1. There are three types of faults on Earth:
   a. Normal: Extensional forces, vertical motion
   b. Reverse: Compressional forces, vertical motion
   c. Strike Slip: Shear forces, horizontal motion
2. Focal Mechanism maps tell us what type of fault generated the earthquake and the sense of motion on the fault. Top (strike-slip), bottom right (reverse), bottom left (normal).
3. Certain types of faults are associated with certain types of magmatism.
4. Earthquakes occur on a daily basis but cannot be predicted (yet).

TECTONICS

1. Know the important ideas that helped lead to plate tectonic theory.
2. Plate= single chunk of lithosphere that behaves as a rigid block on the surface of the earth.
3. Plate boundaries defined where (2) is violated.
4. Review of structure:

5. Be able to explain these drawings:
6. Continental Collision = Orogeny

Orogeny = Mountain Building. Example, Himalayas are the result of the Indian Continent colliding with the Asian Continent.

7. Summing Up

- Convergent Boundaries form where plates move together. This can be:
  - Ocean-Ocean Convergence
  - Continent-Ocean Convergence
  - Continent-Continent Convergence

8. Divergent boundaries occur where things move apart. What types of volcanoes and earthquakes are associated with divergence?
9. Strike slip (or transform boundaries) occur where plates move apart.

10. The Development of a transform fault (explain this diagram):
11. Summary Slide of transform boundaries

Transform Boundaries

• 3 Types of Transform Boundaries
  – Ridge-Ridge (example given)
  – Ridge-Trench
  – Trench-Trench

  – Plate Picture on a Ridge-Ridge is as follows

12. Global view of tectonism

[Diagram showing various tectonic boundaries and features, including transform faults, divergent boundaries, convergent boundaries, and subduction zones.]

RGB = Rifted Ocean Basins
DCM = Divergent Continental Margin
MC = Microcontinent
VA = Volcanic Arc (Island or Magmatic Arc)
Terra Nova = a small floating block of crust, such as a volcanic arc or microcontinent
13. Summary Slide:

Summary Slide

- The Outer part (lithosphere-crust-asthenosphere) of the Earth is a dynamic system.
- New oceanic material is created at Divergent Plate Boundaries.
- Old Oceanic material is destroyed at Convergent Plate Boundaries.
- Transform Plate Boundaries accommodate motions between plates.

14. Continental Drift

Evidence for Continental Drift

- The idea that continents have moved through time is not new, but it was only recently supported by evidence.
- Alfred Wegener (German Meteorologist) proposed an idea in the early 1900s. It was based on the following observations:
  - Matching coastlines (e.g. South America and Africa)
  - Glacial Deposits on the Equator made no sense— but if the continents moved from the poles to the equator
  - Matching fossils such as land-based dinosaurs across the Atlantic

15. Know the problems with Wegener’s original claim. Also note that Snider and Pellegrini and others had proposed similar ideas.
16. Know the contributions of Vine, Mathews, Morley and Harry Hess to the discussion of plate tectonics.

17. Earth’s Magnetic Field Features.

**Earth’s Magnetic Field**

**Main Features**

1. The Field is generated by the liquid motion of the outer core about the solid Fe inner core.
2. The field is nearly dipolar (bar magnet).
3. The earth’s field is a vector having 3-D direction and strength.
4. The magnetic field reverses.

18. Field is generated in the core via convection.

19. Declination = angle between you and magnetic north. Inclination: angle between the field and horizontal.

20. The earth’s magnetic field reverses from time to time. This causes a change in both the declination and inclination of the field as shown:
21. Magnetite and hematite record the magnetic field.
22. Thermal remanence occurs as shown below:

**Earth’s Field**

Blob of Magma
`1200 C`

**Earth’s Field**

Igneous Rock
< 575 C
23. Detrital remanence occurs as shown below:

*Earth’s Field*

![Diagram](image)

24. Reversals on the seafloor help reconstruct the continents:

![Diagram](image)

25. In an ideal case, we can run the tape recorder backward to establish the original relationships between continents/
26. Summary Slide of Ocean Floor magnetism

**Magnetic Reversals**

- **Important Note:**
  - Magnetic Reversals act as a ‘tape recorder’ on the ocean floor and allow us to run the tape backward to establish relationships between continents.
  - Magnetic ‘stripes’ do not move the plates, they record the motion.
  - Oldest ocean floor is ~180 Ma.

27. Latitude versus longitude:

**Quick Review**

- **Latitude Lines:** Run E-W, but denote North-South position.
- **Longitude Lines:** Run N-S, but denote East-West position.

28. Declination (North pointing in normal field, south pointing in reverse field. This allows us to orient the continent in times past:
29. Know how to reach the solution given this information:

**Reconstruction 3**

Suppose:
(a) We find a 200 million year old rock.
(b) Declination is due west
(c) Field was normal when the rock formed.

30. Solution to #29

31. Inclination gives us paleolatitude via the equation:
\[ \tan(\text{Inclination}) = 2 \times \tan(\text{latitude}) \]

32. If the inclination in our example above (#29) was 0, then the latitude via equation #31 would be 0. The complete reconstruction would be:
33. Pmag does not constrain longitude:
34. Plate Driving Forces:

Ridge Push: Effective in the region of the ridge (gravitational energy)

Trench Pull: Effective across the entire plate (gravitational energy)

Thermal Convection: Heat released from within.

RIDGE PUSH

MANTLE HEAT