Lightning

Shockingly Dangerous! Ok, maybe not that shocking.

Demo VDG

- Show how lightning rods behave.
- Show how pointed objects leak charge.
- Applying this to life we learn to use pointed lightning rods.

Lightning Rods

- Four characteristics of lightning rods
  - Pointed geometry
  - Grounded
  - Conducting material
  - Highest point on the structure

Lightning films.

- http://science.howstuffworks.com/nature/natural-disasters/lightning.htm
  - This shows how lightning works.
  - Important concepts are stepped leader and streamers.
- https://www.youtube.com/watch?v=_1mB5rM8WHU&context=C36b8ceeADOEgsToPDskLx1bGKjQdwBLYGmmJMCTSP
  - Slow motion lightning

Fulgurite

- “lightning rock”
- What happens to sand when struck by lightning.
- Hard to find because of how fragile it is.
- Natural glass.

Lightning Information

- 92 deaths/year in U.S., 1959-1994; only 50 a year from 1995-2004
- Ben Franklin: lightning is an electrical discharge; kite experiment, 1752
- 80% of lightning remains in clouds

Formation

- Separation of charge in cloud, + on top, — on bottom
- Stepped leaders, top-down, 15-30 meters long
- Return stroke, ground up (this is what we see)

“Average” lightning strike

- 40,000 amps; 10-100 million volts
- 30 μ sec long; 500 MJ; 1012 watts
- 1 cm path width
- 54,000°F; speed of 60,000 m/s

Daily Statistics

- 2000 thunderstorms
- 5 million cloud-to-ground strikes
- 65 deaths around the world
- 275,000 tons of nitrogen oxides fall out of
- atmosphere
- 27 forest fires start from lightning strikes

Earth

- Giant, spherical capacitor, negatively charged
- Lightning strikes help to recharge Earth as electrons drain to ground
- Atmosphere's average E field: 6 volts/meter
- Air breakdown: 3 million volts/meter

Density of lightning strikes throughout the US over a five year period

- http://www.lightningsafety.noaa.gov/lightning_map.htm

Lightning Safety Sheet

- http://artemis.crosslink.net/~cherylw/in-case-of-lightning.html
- https://gaggle.net/gaggleVideoProxy.do?op=view&v=a7059407f66417d83e885166f37b59c0
  - Nova Lightning Safety 36:30-38:30
- Story of friend

Electrostatics Study Sheet

- Problems 7-10, more on the back.

Quiz Tomorrow

- Covers
  - Conductors, Insulators, and Semiconductors
  - Polarization
  - Path of least resistance
  - Charge location
  - Electric fields
  - Coulomb and his law
  - Electrophorus
    - Alessandro Volta
  - Don't worry about Induction or residual charge by conduction.

Lightning when it strikes the ground

- https://www.youtube.com/watch?v=u_6b6Bk6bM8&feature=related