I. Earthquakes
  A. General features
    1. Vibration of Earth produced by the rapid release of energy
    2. Associated with movements along faults
      a. Explained by the plate tectonics theory
      b. Mechanism for earthquakes was first explained by H. Reid
  B. Early 1900s
    1. Rocks "spring back"
      a. Phenomena called elastic rebound
      b. Vibrations (earthquakes) occur as rock elastically returns to its original shape
    2. Often preceded by foreshocks
    3. Often followed by aftershocks
    4. Fault creep
II. Earthquake waves
  A. Study of earthquake waves is called seismology
  B. Earthquake recording instrument (seismograph)
    1. Records movement of Earth
    2. Record is called a seismogram
  C. Types of earthquake waves
    1. Body waves travel through Earth—two types
      a. Primary (P) waves
        1) Push-pull (compressional) motion
        2) Travel through
          a) Solids
          b) Liquids
          c) Gases
      b. Greatest velocity of all earthquake waves
    2. Secondary (S) waves
      a. "Shake" motion, side-to-side
      b. Travel only through solids
      c. Slower velocity than P waves
    3. Surface waves—
      a. travel on Earth's surface
      b. often extremely damaging
      c. Complex motion
      d. Slowest velocity of all waves

III. Locating an earthquake
   A. Focus – the place within Earth where earthquake waves originate
   B. Epicenter
      1. Point on the surface, directly above the focus
      2. Located using the difference in the arrival times between P and S wave recordings, which are related to distance
         a. Three station recordings are needed to locate an epicenter
         b. Circle equal to the epicenter distance is drawn around each station
         c. Point where three circles intersect is the epicenter
   C. Earthquake zones are closely correlated with plate boundaries
      1. e.g., Circum-Pacific belt
      2. e.g., Oceanic ridge system
IV. Earthquake intensity and magnitude
   A. Intensity
      1. A measure of the degree of earthquake shaking at a given locale based on the amount of damage
      2. Most often measured by the Modified Mercalli Intensity Scale
         a. Described by how it is felt
         b. Dependent on
            1) amount of energy released,
            2) rock type, and
            3) distance to earthquake
         c. modified Mercalli scale
            1) not felt except by a very few un favorable circumstances
            2) felt only by a few persons at rest, especially on upper floors of buildings
            3) felt quite noticeably indoors, especially on upper floors, but often not recognized as earthquake
            4) felt indoors by many, outdoors by few. Sensation of truck striking building
            5) felt by nearly everyone, many awakened. Disturbances of trees, plies, other tall objects sometimes noticed
            6) felt by all; many frightened and run outdoors. Some heavy furniture moved. Few instances of fallen plaster or damaged chimneys. Damage slight
            7) everyone runs outdoors. Damage negligible in buildings of good design and construction; slight-to-moderate in well-built ordinary structures; considerable in poorly built or badly designed structures.
            8) Damage slight only in specially designed structures; considerable in ordinary substantial buildings with partial collapse; great in poorly built structures. (Chimneys fall, etc.)

9) Damage considerable in specially designed structures. Buildings shifted off foundations. Ground cracked conspicuously.
10) Damage total. Waves seen on ground surfaces. Objects thrown upward into the air.

B. Magnitude

1. Concept introduced by Charles Richter in 1935
2. Often measured using the Richter scale
   a. Based on the amplitude of the largest seismic wave
   b. Each unit of Richter magnitude equates to roughly a 32-fold energy increase
      1) Can be discerned by seismometers
      2) Generally not felt
      3) Felt by some
      4) Felt by most
      5) Damaging
      6) Destructive in populous areas
      7) Major earthquakes, serious damage
      8) Great, rare, destroy communities near epicenter
   c. Does not estimate adequately the size of very large earthquakes
3. Moment magnitude scale
   a. Measures very large earthquakes
   b. Derived from the amount of displacement that occurs along a fault zone, area of the rupture surface, and the strength of the rock that was ruptured.
   c. Small earthquakes have roughly same moment magnitude and Richter magnitude