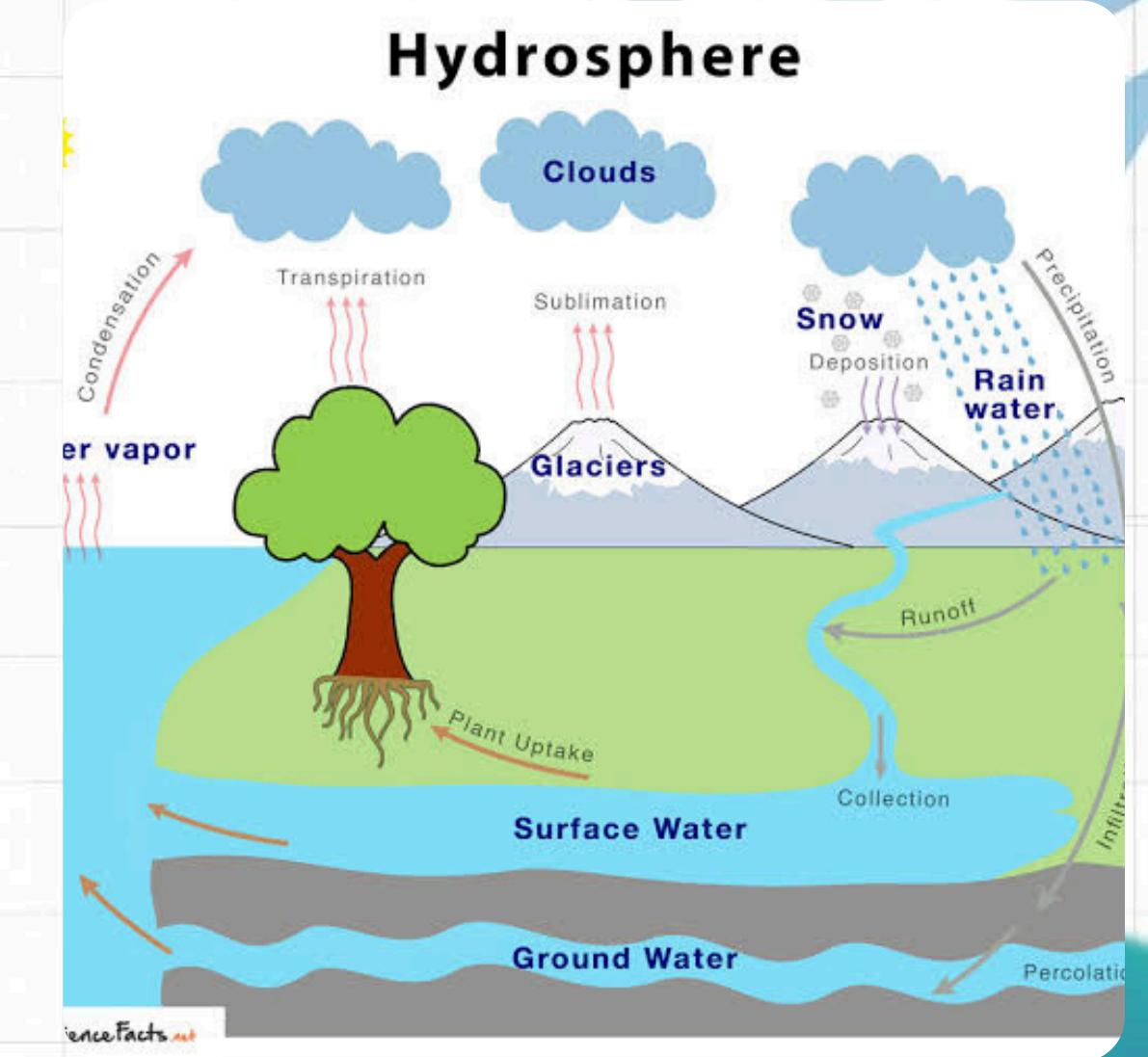
- **BLOCK SOLAR WINDS THROUGH THE MAGNETOSPHERE**
- **PROTECTS THE EARTH FROM FALLING METEOROIDS AND OTHER BODIES**
- **BLOCKS THE HARMFUL UV RADIATION OF THE SUN THROUGH THE OZONE LAYER**

IMPORTANCE OF THE ATMOSPHERE

- TRAPS HEAT TO MAINTAIN GLOBAL TEMPERATURE
- WEATHER AND CLIMATE CONDITIONS HAPPEN DUE TO THE ATMOSPHERE
- TEMPERATURE, PRECIPITATION, HUMIDITY OR WIND VELOCITY
- WIND PATTERNS OR MOVEMENTS

