

Plastics

Question:

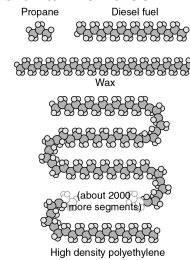
Which is more effective at cleaning your hair:
a thick, viscous shampoo or a thin, freely
flowing shampoo, or are they probably
about equal?

Observations About Plastics

- Some plastics are clear, others translucent
- Some plastics are stiff, others are flexible
- Some plastics stretch, others don't
- Some plastics melt, others don't
- Some plastics smell, particularly when hot
- Some glues dry, others harden without drying

Plastic

- Polymers: enormous chain or tree like molecules



Chemical bonds

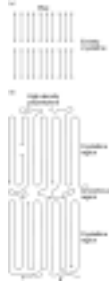
- Metallic bond
 - electrons shared between many atoms
- Ionic bond
 - atoms become oppositely charged ions
- Covalent bond
 - atoms share a pair of electrons

Polymerization

- Plastics employ covalent bonds
- Individual monomer molecules are joined
- This polymerization forms giant molecules
 - Some molecules are linear chains
 - Some are branched tree-like structures
 - Some are networked together completely

Plastic structure

- Amorphous
 - random mess of polymers
- Crystalline
 - neatly oriented polymers



Regimes

- Glassy: hard, brittle solid
- Glass-rubber transition: leathery
- Rubbery plateau: flexible and elastic
- Rubbery flow: viscous flow but elastic
 - Reptation: chains slide along their length
- Liquid flow: viscous liquid

Changing regimes

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

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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 (Epoxies)

Oriented Plastics

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