

PLMSE 406
Practice Test 2

1. A polymer chain in the melt or in the rubbery state has an average end-to-end distance that is proportional to

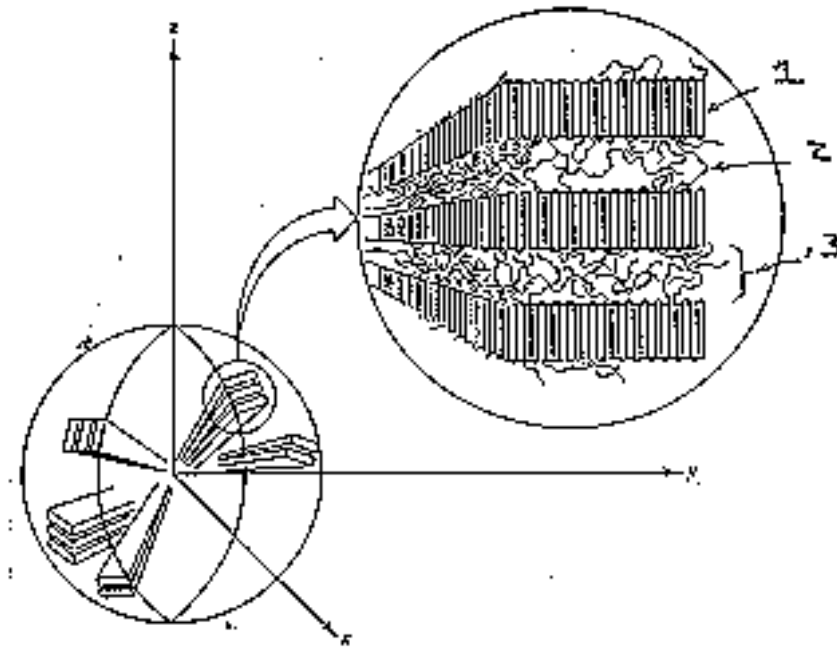
- a. N
- b. $N^{0.75}$
- c. $N^{0.6}$
- d. $N^{0.5}$
- e. $N^{0.33}$

where N is the number of units in the chain.

2. Which of the following polymers would you expect to have the best barrier properties (i.e., provide the best barrier to diffusion of a gas and hence prove most effective as a beverage container)?

- a. Atactic polystyrene
- b. A random ethylene/propylene copolymer (50/50) composition.
- c. Low density polyethylene
- d. High density polyethylene

3. Consider the following polymer crystal form:



This is a schematic picture of

- a. A spherulite.
 - b. A fringed micelle.
 - c. A single crystal lamellae.
4. The material marked 3 is
- a. Folded chain crystals.
 - b. Crystalline chains.
 - c. Amorphous material.
5. The thing labeled 2 is
- a. A fold.
 - b. A randomly coiled chain.
 - c. A tie molecule.

6. Atactic polystyrene ($T_g = 100^\circ\text{C}$) quenched (i.e., cooled very quickly) from 120°C to room temperature
 - a. Is a rubbery material.
 - b. Crystallizes.
 - c. Is a glassy material.

7. High density polyethylene cooled slowly from 160°C to room temperature
 - a. Is still amorphous.
 - b. Crystallizes.
 - c. Is a glass.
 - d. Is a mixture where some regions are rubbery and some regions are glassy.

8. When a single polymer chain is stretched the origin of the restoring force is related to
 - a. The entropy of chain conformations.
 - b. The enthalpy of chain conformations.
 - c. The degree of cross-linking.
 - d. The elastic forces in each of the individual bonds in the chain.

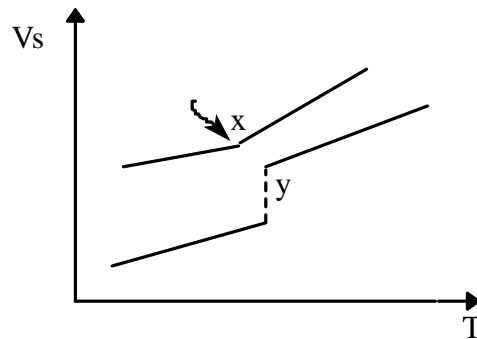
9. A polymer drawn from the melt usually forms
 - a. Fringed micelles
 - b. Single crystal lamellae.
 - c. Spherulites.
 - d. Extended chain fibers.

10. Polyethylene and polypropylene (in the melt) will
 - a. Form hydrogen bonds with one another.
 - b. Interact strongly due to polar forces.
 - c. Only interact weakly through dispersion forces.

11. Which of the following polymers would you expect to be most suitable for the production of a rubber car bumper guard?
 - a. Atactic polystyrene ($T_g \sim 100^\circ\text{C}$)
 - b. A random ethylene/propylene copolymer (50/50 composition) $T_g \sim 40^\circ\text{C}$.
 - c. Low density polyethylene.
 - d. High density polyethylene.

12. Which of the polymers in question 11 would be most suitable for use as a flexible film wrap?

13. What is the root mean square end-to-end distance of a chain of 100 freely hinged and jointed monomer units, each of which has a length of 4 \AA ?
- 200 \AA
 - 400 \AA
 - 20 \AA
 - 40 \AA
 - $100 \sqrt{2} \text{ \AA}$
14. If rotations around a bond in a polymer chain can take on any one of four conformations (i.e. arrangements of the groups it is linking relative to one another), then for a polymer chain consisting of 1000 bonds there are the following number of possible conformations;
- 4^{1000}
 - 4×1000
 - 1000^4
 - 1000×4^{1000}
15. Consider the two transitions from the “solid” to the liquid or rubbery state shown below on a plot of specific volume vs temperature



- The transition X is a T_g while transition Y is a crystalline melting point.
- Y is the T_g while X is the T_m .
- Both X and Y are melting points, but X is the T_m of a semi-crystalline material and Y is the T_m of an almost perfect crystal.

16. A fringed micelle is
- An exotic form of nightware that can be purchased at Victoria's Secret.
 - A model for polymer crystals where polymer chains have parts of themselves in crystal domains and parts in amorphous regions.
 - A sphere shaped crystal form obtained by cooling from the melt.
 - A flat lozenge shape crystal obtained from dilute solutions
17. Polymer crystalline in a folded chain form because
- This is the shape that minimizes the free energy, because folds are created.
 - Extended chain crystals have a lower free energy, but the probability of forming the first nuclei with fully stretched out chains is vanishingly small. Therefore folded chain nuclei are formed first and become kinetically trapped.
 - Extended chain crystals have a higher free energy because there are less folds and therefore stronger interactions between the segments in the crystals. Again the folded chain form becomes kinetically trapped.
18. Consider the following polymers

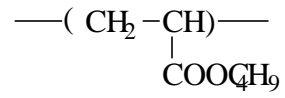
- $\text{—CH}_2\text{—CH}_2\text{—}$
- $\text{—CH}_2\text{—CH—}$
|
 CH_3
- $\text{—CH}_2\text{—CH—}$
|
 Cl
- $\text{—CH}_2\text{—CH}_2\text{—O—}$

Which of these will have the highest T_g?

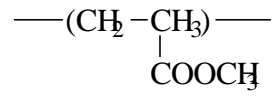
19. Which will have the lowest? (A-D of previous question)

20.

Poly n-butyl acrylate



has a lower T_g than polymethyl



because of

- A) Weaker intermolecular attractions
- B) Free Volume effects
- C) the stiffness of the side chain