HYDROSPHERE

- COMPRISES 3/4 OF THE EARTH'S SURFACE
- MAINLY COMPOSED OF WATER



COMPOSITION: WATER

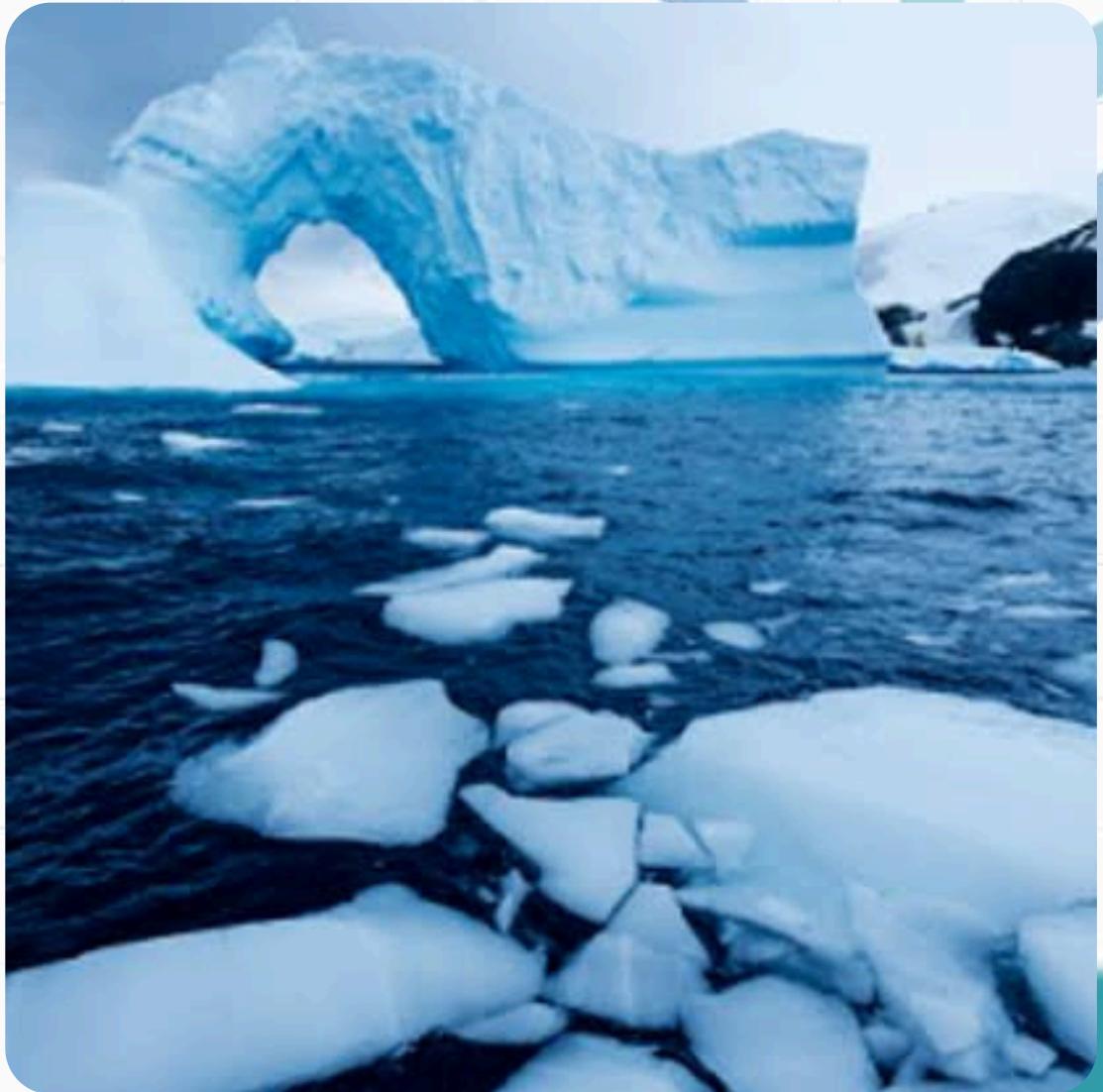
- COMPOSED OF TWO HYDROGEN ATOMS AND AN OXYGEN ATOM
- ODORLESS, COLORLESS, AND TASTELESS
- WATER MOLECULES ARE LINKED TOGETHER THROUGH HYDROGEN BOND

