Geography of Earth & Oceans

Latitude & longitude

Properties of Water

Structure of water molecule: polarity, hydrogen bonds, effects on water as a solvent and on freezing
Latent heat of fusion & vaporization & physical explanation
Effects of latent heat on heat transport between ocean & atmosphere & within atmosphere
Definition of density, density of ice vs. water
Physical meaning of temperature & heat
Heat capacity of water & why water requires a lot of heat gain or loss to change temperature
Effects of heating & cooling on density of water, and physical explanation
Difference in albedo of ice/snow vs. water, and effects on Earth temperature

Properties of Seawater

Definitions of salinity, conservative & non-conservative seawater constituents, density (sigma-t)
Average ocean salinity & how it is measured
3 technology systemss for monitoring ocean salinity and other properties
6 most abundant constituents of seawater & Principle of Constant Proportions
Effects of freezing on seawater
Effects of temperature & salinity on density, T-S diagram
Processes that increase & decrease salinity & temperature and where they occur
Generalized depth profiles of temperature, salinity, density & ocean stratification & stability
Generalized depth profiles of O_2 & CO_2 and processes determining these profiles
Forms of dissolved inorganic carbon in seawater and their buffering effect on pH of seawater

Water Properties and Climate Change

2 main causes of global sea level rise, 2 main causes of local sea level rise
Physical properties of water that affect sea level rise
Icebergs & sea ice: Differences in sources, and effects of freezing & melting on sea level
How heat content of upper ocean & Arctic sea ice extent have changed since about 1970s
Invasion of fossil fuel CO2 in the oceans and effects on pH

The Sea Floor & Plate Tectonics

General differences in rock type & density of oceanic vs. continental crust
Mantle convection process driving sea-floor spreading & plate motion
Tectonic plates & relationship to deep & shallow earthquakes
3 types of plate boundaries, their relative plate motion & extent of quake & volcano activity
Subduction, crust density, trenches & sediments
Differences between hot spot and islands arc volcano chains
Characteristics & examples of 2 types of continental margins
Origins & general locations of canyons, continental rises, seamounts, abyssal plains & hills
Origin & results of turbidity currents
General locations & origins of hydrothermal vents & “Lost City”
Geochemical processes creating hydrothermal vents & “Lost City”

Atmospheric Circulation

Layers of the atmosphere & their general properties

2 reasons for uneven distribution of solar energy striking Earth's surface
Convection, atmospheric pressure, and precipitation patterns on an idealized Earth with no rotation & no land
Coriolis effect & how it changes air motions on an idealized Earth with rotation & no land
Heat capacity of land vs. water and effects on continents on global & seasonal wind patterns
Effects of mountains on wind & precipitation

Ocean Water Column Structure & Thermohaline Circulation

General geographic differences in surface temperature & density & causes
General seasonal changes in depth profiles of temperature & density
Temperature & salinity conditions that create convection in the oceans
Regions of upwelling & downwelling, convergence & divergence in ocean convection
"Global conveyor belt" and its relationship to climat change
Normal vs. Niño conditions: geographic patterns of atmospheric pressure, winds, precipitation, water temperature, thermocline, currents, upwelling in the equatorial Pacific
2 monitoring systems for El Niño detection

Ocean Surface Currents

Processes explaining wind-driven surface current, Ekman Spiral, & net transport
Sea surface elevation, currents, convergence, divergence, upwelling & downwelling driven by trade winds & westerlies
Effects of winds on sea surface elevation & depth of pycnocline
Effect of continents in creating gyres
Balance of pressure and Coriolis in geostrophic flow
Explain processes driving major currents of N. & S. Pacific, N. & S. Atlantic gyres

Tides

Basic tidal terminology: crest, trough, height, range, period, day, ebb, flood, slack, datum
3 types of tides by period & where they are observed: diurnal, semidiurnal, mixed semidiurnal
Equilibrium tidal theory, interactions of gravity & "centrifugal" forces causing tides
Relative magnitude of moon & sun influences on tides & explanation
Why the tidal day is 24 hours 50 minutes
Why generic tides should be semidiurnal
Interaction of moon & sun to give spring & neap tides
Variation of tidal range between solstice & equinox
Origin of semidiurnal mixed tides

Albedo	Antarctic Bottom Water	Asthenosphere
Convection	Downwelling	ENSO
Geostrophic flow	Gyres	Halocline
Heat capacity	Indonesian Low	Intertropical convergence zone
Land & sea breeze	Lithosphere	Mixed layer
N. Atlantic Deep Water	Ocean conveyor belt	Orographic effect
Plate tectonics	Polar easterlies	Polar jet stream
Prevailing Westerlies	Pycnocline	ROV's and AUV's
S. Pacific High	Subtropical jet	Thermocline
Thermohaline circulation	Trade winds	Upwelling