

**University of Virginia**

**Department of Physics**

Physics 606: How Things Work II

Lecture #37 Slides:

**Plastics II**

**and**

**Nuclear Weapons**

## Changing regimes

- Temperature
- Plasticizers
  - Chemical dissolved in a polymer to soften it
  - Shift a polymer's behavior to a different regime

## Question:

Which is more effective at cleaning your hair: a thick, viscous shampoo or a thin, freely flowing shampoo, or are they probably about equal?

## Thermoplastics

- Individual strands
- Change behavioral regimes when heated

## Thermosets

- Polymers are cross-linked
- Can't melt
- Vulcanization: cross-linking of a thermoplastic

## Glues are Plastics

- White Glue (Water-Soluble Plastic)
- Model Cement (Solvent-Soluble Plastic)
- Heat Melting Glue (Glue Gun Glue)
- UV-Hardening Acrylic Glues (Acrylates)
- Superglues (Cyanoacrylates)
- Mix-Hardening Glues (Epoxyes)

## Oriented Plastics

- Kevlar (Liquid Crystal Plastics)
- Spectra (Draw-Ordered Plastics)

## Nuclear Weapons

### Question:

Is it possible to have 100 tons of plutonium and not have it explode?

### Observations About Nuclear Weapons

- They release enormous amounts of energy
- They produce incredible temperatures
- They produce radioactive fallout
- They are relatively hard to make
- They use chain reactions

### Atomic Nucleus

- Atoms are usually electrically neutral
  - They must have as many + charges as – charges
  - Each electron must be matched by a + charge
- At the center of an atom is its nucleus
  - Extremely small (1/100,000th of the atom's diameter)
  - Contains most of the atom's mass
  - Also contains most of the atom's potential energy
    - Evidence is related to:  $E=mc^2$

### Structure of Nucleus

- Nucleus contains two kinds of nucleons
  - Protons are positively charged
  - Neutrons are neutral
- Two forces are active in a nucleus
  - Electrostatic repulsion between protons
  - Nuclear force attraction between touching nucleons
  - At short distances, nuclear force is stronger than electric
  - At long distances, electric force is stronger than nuclear