Water molecule



FORMS OF WATER

- LIQUID WATER IN DIFFERENT BODIES OF WATER
- WATER VAPOUR IN CLOUDS AND FOGS
- ICE IN GLACIERS AND POLAR REGIONS



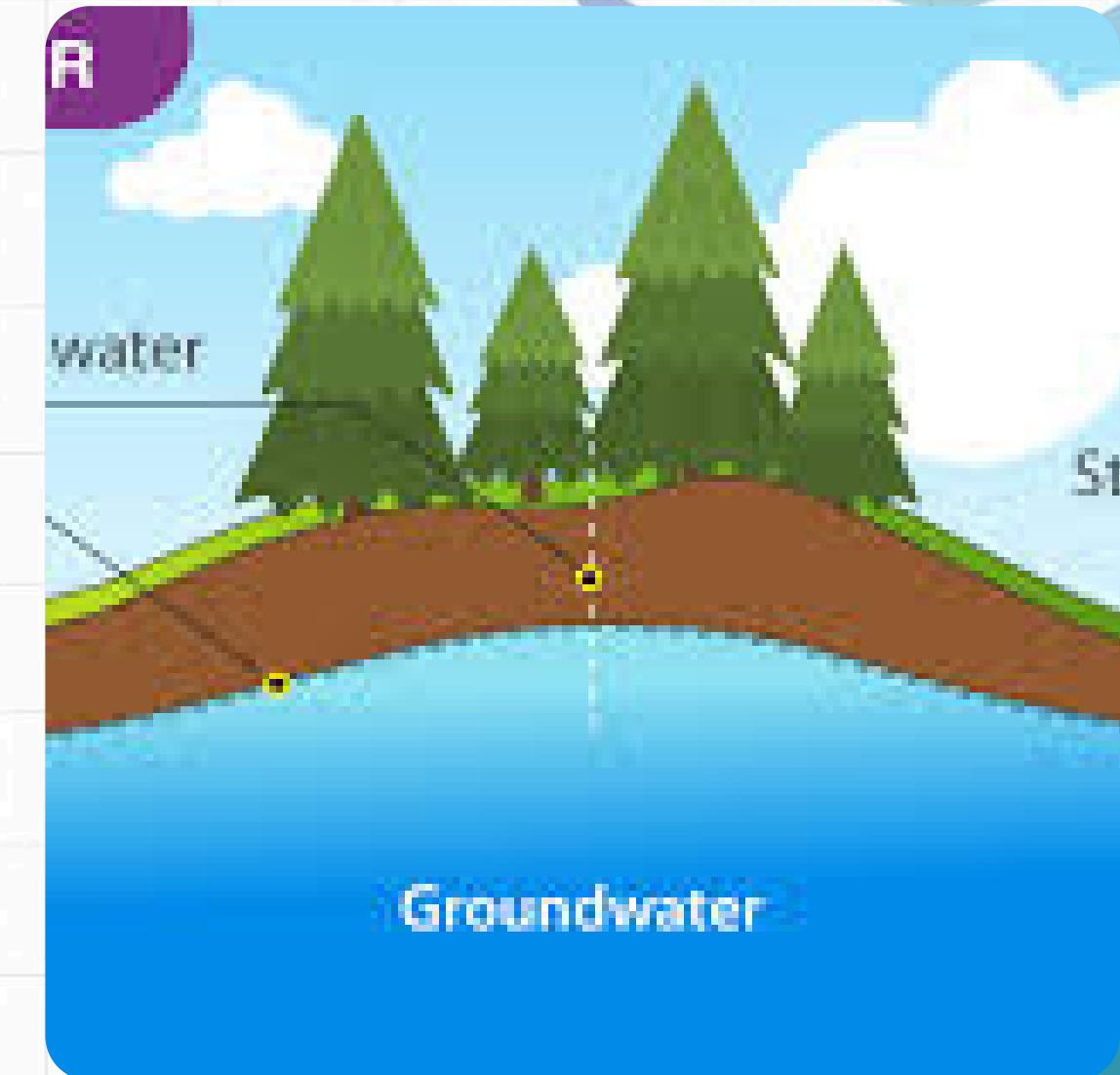
TYPES OF WATER

- **SALTWATER (97%)**
 1. HIGH SALINITY
 2. FOUND IN OCEANS AND SEAS
- **FRESHWATER (3%)**
 1. FOUND IN POLAR REGIONS, AQUIFER, AND OTHER BODIES OF WATER

