Quizlet
Magnetic stripes along the seafloor are evidence for
a) Earth's magnetic reversals
b) Seafloor spreading
c) Convection currents in the mantle
d) Magnetite's ability to orient with a magnetic field

Plate tectonics

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<thead>
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<th>Converge</th>
<th>Diverge</th>
<th>Transform</th>
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<td>Ocean/ocean</td>
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Introduction to Plate Tectonics
- Plates are moving from 1-12 cm per year
  - India: 12 cm per year, Africa: abt. 1 cm/year
  - Distance between North America and Europe increasing about 2 cm/year
True or false: The asthenosphere is liquid.

A. True  
B. False  
C. 90% false and 10% true

Problems and answers

P. How do continents drift through rock?  
A. They don’t. The continents are frozen into the lithosphere. The continents move with the large chunks of lithosphere called plates.

P. Why doesn’t the earth get bigger if new crust is being made?  
A. Part of the crust is pushed down into the asthenosphere where it melts.

P. There isn’t any force to make them move, is there?  
A. Yes, there is…our good friend gravity

1. The lithosphere is broken into about a dozen large plates (and some smaller ones) that “float” on asthenosphere.
2. Convection currents in the asthenosphere move the plates (1 to 15 cm per year).
3. Gravitational and electromagnetic forces push the plates.
4. Energy comes from radioactive decay of atoms in upper mantle.

Plate Margins

Divergent Plate Boundaries

1. Oceanic spreading centers.
   - some volcanic activity (Iceland)
   - shallow, frequent, mild earthquakes
   - Hot, less dense ridge material floats higher on asthenosphere
   - sea floor forming - spreading - abyssal hills - abyssal plains
   - older rock & thicker sediment as you go away from ridge
**Divergent Plate Boundaries**

2. Continental rift zone

- shallow earthquakes and some volcanic activity
- eventually a shallow sea
- later -- an oceanic ridge
  (East Africa, Baja - continental rifts in process)

Partial melting of peridotite in the mantle produces basalt.
Why doesn't this process just produce more peridotite?

Continental rifts eventually become ocean ridges.

Different mineral components in the peridotite melt at different T's
What will happen if only a small fraction of the rock melts?
Will the melted part have the same composition as the original rock?

**Thought question**

There are Ocean-Ocean and Continent-Continent divergent boundaries, so why aren't there any continent-ocean divergent plate boundaries?
Which type of rock is the most dense?
A. Continental crust (granitic)
B. Oceanic crust (basaltic)
C. Lake sediment
D. Hot magma on the surface
E. None of these

When an oceanic and continental plate collide, which should end up on top?
A. The continental plate
B. The oceanic plate
C. It is impossible to predict

Which kind of plate boundary should produce the deepest earthquake foci?
A. Oceanic divergent boundary
B. Continental divergent boundary
C. Convergence of two continental plates
D. Convergence of an oceanic plate with a continental plate

Convergent Plate Boundaries
1. Two oceanic plates
   - More dense plate shoved below less dense plate
   - Benioff or subduction zone formed
   - Partial melting of subducting plate
   - Earthquakes at different depths, severe
   - Volcanic island arcs
   - Trench

Convergent Plate Boundaries
2. Oceanic plate and continental plate
   - Oceanic plate more dense
   - Compresses and thickens continental edge
   - Volcanic Mountain chain - violent
   - Fold mountain belt
   - Earthquakes, trench
   - Oceanic crust destroyed
   - (Nazca plate - West South America)

The Cascade Range
- Collision of Juan de Fuca (oceanic) plate with North American (continental) plate
- Which plate is being subducted?
- Volcanism - Mt. St. Helens, Mt. Rainier, etc.
- Earthquakes
Convergent Plate Boundaries

3. Two continental plates

- initially some subduction, but it soon stops
- compresses and thickens continental edges - suture zone
- fold mountain belts

Why are they called folded mount belts?

Would you expect volcanoes at this type of boundary? Why? Explain to a neighbor.

India is now a part of Asia. The Asian continent has grown.

Build-up of North America through time

Transform Faults

1. Transform faults connect segments of spreading centers.
2. They form the boundaries of plates moving past one another. -- the edge of a plate is not usually a straight line.
3. The San Andreas fault in California is a transform fault. -- the edge of California is on a different plate than the rest of the United States.
4. Strong, frequent, shallow earthquakes
Hot Spot Trails:
- island chains far from plate boundaries
- assume hot spot does not move
- as plate slides past, islands are formed
- oldest - most eroded on far end of chain
- date lava - measure absolute motion of plate
- Hawaii, Yellowstone
**Major Surface Features of the Earth**

Name that boundary….

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**Plate Tectonics Anywhere But Earth?**

- **Mars:**
  - shield volcanoes mark hot spots, but plates don’t appear to move
  - planet too small, cooled quickly?

- **Venus:**
  - couldn’t “see” surface until recently
  - new radar maps suggest many scattered volcanoes, but no hot spot trails
  - surface too hot for hydrated minerals needed for tectonics?

- Why don’t we see tectonic features elsewhere?

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**Summary**

- Plate Tectonics explains what is observed
  - rift valleys, island arcs, fold mountain belts, etc.

- Continents rest on large plates moved by convection forces
  - Gravitation and electromagnetic
  - Fueled by radioactivity in earth’s core

- Features
  - Convergent Plate Boundaries
  - Divergent Boundaries
  - Transform Faults
  - Hot Spots

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