Oceanography Midterm Exam Review

Who is the father of Oceanography?

- Matthew Maury

What were some of the contributions of the Greeks and Romans?

- Pytheas—latitude and longitude (using northern horizon and North Star)
- Eratosthenes—accurately predicted Earth's circumference (24,840 miles)
- Ptolemy—map with latitude and longitude lines

How did WWII contribute to oceanography studies?

- Sonar

What was the first voyage designed to collect ocean data?

- HMS Challenger

What are marine chronometers?

- Keeps accurate time at sea

What current did Ben Franklin help to chart in the Atlantic?

- Gulf Steam

What kind of crust makes up the ocean floor? What kind makes up most of continental crust?

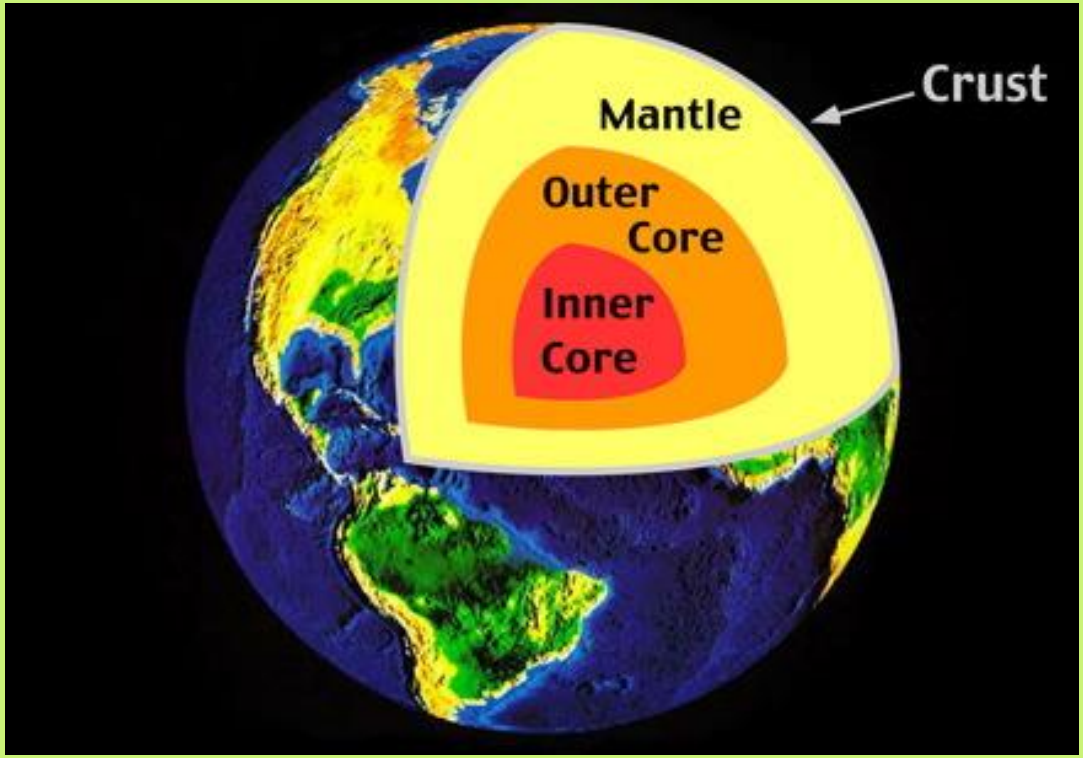
- Ocean: Basalt
- Continental: Granite

What are the major bodies of water on earth? Around which ocean is the "Ring of Fire" located?

- Pacific-Ring of Fire
- Atlantic
- Indian
- Arctic
- Southern

What are the Earth's layers?

- Crust-lithosphere
- Mantle-asthenosphere
- Outer Core
- Inner Core



Where are the youngest seafloor rocks found?

- Near the mid ocean ridge (where new seafloor is being formed)

What drives the movement of plates?