SOURCES OF WATER

- **BODIES OF WATER**
- **BODIES OF WATER IN LANDFORMS**
- **GROUNDWATER**

SOURCES OF WATER

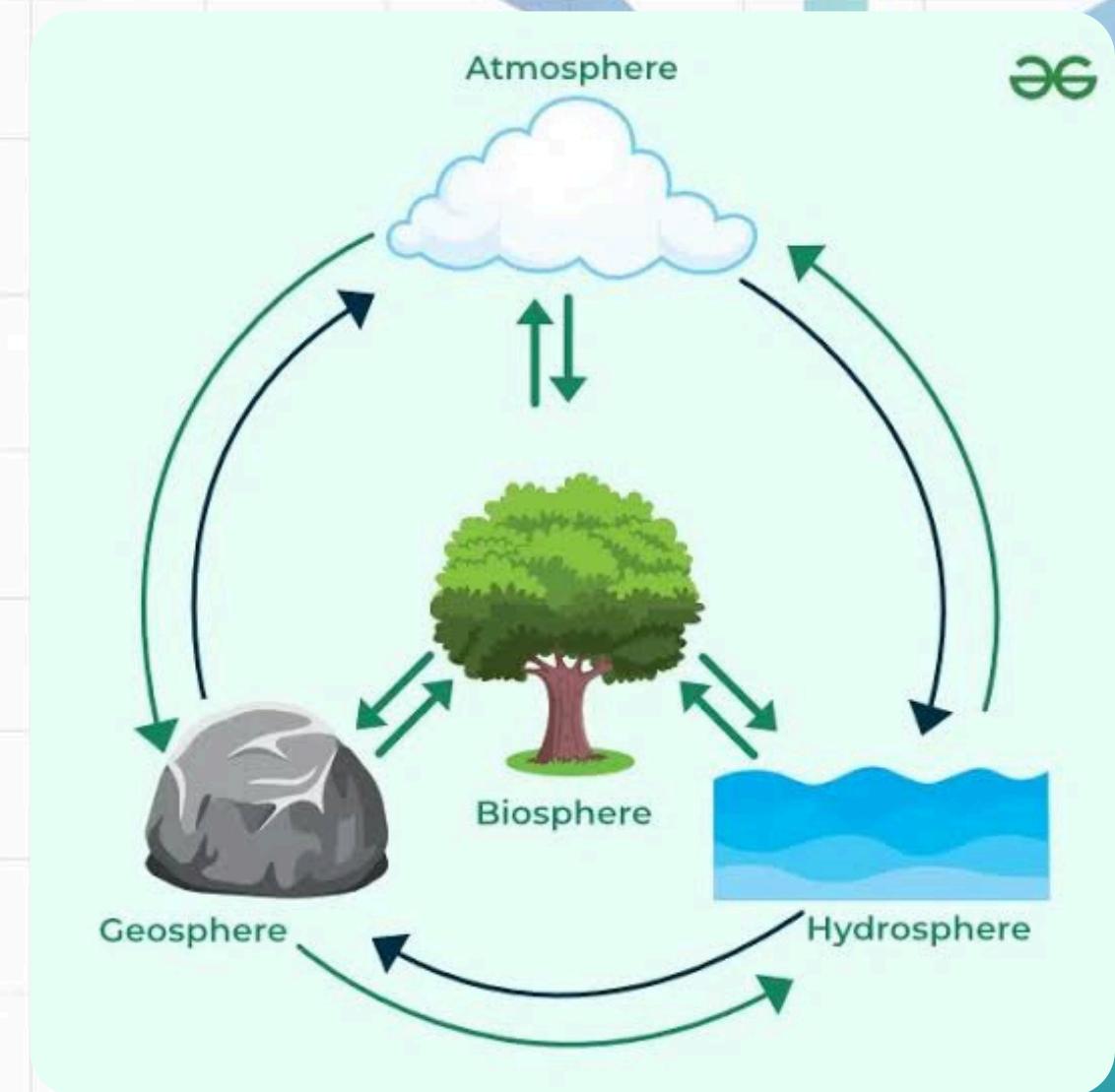


IMPORTANCE OF HYDROSPHERE

- PROVIDES WATER WHICH IS IMPORTANT IN ALL ORGANISMS**
- HABITAT AND NOURISHMENT FOR MANY ORGANISMS**
- ALLOWS MANY BIOGEOCHEMICAL CYCLES**

