Atmospheric gases

CO_2-0.03%

O_2-21%

O_2-decreases and CO_2 increases as one goes deeper in soil and sediments

The atmospheric gases are varying in water from time to time and place to place

0_2 is more soluble in H_20 than N_2

Temperature, dissolved salt influence the ability of H_20 to hold 0_2

Low temp

High salinity

Source of 0_2 in H_20

02 supply in H_20 comes from diffusion from air photosynthesis by plants

AIDING 0_2 DIFFUSION

Wind and water movements

Light penetration and to 0_2 production

Carbondioxide

Present in low concentration in air

- Aqueous carbon dioxide, CO_2 (aq), reacts with water forming carbonic acid, H_2CO_3 (aq). Carbonic acid may loose protons to form bicarbonate, HCO_3^- , and carbonate, CO_3^{2-}.
- Because carbon dioxide is soluble in water, it occurs naturally
  in groundwater, rivers and lakes, ice
  caps, glaciers and seawater. It is present in deposits of petroleum and natural gas

- Plants, algae and cyanobacteria use light energy to ph otosynthesize carbohydrate from carbon dioxide and water, with oxygen produced as a waste product.
- Carbon dioxide (CO_2) is produced by all aerobic organisms when they metabolize carbohydrates and lipids to produce energy by respiration. It is returned to water via the gills of fish and to the air via the lungs of air-breathing land animals, including humans.
- Carbon dioxide is produced during the processes of decay of organic materials and the fermentation of sugars in bread, beer and winemaking. It is produced by combustion of wood and other organic materials and fossil fuels such as coal, peat, petroleum and natural gas.

CO_2 is extremely soluble in H_2O

Source of CO_2 ➡ Respiration ,decay and soil or underground source

CO_2 ➕ H_2O ➡ H_2CO_3

-HCO_3 and ➖ CO_3 ⬅ lime stone

-Helps in maintaining pH concentration of aqueous environment.

- ⬆ In CO_2 ⬆ photosynthesis and devt process of many organisms

-High CO_2 con. ⬇ 0_2 conc.

-Fishes respond to ⬆ in CO_2 and may be killed if water is too heavily charged with unbound CO_2

Macro nutrients And Micro nutrients

Dissolved salts vital to life- Biogenic salt

Nitrogen-

Phosphorour –

Potassium –

Calcium- Mollusks and vertebrates

Sulfur

Magnesium – Chlorophyll

Elements their compds largely needed are known as Macronutrients.

Those required in minute quantities are known as Micronutrients.

Iron, manganese, copper, zinc, boron, silicon, chlorine, molybdenum, vanadium and cobalt

Function

- Required Photosynthesis

Mn, Fe, cl, Zn and V

- Required for N2 metabolism

Mo, B, Co, Fe

- Required for other metabolism functions:

Mn, B, CO, CU, and SI

Iodine essential for vertebrate.

SOIL –Edaphic factor

- Pedology –study of soil

A healthy soil ecosystem will:

- Decompose organic matter into humus;
- Retain nitrogen and other plant nutrients;
- Glue soil particles together and create pores for best passage of air and water;
- Protect roots from diseases and parasites;
- Make available nutrients to the plant;
- Produce hormones that help plants grow;
- Retain water.