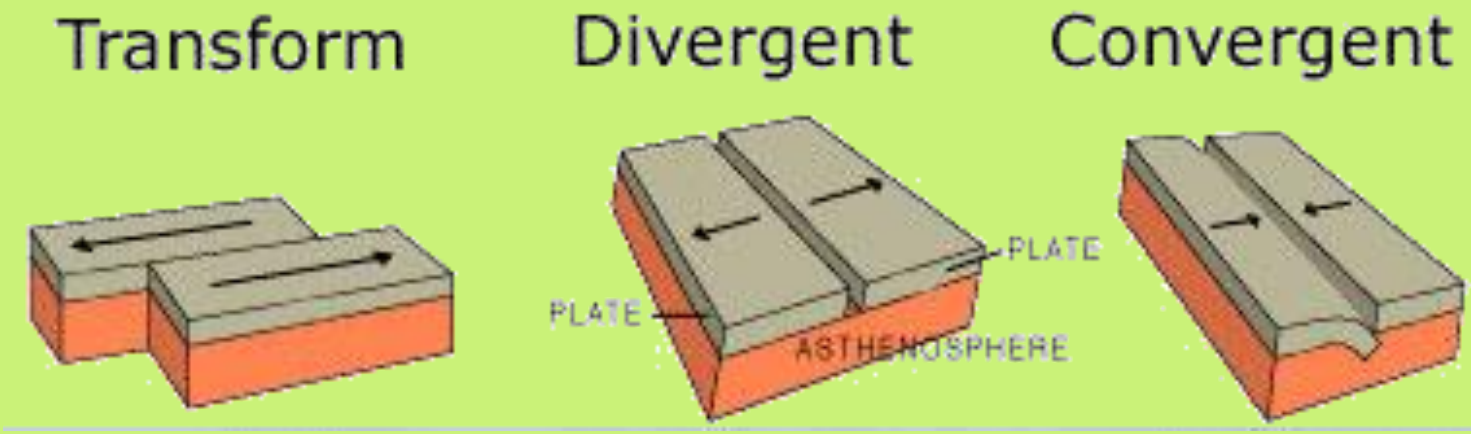
- Convection currents-movement of the asthenosphere

Who developed the idea of Continental Drift?

- Alfred Wegener

What are the three types of plate boundaries and what is happening at each?

- Convergent-plates crash together
- Divergent: Plates move away from each other
- Transform: Plates slide past each other

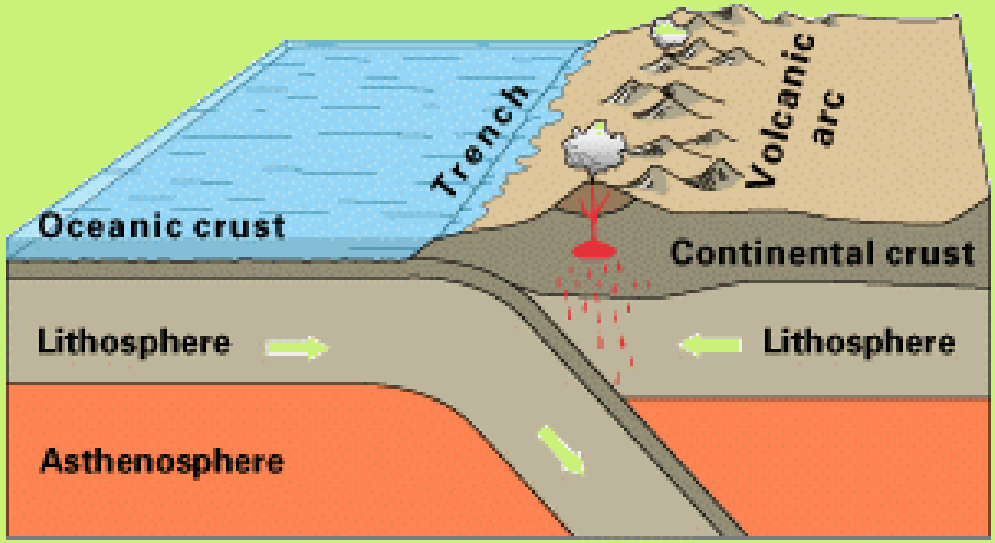


What is subduction?