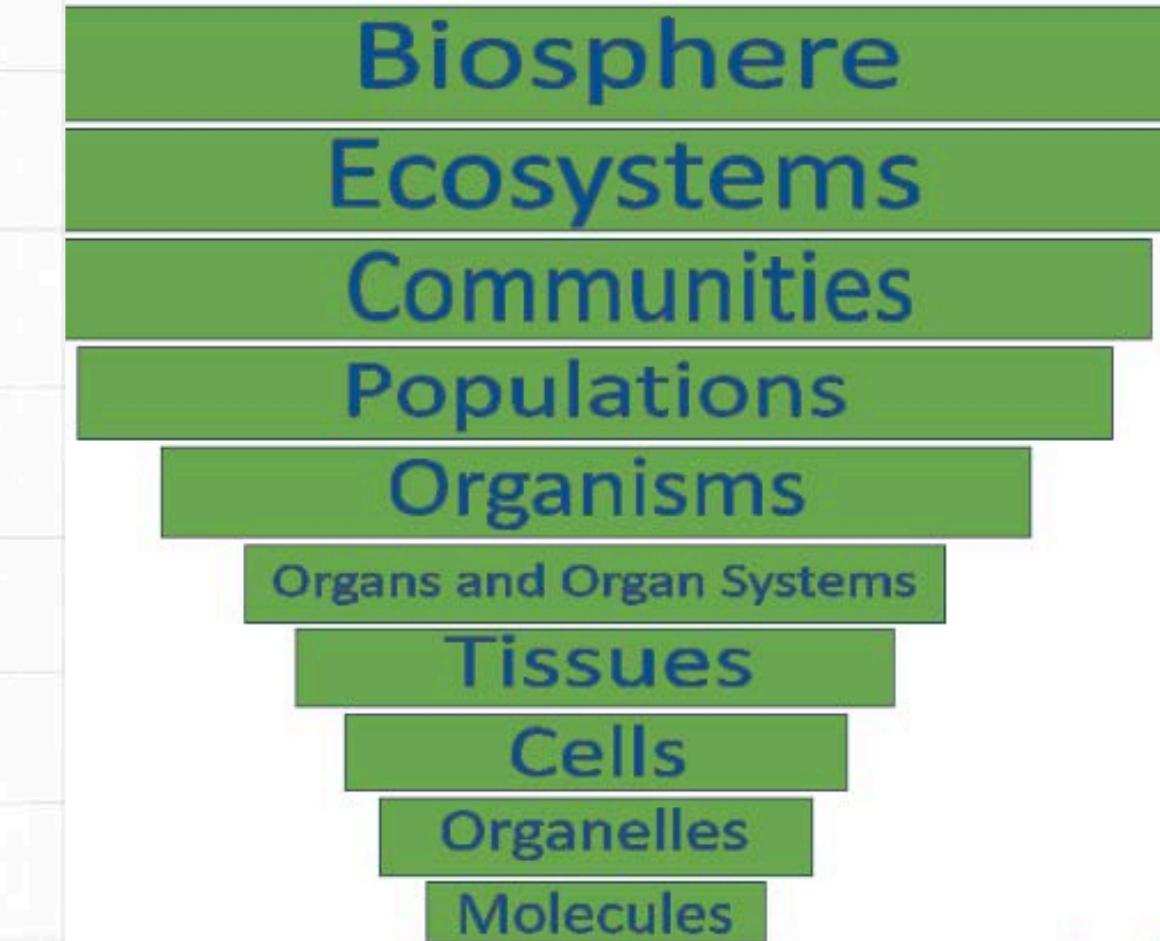
BIOSPHERE

- WHERE LIFE EXISTS
- WHERE ORGANISMS LIVE AND INTERACT WITH ITS OR VARIOUS OTHER COMPONENTS SUBSYSTEMS
- TOTALITY OF BIODIVERSITY



LEVEL OF BIOLOGICAL ORGANIZATION

- **POPULATION – SAME SPECIES**
- **COMMUNITY – DIFFERENT POPULATIONS**
- **ECOSYSTEM – DIFFERENT COMMUNITIES INTERACTING WITH THE ENVIRONMENT**
- **BIOSPHERE – COMBINATION OF ALL ECOSYSTEMS**



THREE DOMAINS OF ORGANISMS

- ARCHAEA
- BACTERIA
- EUKARYA

BIOMES

- **BIOLOGICAL COMMUNITIES WITH DISTINCT CLIMATE, GEOGRAPHICAL LOCATION, BIODIVERSITY AND PHYSICAL CHARACTERISTICS**
- **TERRESTRIAL AND AQUATIC**



