

Polymer Science 2024

Exercise 2

1. Classify the following polymers according to their rigidity (from 1 to 4, 1 for the most rigid and 4 for the least rigid): polyethylene, poly(ether ether ketone), poly(ethylene terephthalate), polypropylene. Explain your choice.
2. Place the following molecules into order of increasing boiling point: CH_4 , CH_2O , CH_3OH . Explain your answer!
3. Which of the following pairs has the highest melting point? Explain your answer!
 - a) pentane or octane
 - b) tetrahydrofuran (THF) or diethyl ether (Et_2O)?
 - c) triethylamine or ethylamine?
 - d) poly(ϵ -caprolactone) or nylon 6?
4. The origin of the polarity of molecules (like water) is in the electronegativity differences of the constituting atoms. Explain, why polyethylene is a non-polar polymer with no dipole moment, even though its constituting atoms (C and H) display electronegativity differences of 2.5 vs. 2.1. What about polyvinylchloride (PVC)?
5. Which statement is wrong?
 - a) It is not possible to evaporate a polymer of large molar mass by simple heat input without chemically degrading it.
 - b) Cohesive energy is the energy required to separate molecules of a liquid/solid.
 - c) The compression modulus of a polymer depends little on temperature.
 - d) The intramolecular bonds of polymers are associated with energies on the order of 10 kJ/mol per repeating unit.
6. A hypothetical polymer chain of 100 segments of length $a = 3 \text{ \AA}$ has the root-mean-square (RMS) end-to-end distance of 100 $\text{\AA}$. Does this chain behave as an ideal freely-jointed chain? Calculate the number of Kuhn's statistical segments in the chain and the Kuhn's statistical segment length.

Reading suggestions: Lecture Notes of Chapters 2 and 3.1.