- When one plate slides beneath another plate- associated with trench and volcano

Where would mid-ocean ridges be found?

- At divergent plate boundaries



Oceanic-continental convergence

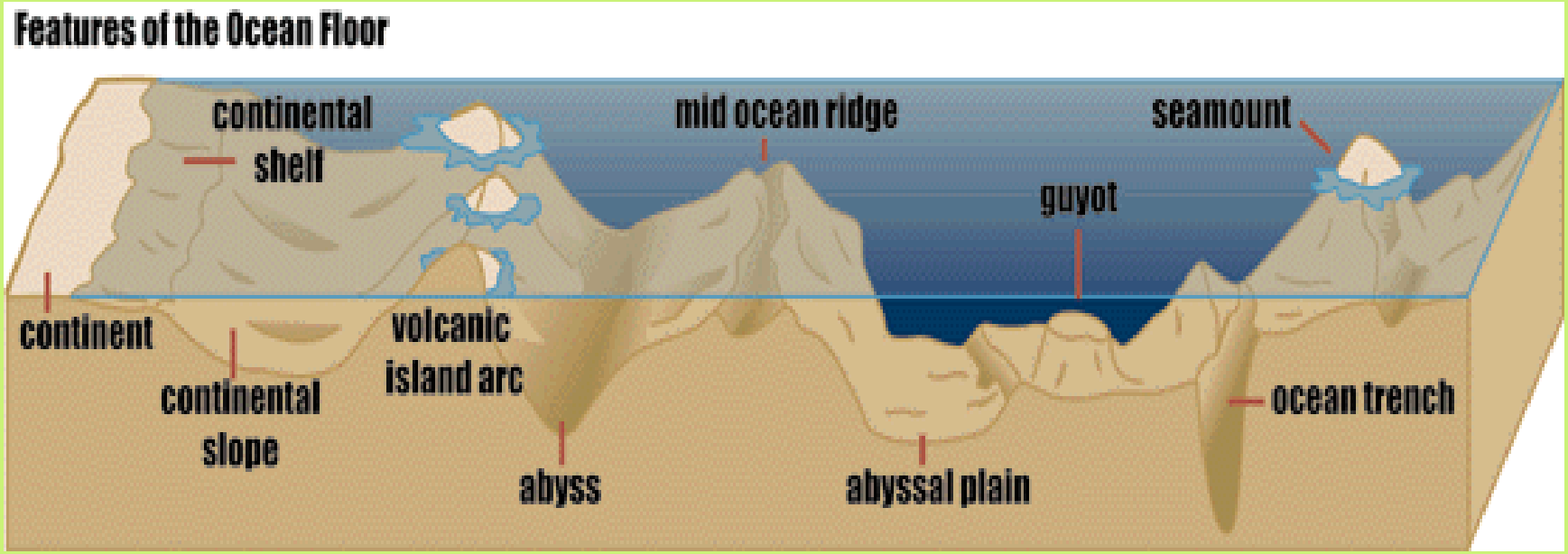
Why are satellites used to map the ocean floor?

- Faster and easy

About how fast are crustal plates moving?

- 2-3 cm/yr

What seafloor features would you find as you move from the coast out into the ocean?



What is the flat area of seafloor that makes up most of the ocean basins, and is found in deep water areas?

- Abyssal Plain

When and where were hydrothermal vents first discovered?

- 1977 by Bob Ballard in the Alvin at the Mariana's trench

How hot can it get at a hydrothermal vent?

- 250-400^{0}C

What organisms do you typically find around a vent?

- Tube worms, vent shrimp, mussels

Describe the relationship between tubeworms and bacteria.

- Tubeworms provide home for bacteria
- Bacteria provide food for the tube worm (chemosynthesis)
- Mutualism-both benefit

How do bacteria provide food for hydrothermal vent communities?

- Bacteria oxidize the hydrogen sulfide, and are often eaten by other organisms for energy.

Describe water's chemical structure and properties.

- Water is made of two hydrogen and one oxygen atom held together by a covalent bond/Hydrogen Bond (as strong as a Ionic Bond)
- Electrons are not shared equally (oxygen has greater electronegativity), so water is POLAR

What are some of the sources of the ocean's salts?