BIOMES: TERRESTRIAL

- TROPICAL RAINFOREST
- DESERT
- CHAPARRAL
- GRASSLAND
- TUNDRA
- SAVANNAS

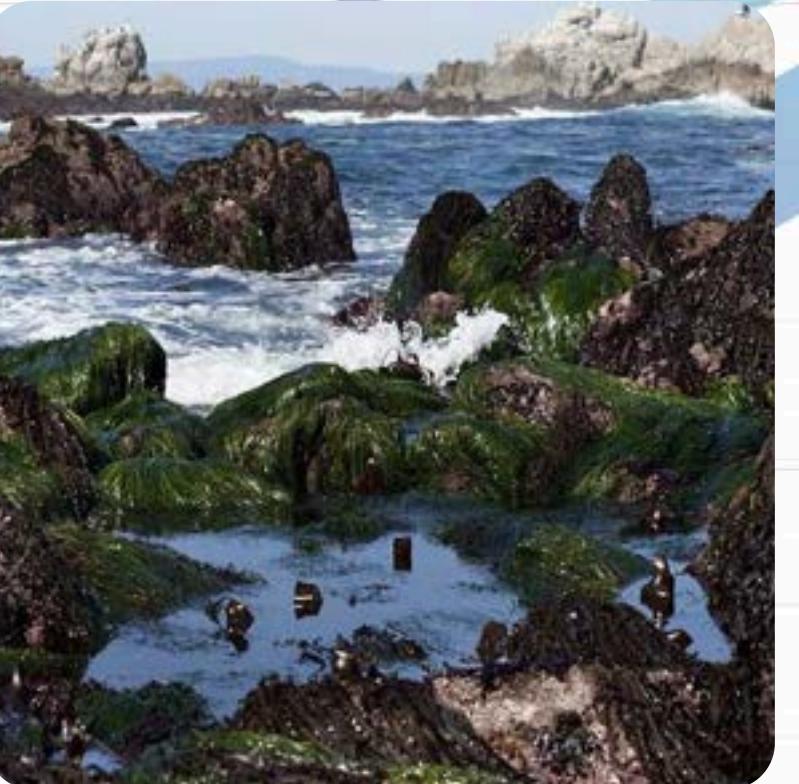
BIOMES: TERRESTRIAL



BIOMES: AQUATIC

- MAGROVE FOREST
- CORAL REEFS
- ESTUARIES
- INTERTIDAL ZONES

BIOMES: AQUATIC



Oceanic and Atmospheric Administration/Department

IMPORTANCE OF BIOSPHERE

- ESSENTIAL IN MANY BIOGEOCHEMICAL CYCLES AND NATURAL PROCESSES**
- HOME TO THE HUMAN POPULATION**

SUMMARY

SHORT QUIZ



LESSON 5:

Minerals and Rocks

MINERALS

- **BUILDING BLOCKS OF ROCKS**
- **COMPOSED OF ONE OR MORE CHEMICAL ELEMENTS**
- **WITH DEFINITE CHEMICAL COMPOSITION**
- **NATURE: SOLID, MOSTLY INORGANIC**



MINERALS

- DISTINGUISHED BASED ON DIFFERENT PHYSICAL AND CHEMICAL PROPERTIES
- PHYSICAL PROPERTIES CAN BE READILY DETERMINED
- CHEMICAL PROPERTIES ARE NOT READILY DETERMINED

