# EXAM: MODULE 1 THE OCEAN – 9/24/24

## 8/26:

Ratios of water to land in each hemisphere:

Northern – 53% Water: 47% Land

Southern – 89% Water: 6% Land, 5% Polar Ice Cap

Compare depth/height between oceans and land:

The oceans are deeper than the highest mountains on land, with the Mariana Trench reaching about 11,000 meters below sea level, while Mount Everest stands at about 8,848 meters above sea level.

Names and locations of major oceans:

Arctic, Atlantic, Pacific, Indian, Southern

Average depth and relative size of each ocean:

Pacific – 150,000,000 sq km - (1)

Atlantic – 80,000,000 sq km - (2)

Indian – 67,000,000 sq km - (3)

Southern – 21,000,000 sq km - (4)

Arctic – 9,000,000,000 sq km - (5)

## 8/28:

Concept of latitude and longitude:

Latitude measures how far north or south a location is from the equator, ranging from -90° (South) to 90° (North).

Longitude measures how far east or west a location is from the prime meridian, ranging from -180° (West) to 180° (East).

Locate equator and prime meridian on map:

The **Equator** divides the Earth into Northern and Southern Hemispheres.

The **Prime Meridian** divides the Earth into Eastern and Western Hemispheres and passes through Greenwich, England.

Calculations based on coordinates:

Given a set of coordinates or a point of a map determine the other.

Earth’s division into time zones:

It takes the sun to traverse **15 degrees of longitude every hour**, for every 15 degrees traveled you gain or lose an hour of “time” (sunlight or darkness)

The prime meridian in the Pacific Ocean determines the change of the date point

Tropical and polar boundaries:

Special - The tropical boundaries (Tropics of Cancer and Capricorn) mark the farthest points north and south where the sun can be directly overhead at noon. The polar boundaries (Arctic and Antarctic Circles) mark the regions where, for at least one day each year, there is continuous daylight or darkness.

Determined - Tropical boundaries are determined by the Earth's axial tilt, currently at approximately 23.5 degrees. The polar boundaries are determined by the points 66.5 degrees from the equator, corresponding to the Earth's tilt relative to its orbit around the sun.

## 9/3:

How planets are formed:

Accretion (Protoplanetary Disk) – Accretion in a protoplanetary disk refers to the process where dust and gas surrounding a young star gradually clump together to form larger bodies, eventually leading to the formation of planets. This disk of material is essential for the birth of planetary systems.

List and describe the evidence compiled by Wegener to support his Continental Drift Hypothesis:

The continents have drifted apart over time and there was once a single super-continent – Pangea

Fit of the continents

Fossil distribution

Ancient mountain belts

Matching rock units

Patterns of glaciation

Why was it rejected:

Did not propose a convincing mechanism of how the continents drifted apart

Evidence to support seafloor spreading hypothesis:

Rigid lithospheric plats “float” atop a plastic interior

Rising, cooling and sinking of materials within Earth’s interior

Crust formation where materials rise

Crust destruction where materials sink

Paleomagnetism – shows bands of reversed and normal polarity on the sea floor

Theory of Plate Tectonics:

Continental Drift + Seafloor Spreading = Plate Tectonics Theory

## 9/5:

Layers of the Earth

Crust, Mantle, Outer Core, Inner Core: Key layers with distinct compositions.

Lithosphere and Asthenosphere

Lithosphere: Rigid outer layer (crust + upper mantle).

Asthenosphere: Ductile layer beneath, enabling tectonic plate movement.

Crust Density

**Continental Crust: Less dense.**

**Oceanic Crust: More dense.**

Major Plates

Seven major tectonic plates: **African, Antarctic, Eurasian, Indo-Australian, North American, Pacific, South American.**

Plate Boundaries

Divergent: Plates move apart, new crust forms (e.g., mid-ocean ridges).

Convergent: Plates move together, causing subduction or mountain formation.

Transform: Plates slide past each other, causing earthquakes.

Ocean Formation and Destruction

Oceans form at divergent boundaries and are subducted at convergent boundaries.