- Salts come from erosion, hydrothermal vents, and calcium carbonate shells

Where would you expect the salinity to be highest: open ocean or coastal areas? Why?

- Open ocean
- Coastal areas (where rivers and streams enter)—lower salinities

What is pH, what is the pH of ocean water, and what are buffers?

- pH Measure of H^+ ions in solution
- Ocean water—pH of 8-9
- Buffers help change & maintain stable pH levels

Describe the density differences between fresh and saltwater; between cold and warm water.

- Density increases with salinity
- Density decreases with temperature
- (cold water is more dense than warm water)

What salt is most abundant in seawater?

- Chloride

What is a hydrometer? Refractometer?

- Hydrometer: measures salinity based on specific gravity
- Refractometer: measures salinity based on refractive index

Which color of light penetrates deepest in the ocean?

- blue

What is the area of light penetration called?

- Photic zone

What is the SOFAR channel?

- Sound Fixing and Ranging
- Sound travels very slow for a long distance

What is a sediment?

- Eroded particles and debris that settle on the ocean floor

What are some reasons to study marine sediments (why are they important)?

- Resources (oil, sand and cement (lime))
  - Oil (29%) and Gas (22%) extracted from offshore fields
- Document evolution of life, changes in climate

What are sizes of sediments and how are they measured?

- Size of sediments classified according to the Wentworth Scale:
- (smallest) clay, silt, sand, gravel (largest)

Why has much of the ocean's sediment record been "lost" over time?

- Shift in the sediment and movement of the plates

type of sediment	origins	composed of?	main location
biogenous	from once living organisms	microscopic shells	warm shallow seas
lithogenous	from rock	mostly quartz	coasts of major continents
cosmogenous	from space	metals (tektite)	widespread, not abundant
hydrogenous	from water	metal precipitates	deep basins, mid ocean ridges

What are the two major forces that determine global air circulation?

- Uneven solar heating and the Coriolis effect

How are hurricanes ranked? Describe how hurricanes form. What is the difference between a hurricane and a typhoon?

- Saffir-Simpson scale
- Hurricanes forms: warm water and winds
- Hurricane: Atlantic
- Typhoon: Pacific

What are convection cells? How does air move within them (talk about density)?

- Warm less dense air rises and cool more dense air falls

What are the wind currents within the different convection cells (look at latitude of the cells)?

- Hadley cells: Trade winds
- Ferrel cells: westerlies
- Polar cells: Easterlies

What is the Coriolis effect? Why does it happen? How is it different in the Northern and Southern hemispheres?

- The idea that object move in a curvilinear (curved) path not a straight line

- It happens because the Earth is rotating.

- Due to the Coriolis effect, air circulates to the right in the Northern Hemisphere and to the left in the Southern hemisphere.