MINERALS: DIAMOND

- HARDEST NATURALLY-OCCURING MINERAL
- MADE UP OF LATTICE OF CARBON MOLECULES
- EXCELLENT INSULATOR OF ELECTRICITY



MINERALS: CALCITE

- CALCIUM CARBONATE
- NON-SILICATE ROCK-FORMING MINERAL
- BRITTLE
- FOUND IN SEDIMENTARY AND HYDROTHERMAL ENVIRONMENTS



MINERALS: QUARTZ

- COMPLEX SILICATE
- OFTEN REFERRED TO AS FRAMEWORK SILICATE
- FOUND IN DIFFERENT KINDS OF ROCKS



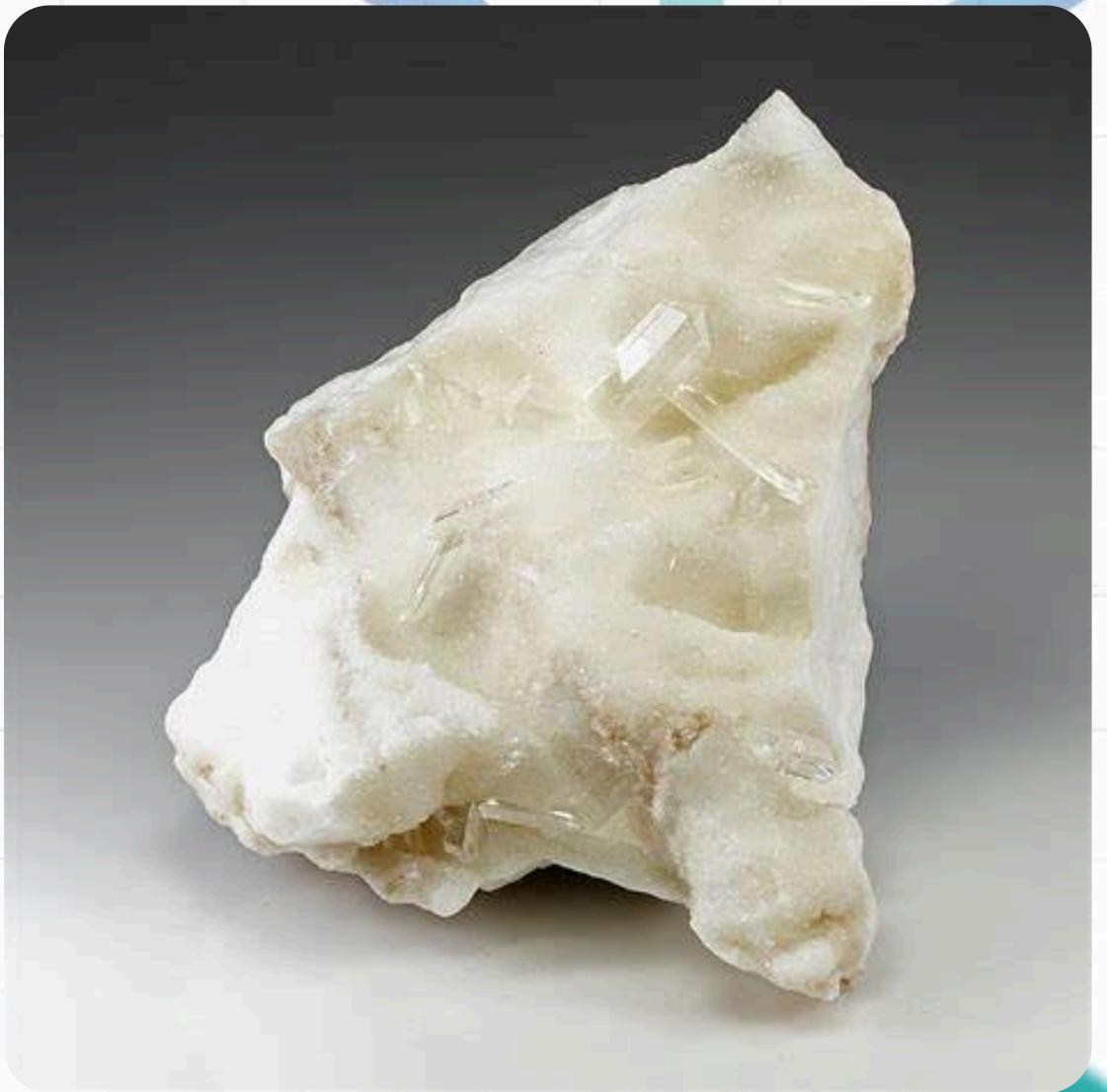
MINERALS: BIOTITE

- MEMBER OF THE SHEET SILICATES
- FLEXIBLE BUT BREAKABLE
- NEEDS OPTICAL, CHEMICAL, OR X-RAY ANALYSIS
- NOT VERY RESISTANT TO WEATHERING



MINERALS: GYPSUM

- WATER-SOLUBLE MINERAL SEDIMENT
- MOST COMMON SULFATE MINERAL
- LIMITED DURABILITY DUE TO HARDNESS
- SOLUBLE IN HYDROCHLORIC ACID



