

The following is a collection of questions and some answers used by myself and others associated with material covered in *Polymer Chemistry*. They are somewhat intentionally broad because the course is often taught as an introduction covering many diverse topics. The questions are a combination of matching, short essay, short answers, etc. Good luck.

Charles Carraher, Jr.

## 1. Definitions

Match the following:

Amorphous \_\_\_\_H

Atactic \_\_\_\_F

Backbone \_\_\_\_N\_

Copolymer \_\_\_\_M\_

Crystalline \_\_\_\_G

Crosslinks \_\_\_\_K

Degree of polymerization J \_\_\_\_

DSC (differential scanning calorimetry) \_\_\_\_S

Entropy of mixing \_\_\_\_P

Glass transition temperature E \_\_\_\_

Helix and pleated \_\_\_\_U

Hilderband's equation \_\_\_\_O

Homopolymer \_\_\_\_L

Mark-Houwink equation \_\_\_\_Q

Melting point or range \_\_\_\_D

Mer \_\_\_\_B

Plasticizer A \_\_\_\_

Polymer or macromolecule \_\_\_\_I

Protein \_\_\_\_V

TGA or TG (thermal gravimetric analysis) T \_\_\_\_

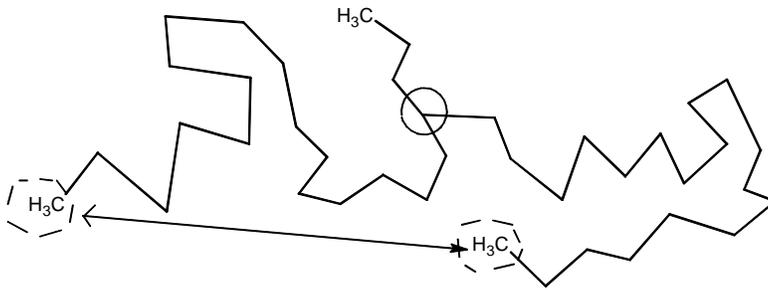
Vinyl polymer \_\_\_\_C

Young's modulus \_\_\_\_R

- A. A compound that "solubilizes" only a portion of a polymer chain; added to give flexibility.
- B. Repeat unit in a polymer chain.
- C. Polymer derived from the polymerization of vinyl monomers.
- D. Temperature range or point where a polymer achieves full chain mobility.
- E. Temperature range where only local, segmental mobility occurs; where only relatively small portions of the polymer can move.
- F. Polymer where there is a random arrangement of pendant groups on each side of the polymer backbone.
- G. Polymer portion with a highly ordered structure.
- H. Polymer portion with a (highly) disorganized structure.
- I. Molecule composed of many mers or repeat units; a very large molecule.

- J. Number of units within a polymer.
- K. Covalent or physical bonds between two or more linear polymer chains.
- L. Polymer composed of only one repeat unit.
- M. Polymer composed of more than one repeat unit; usually employed to describe a vinyl polymer derived from two different vinyl molecules.
- N. Principal chain in a polymer molecule.
- O. Describes the forces holding a material together; CED; used to help predict solubility.
- P. Major force that encourages (drives) solubility.
- Q. Viscosity =  $KM^a$ .
- R. Stress-strain.
- S. Measures energy (heat) changes typically as a function of temperature.
- T. Measures weight changes typically as a function of temperature.
- U. Most common shapes of polymers.
- V. Natural "nylon"; composed of amino acid units.

2. For the following polymer chain, circle only a branch point; draw a dotted line about the two end-groups; and indicate by a two-headed line (<---->) the end-to-end distance.



3. Underline only those that would be more likely to soften and melt if heated.

Uncrosslinked polyethylene or highly crosslinked rubber

4. Underline only those polymers where hydrogen bonding occurs within and/or between polymer chains.

Nylon/protein    Polyethylene    Cellulose

Polybutylene    Polyester

5. A. What is the molecular weight of polyethylene,  $-(\text{CH}_2\text{CH}_2)-$ , which has a DP of 100?

$$100 \text{ units} \times 28 \text{ amu/unit} = 2800$$

B. What is the DP of a polyethylene that has a molecular weight of 56,000 Da?

$$56,000 \text{ amu} / 28 \text{ amu/unit} = 2000 \text{ units}$$