Horseshoe Crabs

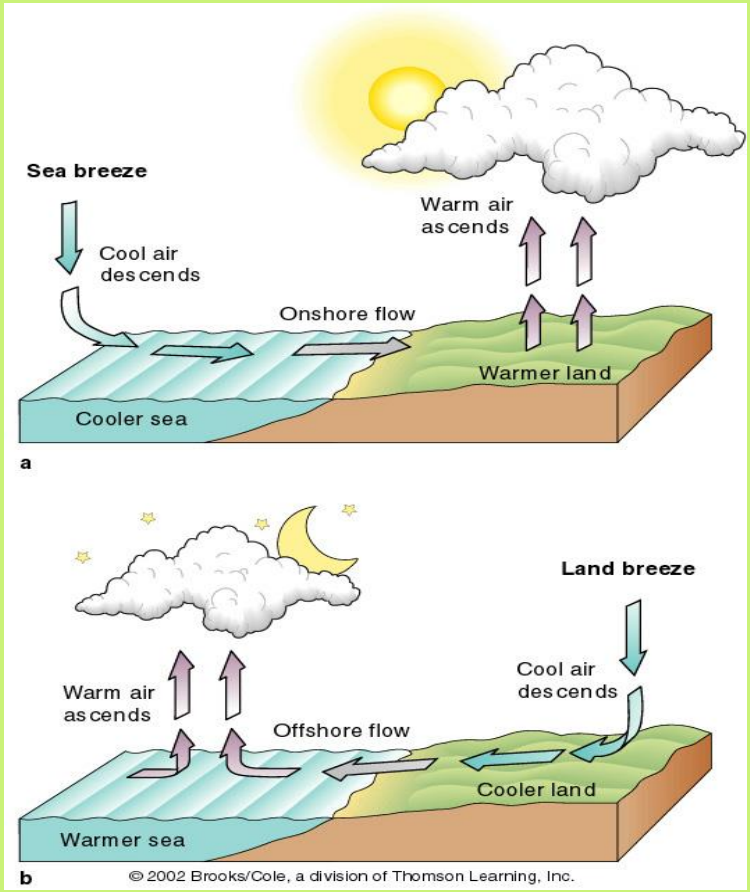
- Horseshoe Crabs are arthropods in class Merostomata. They use book gills, have 4 eyes, and are considering "living fossils" since they've been around basically unchanged for 400 million years.

What are differences between land and sea breezes?

Sea breeze is cool air from over the water moving toward land. Sea breezes occur after sunrise.

Land breezes occur after sunset when air warmed by the land blows toward the sea.

- Land and sea breezes are a function of the relative temperature of the land and water.
- Sea breezes occur during the day (a), and land breezes form at night (b).



Ocean Circulation

- **What is the difference between surface and deep water circulation? What drives each?**

Surface Currents--Wind Circulation

- These waters make up about 10% of all the water in the ocean.
- These waters are the upper 400 meters of the ocean.
- Wind driven (friction between water & wind)
- Horizontal

Deep Water Currents--Thermohaline Circulation

- These waters make up the other 90% of the ocean
- Caused by density and temperature differences
- Affect living organisms by mixing water
- Vertical

What are gyres? How do they move in the Northern hemisphere? In the Southern hemisphere?

- large circles that the currents follow are called Gyres

- In North, moves in clockwise

- In South, counter-clockwise

What are differences between ocean currents on the eastern sides of ocean basins versus western sides?

- Western: warm, narrow, deep, fast
- Eastern: cold, broad, shallow, slow

Table 9.1 Boundary Currents in the Northern Hemisphere

Type of Current (example)	General Features	Speed	Transport (millions of cubic meters per second	Special Features
Western Boundary Currents	**Warm**			
Gulf Stream, Kuroshio (Japan) Current	Narrow, , 100 km. Deep—substantial transport to depths of 2 km	Swift, hundreds of kilometers per day.	Large, usually 50 sv or greater.	Sharp boundary with coastal circulation system; little or no coastal upwelling; waters tend to be depleted in nutrients, unproductive; waters derived from trade wind belts.
Eastern Boundary Currents	**Cold**			
California Current. Canary Current	Broad, ~1,000 km. Shallow, , 500 m.	Slow, tens of kilometers per day.	Small, typically 10–15 sv.	Diffuse boundaries separating from coastal currents; coastal upwelling common; waters derived from mid-latitudes.

The overall purpose of air and water circulation is to

- create thermal balance between the equator and poles

What causes the Ekman spiral ?

- Friction between water layers

What is El Nino? When does it happen? How often does it happen? What effects does it have?

- El Niño is the shift is weather patterns. Area that are cold become warm-no upwelling
- El Niño occurs around the time of **Christmas.**
- How often does El Niño occur? **Every 3-7 years**
- Some of the expected global effects of El Niño are **droughts, snowstorms, and mudslides.**

What is a downwelling?

- When surface waters are pushed away from land, especially along the western South American coast.