ROCKS

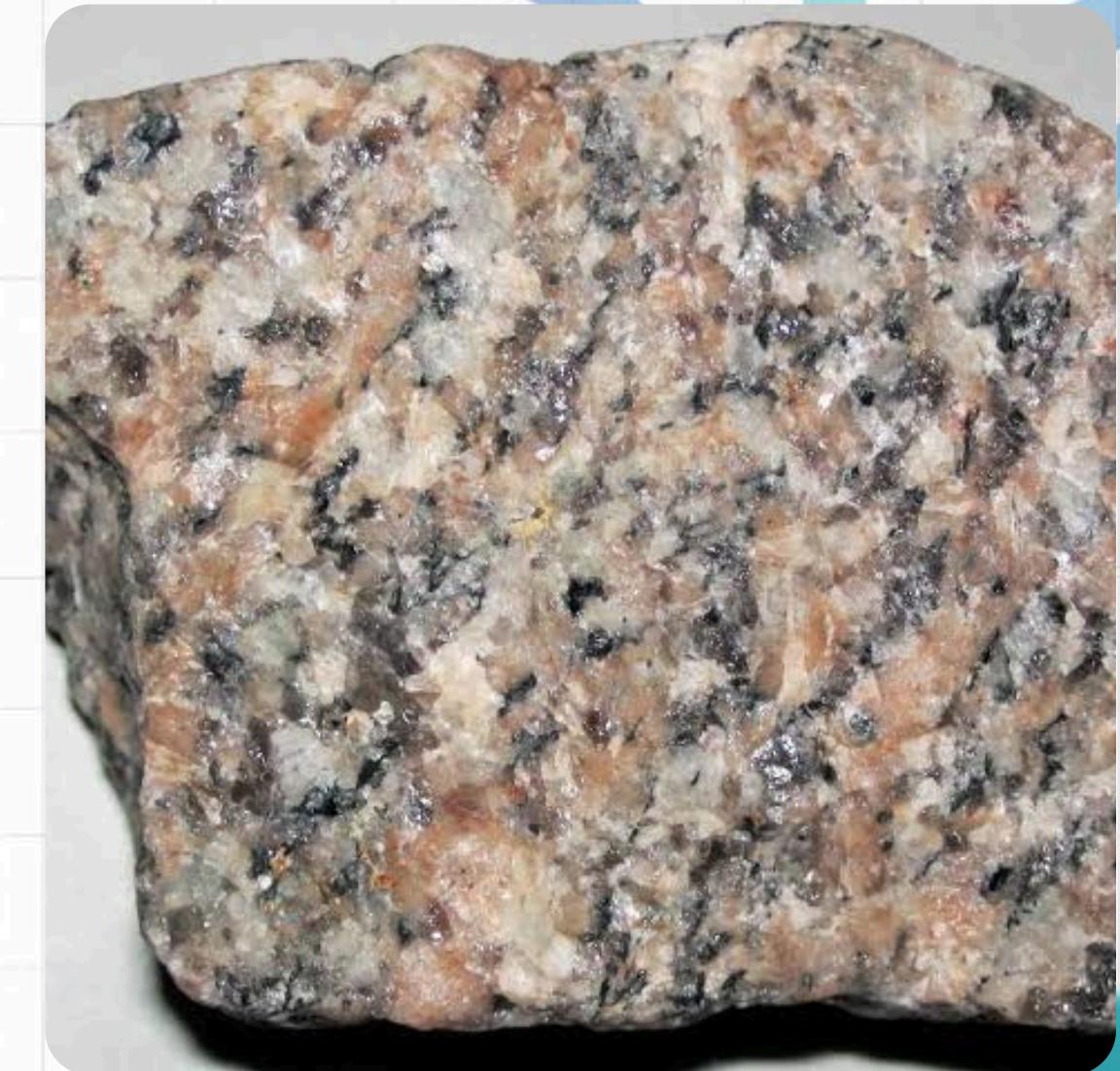
- NATURALLY-OCCURING AGGREGATES OR CONGLOMERATES OF MINERALS
- PETROLOGY: BRANCH OF SCIENCE THAT STUDIES ROCKS

TYPES OF ROCKS

- **IGNEOUS (INTRUSIVE AND EXTRUSIVE)**
- **SEDIMENTARY (CLASTIC, CHEMICAL, AND ORGANIC)**
- **METAMORPHIC (FOLIATED AND NON-FOLIATED)**

TYPES OF ROCKS: IGNEOUS ROCK

- **ROCKS THAT COOLED AND CRYSTALLIZED FROM MOLTEN MAGMA**
- **MANY FORM BENEATH, ON, OR ABOVE THE SURFACE OF THE EARTH**



TYPES OF ROCKS: IGNEOUS ROCK

- **INTRUSIVE – FORMED DEEP WITHIN THE EARTH, LARGE CRYSTALS**
 1. GRANITE AND DIORITE
- **EXTRUSIVE – FORMED AT THE SURFACE OF THE EARTH, FINE-GRAINED CRYSTALS**
 1. OBSIDIAN AND BASALT

TYPES OF ROCKS: SEDIMENTARY ROCK

- ROCKS FORMED FROM
SEDIMENTS, DEPOSITION OF
ERODED PARTICLES OF OTHER
ROCKS OR PRECIPITATION OF
MINERALS FROM WATER**



TYPES OF ROCKS: SEDIMENTARY ROCK

- **CLASTIC – DEBRIS FORMED FROM MECHANICAL WEATHERING**
 1. CONGLOMERATE
- **CHEMICAL – PRECIPITATED DISSOLVED MATERIALS FROM A SOLUTION**
 2. ROCK SALT (HALITE)
- **ORGANIC – AGGREGATES OF PLANTS OR ANIMAL DEBRIS**
 3. COAL

TYPES OF ROCKS: METAMORPHIC ROCK

- **HEAT, PRESSURE, OR CHEMICALLY MODIFIED ROCKS**
- **MODIFICATION HAPPENS DEEP BELOW THE EARTH'S SURFACE**
- **MODIFICATION AFFECTS THE TEXTURE, MINERAL, AND CHEMICAL COMPOSITION**



TYPES OF ROCKS: METAMORPHIC ROCK

- **FOLIATED – SHOW LAYERS OR BANDS DUE TO HEAT EXPOSURE AND DIRECT PRESSURE**

1. GNEISS

- **NON-FOLIATED – SHOWS NO LAYERS NOR BANDS**

1. QUARTZITE

SUMMARY

SHORT QUIZ

REFERENCES

*[https://k12.starbooks.ph/course/view.php?
id=101#section-1](https://k12.starbooks.ph/course/view.php?id=101#section-1)*