Island Chains and Hot Spots

Hot Spots: Magma plumes create volcanic islands (e.g., Hawaiian Islands).

Guyots

Flat-topped seamounts, once volcanic islands, eroded and submerged.

## 9/10:

Why the Sea is Salty:

* Minerals and salts are washed from land into the ocean by rainwater and rivers.

Sources and Sinks of Salt:

* Salt enters the sea from land runoff and seafloor openings. It is removed by biological processes and sedimentation, maintaining stable salinity over millions of years.

Salt Cycle:

* Weathering of rocks, transport of dissolved salts to the ocean, and removal through sedimentation and biological processes.

Water Cycle:

* Evaporation, condensation, precipitation, and collection.

pH Scale:

* Measures how acidic or basic a substance is, ranging from 0 to 14, with 7 being neutral.

Buffer:

* Resists changes in pH. The carbonate buffering system in the sea involves carbonic acid, bicarbonate, and carbonate ions to maintain stable ocean pH.

Photosynthesis:

* Converts sunlight, water, and carbon dioxide into oxygen and glucose, providing energy for plants and releasing oxygen as a byproduct.

Chemosynthesis:

* Certain organisms produce food using inorganic chemicals, occurring in deep-sea environments without sunlight, crucial for life in the sea.

Solar Radiation and Seasons:

* Solar radiation varies with the seasons due to the Earth’s tilt. Summer receives more direct sunlight, while winter receives less.

Latitude and Sun’s Rays:

* Equator (0°) during equinoxes, Tropic of Cancer (23.5° N) during summer solstice, Tropic of Capricorn (23.5° S) during winter solstice.

Heat Distribution Forces:

* Solar radiation and ocean currents.

Factors Affecting Air Density:

* Temperature (warmer air is less dense), humidity (moist air is less dense), and altitude (air density decreases with altitude).

Weather vs. Climate:

* Weather: Short-term atmospheric conditions.
* Climate: Long-term average of weather patterns.

Coriolis Force:

* Apparent deflection of moving objects due to Earth’s rotation, causing rightward deflection in the Northern Hemisphere and leftward in the Southern Hemisphere.

Prevailing Wind Patterns:

* High pressure: Descending air, clear skies.
* Low pressure: Rising air, precipitation.
* Hadley Cell: Equator to 30°.
* Ferrel Cell: 30° to 60°.
* Polar Cell: 60° to poles.

Wind Rotation:

* Northern Hemisphere: High pressure (clockwise), low pressure (counterclockwise).
* Southern Hemisphere: High pressure (counterclockwise), low pressure (clockwise).

Factors Affecting Water Density:

* Temperature (colder water is denser), salinity (higher salinity increases density), and pressure (increases with depth).

Thermohaline Circulation:

* Global movement of ocean water driven by temperature and salinity differences, regulating climate.

Thermocline and Halocline:

* Thermocline: Rapid temperature change with depth.
* Halocline: Rapid salinity change with depth.

Stable and Unstable Stratification:

* Stable: Denser water below less dense water, preventing mixing.
* Unstable: Less dense water below denser water, leading to mixing and overturning.

1. Major water masses in the Atlantic Ocean, such as North Atlantic Deep Water (NADW), Antarctic Bottom Water (AABW), and Mediterranean Overflow Water (MOW), can be identified by their distinct depths and characteristics.
2. The Great Ocean Conveyor Belt is a global circulation system that moves water around the world’s oceans, driven by differences in temperature and salinity.
3. Density increases with higher salinity and lower temperature, causing denser water masses to sink and form layers in the Atlantic Ocean.
4. North Atlantic Deep Water (NADW) originates in the North Atlantic and sinks to intermediate depths, Antarctic Bottom Water (AABW) forms around Antarctica and occupies the deepest layers, Mediterranean Overflow Water (MOW) flows from the Mediterranean Sea and spreads at intermediate depths, and Antarctic Intermediate Water (AAIW) forms near Antarctica and resides above the NADW.

