Introduction to Polymer Chemistry 4th edition Carraher Jr Test Bank

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1. DEFINITIONS

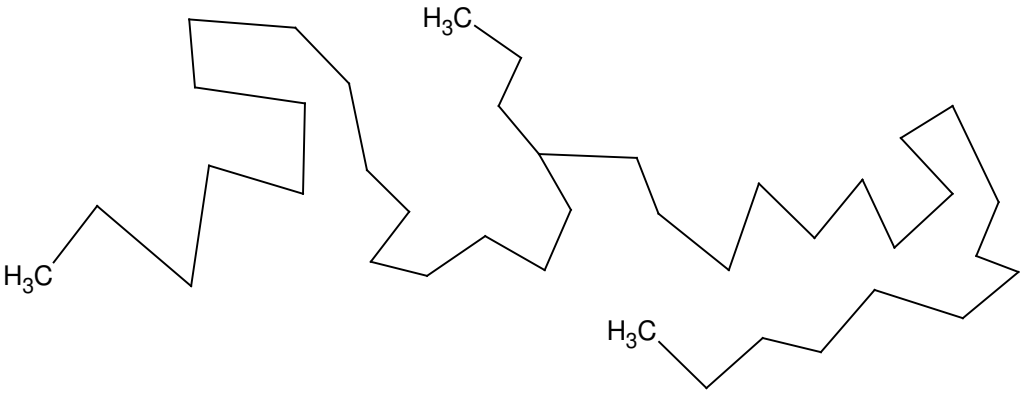
Match the following
Amorphous ____
Atactic ____
Backbone ____
Copolymer ____
Crystalline ____
Crosslinks ____
Degree of polymerization ____
DSC (Differential scanning calorimetry) ____
Entropy of mixing ____
Glass transition temperature ____
Helix and pleated ____
Hilderband's equation ____
Homopolymer ____
Mark-Houwink equation ____
Melting point or range _____
Mer ____
Plasticizer ____
Polymer or macromolecule ____
Protein ____
TGA OR TG (Thermal gravimetric analysis) ____
Vinyl polymer ____
Young's modules ____

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 poliont where a polymer achieves full chain mobility.
E. Temperature range where only local, gegmental 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 .

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K. Covalent or physical bonds between two or more linear polyer 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 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 abount the two end groups; and indicated by a two headed line (<---->) the end-to-end distance.



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

A. 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, -(-CH_2CH_2-)-, which has a DP of 100? _____

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

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6. Underline only those groups that are apt to add flexibility to a polymer chain.

$-CH_2-$ AMIDE $-C(=O)-N(H)-$ $-CH_2-O-$ 1,4-PHENYLENE

7. A. An elastomer (rubber) is flexible **above** or **below** (underline only the correct answer) its glass transition temperature.

B. Underline only those properties/conditions that (generally) describe an elastomer (rubber).

WELL ORDERED HIGHLY DISORIENTED CHAINS IN UNSTRETCHED FORM

LARGELY HYDROCARBON MINIMAL INTERACTION BETWEEN CHAINS

ORIGINALLY A LOT OF ELONGATION FOR A LITTLE STRAIN

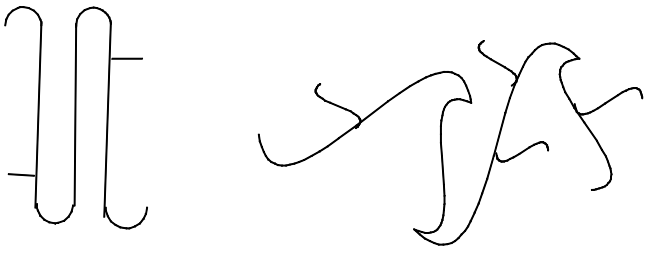
8. For polyethylene, as visualized below, underline the correct answer.

A. The polyethylene chain, below, that should have the lower glass transition temperature is a or b.

B. The polyethylene that should be stronger is a or b.

C. The polyethylene that should be more porous and susceptible to ultraviolet degradation is a or b.

D. The polyethylene that should be denser is a or b.



a. b.

9. Compute the following average distances for a polyethylene chain of 100 units where each ethylene unit is 0.25 nm (for a zigzag structure). Contour length is 0.25 nm/ethylene unit x 100 units = 25 nm.

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Root-mean-squared average end-to-end distance = _____.

10. Underline which of the following represents a head-to-tail polystyrene structure.

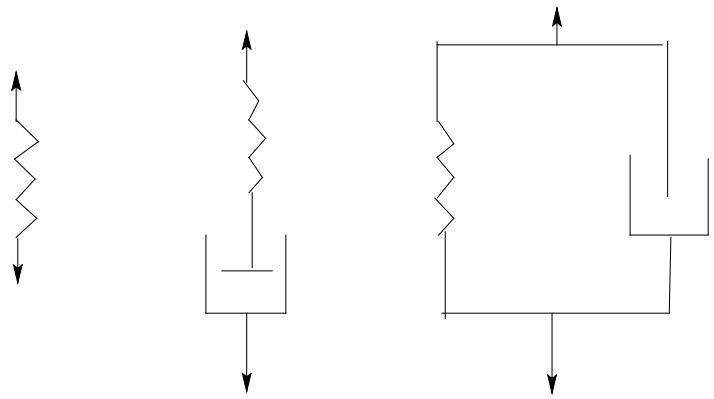
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-C-C-C-C-        -C-C-C-C-        -C-C-C-C-
   |   |            | |              |     |
  Ph  Ph           Ph Ph            Ph    Ph
```

11. Underline only the correct answer for each.

a. Which, a, b, or c, is a Maxwell Model?

b. Which, a, b, or c, is a "Hookean" spring model?

c. Which, a, b, or c, is a Voigt-Kelvin model.



a. b. c.

12. Viscosity relationships.

A. Give an equation that describes the relative viscosity or viscosity ratio.

B. Give an equation that describes the intrinsic viscosity or limiting viscosity number.

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C. Give an equation that describes the reduced viscosity or viscosity number.

13. A. Give the relationship between number of chains and the molecular weight for each in terms of number of each chain, N_i, and molecular weight of each chain, M_i.

Weight-average molecular weight =

Number-average molecular weight =

B. Give one technique that will generally give you a weight average molecular weight.

C. Give one technique that will generally give you number average molecular weight.

D. For the following molecular weight distribution plot identify "A" and "B" as to type of molecular weight-either number or weight average.

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