- Deep-water waves - depth greater than half the wavelength. Speed of deep-water waves depends on their wavelength. Longer the wave, the faster it goes
- Shallow-water waves - depth less than half wavelength. For shallow-water waves, the ocean bottom interferes with circular orbital motion, flattening them; the wave begins to "feel bottom". The speed of shallow-water waves is influenced only by gravity and water depth. Since gravitational acceleration is constant, the formula for wave speed (in meters per second) is now \( 3.13 \times \sqrt{\text{water depth}} \)
- Wind blowing over the ocean generates wind waves
  - Capillary waves (ripples) are almost always present
  - They form as wind creates pressure and stress, deforming the ocean surface
  - Capillary waves become gravity waves when wavelength exceeds about 2 centimeters
  - Gravity waves (wind waves) continue to grow as long as the wind above them exceeds their speed
  - Wind waves continue to grow until they reach an equilibrium condition, called "fully developed sea" (depends on wind speed)
- The size of wind waves depends on fetch, wind speed, and duration
  - Fetch is the uninterrupted distance over which the wind blows without significant change in direction
  - A strong wind must blow continuously in one direction for nearly three days for the largest waves to develop fully
- Wave dispersion: waves with longest wavelength move the fastest and leave the area of wave formation first (waves are being sorted according to speed)
  - Swell: smooth, undulating homogenous waves caused by wave dispersion
  - Swell can come ashore with no wind, as waves propagate outside of the area where they formed
  - Interference patterns: when swells from different storms come together, the waves interfere with each other forming a complex pattern
  - Observed wave patterns are usually the results of mixed interference of many different overlapping wave sets
- When do waves break?
  - When the ratio of wave height:wavelength is greater than 1:7, the wave will break
  - Whitecaps are a way to dissipate excess wind energy as turbulence
  - Physical changes of a wave in the surf zone
    - As wave feels bottom, water movement at base of wave is retarded
    - As wavelength shortens, wave height increases to conserve mass
    - Wave breaks when height:length ratio exceeds 1:7
- Tsunami (harbor wave)
  - Tsunami are long-wavelength, shallow water progressive waves caused by rapid displacement of seawater
  - Most often this displacement is due to sudden vertical movement of underwater faults that change the volume of the ocean basin, affecting the entire water column to create seismic sea waves
  - All seismic sea waves are tsunami, but not all tsunami are seismic sea waves
  - Landslides, calving icebergs, underwater volcanic eruptions, or meteorite impacts can also create tsunami
- Wind waves come and go without flooding higher areas
  - Tsunami run quickly over land as a wall of water
  - Long wavelengths, typically exceed 200 kilometers (125 miles)
  - Therefore, tsunami are shallow-water waves and always "feel bottom"