Horizons

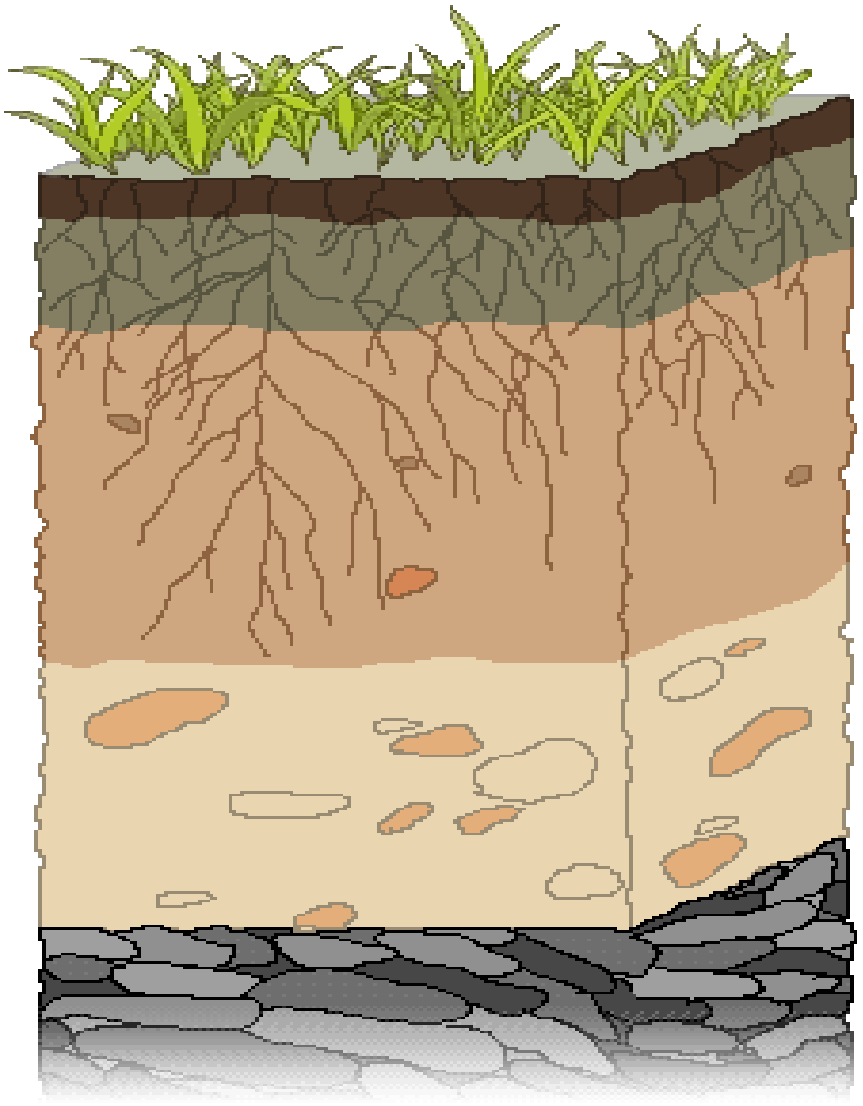
O (Organic)

A (Surface)

B (Subsoil)

C (Substratum)

R (Bedrock)



- **A –horizon (top soil)**

Upper layer of soil. bodies of plants and animals which are being reduced to finely divided organic material by humification

Fats sugars and proteins are decomposed readily but cellulose, lignin of wood, chitin, hair and bones acted on very slowly.

a. A_{oo} region (L-horizon)-surface layer rich in litter.
b. A_o region (F-horizon)- Large amount of detritus is present.
c. A_1 region –Dark coloured layer -humus; detritus+ minerals.
d. A_2 region- light colored –contains coarse sand - leaching
e. A_3 region –transitional from A to B

- **B- horizon- (sub soil)**

mineral soil- organic compds have been converted by decomposers into inorganic compds by the process of mineralization

- **C- Horizon-**

Thick layer of weathered mineral material

- **D- Horizon- R**

Lowermost stratum of soil consists of rock.

Humic substances are condensations of aromatic substances (phenols) combined with decomposition products of protein and polysaccharides.

More resistant products of decomposition ends up as humus.

The soil profile of relative thickness depends on climate and topography

Forest- litter and root decay slowly ,mineralization

Rapid ,humus layer is narrow.

Humus content of grassland 600 tons/ area while forest 50 tons/ area.

Soil composition

- Mineral matter-40%-

Formed of rock particles of different size –gravel, coarse sand

- Organic matter(humus) -10%

Organic content, great water holding capacity

- Soil water – 25%
- Soil air -25%
- Biological system

Soil texture is simply defined as the relative proportion of sand, silt, and clay particles found in the soil.