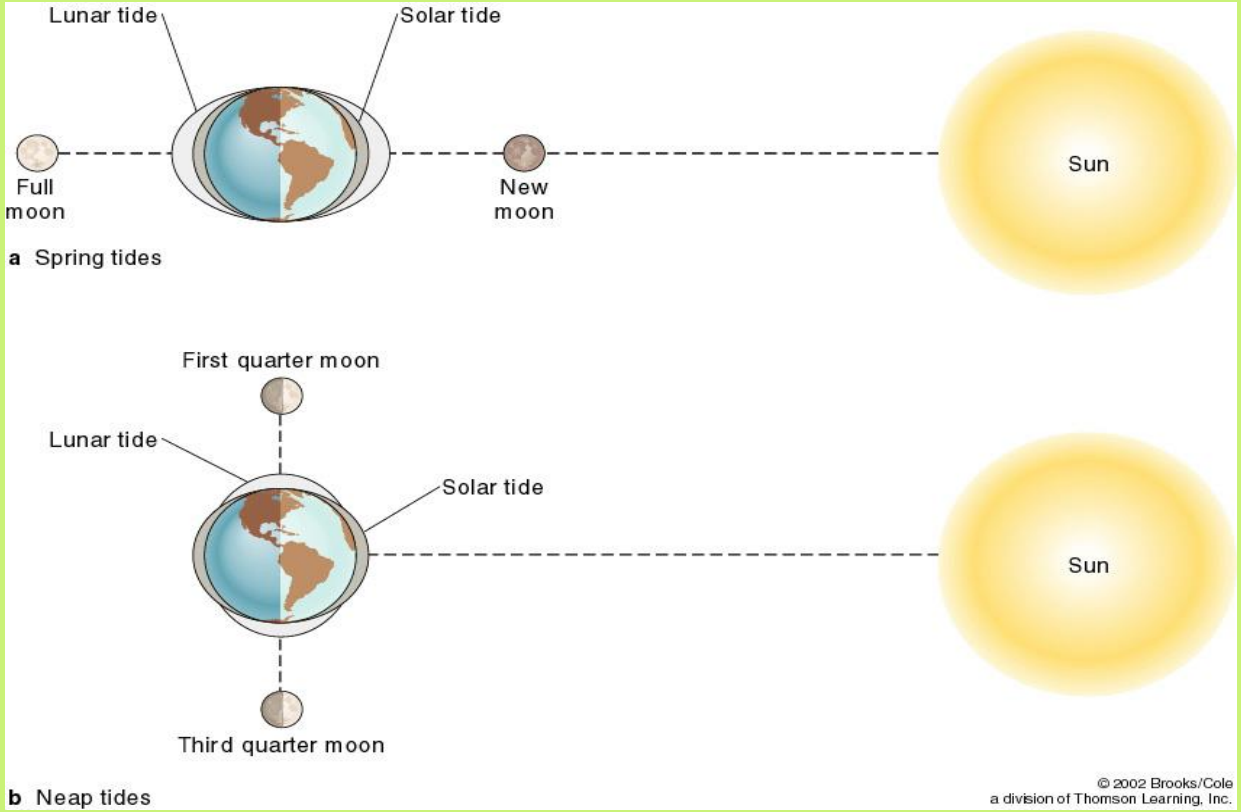
Which would have more nutrients and oxygen:

- Cold water

The ultimate source for ocean and air currents is the

- Sun

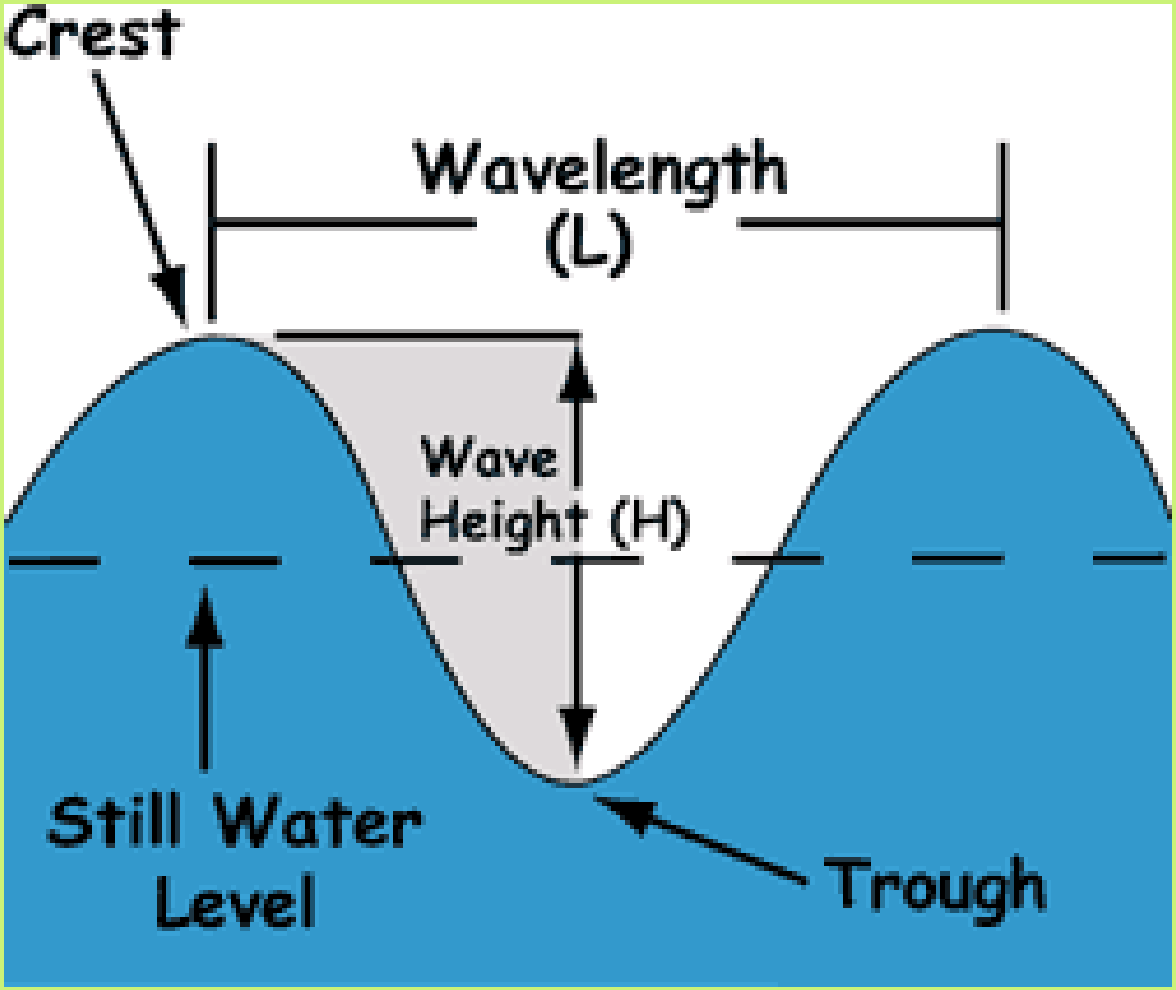
How are spring and neap tides different?



top: The positions of the Sun, the moon and Earth during a **spring tide**.

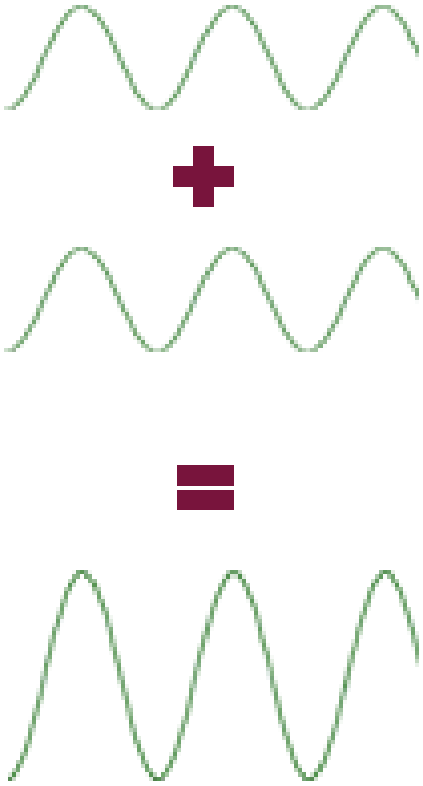
bottom: The positions of the Sun, the moon and Earth during a **neap tide**.

