The Earth as a Terrestrial Planet

Mass -- $6 \times 10^{27}$ gm ($6 \times 10^{24}$ kg)

Size -- diameter 12,756 km (eq.)

Density – mean 5.5 gm/cm$^3$

Surface -- 71% water
Densities – crust $< 3 \text{ gm/cm}^3$

- mantle $3.5 \text{ gm/cm}^3 \rightarrow$ ?

Very dense core $\sim 15 \text{ gm/cm}^3 \rightarrow$ Fe/Ni

Outer core – molten (5000-7000K)

Inner core – solid $\sim 7000K$

Why? – differentiation of elements

Rotating molten core produces magnetic field
Age Dating of Earth

Radioactive decay -- uranium, plutonium, thorium

\[ U^{238} \rightarrow Pb^{206} \]

\[ Th^{232} \rightarrow Pb^{208} \] using known half-life

Rocks on Earth -- newly formed to \( \sim 3.5 - 4 \times 10^9 \) yrs

Oldest Moon rocks -- \( 4.5 - 4.6 \times 10^9 \) yrs
Our Active Earth – Plate Tectonics or Continental Drift
DIGITAL TECTONIC ACTIVITY MAP OF THE EARTH
Tectonism and Volcanism of the Last One Million Years

DTAM

NASA/Goddard Space Flight Center
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Robinson Projection

October 1998

Mainly oceanic crust

Legend:
- Actively-spreading ridges and transform faults
- Total spreading rate, cm/year, NUVEL-1 model (DeMets et al., Geophys. J. International, 101, p26, 1990)
- Major active fault or fault zone; dashed where nature, location, or activity uncertain
- Normal fault or rift; backarc on downthrown side
- Reverse fault (overthrust, subduction zones); generalized; bars on upthrown side
- Volcanic centers active within the last one million years; generalized. Minor basaltic centers and seamounts omitted.
Consequences—earthquakes, volcanoes, mountain building
San Andreas Fault
Caused by convective currents in mantle transfers heat to crust
The Earth at Night
The Earth and Moon as a Double Planet

\[ \frac{M_{\text{moon}}}{M_{\text{earth}}} = 0.012 \ (1/80^{\text{th}}) \]

\[ \frac{R_{\text{moon}}}{R_{\text{earth}}} = 0.27 \ (1/4^{\text{th}}) \]

Largest in Solar System
Surface Features

Mare

Craters

Highlands
Origin of the Moon

Sister planet – by fission

Co-accretion – at same distance, same material

Capture – not dynamically feasible

Current theory – massive collision – computer modeling
Lunar rocks and soil samples
Age Dating Lunar rocks and soil samples

Mare – $3.8 \times 10^9$ yrs
Highlands – $4.3 - 4.6 \times 10^9$ yrs