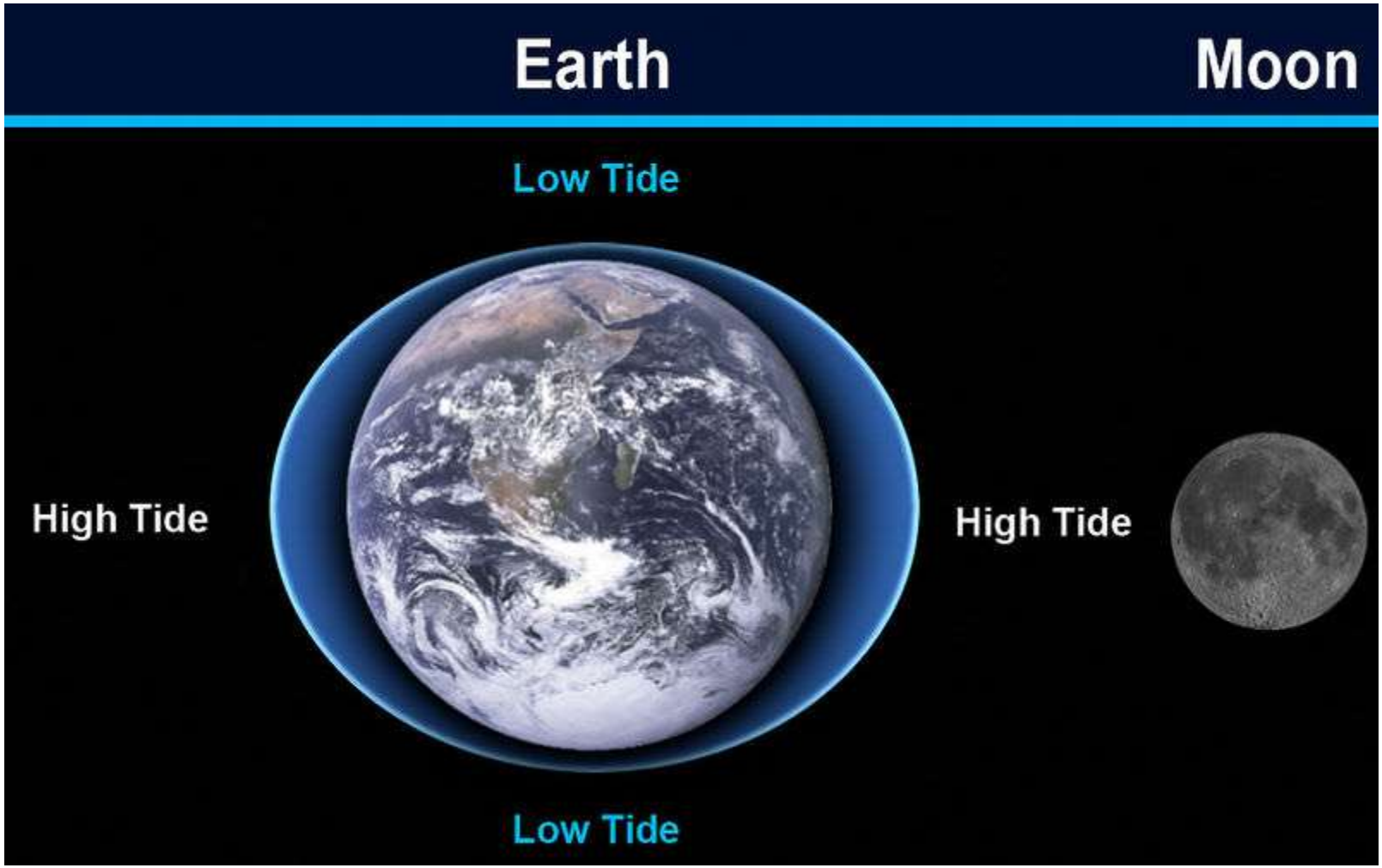
- Clay has super fine particles that cling together and prohibit water and nutrient movement, while sand has coarse particles which allow water and nutrients to leach too rapidly. There actually is one more classification called silt which has particles sized between clay and sand.