Draw a wave and label the parts



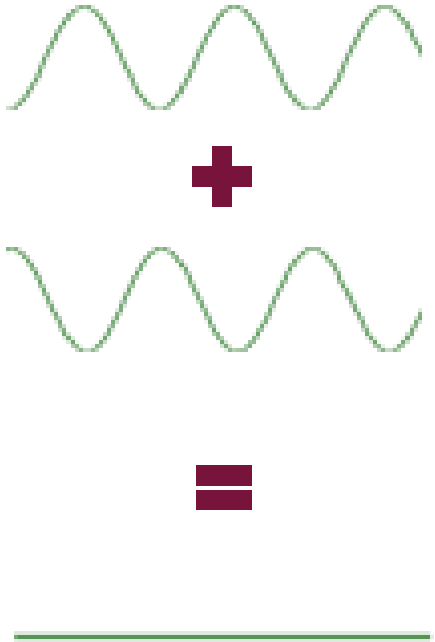
Compare and contrast wave interference

Waves add together



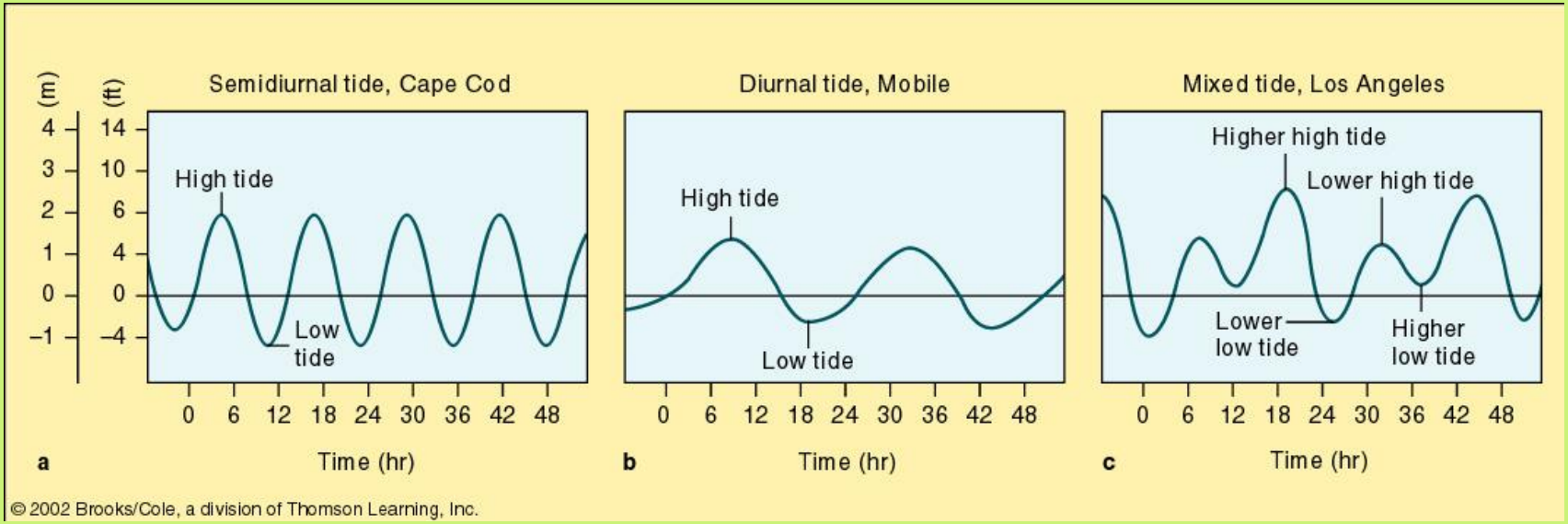
CONSTRUCTIVE

Waves cancel each other



DESTRUCTIVE

Review types of tides



semidiurnal tide: two high tides and two low tides each day, equal height	diurnal tides: one low tide and one high tide daily	mixed semidiurnal tides: two high tides and two low tides each day, high tides are of differing heights each day