Soil texture

- Sandy soil -85% sand,15% clay or silt
- Loamy soil-sand ,clay silt equal - suitable
- Sandy loam soil – 50% and rest silt or clay- avg
- Clayey soil –clay predominant –not suitale for plants
- Clayey loam soil -20-30% clay. Suitable for life.
- Silt loam soil -51%clay or silt. Not suitable for life

Tides

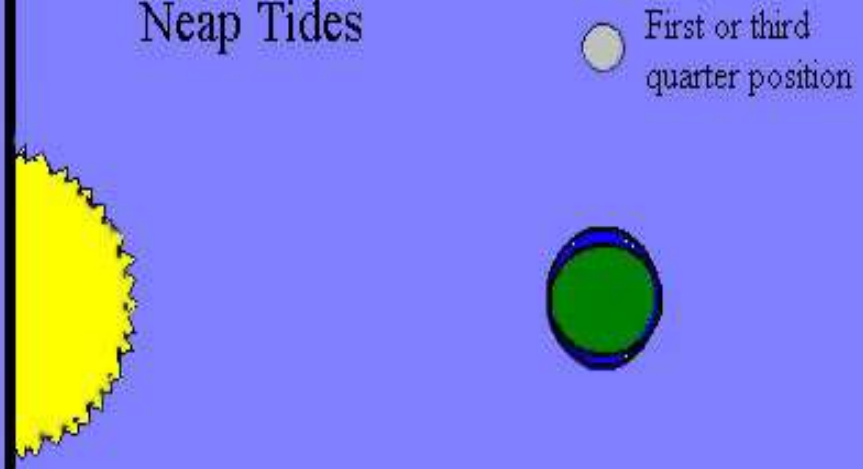
- Tides are the periodic short-term changes in the height of the ocean surface at a particular place.
- Tides are caused by the interaction of gravitational forces of the sun and moon and the rotation of the Earth.
- Most parts of the ocean experience two high tides and two low tides daily. Some places only have one high and one low tide daily.
- The timing and height of tides are influenced by the alignment of the sun and moon, tidal patterns in the deep ocean, and the shape of the coastline and adjacent seafloor.


Earth
Moon
Low Tide
High Tide
High Tide
Low Tide

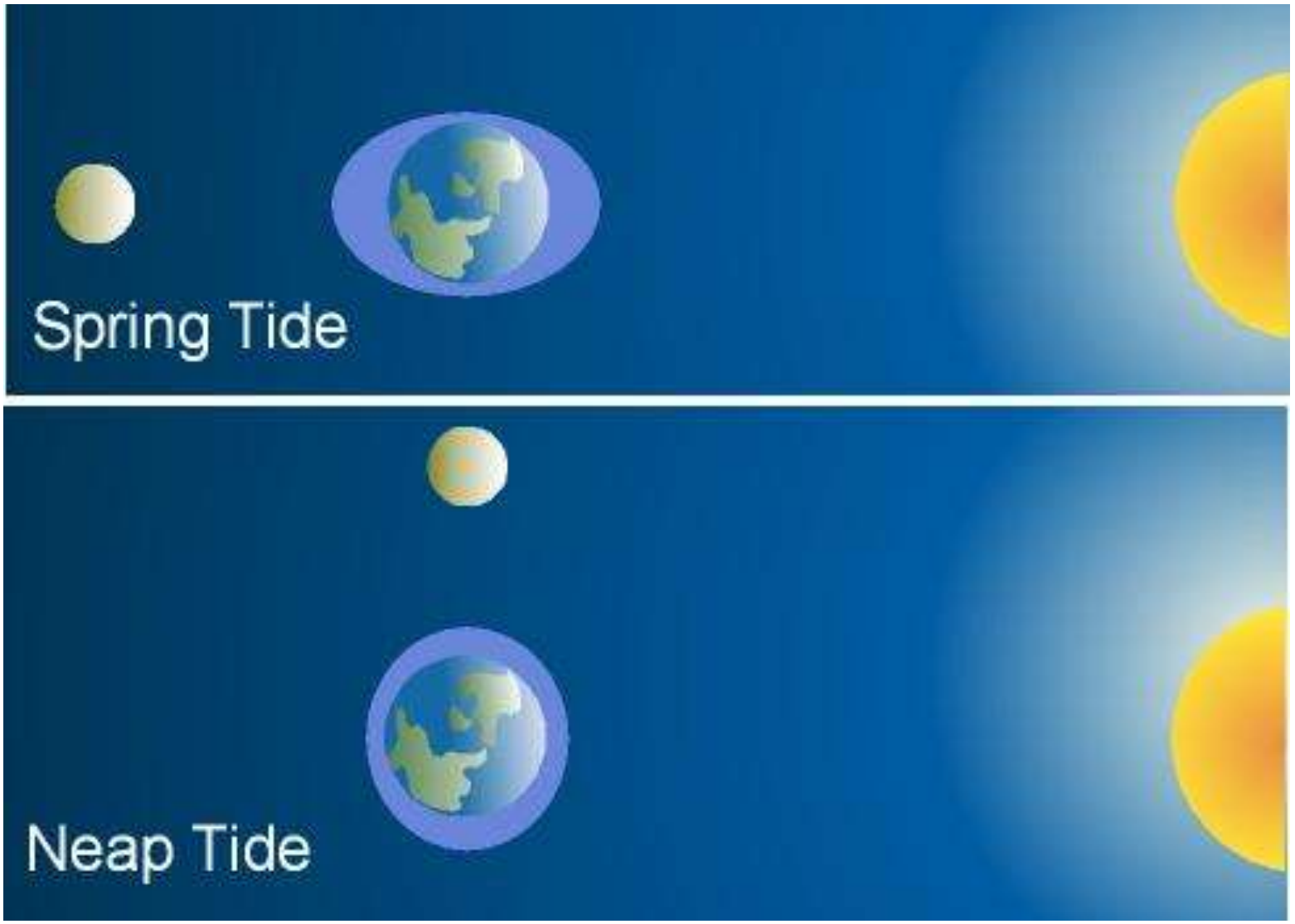
Spring Tides

Tides are the strongest when the Sun, Earth, and Moon are all in a line. This happens when the Moon is in either the New Moon or the Full Moon position.

Neap Tides



Weaker tides occur when the Moon is in the first or third quarter positions. Also regardless if it is a spring tide or a neap tide there are always two high tides: one on the side facing the Moon while the other high tide is on the opposite side of the Earth.


Spring Tide
Neap Tide

- The parts of the ocean most impacted by tides are those along the coast: salt marshes, mudflats, rocky shores, and sandy shores.
- Daily tidal changes of these coastal ecosystems can result in extreme changes in water temperature, salinity (salt content), and oxygen levels.
- As the tide lowers, organisms in these areas are further threatened by wave action, light exposure, and drying out. These organisms must have special adaptations to survive.

Waves

- Waves are disturbances caused by the movement of energy through ocean water.
- In deep water, waves represent a forward movement of energy, not water. The water molecules are not actually moving forward.
- Ocean waves range in size from small ripples to tsunami waves that are ten stories high.
- The most common cause of waves is wind.
- The strength of the wind, the distance the wind blows, and the duration of the wind determine how large or small a wave will be.
- Wavelengths, wave heights, and wave periods are measurements used to classify waves.

- Breaking waves represent a slowing or stoppage in the forward movement of energy carried by the wave.
- The area where waves break is often called the surf zone.
- Waves impact organisms throughout the ocean, especially those living along coastlines and in the surf zone.
- Organisms living in rocky and sandy shore ecosystems must have special adaptations to survive the energy of breaking waves. Many bury themselves in the sand. Some have special structures that help them to “hold on” to rocks.

Current

- Currents are mass flows of water, usually in a horizontal direction.
- The ocean has an interconnected circulation or current system powered by wind, tides, the force of the Earth's rotation (Coriolis effect), the sun, and water density differences.
- Water density is affected by the temperature, salinity, and depth of the water.
- The shape of ocean basins and adjacent land masses also influence the path of ocean currents.
- Global ocean circulation is the result of two simultaneous processes: warm surface currents carrying less dense water away from the Equator towards the Poles, and cold surface currents carrying more dense water away from the Poles towards the Equator. This global current system regulates the Earth's climate.
- It also distributes larvae, eggs, and nutrients throughout the ocean. This means that currents connect all ecosystems and make life possible throughout the ocean.

Pressure

Pressure – pressure 1 atmosphere for every 10 m.

Animals can tolerate wide variations in pressure if body does not contain free air or gas.